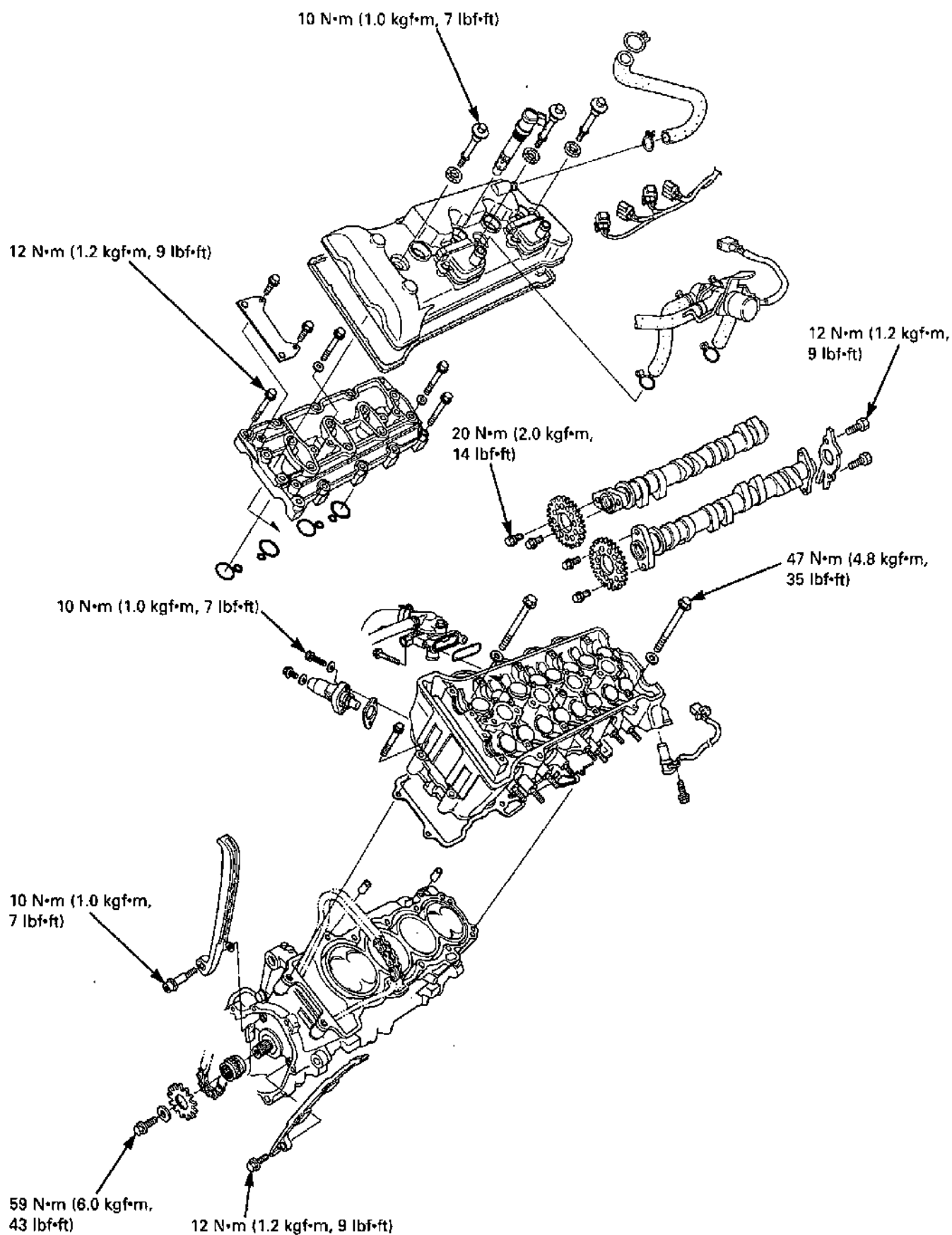


CYLINDER HEAD/VALVES



8. CYLINDER HEAD/VALVES

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SERVICE INFORMATION

8

GENERAL

- This section covers service of the cylinder head, valves and camshaft.
- The camshaft service can be done with the engine installed in the frame. The cylinder head service requires engine 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 lubricating oil is fed through oil passages in the cylinder head. Clean the oil passages before assembling the cylinder head.
- Be careful not to damage the mating surfaces when removing the cylinder head cover and cylinder head.

CYLINDER HEAD/VALVES

SPECIFICATIONS

Unit: mm (in)

ITEM			STANDARD	SERVICE LIMIT
Cylinder compression			1,226 kPa (12.5 kgf/cm ² , 178 psi) at 350 rpm	—
Valve clearance		IN	0.20 ± 0.03 (0.008 ± 0.001)	—
		EX	0.28 ± 0.03 (0.011 ± 0.001)	—
Camshaft	Cam lobe height	IN	36.56 – 36.80 (1.439 – 1.449)	36.5 (1.44)
		EX	35.34 – 35.58 (1.391 – 1.401)	35.3 (1.39)
	Runout		—	0.05 (0.002)
	Oil clearance		0.030 – 0.072 (0.0012 – 0.0028)	0.10 (0.004)
Valve lifter	Valve lifter O.D.		25.978 – 25.993 (1.0228 – 1.0233)	25.97 (1.022)
	Valve lifter bore I.D.		26.010 – 26.026 (1.0240 – 1.0246)	26.04 (1.025)
Valve, valve guide	Valve stem O.D.	IN	3.975 – 3.990 (0.1565 – 0.1571)	3.965 (0.1561)
		EX	3.965 – 3.980 (0.1561 – 0.1567)	3.955 (0.1557)
	Valve guide I.D.	IN/EX	4.000 – 4.012 (0.1575 – 0.1580)	4.04 (0.159)
	Stem-to-guide clearance	IN	0.010 – 0.037 (0.0004 – 0.0015)	0.075 (0.0030)
		EX	0.020 – 0.047 (0.0008 – 0.0019)	0.085 (0.0033)
	Valve guide projection above cylinder head	IN	16.1 – 16.4 (0.63 – 0.65)	—
		EX	14.3 – 14.6 (0.56 – 0.57)	—
	Valve seat width	IN/EX	0.90 – 1.10 (0.035 – 0.043)	1.5 (0.06)
Valve spring free length	IN	Outer	42.2 (1.66)	41.36 (1.628)
		Inner	36.4 (1.43)	35.57 (1.400)
	EX		36.3 (1.43)	35.57 (1.400)
Cylinder head warpage			—	0.10 (0.004)

TORQUE VALUES

Cylinder head mounting bolt/washer	47 N•m (4.8 kgf•m, 35 lbf•ft)	Apply molybdenum disulfide oil to the threads and seating surface.
Camshaft holder flange bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply oil to the threads.
Cylinder head sealing bolt	18 N•m (1.8 kgf•m, 13 lbf•ft)	Apply a locking agent to the threads.
Cylinder head cover bolt	10 N•m (1.0 kgf•m, 7 lbf•ft)	
Breather plate flange bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads. CT bolt.
PAIR reed valve cover SH bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	CT bolt.
Cam sprocket flange dowel bolt	20 N•m (2.0 kgf•m, 14 lbf•ft)	Apply a locking agent to the threads.
CMP sensor rotor flange dowel bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads.
Cam chain lifter mounting socket bolt	10 N•m (1.0 kgf•m, 7 lbf•ft)	
Cam chain tensioner pivot socket bolt	10 N•m (1.0 kgf•m, 7 lbf•ft)	Apply a locking agent to the threads.
Cam chain guide bolt/washer	12 N•m (1.2 kgf•m, 9 lbf•ft)	
Cylinder head stud bolt (exhaust pipe stud bolt)	See page 1-14	
CKP sensor rotor special bolt	59 N•m (6.0 kgf•m, 43 lbf•ft)	

TOOLS

Compression gauge attachment	07RMJ-MY50100	Equivalent commercially available in U.S.A.
Valve spring compressor	07757-0010000	
Valve spring compressor attachment	07959-KM30101	
Tappet hole protector	07HMG-MR70002	
Valve guide driver	07JMD-KY20100	
Valve guide reamer, 4.008 mm	07MMH-KV90100	
Valve seat cutters		Equivalent commercially available in U.S.A.
Seat cutter, 27.5 mm (45° IN)	07780-0010200	
Seat cutter, 24.5 mm (45° EX)	07780-0010100	
Flat cutter, 27 mm (32° IN)	07780-0013300	
Flat cutter, 24 mm (32° EX)	07780-0012500	
Interior cutter, 26 mm (60° IN)	07780-0014500	
Interior cutter, 22 mm (60° EX)	07780-0014202	
Cutter holder, 4.0 mm	07781-0010500	

TROUBLESHOOTING

- Engine top-end problems usually affect engine performance. These problem 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 white smoke in the crankcase breather hose. If the hose is smoky, check for a seized piston ring (Section 12).

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

- Valves:
 - Incorrect valve adjustment
 - Burned or bent valve
 - Incorrect valve timing
 - Broken valve spring
 - Uneven valve seating
- Cylinder head:
 - Leaking or damaged head gasket
 - Warped or cracked cylinder head
- Worn cylinder, piston or piston rings (section 12)

Compression too high, overheating or knocking

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

Excessive smoke

- Cylinder head:
 - Worn valve stem or valve guide
 - Damaged stem seal
- Worn cylinder, piston or piston rings (section 12)

Excessive noise

- Cylinder head:
 - Incorrect valve adjustment
 - Sticking valve or broken valve spring
 - Damaged or worn camshaft
 - Loose or worn cam chain
 - Worn or damaged cam chain
 - Worn or damaged cam chain tensioner
 - Worn cam sprocket teeth
- Worn cylinder, piston or piston rings (section 12)

Rough idle

- Low cylinder compression

CYLINDER COMPRESSION TEST

Warm up the engine to normal operating temperature.

Stop the engine and remove all the direct ignition coil/spark plug caps and spark plugs (page 3-6).
Support the front end of fuel tank (page 3-4).

Disconnect the fuel pump/reserve sensor 3P (Black) connector.

Install a compression gauge into the spark plug hole.

TOOL:

Compression gauge attachment 07RMJ-MY50100
(equivalent commercially available in U.S.A.)

Open the throttle all the way and crank the engine with the starter motor until the gauge reading stops rising.

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

Compression pressure:

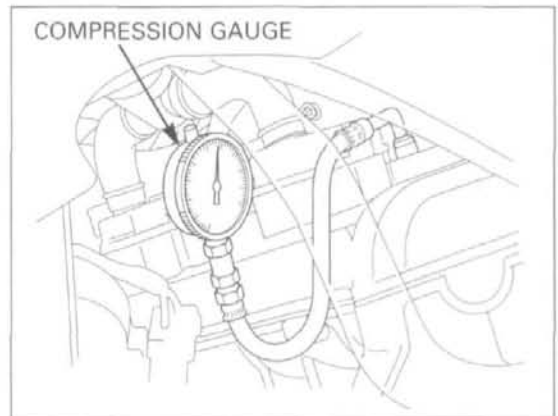
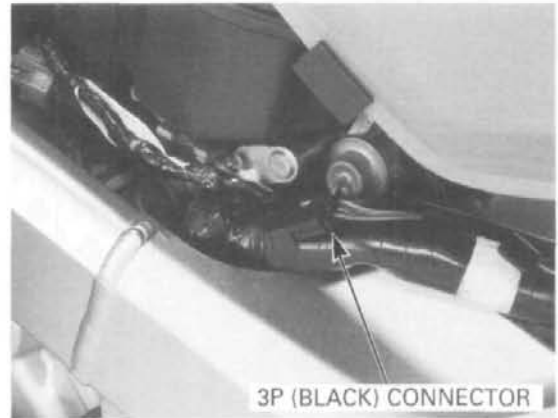
1,226 kPa (12.5 kgf/cm², 178 psi) at 350 rpm

Low compression can be caused by:

- Blown cylinder head gasket
- Improper valve adjustment
- Valve leakage
- Worn piston ring or cylinder

High compression can be caused by:

- Carbon deposits in combustion chamber or on piston head



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

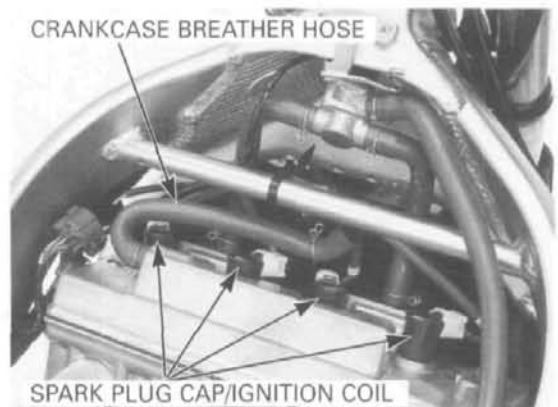
CYLINDER HEAD COVER REMOVAL

Remove the following:

- Throttle body (page 5-62)
- Spark plug cap/ignition coils (page 3-6)

Remove the crankcase breather hose.

