

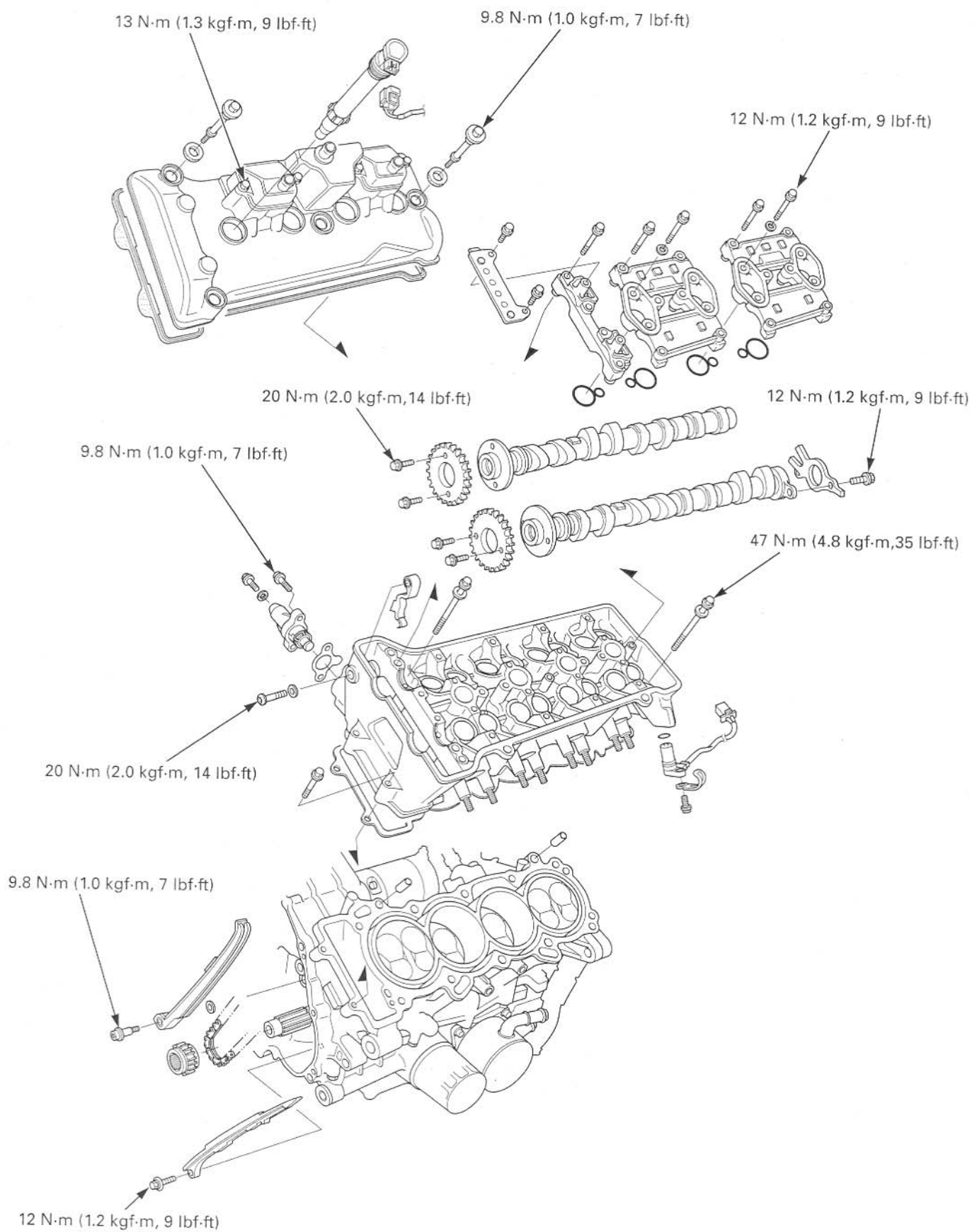
## 9. CYLINDER HEAD/VALVES

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## CYLINDER HEAD/VALVES

### COMPONENT LOCATION



## SERVICE INFORMATION

### GENERAL

- This section covers service of the cylinder head, valves and camshaft.
- The camshaft services 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 cylinder head.
- Be careful not to damage the mating surfaces when removing the cylinder head cover and cylinder head.

### SPECIFICATIONS

Unit: mm (in)

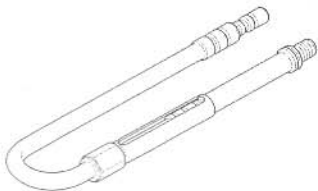
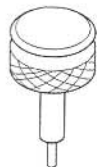
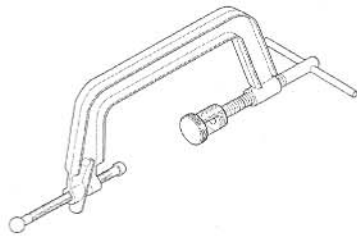


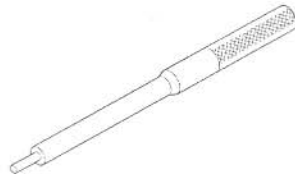
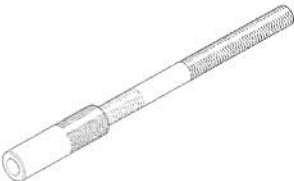

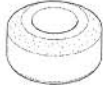

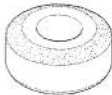

ITEM			STANDARD	SERVICE LIMIT
Cylinder compression			1,226 kPa (12.5 kgf/cm <sup>2</sup> , 178psi) at 350 rpm	
Valve clearance		IN	0.20 ± 0.03 (0.008 ± 0.001)	—
		EX	0.28 ± 0.03 (0.011 ± 0.001)	—
Camshaft	Cam lobe height	IN	36.36 – 36.60 (1.431 – 1.441)	36.34 (1.431)
		EX	35.34 – 35.58 (1.391 – 1.401)	35.32 (1.391)
	Runout		—	0.05 (0.002)
	Oil clearance		0.020 – 0.062 (0.0008 – 0.0024)	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	17.1 – 17.4 (0.67 – 0.69)	—
		EX	13.3 – 13.6 (0.52 – 0.54)	—
	Valve seat width	IN	0.90 – 1.10 (0.035 – 0.043)	1.5 (0.06)
		EX	0.90 – 1.10 (0.035 – 0.043)	1.5 (0.06)
Valve spring free legth	IN	Inner	36.17 (1.424)	35.1 (1.38)
		Outer	39.76 (1.565)	38.8 (1.53)
	EX	Inner	35.34 (1.391)	34.4 (1.35)
		Outer	39.05 (1.537)	38.1 (1.50)
Cylinder head warpage			—	0.10 (0.004)

### TORQUE VALUES

Cylinder head mounting bolt	47 N·m (4.8 kgf·m, 35 lbf·ft)	Apply molybdenum disulfide oil to the threads and seating surface
Camshaft holder bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	Apply oil to the threads
Cylinder head cover bolt	9.8 N·m (1.0 kgf·m, 7 lbf·ft)	
Breather plate bolt	13 N·m (1.3 kgf·m, 9 lbf·ft)	Apply a locking agent to the threads
PAIR reed valve cover bolt	13 N·m (1.3 kgf·m, 9 lbf·ft)	CT bolt
Cam sprocket bolt	20 N·m (2.0 kgf·m, 14 lbf·ft)	CT bolt
Cam pulse generator rotor bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	Apply a locking agent to the threads
Cam chain tensioner lifter mounting socket bolt	9.8 N·m (1.0 kgf·m, 7 lbf·ft)	Apply a locking agent to the threads
Cam chain tensioner A pivot bolt	9.8 N·m (1.0 kgf·m, 7 lbf·ft)	Apply a locking agent to the threads
Cam chain tensioner B pivot bolt	20 N·m (2.0 kgf·m, 14 lbf·ft)	Apply a locking agent to the threads
Cam chain guide A bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	
Spark plug	16 N·m (1.6 kgf·m, 12 lbf·ft)	

## CYLINDER HEAD/VALVES

### TOOLS

<p>Compression gauge attachment 07RMJ-MY50100</p>  <p>or equivalent commercially available in U.S.A.</p>	<p>Cam chain tensioner holder 07ZMG-MCAA400</p> 	<p>Valve spring compressor 07757-0010000</p> 
<p>Valve spring compressor attachment 07959-KM30101</p> 	<p>Tappet hole protector 07HMG-MR70002</p>  <p>not available in U.S.A.</p>	<p>Valve guide driver 07JMD-KY20100</p> 
<p>Valve guide driver 07743-0020000</p>  <p>not available in U.S.A.</p>	<p>Valve guide reamer, 4.008 mm 07MMH-MV90100</p>  <p>or 07MMH-MV9010A (U.S.A. only)</p>	<p>Valve seat cutter, 27.5 mm (45° IN) 07780-0010200</p>  <p>or equivalent commercially available in U.S.A.</p>
<p>Valve seat cutter, 24 mm (45° EX) 07780-0010600</p>  <p>or equivalent commercially available in U.S.A.</p>	<p>Flat cutter, 30 mm (32° IN) 07780-0012200</p>  <p>or equivalent commercially available in U.S.A.</p>	<p>Flat cutter, 24 mm (32° EX) 07780-0012500</p>  <p>or equivalent commercially available in U.S.A.</p>

## CYLINDER HEAD/VALVES

<p>Interior cutter, 26 mm (60° IN) 07780-0014500</p>  <p>or equivalent commercially available in U.S.A.</p>	<p>Interior cutter, 22 mm (60° EX) 07780-0014202</p>  <p>or equivalent commercially available in U.S.A.</p>	<p>Cutter holder, 4.0 mm 07781-0010500</p>  <p>or equivalent commercially available in U.S.A.</p>
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## 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 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 (page 13-15).

### 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 (page 13-15)

### 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 (page 13-15)

### 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 (page 13-15)

### Rough idle

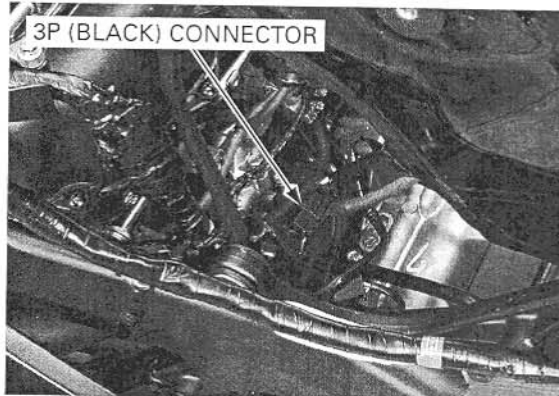
- Low cylinder compression

## CYLINDER HEAD/VALVES

### CYLINDER COMPRESSION TEST

Warm the engine to normal operating temperature. Stop the engine and remove the all direct ignition coil/spark plug caps and spark plugs (page 4-7). Lift and support the fuel tank (page 6-61).

Disconnect the fuel pump unit 3P (Black) connector.



Install a compression gauge into the spark plug hole.

#### TOOL:

Compression gauge attachment

07RMJ-MY50100 or 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/cm<sup>2</sup>, 178 psi) at 350 rpm

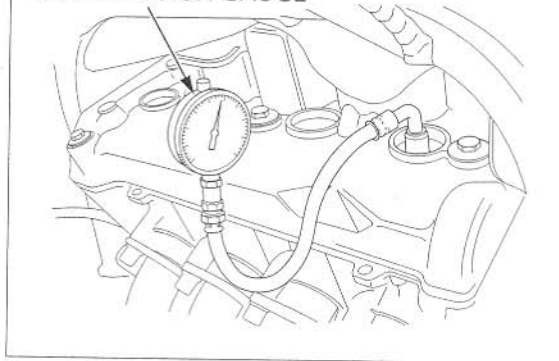
Low compression can be caused by:

- 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

COMPRESSION GAUGE



### CYLINDER HEAD COVER REMOVAL

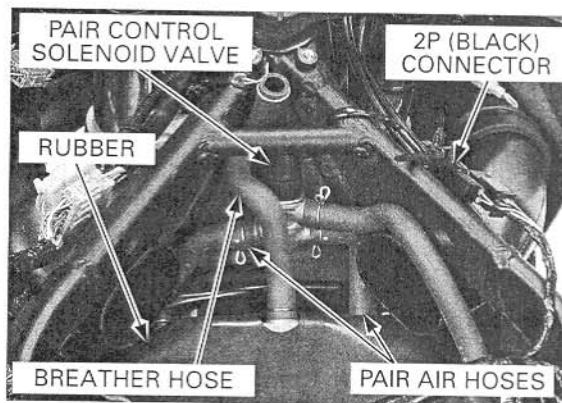
Remove the throttle body (page 6-72).

Remove the crankcase breather hose.

Disconnect the PAIR control solenoid valve 2P (Black) connector.

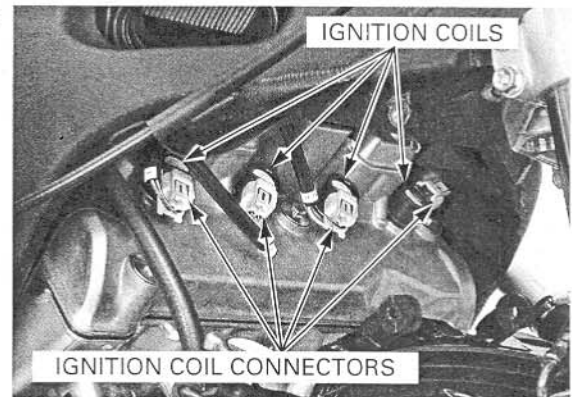
Disconnect the PAIR air hoses from the cylinder head and remove the PAIR control solenoid valve.

