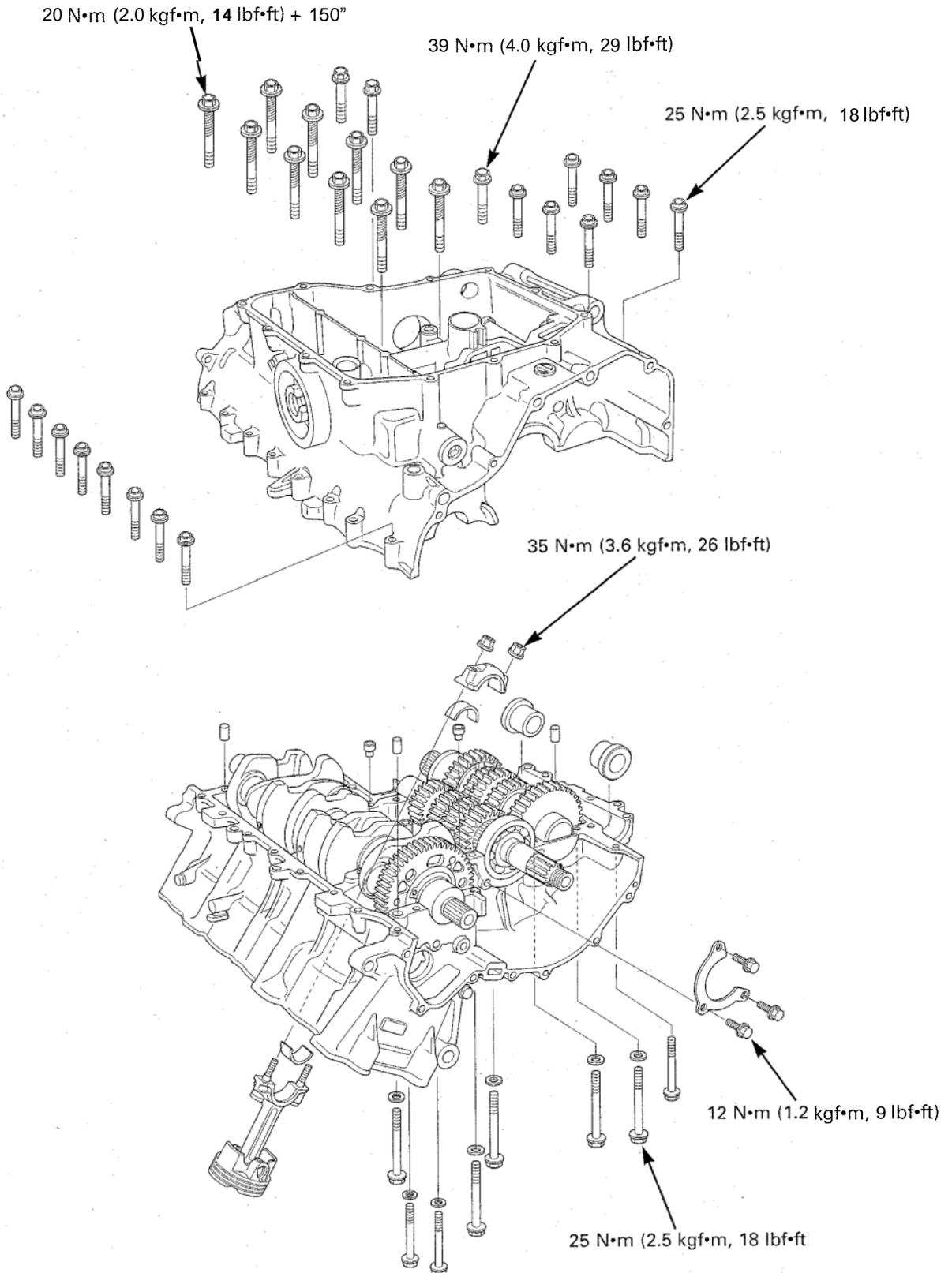


CRANKCASE/PISTON/CYLINDER



11. CRANKCASE/PISTON/CYLINDER

SERVICE INFORMATION	11-1	PISTON/CONNECTING ROD	11-4
TROUBLESHOOTING	11-2	CRANKCASE COMBINATION	11-12
CRANKCASE SEPARATION	11-3		

SERVICE INFORMATION

GENERAL

NOTICE

- *The main journal 9-mm bolts tightening method uses the Plastic Region Tightening Method (page 11-12).*
- *Always use a new main journal 9-mm bolts (page 11-12).*
- *The main journal 9-mm bolts is pre-coated with an oil additive for axial tension stability. Do not remove the oil additive from the new 9-mm bolt surfaces.*
- *Be sure to follow the tightening procedure on page 11-12 for crankcase bolt tightening.*
- This section covers crankcase separation for service of the crankshaft and pistons.
- The following parts must be removed before separating the crankcase.
 - Alternator/flywheel (Section 10)
 - Clutch/gearshift linkage (Section 9)
 - Cylinder head (Section 8)
 - Engine (Section 7)
 - Oil pump (Section 4)
- Mark and store the disassemble parts to ensure that they are installed in their original locations.
- Mark and store the bearing inserts to be sure of their correct locations for reassembly. If the inserts are improperly installed, they will block the oil hole, causing insufficient lubrication and eventual engine seizure.
- The connecting rod bearing inserts are select fit and are identified by color codes. Select replacement bearings from the code tables. After installing new bearings, recheck them with plastigauge to verify clearance. Apply molybdenum disulfide oil to the crank pin during assembly.