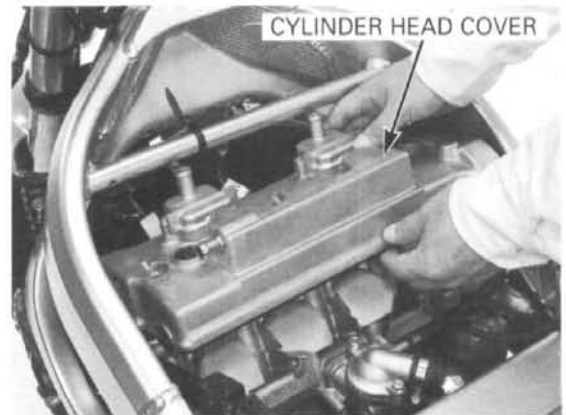
Disconnect the PAIR air suction hoses from the PAIR reed valve covers.



Remove the cylinder head cover bolts and washers.

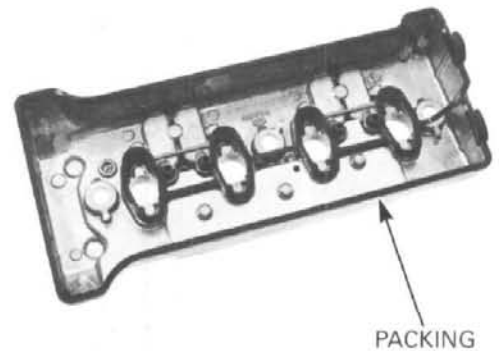


Remove the cylinder head cover rearward.

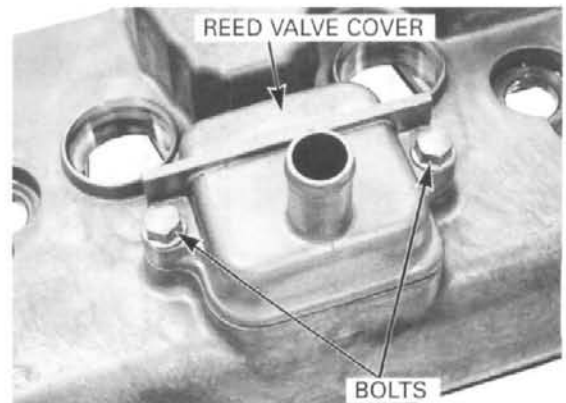


CYLINDER HEAD COVER DISASSEMBLY

Remove the cylinder head cover packing.

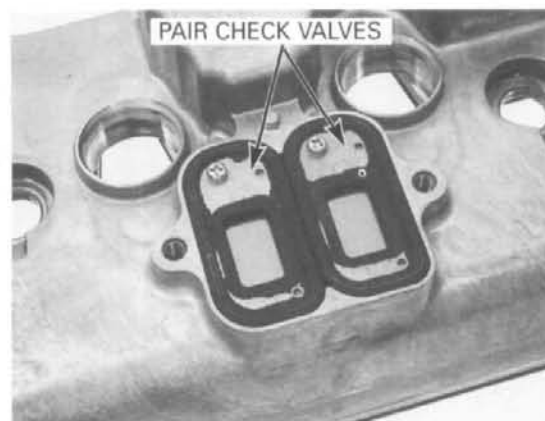


Remove bolts and breather separator and gasket

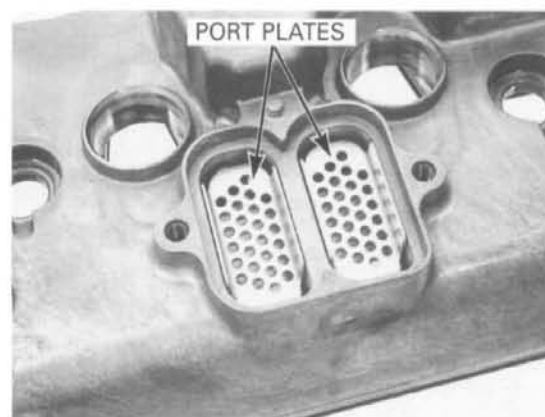


CYLINDER HEAD/VALVES

Check the PAIR check valve for wear or damage, replace if necessary.



Remove the port plates from the cylinder head cover.

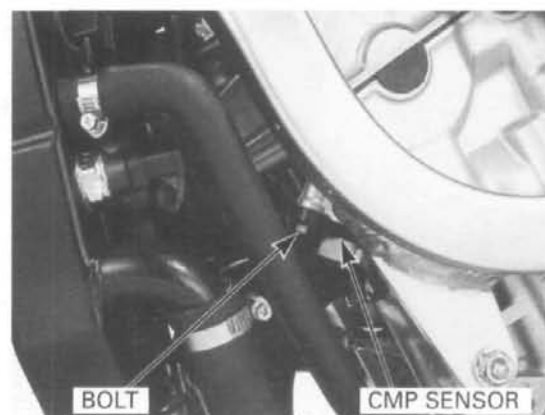


CAMSHAFT REMOVAL

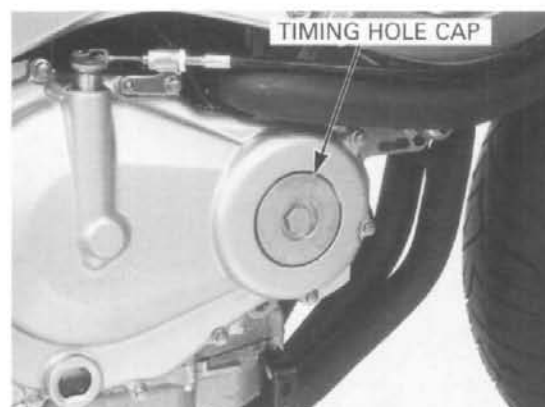
Remove the cylinder head cover (page 8-4).

Avoid damaging the CMP sensor while removing the camshafts.

Remove the bolt and CMP sensor from the cylinder head.

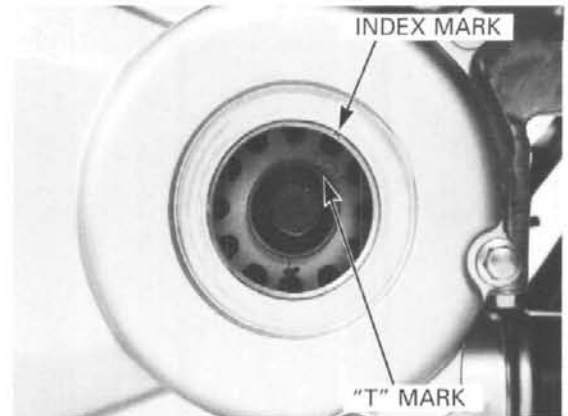


Remove the timing hole cap and O-ring.

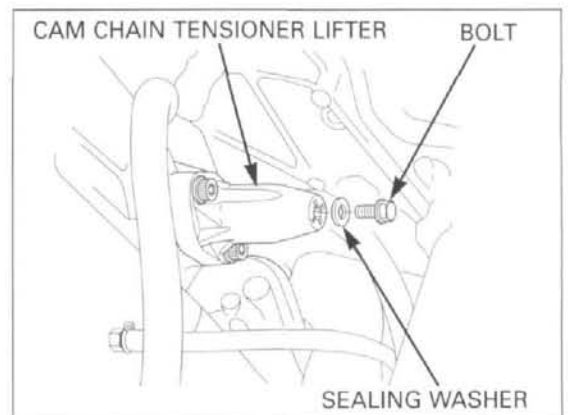


Turn the crankshaft clockwise, align the "T" mark on the CKP sensor rotor with the index mark on the right crankcase cover.

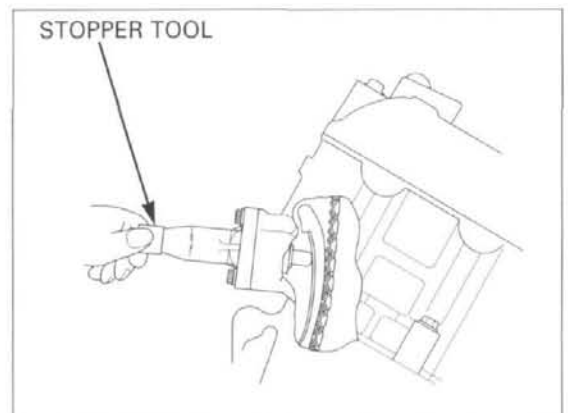
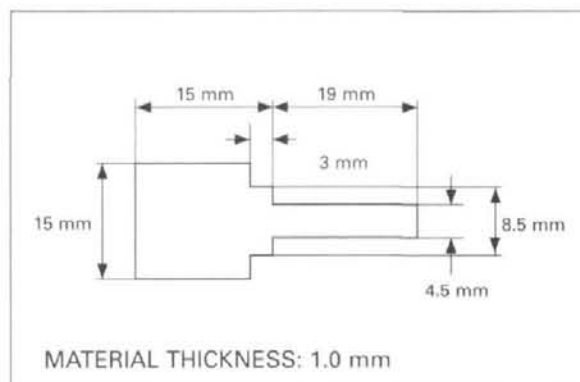
Make sure the No.1 piston is at TDC (Top Dead Center) on the compression stroke.



Remove the cam chain tensioner lifter sealing bolt and sealing washer.



Turn the tensioner lifter shaft fully in (clockwise) and secure it using the stopper tool. This tool can easily be made from a thin (1 mm thickness) piece of steel.

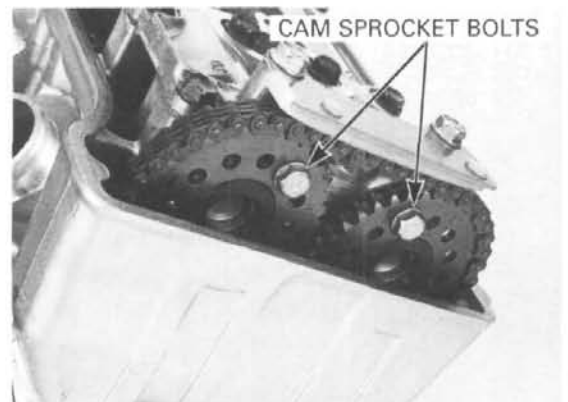


It is not necessary to remove the cam sprocket from the camshaft except when replacing the camshaft and/or cam sprocket.

If you plan to replace the camshaft and/or cam sprocket, loosen the cam sprocket bolts as follow:

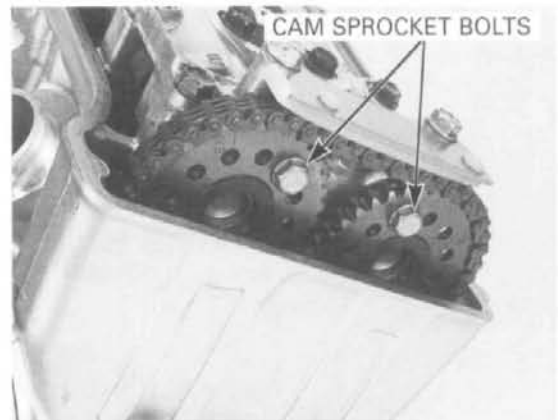
Be careful not to drop the cam sprocket bolts into the crankcase.

– Remove the cam sprocket bolts from the intake and exhaust camshafts.

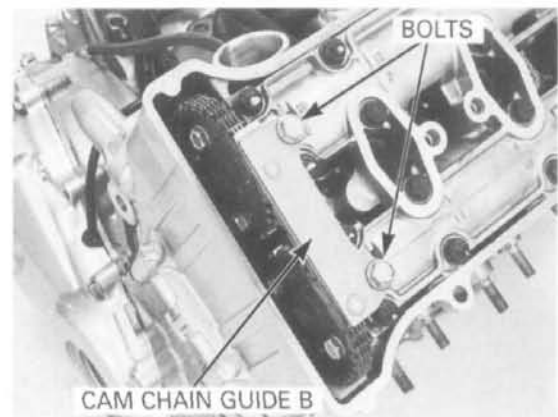


CYLINDER HEAD/VALVES

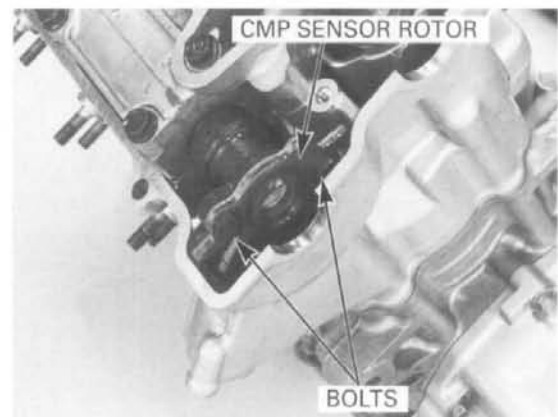
- Turn the crankshaft one full turn (360°), remove the other cam sprocket bolts from the camshafts.



- Remove the bolts and cam chain guide B.
- Remove the cam sprocket from the camshaft.



- Remove the bolts and CMP sensor rotor.