Remove the heat guard rubber.

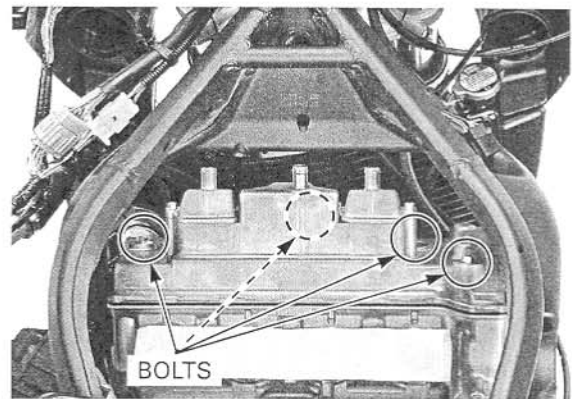


## CYLINDER HEAD/VALVES

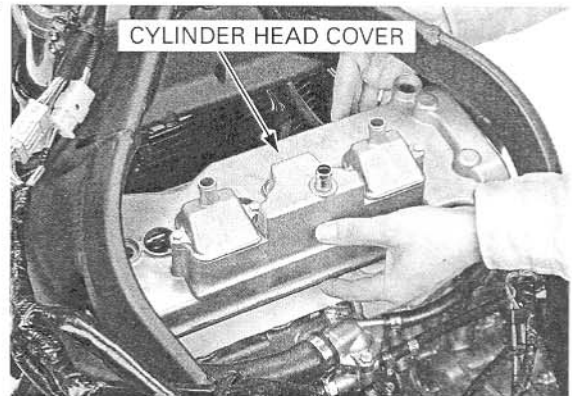
Disconnect the ignition coil connectors and remove the direct ignition coils.



Remove the cylinder head cover bolts.



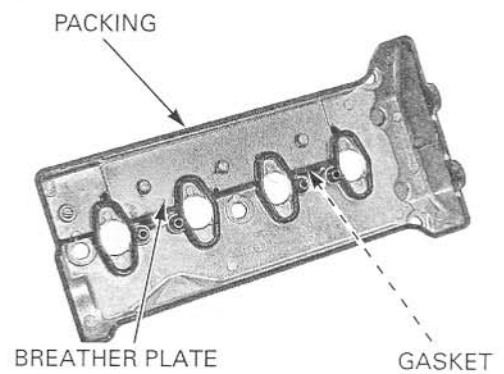
Remove the cylinder head cover from the cylinder head.



## CYLINDER HEAD COVER DISASSEMBLY

Remove the cylinder head cover packing.

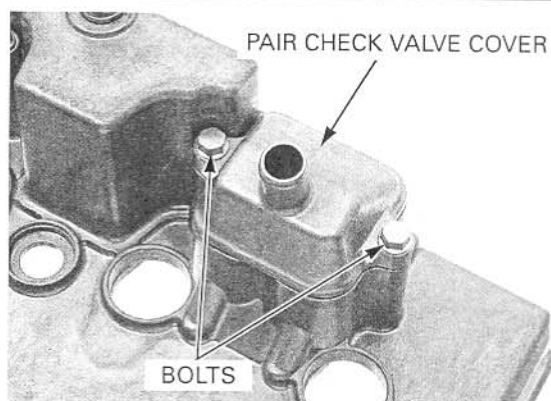
Remove the bolts and breather plate and gasket.





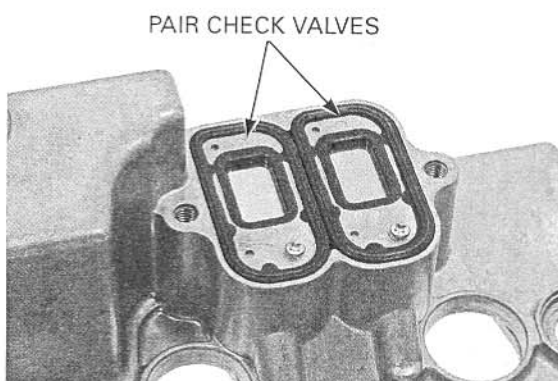
## CYLINDER HEAD/VALVES

Remove the bolts and PAIR check valve cover.

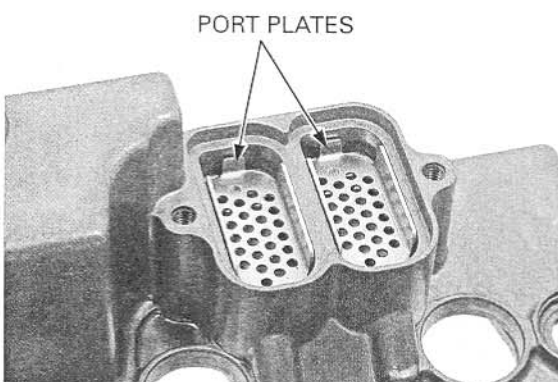


Remove the PAIR check valves from the cylinder head cover.

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



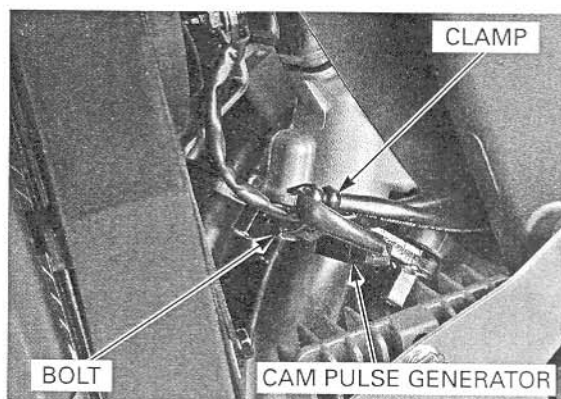
Remove the port plates from the cylinder head cover.



## CAMSHAFT REMOVAL

Remove the cylinder head cover (page 9-6).

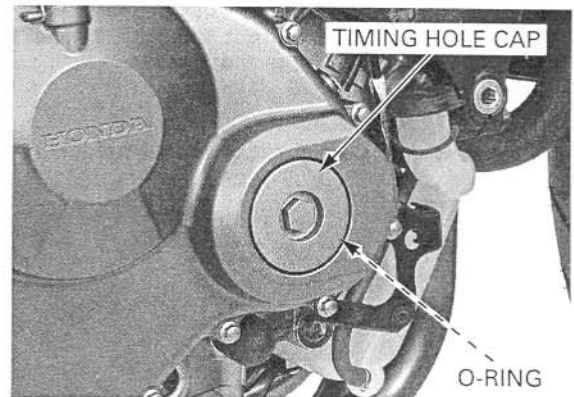
Avoid damaging the cam pulse generator while removing the camshafts, remove the bolt, clamp and cam pulse generator from the cylinder head.



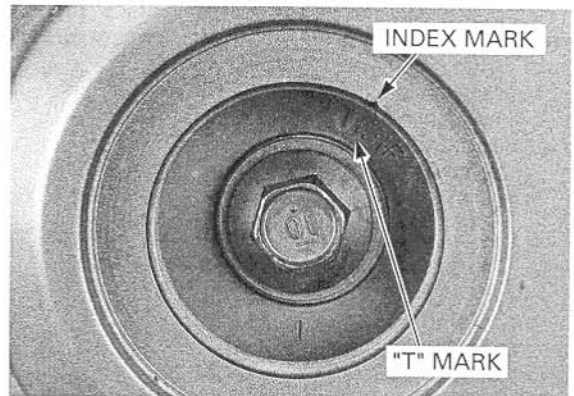


## CYLINDER HEAD/VALVES

Remove the timing hole cap and O-ring.

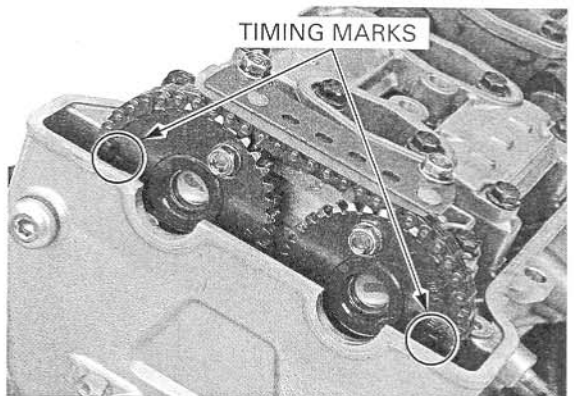


Turn the crankshaft clockwise, align the "T" mark on the ignition pulse generator rotor with the index mark on the right crankcase cover.

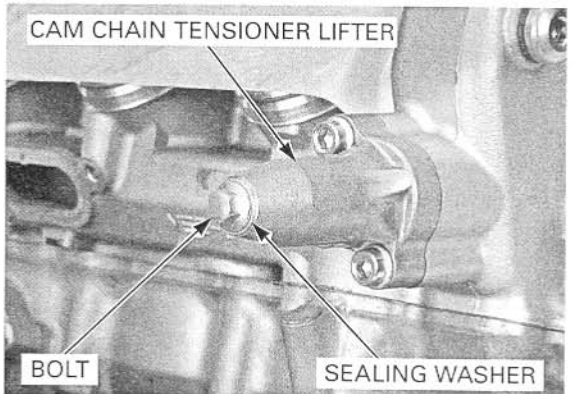


The timing marks ("IN" and "EX") on the cam sprockets must be flush with the cylinder head surface and facing outward as shown.

If the timing marks on the cam sprocket are facing inward, turn the crankshaft clockwise one full turn (360°) and realign the timing marks with the cylinder head surface so they are facing outward.



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

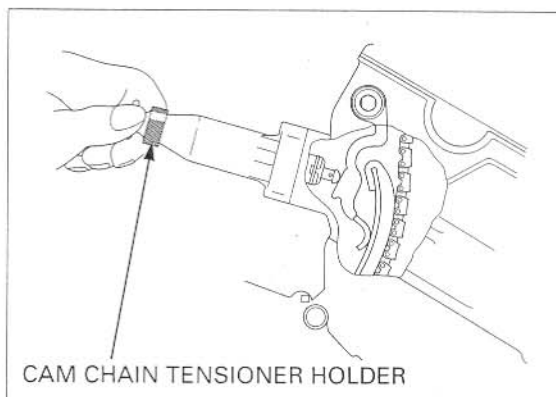


## CYLINDER HEAD/VALVES

Turn the tensioner lifter shaft fully in (clockwise) and secure it using the special tool to prevent damaging the cam chain.

### TOOL:

Cam chain tensioner holder 07ZMG-MCAA400

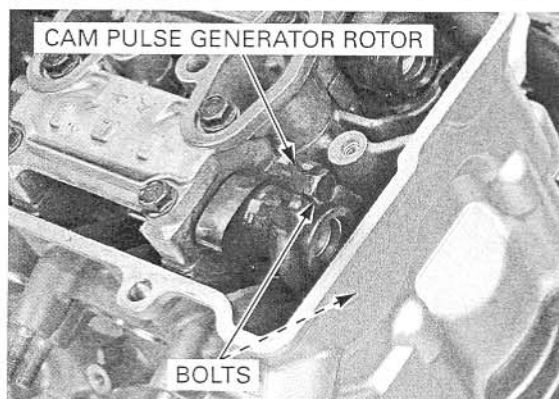
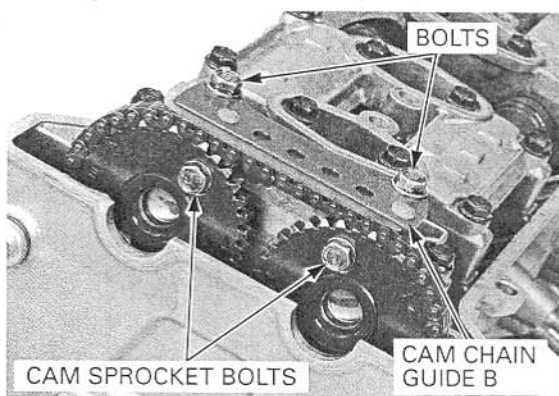
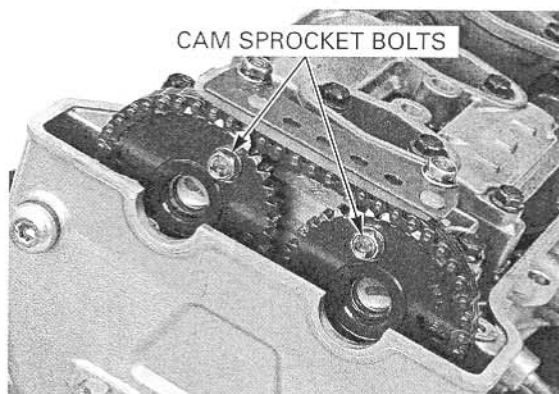


*It is not necessary to remove the cam sprocket from the camshaft except when replacing the camshaft and/or cam sprocket.*

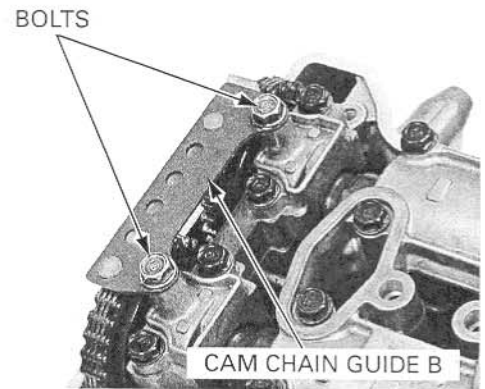
If you plan to replace the camshaft and/or cam sprocket, loosen the cam sprocket bolts as follows:

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

- Remove the cam sprocket bolts from the intake and exhaust camshafts.
- Turn the crankshaft clockwise one full turn (360°), remove the other cam sprocket bolts from the camshafts.
- Remove the bolts and cam chain guide B.
- Remove the cam sprockets from the camshafts.
- Remove the bolts and cam pulse generator rotor from the exhaust camshaft.



