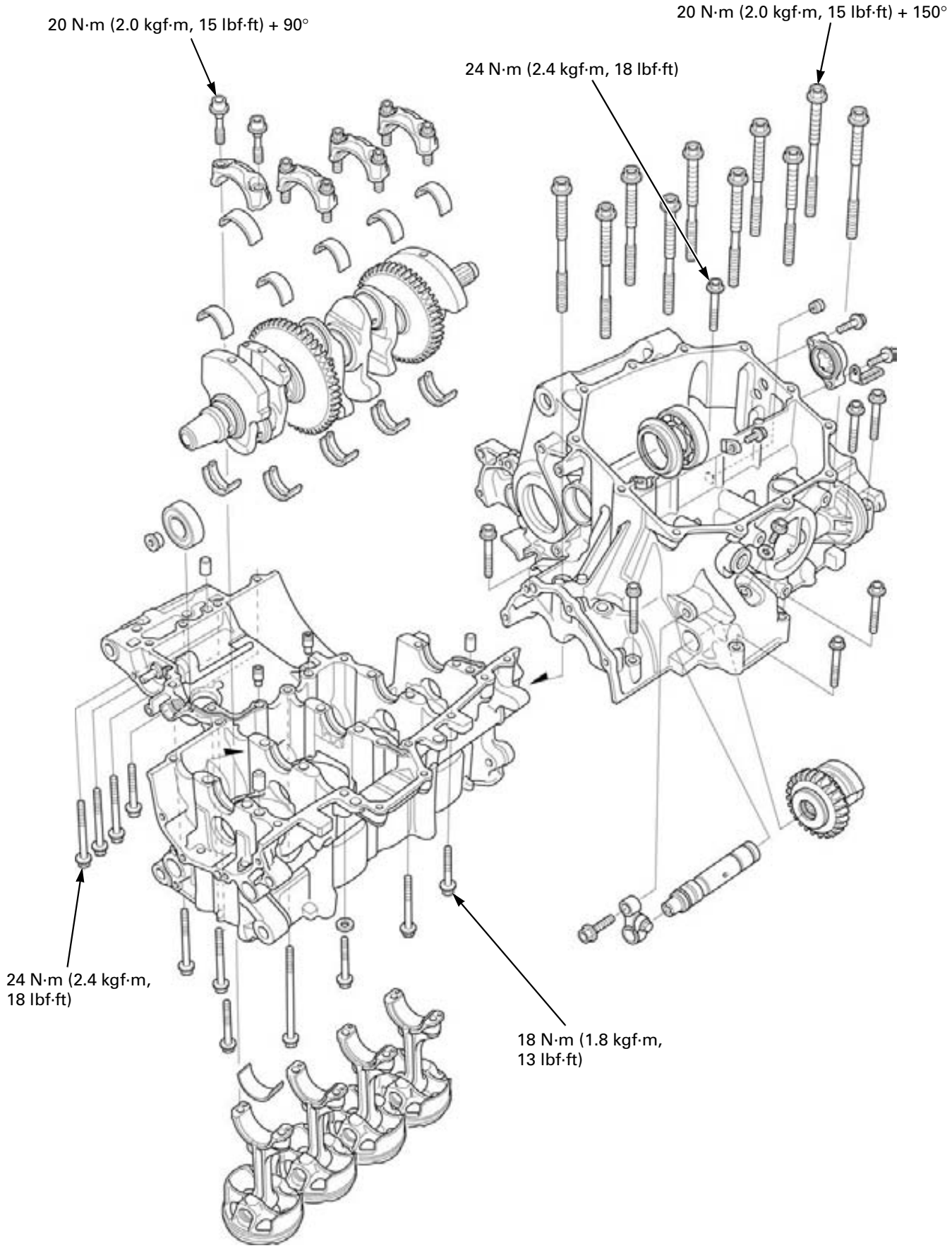
13. CRANKCASE/CRANKSHAFT/BALANCER/PISTON/CYLINDER

COMPONENT LOCATION



SERVICE INFORMATION

GENERAL

- The crankcase must be separated to service the following:
  – Crankshaft (page 13-8)
  – Piston/connecting rod/cylinder (page 13-16)
  – Balancer (page 13-29)
- The following components must be removed before separating the crankcase:
  – Engine (page 8-4)
  – Clutch (page 10-17)
  – Cylinder head (page 9-12)
  – Flywheel (page 11-7)
  – Gearshift linkage/transmission (page 12-11)
  – Oil pan (page 5-6)
  – Oil pump (page 5-8)
  – Oil cooler (page 5-12)
  – Starter clutch (page 10-28)
  – Starter motor (page 20-6)
  – Water pump (page 7-16)
- Replace the crankcase and transmission holder as an assembly.
- Be careful not to damage the crankcase mating surfaces when servicing.
- Prior to assembling the crankcase halves, apply sealant to their mating surfaces. Wipe off excess sealant thoroughly.
- Mark and store the connecting rods, bearing caps and bearing inserts to be sure of their correct locations for reassembly.
- The crankpin and main journal bearing inserts are select fit and are identified by color codes. Select replacement bearings from the code tables. After selecting new bearings, recheck the oil clearance with a plastigauge. Incorrect oil clearance can cause major engine damage.

SPECIFICATIONS

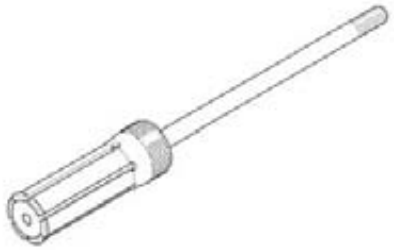
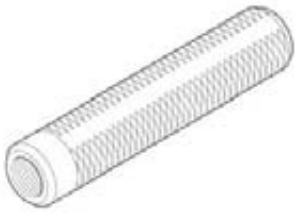
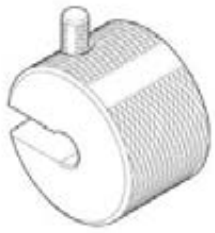
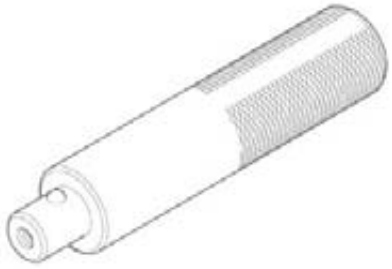
Unit: mm (in)

ITEM			STANDARD	SERVICE LIMIT
Crankshaft	Connecting rod side clearance		0.05 – 0.20 (0.002 – 0.008)	0.25 (0.098)
	Crankpin bearing oil clearance		0.030 – 0.052 (0.0012 – 0.0020)	0.06 (0.002)
	Main journal bearing oil clearance		0.019 – 0.037 (0.0007 – 0.0015)	0.05 (0.002)
	Runout		–	0.05 (0.002)
Piston, piston rings	Piston O.D. at 9.0 (0.35) from bottom		74.960 – 74.980 (2.9512 – 2.9520)	74.895 (2.9486)
	Piston pin bore I.D.		17.002 – 17.008 (0.6694 – 0.6696)	17.030 (0.6705)
	Piston pin O.D.		16.994 – 17.000 (0.6690 – 0.6693)	16.980 (0.6685)
	Piston-to-piston pin clearance		0.002 – 0.014 (0.0001 – 0.0006)	0.04 (0.002)
	Piston ring end gap	Top	0.22 – 0.32 (0.009 – 0.013)	0.52 (0.020)
		Second	0.48 – 0.63 (0.019 – 0.025)	0.82 (0.032)
		Oil (side rail)	0.2 – 0.7 (0.01 – 0.03)	1.0 (0.04)
	Piston ring-to-ring groove clearance	Top	0.050 – 0.085 (0.0020 – 0.0033)	0.125 (0.0049)
		Second	0.015 – 0.050 (0.0006 – 0.0020)	0.075 (0.0030)
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		–	0.10 (0.004)
Cylinder-to-piston clearance			0.020 – 0.055 (0.0008 – 0.0022)	0.10 (0.004)
Connecting rod small end I.D.			17.030 – 17.042 (0.6705 – 0.6709)	17.048 (0.6712)
Connecting rod-to-piston pin clearance			0.030 – 0.046 (0.0012 – 0.0018)	0.07 (0.003)

TORQUE VALUES

Crankcase	7 mm bolt	18 N·m (1.8 kgf·m, 13 lbf·ft)	
	8 mm bolt	24 N·m (2.4 kgf·m, 18 lbf·ft)	
	9 mm bolt (main journal bolt)	See page 13-23	
Lower crankcase sealing bolt (22 mm)		59 N·m (6.0 kgf·m, 44 lbf·ft)	Apply a locking agent to the threads.
Lower crankcase socket bolt (10 mm)		12 N·m (1.2 kgf·m, 9 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.
Lower crankcase socket bolt (8 mm)		23 N·m (2.3 kgf·m, 18 lbf·ft)	Apply a locking agent to the threads.
Connecting rod bolt (new bolt)		See page 13-9	Apply oil to the threads and seating surface.
Connecting rod bolt (retightening)		See page 13-13	Apply oil to the threads and seating surface.

TOOLS:

Bearing remover shaft, 35 mm 07936-3710400 	Remover shaft handle 07936-3710100 	Remover weight 07741-0010201 
Driver 07749-0010000 	Attachment, 72 x 75 mm 07746-0010600 	Pilot, 35 mm 07746-0040800 

TROUBLESHOOTING

Cylinder compression is too low, hard to starting or poor performance at low speed
- Leaking cylinder head gasket
- Worn, stuck or broken piston ring
- Worn or damaged cylinder and piston

Cylinder compression too high, overheating or knocking
- Excessive carbon built-up on piston head or combustion chamber

Excessive smoke
- Worn cylinder, piston or piston ring
- Improper installation of piston rings
- Scored or scratched piston or cylinder wall

Abnormal noise
- Worn piston pin or piston pin hole
- Worn connecting rod small end
- Worn cylinder, piston or piston rings
- Worn main journal bearings or crankpin bearings

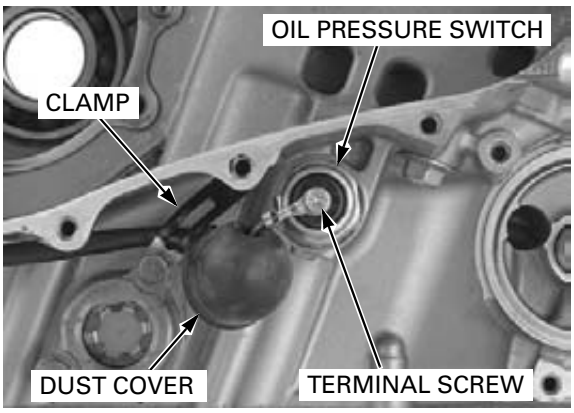
Engine vibration
- Excessive crankshaft runout
- Incorrect balancer timing

CRANKCASE SEPARATION

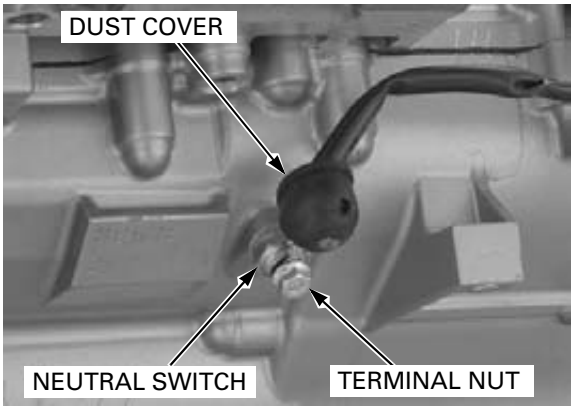
Refer to Service Information for removal of necessary parts before separating the crankcase (page 13-3).

Release the oil pressure switch wire from the clamp and remove the dust cover.

Remove the terminal screw and terminal eyelet from the oil pressure switch.

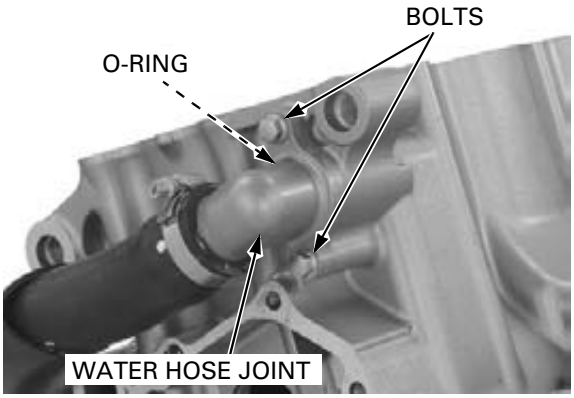


Remove the dust cover, terminal nut and terminal eyelet from the neutral switch.