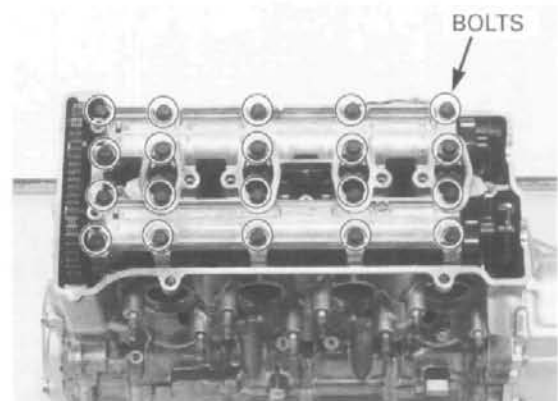
Suspend the cam chain with a piece of wire to prevent the chain from falling into the crankcase.

Loosen and remove the camshaft holder bolts, then remove the camshaft holder and camshaft.

NOTICE

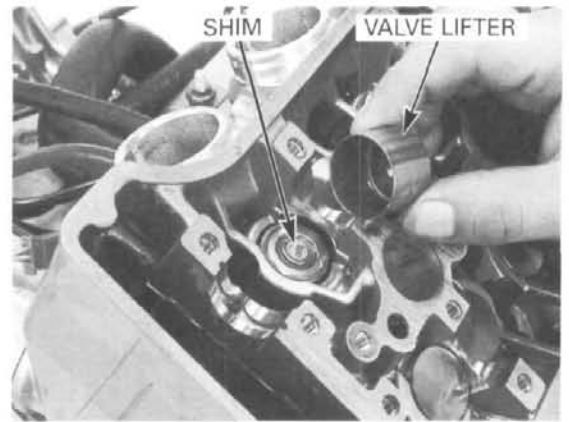
From outside to inside, loosen the bolts in a crisscross pattern in several steps or the camshaft holder might break.

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



Remove the valve lifters and shims.

- Be careful not to damage the valve lifter bore.
- The shim may stick to the inside of the valve lifters. Do not allow the shims to fall into the crankcase.
- Mark all valve lifters and shims to ensure correct reassembly in their original locations.
- The valve lifter can be easily removed with a valve lapping tool or magnet.
- The shims can be easily removed with a tweezers or magnet.



INSPECTION

CAMSHAFT

Check the cam and journal surfaces of the camshaft for scoring, scratches or evidence of insufficient lubrication.

Check the oil holes in the camshaft for clogs.

Support both ends of the camshaft with V-blocks and check the camshaft runout with a dial gauge.

SERVICE LIMIT: 0.05 mm (0.002 in)

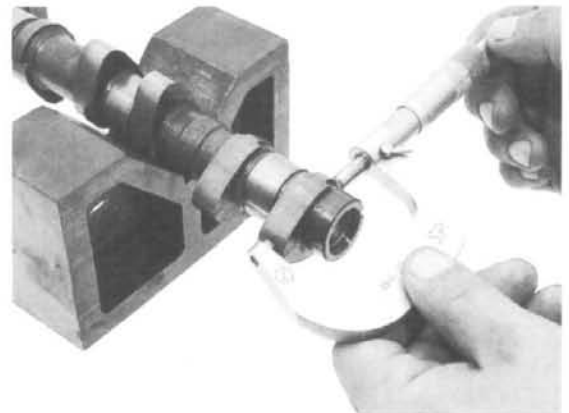


Using a micrometer, measure each cam lobe height.

SERVICE LIMITS:

IN: 36.5 mm (1.44 in)

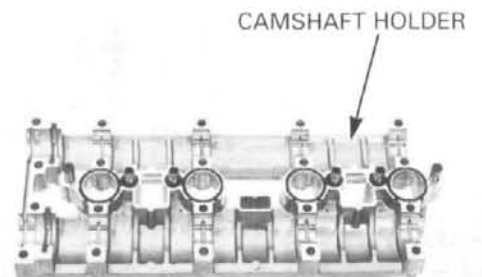
EX: 35.3 mm (1.39 in)



CAMSHAFT HOLDER

Inspect the bearing surface of the camshaft holder for scoring, scratches, or evidence of insufficient lubrication.

Inspect the oil orifices of the holders for clogs.



CYLINDER HEAD/VALVES

CAM CHAIN GUIDE B

Inspect the cam chain slipper surface of the cam chain guide for wear or damage.

CAM CHAIN GUIDE B

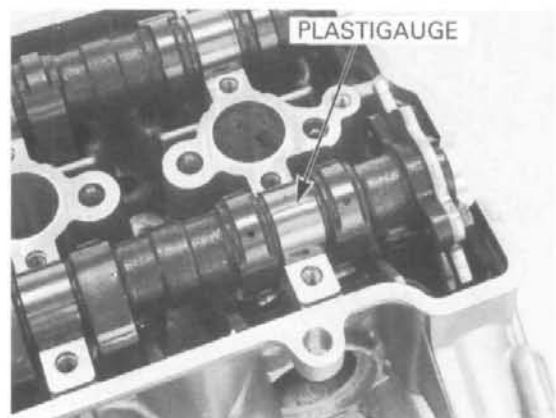


CAMSHAFT OIL CLEARANCE

Remove the cylinder head and valves (page 8-11).

Wipe any oil from the journals of the camshaft, cylinder head and camshaft holders.

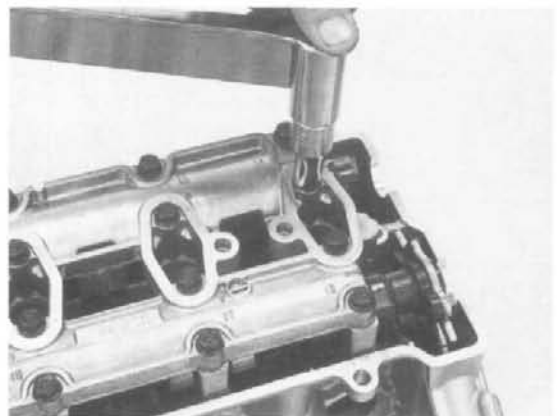
Lay a strip of plastigauge lengthwise on top of each camshaft journal.



Do not rotate the camshaft when using plastigauge.

Install the camshaft holder onto the camshafts. Apply engine oil to the threads and seating surfaces of the camshaft holder bolts. Install the twenty holder bolts with the eight sealing washers.

In case the valves in cylinder head:
The camshaft holder have the number "1 thru 20".
Temporarily tighten the four bolts of the center area gradually in the sequence 6 - 5 - 8 - 7 until the dowel pins on the camshaft holder inserts into the pin holes in the cylinder head properly. (The clearance between the holder and head is 1 - 5 mm)
Next tighten the all holder bolts in numerical order cast on the camshaft holder (1 thru. 20) in several steps, then tighten them to the specified torque.

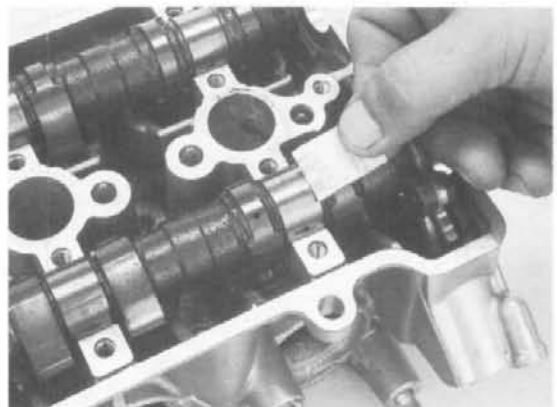


TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

Remove the camshaft holders and measure the width of each plastigauge.
The widest thickness determines the oil clearance.

SERVICE LIMIT: 0.10 mm (0.004 in)

When the service limits are exceeded, replace the camshaft and recheck the oil clearance.
Replace the cylinder head and camshaft holders as a set if the clearance still exceeds the service limit.



CYLINDER HEAD REMOVAL

Drain the coolant (page 6-5).

Remove the following:

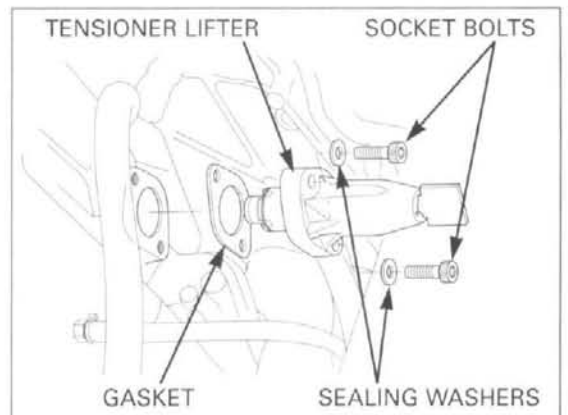
- Camshaft (page 8-6)
- Thermostat housing (page 6-6)

Remove the cylinder drain bolt and sealing washer. Drain the coolant from the cylinder head and cylinder block.

Check the sealing washer is in good condition, replace if necessary.

Reinstall the sealing washer and drain bolt.

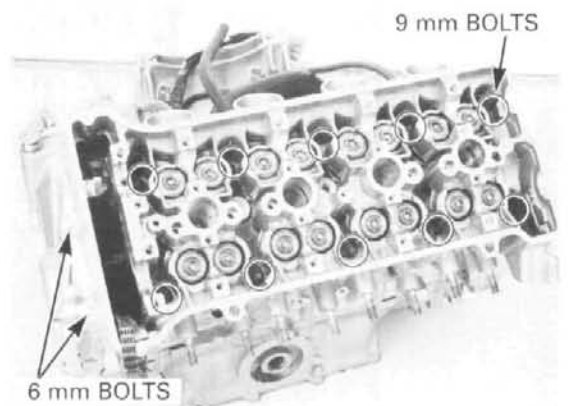
Remove the socket bolts, sealing washers and cam chain tensioner lifter and gasket.



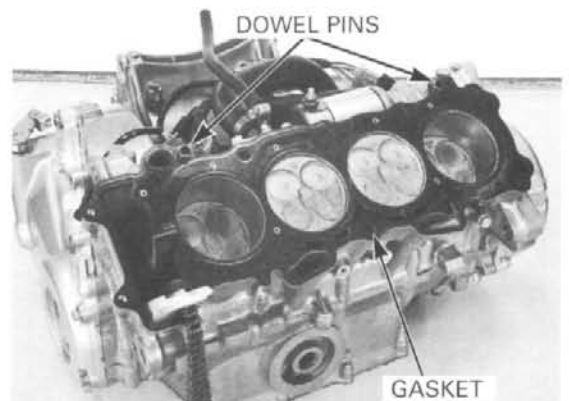
Loosen the 9-mm bolts in a criss-cross pattern in two or three steps.

Remove the two 6-mm flange bolts.
Remove the ten 9-mm bolts/washers.

Remove the cylinder head.



Remove the gasket and dowel pins.

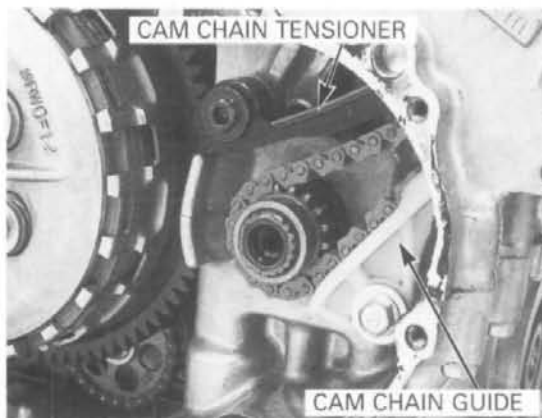


CYLINDER HEAD/VALVES

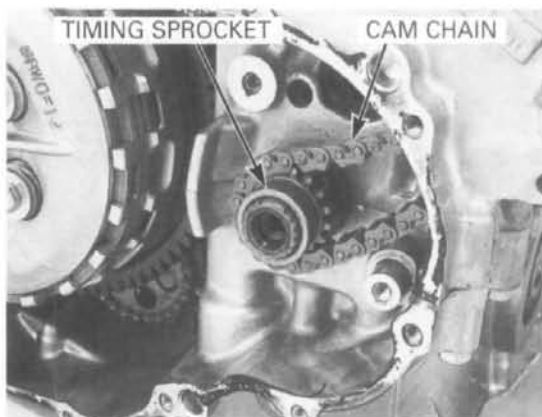
Remove the right crankcase cover and ignition pulse generator rotor (page 17-7).

Remove the socket bolt, washer, cam chain guide and collar.

Remove the socket bolt, cam chain tensioner and washer.



Remove the cam chain and timing sprocket from the crankshaft.



CYLINDER HEAD DISASSEMBLY

Remove the spark plugs from the cylinder head.

Install the tappet hole protector into the valve lifter bore.