Remove the bolts and cam chain guide B.



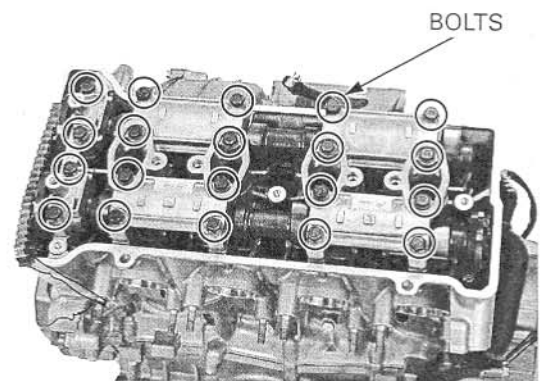
*Suspend the cam chain with a piece of wire to prevent the chain from falling into the crankcase.*

Loosen and remove the camshaft holder bolts/washers, then remove the camshaft holders and camshafts.

**NOTE:**

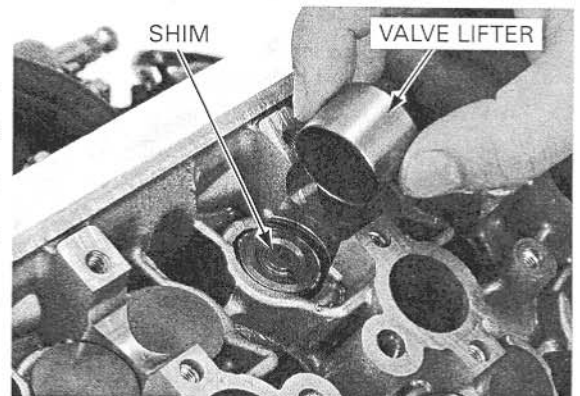
From outside to inside, loosen the bolts in a criss-cross pattern in several steps or the camshaft holder might break.

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



Remove the valve lifters and shims.

- Be careful not to damage the valve lifter bore.
- Shim may stick to the inside of the valve lifter. 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 clogging.

Support both sides of the camshaft (at journals) with V-blocks and check the camshaft runout with a dial gauge.

**SERVICE LIMIT:** 0.05 mm (0.002 in)



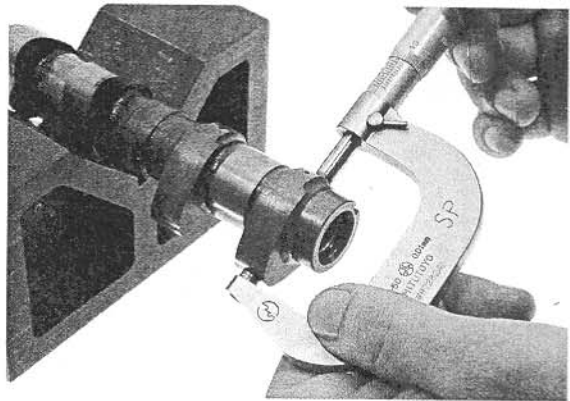
## CYLINDER HEAD/VALVES

Using a micrometer, measure each cam lobe height.

### SERVICE LIMITS:

IN: 36.34 mm (1.431 in)

EX: 35.32 mm (1.391 in)



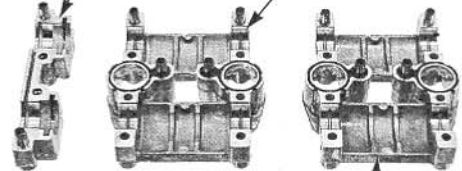
### CAMSHAFT HOLDERS

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

Inspect the oil orifices of the holders for clogging.

CAMSHAFT HOLDER A

CAMSHAFT HOLDER B

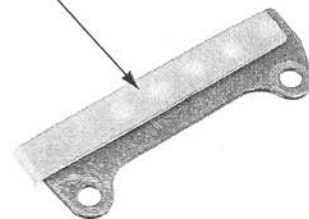


CAMSHAFT HOLDER C

### CAM CHAIN GUIDE B

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

CAM CHAIN GUIDE B

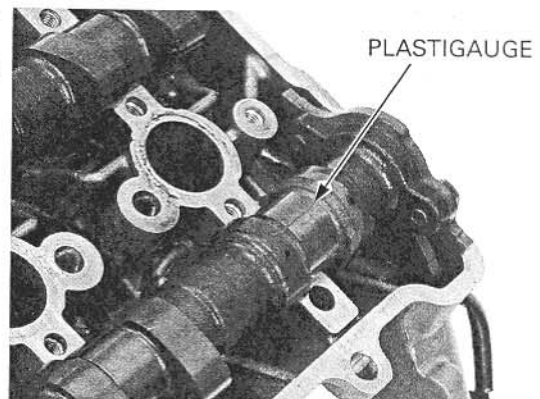


### CAMSHAFT OIL CLEARANCE

*Do not rotate the camshaft when using plastigauge.*

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.



## CYLINDER HEAD/VALVES

Be sure the dowel pins in the camshaft holder align the holes in the cylinder head.

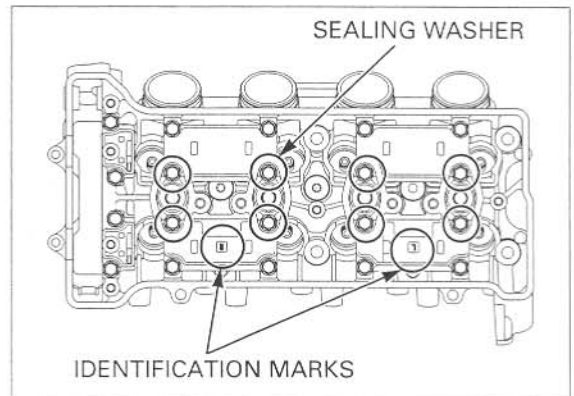
Install the each camshaft holder to the correct locations with the identification marks.

- No mark: right camshaft holder
- "R" mark: center camshaft holder
- "L" mark: left camshaft holder

Apply engine oil to the threads and seating surfaces of the camshaft holder bolts.

Install the twenty holder bolts with the eight sealing washers.

Finger tighten the bolts.



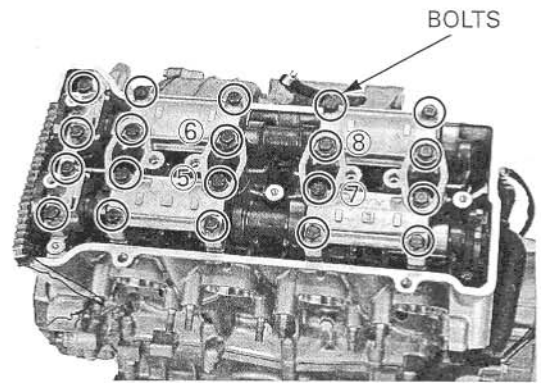
First gradually tighten the four bolts (No.5 – No.6 – No.7 – No.8) in the numerical order cast on the camshaft holders.

Gradually tighten the other camshaft holder bolts until the camshaft holders lightly contact the cylinder head surface.

### NOTICE

Failure to tighten the camshaft holder in a criss-cross pattern might cause a camshaft holder to break.

Tighten all camshaft holder bolts in the numerical order casted on the camshaft holders.

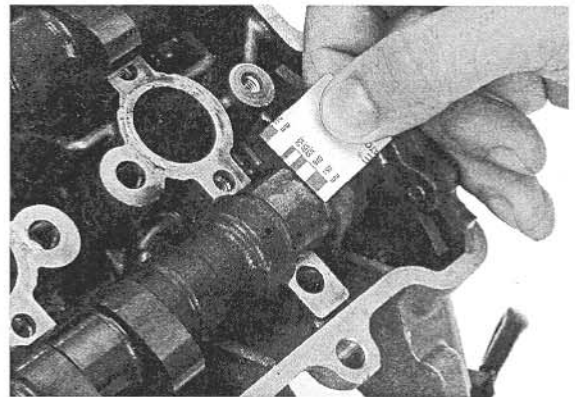


**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

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.



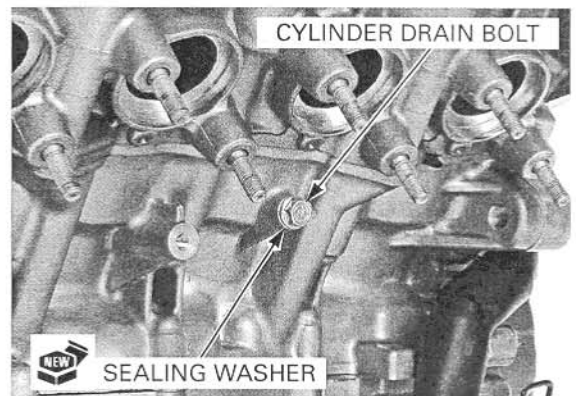
## CYLINDER HEAD REMOVAL

Remove the engine from the frame (page 8-5).  
Remove the camshafts (page 9-8).

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

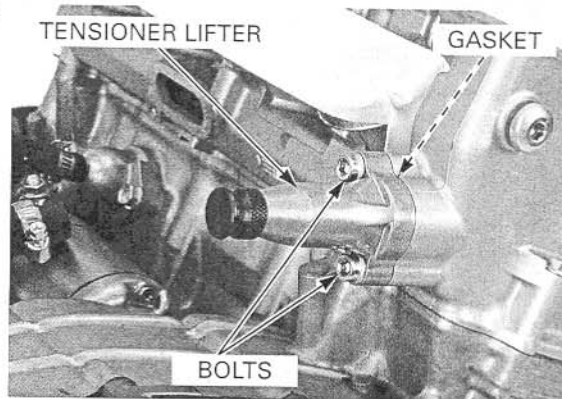
Check the sealing washer is in good condition, replace it if necessary.

Install a new sealing washer and drain bolt. Tighten the drain bolt securely.



## CYLINDER HEAD/VALVES

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

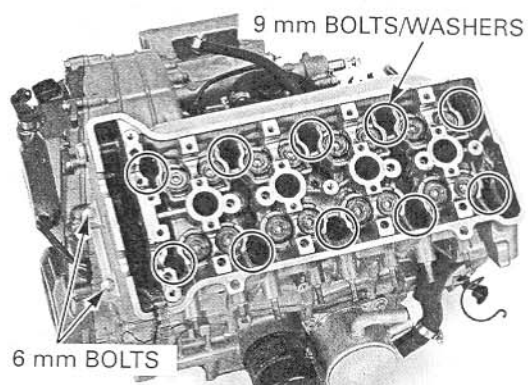


Remove the two 6 mm bolts.

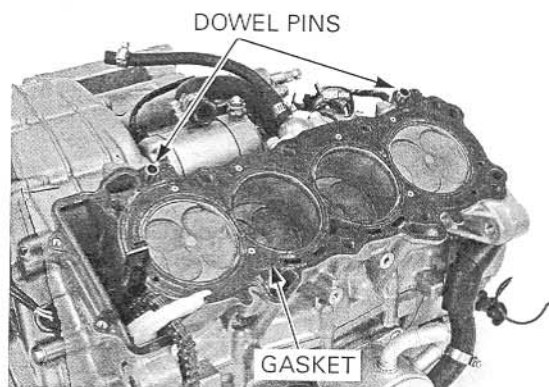
*Loosen the 9 mm bolts in a criss-cross pattern in two or three steps.*

Remove the ten 9 mm bolts/washers.

Remove the cylinder head.



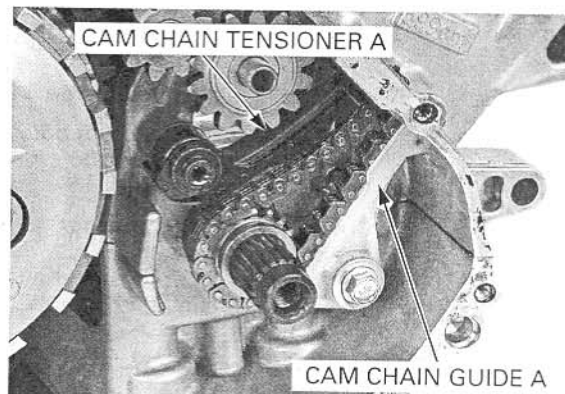
Remove the gasket and dowel pins.



Remove the following:

- Right crankcase cover (page 10-5)
- Starter clutch (page 10-17)

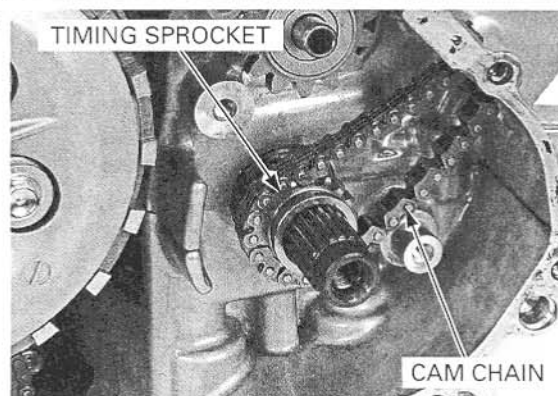
Remove the bolt, washer and cam chain guide A. Remove the socket bolt, cam chain tensioner A and washer.