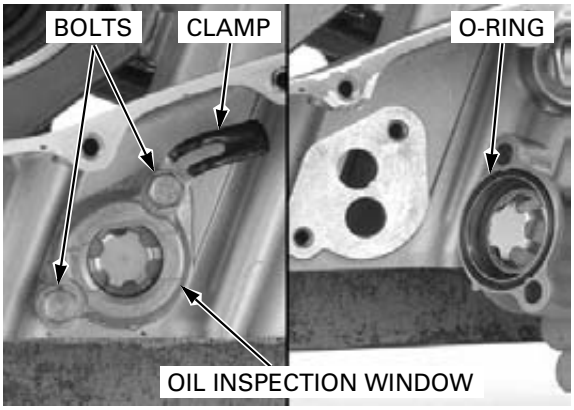
Remove the bolts and water hose joint.

Remove the O-ring from the hose joint.



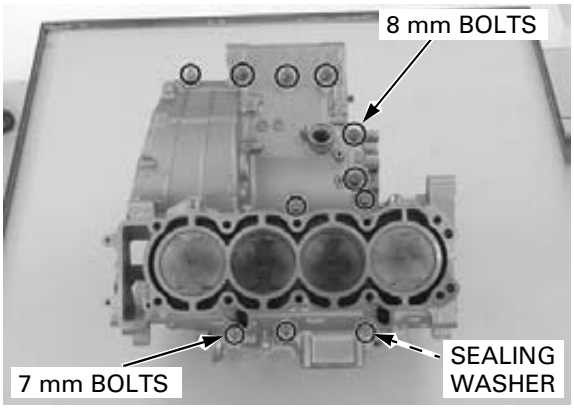
Remove the bolts, clamp and oil inspection window.

Remove the O-ring from the oil inspection window.



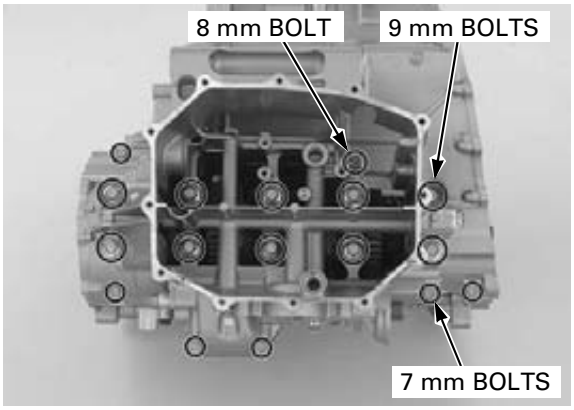
Loosen the 7 mm bolts (six) in two to three steps.
Loosen the 8 mm bolts (five) in two to three steps.

Remove the 8 mm bolts, 7 mm bolts and sealing washer.



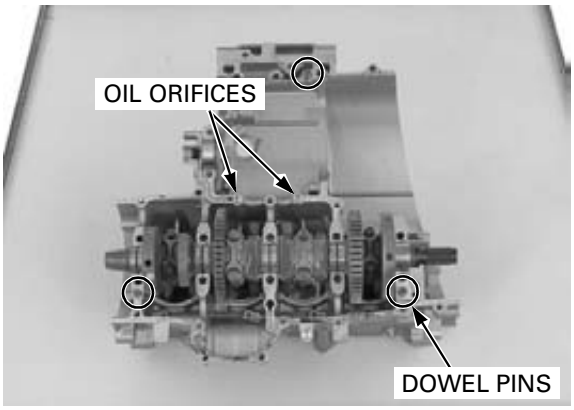
Place the engine upside down.
Loosen the 7 mm bolts (six) and 8 mm bolt in a crisscross pattern in two to three steps, then remove the bolts.
Loosen the 9 mm bolts (main journal bolts) in a crisscross pattern in two to three steps, then remove the bolts.

Separate the lower crankcase from the upper crankcase.

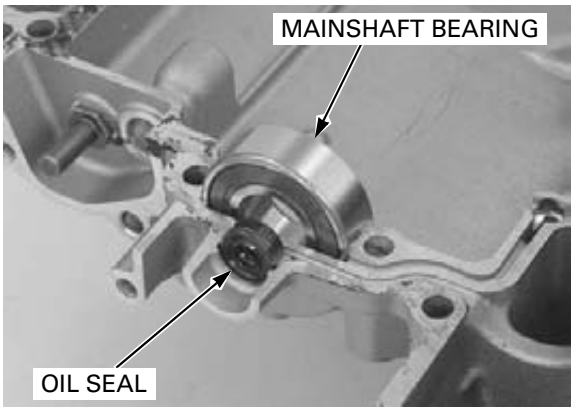


Remove the three dowel pins and two oil orifices.

Clean any sealant off from the crankcase mating surface.



Remove the mainshaft bearing and clutch lifter rod oil seal from the upper crankcase.



CRANKSHAFT

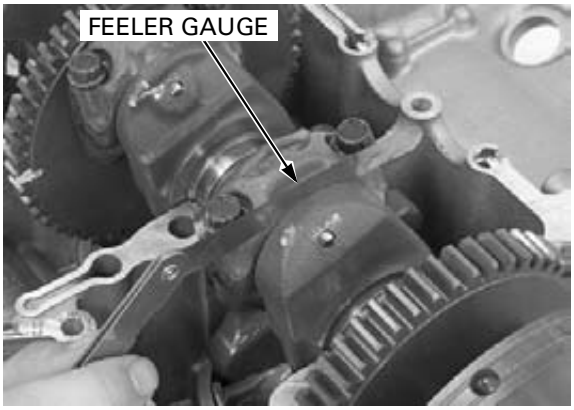
SIDE CLEARANCE INSPECTION

Separate the crankcase halves (page 13-6).

Measure the connecting rod side clearance.

SERVICE LIMIT: 0.25 mm (0.098 in)

If the clearance exceeds the service limit, replace the connecting rod.
Recheck and if still out of limit, replace the crankshaft.



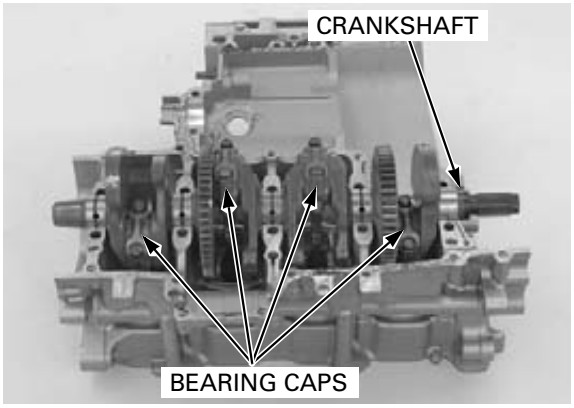
REMOVAL

Mark the bearing caps and bearings as you remove them to indicate the correct cylinder for reassembly.

Tap the side of the bearing cap lightly if it is hard to remove.

Remove the connecting rod bearing cap bolts and bearing caps.

Remove the crankshaft from the upper crankcase.

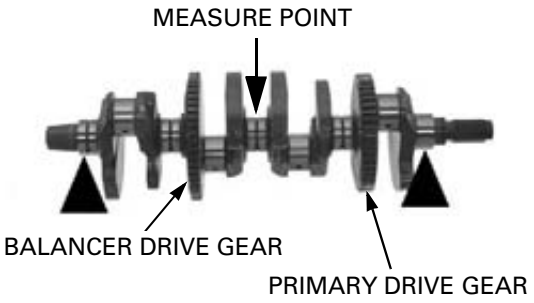


INSPECTION

Support the crankshaft on both end journals.
Set a dial gauge on the center main journal of the crankshaft.
Rotate the crankshaft two revolutions and read the runout.

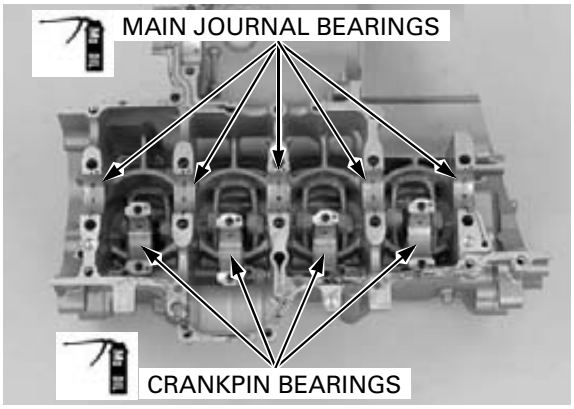
SERVICE LIMIT: 0.05 mm (0.002 in)

Check the primary drive gear and balancer drive gear teeth for abnormal wear or damage.

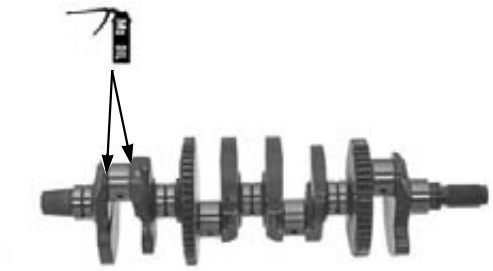


INSTALLATION

Apply molybdenum oil solution to the main journal bearing sliding surfaces on the upper crankcase and the crankpin bearing sliding surfaces on the connecting rods.



Apply molybdenum oil solution to each thrust surface of the crankshaft as shown.



NOTICE

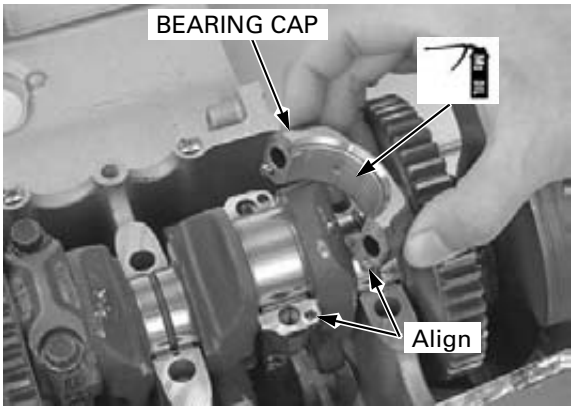
Position all the pistons at TDC (Top Dead Center) to prevent connecting rod from damaging the crankpin.

Install the crankshaft carefully onto the upper crankcase.

Set the connecting rods onto the crankpins.

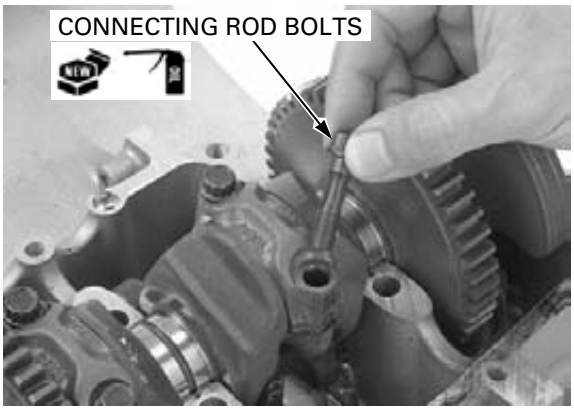
Apply molybdenum oil solution to the crankpin bearing sliding surfaces on the connecting rod bearing caps.

Install the connecting rod bearing caps, aligning the dowel pins with the holes in the connecting rods. Be sure each part is installed in its original position, as noted during removal.



The connecting rod bolts cannot be reused. Once the connecting rod bolts have been loosened, replace them with new ones.

Apply oil to new connecting rod bearing cap bolt threads and seating surfaces, and install the bolts.



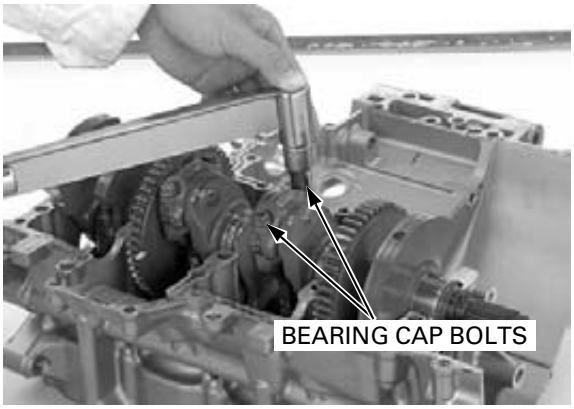
Tighten the connecting rod bearing cap bolts with a Plastic Region Tightening Method.

Tighten the bolts in two to three steps alternately, then tighten the bolts to the specified torque.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)

Further tighten the connecting rod bearing cap bolts 90 degrees.

Assemble the upper and lower crankcase (page 13-23).