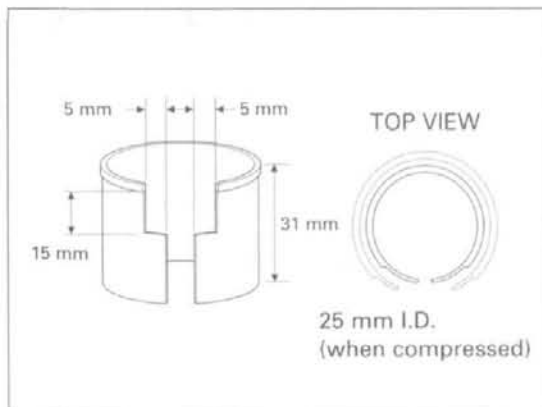
TOOL:

Tappet hole protector

07HMG-MR70002



An equivalent tool can easily be made from a 35-mm plastic film container as shown.



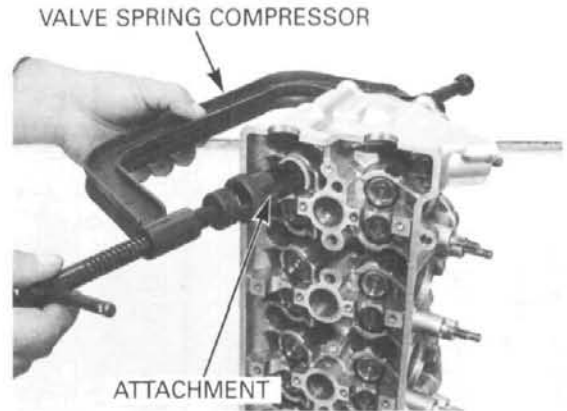
Remove the valve spring cotters using the special tools as shown.

TOOLS:

Valve spring compressor 07757-0010000
Valve spring compressor attachment 07959-KM30101

NOTICE

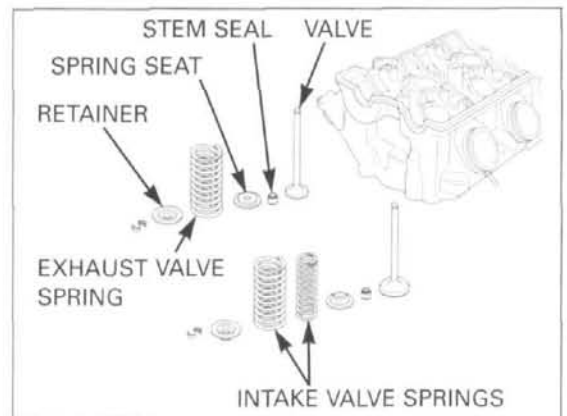
To prevent loss of tension, do not compress the valve springs more than necessary to remove the cotters.



Mark all parts during disassembly so they can be placed back in their original locations.

Remove the following:

- Spring retainer
- Valve spring
- Valve
- Stem seal
- Valve spring seat



CYLINDER HEAD INSPECTION

CYLINDER HEAD

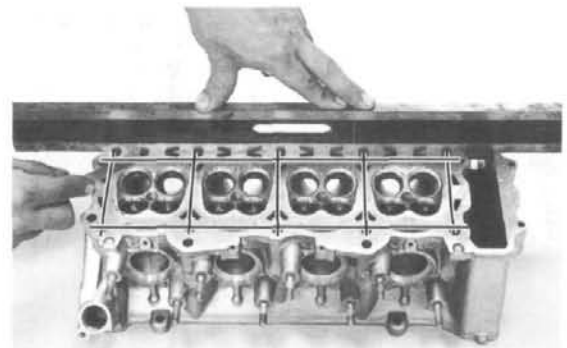
Avoid damaging the gasket surface.

Remove carbon deposits from the combustion chamber, being careful not to damage the gasket surface. Check the spark plug hole and valve areas for cracks.



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

SERVICE LIMIT: 0.10 mm (0.004 in)



CYLINDER HEAD/VALVES

VALVE LIFTER BORE

Inspect each valve lifter bore for scratches or abnormal wear.

Measure the each valve lifter bore I.D.

SERVICE LIMIT: 26.04 mm (1.025 in)

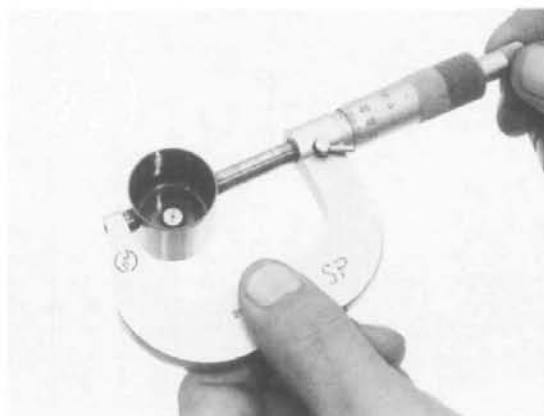


VALVE LIFTER

Inspect each valve lifter for scratches or abnormal wear.

Measure the each valve lifter O.D.

SERVICE LIMIT: 25.97 mm (1.022 in)



VALVE SPRING

Measure the the valve spring free length.

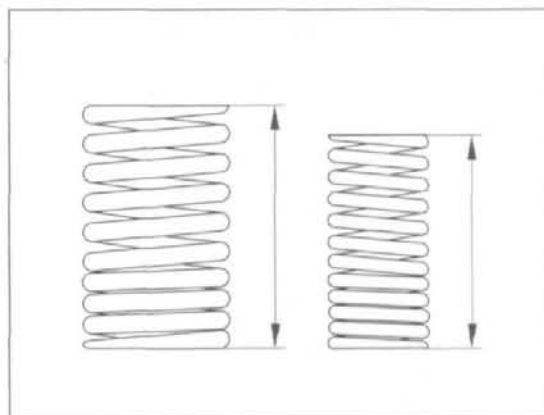
SERVICE LIMITS:

Intake: Outer: 41.36 mm (1.628 in)

Inner: 35.57 mm (1.400 in)

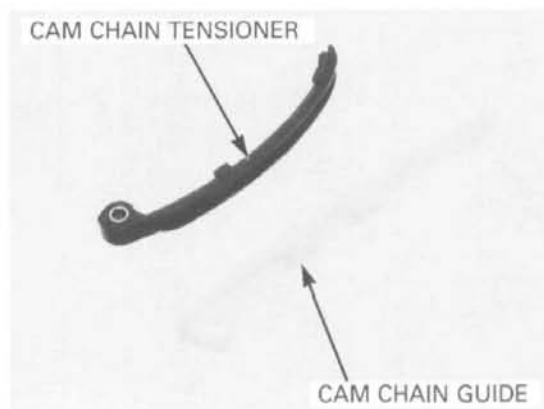
Exhaust: 35.57 mm (1.400 in)

Replace the springs if they are shorter than the service limits.



CAM CHAIN TENSIONER/CAM CHAIN GUIDE

Inspect the cam chain tensioner and cam chain guide for excessive wear or damage, replace if necessary.



VALVE/VALVE GUIDE

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

Check valve movement in the guide, measure and record each valve stem O.D.

SERVICE LIMITS:

IN: 3.965 mm (0.1561 in)

EX: 3.955 mm (0.1557 in)



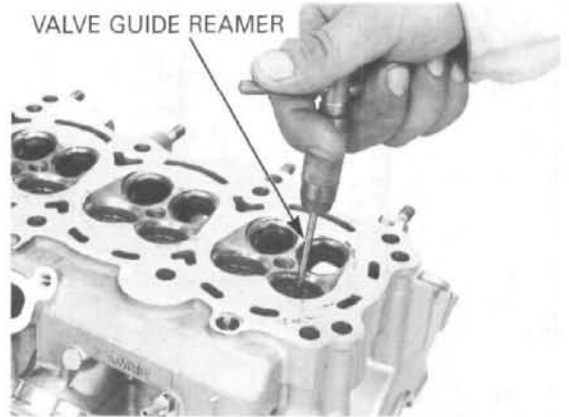
Ream the guides to remove any carbon deposits before checking clearances.

Insert the reamer from the combustion chamber side of the head and always rotate the reamer clockwise.

TOOL:

Valve guide reamer, 4.008 mm 07MMH-MV90100

VALVE GUIDE REAMER



Measure and record each valve guide I.D.

SERVICE LIMIT: IN/EX: 4.04 mm (0.159 in)

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

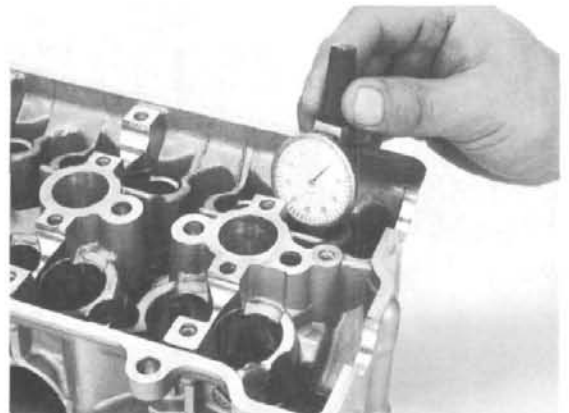
SERVICE LIMITS:

IN: 0.075 mm (0.0030 in)

EX: 0.085 mm (0.0033 in)

Reface the valve seats whenever the valve guides are replaced (page 8-17).

If the stem-to-guide clearance is out of standard, determine if a new 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 is out of standard with the new guides, replace the valves and guides.



VALVE GUIDE REPLACEMENT

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

Heat the cylinder head to 100 – 150°C (212 – 300°F) with a hot plate or oven.

NOTICE

Do not use a torch to heat the cylinder head; it may cause warpage.

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

TOOL:

Valve guide driver 07JMD-KY20100

Drive in the guide to the specified depth from the top of the cylinder head.

SPECIFIED DEPTH:

IN: 16.1 – 16.4 mm (0.63 – 0.65 in)

EX: 14.3 – 14.6 mm (0.56 – 0.57 in)

TOOL:

Valve guide driver 07JMD-KY20100

Let the cylinder head cool to room temperature.

Use cutting oil on the reamer during this operation.

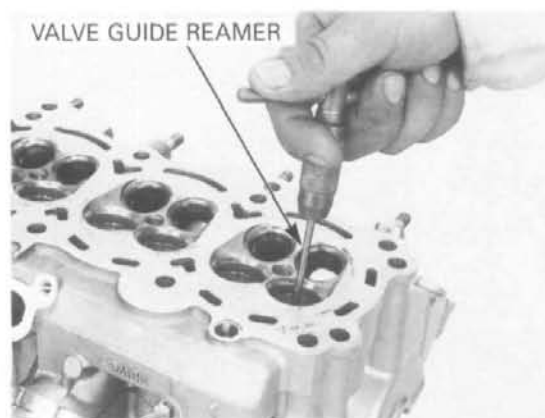
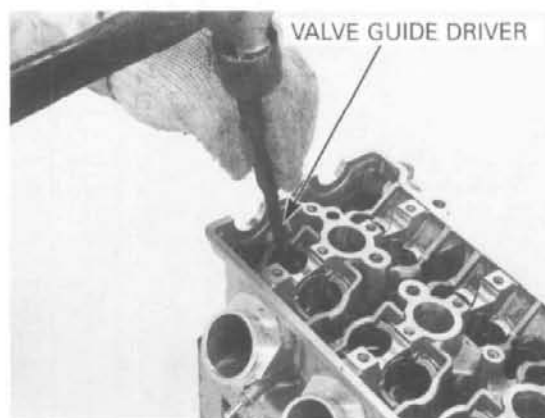
Ream the new valve guide after installation. Insert the reamer from the combustion chamber side of the head and also always rotate the reamer clockwise.

TOOL:

Valve guide reamer, 4.008 mm 07MMH-MV90100

Clean the cylinder head thoroughly to remove any metal particles.

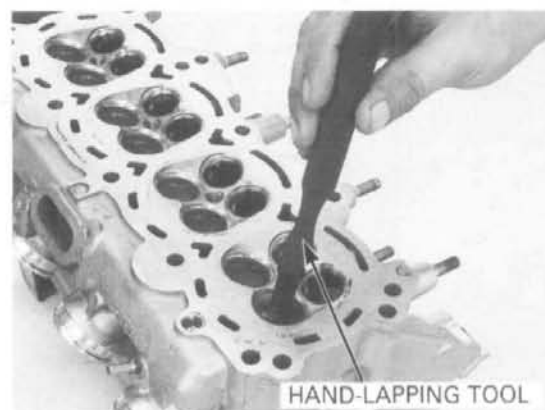
Reface the valve seat (see the following procedure).



VALVE SEAT INSPECTION/REFACING

Clean the intake and exhaust valves thoroughly to remove any carbon deposits.

Apply a light coat of Prussian Blue to the valve seats. Tap the valves and seats using a rubber hose or another hand-lapping tool.

