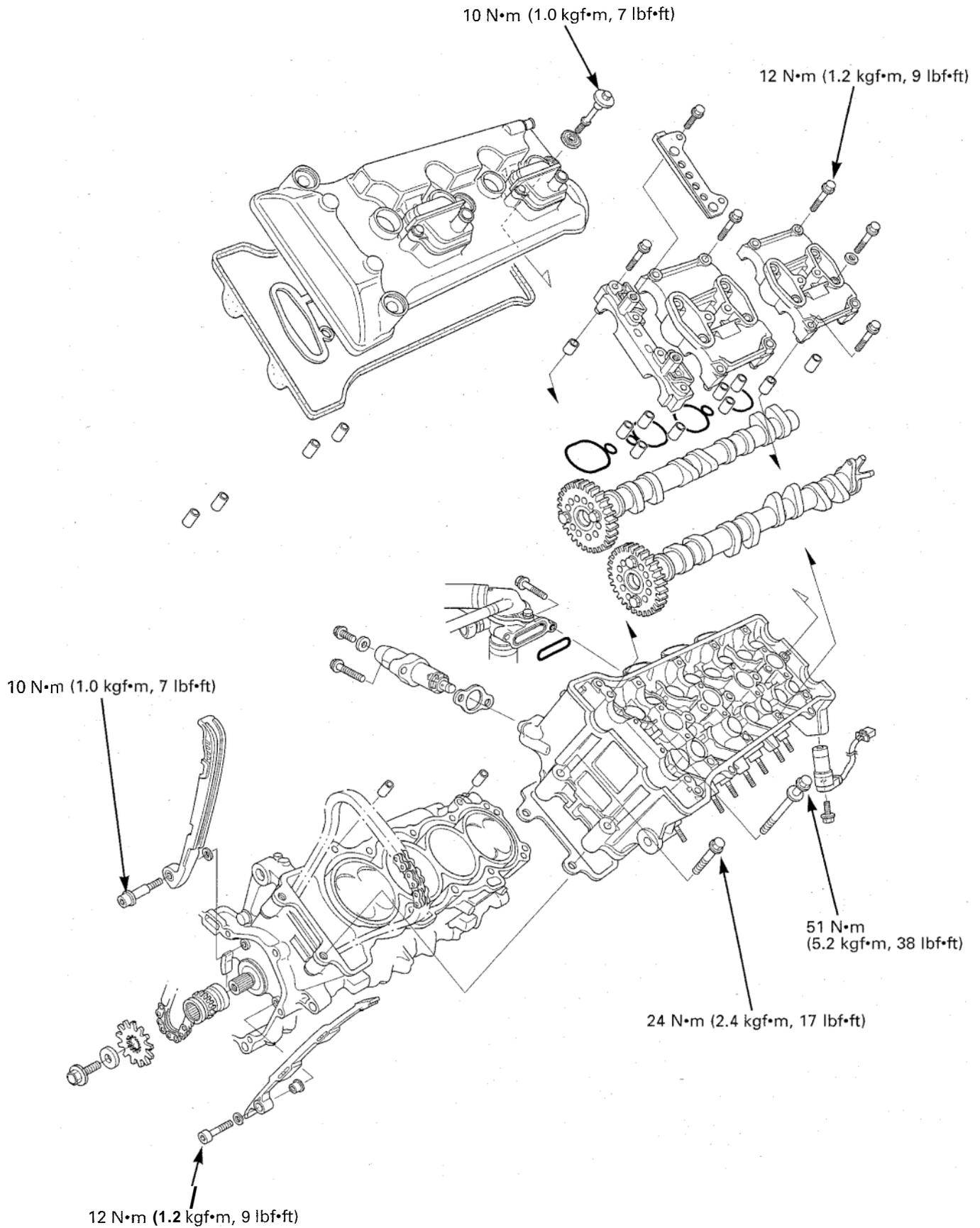


# CYLINDER HEAD/VALVES



# 8. CYLINDER HEAD/VALVES

SERVICE INFORMATION	8-1	VALVE GUIDE REPLACEMENT	8-17
TROUBLESHOOTING	8-3	VALVE SEAT INSPECTION/ REFACING	8-18
CYLINDER COMPRESSION TEST	8-4	CYLINDER HEAD ASSEMBLY	8-20
CYLINDER HEAD COVER REMOVAL	8-5	CYLINDER HEAD INSTALLATION	8-22
CYLINDER HEAD COVER DISASSEMBLY	8-6	CAMSHAFT INSTALLATION	8-24
CAMSHAFT REMOVAL	8-7	CYLINDER HEAD COVER ASSEMBLY	8-29
CYLINDER HEAD REMOVAL	8-12	CYLINDER HEAD COVER INSTALLATION	8-30
CYLINDER HEAD DISASSEMBLY	8-13	CAM CHAIN TENSIONER LIFTER	8-32
CYLINDER HEAD INSPECTION	8-14		

## SERVICE INFORMATION

8

### 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 required 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		1,196 kPa (12.2 kgf/cm <sup>2</sup> , 174 psi) at 350 rpm	—	
Valve clearance	IN	0.16 ± 0.03 (0.006 ± 0.001)	—	
	EX	0.27 ± 0.03 (0.011 ± 0.001)	—	
Cam shaft	Cam lobe height	IN	36.74 - 36.98 (1.446 - 1.456)	
		EX	36.45 - 36.69 (1.435 - 1.444)	
	Runout	—	0.04 (0.002)	
	Oil clearance	0.020 - 0.062 (0.0008 - 0.0024)	0.10 (0.004)	
Valve lifter	Valve lifter O.D.	IN/EX 25.978 - 25.993 (1.0228 - 1.0233)	25.97 (1.022)	
	Valve lifter bore I.D.	IN/EX 26.010 - 26.026 (1.0240 - 1.0246)	26.04 (1.025)	
Valve, valve guide	Valve stem O.D.	IN	4.475 - 4.490 (0.1762 - 0.1768)	
		EX	4.465 - 4.480 (0.1758 - 0.1764)	
	Valve guide I.D.	IN/EX 4.500 - 4.512 (0.1722 - 0.1776)	4.540 (0.1787)	
	Stem-to-guide clearance	IN	0.010 - 0.037 (0.0004 - 0.0015)	—
		EX	0.020 - 0.047 (0.0008 - 0.0019)	—
	Valve guide projection above cylinder head	IN	14.3 - 14.6 (0.56 - 0.57)	—
EX		12.4 - 12.7 (0.49 - 0.50)	—	
Valve seat width	IN/EX	0.90 - 1.10 (0.035 - 0.043)	1.5 (0.06)	
Valve spring free length	IN	Inner	34.80 (1.370)	
		Outer	37.97 (1.495)	
	EX	39.60 (1.559)	37.6 (1.48)	
Cylinder head warpage			0.10 (0.004)	

## TORQUE VALUES

Cylinder head cover bolt	10 N•m (1.0 kgf•m, 7 lbf•ft)	
PAIR reed valve cover flange bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads
Breather plate flange bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads
Camshaft holder flange bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply oil to the threads
Cylinder head sealing bolt	27 N•m (2.8 kgf•m, 20 lbf•ft)	Apply a locking agent to the threads
Cylinder head mounting bolt	51 N•m (5.2 kgf•m, 38 lbf•ft)	Apply molybdenum disulfide oil to the threads and seating surface (after removing anti-rust oil additive)
Cylinder head mounting bolt, 8 mm	24 N•m (2.4 kgf•m, 17 lbf•ft)	Apply oil to the threads
Cam sprocket bolt	20 N•m (2.0 kgf•m, 14 lbf•ft)	Apply a locking agent to the threads
Cam pulse generator rotor dowel bolt	12 N•m (1.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads
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 mounting socket bolt	12 N•m (7.2 kgf•m, 9 lbf•ft)	Apply a locking agent to the threads
Cylinder head stud bolt (exhaust pipe stud bolt)	See page 1-14	
Throttle cable guide bracket mounting bolt	3 N•m (0.3 kgf•m, 2.2 lbf•ft)	

**TOOLS**

Compression gauge attachment	07RMJ-MY50100	or equivalent commercially available in U.S.A.
Valve spring compressor	07757-0010000	
Valve spring compressor attachment	07959-KM30101	
Tappet hole protector	07HMG-MR70002	not available in U.S.A. or refer to page 8-13 for alternative tool (U.S.A. only)
Valve guide driver, 4.5 mm	07HMD-ML00101	
Valve guide reamer, 4.5 mm	07HMH-ML00101	or 07HMH-ML0010A (U.S.A. only)
Valve seat cutters		
Seat cutter, 24.5 mm (45" EX)	07780-0010100	equivalent commercially available in U.S.A.
Seat cutter, 29 mm (45" IN)	07780-0010300	
Flat cutter, 28 mm (32" EX)	07780-0012100	
Flat cutter, 30 mm (32" IN)	07780-0012200	
Interior cutter, 26 mm (60" EX)	07780-0014500	
Interior cutter, 30 mm (60" IN)	07780-0014000	
Cutter holder, 4.5 mm	07781-0010600	
Cam chain tensioner holder	07ZMG-MCAA400	(U.S.A. only)

**TROUBLESHOOTING**

- Engine top-end problems usually affect engine performance. These problems can be diagnosed by a compression test or by tracing engine noises to the top-end with a sounding rod or stethoscope.
- If the performance is poor at low speeds, check for white smoke in the crankcase breather hose. If the hose is smoky, check for a seized piston ring (Section 11).

**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 11)

**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 11)

**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 11)

**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).

Open and support the front end of the 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:**

**1,196 kPa (12.2kgf/cm<sup>2</sup>, 174 psi) at 350 rpm**

Low compression can be caused by:

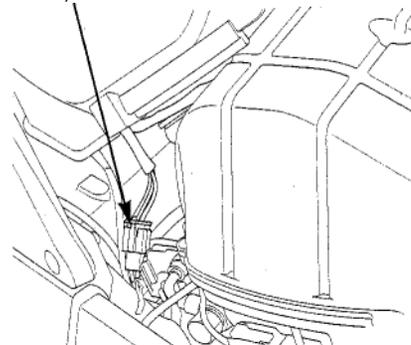
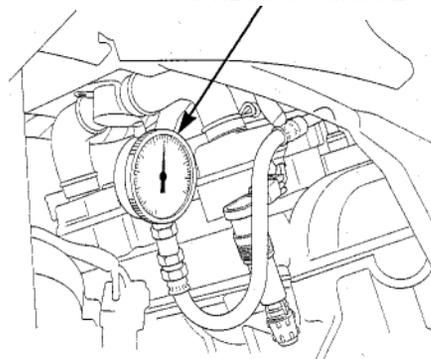
- Blown cylinder head gasket
- Improper valve adjustment
- Valve leakage
- Worn piston ring or cylinder

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*

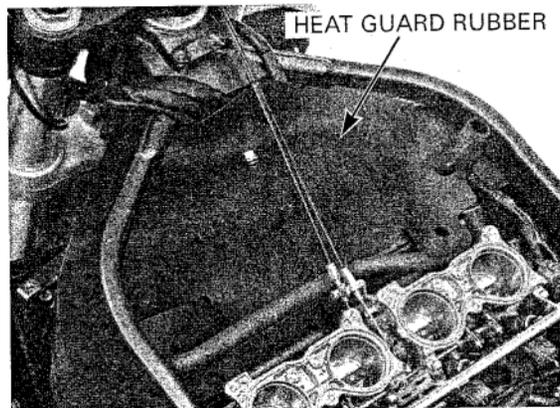
**3P (BLACK) CONNECTOR****COMPRESSION GAUGE**

## CYLINDER HEAD COVER REMOVAL

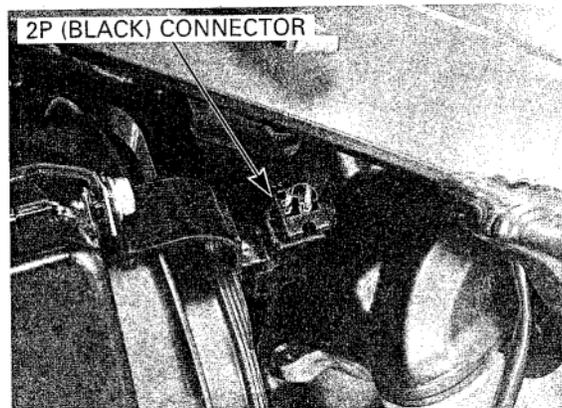
Remove the following:

- Lower cowl (page 2-7)
- Air cleaner housing (page 5-64)

Remove the heat guard rubber.