## CYLINDER HEAD/VALVES

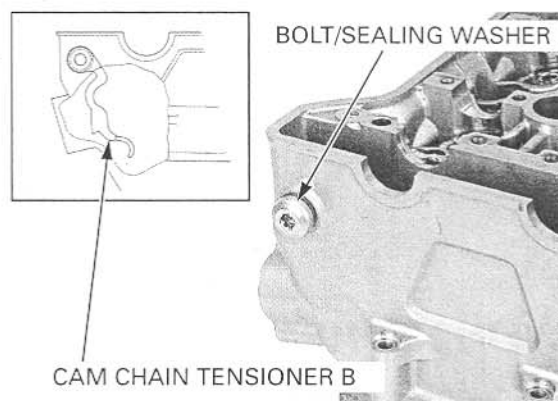
Remove the cam chain and timing sprocket from the crankshaft.



## CYLINDER HEAD DISASSEMBLY

Remove the cylinder head (page 9-13).

Remove the bolt, sealing washer and cam chain tensioner B from the cylinder head.



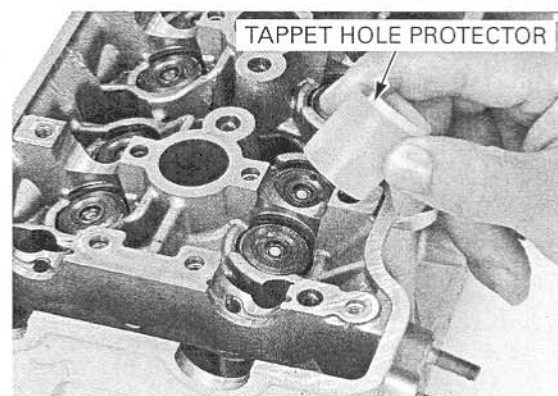
Remove the spark plugs from the cylinder head.

Install the tappet hole protector into the valve lifter bore.

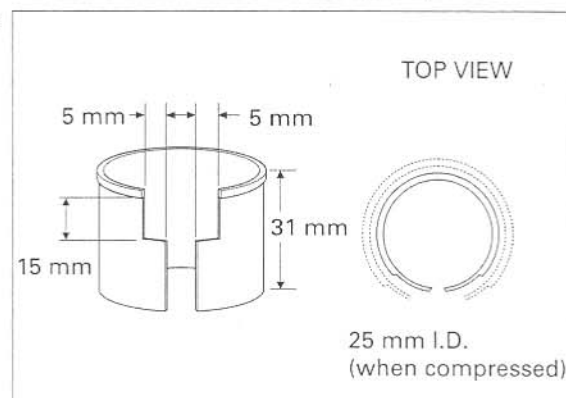
### TOOL:

Tappet hole protector

07HMG-MR70002  
Not available in U.S.A.



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





## CYLINDER HEAD/VALVES

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

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

### TOOLS:

Valve spring compressor

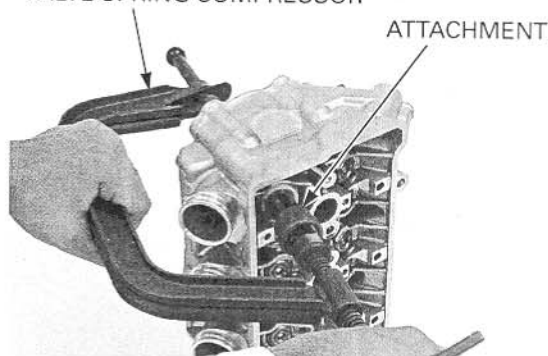
07757-0010000

Valve spring compressor attachment

07959-KM30101

VALVE SPRING COMPRESSOR

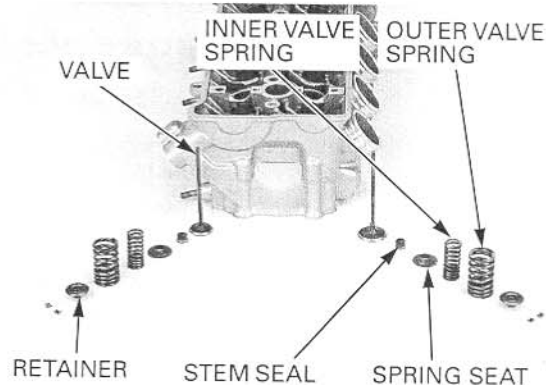
ATTACHMENT



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

Remove the following:

- Spring retainer
- Inner/outer valve springs
- Valve
- Stem seal
- Valve spring seat

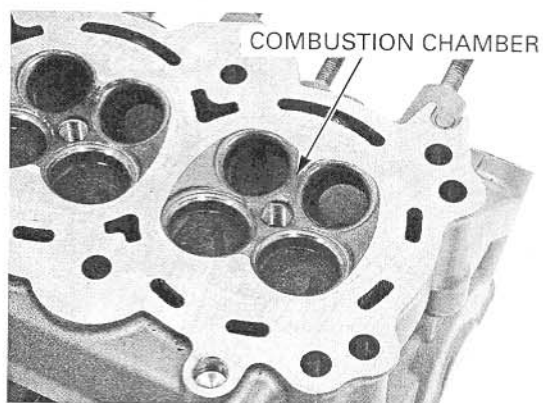


## CYLINDER HEAD INSPECTION

### CYLINDER HEAD

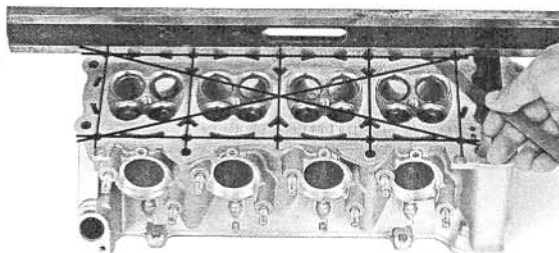
*Avoid damaging the gasket surface.*

Remove carbon deposits from the combustion chambers.  
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)

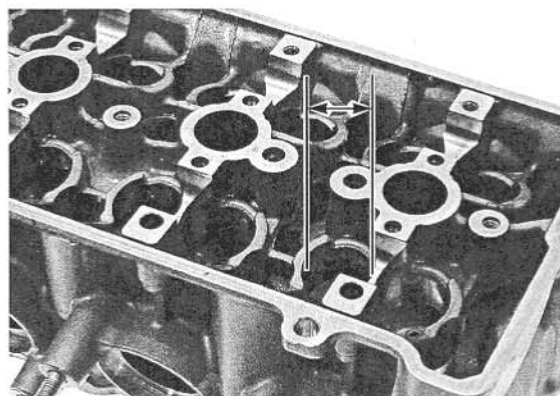


**VALVE LIFTER BORE**

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)

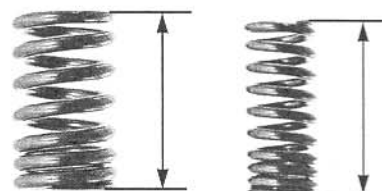
**VALVE SPRING**

Measure the free length of the inner and outer valve springs.

**SERVICE LIMITS:**

<b>IN:</b>	<b>Inner:</b>	35.1 mm (1.38 in)
	<b>Outer:</b>	38.8 mm (1.53 in)
<b>EX:</b>	<b>Inner:</b>	34.4 mm (1.35 in)
	<b>Outer:</b>	38.1 mm (1.50 in)

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

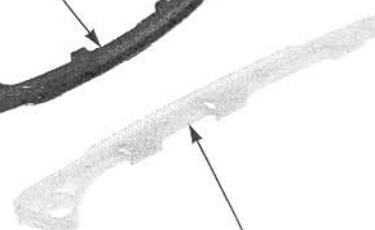
**CAM CHAIN TENSIONER/CAM CHAIN GUIDE**

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

CAM CHAIN TENSIONER A



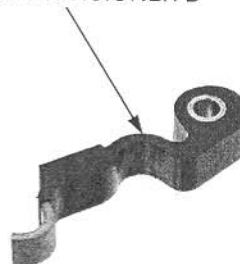
CAM CHAIN GUIDE A



## CYLINDER HEAD/VALVES

Inspect the cam chain tensioner B for excessive wear or damage, replace it if necessary.

CAM CHAIN TENSIONER B



### VALVE/VALVE GUIDE

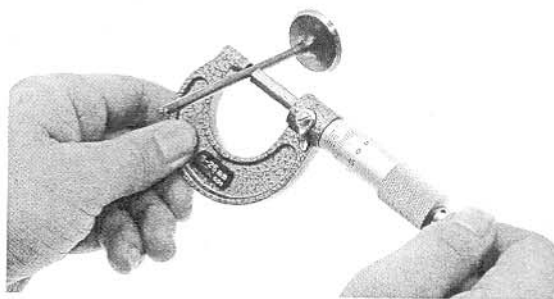
Check that the valve moves smoothly in the guide. Inspect each valve for bending, burning or abnormal stem wear.

Measure and record each valve stem O.D.

#### SERVICE LIMITS:

IN: 3.965 mm (0.1561 in)

EX: 3.955 mm (0.1557 in)

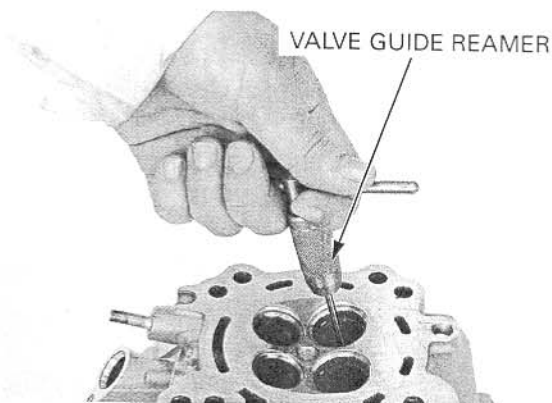


Ream the guides to remove any carbon deposits before checking clearances.

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

#### TOOL:

Valve guide reamer, 4.008 mm 07MMH-MV90100 or 07MMH-MV9010A (U.S.A. only)



Measure and record each valve guide I.D.

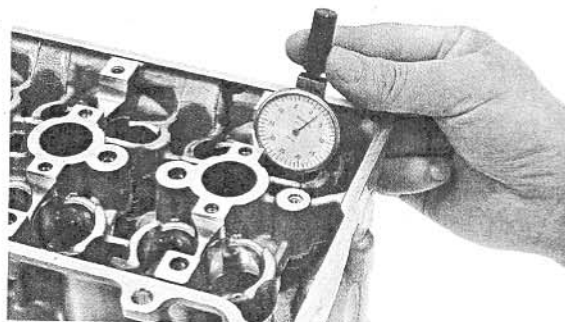
SERVICE LIMIT: IN/EX: 4.04 mm (0.159 in)

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 9-20).*

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 exceeds the service limit with the new guides, replace the valves and guides.

## VALVE GUIDE REPLACEMENT

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

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

Heat the cylinder head to 100 – 150°C (212 – 300°F) with a hot plate or oven. To avoid burns, wear heavy gloves when handling the heated cylinder head.

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 guides to the specified depth from the top of the cylinder head.

**SPECIFIED DEPTH:**

IN: 17.1 – 17.4 mm (0.67 – 0.69 in)

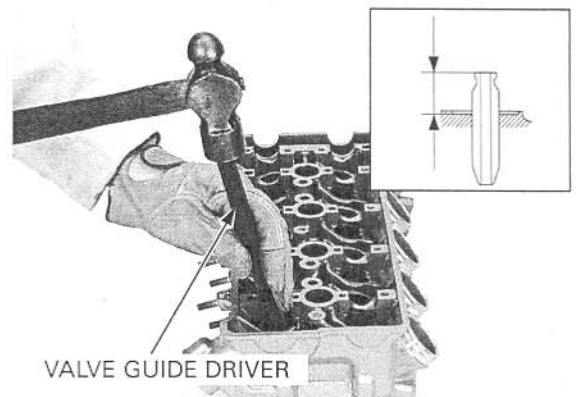
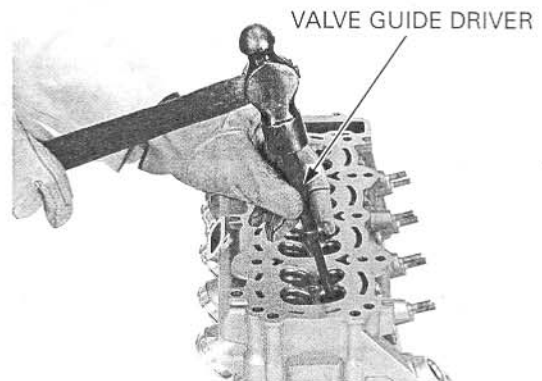
EX: 13.3 – 13.6 mm (0.52 – 0.54 in)

**TOOL:**

Valve guide driver

07743-0020000  
(not available in U.S.A.)

Let the cylinder head cool to room temperature.



*Use cutting oil on the reamer during this operation.*

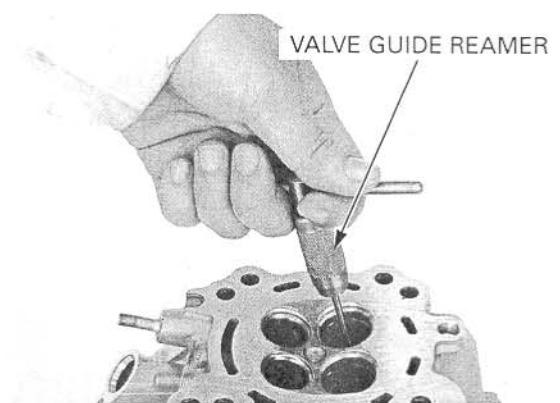
Ream the new valve guides after installation. Insert the reamer from the combustion chamber side of the head and also always rotate the reamer clockwise.