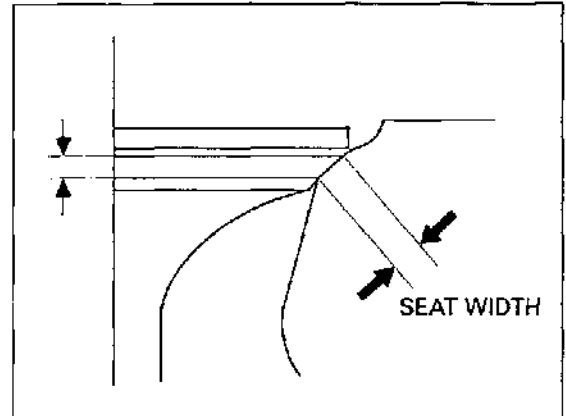


Remove the valve and inspect the valve seat face. The valve seat contact should be within the specified width and even all around the circumference.

STANDARD: 0.90 – 1.10 mm (0.035 – 0.043 in)

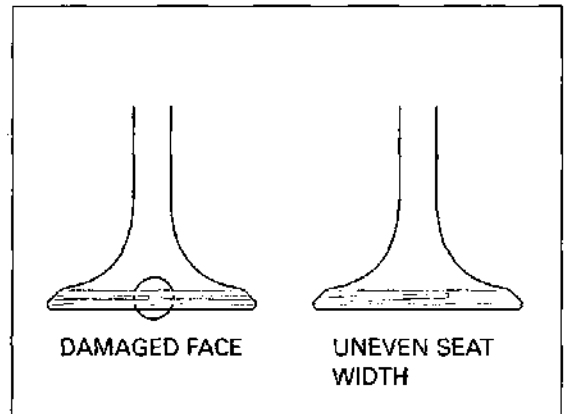
SERVICE LIMIT: 1.5 mm (0.06 in)

If the seat width is not within specification, reface the valve seat (page 8-18).



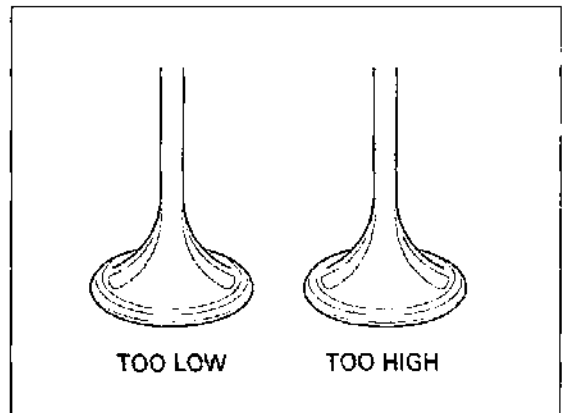
Inspect the valve seat face for:

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



The valves cannot be ground. If a valve face is burned or badly worn or if it contacts the seat unevenly, replace the valve.

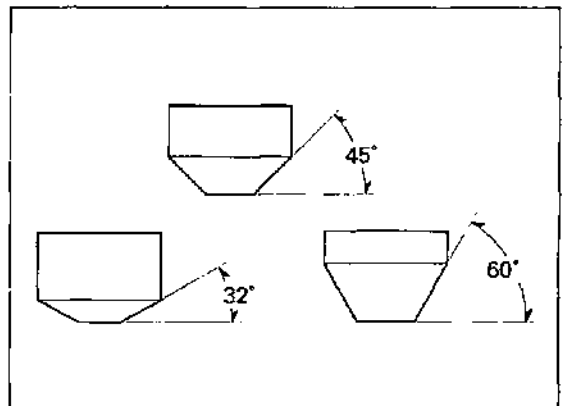
- Contact area (too low or too high)
 - Reface the valve seat.



VALVE SEAT REFACING

Follow the refacing manufacturer's operating instructions.

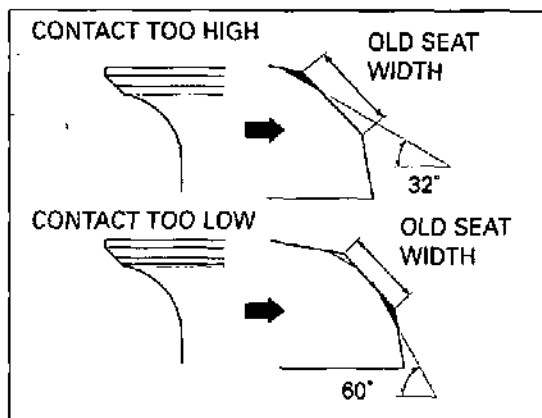
Valve seat cutters/grinders or equivalent valve seat refacing equipment are recommended to correct worn valve seats.



CYLINDER HEAD/VALVES

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.



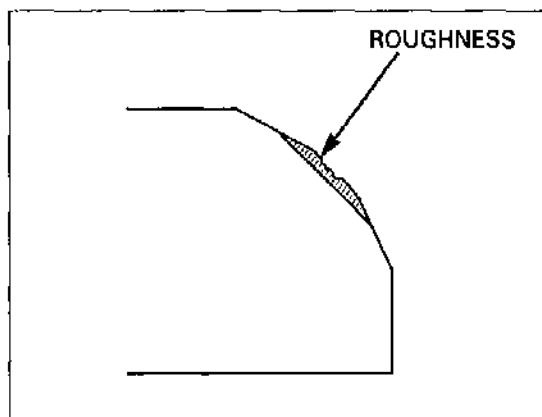
Reface the seat with a 45-degree cutter whenever a valve guide is replaced.

Use a 45-degree cutter to remove any roughness or irregularities from the seat.

TOOLS:

Seat cutter, 27.5 mm (IN)
Seat cutter, 24.5 mm (EX)
Cutter holder, 4.0 mm

07780-0010200
07780-0010100
07781-0010500 or
equivalent commercially available

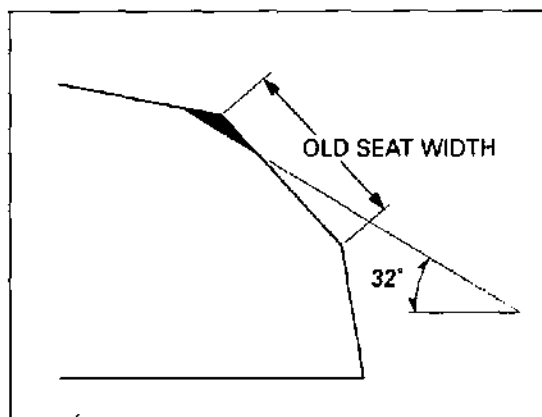


Use a 32-degree cutter to remove the top 1/4 of the existing valve seat material.

TOOLS:

Flat cutter, 27 mm (IN)
Flat cutter, 24 mm (EX)
Cutter holder, 4.0 mm

07780-0013300
07780-0012500
07781-0010500 or
equivalent commercially available

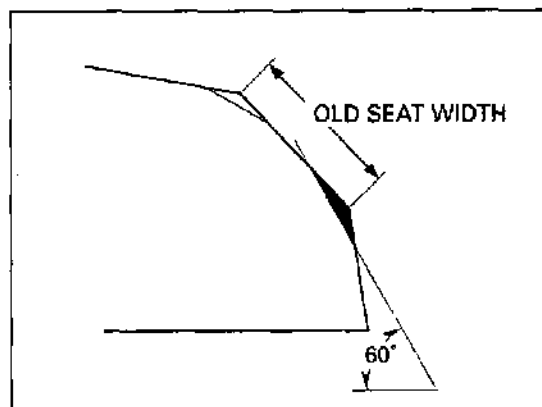


Use a 60-degree cutter to remove the bottom 1/4 of the old seat.

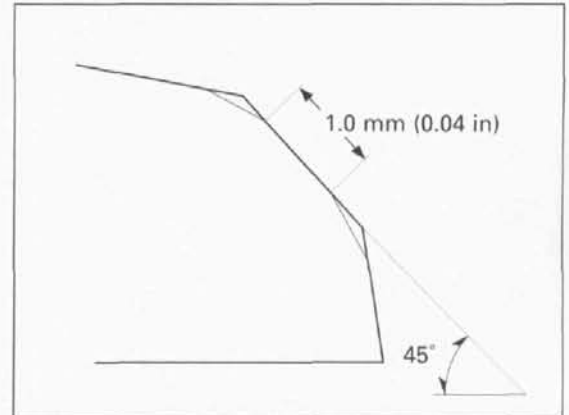
TOOLS:

Interior cutter, 26 mm (IN)
Interior cutter, 22 mm (EX)
Cutter holder, 4.0 mm

07780-0014500
07780-0014202
07781-0010500 or
equivalent commercially available



Using a 45° seat cutter, cut the seat to the proper width.
Make sure that all pitting and irregularities are removed.
Refinish if necessary.

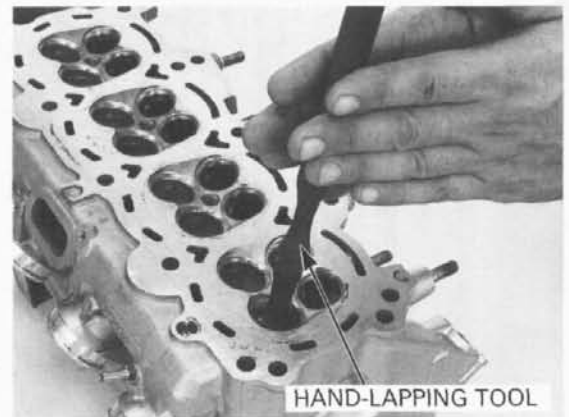


After cutting the seat, apply lapping compound to the valve face, and lap the valve using light pressure.

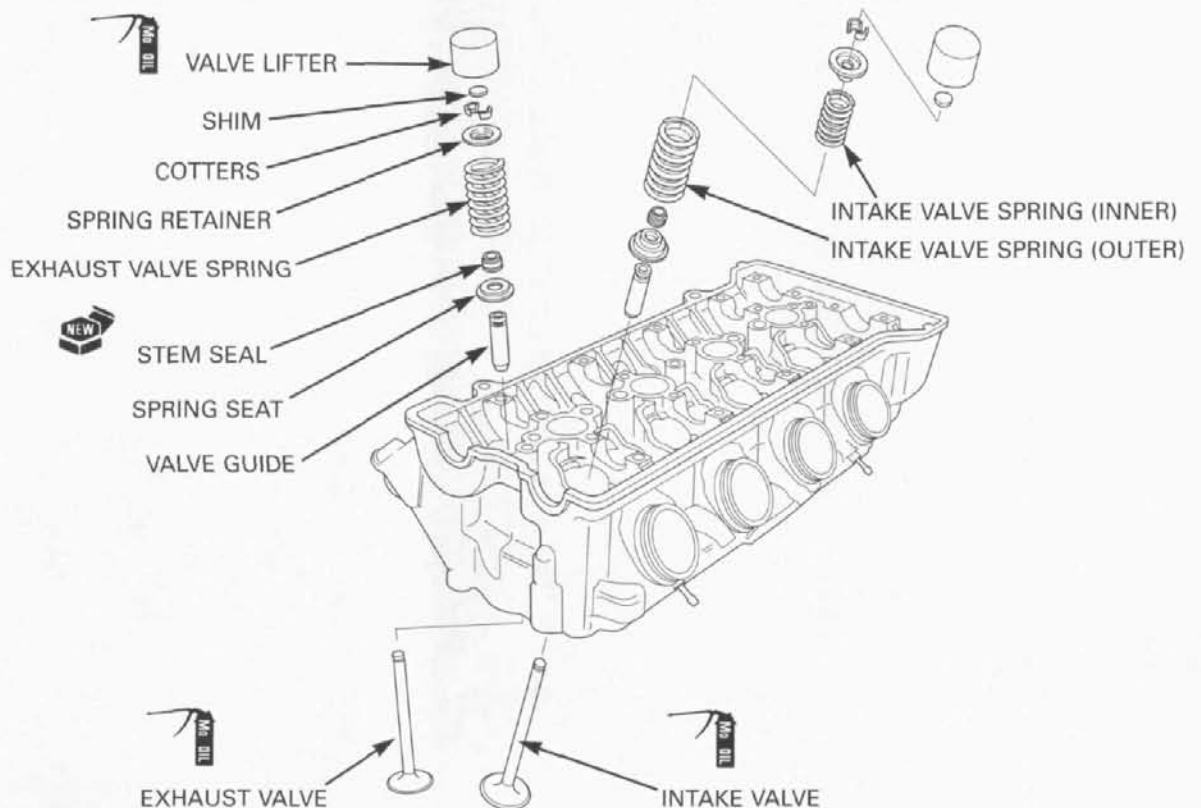
NOTICE

- Excessive lapping pressure may deform or damage the seat.
- Change the angle of the lapping tool frequently to prevent uneven seat wear.
- Do not allow any lapping compound to enter the guides.

After lapping, wash all residual compound off the cylinder head and valve.