SPECIFICATIONS

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT	
Cylinder	I.D.	75.000 - 75.015 (2.9528 - 2.9533)	75.15 (2.959)	
	Out-of-round	—	0.10 (0.004)	
	Taper	—	0.10 (0.004)	
	Warpage	—	0.05 (0.002)	
Piston, piston rings	Piston mark direction	"O" mark facing toward the intake side	—	
	Piston O.D.	74.960 - 74.980 (2.9512 - 2.9520)	74.895 (2.949)	
	Piston O.D. measurement point	4 mm (0.2 in) from bottom of skirt	—	
	Piston pin bore I.D.	17.002 - 17.008 (0.6694 - 0.6696)	17.03 (0.670)	
	Piston pin O.D.	16.994 - 17.000 (0.6691 - 0.6693)	16.98 (0.669)	
	Piston-to-piston pin clearance	0.002 - 0.014 (0.0001 - 0.0006)	—	
	Piston ring-to-ring groove clearance	Top	0.030 - 0.065 (0.0012 - 0.0026)	0.08 (0.003)
		Second	0.015 - 0.045 (0.0006 - 0.0018)	0.06 (0.002)
	Piston ring end gap	Top	0.28 - 0.38 (0.011 - 0.015)	0.5 (0.02)
		Second	0.40 - 0.55 (0.016 - 0.022)	0.7 (0.03)
Oil (side rail)		0.2 - 0.7 (0.01 - 0.03)	0.9 (0.04)	
Cylinder-to-piston clearance		0.020 - 0.055 (0.0008 - 0.0022)	—	
Connecting rod small end I.D.				
Connecting rod-to-piston pin clearance		0.016 - 0.040 (0.0006 - 0.0016)	—	
Connecting rod side clearance		0.05 - 0.20 (0.002 - 0.008)	0.30 (0.012)	
Crankpin oil clearance		0.030 - 0.052 (0.0012 - 0.0020)	0.062 (0.0024)	

TORQUE VALUES

Mainshaft bearing set plate bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads.
Crankcase bolt, 10 mm	39 N•m (4.0 kgf•m, 29 lbf•ft)	
9 mm (main journal bolt)	20 N•m (2.0 kgf•m, 14 lbf•ft) + 150°	See page 11-12.
8 mm	25 N•m (2.5 kgf•m, 18 lbf•ft)	
Connecting rod bearing cap nut	35 N•m (3.6 kgf•m, 26 lbf•ft)	Apply oil to the threads.
Upper crankcase sealing bolt	22 N•m (2.2 kgf•m, 16 lbf•ft)	Apply a locking agent to the threads.
Lower crankcase sealing bolt, 20 mm	30 N•m (3.1 kgf•m, 22 lbf•ft)	Apply a locking agent to the threads.
10 mm	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads.

TROUBLESHOOTING

Cylinder compression is too low, or engine is hard to start

- Blown cylinder head gasket
- Worn, stuck or broken piston ring
- Worn or damaged cylinder or piston
- Bent valve, or bent and deteriorated valve seat

Cylinder compression is too high, or engine overheats or knocks

- Carbon deposits on the cylinder head and/or piston crown

Piston noise

- Worn cylinder, piston and/or piston ring
- Worn piston pin hole and piston pin
- Worn connecting rod small end

Excessive smoke

- Worn, stuck or broken piston ring
- Worn valve stem seal

Excessive noise

- Worn connecting rod big end bearing
- Bent connecting rod
- Worn crankshaft main journal bearing
- Worn transmission bearing

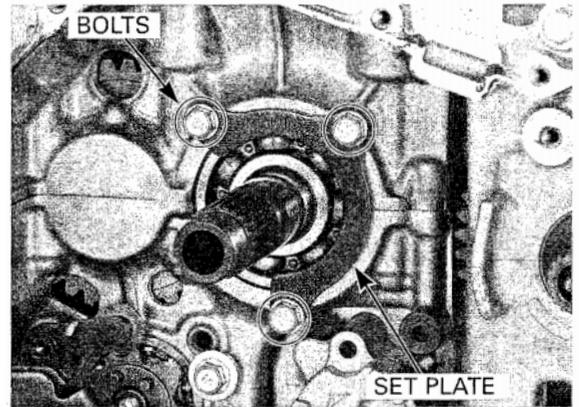
Engine vibration

- Excessive crankshaft runout

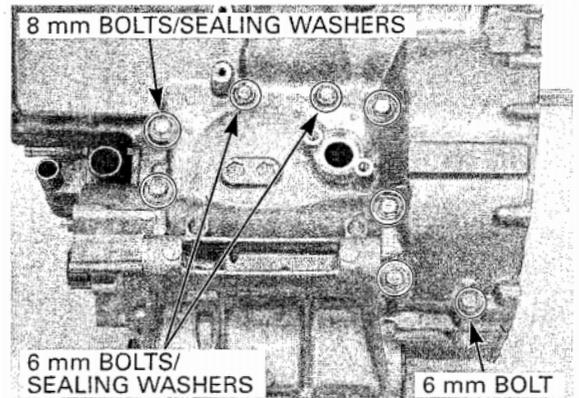
CRANKCASE SEPARATION

Refer to Service Information (page 11-1) for removal of necessary parts before separating the crankcase.

Remove the mainshaft bearing set plate bolts and plate.



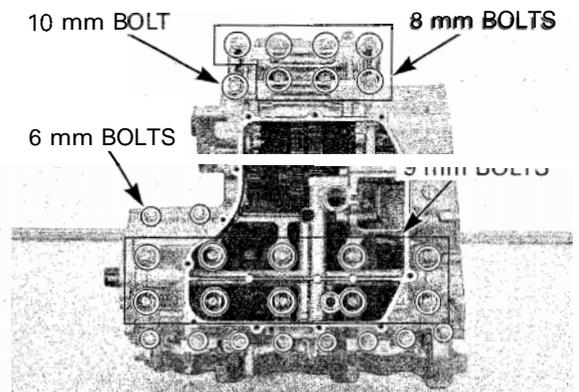
Remove the upper crankcase 8 mm bolts/sealing washers and 6 mm bolt.



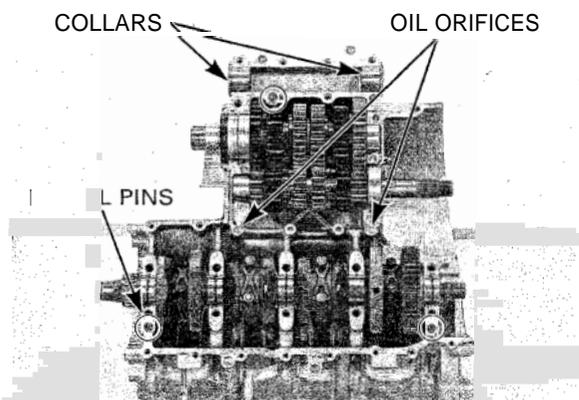
Remove the lower crankcase 6 mm bolts (ten), 8 mm bolts (seven) and 10 mm bolt.

Loosen the ten lower crankcase 9 mm bolts in a criss-cross pattern in two to three steps, then remove the bolts.