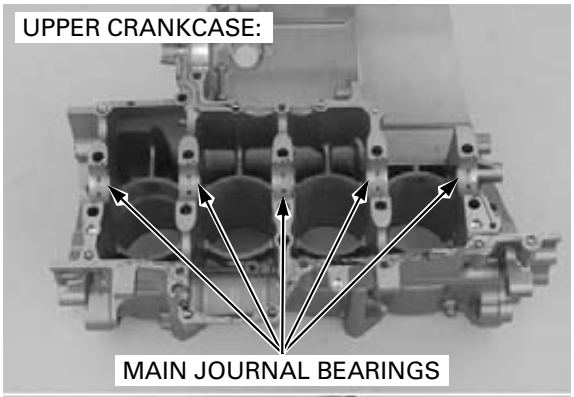
MAIN JOURNAL BEARING

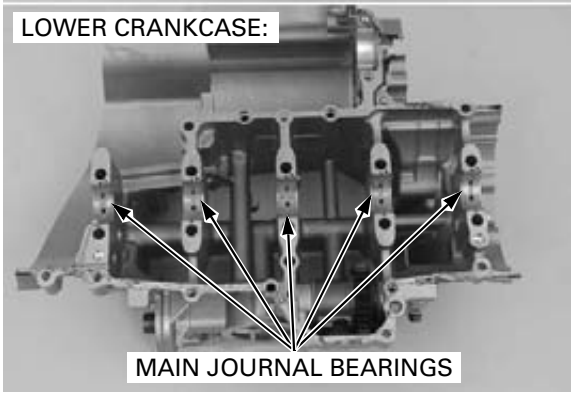
BEARING INSPECTION

Remove the crankshaft (page 13-8).

Inspect the main journal bearing inserts on the upper and lower crankcase halves for unusual wear or peeling.

Check the bearing tabs for damage.

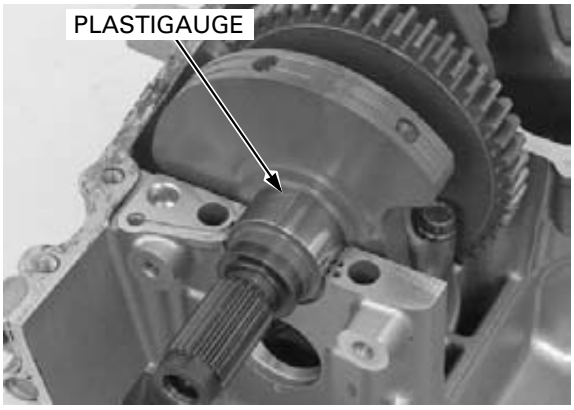




OIL CLEARANCE INSPECTION

Clean off any oil from the bearing inserts and main journals.
Install the crankshaft onto the upper crankcase.
Put a strip of plastigauge lengthwise on each main journal avoiding the oil hole.

- Do not rotate the crankshaft during inspection.

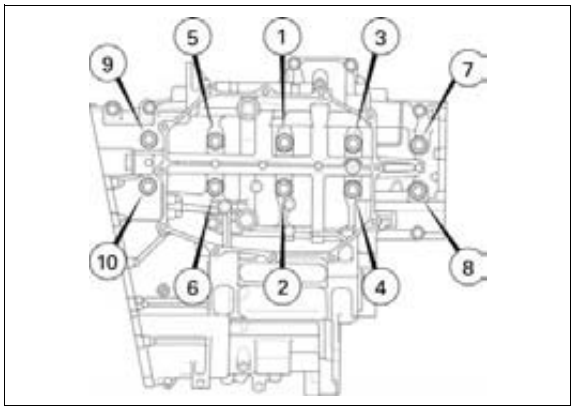


Install the three dowel pins (page 13-24).

Install the lower crankcase onto the upper crankcase, then install the crankcase 9 mm bolts (main journal bolts).

Tighten the 9 mm bolts in numerical order to the specified torque.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)

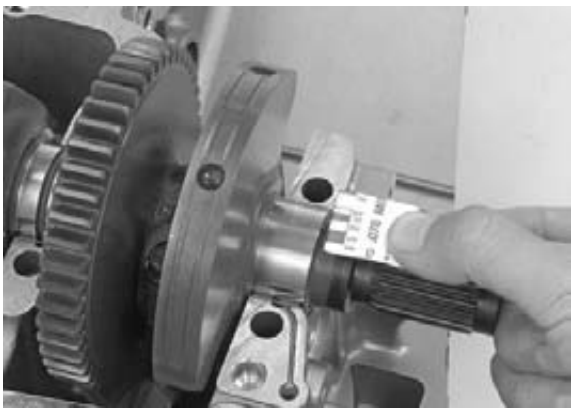


Further tighten the 9 mm bolts 150 degrees.

Remove the crankcase 9 mm bolts (main journal bolts) and the lower crankcase, measure the compressed plastigauge at its widest point on each main journal to determine the oil clearance.

SERVICE LIMIT: 0.05 mm (0.002 in)

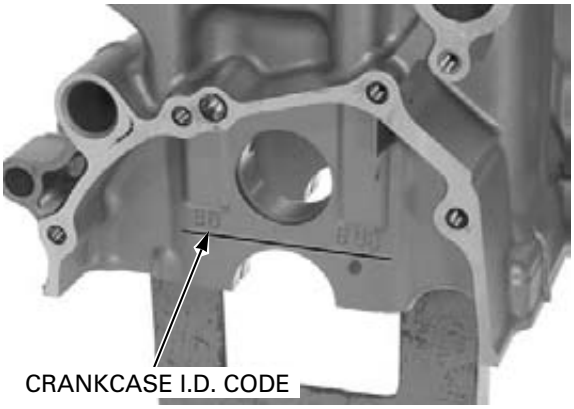
If the oil clearance exceeds the service limit, select a replacement bearing (page 13-12).



BEARING SELECTION

Letters (A, B or C) on the left side of upper crankcase are codes for the bearing support I.D. from left to right.

Record the crankcase bearing support I.D. code letters from the left side of the upper crankcase as shown.



Numbers (1, 2 or 3) on the crank weight are codes for the main journal O.D. from left to right.

Record the corresponding main journal O.D. code numbers from the crank weight.

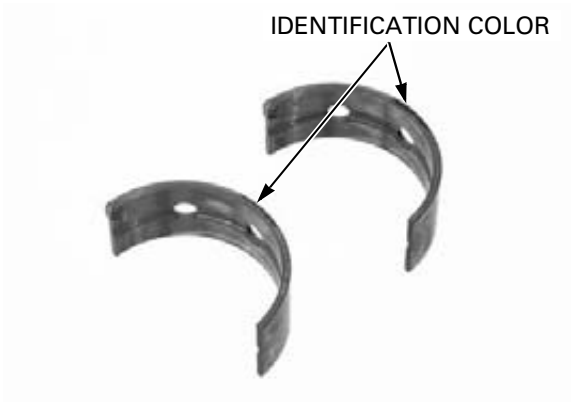
Cross reference the main journal and bearing support codes to determine the replacement bearing color code.

MAIN JOURNAL BEARING SELECTION TABLE:

			BEARING SUPPORT I.D.CODE		
			A	B	C
			37.000 – 37.006 mm (1.4567 – 1.4569 in)	37.006 – 37.012 mm (1.4569 – 1.4572 in)	37.012 – 37.018 mm (1.4572 – 1.4574 in)
MAIN JOURNAL O.D. CODE	1	34.000 – 34.006 mm (1.3386 – 1.3388 in)	Red	Pink	Yellow
	2	33.994 – 34.000 mm (1.3383 – 1.3386 in)	Pink	Yellow	Green
	3	33.988 – 33.994 mm (1.3381 – 1.3383 in)	Yellow	Green	Brown

BEARING THICKNESS:

Brown: **Thickest**
Green:
Yellow:
Pink:
Red: **Thinnest**

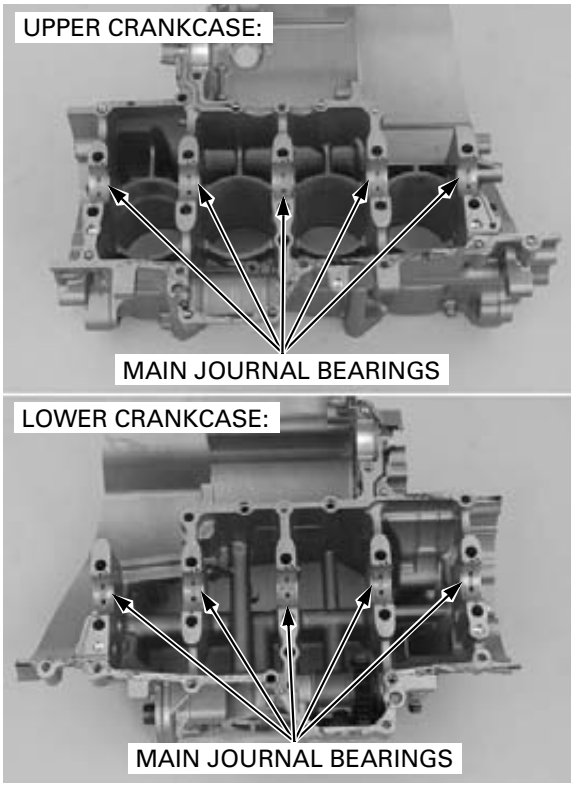


NOTICE

After selecting new bearings, recheck the clearance with a plastigauge. Incorrect clearance can cause severe engine damage.

BEARING INSTALLATION

Clean the bearing outer surfaces and crankcase bearing supports.
Apply molybdenum oil solution to the main journal bearing sliding surfaces on the upper and lower crankcase.
Install the main journal bearing inserts onto the crankcase bearing supports, aligning each tabs with each grooves.



CRANKPIN BEARING

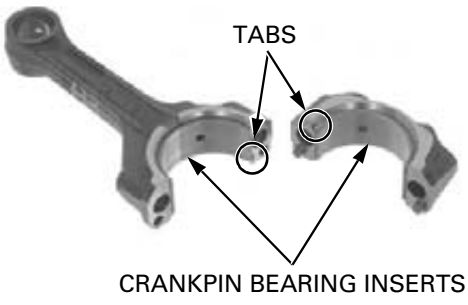
NOTICE

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 crankshaft (page 13-8).

BEARING INSPECTION

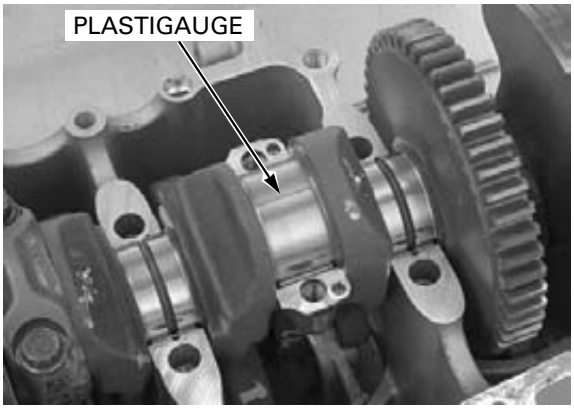
Check the bearing inserts for unusual wear or peeling.
Check the bearing tabs for damage.



OIL CLEARANCE INSPECTION

Clean off any oil from the bearing inserts and crankpins.
Carefully install the crankshaft onto the upper crankcase.
Set the connecting rods onto the crankpins.
Put a strip of plastigauge lengthwise on each crankpin avoiding the oil hole.

- Do not rotate the crankshaft during inspection.



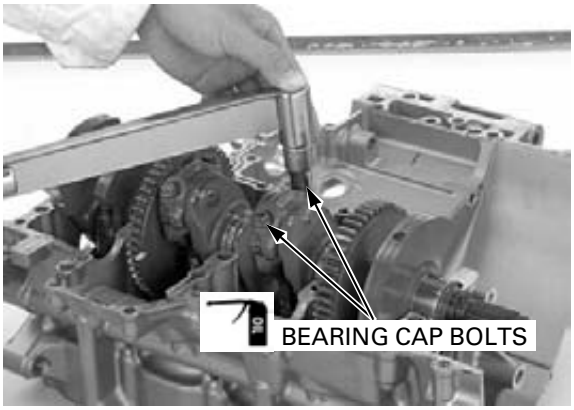
Carefully install the connecting rod bearing caps, aligning the dowel pins with the holes in the connecting rods.

Use the removed connecting rod bolts when checking the oil clearance.

Apply oil to the connecting rod bearing cap bolt threads and seating surfaces and install the bolts.
Tighten the bolts in two to three steps alternately, then tighten the bolts to the specified torque.

TORQUE: 14 N·m (1.4 kgf·m, 10 lbf·ft)

Further tighten the connecting rod bearing cap bolts 90 degrees.



Remove the bolts and bearing caps, and measure the compressed plastigauge at its widest point on the crankpin to determine the oil clearance.