Disconnect the fan motor 2P (Black) connector.

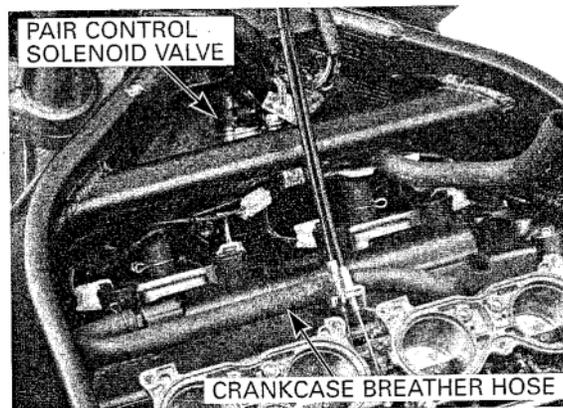


Disconnect the cam pulse generator 2P (natural) connector (page 5-83).

Remove the mounting bolt and PAIR control solenoid valve assembly (page 5-88).

Disconnect the ignition coil sub-harness 4P (Black) connector and sub-harness (page 17-5).

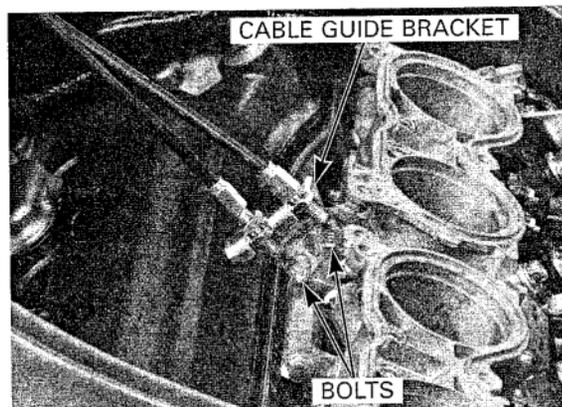
Disconnect the crankcase breather hose.



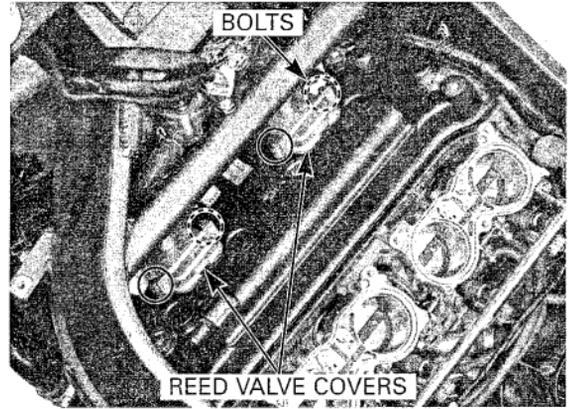
*Place a cloth underneath the bolts to avoid dropping them into the engine area*

Remove the throttle cable guide bracket mounting bolts.

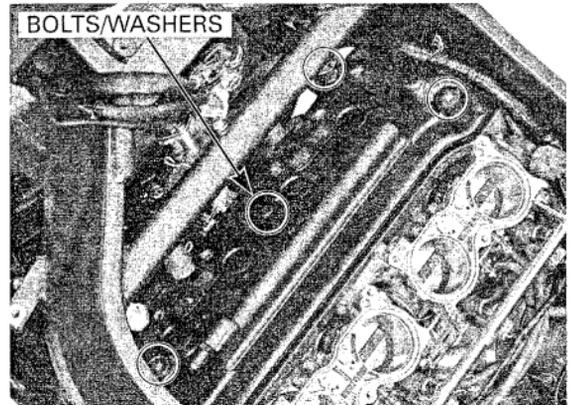
Disconnect the throttle cable ends from the throttle drum.



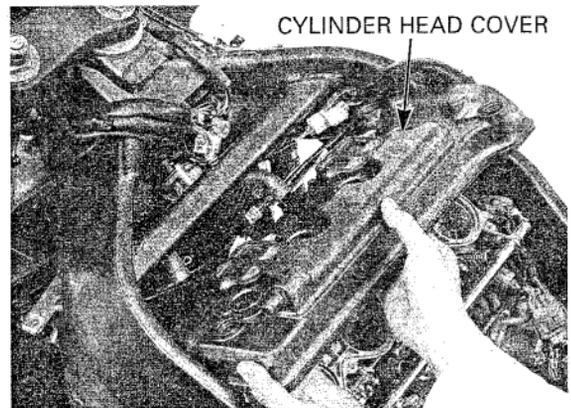
Remove the **SH** bolts and PAIR reed valve covers from the cylinder head.



Remove the cylinder head cover bolts and washers.



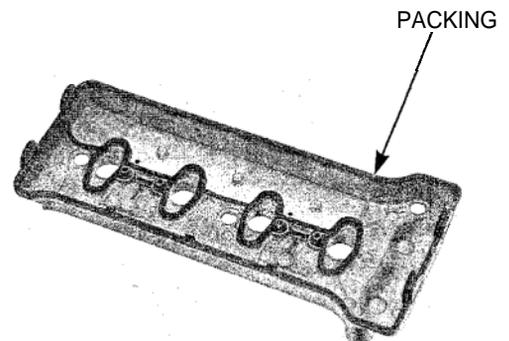
Remove the cylinder head cover rearward.



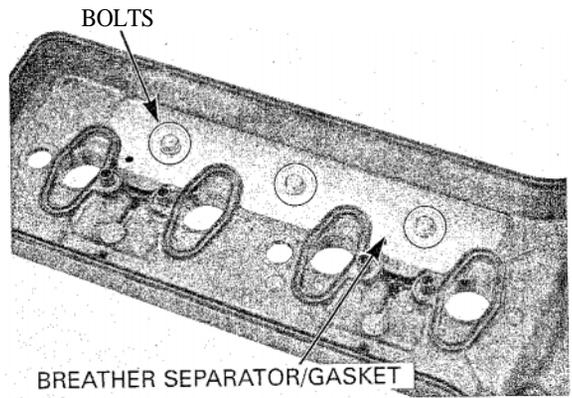
## CYLINDER HEAD COVER DISASSEMBLY

Remove the cylinder head cover (page 8-5).

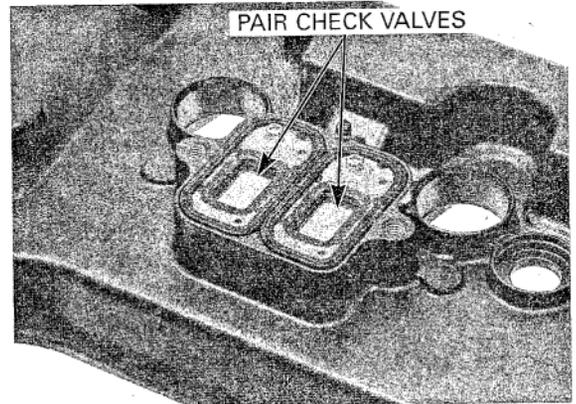
Remove the cylinder head cover packing.



Remove the bolts and breather separator and gasket.



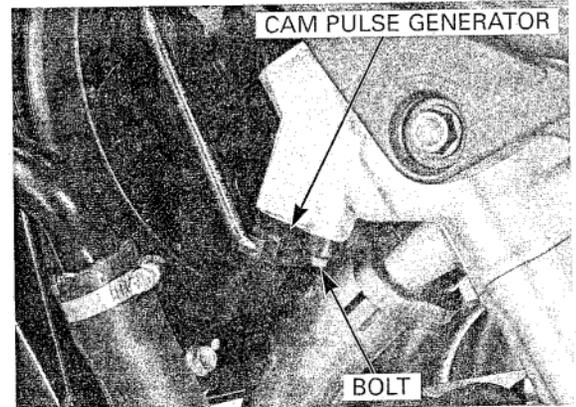
Check the PAIR check valves for wear or damage, replace if necessary.



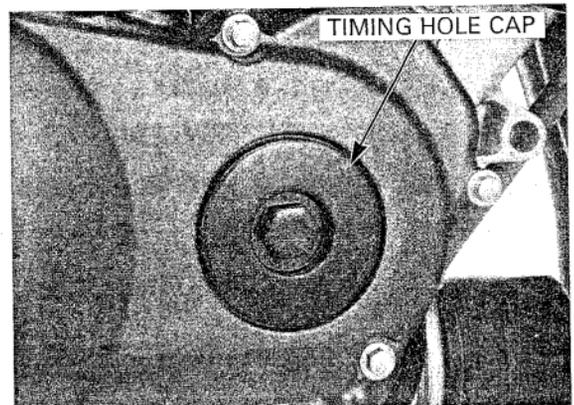
## CAMSHAFT REMOVAL

Remove the cylinder head cover (page 8-5).

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

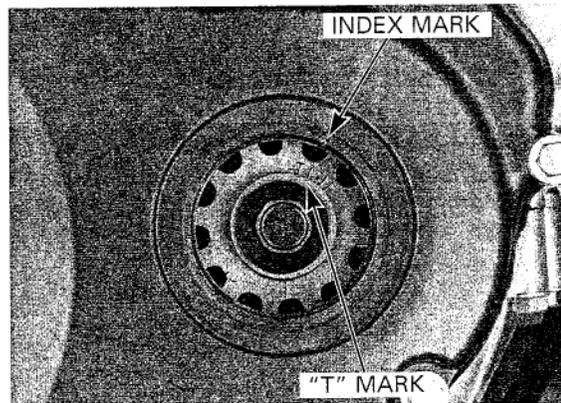


Remove the timing hole cap and O-ring.

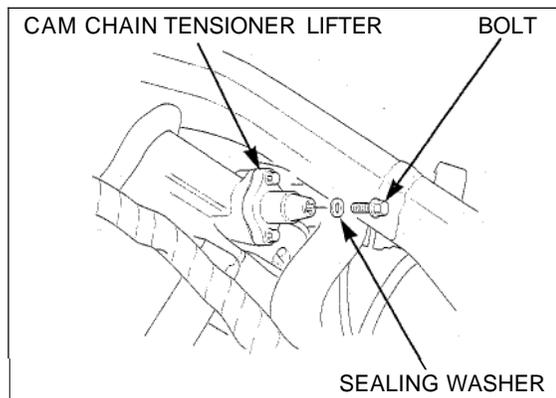


## CYLINDER HEAD/VALVES

Turn the crankshaft clockwise, align the "T" mark on the ignition pulse generator 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.



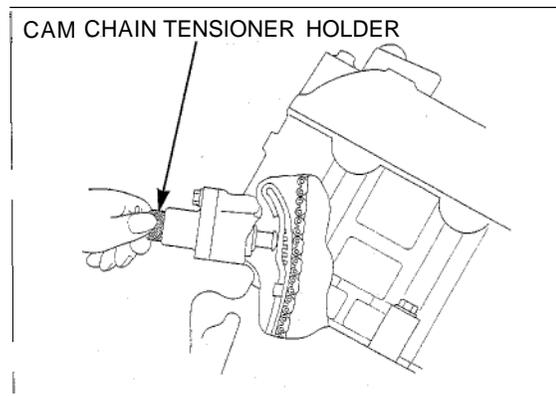
Remove the cam chain tensioner lifter sealing bolt and sealing washer.



