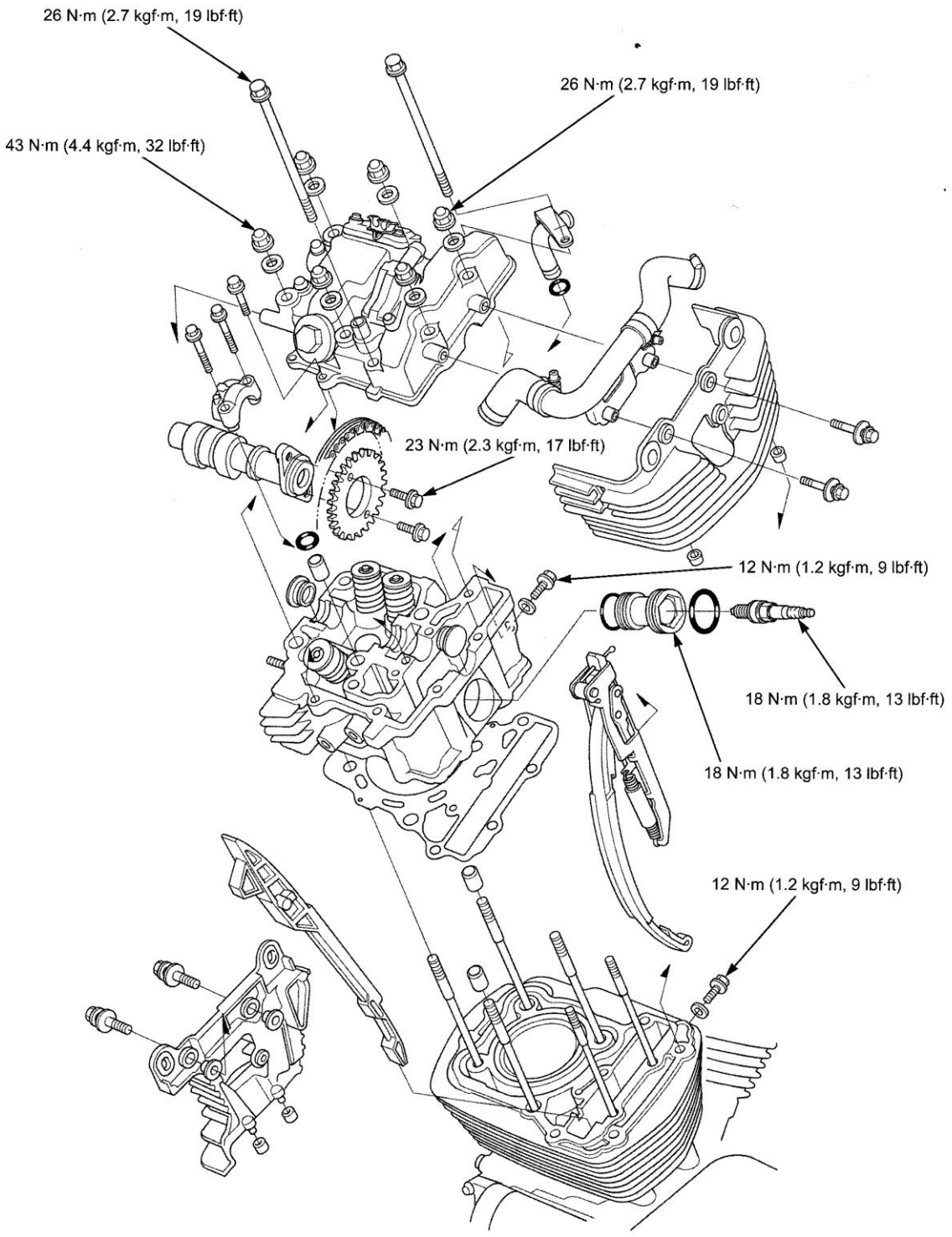
9. CYLINDER HEAD/VALVES

COMPONENT LOCATION



SERVICE INFORMATION

GENERAL

- This section covers service of the rocker arms, camshafts, cylinder head and valves. To service the rear cylinder, the engine must be removed from the frame.
- Be careful not to damage the mating surfaces when removing the cylinder head cover and cylinder head. Do not strike the cylinder head cover and cylinder head too hard during removal.
- When disassembling, mark and store the disassembled parts to ensure that they are reinstalled in their original locations.
- Clean all disassembled parts with cleaning solvent and dry them by blowing them off with compressed air before inspection.
- Camshaft and rocker arm lubricating oil is fed through oil passages in the cylinder head and cylinder head cover. Clean the oil passages before assembling the cylinder head and cylinder head cover.
- The exhaust contains poisonous carbon monoxide gas that may cause lose of consciousness and may lead to death: Run the engine in and open area or with an exhaust evacuation system in an enclosed area.

SPECIFICATIONS

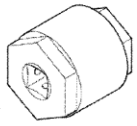
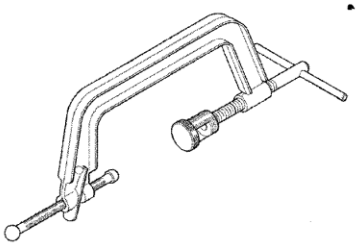
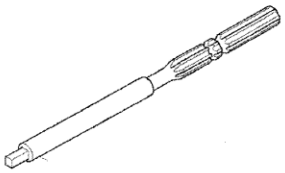
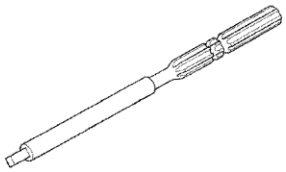
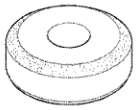
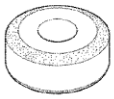
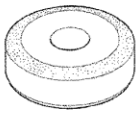
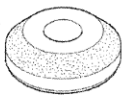
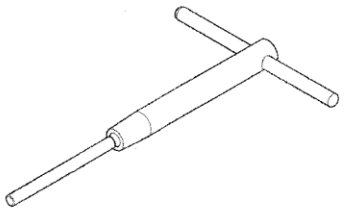
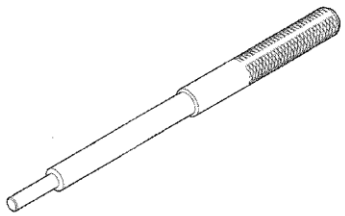
Unit: mm (in)

ITEM			STANDARD	SERVICE LIMIT
Cylinder compression at 300 rpm			1,157 kPa (11.8 kgf/cm², 168 psi)	–
Valve clearance		IN	0.15 ± 0.02 (0.006 ± 0.001)	–
		EX	0.30 ± 0.02 (0.012 ± 0.001)	–
Cam chain tensioner wedge B length			–	9.0 (0.35)
Camshaft	Cam lobe height	IN	38.866 – 39.106 (1.5302 – 1.5396)	38.84 (1.529)
		EX	39.030 – 39.270 (1.5366 – 1.5461)	39.01 (1.536)
	Runout	IN/EX	–	0.04 (0.002)
	Journal O.D.	IN/EX	23.959 – 23.980 (0.9433 – 0.9441)	23.950 (0.9429)
	Oil clearance	A, B	0.040 – 0.101 (0.0016 – 0.0040)	0.120 (0.0047)
		C	0.055 – 0.121 (0.0022 – 0.0048)	0.140 (0.0055)
Rocker arm, rocker arm shaft	Rocker arm shaft O.D.	IN/EX	13.966 – 13.984 (0.5498 – 0.5506)	13.91 (0.548)
	Rocker arm I.D.	IN/EX	14.000 – 14.018 (0.5512 – 0.5519)	14.07 (0.554)
	Rocker arm-to-shaft clearance		0.016 – 0.052 (0.0006 – 0.0020)	0.15 (0.006)
Valve, valve guide	Valve stem O.D.	IN	6.575 – 6.590 (0.2589 – 0.2594)	6.57 (0.259)
		EX	6.560 – 6.575 (0.2583 – 0.2589)	6.545 (0.2577)
	Valve guide I.D.	IN/EX	6.600 – 6.615 (0.2598 – 0.2604)	6.635 (0.2612)
	Stem-to-guide clearance	IN	0.010 – 0.040 (0.0004 – 0.0016)	0.08 (0.003)
		EX	0.025 – 0.055 (0.0010 – 0.0022)	0.115 (0.0045)
	Valve guide projection above cylinder head	IN	14.5 (0.57)	–
		EX	15.5 (0.61)	–
	Valve seat width	IN/EX	0.90 – 1.10 (0.035 – 0.043)	1.5 (0.06)
Valve spring	Free length	IN	45.70 (1.799)	43.90 (1.728)
		EX	43.50 (1.713)	41.80 (1.646)
Cylinder head warpage			–	0.10 (0.004)

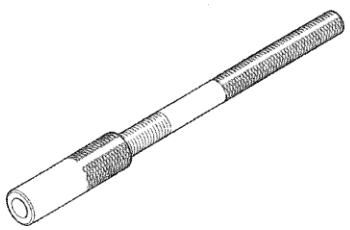
TORQUE VALUES

Spark plug	18 N·m (1.8 kgf·m, 13 lbf·ft)	
Spark plug sleeve	18 N·m (1.8 kgf·m, 13 lbf·ft)	Apply engine oil to the threads.
Cylinder head cover bolt	26 N·m (2.7 kgf·m, 19 lbf·ft)	
Cylinder head cover cap nut (10 mm)	43 N·m (4.4 kgf·m, 32 lbf·ft)	Apply engine oil to the threads and seating surface.
Cylinder head cover cap nut (8 mm)	26 N·m (2.7 kgf·m, 19 lbf·ft)	Apply engine oil to the threads and seating surface.
Cam sprocket bolt	23 N·m (2.3 kgf·m, 17 lbf·ft)	Apply locking agent to the threads.
Cam chain tensioner bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	
V-bank engine mounting bolt	27 N·m (2.8 kgf·m, 20 lbf·ft)	
V-bank engine hanger plate nut	39 N·m (4.0 kgf·m, 29 lbf·ft)	
Exhaust valve adjusting hole cap	15 N·m (1.5 kgf·m, 11 lbf·ft)	Apply grease to the threads.
PAIR check valve cover bolt	5.2 N·m (0.5 kgf·m, 3.8 lbf·ft)	

TOOLS

Fork tube holder attachment 07930-KA50100 	Valve spring compressor 07757-0010000 	Valve guide reamer, 6.612 mm 07984-ZE20001  or 07984-ZE2000D (U.S.A. only)
Valve guide reamer, 6.618 mm 07984-6570101  or 07984-657010D (U.S.A. only)	Seat cutter, 33 mm (45° IN) 07780-0010800  or equivalent commercially available in U.S.A.	Seat cutter, 40 mm (45° EX) 07780-0010500  or equivalent commercially available in U.S.A.
Flat cutter, 33 mm (32° IN) 07780-0012900  or equivalent commercially available in U.S.A.	Flat cutter, 42 mm (32° EX) 07780-0013000  or equivalent commercially available in U.S.A.	Interior cutter, 30 mm (60° IN) 07780-0014000  or equivalent commercially available in U.S.A.
Interior cutter, 37.5 mm (60° EX) 07780-0014100  or equivalent commercially available in U.S.A.	Cutter holder, 6.6 mm 07781-0010202  or equivalent commercially available in U.S.A.	Valve guide driver, 6.6 mm 07742-0010200  or 07942-6570100 (U.S.A. only)

Valve guide driver
07743-0020000



Not available in U.S.A.

TROUBLESHOOTING

- Engine top-end problems usually affect engine performance. These problems can be diagnosed by a compression test, or by tracing engine noises to the top-end with a sounding rod or stethoscope.
- If the performance is poor at low speeds, check for while smoke in the drain tube of the air cleaner housing. If the drain tube is smoky, check for seized piston ring (page 10-6).