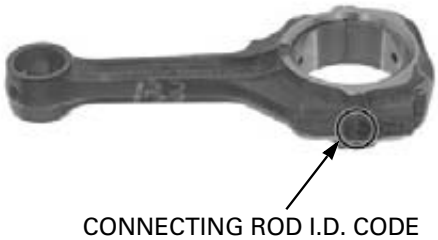
SERVICE LIMIT: 0.06 mm (0.002 in)

If the oil clearance exceeds the service limit, select the correct replacement bearings (page 13-14).

BEARING SELECTION

Numbers (1, 2 or 3) on the connecting rods are the codes for the connecting rod I.D.

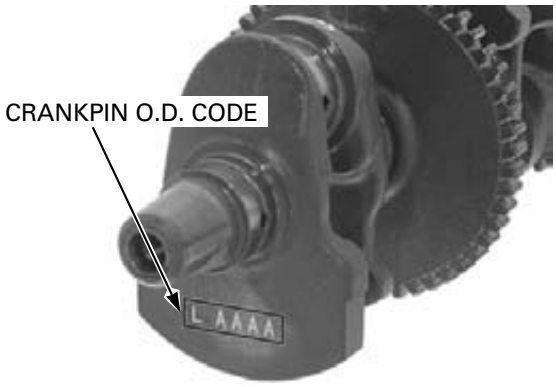
Record the connecting rod I.D. code number (1, 2 or 3) or measure the I.D. with the connecting rod bearing cap installed without bearing inserts.



Letters (A, B or C) on the crankweight are the codes for the crankpin O.D.s from left to right.

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.



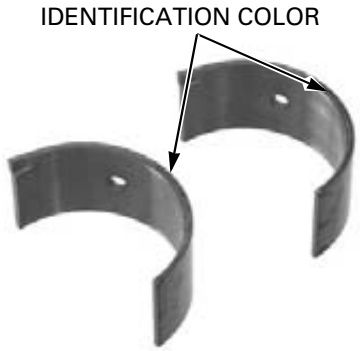
Cross-reference the connecting rod and crankpin codes to determine the replacement bearing color.

CRANKPIN BEARING SELECTION TABLE:

			CONNECTING ROD I.D.CODE		
			1	2	3
			39.500 – 39.506 mm (1.5551 – 1.5554 in)	39.506 – 39.512 mm (1.5554 – 1.5556 in)	39.512 – 39.518 mm (1.5556 – 1.5558 in)
CRANK PIN O.D.CODE	A	36.497 – 36.503 mm (1.4369 – 1.4371 in)	Yellow	Green	Brown
	B	36.491 – 36.497 mm (1.4367 – 1.4369 in)	Green	Brown	Black
	C	36.485 – 36.491 mm (1.4364 – 1.4367 in)	Brown	Black	Blue

BEARING THICKNESS:

Blue: **Thickest**
Black:
Brown:
Green:
Yellow: **Thinnest**

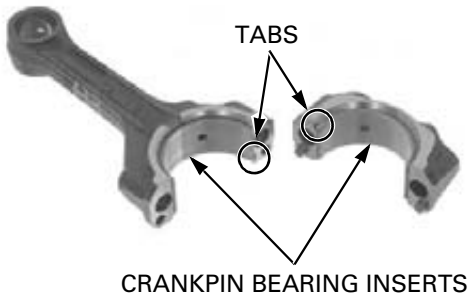


NOTICE

After selecting new bearings, recheck the clearance with a plastigauge. Incorrect clearance can cause severe engine damage.

BEARING INSTALLATION

Clean the bearing outer surfaces, connecting rod bearing cap and connecting rod.
Install the crankpin bearing inserts onto the bearing cap and connecting rod, aligning each tab with each groove.



PISTON/CYLINDER

PISTON/CONNECTING ROD REMOVAL

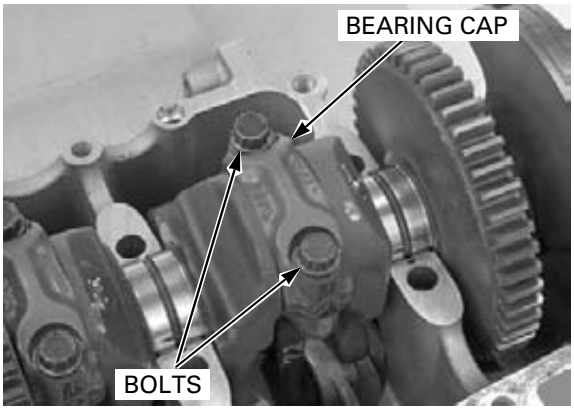
NOTICE

- *This motorcycle is equipped with aluminum cylinder sleeves. Before piston removal, place a clean shop towel around the connecting rod to prevent damaging the cylinder sleeve.*
- *Do not try to remove the piston/connecting rod assembly from bottom of the cylinder; the assembly will get stuck in the gap between the cylinder liner and the upper crankcase.*
- *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.*

Separate the crankcase halves (page 13-6).

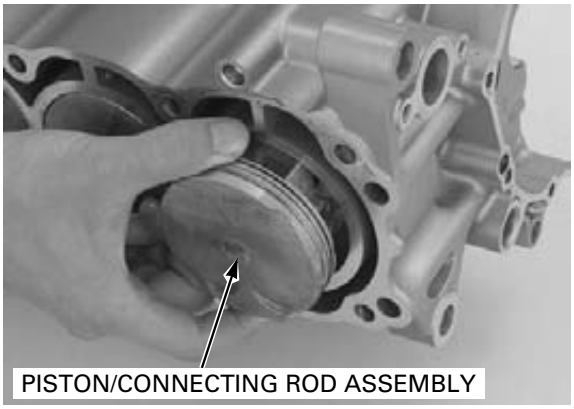
Mark all parts as you remove them to indicate the correct cylinder for reassembly.

Remove the bolts and connecting rod bearing caps.



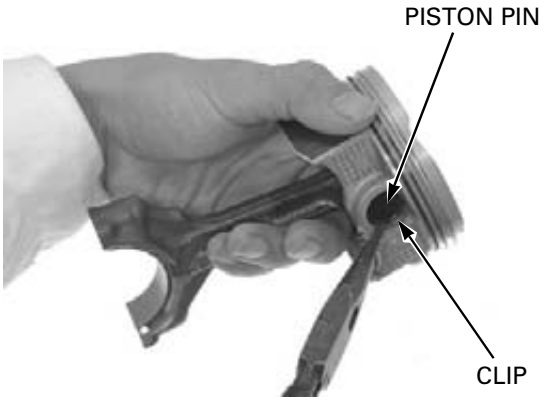
Do not try to remove the connecting rod/piston assembly from the bottom of the cylinder; the assembly will be locked so that the oil ring expands in the gap between the cylinder liner and the upper crankcase.

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



PISTON REMOVAL

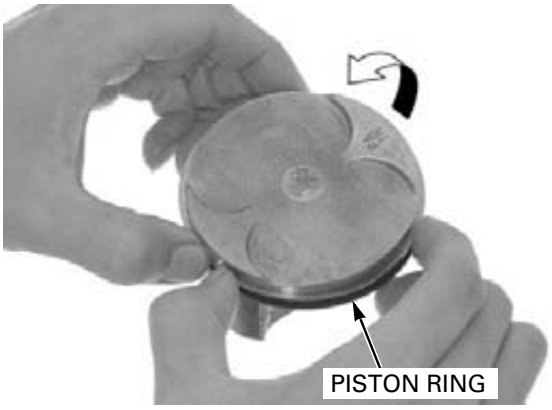
Remove the piston pin clip with pliers.
Push the piston pin out of the piston and connecting rod, and remove the piston.



PISTON DISASSEMBLY

Be careful not to damage the piston ring by spreading the ends too far.

Spread each piston ring ends and remove them by lifting up at a point opposite the gap.



Never use a wire brush; it will scratch the groove.

Clean carbon deposits from the piston ring grooves with a ring that will be discarded.

PISTON INSPECTION

Inspect the piston rings for movement by rotating the rings. The rings should be able to move in their grooves without catching.

Push the ring until the outer surface of the piston ring is nearly flush with the piston and measure the ring-to-ring groove clearance.

SERVICE LIMITS:

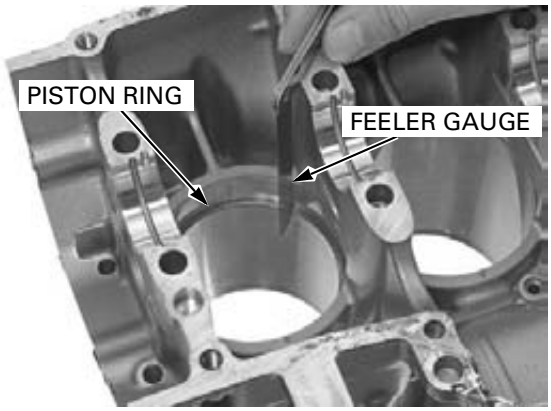
Top:	**0.125 mm (0.0049 in)**
Second:	**0.075 mm (0.0030 in)**

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

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

SERVICE LIMITS:

Top:	**0.52 mm (0.020 in)**
Second:	**0.82 mm (0.032 in)**
Oil (side rail):	**1.0 mm (0.04 in)**



Measure the piston pin bore.

SERVICE LIMIT: 17.030 mm (0.6705 in)

Measure the O.D. of the piston pin.

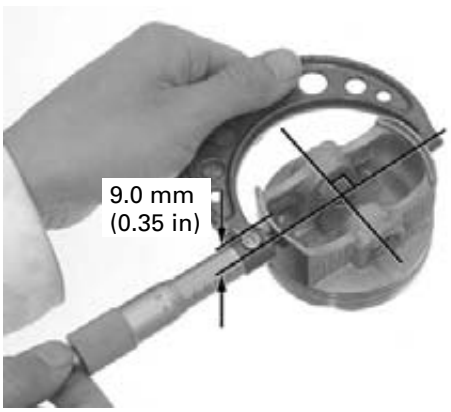
SERVICE LIMIT: 16.980 mm (0.6685 in)

Calculate the piston-to-piston pin clearance.

SERVICE LIMIT: 0.04 mm (0.002 in)

Measure the diameter of the piston at 9.0 mm (0.35 in) from the bottom and 90 degrees to the piston pin hole.

SERVICE LIMIT: 74.895 mm (2.9486 in)



CONNECTING ROD INSPECTION

Measure the connecting rod small end I.D.

SERVICE LIMIT: 17.048 mm (0.6712 in)

Calculate the connecting rod-to-piston pin clearance.

SERVICE LIMIT: 0.07 mm (0.003 in)

CYLINDER INSPECTION

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.

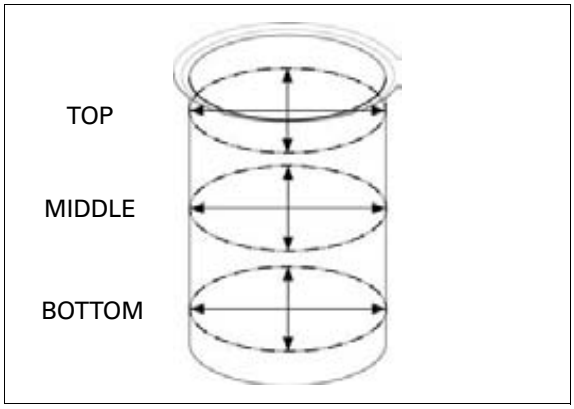
SERVICE LIMIT: 75.15 mm (2.959 in)

Calculate the piston-to-cylinder clearance.
Take a maximum reading to determine the clearance.
Refer to the procedures for measurement of the piston O.D. (page 13-18).

SERVICE LIMIT: 0.10 mm (0.004 in)

Calculate the taper and out-of-round at three levels in X and Y axis. 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)



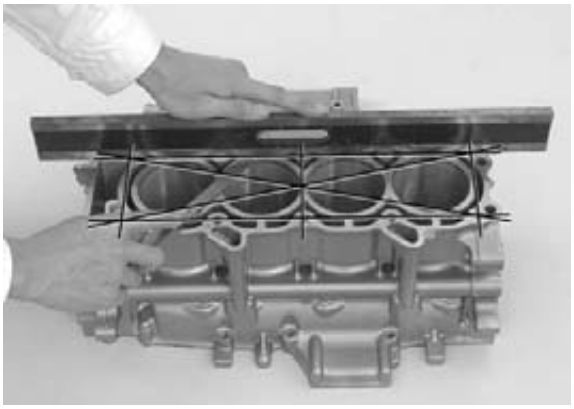
The cylinder must be rebored and an oversize piston fitted if the service limits are exceeded.

The following oversize piston is available:
0.25 mm (0.010 in)

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

Inspect the top of the cylinder for warpage.