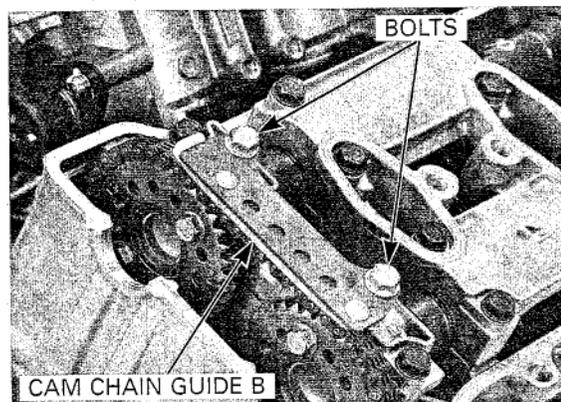
Turn the tensioner lifter shaft fully in (clockwise) and secure it using the cam chain tensioner holder.

**TOOL:**

**Cam chain tensioner holder**      **07ZMG-MCAA400**  
(U.S.A. only)

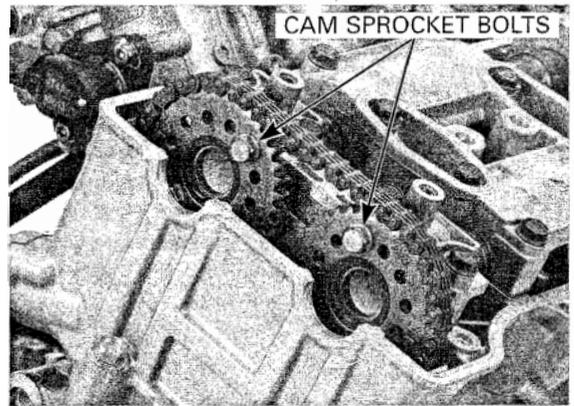


Remove the bolts and cam chain guide B.



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

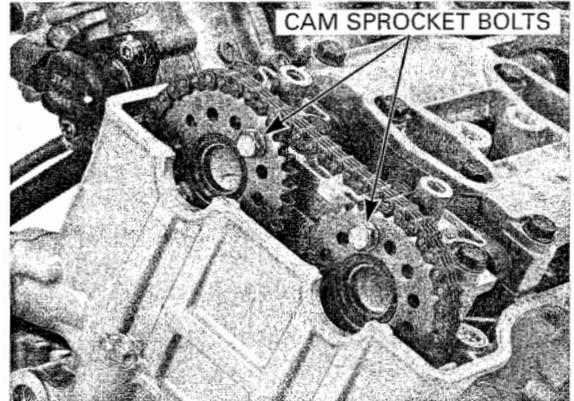
If you plan to replace the camshaft and/or cam sprocket, loosen the cam sprocket bolts as follows:



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

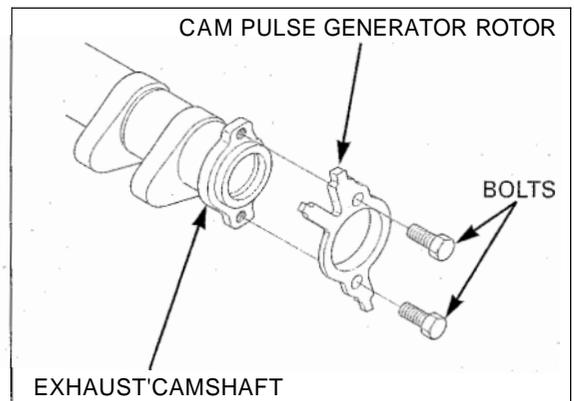
- Remove the cam sprocket bolts from intake and exhaust camshafts.

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



*Be careful not to drop the rotor or bolts into the crankcase*

- Remove the bolts and cam pulse generator rotor from the exhaust camshaft.

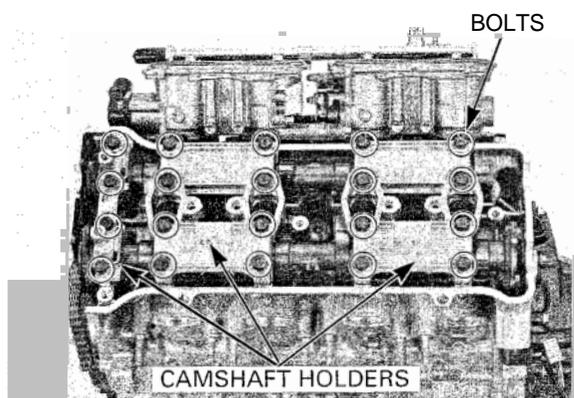


*Suspend the cam chain with a piece of wire to prevent the chain from falling into the crankcase.*

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

## NOTICE

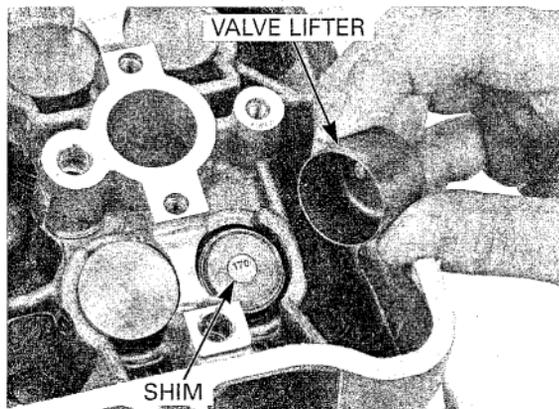
*From outside to inside, loosen the bolts in a crisscross pattern in several steps or the camshaft holder might break.*



# CYLINDER HEAD/VALVES

Remove the valve lifters and shims.

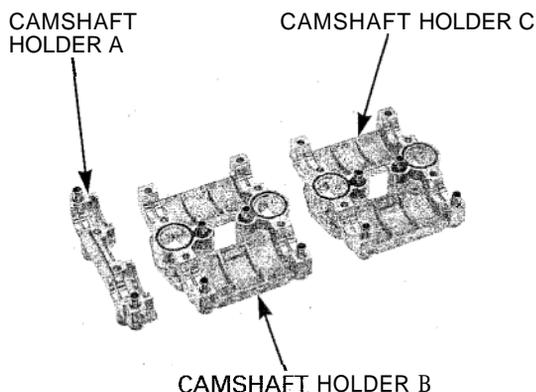
- Be careful not to damage the valve lifter bore.
- Shims may stick to the inside of the valve lifters. Do not allow the shims to fall into the crankcase.
- Mark all valve lifters and shims to ensure correct reassembly in their original locations.
- The valve lifter can be easily removed with a valve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



## INSPECTION

### CAMSHAFT HOLDER

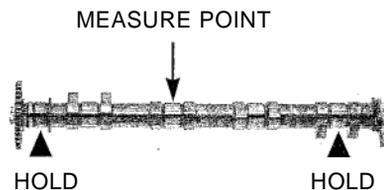
Inspect the bearing surface of each camshaft holder for scoring, scratches, or evidence of insufficient lubrication.



### CAMSHAFT RUNOUT

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

**SERVICE LIMIT: 0.04 mm (0.002 in)**



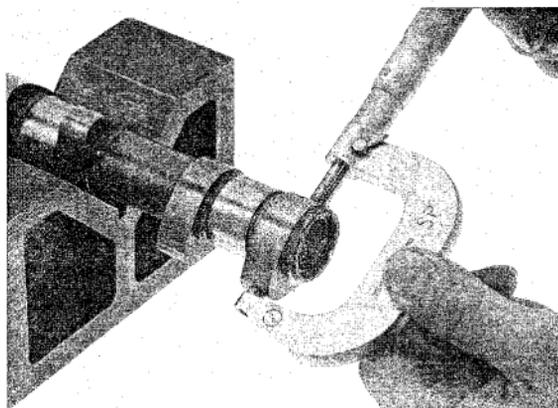
### CAM LOBE HEIGHT

Using a micrometer, measure each cam lobe height.

#### SERVICE LIMITS:

**IN: 36.72 mm (1.446 in)**

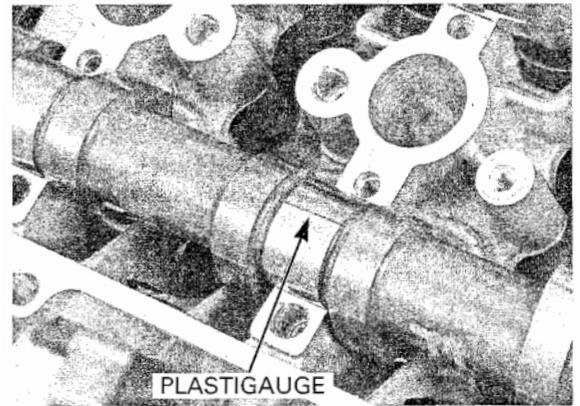
**EX: 36.43 mm (1.434 in)**



*Do not rotate the camshaft during inspection.*

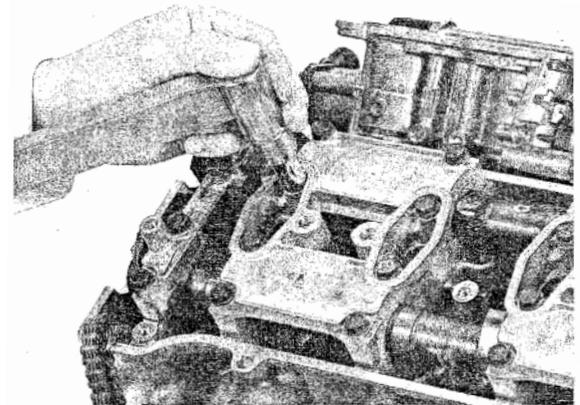
**CAMSHAFT OIL CLEARANCE**

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.



Install the camshaft holders and tighten the bolts in a crisscross pattern in two to three steps.

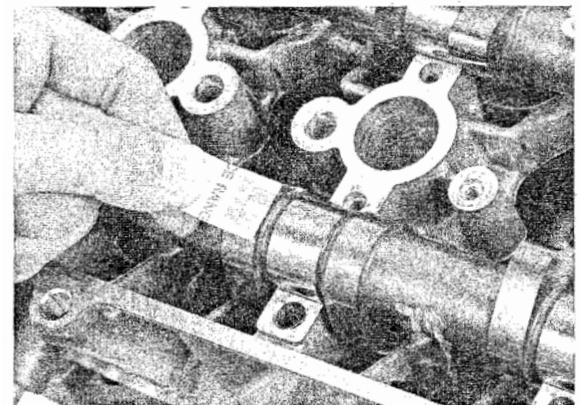
**TORQUE: 12 N·m (1.2kgf·m, 9 lbf·ft)**



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

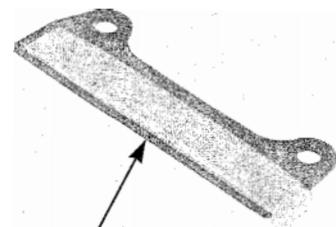
**SERVICE LIMIT: 0.10 mm (0.004 in)**

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.



**CAM CHAIN GUIDE B**

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



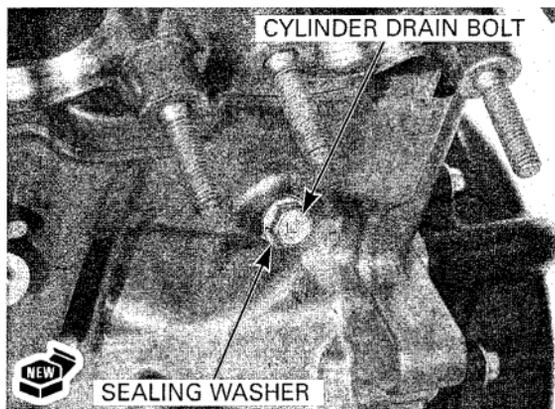
CAM CHAIN GUIDE B

## CYLINDER HEAD REMOVAL

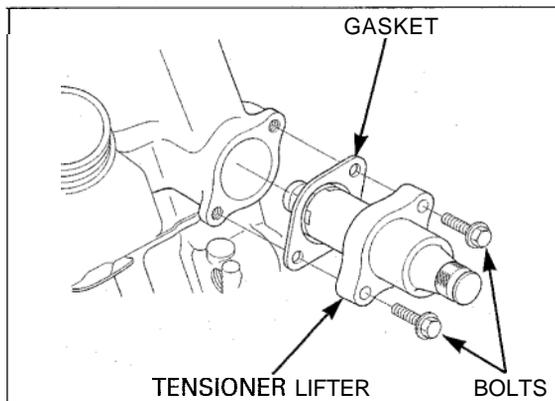
Remove the engine from the frame (page 7-3).  
Remove the camshaft (page 8-7).