**TOOL:**

Valve guide reamer, 4.008 mm 07MMH-MV90100 or  
07MMH-MV9010A  
(U.S.A. only)

Clean the cylinder head thoroughly to remove any metal particles.

Reface the valve seat (page 9-20).

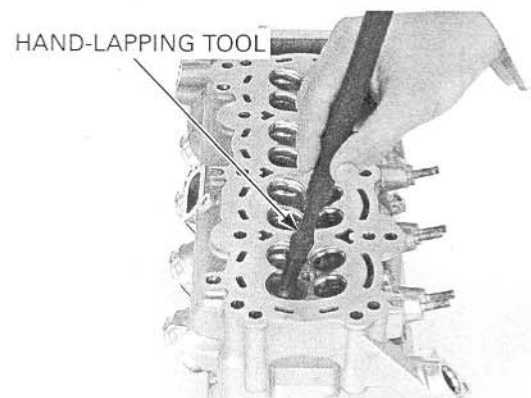


## VALVE SEAT INSPECTION/REFACING

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

Apply a light coating of Prussian Blue to the valve seats.

Tap the valves and seats using a rubber hose or other hand-lapping tool.



## CYLINDER HEAD/VALVES

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:

IN: 0.90 – 1.10 mm (0.035 – 0.043 in)

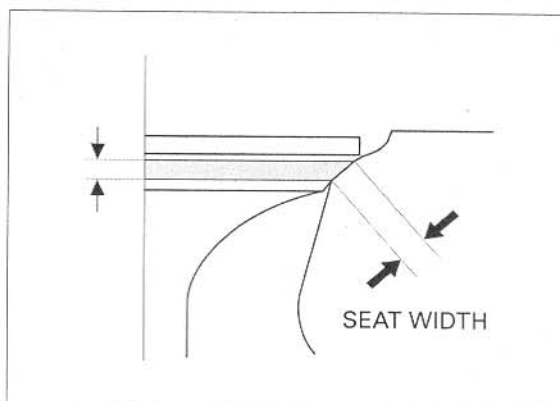
EX: 0.90 – 1.10 mm (0.035 – 0.043 in)

### SERVICE LIMITS:

IN: 1.5 mm (0.06 in)

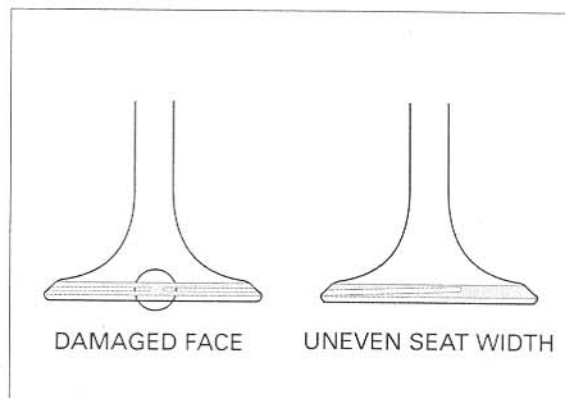
EX: 1.5 mm (0.06 in)

If the seat width is not within specification, reface the valve seat (page 9-20).



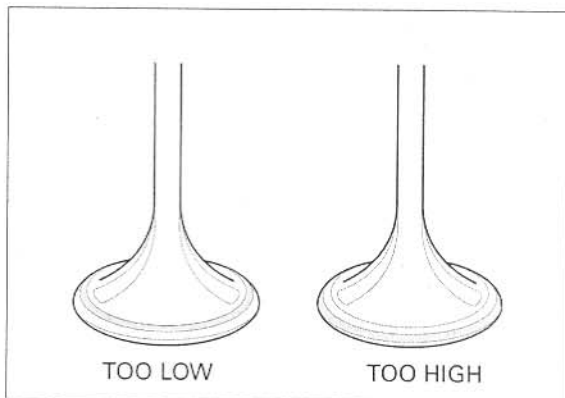
Inspect the valve seat face for:

- 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.*

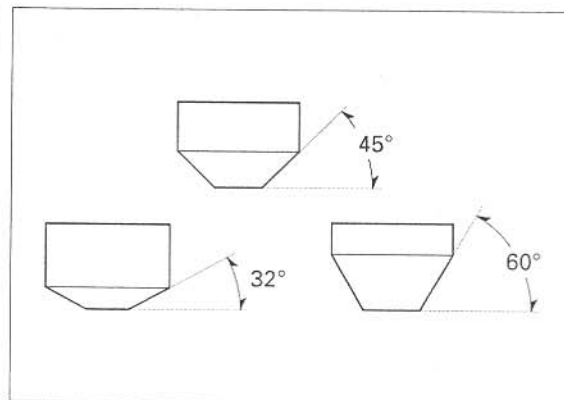
- Contact area (too high or too low)
  - Reface the valve seat.



## VALVE SEAT REFACING

*Follow the refacing manufacturer's operating instructions.*

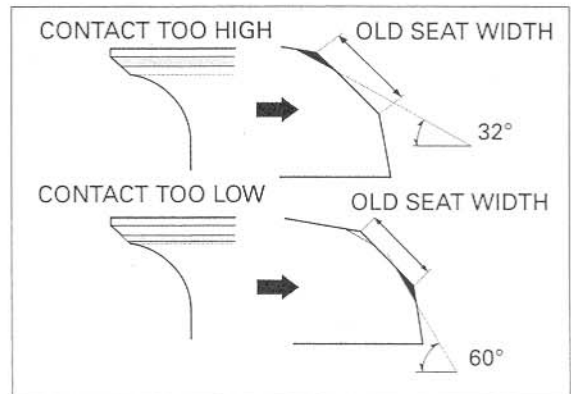
Valve seat cutters/grinders or equivalent valve seat refacing equipment are recommended to correct worn valve seats.



## CYLINDER HEAD/VALVES

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

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



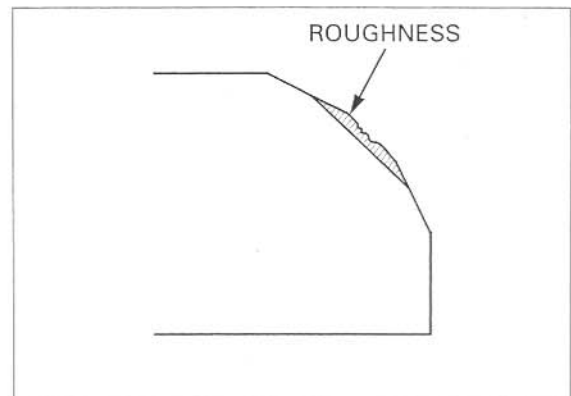
*Reface the seat with a 45-degree cutter whenever a valve guide is replaced.*

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

### TOOLS:

Seat cutter, 27.5 mm (IN)  
Seat cutter, 24 mm (EX)  
Cutter holder, 4.0 mm

07780-0010200  
07780-0010600  
07781-0010500 or  
equivalent commercially  
available in  
U.S.A.

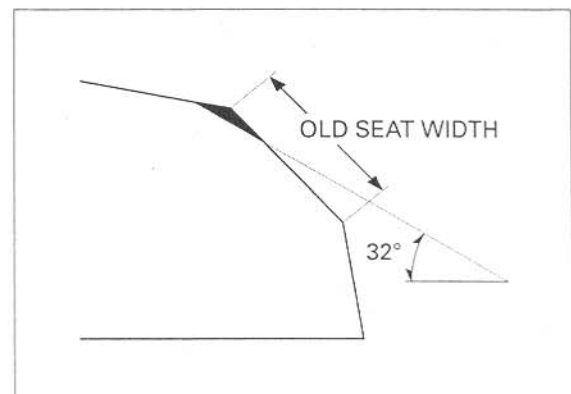


Use a 32-degree cutter to remove the top 1/4 of the existing valve seat material.

### TOOLS:

Flat cutter, 30 mm (IN)  
Flat cutter, 24 mm (EX)  
Cutter holder, 4.0 mm

07780-0012200  
07780-0012500  
07781-0010500 or  
equivalent commercially  
available in  
U.S.A.

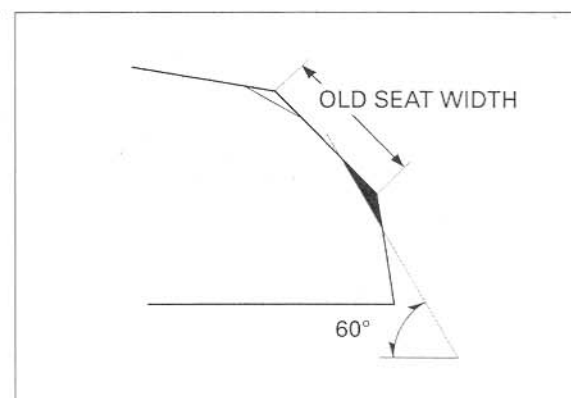


Use a 60-degree cutter to remove the bottom 1/4 of the old seat.

### TOOLS:

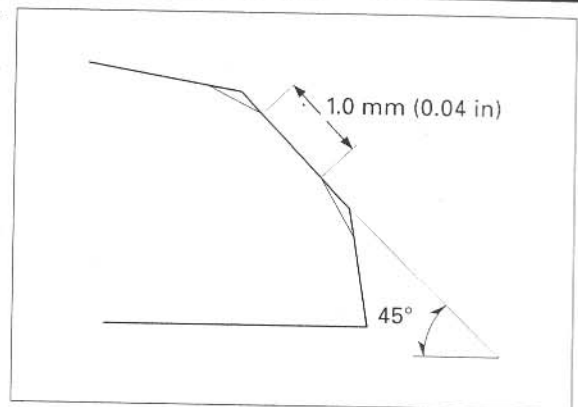
Interior cutter, 26 mm (IN)  
Interior cutter, 22 mm (EX)  
Cutter holder, 4.0 mm

07780-0014500  
07780-0014202  
07781-0010500 or  
equivalent commercially  
available in  
U.S.A.



## CYLINDER HEAD/VALVES

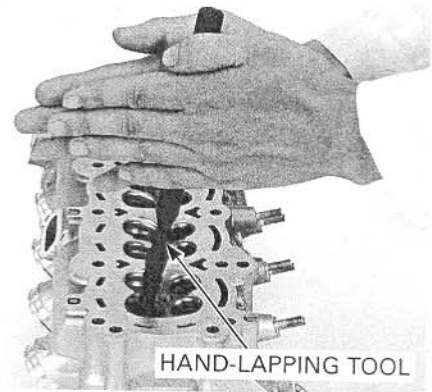
Using a 45-degree seat cutter, cut the seat to the proper width.  
Make sure that all pitting and irregularities are removed.  
Refinish if necessary.



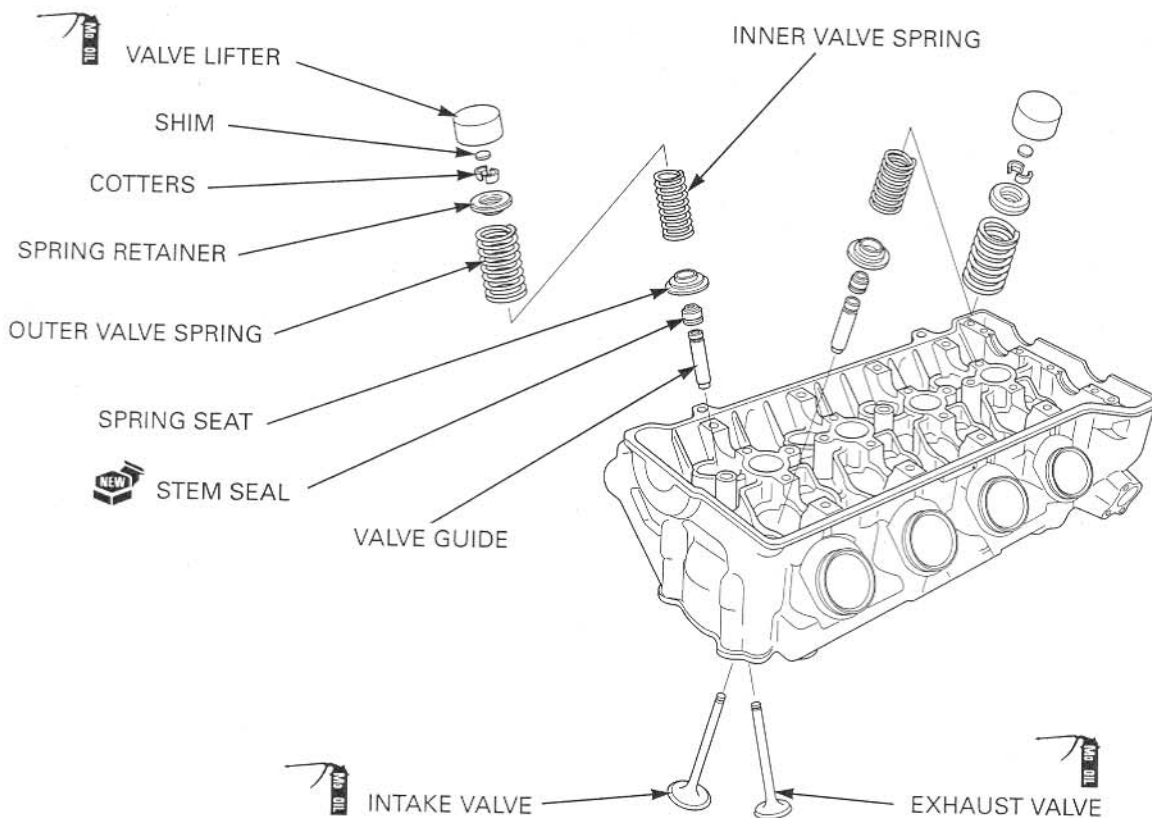
After cutting the seat, apply lapping compound to the valve face, and lap the valve using light pressure.