SERVICE LIMIT: 0.10 mm (0.004 in)



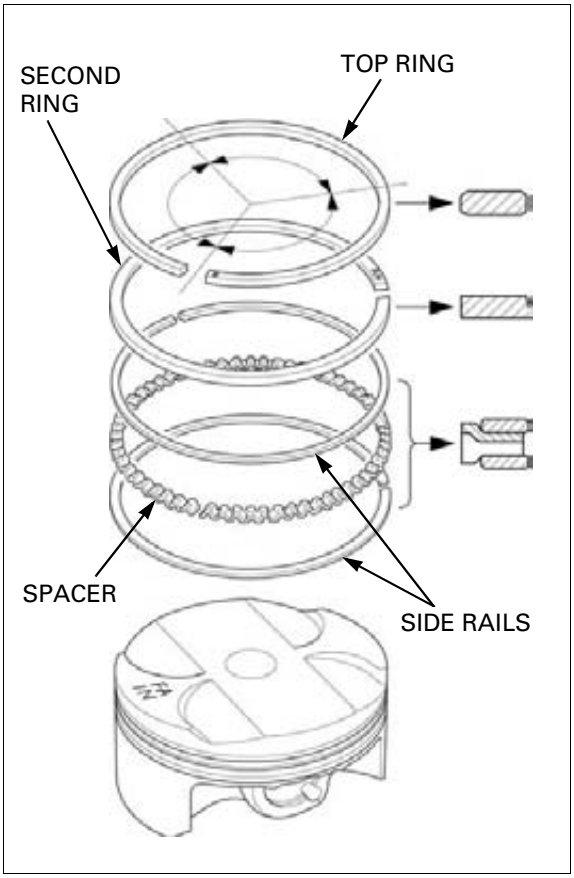
PISTON ASSEMBLY

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 confuse the top and second rings.
- To install the oil ring, install the spacer first, then install the side rails.

Stagger the piston ring end gaps 120° apart from each other.
Stagger the side rail end gaps as shown.

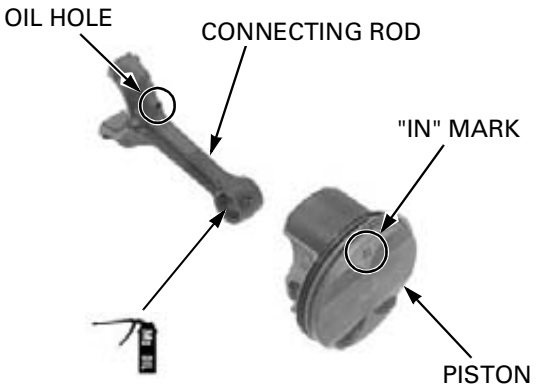
After installation, the rings should rotate freely in the ring groove.



PISTON INSTALLATION

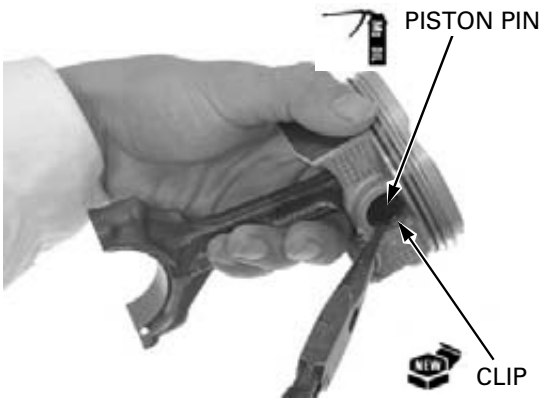
Apply molybdenum oil solution to the connecting rod small end inner surfaces and piston pin outer surfaces.

Assemble the piston and connecting rod so that the piston "IN" mark aligns with the oil hole on the connecting rod.

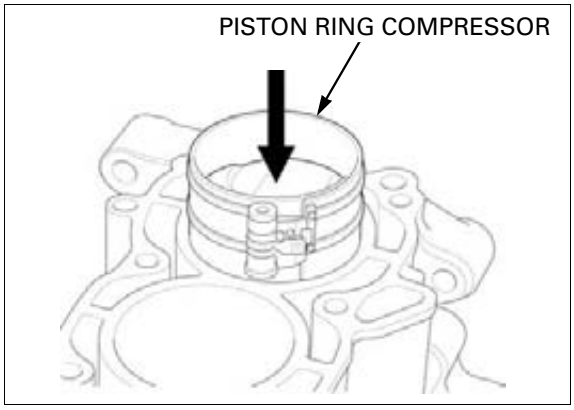


Install the piston pin and secure it using new piston pin clips.

- Make sure that the piston pin clips are seated in the groove securely.
- Do not align the piston pin clip end gap with the cut-out of the piston bore.



Coat the cylinder walls, piston outer surfaces and piston rings with engine oil.



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

Install the piston/connecting rod assemblies into the cylinders 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, be 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.*

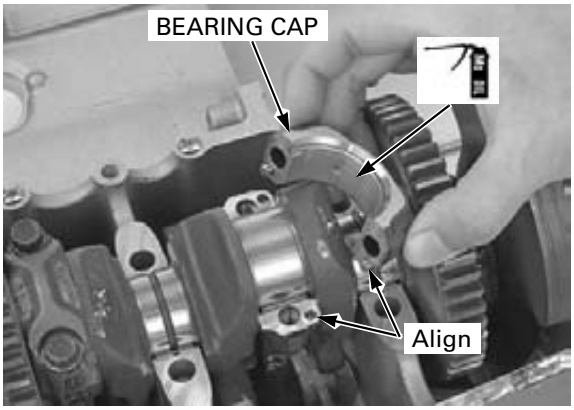
Make sure the piston ring compressor tool sits flush on the top surface of the cylinder.

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

Install the crankshaft (page 13-9).

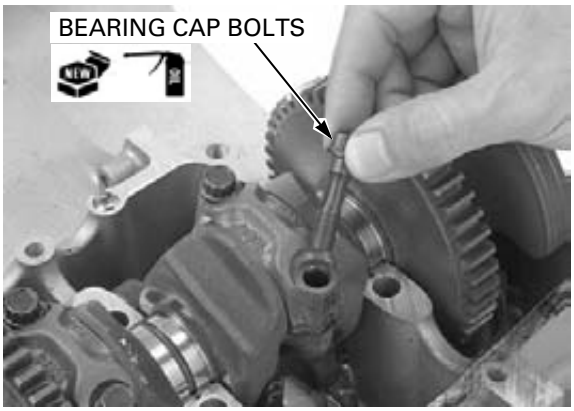
Apply molybdenum oil solution to the crankpin bearing sliding surface on the bearing caps.

Install the connecting rod bearing caps, aligning the dowel pins with the holes in the connecting rods.



The connecting rod bolts cannot be reused. Once the connecting rod bolts have been loosened replace them with new ones.

Apply oil to new connecting rod bearing cap bolt threads and seating surfaces, and install the bolts.

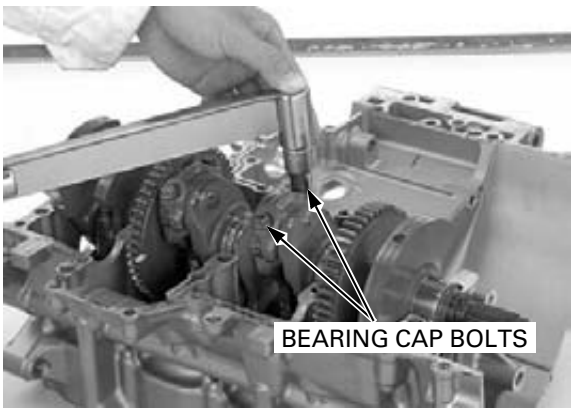


Tighten the bolts in two to three steps alternately.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)

Further tighten the connecting rod bearing cap bolts 90 degrees.

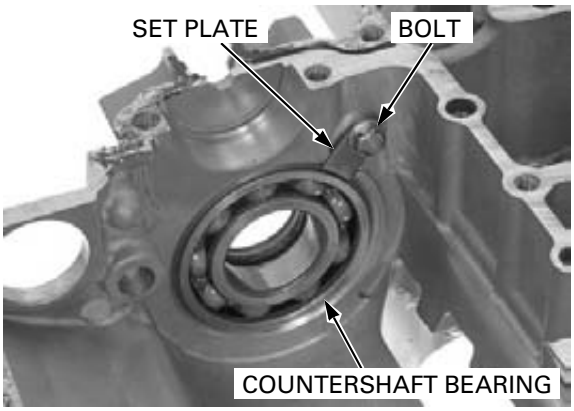
Assemble the crankcase halves (page 13-23).



COUNTERSHAFT BEARING REPLACEMENT

Separate the crankcase halves (page 13-6).
Remove the main journal bearings from the lower crankcase (page 13-10).

Remove the bolt and bearing set plate.



Remove the countershaft bearing from the lower crankcase using the special tool.

TOOLS:

Bearing remover shaft, 35 mm	**07936-3710400**
Remover shaft handle	**07936-3710100**
Remover weight	**07741-0010201**

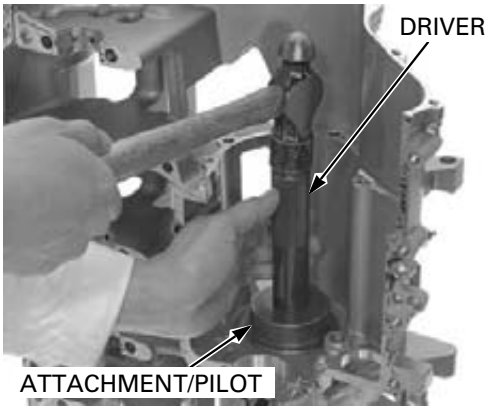
Remove the countershaft oil seal from inside of the crankcase.

Apply grease to new countershaft oil seal lips and install it from inside of the crankcase.

Drive the countershaft bearing into the lower crankcase using the special tool.

TOOLS:

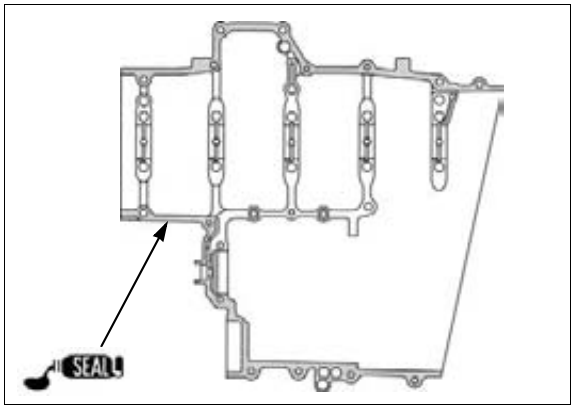
Driver	**07749-0010000**
Attachment, 72 x 75 mm	**07746-0010600**
Pilot, 35 mm	**07746-0040800**



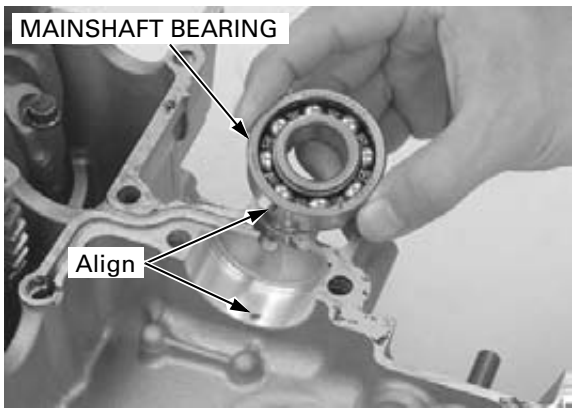
CRANKCASE ASSEMBLY

Replace the transmission bearing holder and crankcase as a set.

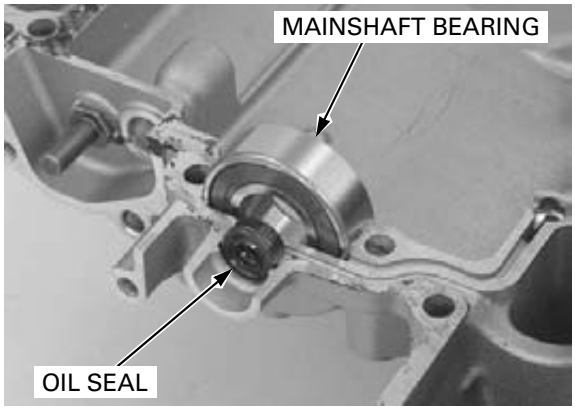
Apply a light, but thorough, coating of liquid sealant (Three Bond 1207B) to the crankcase mating surface. Do not apply sealant to the crankcase 9 mm bolt (main journal bolt) area and the oil passage area as shown.