Separate the lower crankcase from the upper crankcase.



Remove the swingarm pivot collars, dowel pins and oil orifices.



PISTON/CONNECTING ROD

PISTON/CONNECTING ROD REMOVAL

Mark all parts during removal so they can be replaced in their original locations

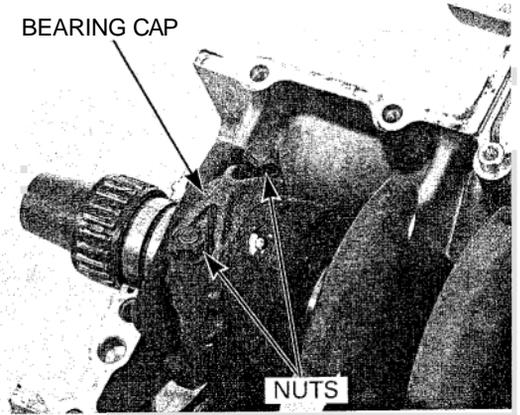
NOTICE

Do not interchange the bearing inserts. They must be installed in their original locations or the correct bearing oil clearance may not be obtained, resulting in engine damage.

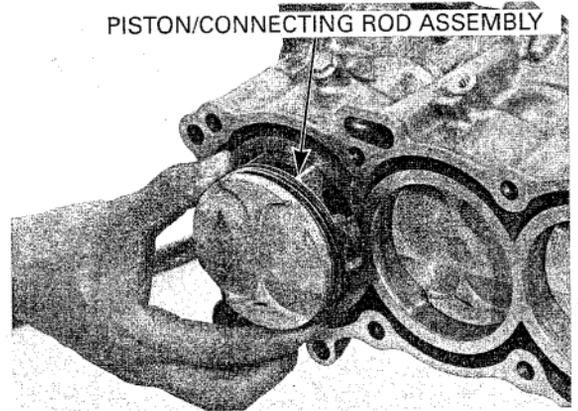
Remove the nuts and connecting rod bearing cap.

Remove the piston/connecting rod assembly from the top of the cylinder.

BEARING CAP



PISTON/CONNECTING ROD ASSEMBLY

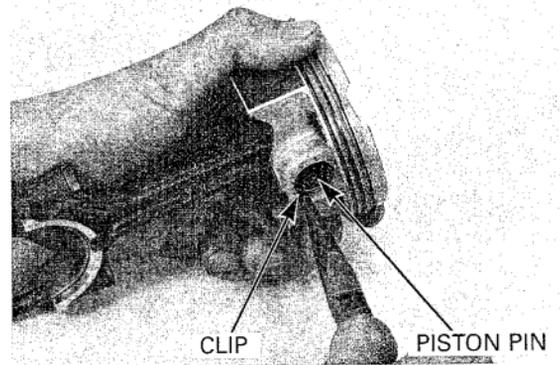


PISTON REMOVAL

Remove the piston pin clip with pliers.
Press the piston pin out of the piston and remove the piston from the connecting rod.

CLIP

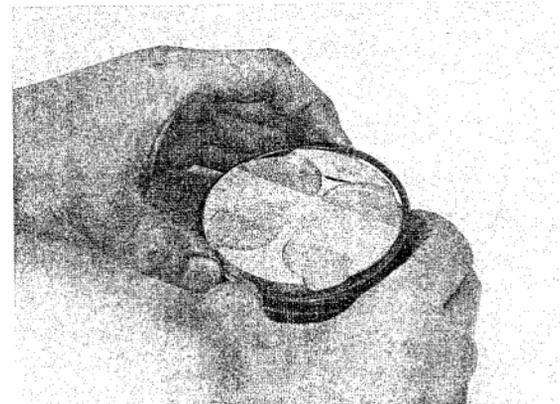
PISTON PIN



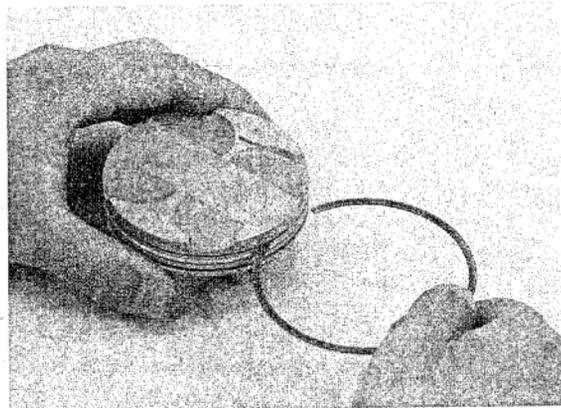
PISTON DISASSEMBLY

Do not damage the piston rings during removal.

Remove the piston rings.



Remove any carbon deposits from the piston ring grooves, using an old piston ring as shown.



PISTON INSPECTION

Temporarily install the piston rings to their proper position with the mark facing up.

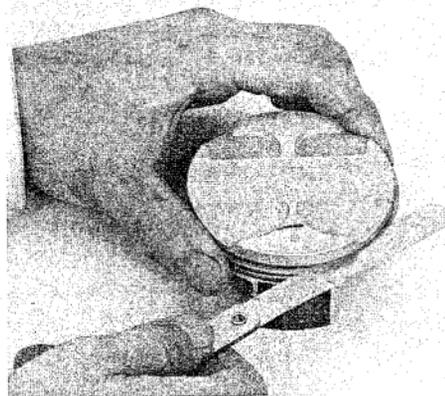
Measure the piston ring-to-ring groove clearance with the rings pushed into the grooves.

SERVICE LIMITS:

Top: 0.08 mm (0.003 in)

Second: 0.06 mm (0.002 in)

Inspect the piston for wear or damage.



Push the rings into the cylinder with the top of the piston to be sure they are squarely in the cylinder.

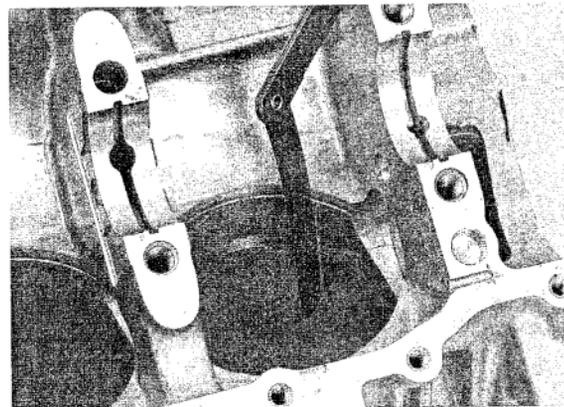
Insert the piston ring squarely into the bottom of the cylinder and measure the ring end gap.