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

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



## CYLINDER HEAD ASSEMBLY





## CYLINDER HEAD/VALVES

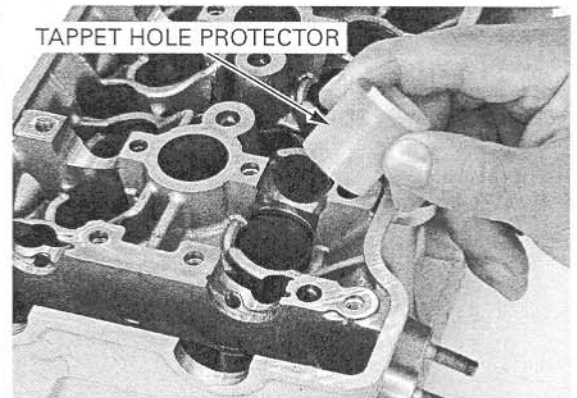
Blow through all oil passages in the cylinder head with compressed air.

Install the tappet hole protector into the valve lifter bore.

### TOOL:

Tappet hole protector

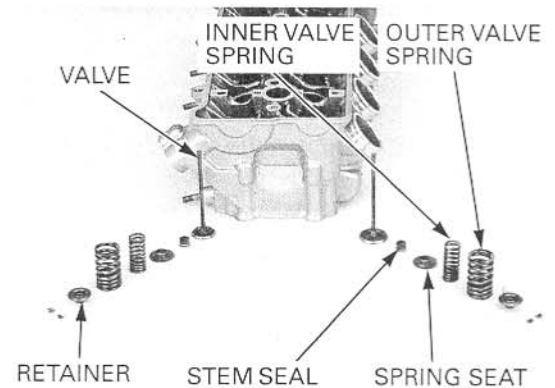
07HMG-MR70002  
(not available in U.S.A.) or refer to page 9-15 for alternative tool



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

Lubricate the valve stems with molybdenum oil solution.

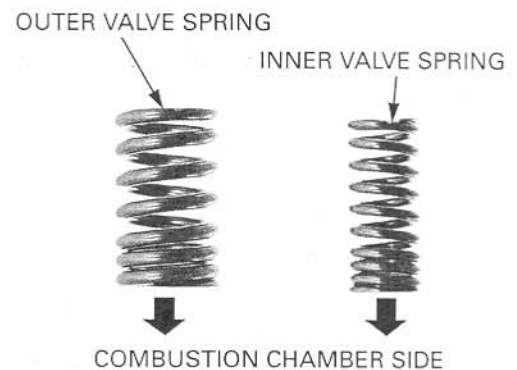
Insert the valve into the valve guide while turning it slowly to avoid damage to the stem seal.



*The exhaust valve springs has a orange paint marks and the intake valve springs has blue paint marks.*

Install the valve springs 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.

### NOTE:

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

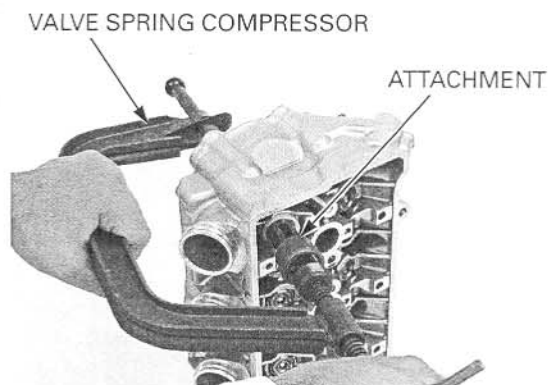
### TOOLS:

Valve spring compressor

07757-0010000

Valve spring compressor attachment

07959-KM30101



## CYLINDER HEAD/VALVES

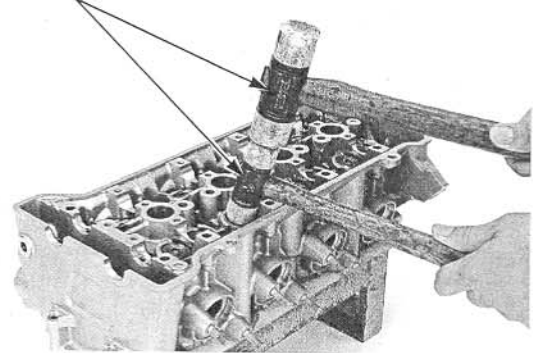
*Support the cylinder head above the work bench surface to prevent possible valve damage.*

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

Install and tighten the spark plugs.

**TORQUE: 16 N·m (1.6 kgf·m, 12 lbf·ft)**

PLASTIC HAMMERS

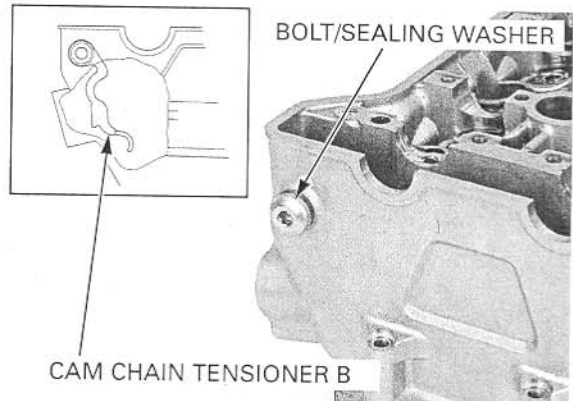


Apply a locking agent to the cam chain tensioner pivot bolt threads.

Install the sealing washer, bolt and cam chain tensioner B as shown.

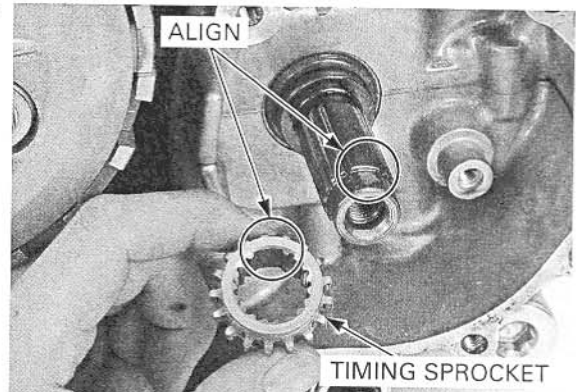
Tighten the cam chain tensioner B pivot bolt to the specified torque.

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

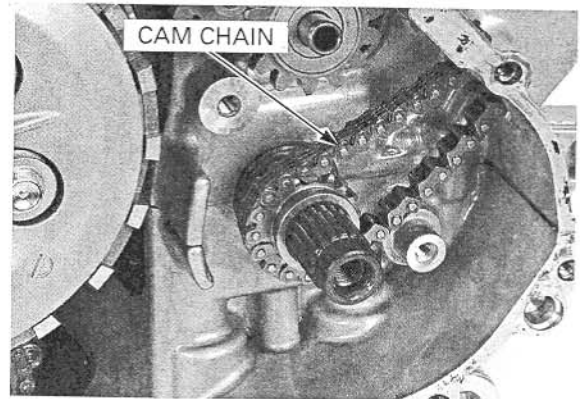


## CYLINDER HEAD INSTALLATION

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



Install the cam chain.



## CYLINDER HEAD/VALVES

Install the cam chain guide A and bolt.

CAM CHAIN GUIDE A

BOLT

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

CAM CHAIN TENSIONER A

WASHER

PIVOT BOLT

LOCK

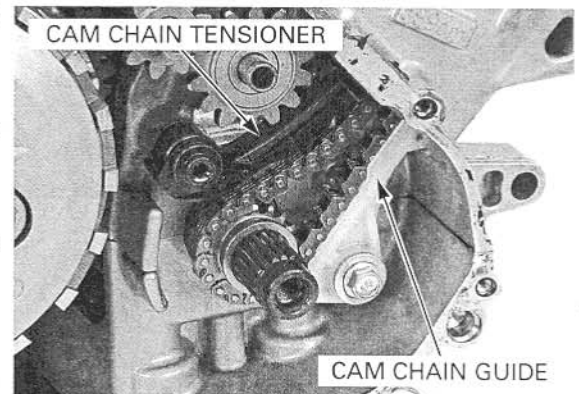
Tighten the cam chain guide A bolt to the specified torque.

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

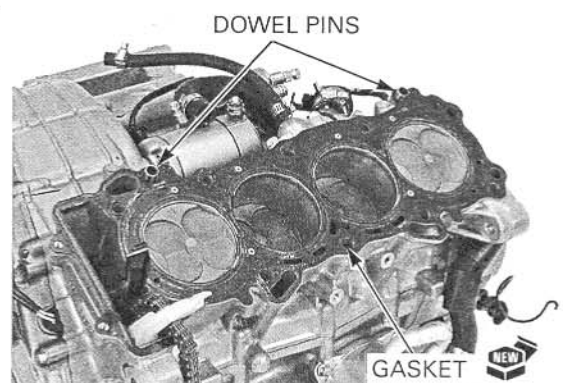
Tighten the cam chain tensioner A pivot bolt to the specified torque.

**TORQUE: 9.8 N·m (1.0 kgf·m, 7 lbf·ft)**

Install the starter clutch (page 10-20) and right crankcase cover (page 10-24).

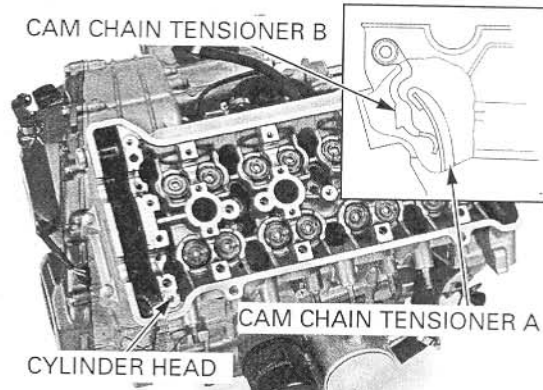


Install the dowel pins and a new cylinder head gasket as shown.



## CYLINDER HEAD/VALVES

Install the cylinder head onto the cylinder block while aligning the cam chain tensioner A and B as shown.



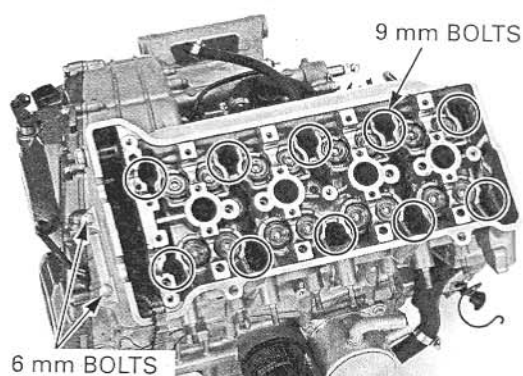
Apply molybdenum disulfide oil solution to the threads and seating surface of the 9 mm bolts/washers and install them.

Install the two 6 mm flange bolts.

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

**TORQUE: 47 N·m (4.8 kgf·m, 35 lbf·ft)**

Tighten the 6 mm flange bolts.

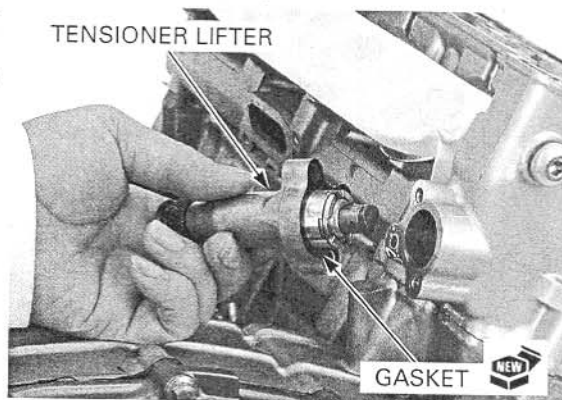


Install the cam chain tensioner lifter onto the cylinder head with a new gasket.

Install and tighten the socket bolts to the specified torque.

**TORQUE: 9.8 N·m (1.0 kgf·m, 7 lbf·ft)**

Install the engine into the frame (page 8-10).

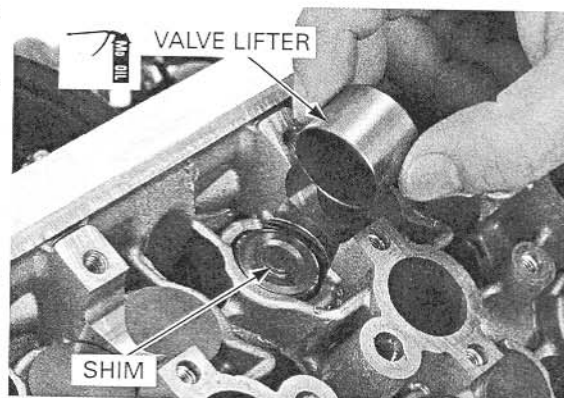


## CAMSHAFT INSTALLATION

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

*Install the shims and valve lifters in their original locations.*

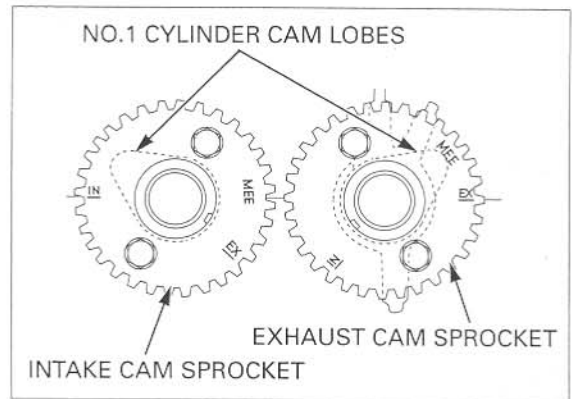
Install the shims on the retainers and valve lifters into the valve lifter bores.