Compression too low, hard starting or poor performance at low speed

- Valves:
  - Incorrect valve clearance adjustment
  - Burned or bent valve
  - Incorrect valve timing
  - Broken valve spring
  - Uneven valve seating
  - Valve stuck open
- Cylinder head:
  - Leaking or damaged cylinder head gasket
  - Warped or cracked cylinder head
  - Loose spark plug
- Cylinder/piston problem (page 10-3)

Compression too high, over-heating or knocking

- Excessive carbon build-up on piston head or combustion chamber

Excessive smoke

- Worn valve stem or valve guide
- Damaged stem seal
- Cylinder/piston problem (page 10-3)

Excessive noise

- Incorrect valve clearance adjustment
- Sticking valve or broken valve spring
- Excessive worn valve seat
- Worn or damaged camshaft
- Worn or damaged rocker arm and/or shaft
- Worn rocker arm follower or valve stem end
- Worn cam sprocket teeth
- Worn cam chain
- Worn or damaged cam chain tensioner
- Cylinder/piston problem (page 10-3)

Rough idle

- Low cylinder compression

CYLINDER COMPRESSION

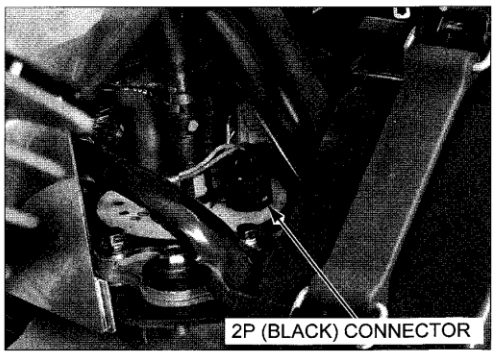
NOTE:

- Before starting the inspection, warm up the engine to normal operating temperature. Stop the engine.

Remove the following:

- Left side cover (page 3-6)
- Over head cover (page 3-5)

Disconnect the fuel pump 2P (Black) connector.



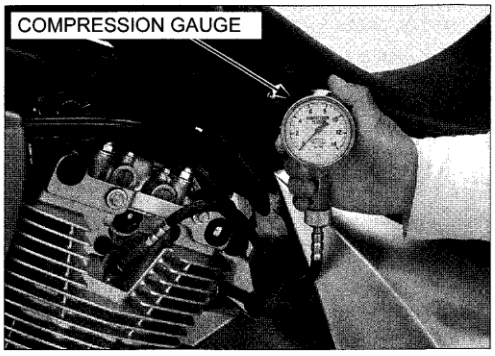
To measure the cylinder compression of each cylinder, remove only one plug at a time.

Disconnect all the spark plug caps and remove one spark plug from each cylinder head (page 4-8).

Install the compression gauge into the spark plug hole.

TOOL:

Compression tester	**EEPV303B (U.S.A. only)**



Shift the transmission into neutral.

Turn the ignition switch ON and engine stop switch "○".

Crank the engine with the starter motor until the gauge reading stops rising.

To avoid discharging the battery, do not operate the starter motor for more than 7 seconds.

The maximum reading is usually reached within 4 – 7 seconds.

COMPRESSION PRESSURE:
1,157 kPa (11.8 kgf/cm², 168 psi) at 300 rpm

Low compression can be caused by:

- Incorrect valve clearance adjustment
- Burned or bent valve
- Incorrect valve timing
- Broken valve spring
- Uneven valve seating
- Valve stuck open
- Leaking or damaged cylinder head gasket
- Warped or cracked cylinder head

High compression can be caused by:

- Excessive carbon build-up on piston head or combustion chamber

FIN

REMOVAL/INSTALLATION

FRONT

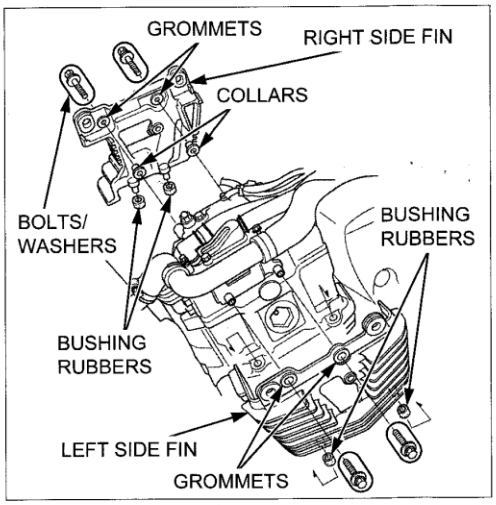
Left side: Remove the bolts, washers and left side fin while removing the water pipe boss.

Right side: Remove the following:

- Bolts
- Washers
- Collars
- Right side fin

Remove the bushing rubbers and grommets.

Installation is in the reverse order of removal.



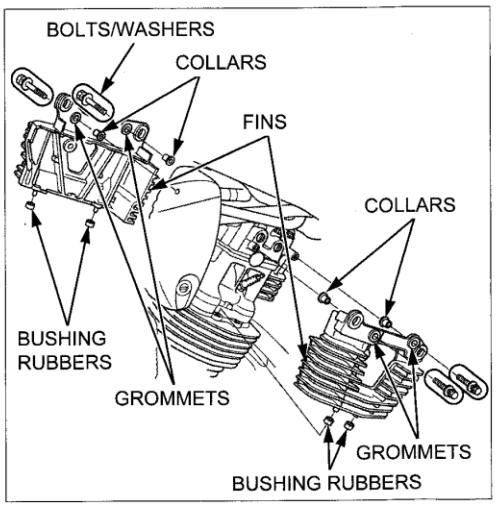
REAR

Remove the following:

- Bolts
- Washers
- Collars
- Fins

Remove the bushing rubbers and grommets.

Installation is in the reverse order of removal.



CYLINDER HEAD COVER REMOVAL

NOTE:

- When removing the rear cylinder head cover, the engine must be removed from the frame.
- When removing the cylinder head, align the TDC (Top Dead Center) on the compression stroke (page 4-9).

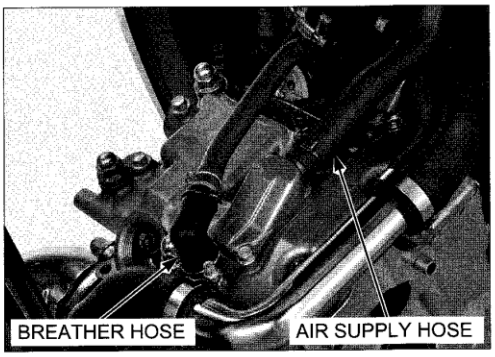
Drain the coolant from the system (page 7-7).

Remove the following:

- Over head cover (page 3-5)
- Fin (page 9-7)
- Ignition switch (page 22-20)

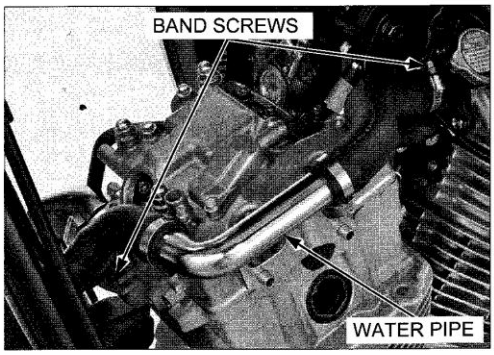
Disconnect the secondary air supply hose.

Front only: Disconnect the crankcase breather hose.



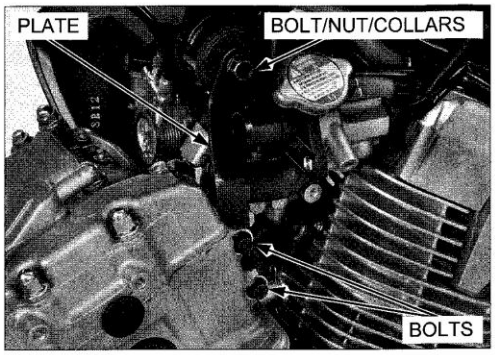
Front only: Loosen the water hose band screws.

Remove the water pipe by disconnecting the water hoses.

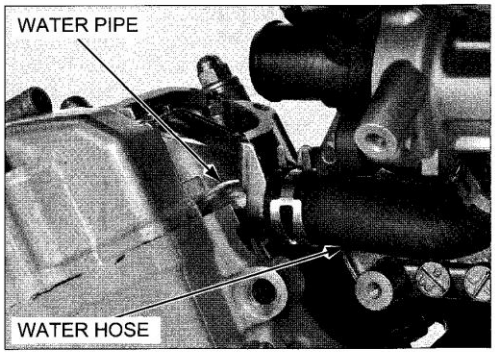


Front only: Remove the following:

- Bolts
- Nut
- Collars
- Engine hanger plate

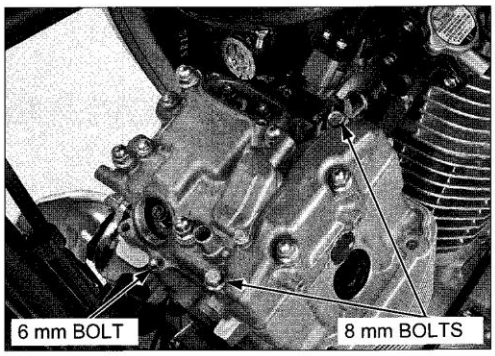


Disconnect the water hose from the water pipe.



Remove the following:

- 6 mm bolt
- 8 mm bolts

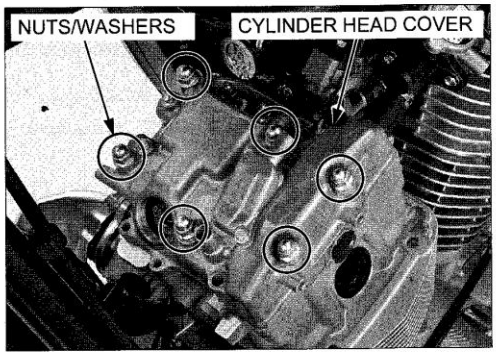


Loosen the cap nuts in a crisscross pattern in several steps.

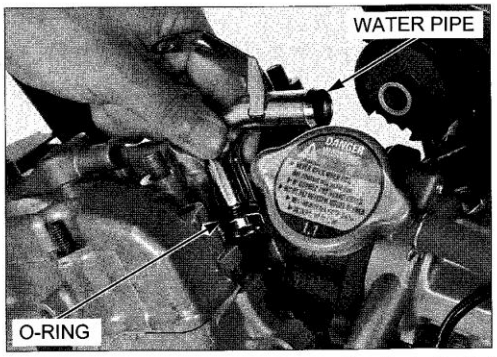
Remove the cap nuts, sealing washers and cylinder head cover.

NOTE:

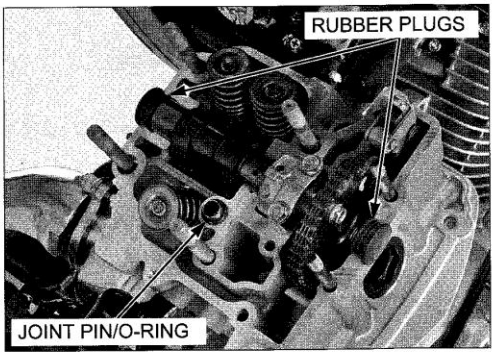
- Do not strike the cylinder head cover too hard and do not damage the mating surfaces with a any tool used for leverage.
- Do not forcibly remove the dowel pins from the cylinder head cover.



Remove the water pipe and O-ring.



Remove the rubber plugs, joint pin and O-ring.



ROCKER ARM REMOVAL

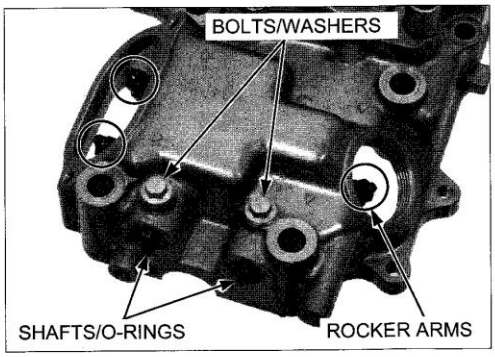
NOTE:

- The front and rear rocker arm service procedures are the same.

Remove the cylinder head cover (page 9-7).

Remove the following:

- Bolts
- Sealing washers
- Rocker arm shafts
- O-rings
- Rocker arms

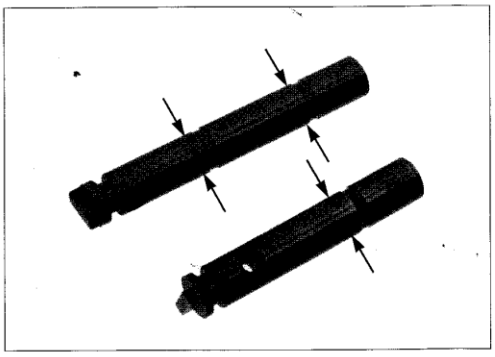


INSPECTION

Inspect the sliding surfaces of the rocker arm shafts for wear or damage.
Check the oil holes for clogs.