SERVICE LIMITS:

Top: 0.5 mm (0.02 in)

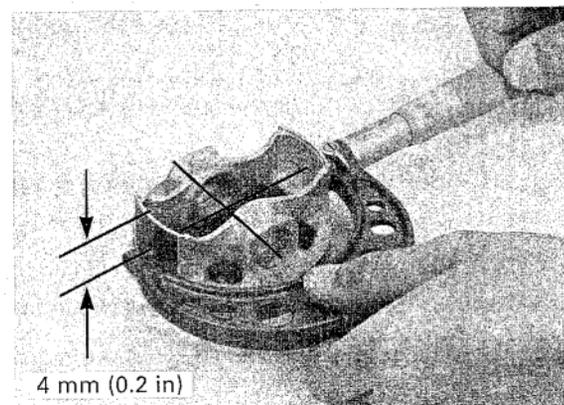
Second: 0.7 mm (0.03 in)

Oil (side rail): 0.9 mm (0.04 in)



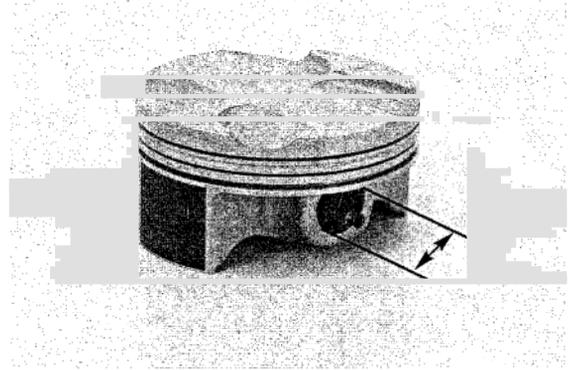
Measure the diameter of the piston at 4 mm (0.2 in) from the bottom and 90 degrees to the piston pin hole.

SERVICE LIMIT: 74.895 mm (2.949 in)



Measure the piston pin bore.

SERVICE LIMIT: 17.03 mm (0.670 in)

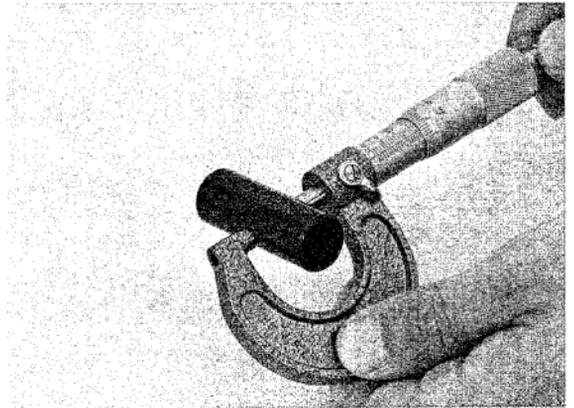


Measure the O.D. of the piston pin.

SERVICE LIMIT: 16.98 mm (0.669 in)

Calculate the piston-to-piston pin clearance.

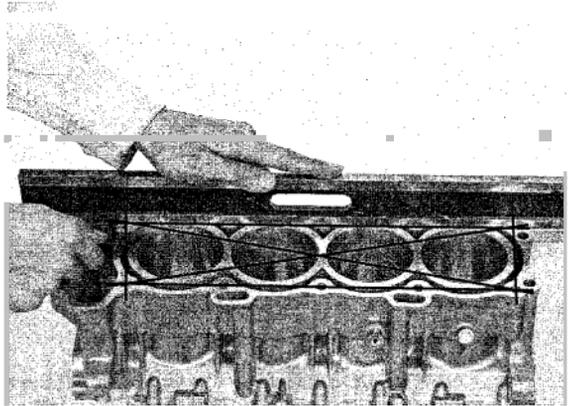
STANDARD: 0.002 - 0.014 mm (0.0001 - 0.0006 in)



CYLINDER INSPECTION

Inspect the top of the cylinder for warpage.

SERVICE LIMIT: 0.05 mm (0.002 in)

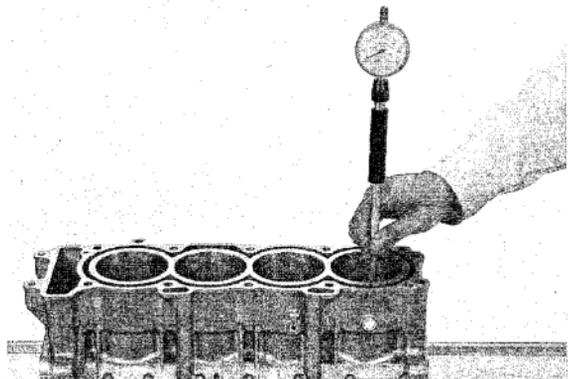


Inspect the cylinder bore for wear or damage.
Measure the cylinder I.D. in X and Y axis at three levels.
Take the maximum reading to determine the cylinder wear.

SERVICE LIMIT: 75.15 mm (2.959 in)

Calculate the piston-to-cylinder clearance.
Take a maximum reading to determine the clearance.
Refer to page 11-5 for measurement of the piston O.D.

STANDARD: 0.020 - 0.055 mm (0.0008 - 0.0022 in)



Calculate the taper and out-of-round at three levels in the X and Y axes. Take the maximum reading to determine them.

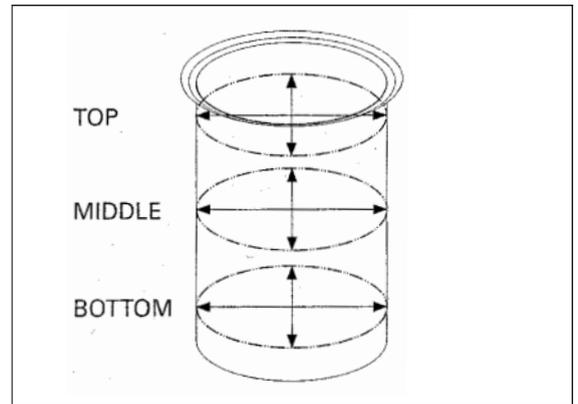
SERVICE LIMITS:

Taper: 0.10 mm (0.004 in)

Out-of-round: 0.10 mm (0.004 in)

The cylinder must be rebored and an oversize piston fitted if the service limits are exceeded.