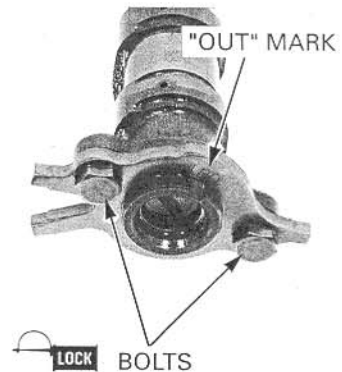
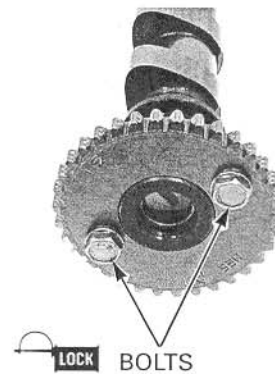
## CYLINDER HEAD/VALVES

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.



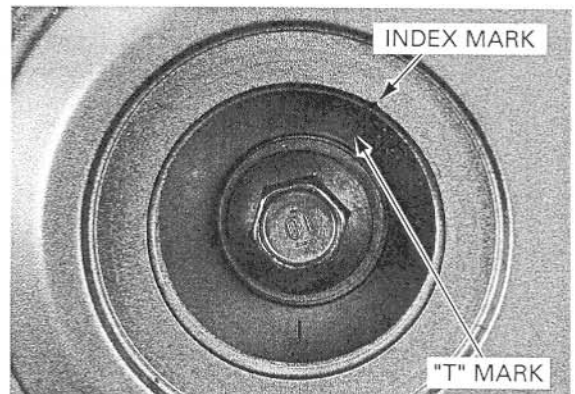
Clean and apply a locking agent to the cam sprocket bolt threads.  
Install the cam sprockets and bolts.



*Exhaust camshaft only:* Clean and apply a locking agent to the cam pulse generator rotor bolt threads.

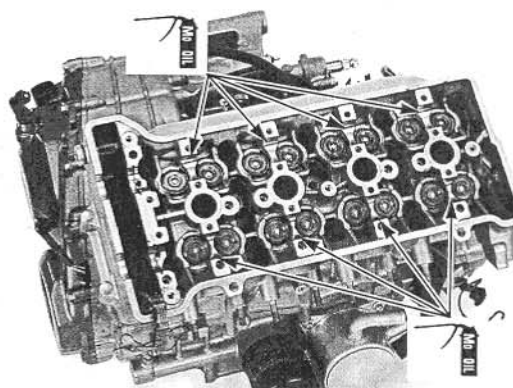
*Install the cam pulse generator rotor with the No.1 cylinder cam lobes facing down and rotor 'OUT' mark facing up as shown.* Install the cam pulse generator rotor and bolts.

Turn the crankshaft clockwise and align the "T" mark on the ignition pulse generator rotor with the index mark on the right crankcase cover.



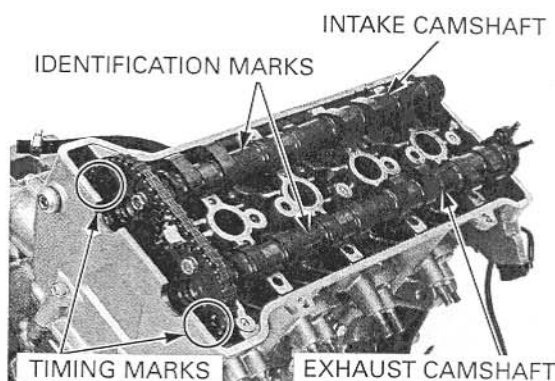
## CYLINDER HEAD/VALVES

Apply molybdenum oil solution to the camshaft journal of the cylinder head.

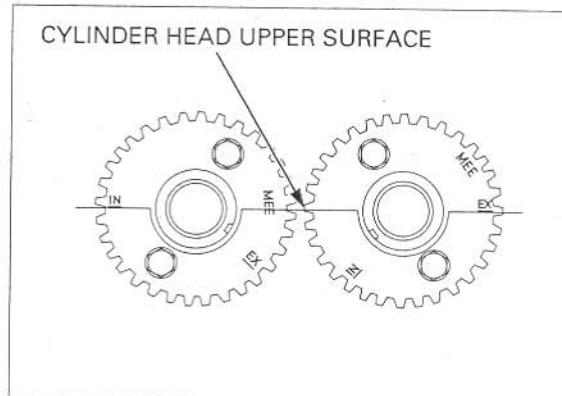


Install the cam chain over the cam sprockets and then install the intake and exhaust camshafts.

- Install the each camshaft to the correct locations with the identification marks.  
"IN": Intake camshaft  
"EX": Exhaust camshaft

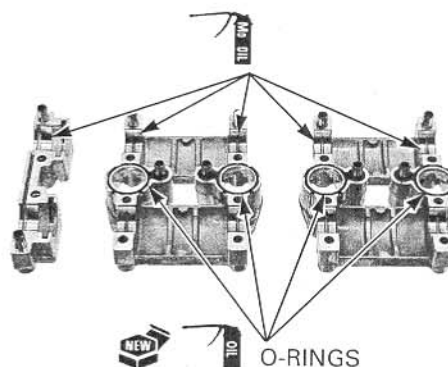


- Make sure that the timing marks on the cam sprockets are facing outward and flush with the cylinder head upper surface as shown.



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

Apply molybdenum oil solution to the camshaft journals of the camshaft holders.

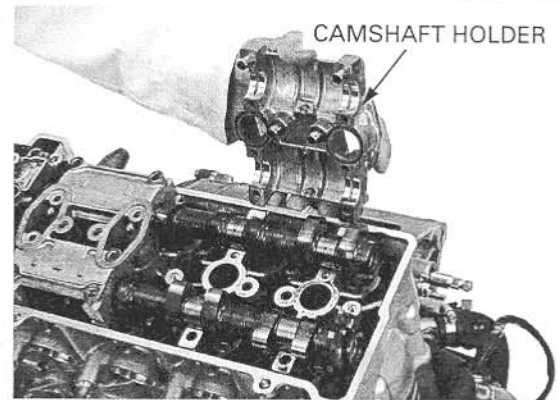




## CYLINDER HEAD/VALVES

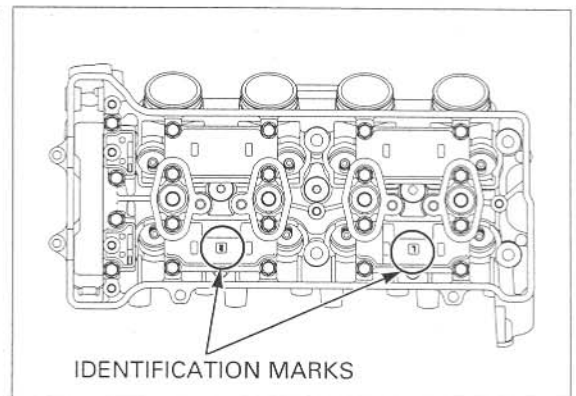
Be sure to align the dowel pins in the camshaft holder align properly with the holes in the cylinder head properly.

Install the each camshaft holder onto the camshafts.



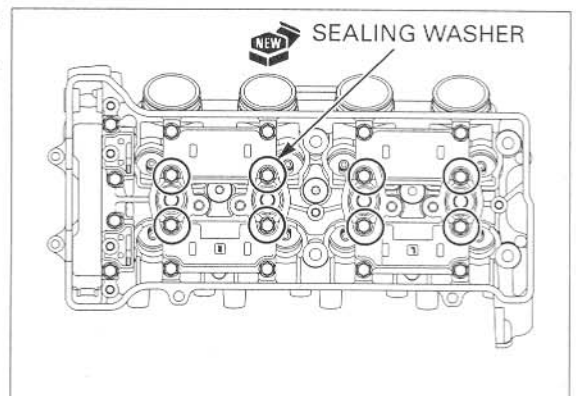
Note the correct locations with the identification marks as shown.

- No mark: right camshaft holder
- "R" mark: center camshaft holder
- "L" mark: left camshaft holder



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

Finger tighten the bolts.



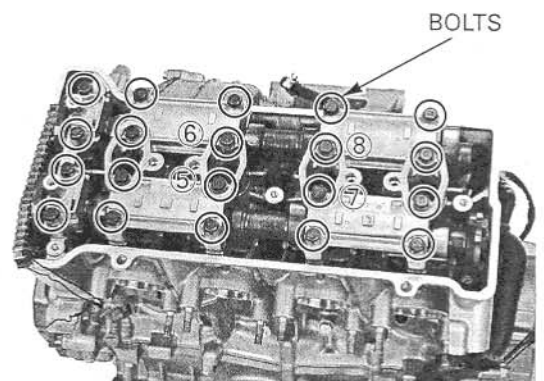
First gradually tighten the four bolts (No.5 – No.6 – No.7 – No.8) in the numerical order cast on the camshaft holders. Gradually tighten the other camshaft holder bolts until the camshaft holders lightly contact the cylinder head surface.

### NOTICE

*Failure to tighten the camshaft holder in a criss-cross pattern might cause a camshaft holder to break.*

Tighten all camshaft holder bolts in the numerical order casted on the camshaft holders.

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

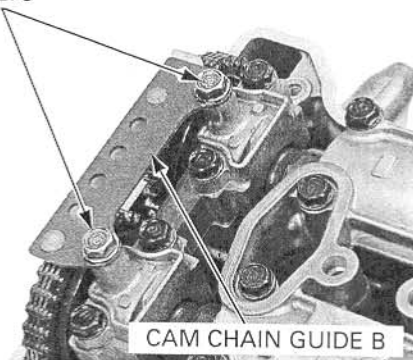




## CYLINDER HEAD/VALVES

Install the cam chain guide B, and tighten the bolts.

BOLTS

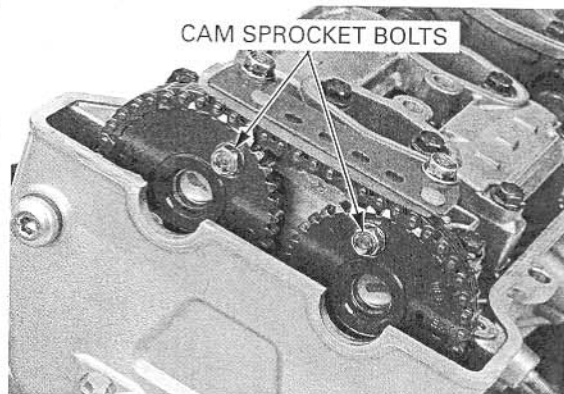


In case the cam sprockets were removed, tighten the cam sprocket bolts to the specified torque.

**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.

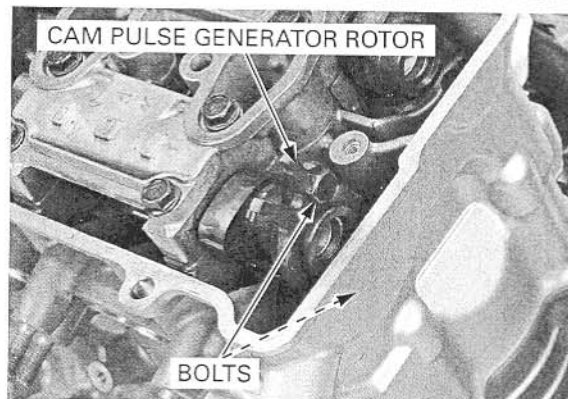
CAM SPROCKET BOLTS



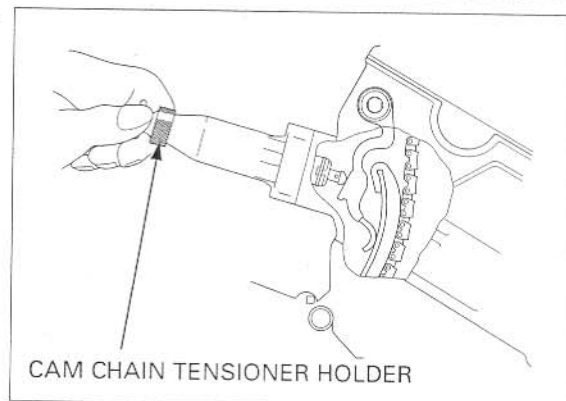
In case the cam pulse generator rotor was removed, tighten the cam pulse generator rotor bolts to the specified torque.

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

CAM PULSE GENERATOR ROTOR



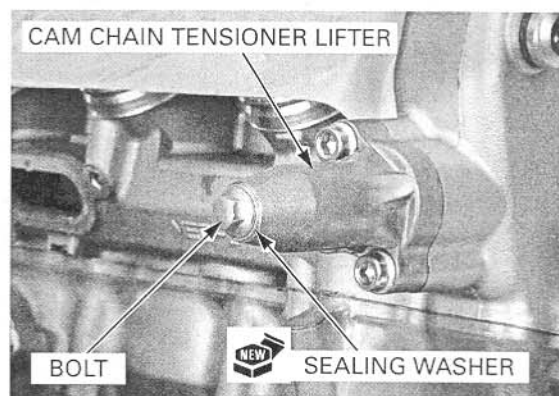
Remove the special tool from the cam chain tensioner lifter.



## CYLINDER HEAD/VALVES

Install a new sealing washer and tighten the sealing bolt.