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

Reinstall a new sealing washer and drain bolt.



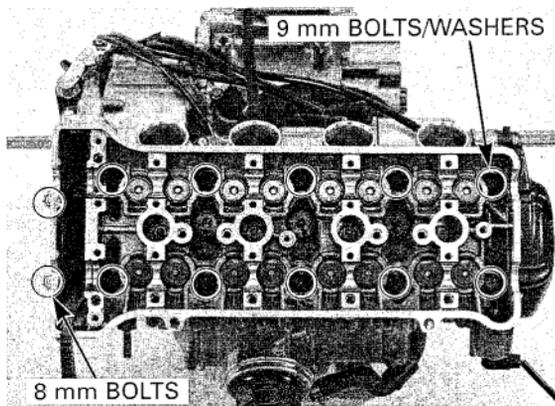
Remove the bolts and cam chain tensioner lifter and gasket.



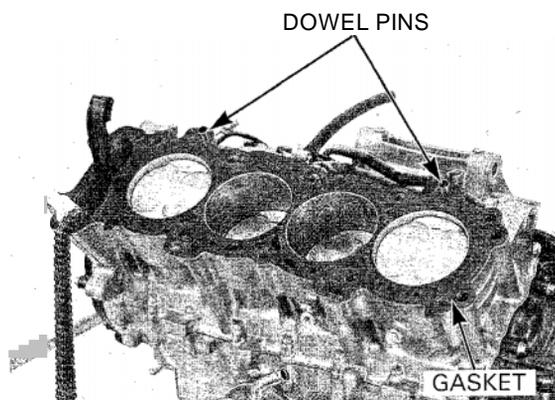
*Loosen the 9 mm bolts in a criss-cross pattern in two or three steps.*

Remove the two 8 mm flange bolts.  
Remove the ten 9 mm bolts/washers.

Remove the cylinder head.



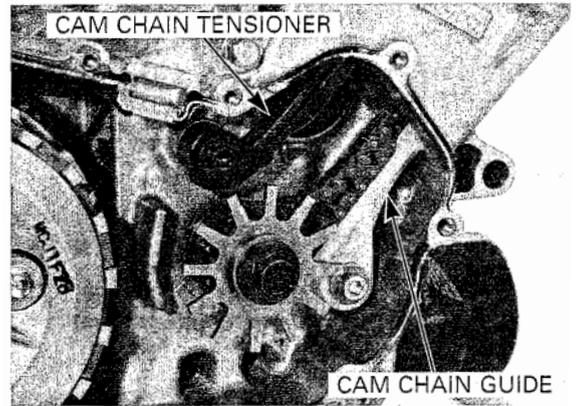
Remove the dowel pins and cylinder head gasket.



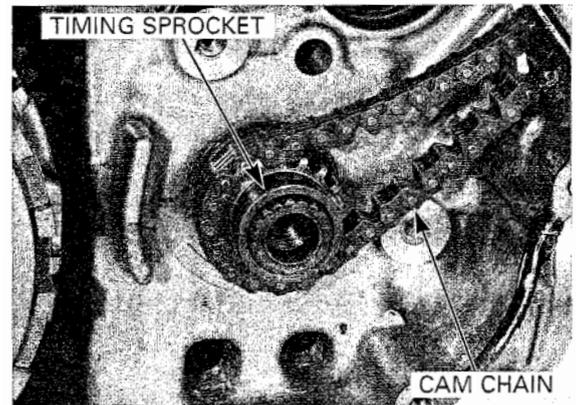
Remove the right crankcase cover and ignition pulse generator rotor (page 17-6).

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 cylinder head (page 8-12).

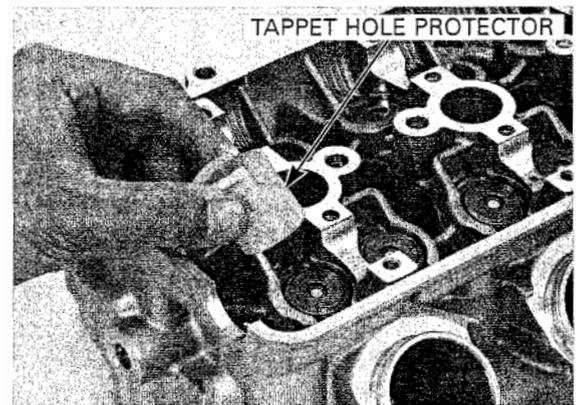
Remove the spark plugs from the cylinder head.

Install the tappet hole protector into the valve lifter bore.

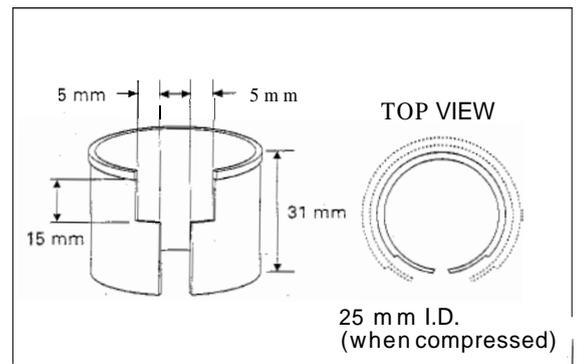
**TOOL:**

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

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

### TOOLS:

Valve spring compressor      07757-001000

Valve spring compressor attachment      07959-KM30101

### NOTICE

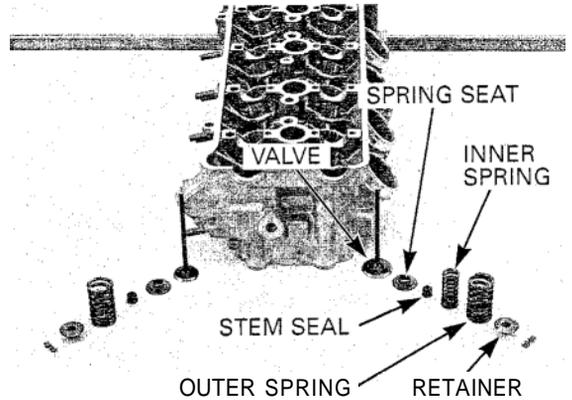
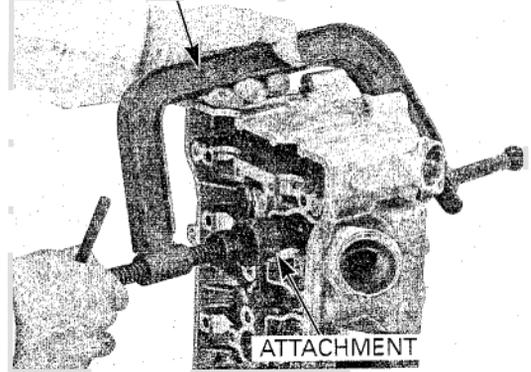
To prevent loss of tension, do not compress the valve springs more than necessary to remove the cotters.

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

Remove the following:

- Spring retainer
- Intake valve springs (Orange painted)
- Exhaust valve spring (Pink painted)
- Valve
- Stem seal
- Valve spring seat

VALVE SPRING COMPRESSOR



## CYLINDER HEAD INSPECTION

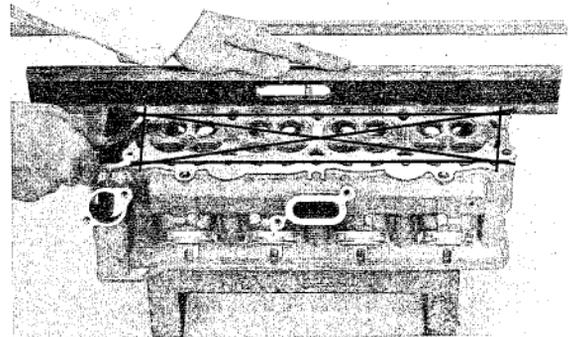
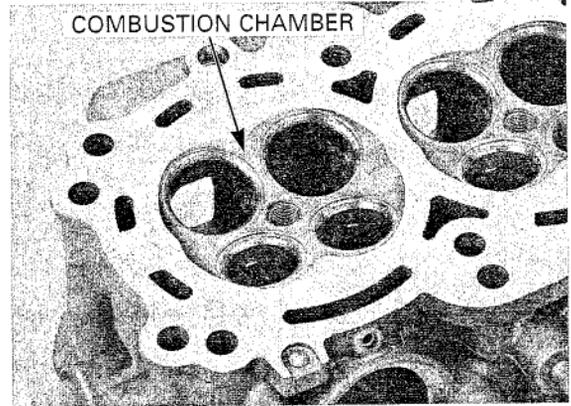
### CYLINDER HEAD

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.

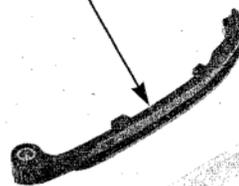
**SERVICE LIMIT: 0.10 mm (0.004 in)**



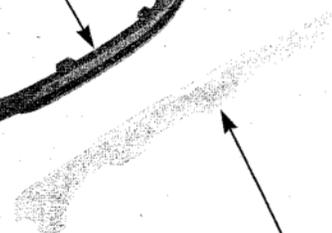
## CAM CHAIN TENSIONER/CAM CHAIN GUIDE

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

CAM CHAIN TENSIONER



CAM CHAIN GUIDE



## VALVE SPRING

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

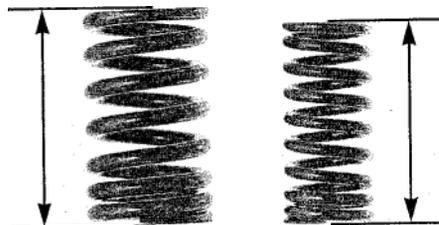
### SERVICE LIMITS:

Intake: Inner: 33.1 mm (1.30 in)

Outer: 36.1 mm (1.42 in)

Exhaust: 37.6 mm (1.48 in)

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



## 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)**

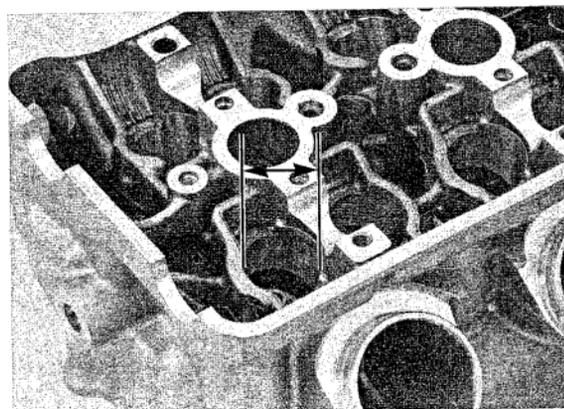


## VALVE LIFTER BORE

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/VALVE GUIDE

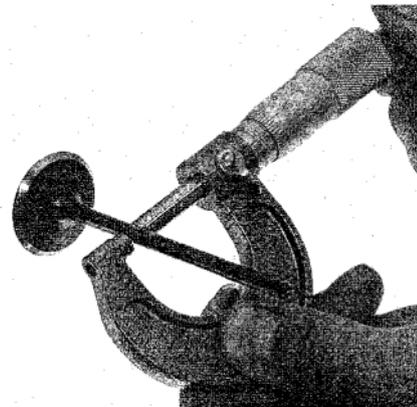
Inspect each valve for bends, burns or abnormal stem wear.