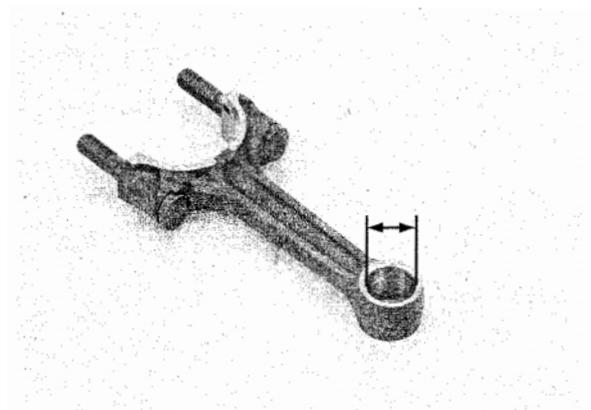
The piston to cylinder clearance for the oversize piston must be: 0.015 – 0.050 mm (0.0006 – 0.0020 in).



CONNECTING ROD INSPECTION

Measure the connecting rod small end I.D.

SERVICE LIMIT: 17.04 mm (0.671 in)

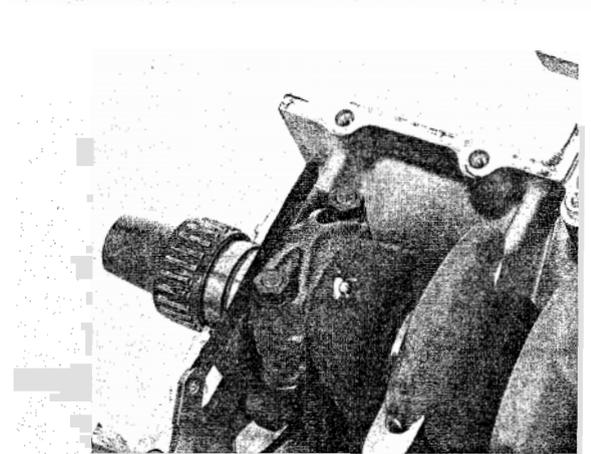


Temporarily install the connecting rod to the crankshaft.

Install the bearing inserts and bearing cap, and tighten the nuts.

Measure the connecting rod side clearance.

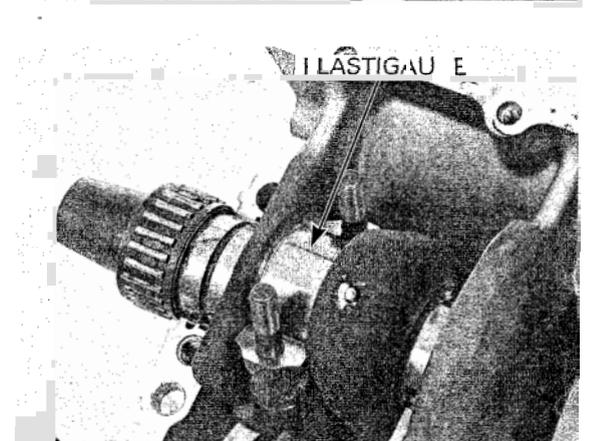
SERVICE LIMIT: 0.30 mm (0.012 in)



CRANKPIN BEARING INSPECTION

Wipe all oil from the bearing inserts and crankpins. Put a piece of plastigauge on each crankpin.

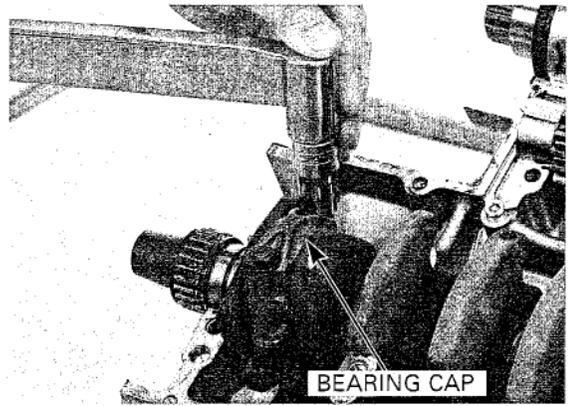
- Do not put the plastigauge over the oil hole in the crankpin.
- Do not rotate the crankshaft during inspection.



CRANKCASE/PISTON/CYLINDER

Install the bearing caps and connecting rods on a correct crankpins, and tighten the cap nuts to the specified torque.

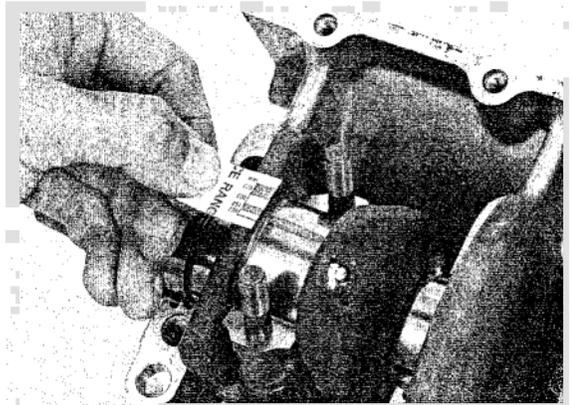
TORQUE: 35 N•m (3.6kgf•m, 26 lbf•ft)



Remove the connecting rod caps and measure the compressed plastigauge on each crankpin.

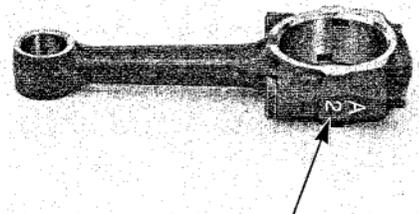
SERVICE LIMIT: 0.062mm (0.0024in)

If the connecting rod bearing clearance is beyond tolerance, select replacement bearing.



CRANKPIN BEARING SELECTION

Record the connecting rod I.D. code number (1, 2 or 3) or measure the I.D. with the bearing cap installed without bearing inserts.