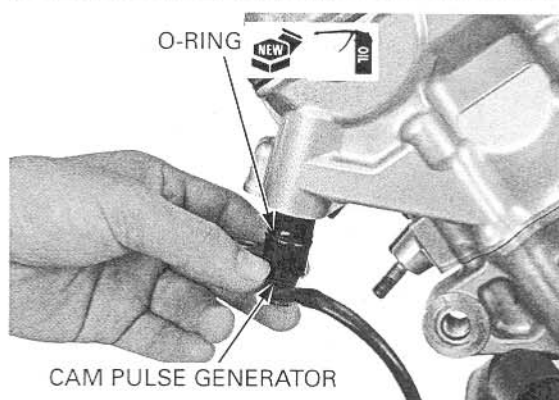
Recheck the valve timing.



Apply oil to a new O-ring, and install it onto the cam pulse generator.

Install the cam pulse generator into the cylinder head.

Install and tighten the mounting bolt, clamp securely.



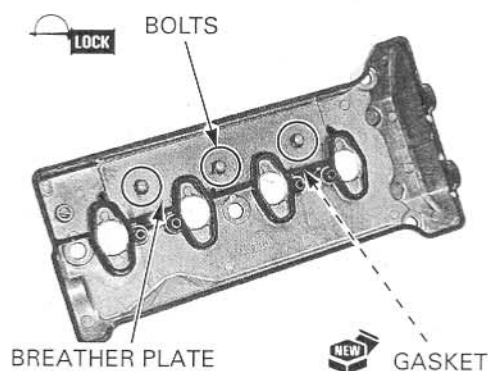
## CYLINDER HEAD COVER ASSEMBLY

Install a new gasket and crankcase breather plate onto the cylinder head cover.

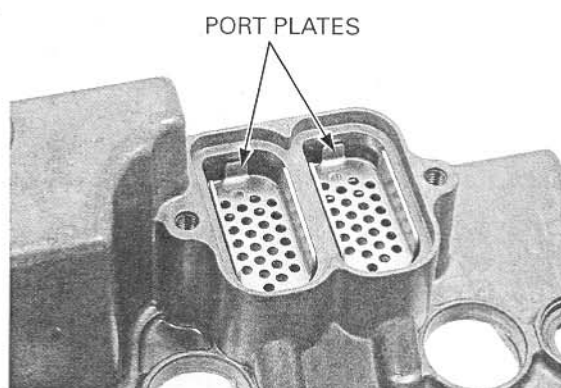
Apply a locking agent to the crankcase breather plate bolt threads.

Install and tighten the bolts to the specified torque.

**TORQUE: 13 N·m (1.3 kgf·m, 9 lbf·ft)**

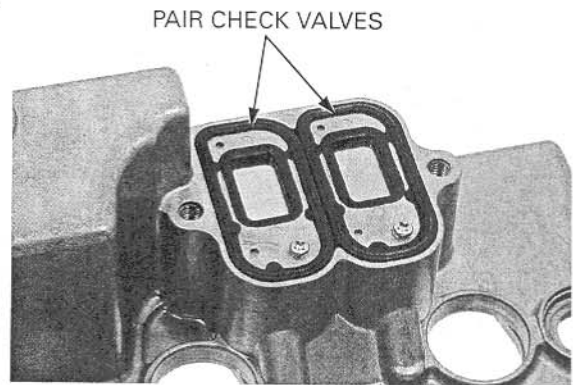


Install the PAIR check valve port plates into the cylinder head cover.



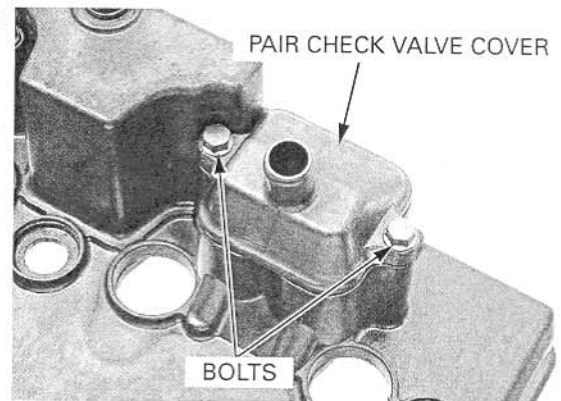
## CYLINDER HEAD/VALVES

Install the PAIR check valves into the cylinder head cover.



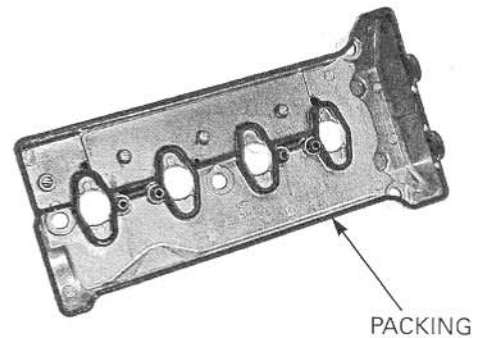
Install the PAIR check valve cover and tighten the bolts to the specified torque.

**TORQUE: 13 N·m (1.3 kgf·m, 9 lbf·ft)**

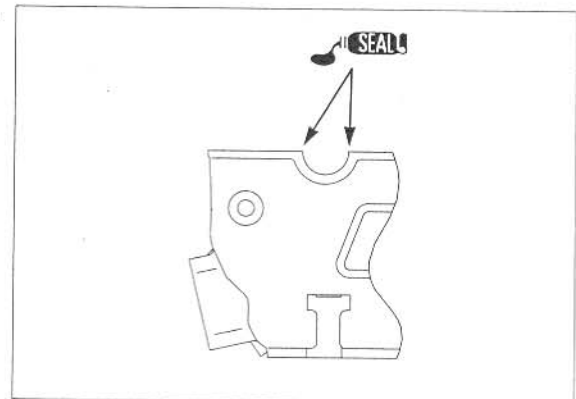


## CYLINDER HEAD COVER INSTALLATION

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

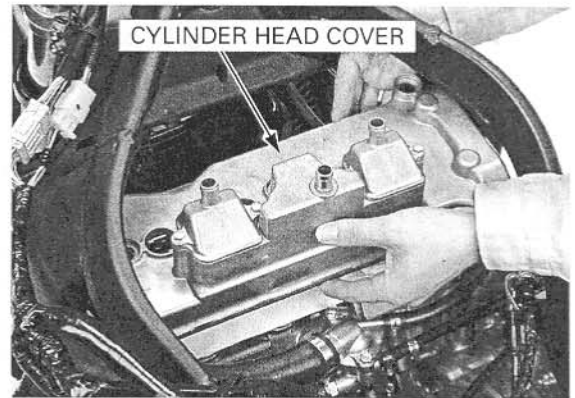


Apply sealant to the cylinder head semi-circular cut-outs as shown.

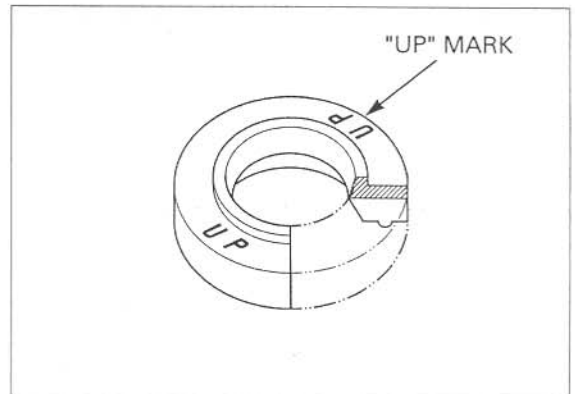


## CYLINDER HEAD/VALVES

Install the cylinder head cover onto the cylinder head.

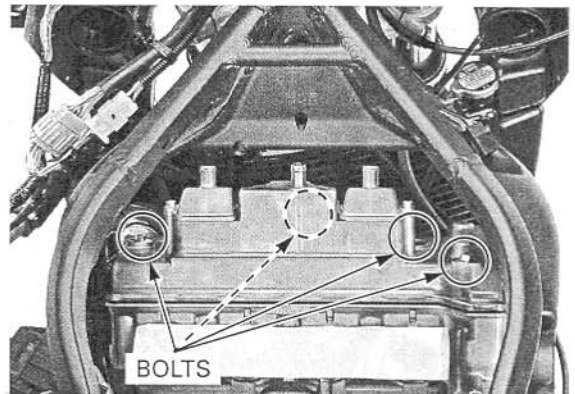


Install the washers to the cylinder head cover with their "UP" mark facing up.



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

**TORQUE: 9.8 N·m (1.0 kgf·m, 7 lbf·ft)**

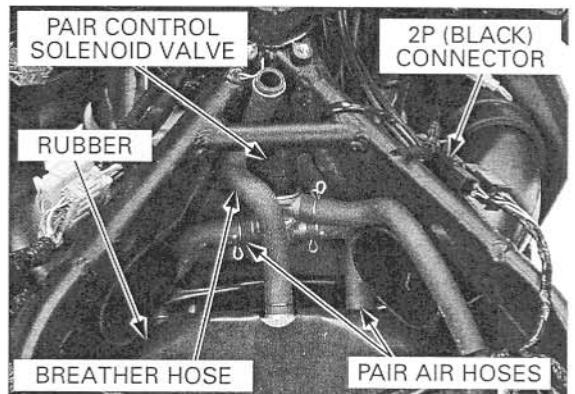


Install the heat guard rubber.

Connect the PAIR air hoses onto the cylinder head and install the PAIR control solenoid valve.

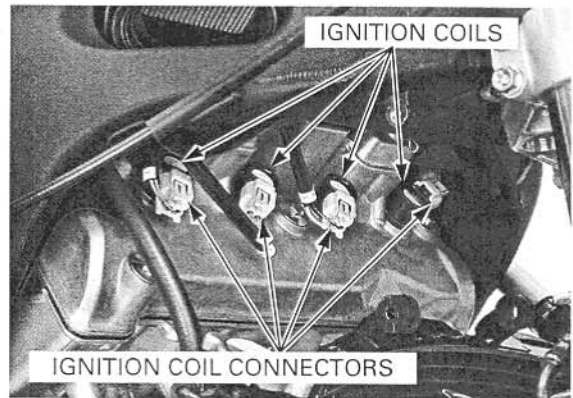
Connect the PAIR control solenoid valve 2P (Black) connector.

Install the crankcase breather hose.



## CYLINDER HEAD/VALVES

Install the direct ignition coils and connect the ignition coil connectors.



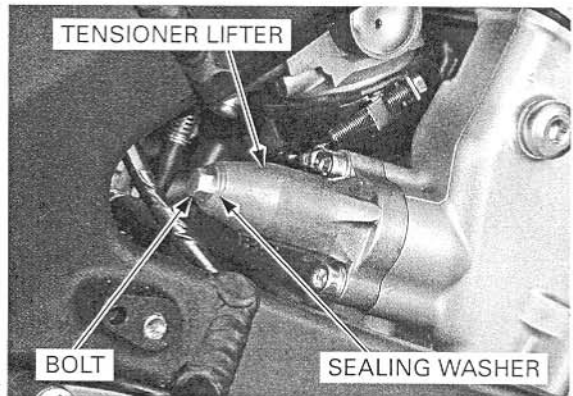
## CAM CHAIN TENSIONER LIFTER

### REMOVAL

Remove the following:

- Lower cowls (page 3-6)
- Middle cowls (page 3-7)
- Tool box (page 6-73)

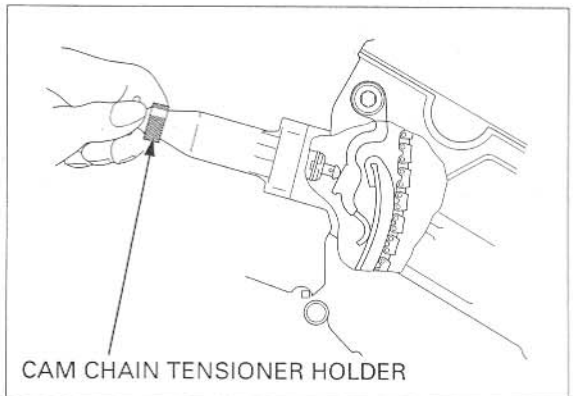
Remove the cam chain tensioner sealing bolt and sealing washer.



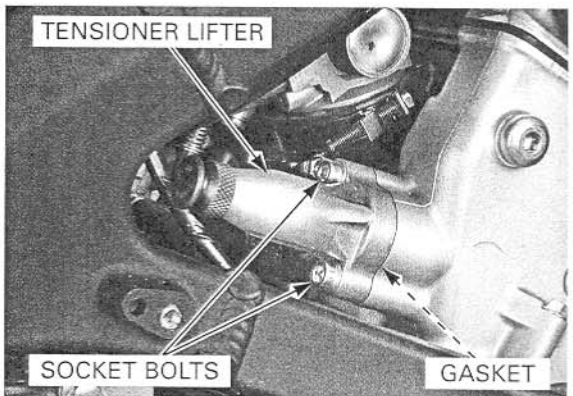
Turn the tensioner shaft fully in (clockwise) and secure it using the special tool to prevent damaging the cam chain.

### TOOL:

Cam chain tensioner holder 07ZMG-MCAA400



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



**INSTALLATION**

*Note the installation direction of the gasket.*

Install a new gasket onto the cam chain tensioner lifter.

Install the cam chain tensioner lifter into the cylinder head.

Install and tighten the socket bolts to the specified torque.

**TORQUE: 9.8 N·m (1.0 kgf·m, 7 lbf·ft)**

Remove the special tool.

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

Installation is the removed parts in the reverse order of removal.