Measure the O.D. of each shaft at the rocker arm sliding areas.

SERVICE LIMIT: 13.91 mm (0.548 in)



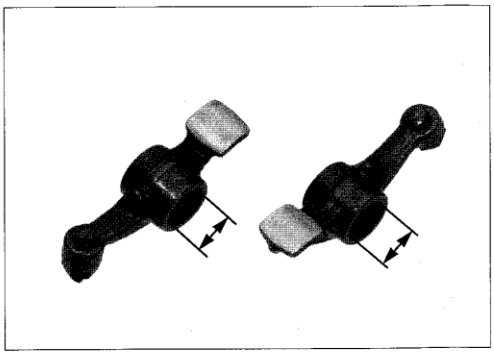
Inspect the sliding surfaces of the rocker arms for wear or damage.
Inspect the rocker arm slipper surface for wear or damage.
Check the oil holes for clogs.

Measure the I.D. of each rocker arm.

SERVICE LIMIT: 14.07 mm (0.554 in)

Calculate the rocker arm-to-shaft clearance.

SERVICE LIMIT: 0.15 mm (0.006 in)



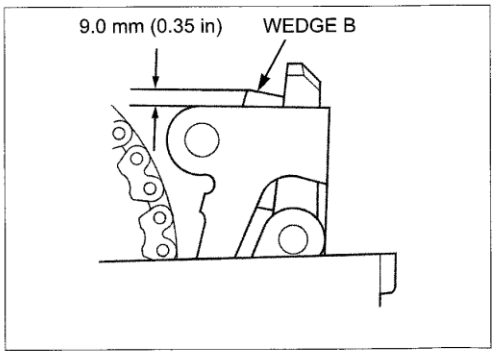
CAMSHAFT REMOVAL

NOTE:
- The front and rear camshaft service procedures are the same.

Remove the cylinder head cover (page 9-7).

Measure the cam chain tensioner wedge B length.

SERVICE LIMIT: 9.0 mm (0.35 in)



Replace the cam chain with a new one if the projection exceeds the service limit.
For the cam chain replacement, remove the following:

Front:

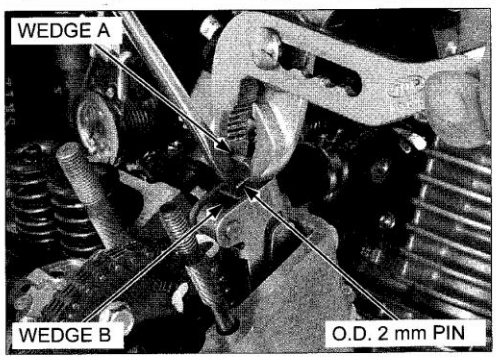
- Front camshaft
- Flywheel (page 12-11)

Rear:

- Rear camshaft
- Primary drive gear (page 11-18)

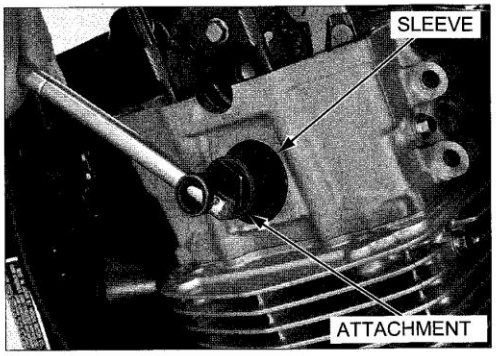
Be careful not to let an O.D. 2 mm pin fall into the crankcase.

Install an O.D. 2 mm pin into the cam chain tensioner wedge A hole while pulling the wedge A straight up and pushing down the wedge B.



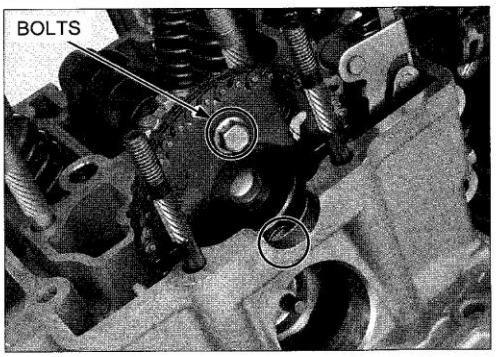
Remove the spark plug sleeve using the special tool.

TOOL:
Fork tube holder attachment 07930-KA50100



Be careful not to let the cam sprocket bolts fall into the crankcase.

Remove the cam sprocket bolt, turn the crankshaft counterclockwise one full turn (360°) and remove the other cam sprocket bolt.

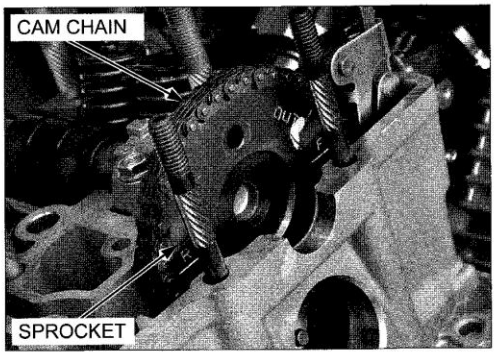


Attach a piece of wire to the cam chain to prevent it from falling into the crankcase.

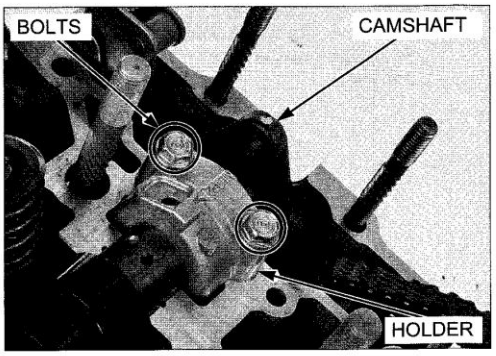
Remove the cam sprocket from the camshaft flange surface.

NOTE:

- Be careful not to damage the spark plug.



Remove the bolts, camshaft holder and camshaft.



NOTE:

- Do not forcibly remove the dowel pins from the camshaft holder.

INSPECTION

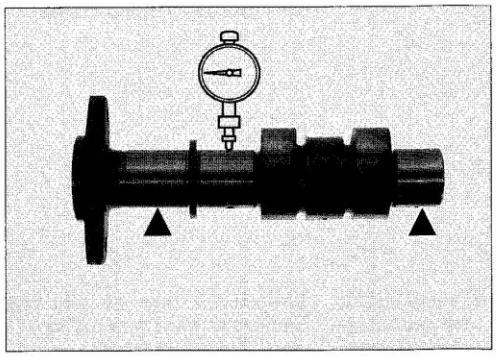
CAMSHAFT RUNOUT

Set the camshaft on V-blocks.

Turn the camshaft and measure the runout using a dial indicator.

Actual runout is 1/2 the total indicator reading.

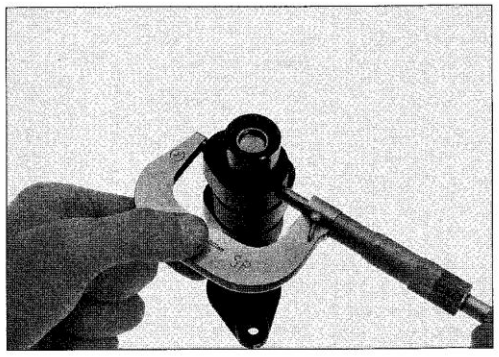
SERVICE LIMIT: 0.04 mm (0.002 in)



CAM LOBE HEIGHT

Measure each cam lobe height using a micrometer.

SERVICE LIMITS: IN: 38.84 mm (1.529 in)
EX: 39.01 mm (1.536 in)



CAMSHAFT JOURNAL

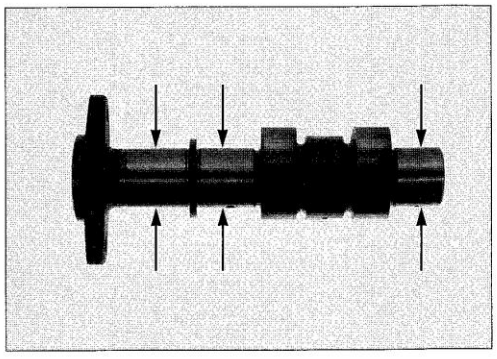
Check the camshaft journal surfaces for scoring or evidence of insufficient lubrication.

Measure the O.D. of each camshaft journal.

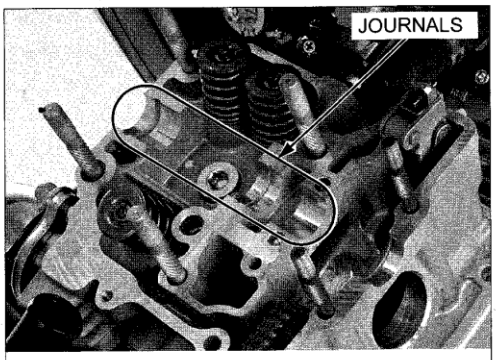
SERVICE LIMITS: 23.950 mm (0.9429 in)

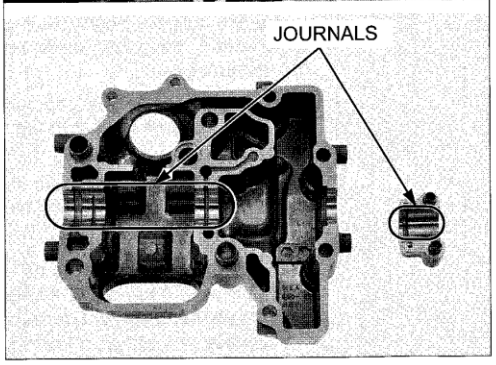
NOTE:

- Check the oil passages and camshaft holder for wear or damage if the journal surface is worn or damaged.



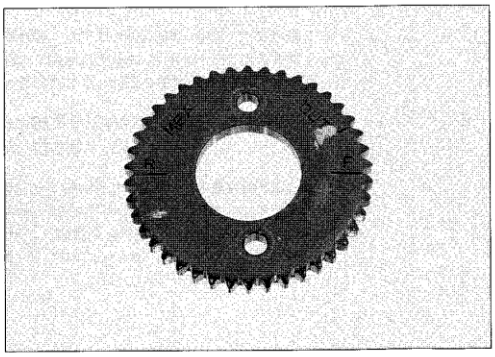
Check the camshaft journal surfaces of the camshaft holder, cylinder head and cylinder head cover for scoring, scratches or evidence of insufficient lubrication.





CAM SPROCKET

Check the cam sprocket for wear or damage.



CAMSHAFT OIL CLEARANCE

NOTE:

- Do not rotate the camshaft during inspection.

Do not hook the cam chain attaching wire against the cylinder head mating surface.

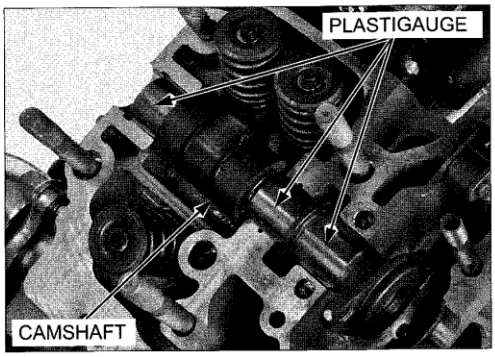
Suspend the cam chain attaching wire through the spark plug sleeve hole.

Clean off any oil from the journals of the camshaft holder, camshaft, cylinder head and cylinder head cover.

Put the camshaft onto the cylinder head and lay a strip of plastigauge lengthwise on each camshaft journal.

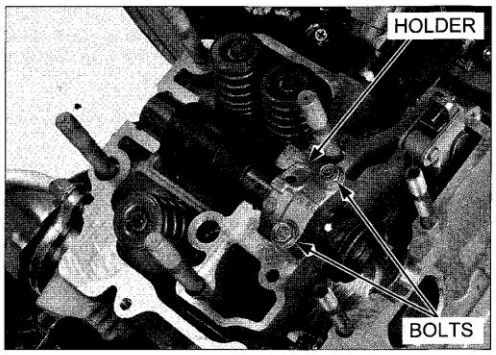
NOTE:

- The camshafts are identified by the stamped marks:
  "F": Front camshaft
  "R": Rear camshaft



Carefully install the camshaft holder.