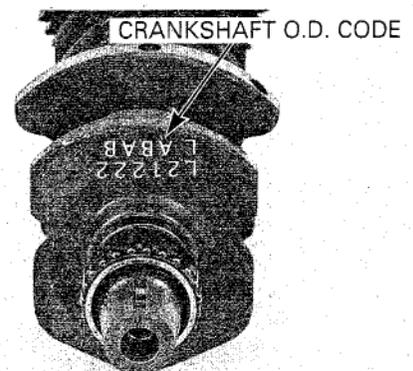


CONNECTING ROD I.D. CODE

Letters (A, B or C) on the crank weight are the codes for the crankpin O.D.s starting from the left

If you are replacing the crankshaft, record the corresponding crankpin O.D. code letter (A, B or C).

If you are reusing the crankshaft, measure the crankpin O.D. with the micrometer.

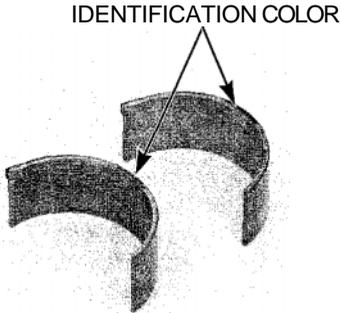


CRANKSHAFT O.D. CODE

Cross-reference the crankpin and rod codes to determine the replacement bearing color.

BEARING THICKNESS:

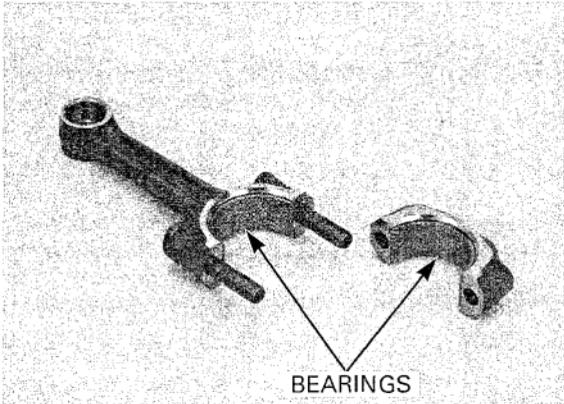
- A (Blue): Thick
- B (Black): ↑
- C (Brown): ↔
- D (Green): ↓
- E (Yellow) Thin



			CONNECTING ROD I.D. CODE		
			1	2	3
			39.000 – 39.006 (1.5354 – 1.5357)	39.006 – 39.012 (1.5357 – 1.5359)	39.012 – 39.018 (1.5359 – 1.5361)
CRANK PIN O.D. CODE	A	35.997 – 36.003 (1.4172 – 1.4174)	E (Yellow)	D (Green)	C (Brown)
	B	35.991 – 35.997 (1.4170 – 1.4172)	D (Green)	C (Brown)	B (Black)
	C	35.985 – 35.991 (1.4167 – 1.4170)	C (Brown)	B (Black)	A (Blue)

*Align the bearing
fabs with the
groove in the con-
necting rod and
bearing cap*

Install the bearing inserts into the connecting rod and bearing cap.



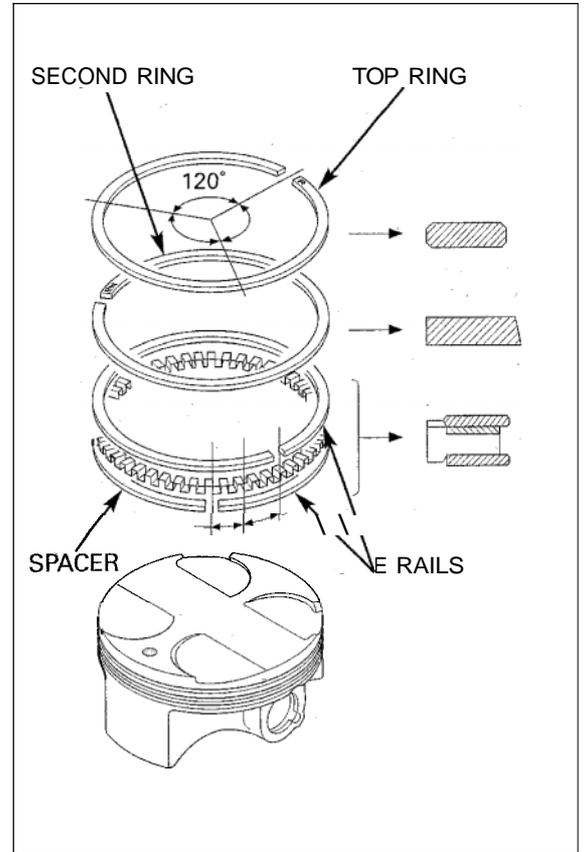
PISTON ASSEMBLY

Clean the piston ring grooves thoroughly and install the piston rings.

- Apply oil to the piston rings.
- Avoid piston and piston ring damage during installation.
- Install the piston rings with the marking (R: top ring, RN: second ring) facing up.
- Do not switch the top and second rings; the top ring is narrower than the second ring in width.

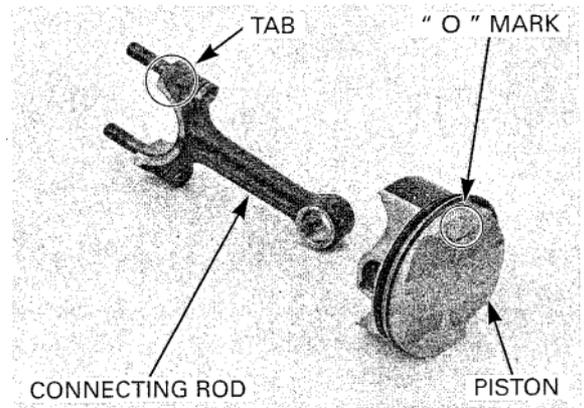
Space the piston ring end gaps 120 degrees apart. Do not align the gaps in the oil rings (side rails).

After installation, the rings should rotate freely in the ring grooves.