CYLINDER HEAD ASSEMBLY



CYLINDER HEAD/VALVES

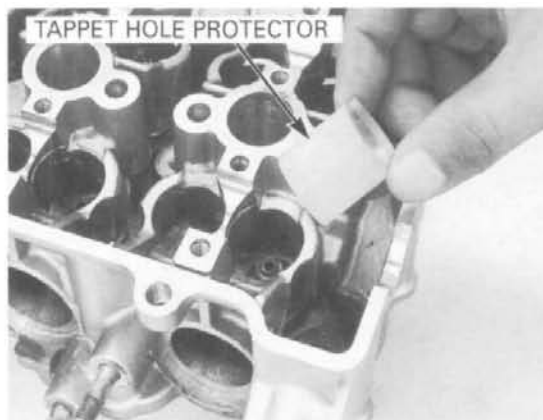
Blow out all oil passages in the cylinder head with compressed air.

Install the tappet hole protector into the valve lifter bore.

TOOL:

Tappet hole protector

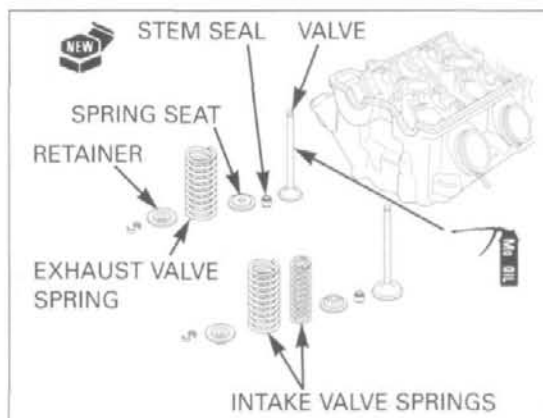
07HMG-MR70002



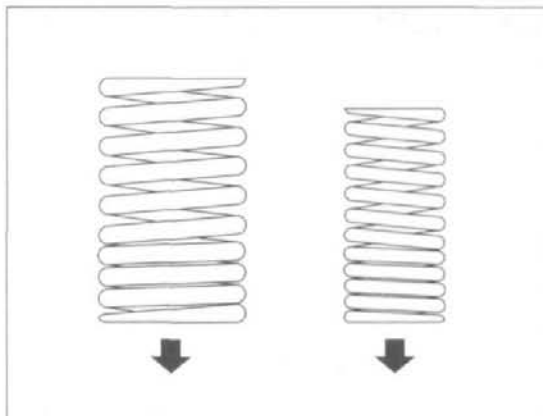
Install the valve spring seats.
Install the new stem seals.

Lubricate the valve stems with molybdenum oil solution.

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



Install the valve spring with the tightly wound coils facing the combustion chamber.
Install the valve spring retainer.



*Grease the
cotters to ease
installation.*

Install the valve cotters using the special tool as shown.

NOTICE

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

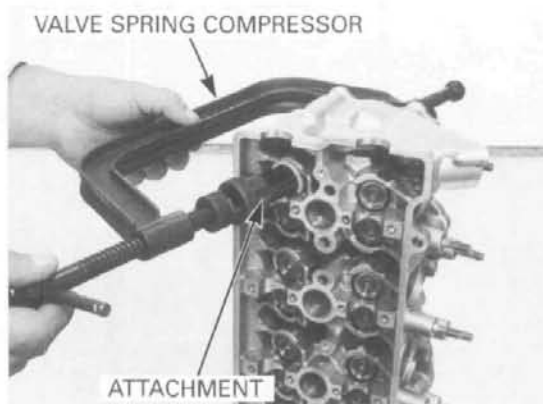
TOOLS:

Valve spring compressor

07757-0010000

Valve spring compressor attachment

07959-KM30101

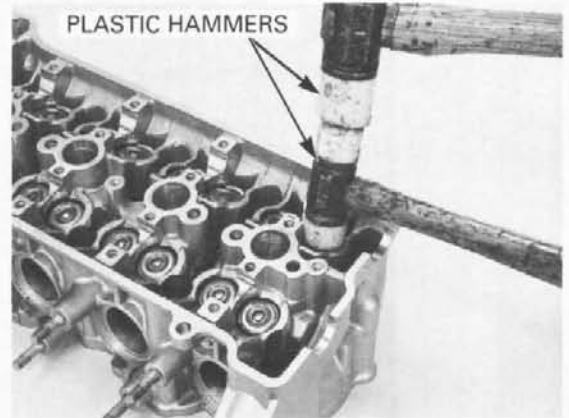


Support the cylinder head above the work bench surface to prevent possible valve damage.

Tap the valve stems gently with two plastic hammers as shown to seat the cotteners firmly.

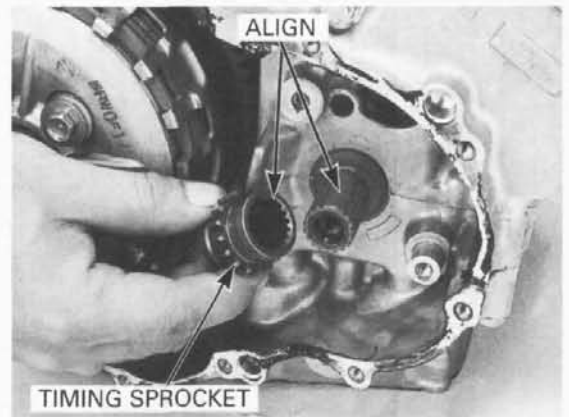
Install and tighten the spark plugs.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

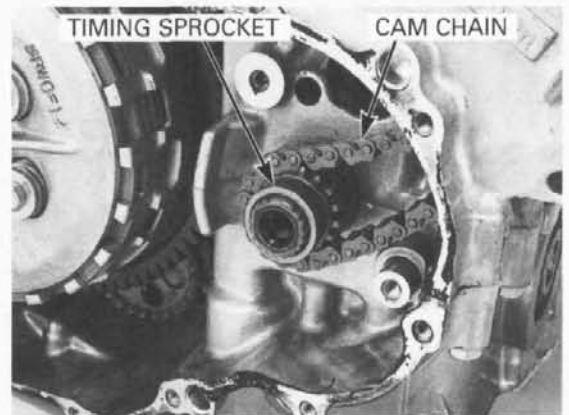


CYLINDER HEAD INSTALLATION

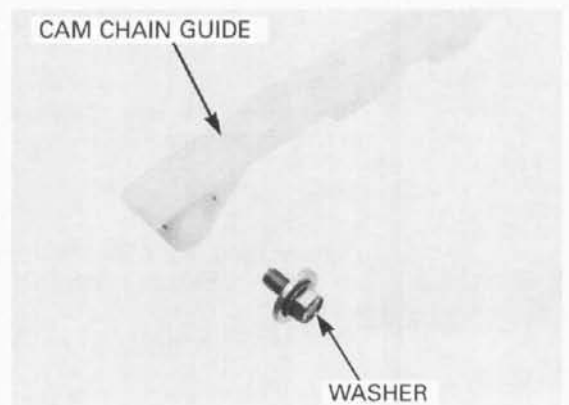
Install the timing sprocket by aligning the wide teeth between the crankshaft and sprocket.



Install the cam chain.

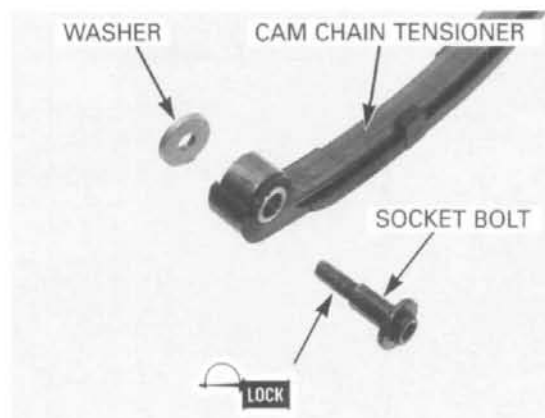


Install the cam chain guide and bolt/washer.



CYLINDER HEAD/VALVES

Apply a locking agent to the cam chain tensioner socket bolt threads.
Install the washer, cam chain tensioner and socket bolt.



Tighten the cam chain guide and cam chain tensioner socket bolts to the specified torque.

TORQUE:

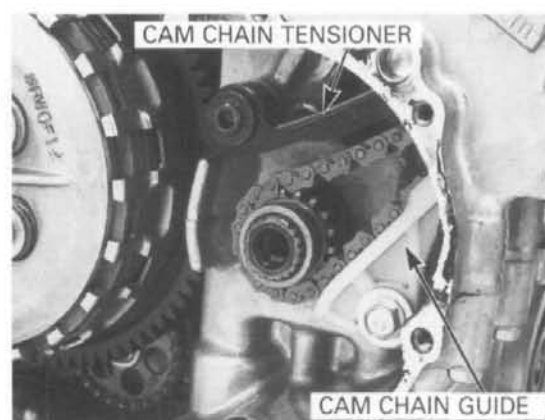
Cam chain tensioner socket bolt:

10 N·m (1.0 kgf·m, 7 lbf·ft)

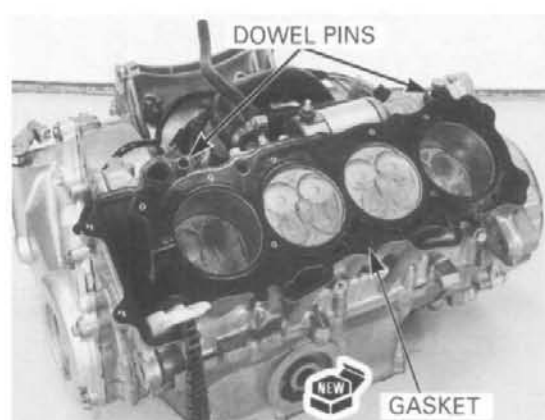
Cam chain guide socket bolt:

12 N·m (1.2 kgf·m, 9 lbf·ft)

Install the ignition pulse generator rotor and right crankcase cover (page 17-7).



Install the dowel pins and a new cylinder head gasket as shown.



Install the cylinder head onto the cylinder block.

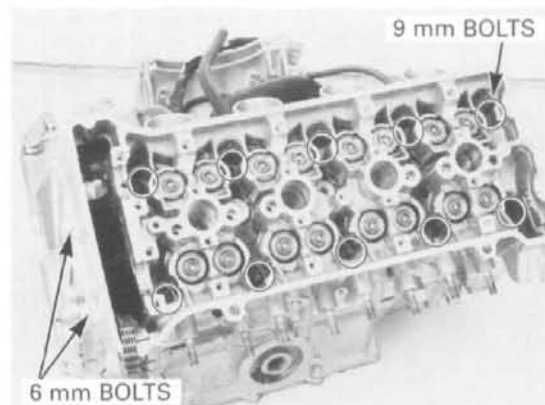
Apply molybdenum disulfide oil solution to the threads and seating surface of the 9-mm bolts/washers and install them.

Install the two 6-mm flange bolts.

Tighten the 9-mm bolts in a crisscross pattern in two to three steps to the specified torque.

TORQUE: 47 N·m (4.8 kgf·m, 35 lbf·ft)

Tighten the 6-mm flange bolts.



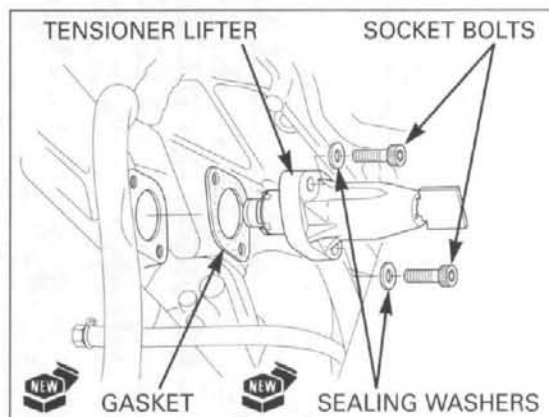
Install the cam chain tensioner lifter onto the cylinder head with a new gasket.

Install new sealing washers and tighten the mounting bolts to the specified torque.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)

Remove the following:

- Thermostat housing (page 6-7)
- Camshaft (see below)

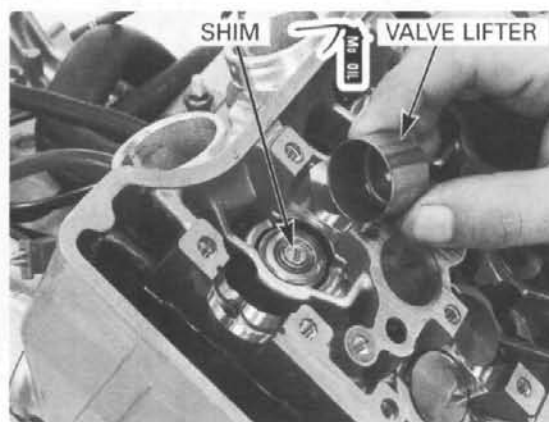


CAMSHAFT INSTALLATION

Apply molybdenum oil solution to the outer surface of each valve lifter.