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

### SERVICE LIMITS:

**IN:** 4.465 mm (0.1758 in)

**EX:** 4.455 mm (0.1754 in)

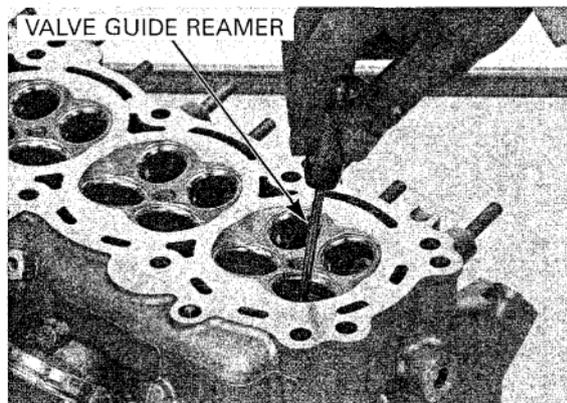


Ream the guides to remove any carbon deposits before checking clearances.

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

### TOOL:

Valve guide reamer, 4.5 mm **07HMH-ML00101** or **07HMH-MLOO10A** (U.S.A. only)



Measure and record each valve guide I.D.

**SERVICE LIMIT: IN/EX: 4.540 mm (0.1787 in)**

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

### STANDARDS:

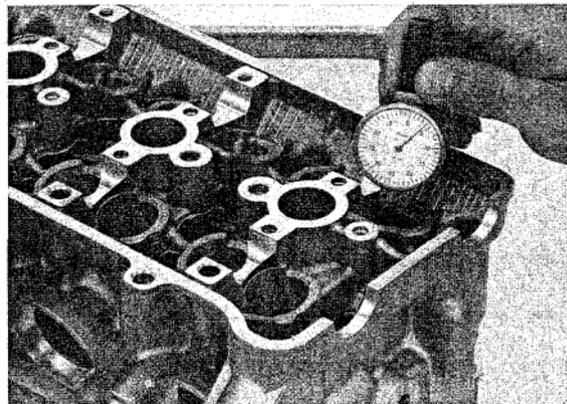
**IN:** 0.010 - 0.037 mm (0.0004 - 0.0015 in)

**EX:** 0.020 - 0.047 mm (0.0008 - 0.0019 in)

*Reface the valve seats whenever the valve guides are replaced (page 8-18).*

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 1 hour.

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.

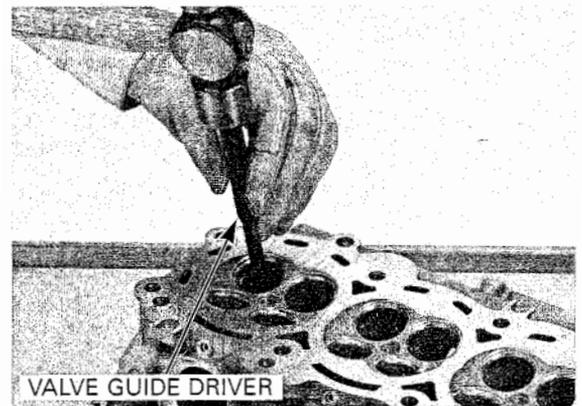
### NOTICE

*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, 4.5 mm    07HMD-ML00101



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

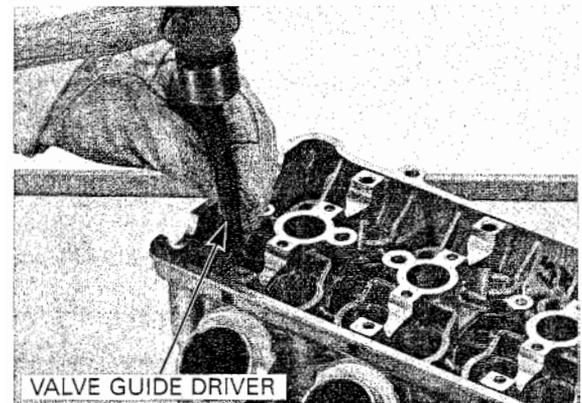
#### SPECIFIED DEPTH:

**IN:** 14.3 - 14.6 mm (0.56 - 0.57 in)

**EX:** 12.4 - 12.7 mm (0.49 - 0.50 in)

#### TOOL:

Valve guide driver, 4.5 mm    07HMD-ML00101



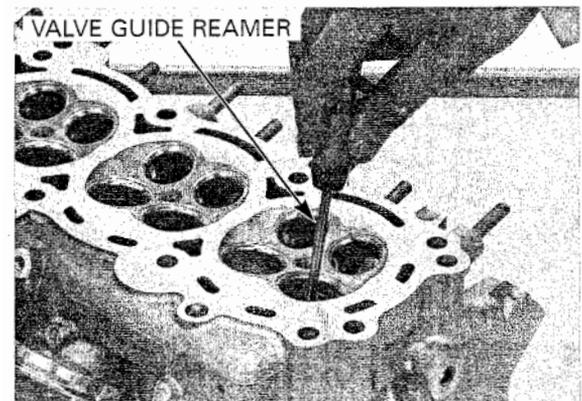
Let the cylinder head cool to room temperature.

*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, 4.5 mm    07HMH-ML00101 or  
07HMH-ML0010A  
(U.S.A. only)



Clean the cylinder head thoroughly to remove any metal particles.

Reface the valve seat (page 8-18).

## 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.

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

Remove and inspect the valves.

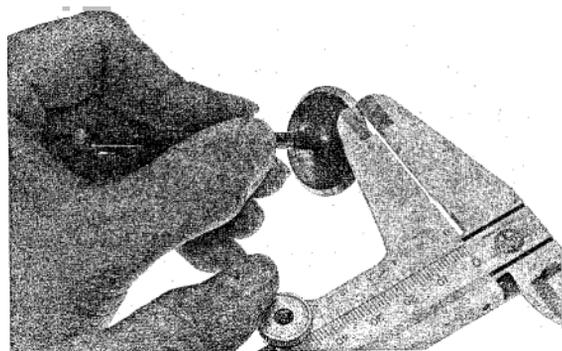
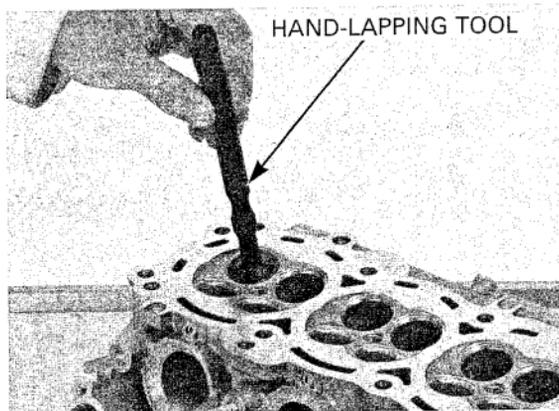
*The valves cannot be ground if a valve face is burned or badly worn or if it contacts the seat unevenly, replace the valve.*

Inspect the width of each valve seat.

**STANDARD: 0.90 - 1.10 mm (0.035 - 0.043 in)**

**SERVICE LIMIT: 1.5 mm (0.06 in)**

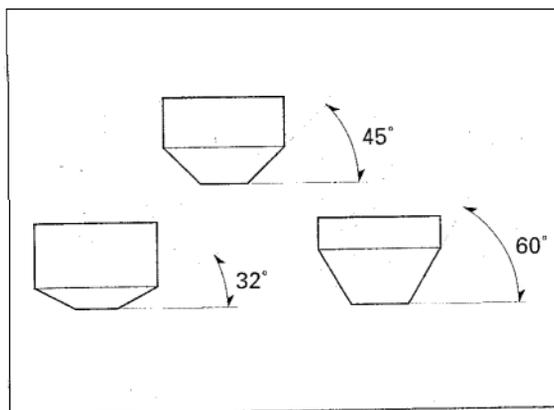
If the seat is too wide, too narrow or has low spots, the seat must be ground.



## VALVE SEAT REFACING

*Follow the valve refacing equipment manufacturer's operating instructions.*

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



*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.

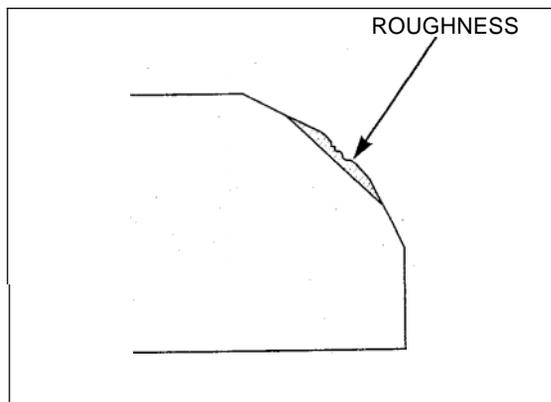
### TOOLS:

**Seat cutter, 29 mm (45° IN) 07780-0010300**

**Seat cutter, 24.5 mm (45° EX) 07780-0010100**

**Cutter holder, 4.5 mm 07781-0010600**

or equivalent commercially available in U.S.A.

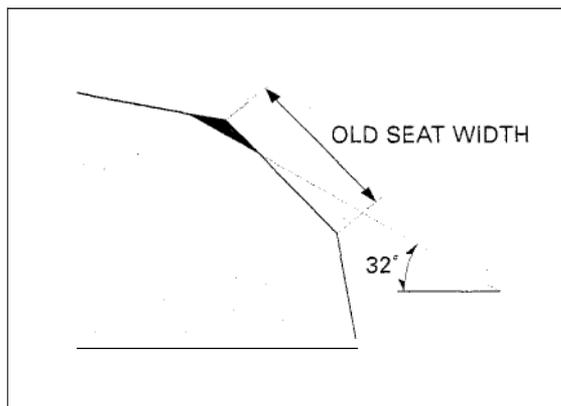


Use a 32-degree cutter to remove the top 1/4 of the existing valve seat material.

**TOOLS:**

- Flat cutter, 30 mm (32° IN)      07780-0012200
- Flat cutter, 28 mm (32° EX)      07780-0012100
- Cutter holder, 4.5 mm              07781-0010600

or equivalent commercially available in U.S.A.

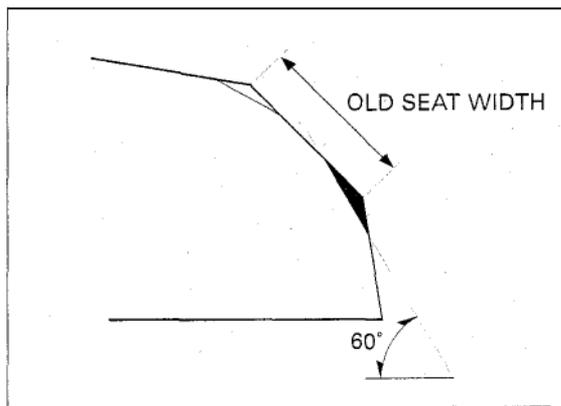


Use a 60-degree cutter to remove the bottom 1/4 of the old seat. Remove the cutter and inspect the area you have refaced.

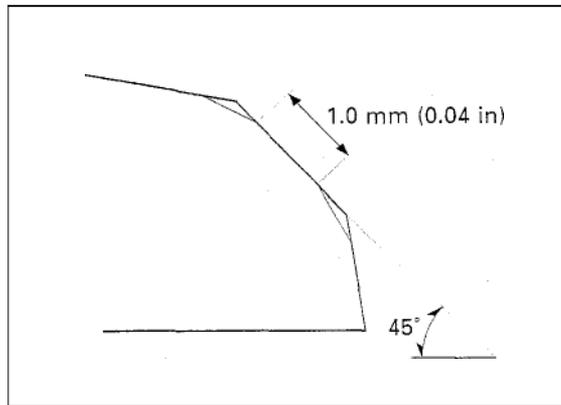
**TOOLS:**

- Interior cutter, 30 mm (60° IN)      07780-0014000
- Interior cutter, 26 mm (60° EX)      07780-0014500
- Cutter holder, 4.5 mm              07781-0010600

or equivalent commercially available in U.S.A.