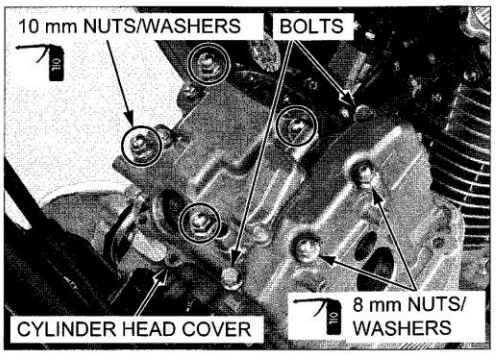
Install and tighten the bolts alternately in several steps.



Install the cylinder head cover onto the cylinder head while holding the rocker arms, being careful not to drop the plastigauge.

Apply engine oil to the cap nut threads and seating surface and install them with the sealing washers.

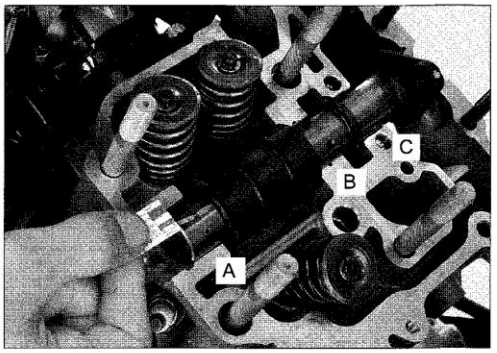
Install the bolts.
Tighten the cap nuts and bolts to the specified torque in a crisscross pattern in several steps.



TORQUE:
Cylinder head cover cap nut (10 mm):
43 N·m (4.4 kgf·m, 32 lbf·ft)
Cylinder head cover cap nut (8 mm):
26 N·m (2.7 kgf·m, 19 lbf·ft)
Cylinder head cover bolt:
26 N·m (2.7 kgf·m, 19 lbf·ft)

Remove the cylinder head cover and camshaft holder, and measure the compressed plastigauge at its widest point to determine the oil clearance.

SERVICE LIMITS: A/B: 0.120 mm (0.0047 in)
C: 0.140 mm (0.0055 in)



If the oil clearance exceeds the service limit, replace the camshaft and recheck the oil clearance.
Replace the cylinder head, cylinder head cover and camshaft holder as a set if the oil clearance still exceeds the service limit.

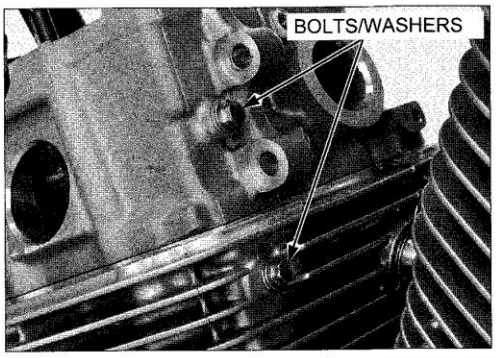
CYLINDER HEAD REMOVAL

NOTE:
- The front and rear cylinder head service procedures are the same.

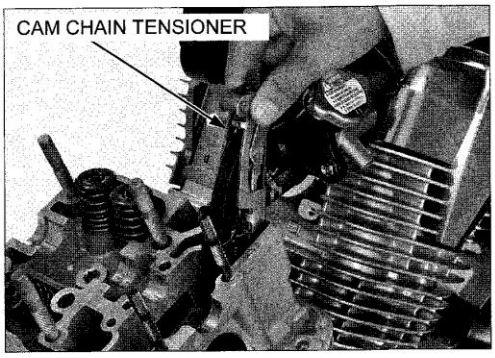
Remove the following:

- Exhaust system (page 3-10)
- Intake manifold (page 6-54)
- Camshaft (page 9-10)

Remove the bolts and sealing washers.

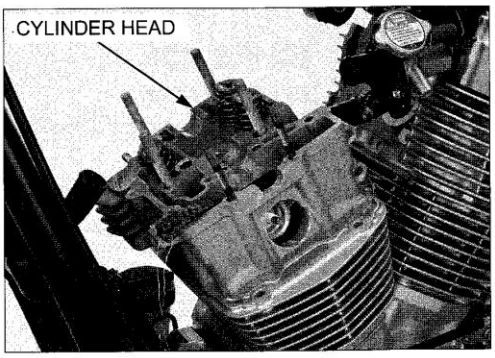


Remove the cam chain tensioner.

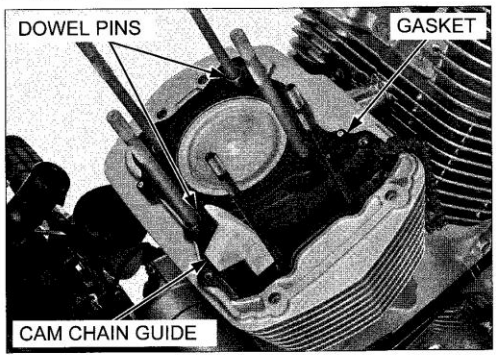


Remove the cylinder head.

NOTE:
- Do not strike the cylinder head too hard and do not damage the mating surface with a any tool used for leverage.



Remove the dowel pins, gasket and cam chain guide.



CYLINDER HEAD DISASSEMBLY

NOTE:
- The front and rear cylinder head service procedures are the same.
- Mark all parts during disassembly so they can be placed back in their original locations.

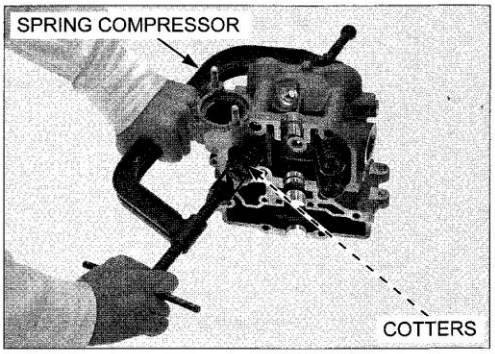
Remove the following:
- Cylinder head (page 9-15)
- Spark plug (page 4-8)

To prevent loss of tension, do not compress the valve spring more than necessary to remove the cotters.

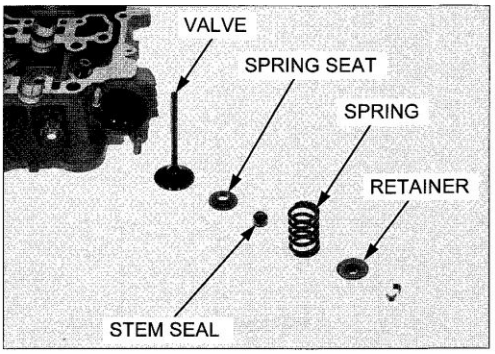
Remove the valve spring cotters using the special tool.

TOOL:
Valve spring compressor 07757-0010000

Remove the special tool.



Remove the following:
- Spring retainer
- Valve spring
- Valve
- Stem seal
- Spring seat



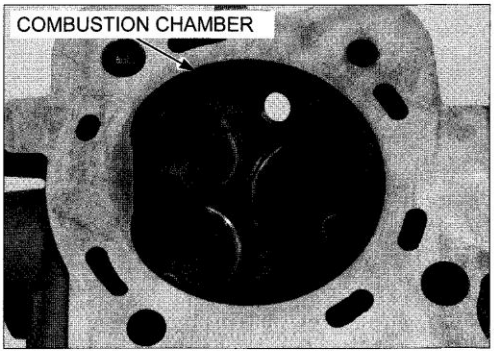
INSPECTION

CYLINDER HEAD

Be careful not to damage the valve seat and gasket surface.

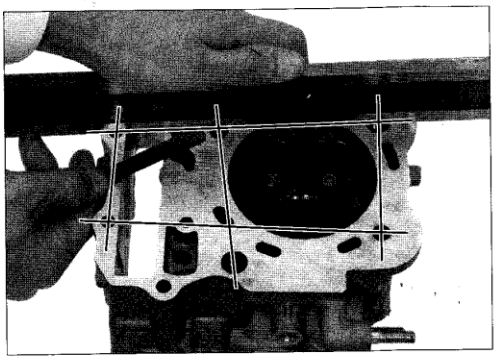
Remove the carbon deposits from the combustion chamber.

Check the spark plug holes and valve areas for cracks.



Check the cylinder head for warpage with a straight edge and feeler gauge across the stud holes.

SERVICE LIMIT: 0.10 mm (0.004 in)

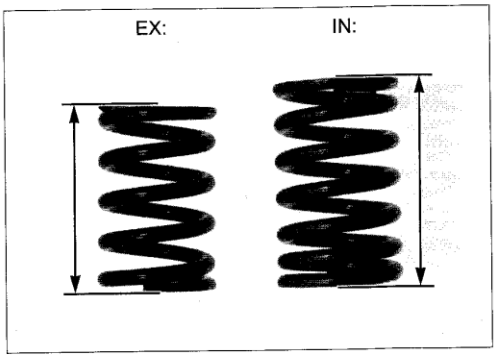


VALVE SPRING

Check the valve springs for fatigue or damage.

Measure the valve spring free length.

SERVICE LIMITS: IN: 43.90 mm (1.728 in)
EX: 41.80 mm (1.646 in)

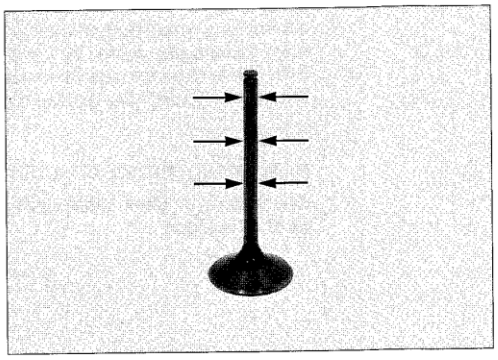


VALVE

Check that the valve moves smoothly in the guide.
Check the valve for bends, burns or abnormal wear.

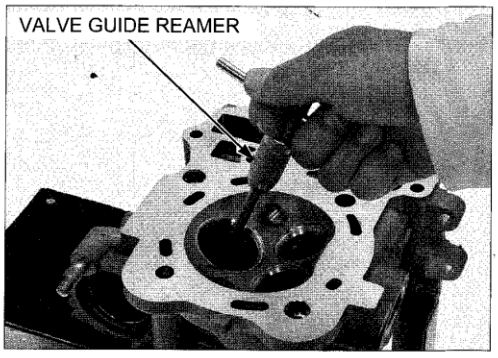
Measure each valve stem O.D. and record it.

SERVICE LIMITS: IN: 6.57 mm (0.259 in)
EX: 6.545 mm (0.2577 in)



VALVE GUIDE

Ream the valve guide to remove any carbon deposits before measuring the guide I.D.



NOTE:

- Take care not to tilt or lean the reamer in the guide while reaming. Otherwise, the valves may be installed slanted, causing oil leakage from the stem seal and improper valve seat contact. This may prevent valve seat refacing.
- Insert the reamer from the combustion chamber side of the cylinder head and always rotate the reamer clockwise.

TOOLS:

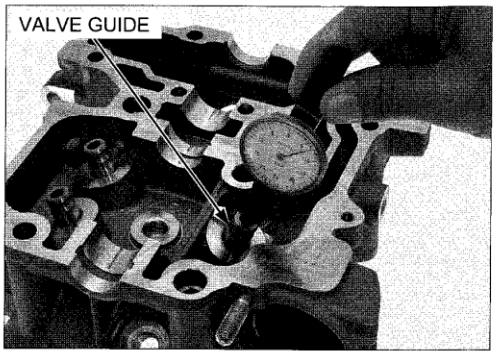
IN:

Valve guide reamer, 6.612 mm	**07984-ZE20001 or 07984-ZE2000D (U.S.A. only)**

EX:

Valve guide reamer, 6.618 mm	**07984-6570101 or 07984-657010D (U.S.A. only)**

Measure each valve guide I.D. and record it.