Install the mainshaft bearing while aligning its locating pin with the crankcase hole.

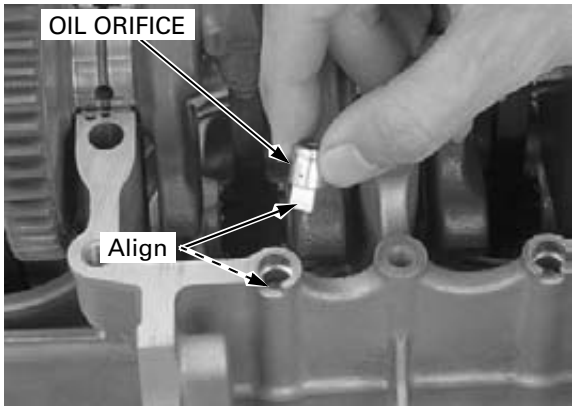


Install the clutch lifter rod oil seal.

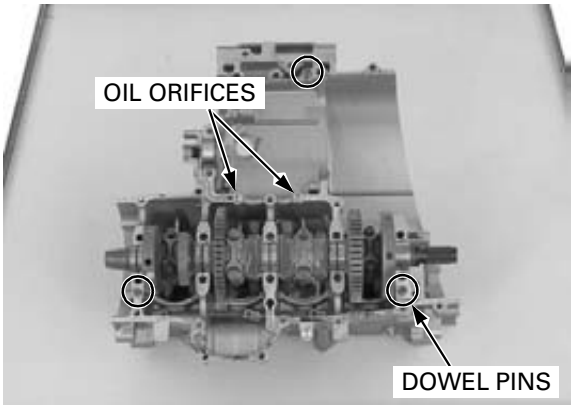


Align each flat of the oil orifice and crankcase.

Install the oil orifices in the upper crankcase.

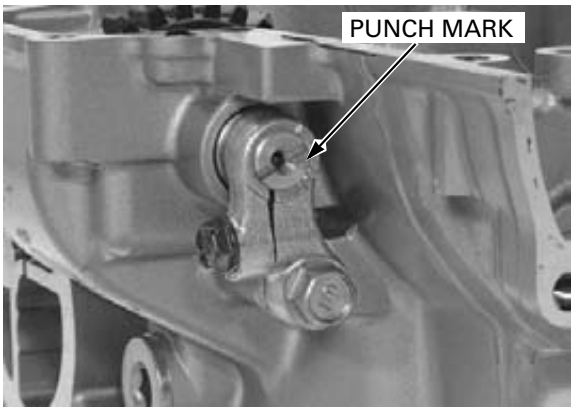


Install the three dowel pins.

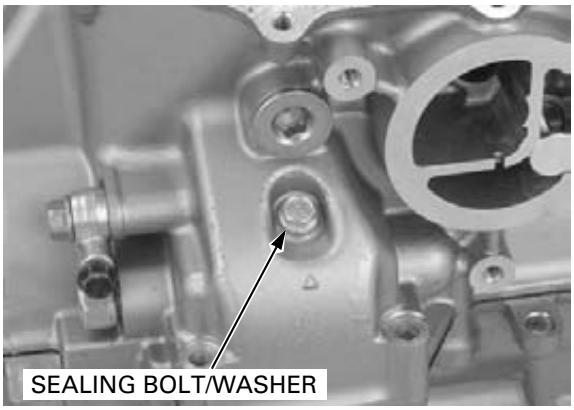


BALANCER TIMING ALIGNMENT/ UPPER CRANKCASE INSTALLATION

1. Avoid damaging the balancer drive and driven gear, turn the balancer shaft and place the punch mark facing down, make the balancer backlash maximum.



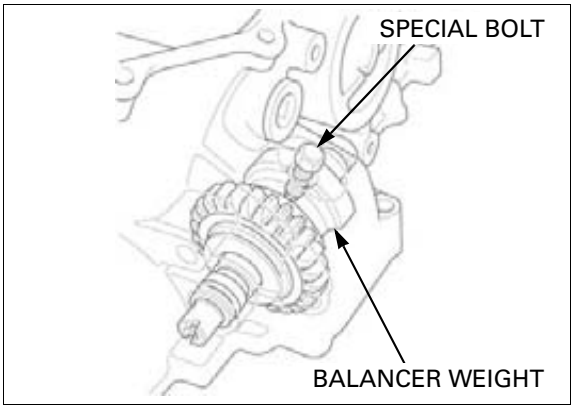
2. Remove the sealing bolt and sealing washer from the lower crankcase.



3. Temporarily install the special bolt into the sealing bolt hole, hold the balancer weight securely.

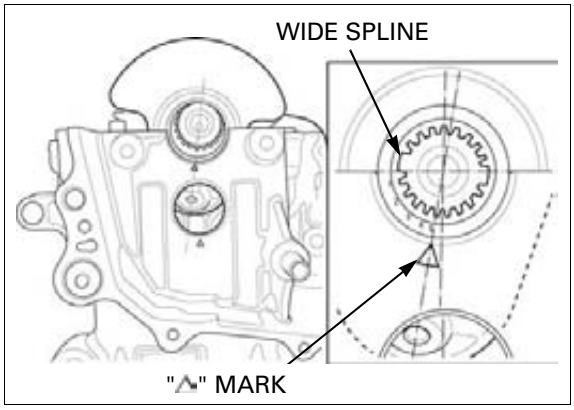
   Make sure the special bolt tip into the balancer weight hole.

   Special bolt, 6 x 18 mm: 90004-MM5-00



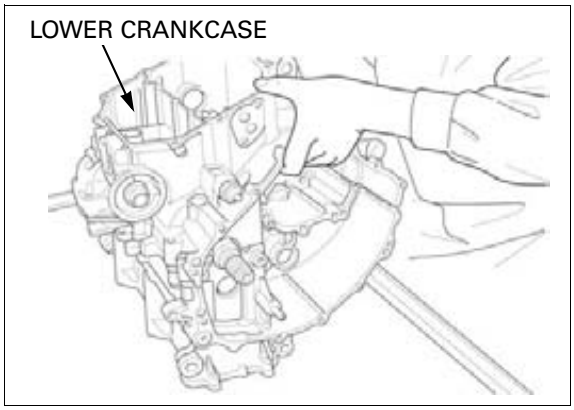
4. Place the crankshaft onto the upper crankcase so that the No.1 piston at TDC (Top Dead Center).

   Slightly turn the crankshaft clockwise and align the crankshaft 5th spline center (from the wide spline) with the "△" mark on the upper crankcase as shown.



5. Carefully place the lower crankcase onto the upper crankcase.

NOTE:
The crankshaft will slightly move counterclockwise when engaging the balancer gears.



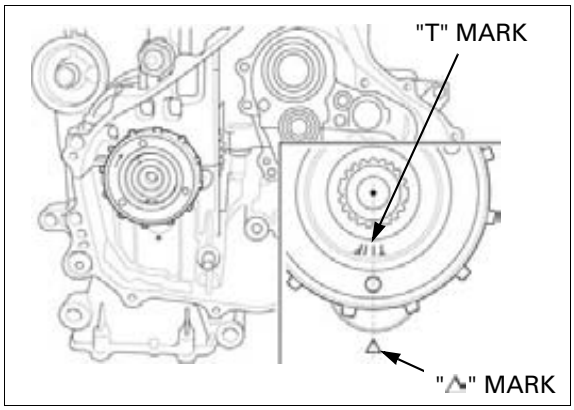
6. Check that the upper and lower crankcase seats properly.

   Check that the crankshaft 5th spline center aligns with the next "△" mark on the upper crankcase as shown.

Temporarily install the starter clutch assembly to check the TDC.

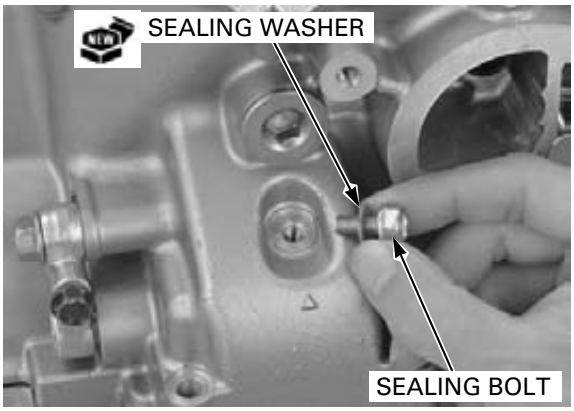
   Make sure the No.1 piston at TDC (Top Dead Center).

   If the crankshaft is not proper position, reassemble the crankcase halves from the beginning.



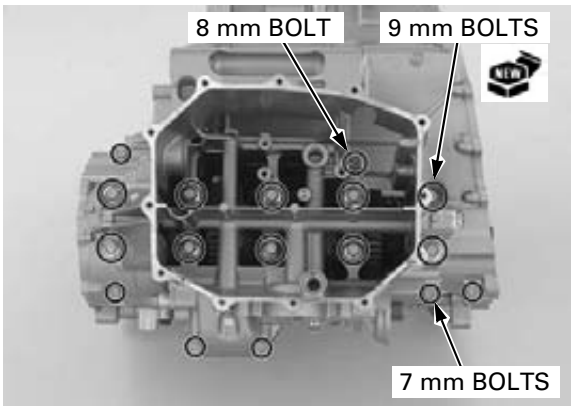
7. Remove the temporarily installed special bolt from the balancer weight.

   Install a new sealing washer and bolt, and tighten the bolt securely.



CRANKCASE BOLT TIGHTENING PROCEDURE

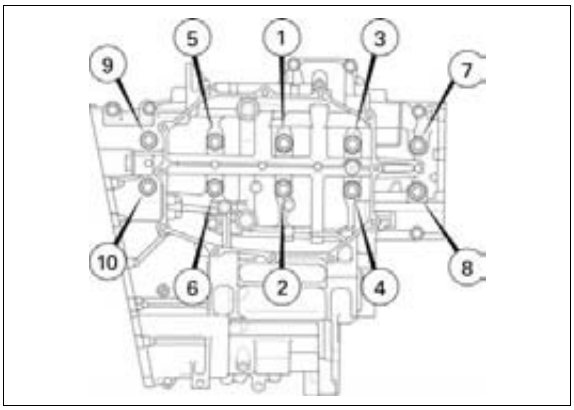
Install new crankcase 9 mm bolts (main journal bolts).
Loosely install all the lower crankcase bolts (8 mm bolt and 7 mm bolts).
Make sure the upper and lower crankcase are seated firmly.



- Tighten the crankcase 9 mm bolts (main journal bolts) using the Plastic Region Tightening Method described on next procedure.
- Do not reuse the crankcase 9 mm bolts (main journal bolts), because the correct axial tension will not be obtained.
- The crankcase 9 mm bolts (main journal bolts) are pre-coated with an oil additive for axial tension stability. Do not remove the oil additive from the new 9 mm bolts (main journal bolts) surface.

Tighten the crankcase 9 mm bolts (main journal bolts) in numerical order in the illustration in two to three steps to the specified torque.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)



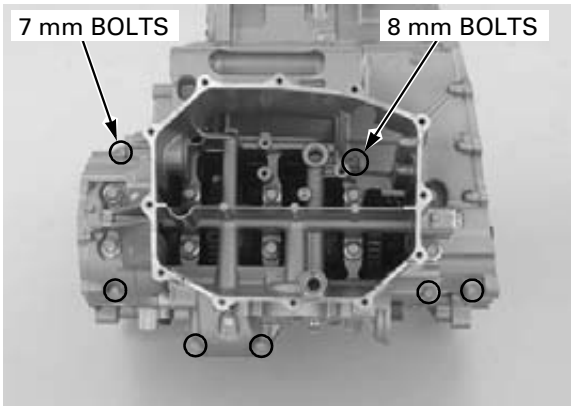
Further tighten the crankcase 9 mm bolts (main journal bolts) 150 degrees.

Tighten the 8 mm bolt to the specified torque.

TORQUE: 24 N·m (2.4 kgf·m, 18 lbf·ft)

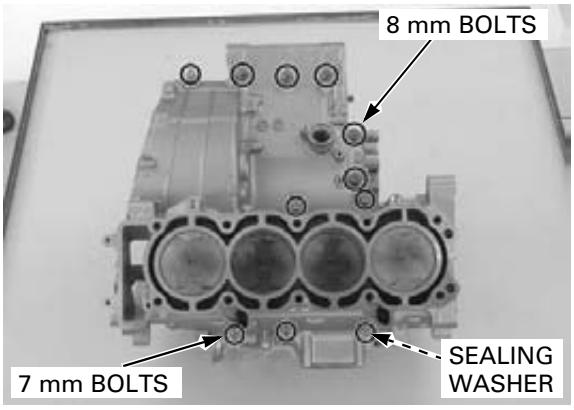
From the inside to outside, tighten the 7 mm bolts to the specified torque.

TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)

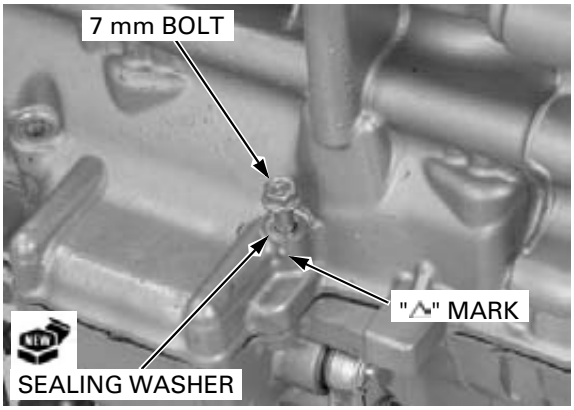


Place the engine with the lower side down.

Install the upper crankcase 8 mm bolts, sealing washer and 7 mm bolts.



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

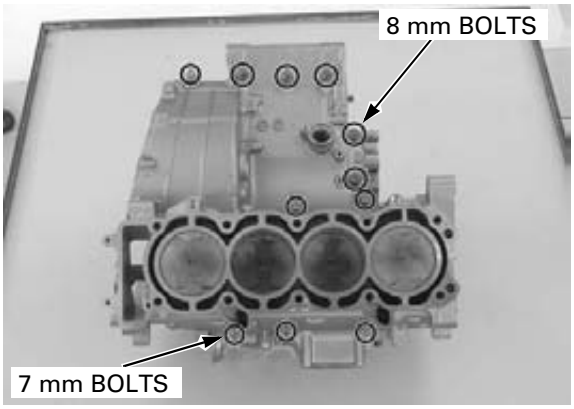


Tighten the 8 mm bolts in a crisscross pattern in 2 to 3 steps.

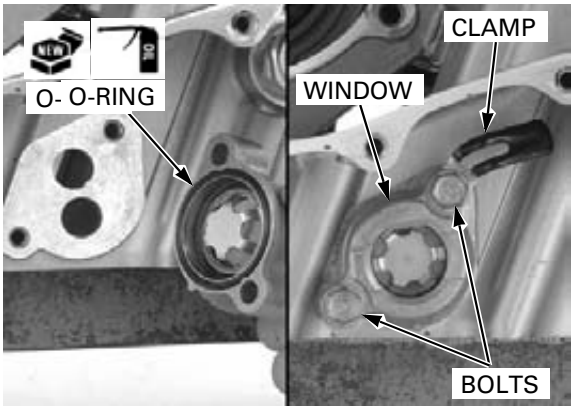
TORQUE: 25 N·m (2.5 kgf·m, 18 lbf·ft)

Tighten the 7 mm bolts in a crisscross pattern in 2 to 3 steps.

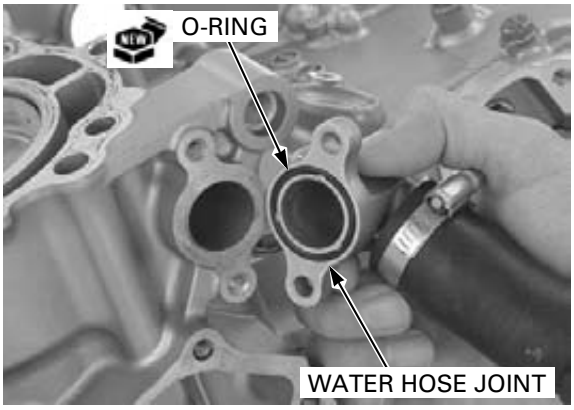
TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)



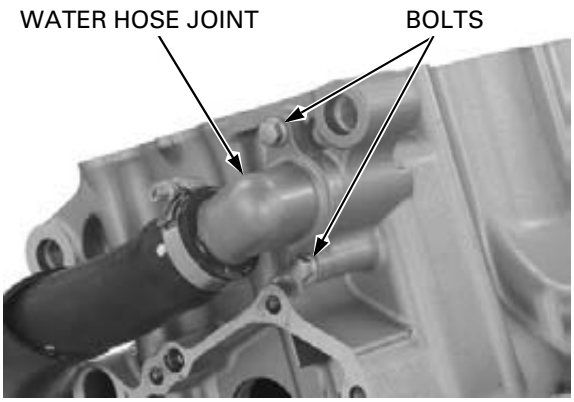
Apply oil to new O-ring and install it into the oil inspection window groove.
Install the oil inspection window onto the lower crankcase.
Install the bolts with the clamp, and tighten the bolts securely.



Install a new O-ring into the water hose joint groove.

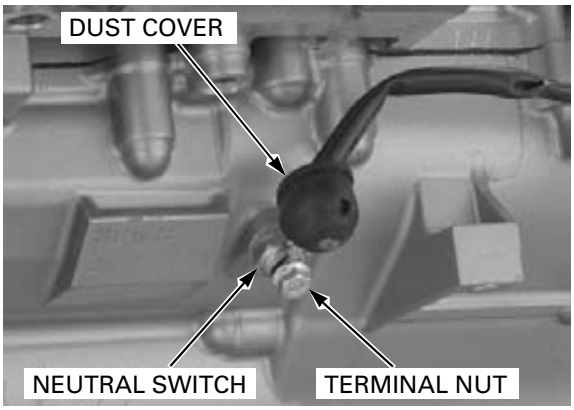


Install the water hose joint to the crankcase, then tighten the two bolts securely.

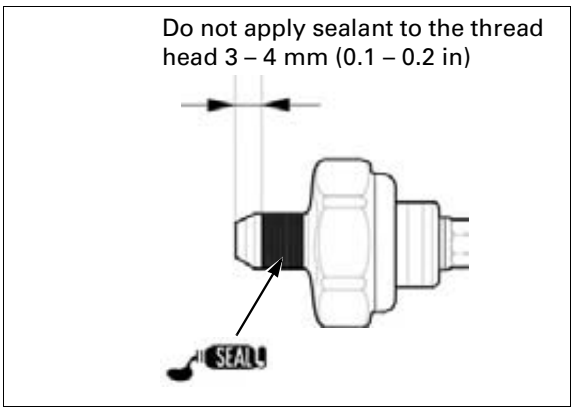


Connect the wire terminal to the neutral switch and tighten the terminal nut.

Install the dust cover over the neutral switch.



Apply a sealant (Three Bond 1207B) to the oil pressure switch threads as shown.



Tighten the oil pressure switch to the specified torque while holding the switch base.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

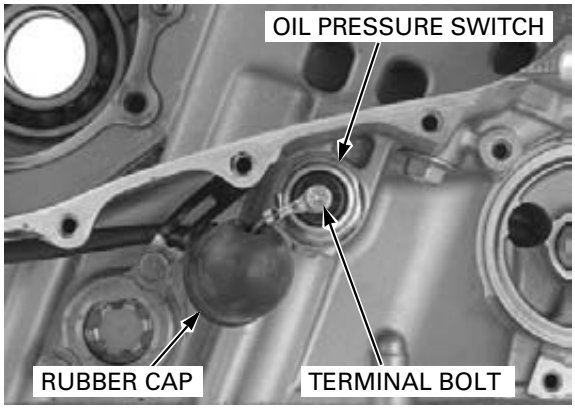
Connect the terminal eyelet to the oil pressure switch, and tighten the terminal bolt to the specified torque.

TORQUE: 2 N·m (0.2 kgf·m, 1.5 lbf·ft)

Refer to "Cable & Harness Routing" for EOP switch wire clamp (page 1-23).

Secure the EOP switch wire with the clamp and install the rubber cap.

Install the removed parts in the reverse order of removal.

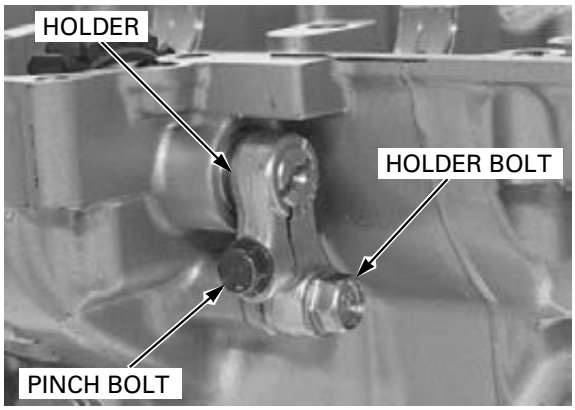


BALANCER

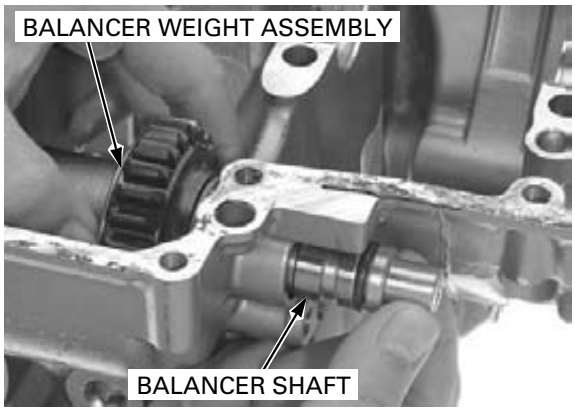
REMOVAL

Separate the crankcase halves (page 13-6).

Loosen the balancer shaft pinch bolt.
Remove the balancer shaft holder bolt and balancer holder.



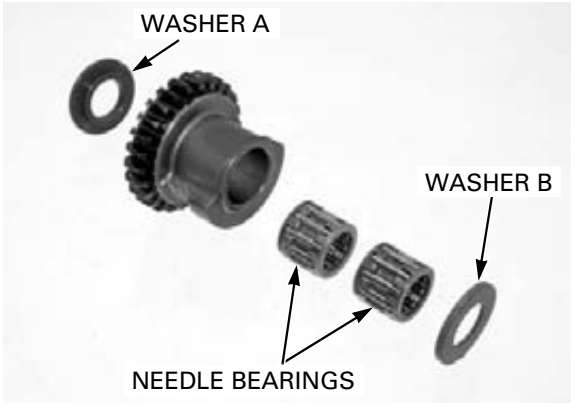
Pull the balancer shaft out and remove the balancer weight assembly from the lower crankcase.



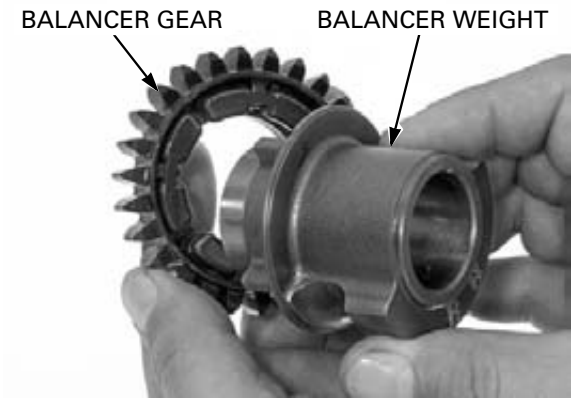
DISASSEMBLY

Remove the O-ring from the balancer shaft.

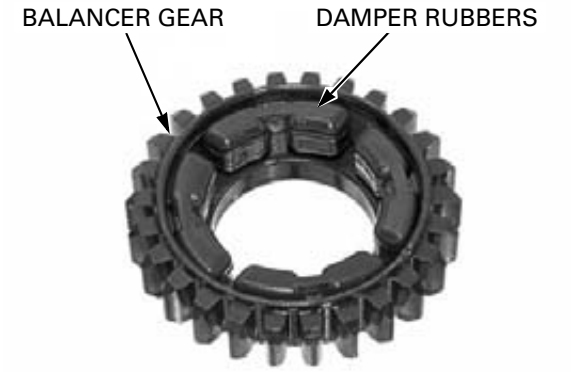
Remove the washers (A, B) and needle bearings from the balancer weight assembly.



Remove the balancer gear assembly from the balancer weight.



Remove the damper rubbers from the balancer gear.

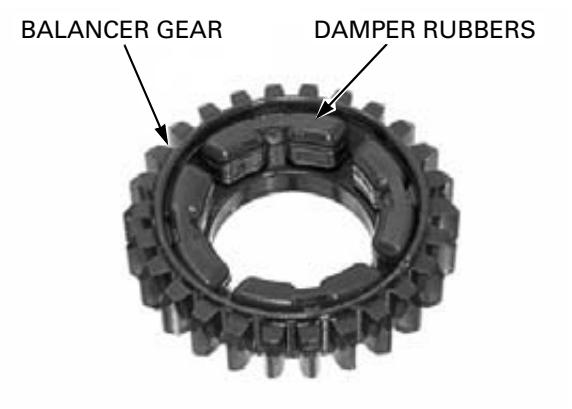


INSPECTION

Replace the balancer weight, balancer shaft, needle bearings as a set

Check the needle bearing for wear or damage, replace if necessary.