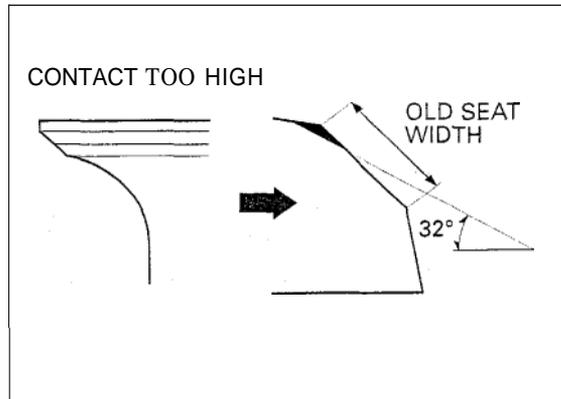
Install a 45-degree finish cutter and cut the seat to the proper width. Make sure all pitting and irregularities are removed. Refinish if necessary.



Apply a thin coating of Prussian Blue to the valve seat. Press the valve through the valve guide and onto the seat to make a clear pattern.

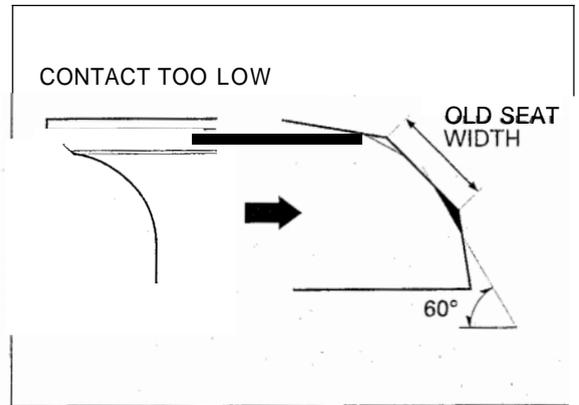
If the contact area is too high on the valve, the seat must be lowered using a 32 degrees flat cutter.

*The location of the valve seat in relation to the valve face is very important for good sealing*

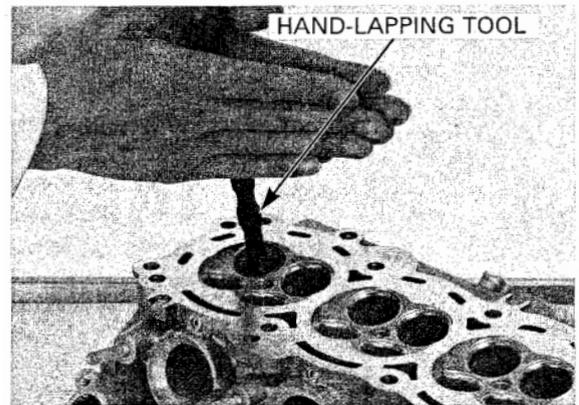


# CYLINDER HEAD/VALVES

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



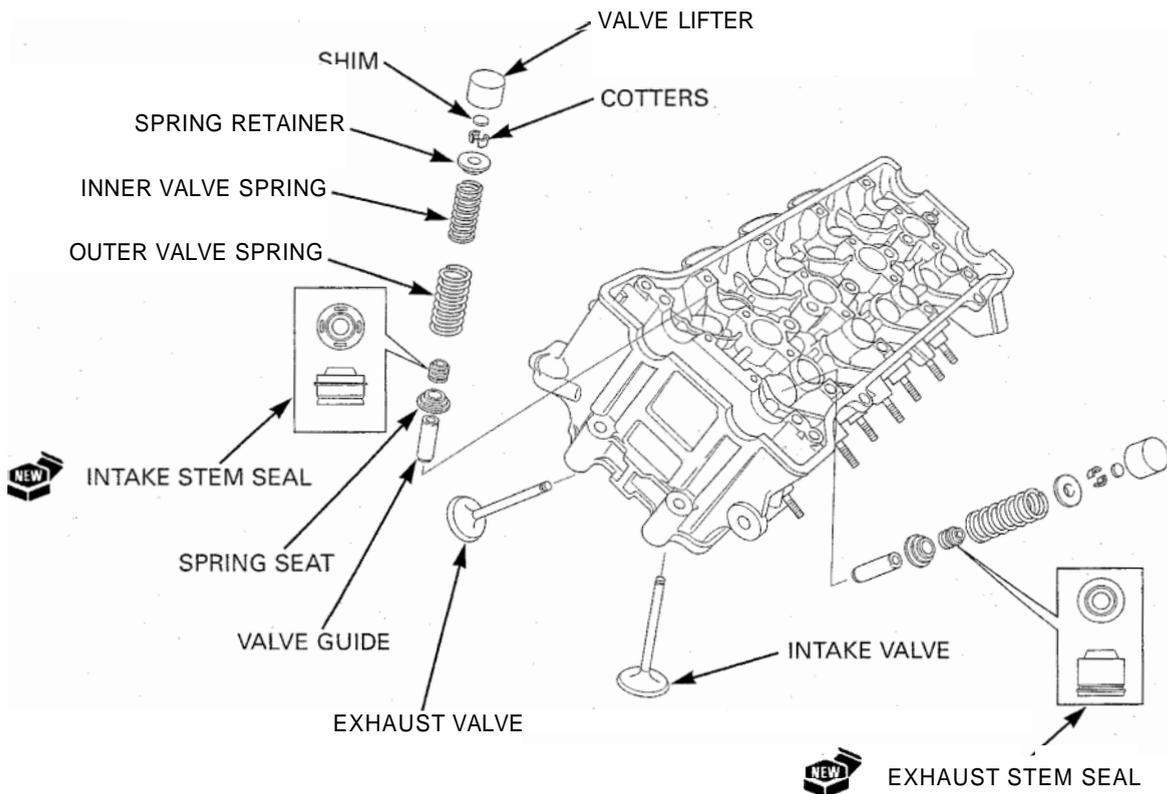
Refinish the seat to specifications, using a 45-degree finish cutter.  
After cutting the seat, apply lapping compound to the valve face, and lap the valve using light pressure.



*Do not allow lapping compound to enter the guides.*

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

## CYLINDER HEAD ASSEMBLY



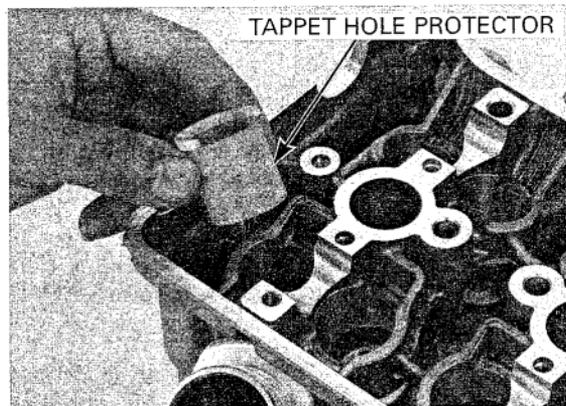
Clean the cylinder head assembly with solvent and blow out all oil passages with compressed air.

Install the tappet hole protector into the valve lifter bore.

**TOOL:**

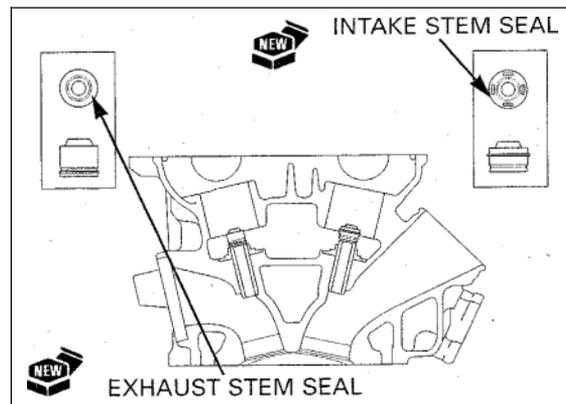
**Tappet hole protector**

**07HMG-MR70002**  
 (Not available in U.S.A.) or  
 refer to page 8-13  
 for alternative tool



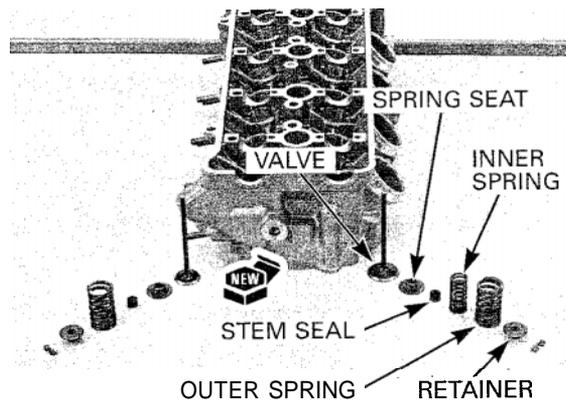
*Do not interchange the inlet and exhaust valve stem seal.*

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



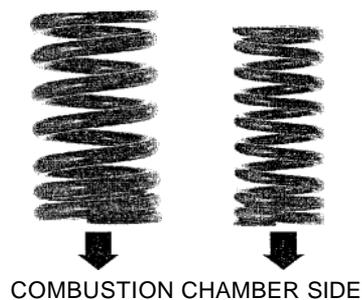
Lubricate the valve stems with molybdenum disulfide oil and insert the valve into the valve guide.

To avoid damage to the stem seal, turn the valve slowly when inserting.



*The exhaust valve spring has a pink paint mark and the intake valve springs have orange paint marks*

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



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:

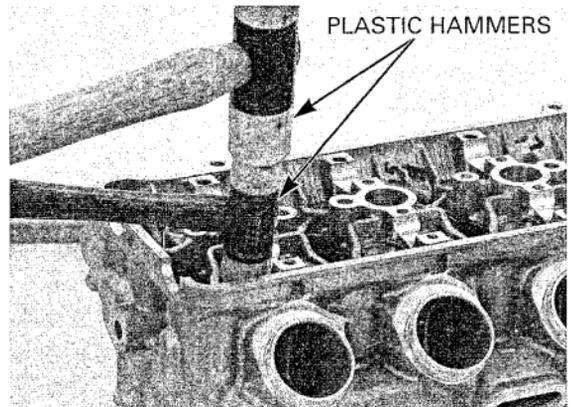
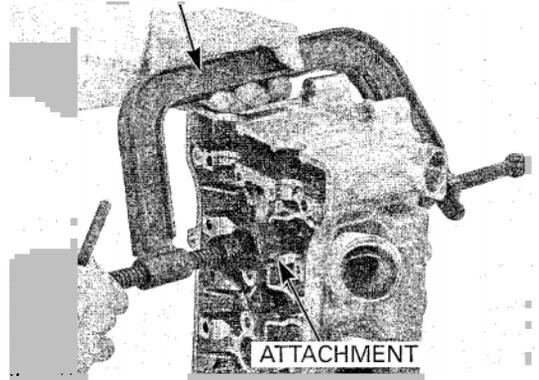
Valve spring compressor 07757-0010000

Valve spring compressor attachment 07959-KM30101

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

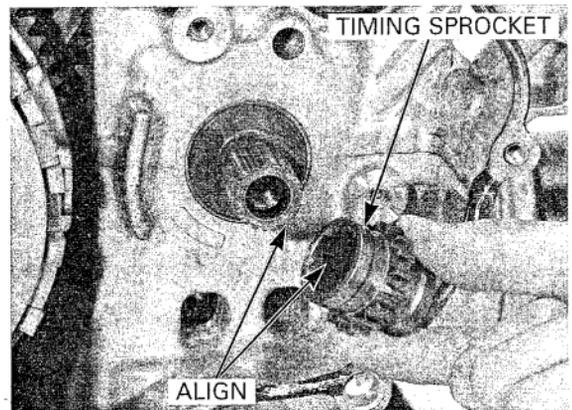
Tap the valve stems gently with two plastic hammers as shown to seat the cotters firmly.