SERVICE LIMIT: IN/EX: 6.635 mm (0.2612 in)

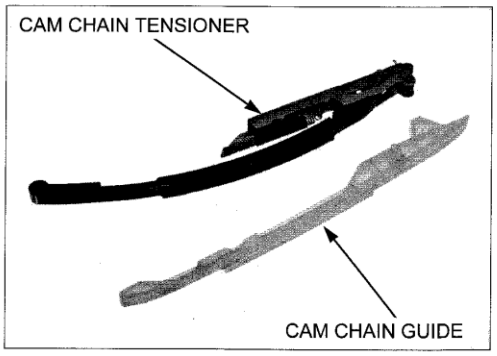
Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

SERVICE LIMITS: IN: 0.08 mm (0.003 in)
EX: 0.115 mm (0.0045 in)

If the stem-to-guide clearance exceeds the service limit, determine if a new valve guide with standard dimensions would bring the clearance within tolerance. If so, replace any guides as necessary and ream to fit. If the stem-to-guide clearance exceeds the service limit with a new guide, also replace the valve.

CAM CHAIN TENSIONER/GUIDE

Check the cam chain tensioner and guide for excessive wear or damage.



VALVE GUIDE /VALVE SEAT

NOTE:

- The front and rear valve guide/valve seat service procedures are the same.

VALVE GUIDE REPLACEMENT

NOTE:

- Inspect and reface the valve seats whenever the valve guides are replaced (page 9-20).

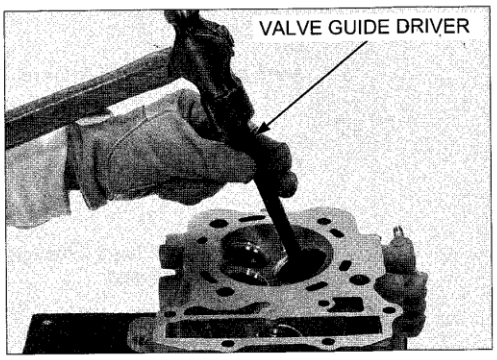
Disassemble the cylinder head (page 9-16).

Chill the new valve guides in a freezer for about an hour.

Be sure to wear heavy gloves when handling the heated cylinder head. Using a torch to heat the cylinder head may cause warpage.

Heat the cylinder head to 130 – 140°C (266 – 284°F) with a hot plate or oven. Do not heat the cylinder head beyond 150°C (302°F). Use temperature indicator sticks, available from welding supply stores, to be sure the cylinder head is heated to the proper temperature.

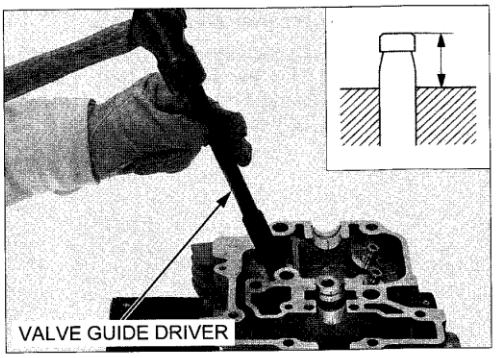
Support the cylinder head and drive the valve guides out of the cylinder head from the combustion chamber side using the special tool.



TOOL:

Valve guide driver, 6.6 mm	**07742-0010200 or 07942-6570100 (U.S.A. only)**

Adjust the valve guide driver to the valve guide height.



TOOL:

Valve guide driver	**07743-0020000 Not available in U.S.A.**

VALVE GUIDE PROJECTION:

IN: 14.5 mm (0.57 in)
EX: 15.5 mm (0.61 in)

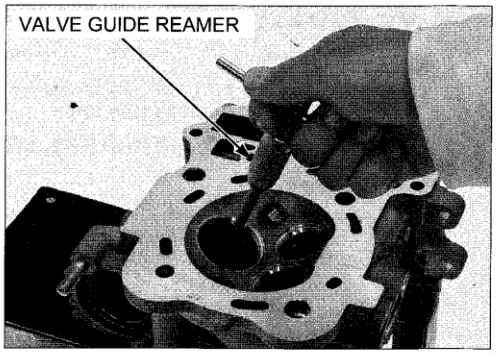
While the cylinder head is still heated, remove the new valve guides from the freezer and drive them into the cylinder head from the camshaft side.

U.S.A. only installation:

Mark the depth of the valve guide using a marker.
Use the valve guide driver to correct the depth.

Let the cylinder head cool to room temperature.

Ream the new valve guides.



NOTE:

- Take care not to tilt or lean the reamer in the guide while reaming. Otherwise, the valves may be installed slanted, causing oil leakage from the stem seal and improper valve seat contact. This may prevent valve seat refacing.
- Insert the reamer from the combustion chamber side of the cylinder head and always rotate the reamer clockwise.

TOOLS:

IN:

Valve guide reamer, 6.612 mm	**07984-ZE20001 or 07984-ZE2000D (U.S.A. only)**

EX:

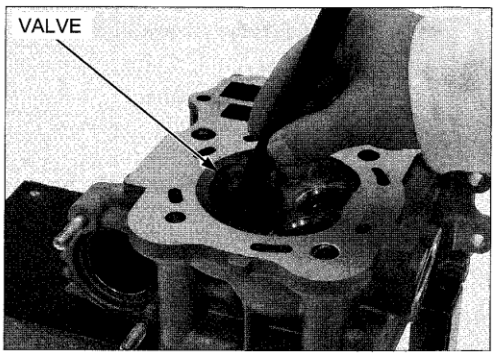
Valve guide reamer, 6.618 mm	**07984-6570101 or 07984-657010D (U.S.A. only)**

Clean the cylinder head thoroughly to remove any metal particles after reaming.

Inspect the valve seat (page 9-20).

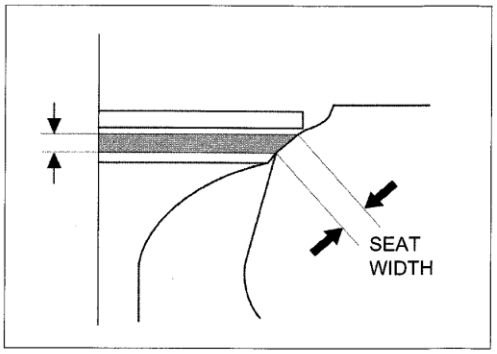
VALVE SEAT INSPECTION

Clean all intake and exhaust valves thoroughly to remove carbon deposits.



Apply a light coat of Prussian Blue to each valve seat. Tap the valve against the valve seat several times without rotating the valve, to check for proper valve seat contact.

Remove the valve and inspect the valve seat face. The valve seat contact should be within the specified width and even all around the circumference.

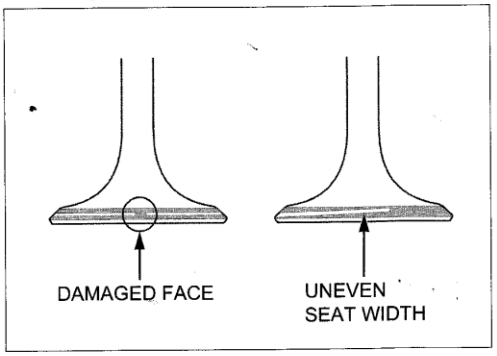


STANDARD: 0.90 – 1.10 mm (0.035 – 0.043 in)
SERVICE LIMIT: 1.5 mm (0.06 in)

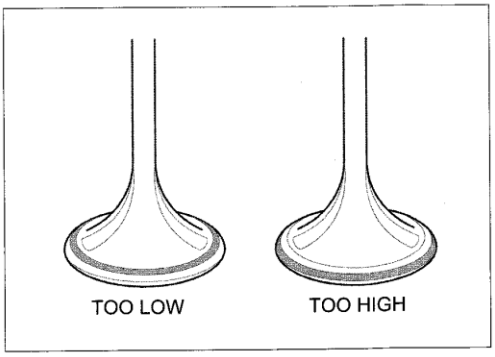
If the valve seat width is not within specification, reface the valve seat (page 9-21).

Inspect the valve seat face for:

- Damaged face:
  – Replace the valve and reface the valve seat.
- Uneven seat width:
  – Replace the valve and reface the valve seat.



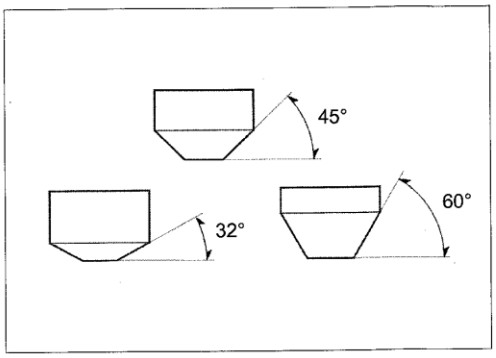
- Contact area (too low or too high)
  – Reface the valve seat.



VALVE SEAT REFACING

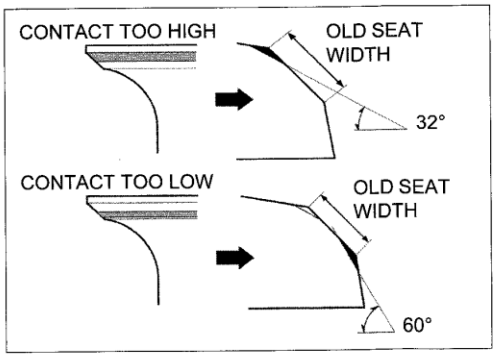
NOTE:

- Follow the refacing manufacturer's operating instructions.
- Be careful not to grind the seat more than necessary.



If the contact area is too high on the valve, the seat must be lowered using a 32° flat cutter.

If the contact area is too low on the valve, the seat must be raised using a 60° interior cutter.

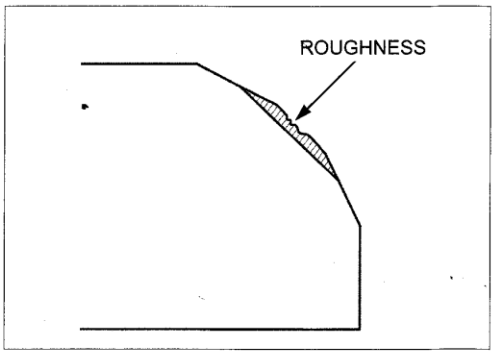


Using a 45° seat cutter, remove any roughness or irregularities from the seat.

TOOLS:

Seat cutter, 33 mm (45° IN)	**07780-0010800**
Seat cutter, 40 mm (45° EX)	**07780-0010500**
Cutter holder, 6.6 mm	**07781-0010202**

or equivalent commercially available in U.S.A.

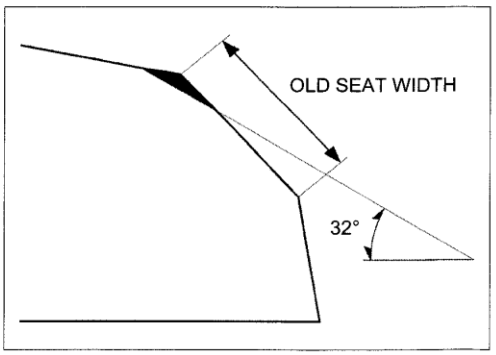


Using a 32° flat cutter, remove 1/4 of the existing valve seat material.

TOOLS:

Flat cutter, 33 mm (32° IN)	**07780-0012900**
Flat cutter, 42 mm (32° EX)	**07780-0013000**
Cutter holder, 6.6 mm	**07781-0010202**

or equivalent commercially available in U.S.A.

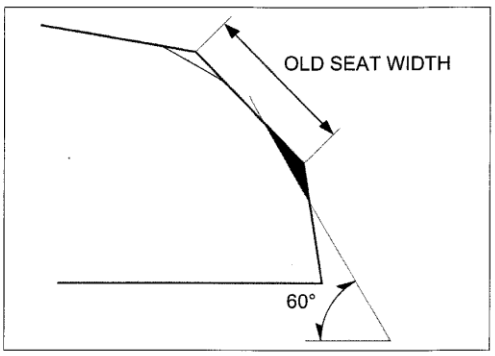


Using a 60° interior cutter, remove 1/4 of the existing valve seat material.