PISTON INSTALLATION

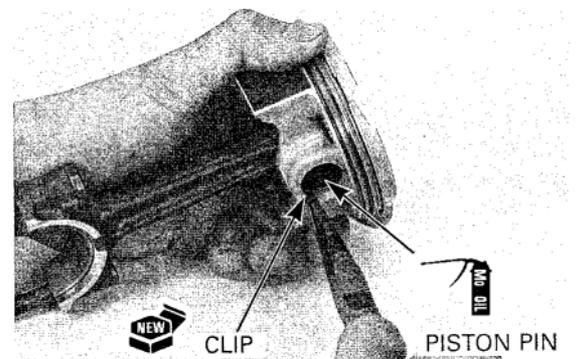
Assemble the piston and connecting rod with the journal bearing tab facing to the piston intake side ("O" mark).



Apply molybdenum disulfide oil to the piston pin outer surface.

Install the piston pin, and secure it using a new piston pin clips.

Do not align the piston pin clips end gap with the piston cut-out



Apply oil to the cylinder sleeves and piston rings.

Install the piston/connecting rod assembly with the piston "O" mark facing to the intake side.

Install the piston/connecting rod assembly into the cylinder using a commercially available piston ring compressor tool.

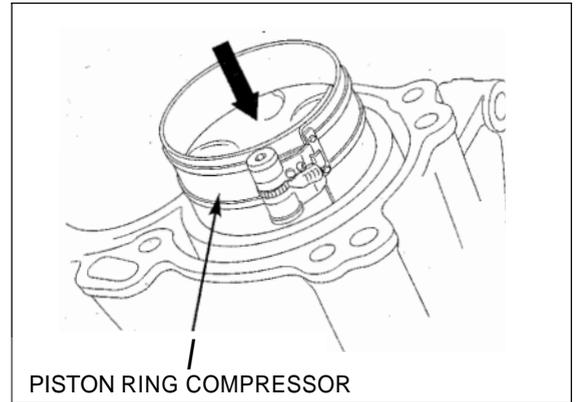
When reusing the connecting rods, they must be installed in their original locations.

NOTICE

- While installing the piston, being careful not to damage the top surface of the cylinder, especially around the cylinder bore.
- Be careful not to damage the cylinder sleeve and crankpin with the connecting rod bolt threads.

Make sure the ring compressor tool sits flush with the top surface of the cylinder

Use the handle of a plastic hammer to tap the piston into the cylinder.

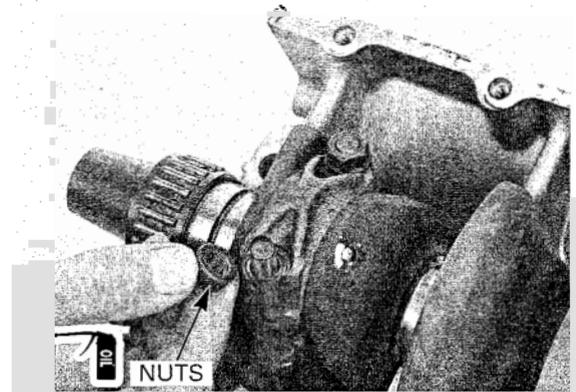


Apply molybdenum disulfide oil to the crankpin bearing surfaces.

Install the bearing cap.

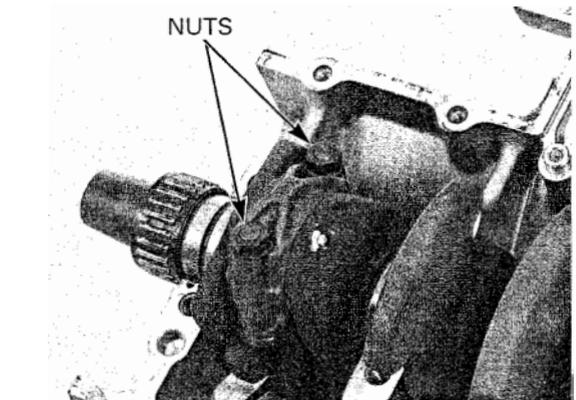
Insure that the marks on the caps are aligned with the marks on the connecting rods.

Apply oil to the connecting rod nut threads and seating surfaces.



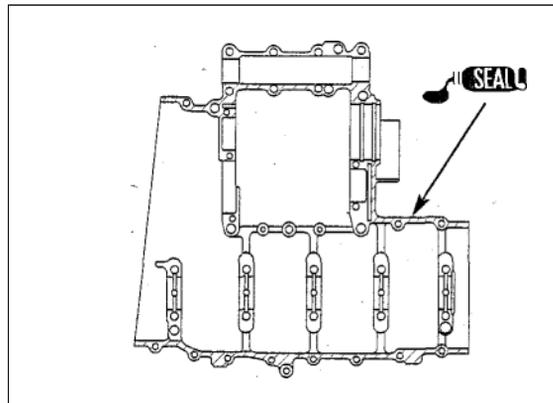
Install the connecting rod bearing cap nuts and tighten the nuts gradually and alternately, then tighten them to the specified torque.

TORQUE: 35 N•m (3.6kgf•m, 26 lbf•ft)



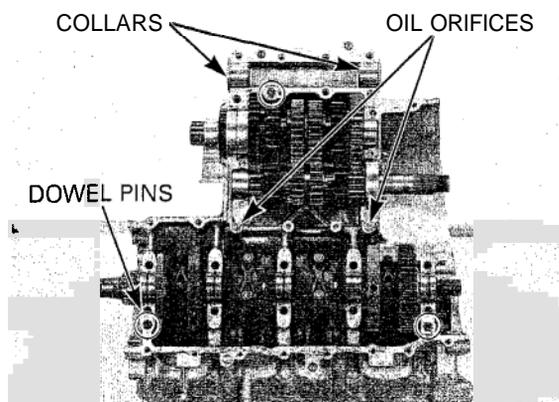
CRANKCASE COMBINATION

Apply a light, but thorough coating of liquid sealant to the crankcase mating surface except to the main bearing journal bolt (lower crankcase bolt, 9 mm) area and the oil passage area as shown.



Install the three dowel pins.
Install oil orifices aligning their cut-out with the groove in the upper crankcase.

Install the swingarm pivot collars.