VALVE SPRING COMPRESSOR

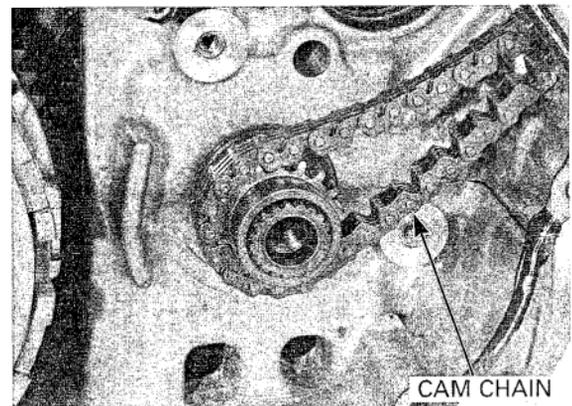


## CYLINDER HEAD INSTALLATION

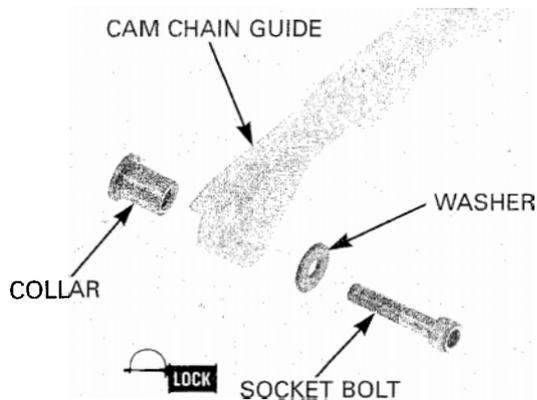
Install the timing sprocket by aligning the wide teeth between the crankshaft and sprocket.



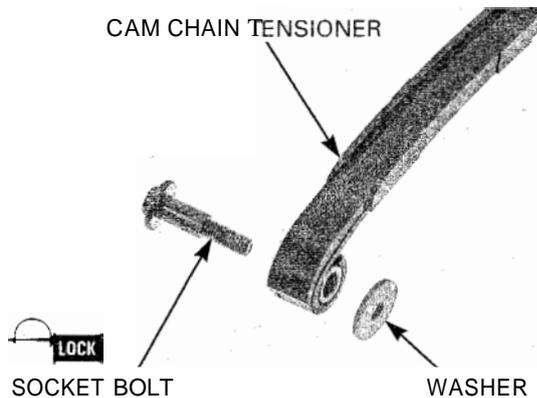
Install the cam chain.



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



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

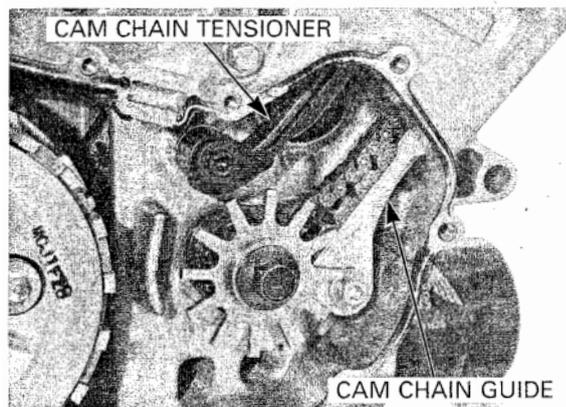


Tighten the cam chain guide and cam chain tensioner socket bolts to the specified torque.

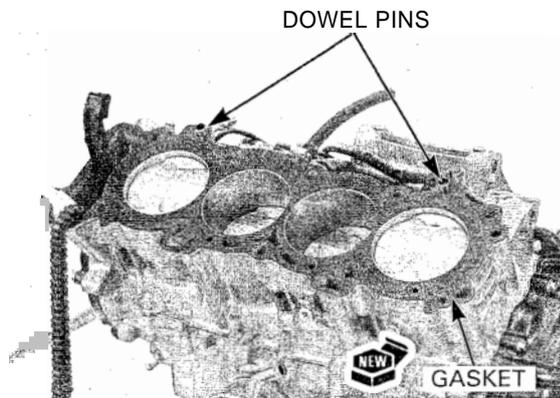
**TORQUE:**

- Cam chain tensioner pivot socket bolt:  
10 N·m (1.0 kgf·m, 7 lbf·ft)
- Cam chain guide mounting 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.



## CYLINDER HEAD/VALVES

Install the cylinder head.

If using a new bolt, remove the anti-rust additive from it.

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

Apply oil to the 8 mm bolt threads and seating surface.

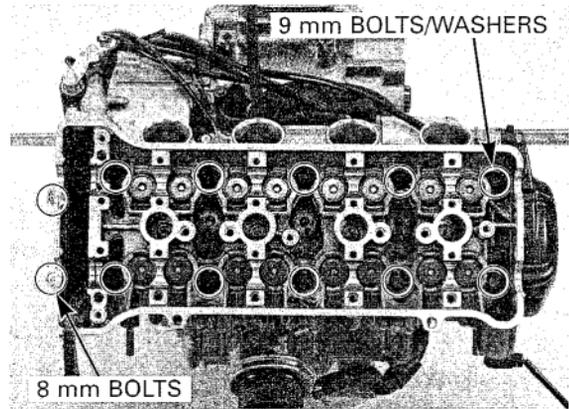
Install the two 8 mm flange bolts.

Tighten the 9 mm bolts in a crisscross pattern in 2 – 3 steps to the specified torque.

**TORQUE: 51 N·m (5.2kgf·m, 38 lbf·ft)**

Tighten the 8 mm flange bolts to the specified torque.

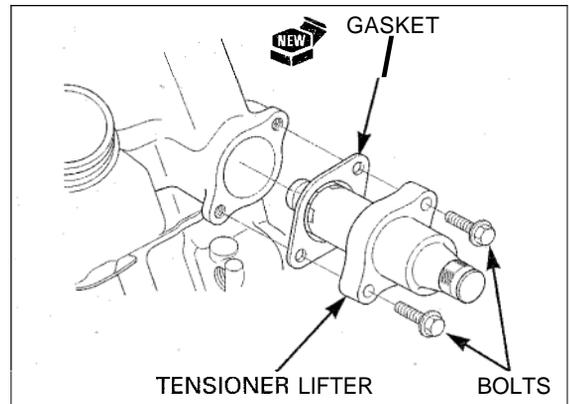
**TORQUE: 24 N·m (2.4 kgf·m, 17 lbf·ft)**



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

Install and tighten the mounting bolts.

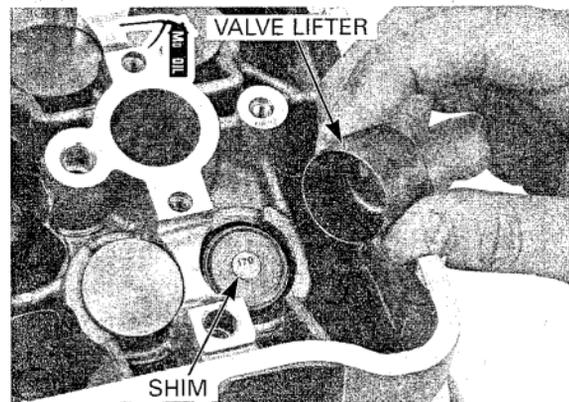
Install the engine into the frame (page 7-7).



## CAMSHAFT INSTALLATION

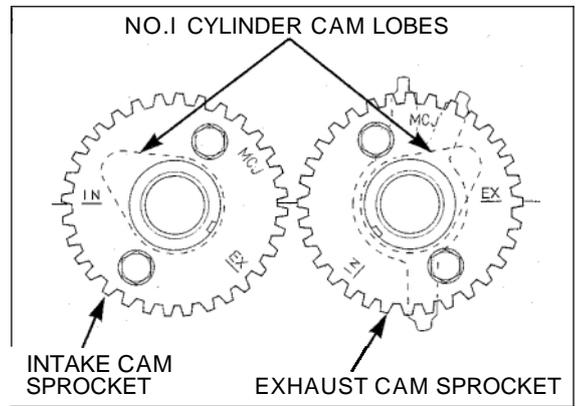
Apply molybdenum disulfide oil to the outer surface of the each valve lifter.

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

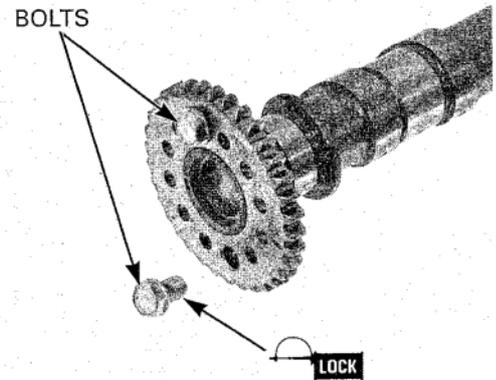


If the cam sprockets are removed, install the cam sprockets onto the camshafts.

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

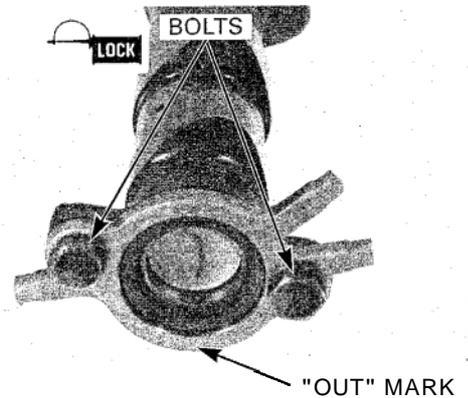


*Exhaust camshaft only:*

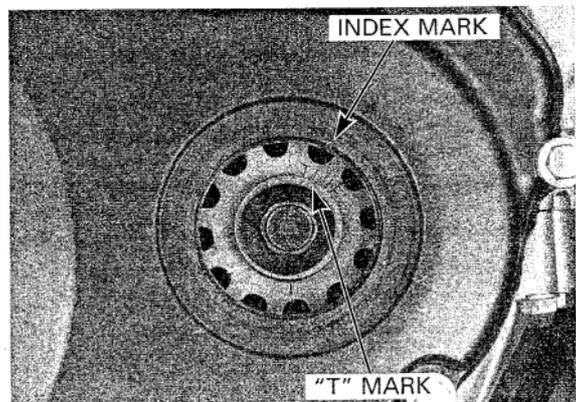
Clean and apply a locking agent to the cam cam pulse generator rotor threads.

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

Install the cam pulse generator rotor and mounting 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 disulfide oil to the camshaft journals of the cylinder head and camshaft holder.

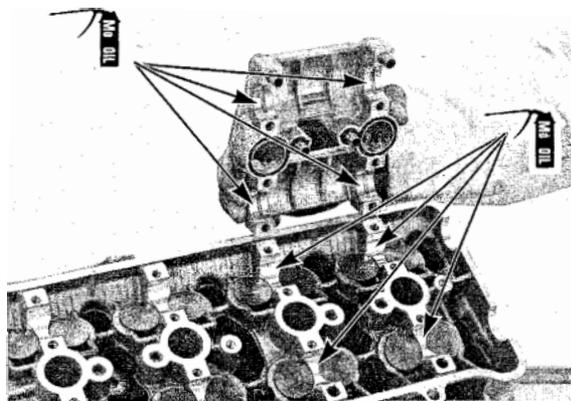
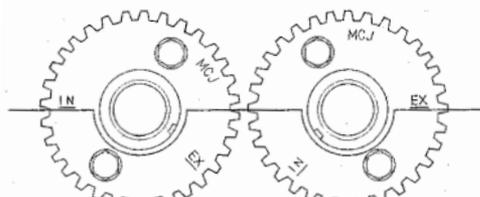
Install the cam chain over the cam sprockets and then install the intake and exhaust camshafts.

- Install each camshaft to the correct location with the identification marks.

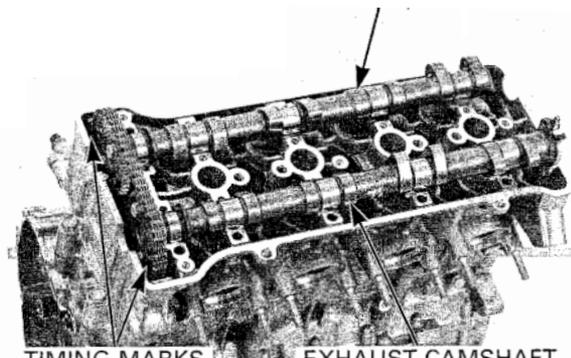
"IN": Intake camshaft

"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.