TOOLS:

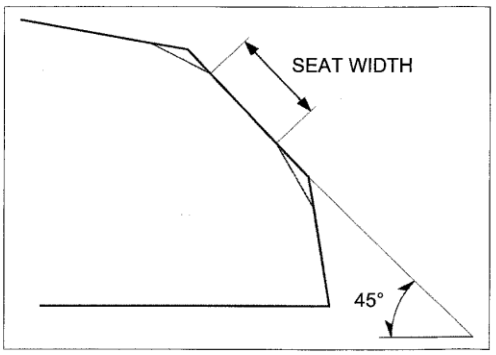
Interior cutter, 30 mm (60° IN)	**07780-0014000**
Interior cutter, 37.5 mm (60° EX)	**07780-0014100**
Cutter holder, 6.6 mm	**07781-0010202**

or equivalent commercially available in U.S.A.



Using a 45° seat cutter, cut the seat to the proper width.

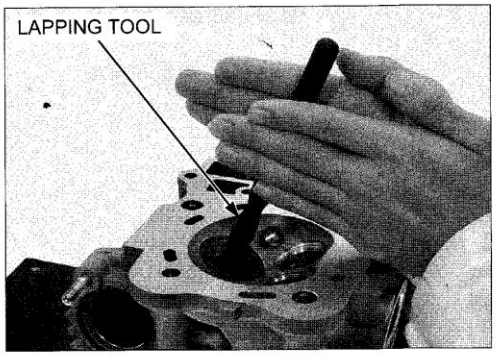
Make sure all pitting and irregularities are removed.



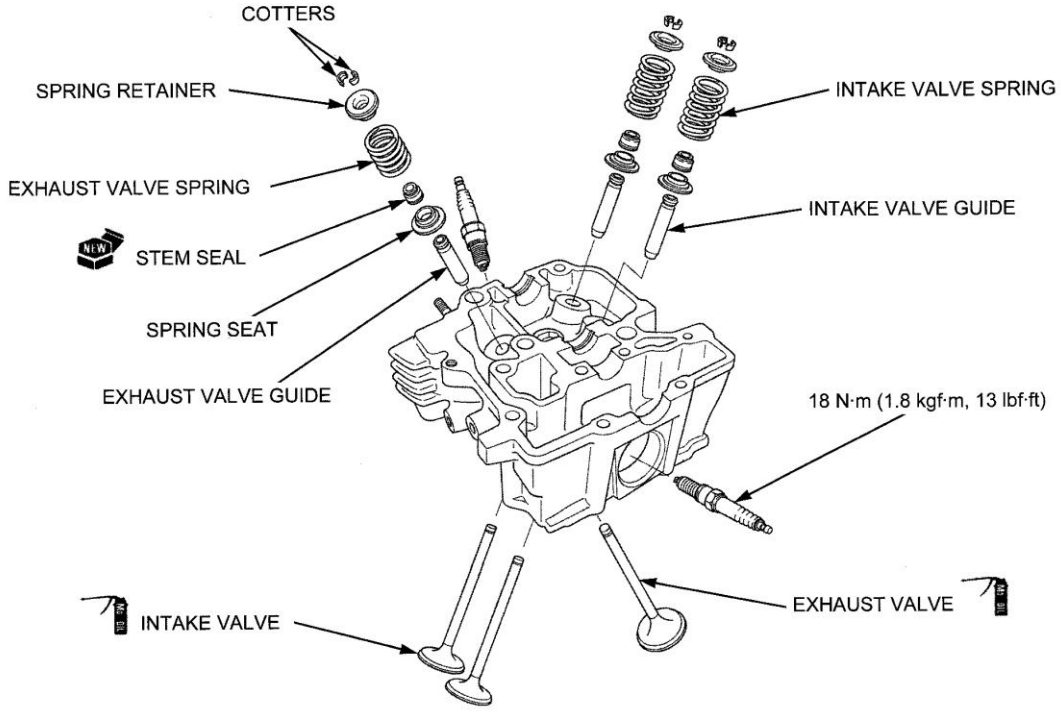
Excessive lapping pressure may deform or damage the seat. Do not allow lapping compound to enter the guides.

After cutting the seat, apply lapping compound to the valve face, and lap the valve using light pressure. Change the angle of the lapping tool frequently to prevent uneven seat wear.

After lapping, wash any residual compound off the cylinder head and valve and recheck the seat contact.



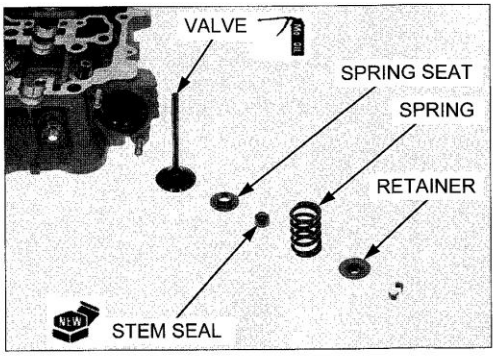
CYLINDER HEAD ASSEMBLY



Blow out all of the oil passages in the cylinder head with compressed air.
Install the spring seats and new stem seals.

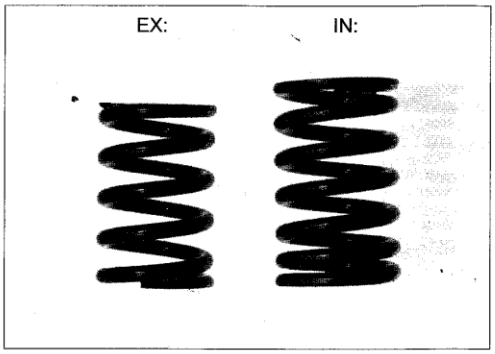
Apply molybdenum oil solution to the valve stem sliding surface.

Insert the valve into the guide while turning it slowly to avoid damaging the stem seal.



Install the valve springs with the paint mark side facing up.

Install the spring retainer.

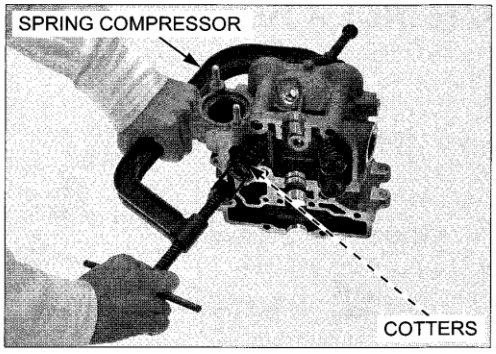


Grease the cotters to ease installation. To prevent loss of tension, do not compress the valve springs more than necessary to install the cotters.

Install the valve spring cotters using the special tool.

TOOL:
Valve spring compressor 07757-0010000

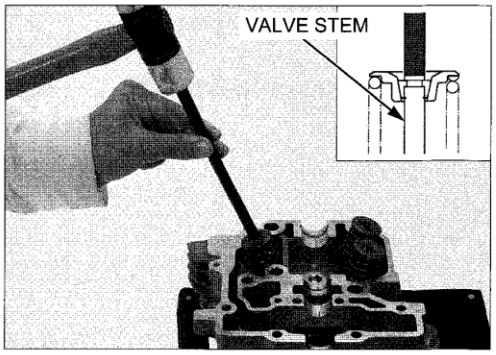
Remove the special tool.



Support the cylinder head so the valve heads will not contact anything and possibly get damaged.

Tap the valve stems gently with hammer and shaft as shown to seat the cotters firmly.

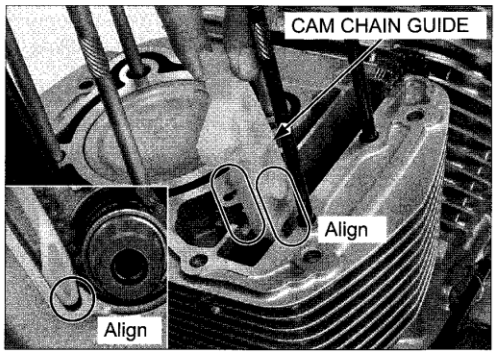
Install the spark plug (page 4-9).



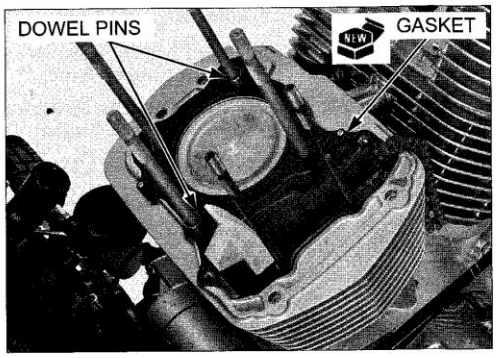
CYLINDER HEAD INSTALLATION

Clean the gasket mating surfaces of the cylinder and cylinder head thoroughly, being careful not to damage them.

Install the cam chain guide by aligning the guide end with the groove in the crankcase and the bosses with the groove in the cylinder.

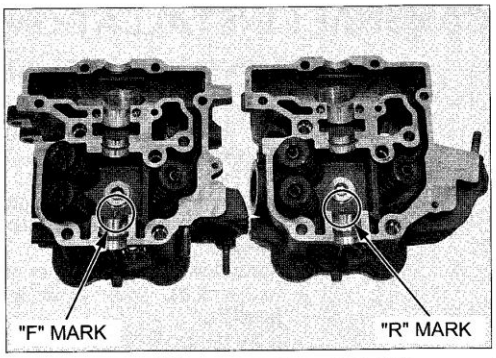


Install the dowel pins and a new gasket.

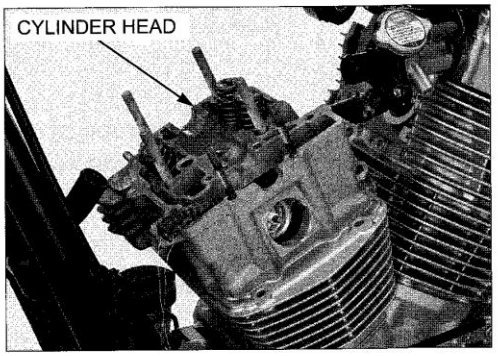


The cylinder heads are identified by marks on their oil pockets.

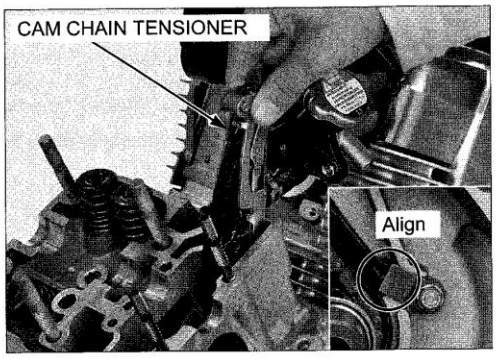
- "F": Front cylinder head
- "R": Rear cylinder head



Route the cam chain through the cylinder head and install it onto the cylinder.



Install the cam chain tensioner, aligning its end with the groove in the crankcase.



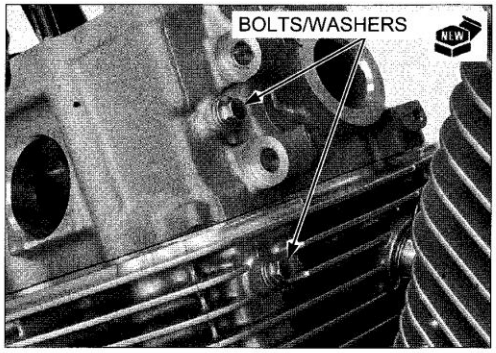
Tighten the cam chain tensioner bolts as follows:

1. Temporarily install the cam chain tensioner bolts with new sealing washers.
2. Tighten the cylinder head side cam chain tensioner bolt to the specified torque.

   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

3. Tighten the cylinder side cam chain tensioner bolt to the specified torque.

   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

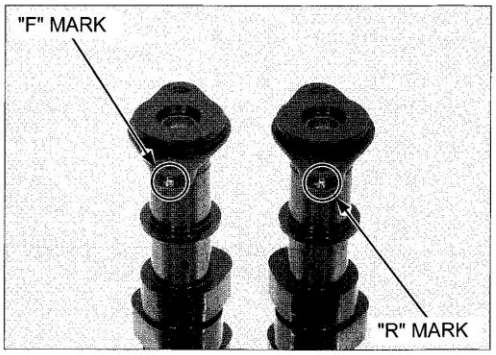


CAMSHAFT INSTALLATION

CAMSHAFT TIMING PROCEDURE

NOTE:

- The camshafts are identified by the stamped marks:
  "F": Front camshaft
  "R": Rear camshaft
- If both (front and rear) camshafts are removed, install the front camshaft first, then install the rear camshaft.
- If the rear cylinder head is not serviced, remove the rear cylinder head cover to check the camshaft position.
- If the front cylinder head is not serviced, remove the front cylinder head cover to check the camshaft position.