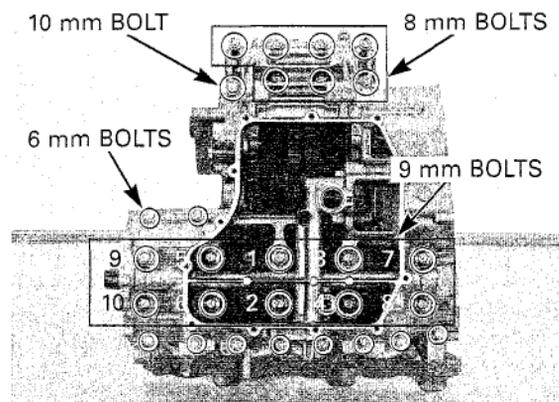


- Tighten the main journal 9 mm bolts using the Plastic Region tightening Method described below.
- Do not reuse the main journal 9 mm bolts, because the correct axial tension will not be obtained.
- The main journal 9 mm bolt is pre-coated with an oil additive for axial tension stability. Do not remove the oil additive from the new 9 mm bolt surface.

Install the lower crankcase onto the upper crankcase.

PLASTIC REGION TIGHTENING METHOD:

Install the new main journal 9 mm bolts.
Loosely install all the lower crankcase bolts.
Make sure the upper and lower crankcase are seated securely.
Make sure the swingarm pivot collar flanges are seated in the crankcase securely.



Tighten the main journal 9 mm bolts as follow:

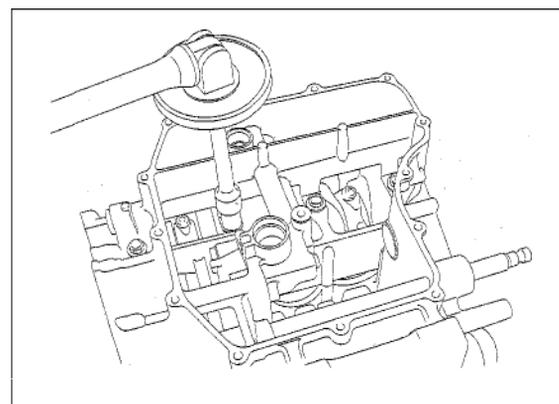
Tighten the 9 mm bolts in numerical order in the illustration to the following torque.

TORQUE: 10 N•m (1.0 kgf•m, 7 lbf•ft)

Retighten the 9 mm bolts in the same order above to the following torque..

TORQUE: 20 N•m (2.0 kgf•m, 14 lbf•ft)

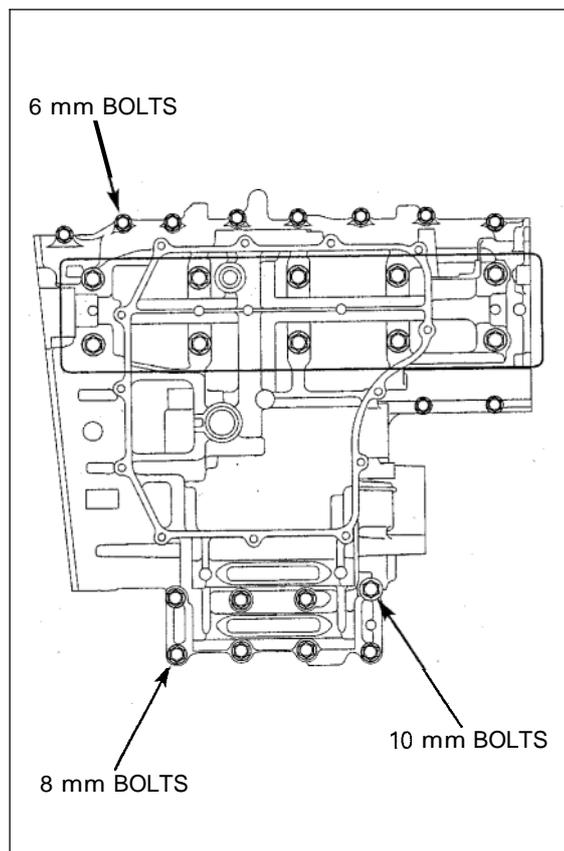
Further tighten the 9 m m bolts 150 degrees.



Tighten the 6 mm bolts securely.

Tighten the 10 mm bolt, and then 8 mm bolts to the specified torque.

TORQUE: 10 mm bolt: 39 N•m (4.0 kgf•m, 29 lbf•ft)
8 mm bolt: 25 N•m (2.5 kgf•m, 18 lbf•ft)



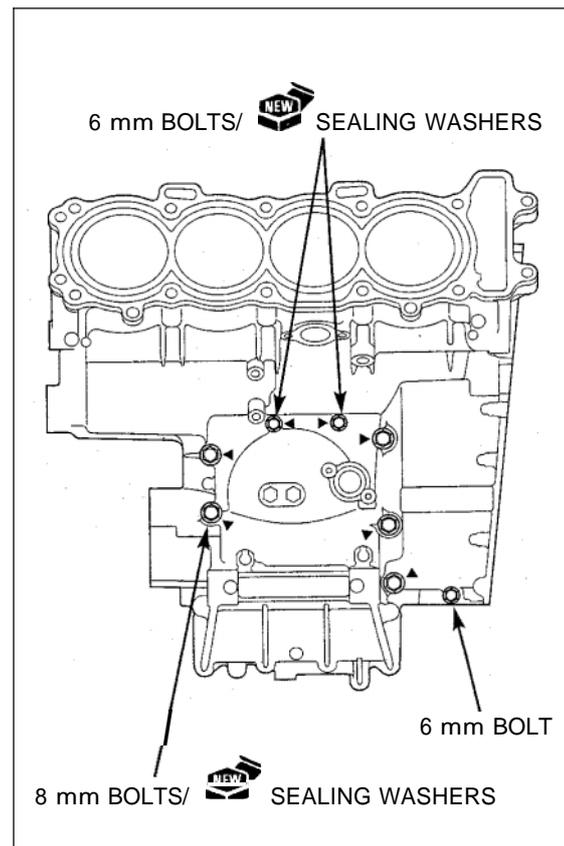
The sealing washer locations are indicated on the upper crankcase using the "A" mark

Install the upper crankcase 8 mm bolts, sealing washers and 6 mm bolt.

Tighten the 8 mm bolts to the specified torque.

TORQUE: 25 N•m (2.5 kgf•m, 18 lbf•ft)

Tighten the 6 mm bolts securely.



CRANKCASE/PISTON/CYLINDER

Apply a locking agent to the mainshaft bearing set plate bolt threads.

Install the mainshaft bearing set plate with its "OUTSIDE" mark facing out.

Tighten the mounting bolts to the specified torque.

TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

Install the removed parts in the reverse order of removal.