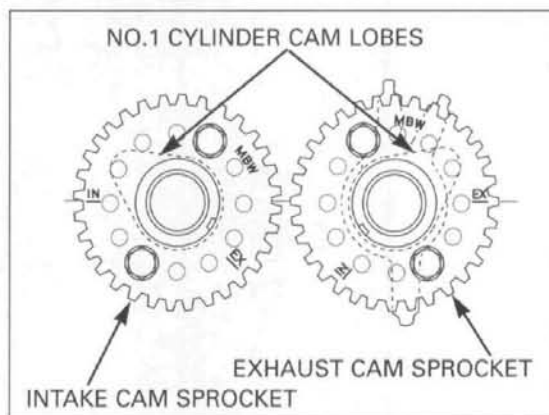
Install the shims and valve lifters in their original locations.

Install the shims and valve lifters into the valve lifter bores.



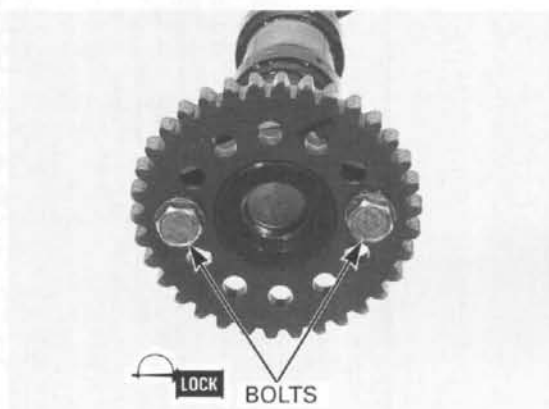
If the cam sprockets are removed, install the cam sprockets onto the camshafts.

- Install the intake cam sprocket with the timing mark (IN) facing outward and the No.1 cam lobes facing up and out as shown.
- Install the exhaust cam sprocket with the timing mark (EX) facing outward and the No.1 cam lobes facing up and out as shown.



Clean the cam sprocket bolt and apply a locking agent to the threads.

Install the cam sprocket bolts.

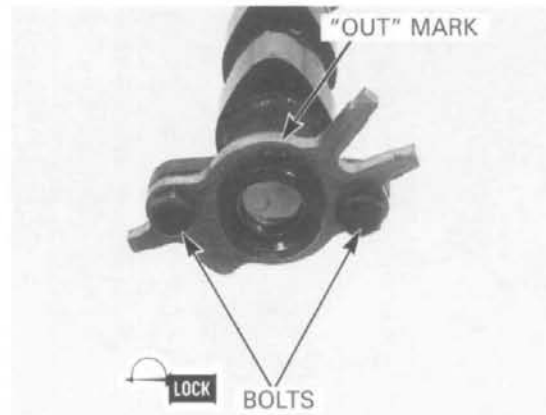


CYLINDER HEAD/VALVES

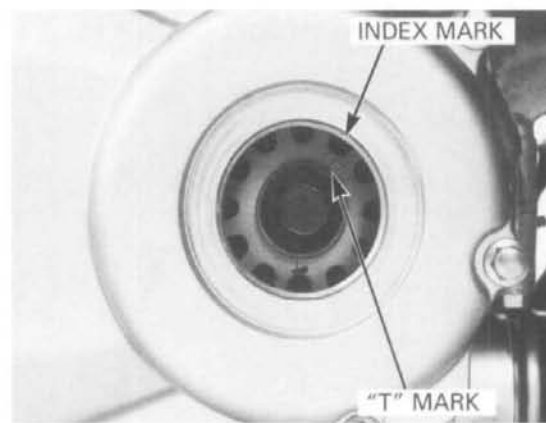
Install the CMP sensor rotor with the No. 1 camshaft lobes facing up and the rotor "OUT" mark facing down as shown.

Clean and apply a locking agent to the CMP sensor rotor threads.

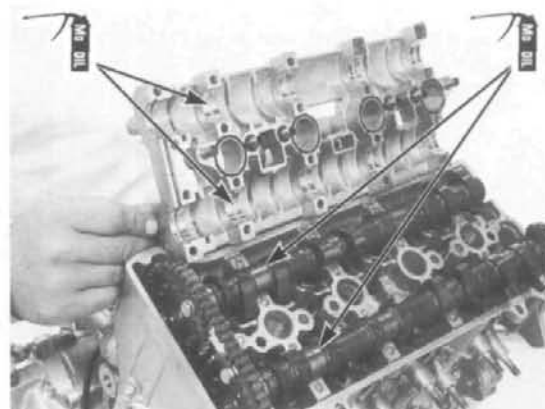
Install the CMP sensor rotor and mounting bolts.



Turn the crankshaft clockwise and align the "T" mark on the CKP sensor rotor with the index mark on the right crankcase cover.

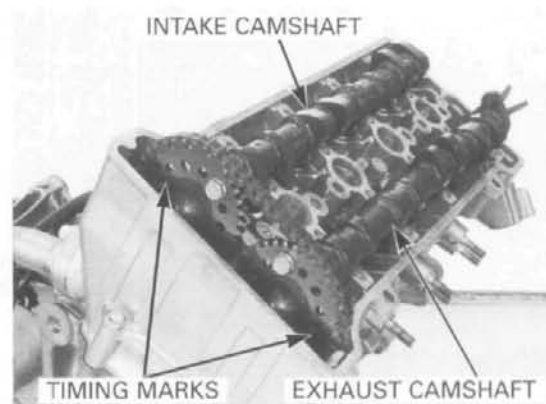


Apply molybdenum oil solution to the camshaft journals of the cylinder head and camshaft holder.



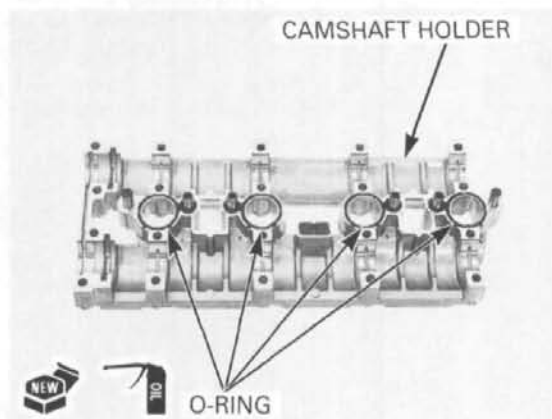
Install the cam chain over the cam sprockets and then install the intake and exhaust camshafts.

- Install each camshaft to the correct locations. Note the identification marks.
"IN": Intake camshaft
"EX": Exhaust camshaft
- Make sure the timing marks on the cam sprockets are facing outward and flush with the cylinder head upper surface as shown.



Coat new O-rings with oil and install them into the grooves in the camshaft holder.

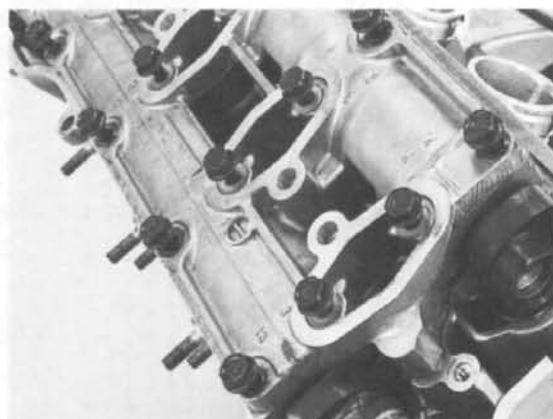
Install the camshaft holder onto the camshafts.



Apply engine oil to the threads and seating surfaces of the camshaft holder bolts. Install the 20 holder bolts with eight new washers as shown.

Finger tighten the bolts.

Make sure the dowel pins in the camshaft holder align properly with the holes in the cylinder head.



The camshaft holder have the numbers "1 through 20" mark on them.

Gradually tighten the #6, #5, #8, and #7 bolts (in that order) 1/4 to 1/2 of a turn at a time to draw the holder down evenly until the clearance between the cylinder head and the holder is 2 – 3 mm all the way around.

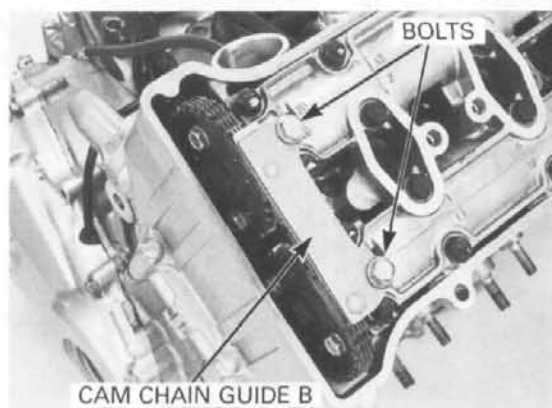
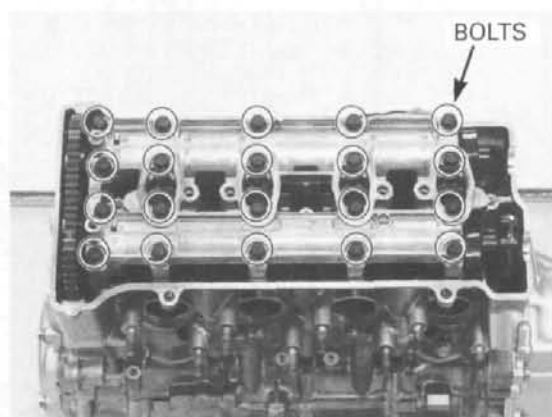
If the holder tilts toward the #1 cylinder during this process, readjust bolts #6, #5, #8, and #7 as necessary to keep the holder level.

When the holder is parallel with the cylinder head, resume tightening the bolts in the sequence specified above.

Once the clearance is within 2 – 3 mm, begin tightening all the bolts in the proper numerical order (#1, #2, #3....#20) 1/4 turn at a time until the holder is fully seated against the cylinder head.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

Install cam chain guide B and tighten the bolts.

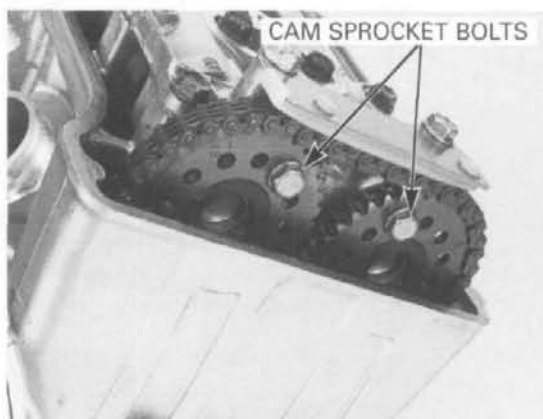


CYLINDER HEAD/VALVES

In case the cam sprockets were removed, tighten the cam sprocket bolts to the specified torque.

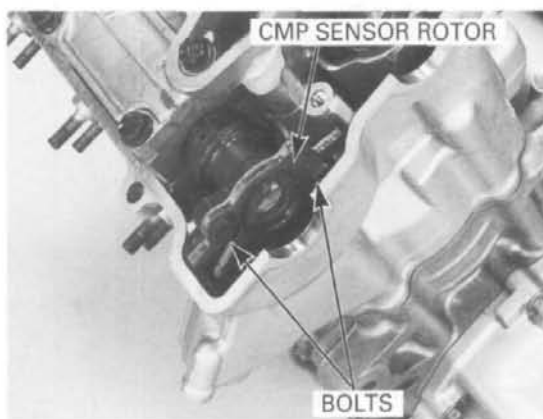
TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft)

Turn the crankshaft clockwise one full turn (360°) and tighten the other cam sprocket bolts.

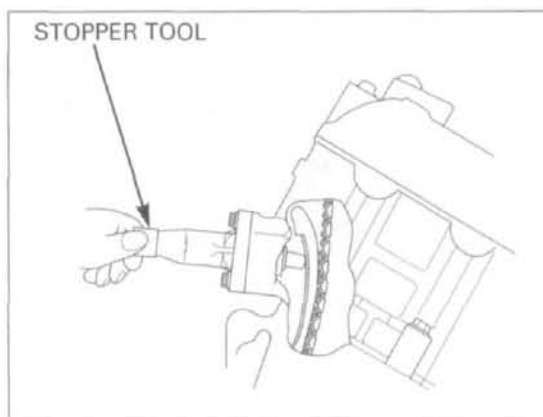


In case the CMP sensor rotor bolts were removed, tighten the rotor bolts to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

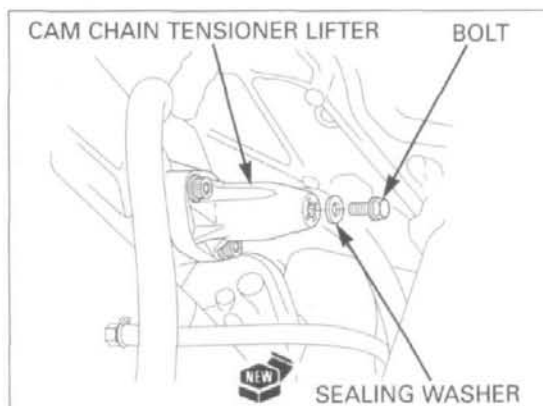


Remove the stopper tool from the cam chain tensioner lifter.