FRONT CYLINDER TDC SETTING

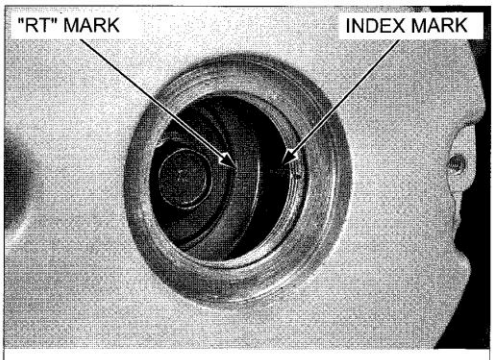
If the rear cylinder has not been serviced, begin here.

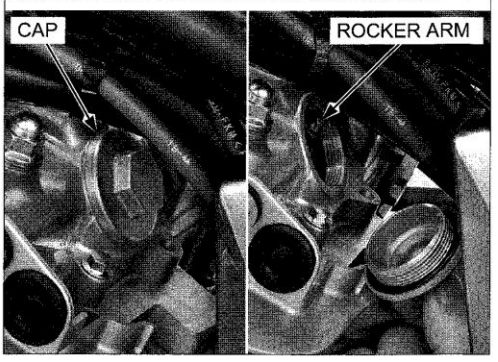
Remove the rear exhaust valve adjusting hole cap (page 4-9) and check the rear camshaft position as follows:

Turn the crankshaft clockwise and align the "RT" mark on the primary drive gear with the index mark on the right crankcase cover, then check the slack in the rocker arm.

- If there is slack, turn the crankshaft clockwise 1-1/7 (412°) turn (align the "FT" mark with the index mark) and begin installation of the front camshaft.
- If there is no slack, turn the crankshaft clockwise 1/7 (52°) turn (align the "FT" mark with the index mark) and begin installation of the front camshaft.

Install the front camshaft (page 9-27).





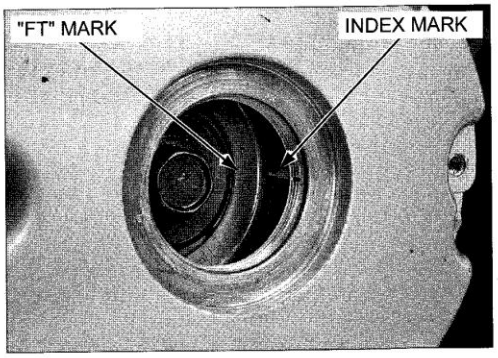
BOTH CYLINDER TDC SETTING

If both camshafts have been serviced, begin installation of the front camshaft.

Align the "FT" mark on the primary drive gear with the index mark on the right crankcase cover.

Install the front camshaft (page 9-27).

Set the rear cylinder at TDC (page 9-27).
Install the rear camshaft (page 9-27).



REAR CYLINDER TDC SETTING

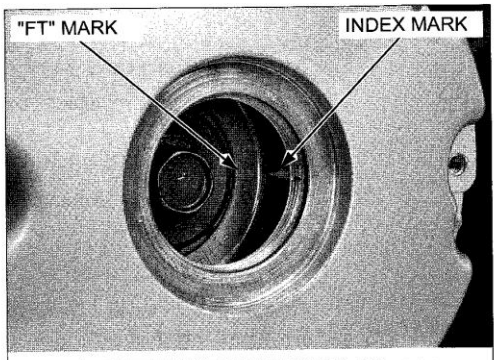
If the front cylinder has not been serviced, begin here.

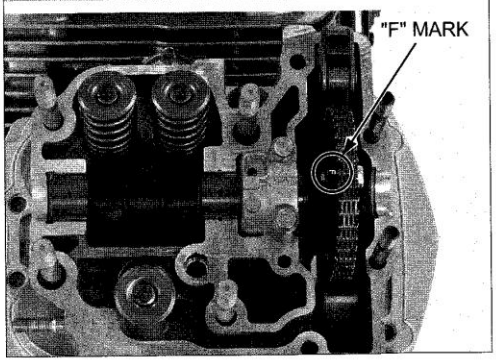
Remove the front cylinder head cover (page 9-7) and check the front camshaft position as follows:

Turn the crankshaft clockwise and align the "FT" mark on the primary drive gear with the index mark on the right crankcase cover, then check the identification mark "F" on the front camshaft.

- If the "F" mark faces up, turn the crankshaft clockwise 6/7 (308°) turn and align the "RT" mark with the index mark.
- If the "F" mark faces down (cannot be seen), turn the crankshaft clockwise 1-6/7 (668°) turn and align the "RT" mark with the index mark.

Install the rear camshaft using the following procedure.





CAMSHAFT INSTALLATION

The front and rear camshafts service procedures are the same.

NOTE:

- Make sure to follow the CAMSHAFT TIMING PROCEDURE (page 9-26) before installing the camshaft.

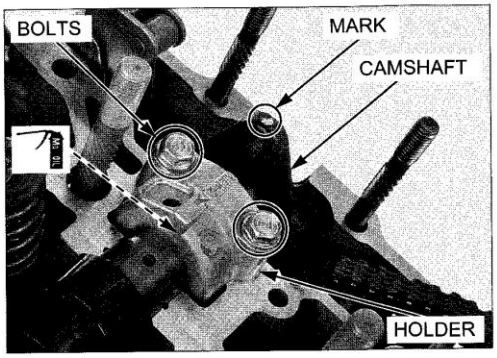
Apply molybdenum oil solution to the camshaft journal surface.

Install the camshaft onto the cylinder head with the "F" mark on the flange facing up.

NOTE:

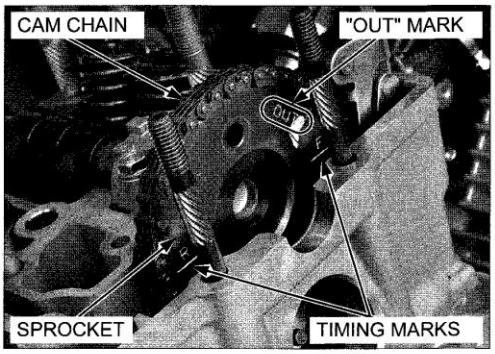
- The camshafts are identified by the following marks:
  - "F": front camshaft
  - "R": rear camshaft

Install the camshaft holder with the dowel pins.
Install and tighten the bolts.



Install the cam sprocket to the cam chain with the "OUT" mark facing outside.

Install the cam sprocket on the camshaft flange and check that the timing marks align with the upper surface of the cylinder head.



Align the bolt holes in the sprocket and camshaft flange.

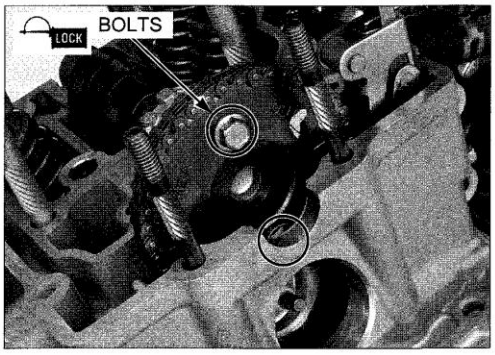
Apply locking agent to the cam sprocket bolt threads (page 1-16).

Install the sprocket bolt. Turn the crankshaft clockwise one revolution and install the remaining bolt.

Tighten the cam sprocket bolt while holding the crankshaft.

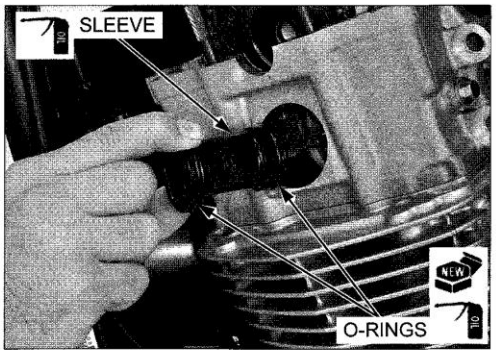
TORQUE: 23 N·m (2.3 kgf·m, 17 lbf·ft)

Turn the crankshaft one revolution and tighten the other bolt to the same torque.



Apply engine oil to new O-rings and install them to the spark plug sleeve grooves.

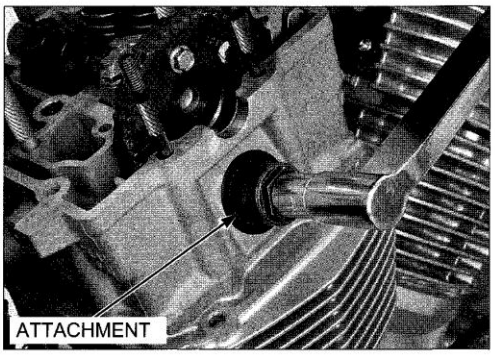
Apply engine oil to the spark plug sleeve threads and install it to the cylinder head.



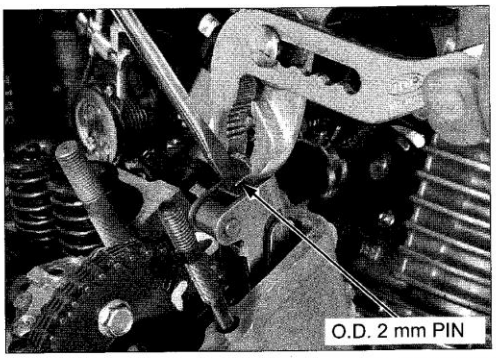
Tighten the spark plug sleeve using the special tool.

TOOL:
Fork tube holder attachment 07930-KA50100

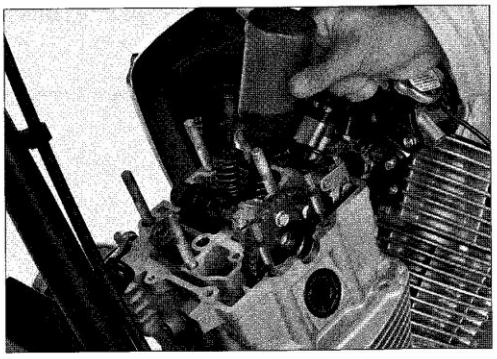
TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)



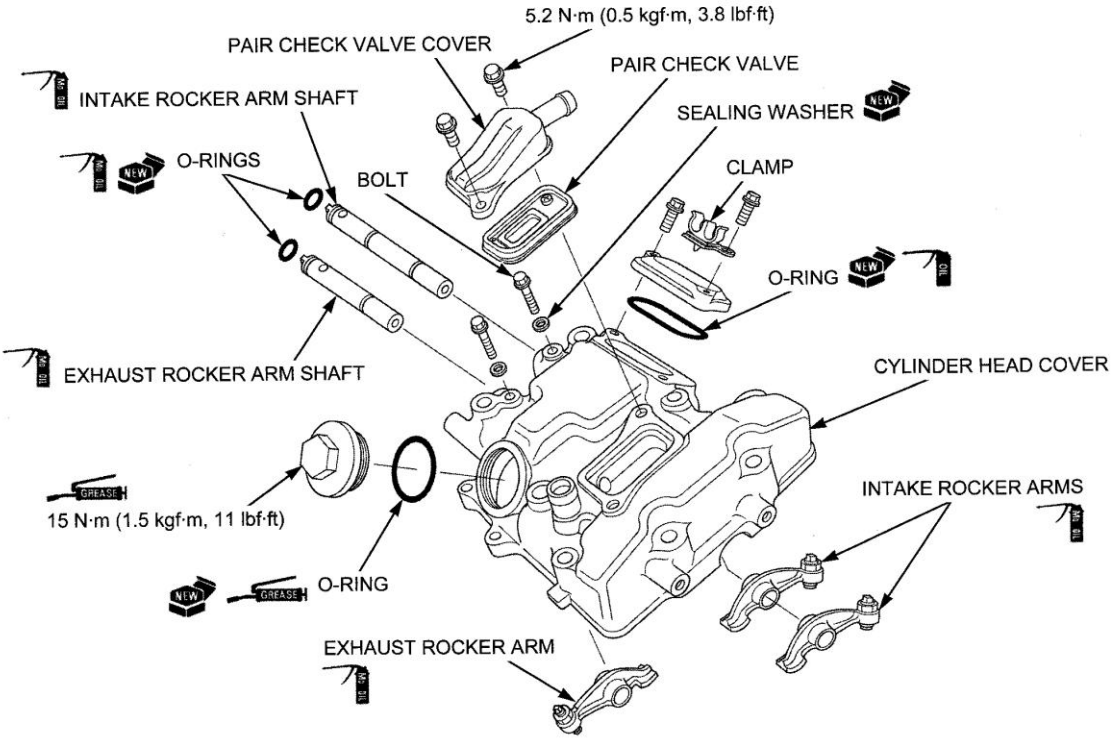
After camshaft installation is completed, remove the O.D. 2 mm pin from each cam chain tensioner.