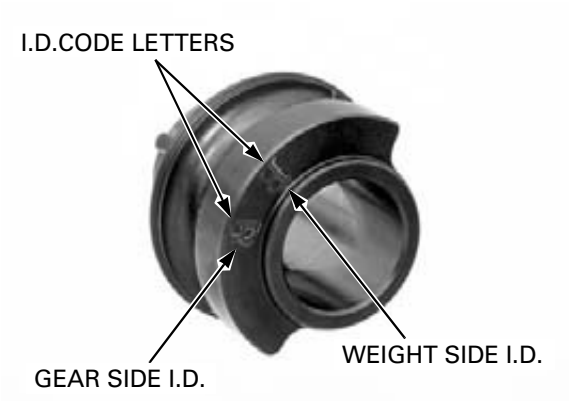
Check the balancer weight and gear for wear or damage.
Check the damper rubbers for fatigue or damage, replace if necessary.



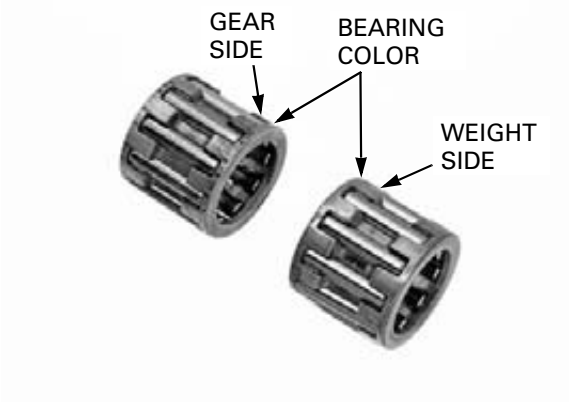
BALANCER BEARING SELECTION

The balancer weight and needle bearings are select fitted.

The balancer weight has two I.D. code letters as shown.
The marking identify each I.D. of the balancer weight as shown.



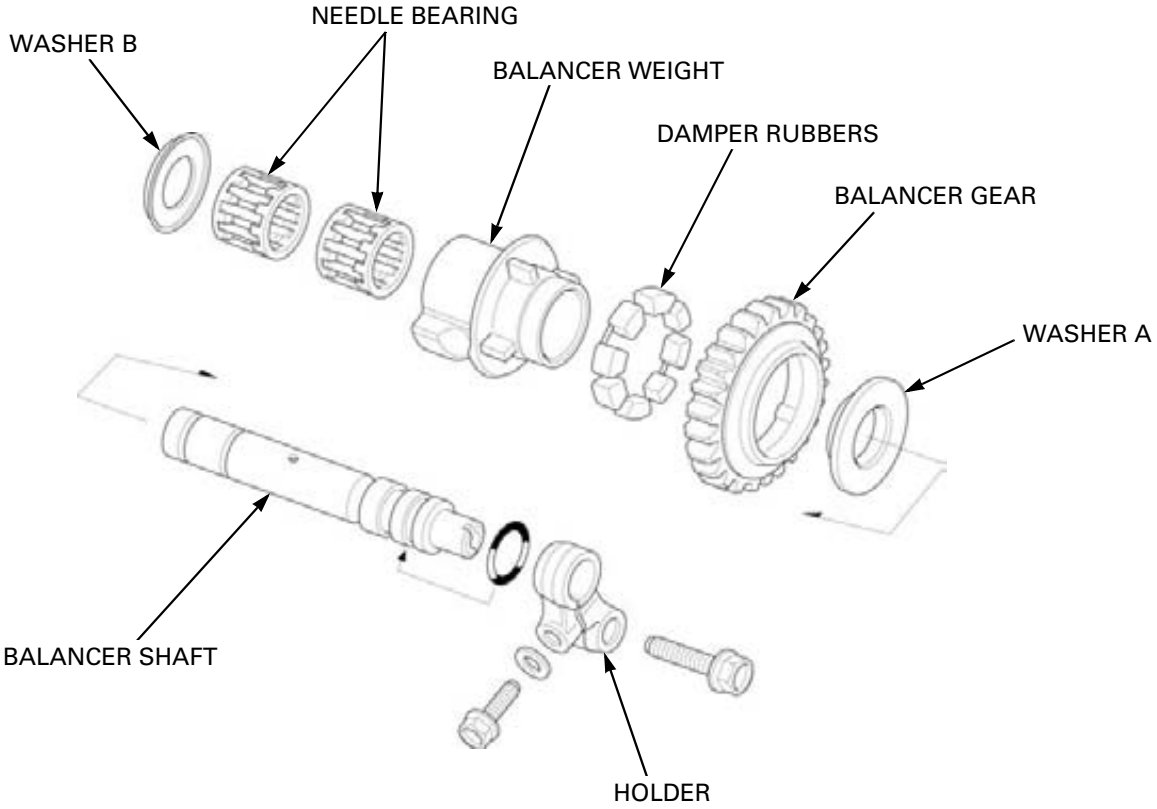
Reference the balancer weight I.D. code letters to determine the replacement bearing color.
Refer to the selection table below for bearing selection.



BALANCER BEARING SELECTION TABLE:

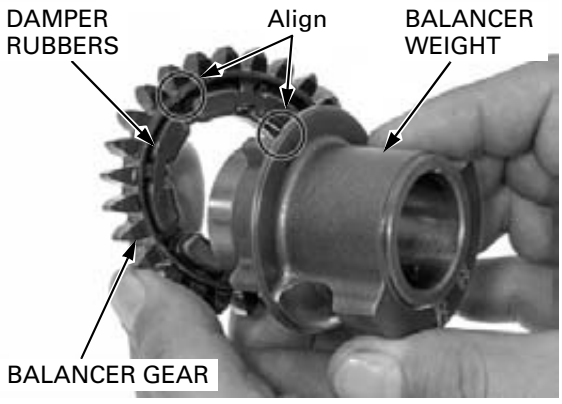
		BALANCER WEIGHT I.D. CODE		
		A	B	C
		27.000 – 27.004 mm (1.0630 – 1.0631 in)	26.991 – 26.996 mm (1.0626 – 1.0628 in)	26.987 – 26.991 mm (1.0624 – 1.0626 in)
BALANCER SHAFT	17.990 – 17.996 mm (0.7083 – 0.7085 in)	Blue	White	Green

DISASSEMBLY



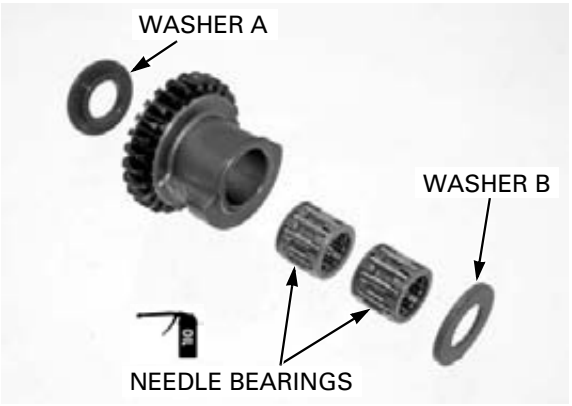
Install the damper rubbers into the balancer gear.

Assemble the balancer gear and weight while aligning the index marks.



Apply oil to the needle bearings, install them into the balancer weight.

Install the washer A and B.

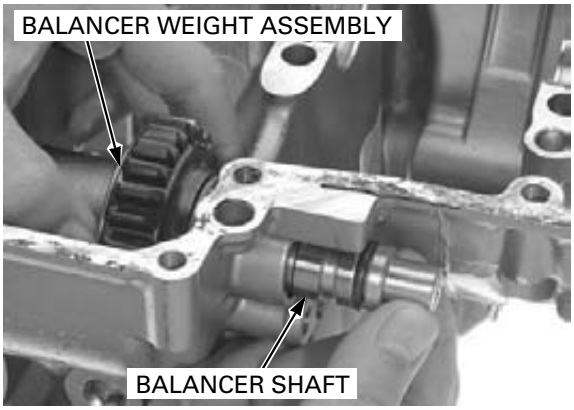


Install a new O-ring to the balancer shaft.

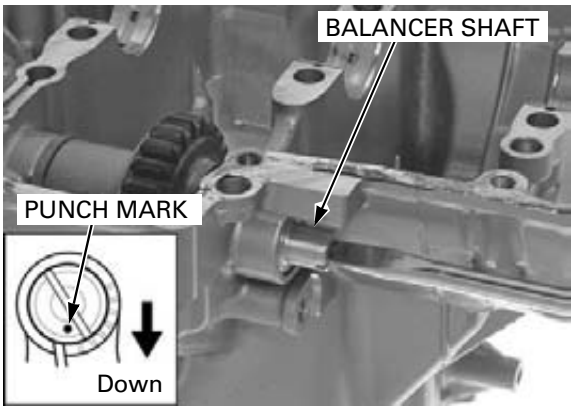
INSTALLATION

Install the balancer weight into the lower crankcase.

Install the balancer shaft.

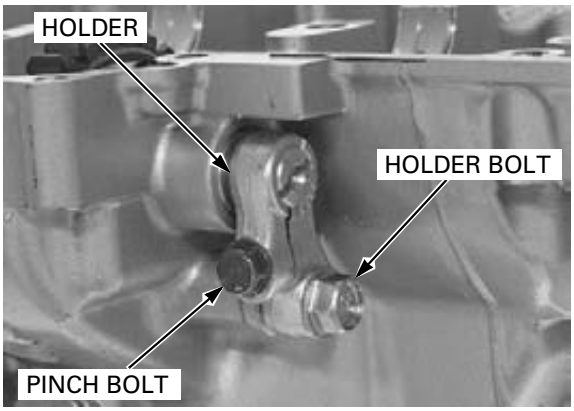


Turn the balancer shaft and place the punch mark on the shaft facing down.



Install the balancer shaft holder.
Install and tighten the holder bolt securely.
Tighten the balancer shaft holder pinch bolt.

Assemble the crankcase halves (page 13-23).

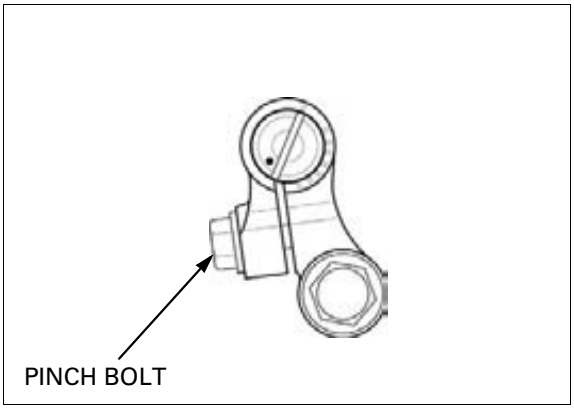


BACKLASH ADJUSTMENT MEMO

Install the engine into the frame (page 8-8).

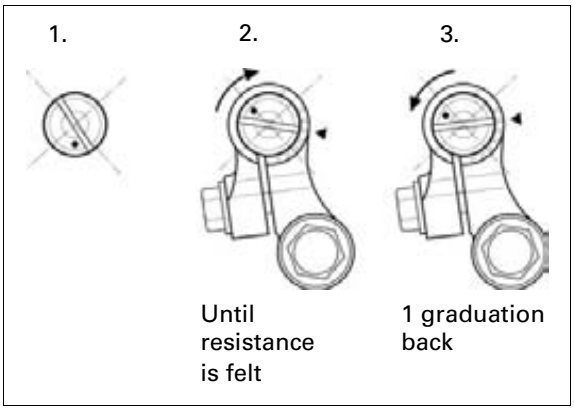
Adjust the backlash while the engine is cold (below 35°C/ 95°F) and the engine is not running.

Loosen the balancer shaft holder pinch bolts.



Excessive force can cause balancer gear, bearing and shaft damage. Do not turn the shaft more than necessary.

Turn the balancer shaft clockwise until resistance is felt, then back it off one graduation using the punch mark as a measure.



Warm up the engine and let it idle.

If the balancer gear noises are excessive, adjust the balancer backlash as follows:

Turn the balancer gear shaft counterclockwise until the gears begin to make a "whining" noise. Then turn the gear shaft clockwise until the gear "whining" noise disappears.

Tighten the balancer shaft pinch bolt.

After all gear backlash adjustments are done, snap the throttle and make sure the gear noises are not excessive.

If the gear "whine" noise is excessive, the backlash is too small.
If the gear "rattling" noise is excessive, the backlash is excessive.