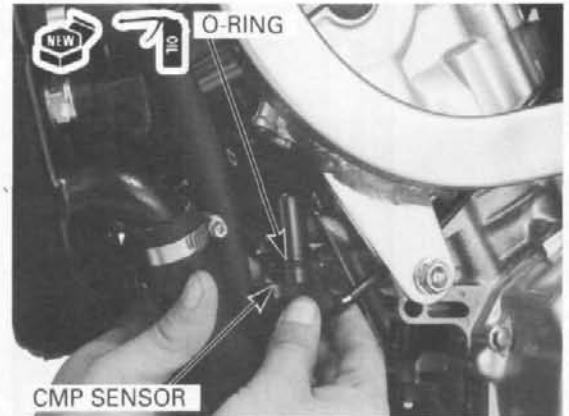


Install a new sealing washer and tighten the sealing bolt.

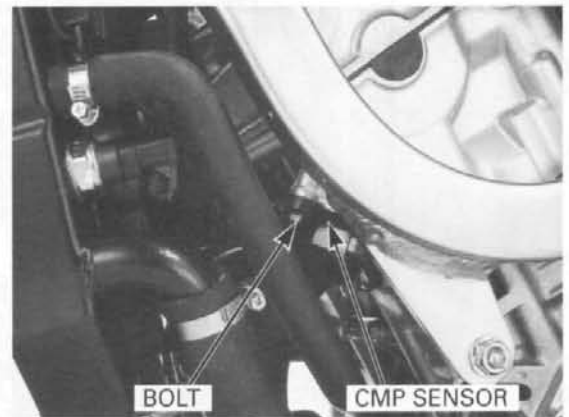
Recheck the valve timing.



Apply oil to the new O-ring and install it onto the CMP sensor.
Install the CMP sensor into the cylinder head.

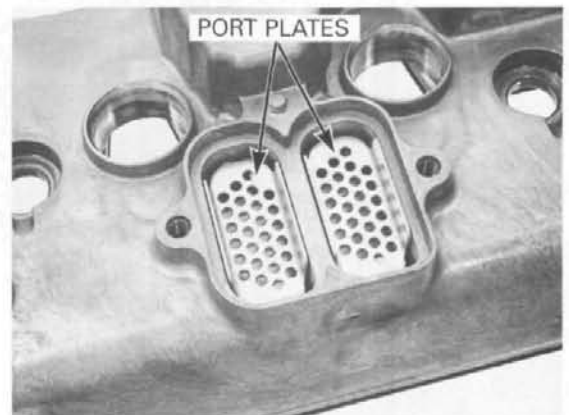


Install and tighten the mounting bolt securely.

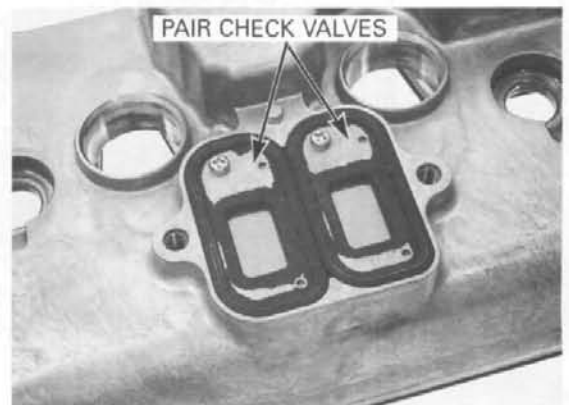


CYLINDER HEAD COVER ASSEMBLY

Install the PAIR check valve port plates into the cylinder head cover.



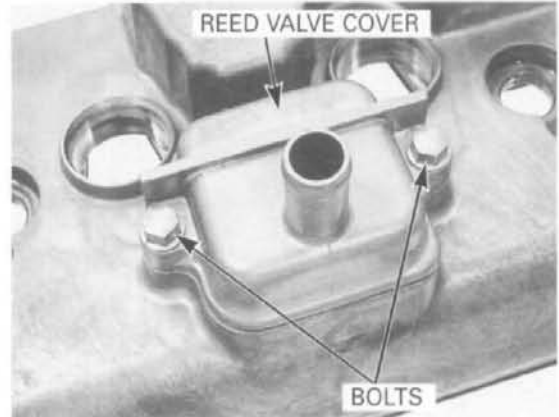
Install the PAIR check valves into the cylinder head cover.



CYLINDER HEAD/VALVES

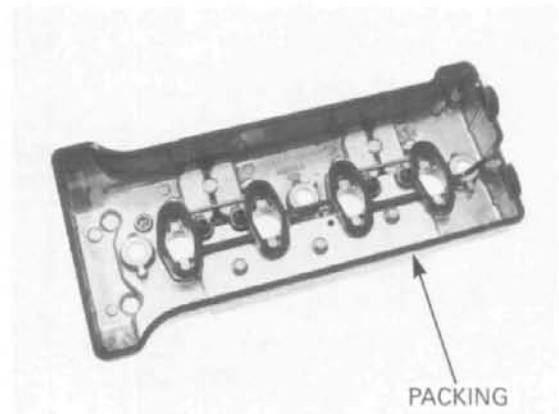
Install the PAIR reed valve covers and tighten the SH bolts to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



CYLINDER HEAD COVER INSTALLATION

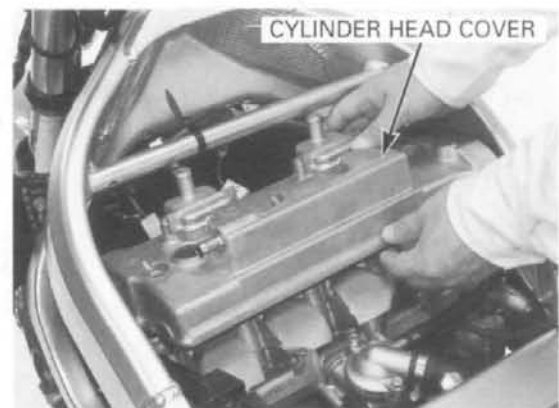
Install the cylinder head packing into the groove of the cylinder head cover.



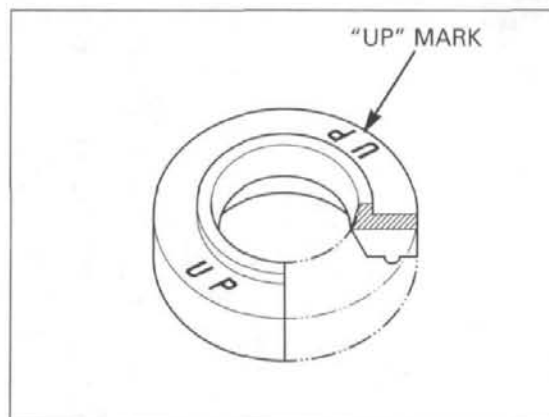
Apply sealant to the cylinder head semi-circular cut-outs as shown.



Install the cylinder head cover onto the cylinder head.



Install the washers with their "UP" mark facing up.



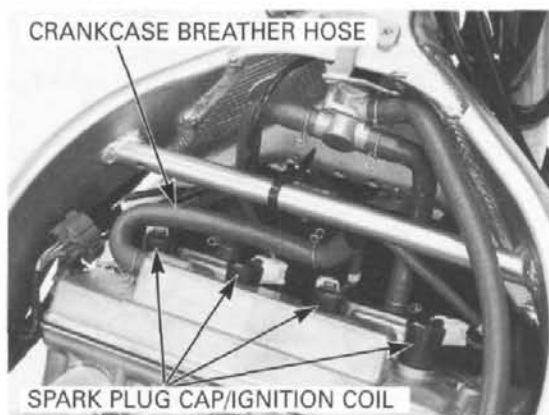
Install and tighten the cylinder head cover special bolts to the specified torque.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)



Install the direct ignition coils and connect the ignition coil connector.
Connect the air suction hoses to the PAIR reed valve covers.

Install the crankcase breather hose.

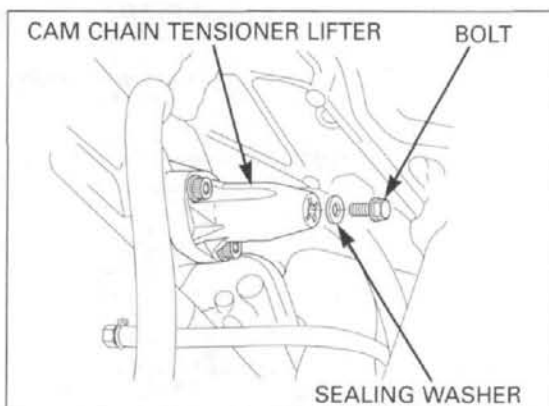


CAM CHAIN TENSIONER LIFTER

REMOVAL

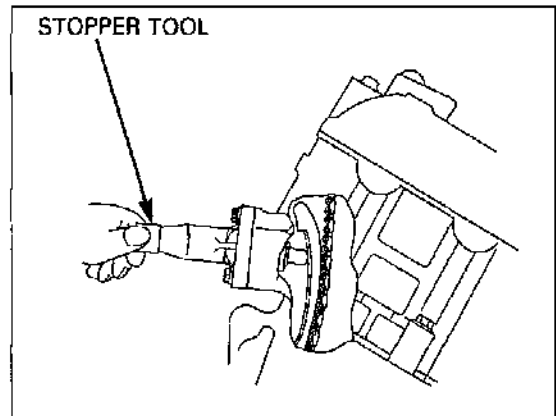
Remove the throttle body (page 5-62).

Remove the cam chain tensioner sealing bolt and sealing washer.

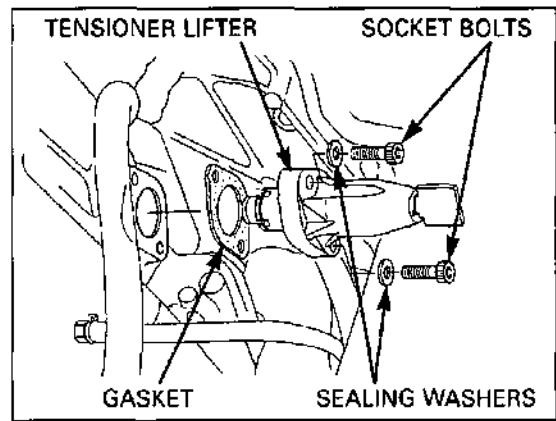


CYLINDER HEAD/VALVES

Turn the tensioner shaft fully in (clockwise) and secure it using the stopper tool to prevent damaging the cam chain.
See page 8-7 for detail of the tool.



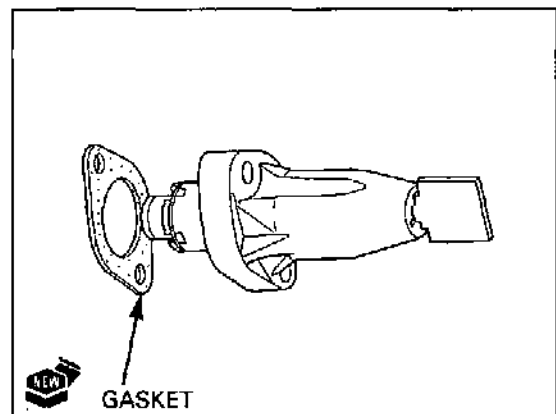
Remove the bolts and cam chain tensioner lifter.
Remove the gasket.



INSTALLATION

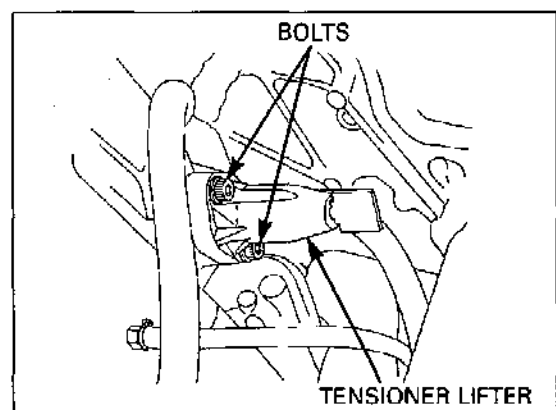
Note the installation direction of the gasket.

Install the new gasket onto the cam chain tensioner lifter.

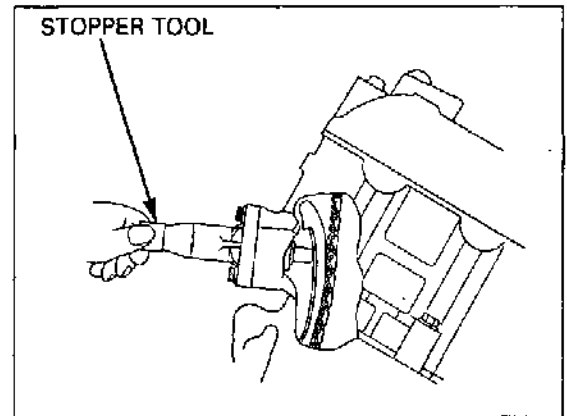


Install the cam chain tensioner lifter into the cylinder head.
Install and tighten the mounting bolts to the specified torque.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)



Remove the stopper tool.



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

Install the removed parts in the reverse order of removal.