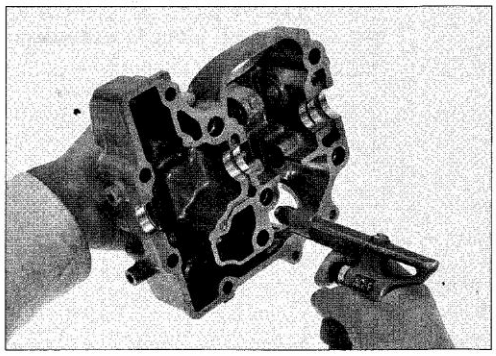
Fill the oil pockets in the cylinder head with engine oil.



ROCKER ARM INSTALLATION

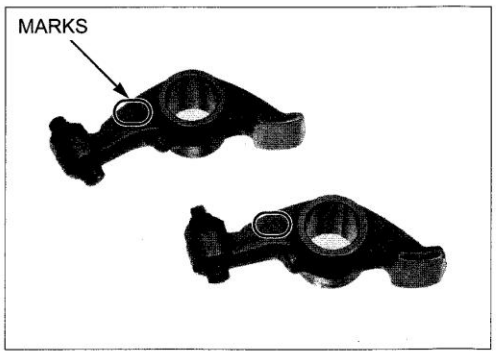


Clean the cylinder head cover with solvent and blow out all of the oil passages with compressed air.



The rocker arms have the following identification marks:
"IN": intake
"EX": exhaust

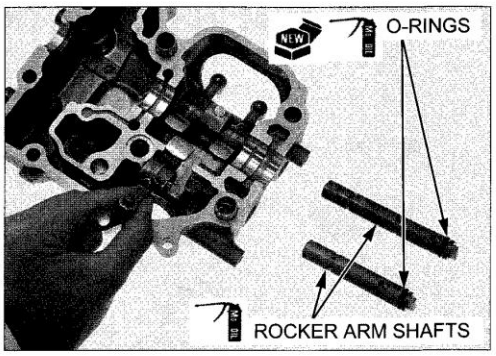
Place the rocker arms into the head cover in the proper position.



Apply molybdenum oil solution to new O-rings and install them to each rocker arm shaft grooves.

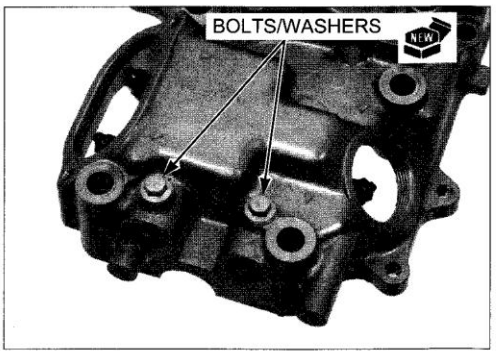
Apply molybdenum oil solution to the rocker arm shaft outer surface.

Install the rocker arm shafts through the cylinder head cover and rocker arms.



Align the bolt holes in the head cover and rocker arm shafts.

Install the bolts with new sealing washers and tighten them.



CYLINDER HEAD COVER INSTALLATION

NOTE:
- Make sure the camshaft lobes face down.

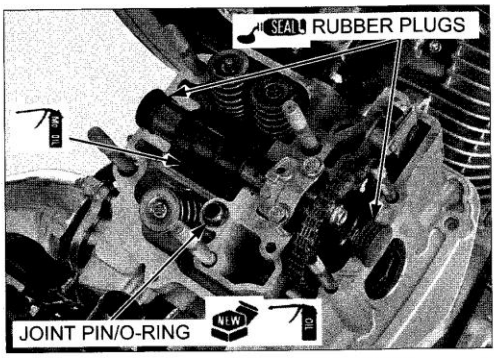
Clean the gasket mating surfaces of the cylinder head and cylinder head cover thoroughly, being careful not to damage them.

Install the joint pin.

Apply engine oil to a new O-ring and install it to the joint pin.

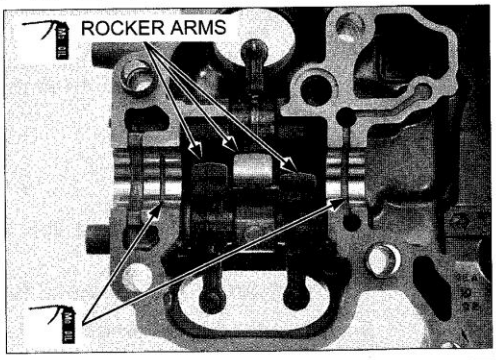
Apply liquid sealant (Three Bond 1207B, 1215 or equivalent) to the camshaft rubber plug seating surface and install them.

Apply molybdenum oil solution to the camshaft lobes.

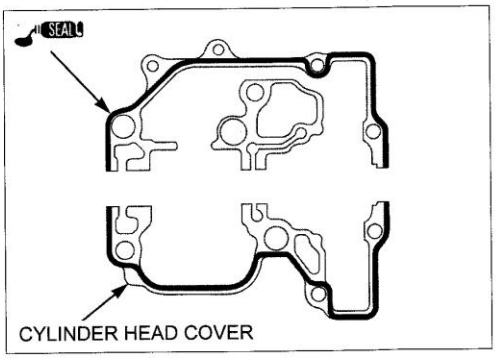


Apply molybdenum oil solution to the camshaft journal surface.

Apply molybdenum oil solution to the rocker arm slipper surface.

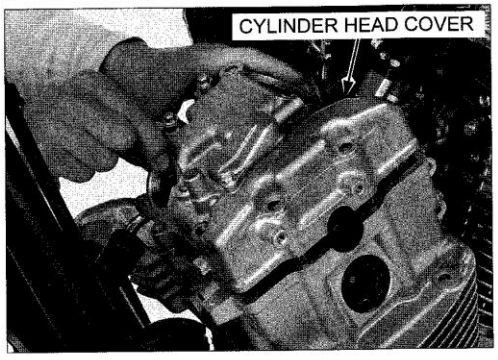


Apply liquid sealant (Three Bond 1207B, 1215 or equivalent) to the cylinder head cover mating surface as shown.

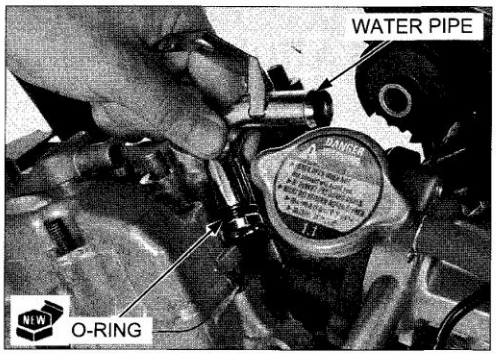


Make sure the sealant is applied evenly to the mating surfaces.

Carefully install the cylinder head cover while holding the exhaust rocker arm to avoid interfering the rocker arm with the valve stem.



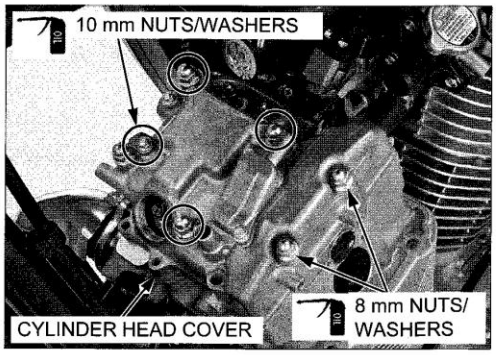
Install a new O-ring to the water pipe and install them to the cylinder head.



Apply engine oil to the cap nut threads and seating surface and install them with the sealing washers.

Tighten the cap nuts to the specified torque in a crisscross pattern in several steps.

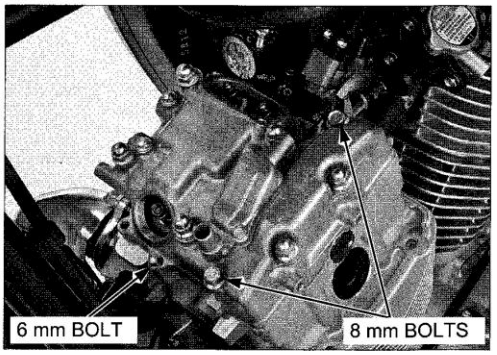
TORQUE:
Cylinder head cover cap nut (10 mm):
43 N·m (4.4 kgf·m, 32 lbf·ft)
Cylinder head cover cap nut (8 mm):
26 N·m (2.7 kgf·m, 19 lbf·ft)



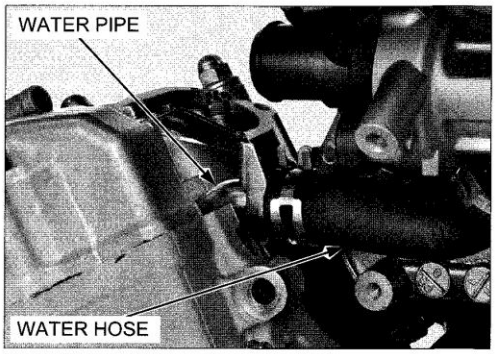
Install and tighten the 8 mm bolts to the specified torque.

TORQUE: 26 N·m (2.7 kgf·m, 19 lbf·ft)

Install and tighten the 6 mm bolt.



Connect the water hose to the water pipe.



Front only: Install the following:

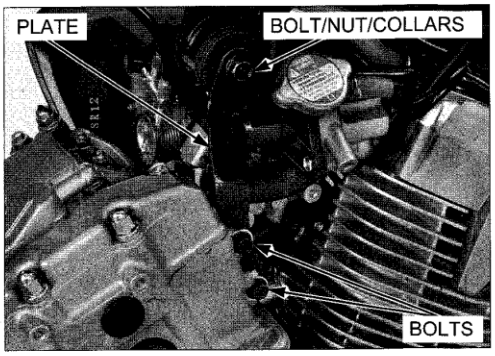
- Engine hanger plate
- Bolts
- Nut
- Collars

Tighten the V-bank engine mounting bolts to the specified torque.

TORQUE: 27 N·m (2.8 kgf·m, 20 lbf·ft)

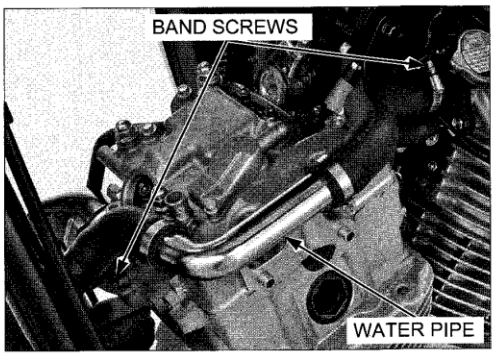
Tighten the V-bank engine hanger plate nut to the specified torque while holding the bolt.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)



Front only: Install the water pipe by connecting the water hoses.

Tighten the water hose band screw (page 7-15).



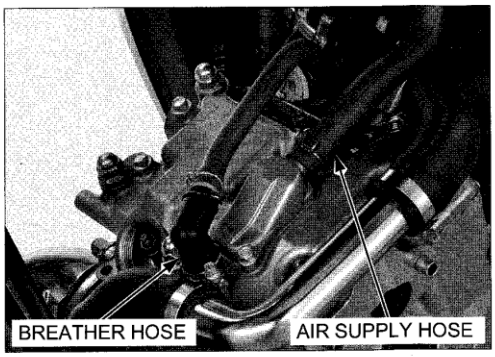
Connect the secondary air supply hose.

Front only: Connect the crankcase breather hose.

Install the following:

- Ignition switch (page 22-20)
- Fin (page 9-7)
- Over head cover (page 3-5)

Fill and bleed the cooling system (page 7-6).
Adjust the valve clearance (page 4-9).



MEMO