INTAKE CAMSHAFT



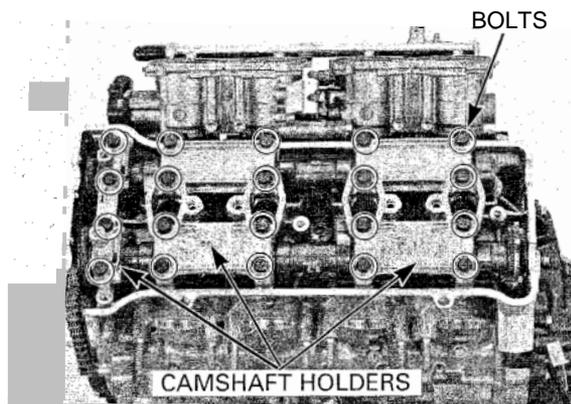
Install the each camshaft holder onto the camshafts.

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

"A": Right camshaft holder

"B": Center camshaft holder

"C": Left camshaft holder

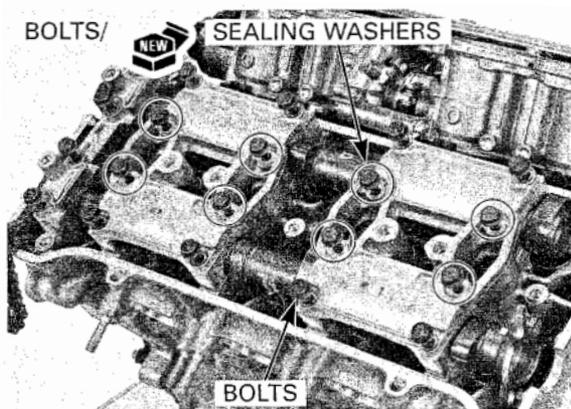


*Install the sealing washers onto camshaft holder 5 and C's center four bolts as shown*

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.



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

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

## NOTICE

*Tightening the camshaft holder bolts on only one-side 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)**

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

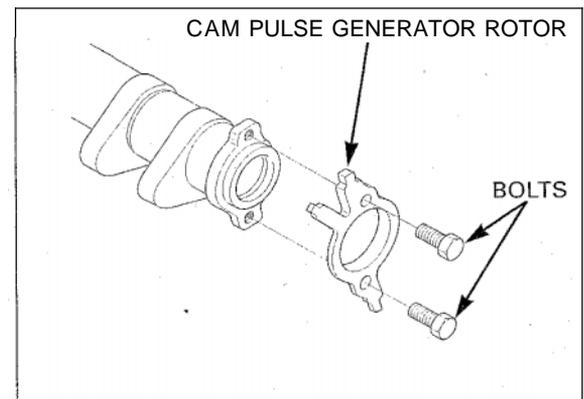
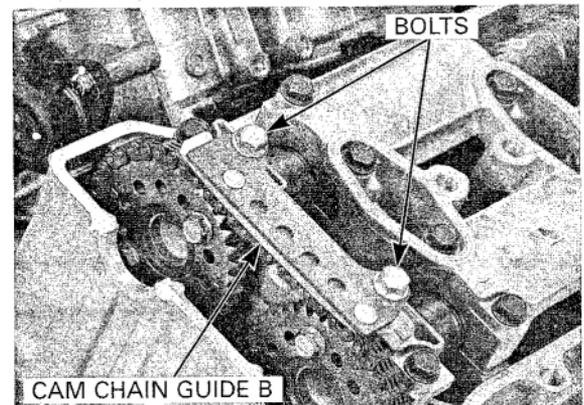
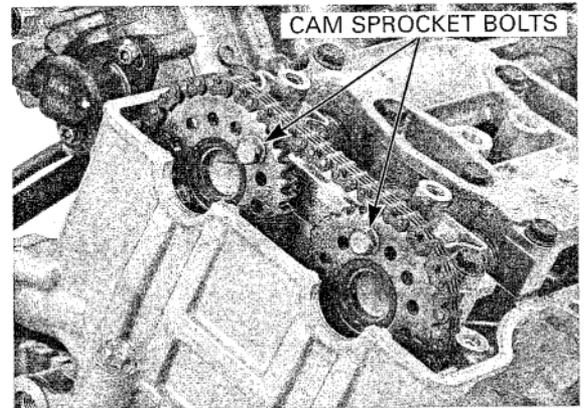
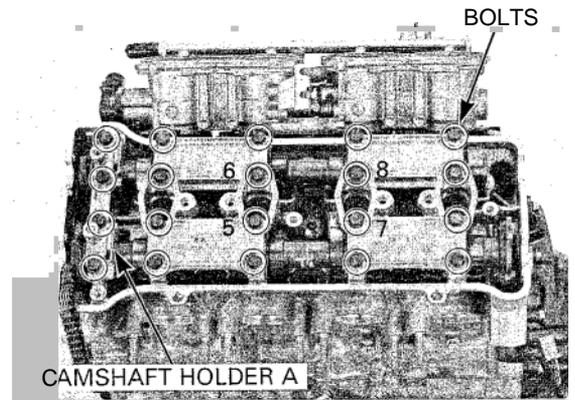
**TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft)**

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

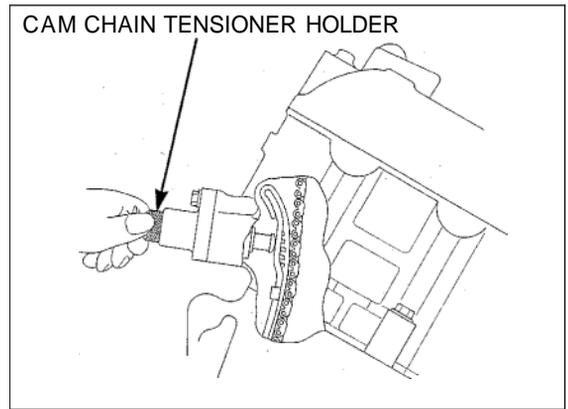
Install cam chain guide B, and tighten the bolts.

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

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

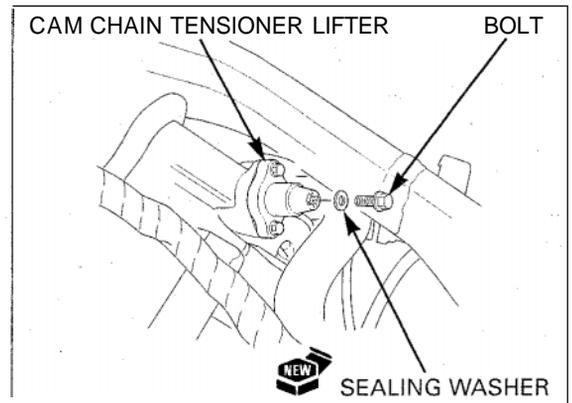


Remove the cam chain tensioner holder from the cam chain tensioner lifter.



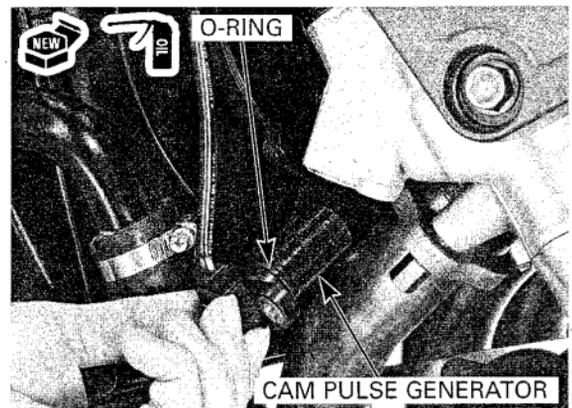
Install a new sealing washer and tighten the sealing bolt.

Recheck the valve timing.

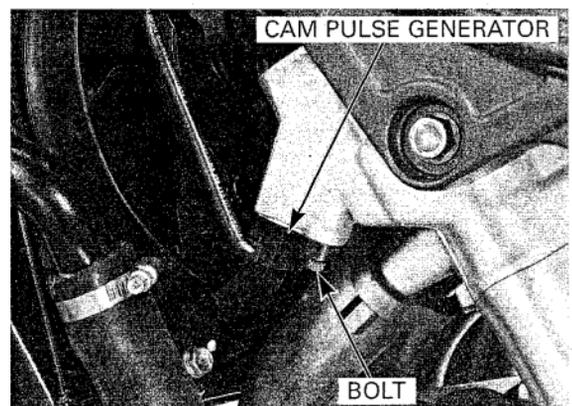


Apply oil to the new O-ring, and install it onto the cam pulse generator.

Install the cam pulse generator into the cylinder head.

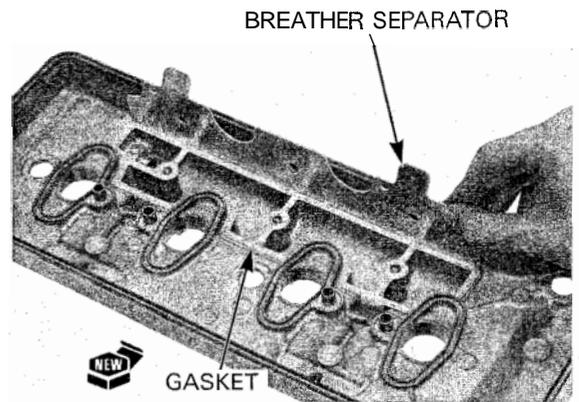


Install and tighten the mounting bolt securely.



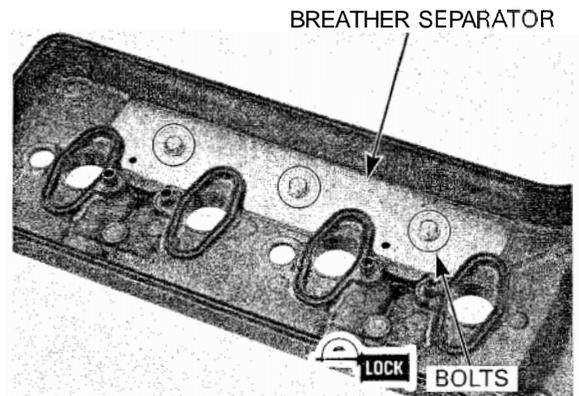
## CYLINDER HEAD COVER ASSEMBLY

Install the new gasket and crankcase breather separator to the cylinder head cover.

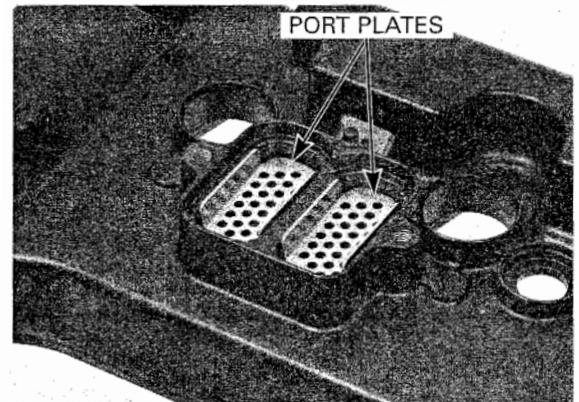


Apply a locking agent to the crankcase breather separator mounting bolt threads. Install and tighten the bolts to the specified torque.

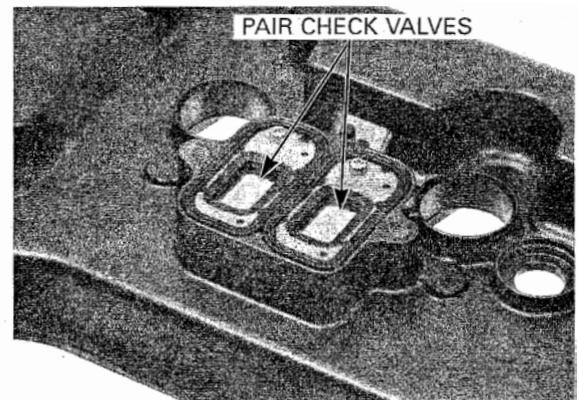
**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**



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

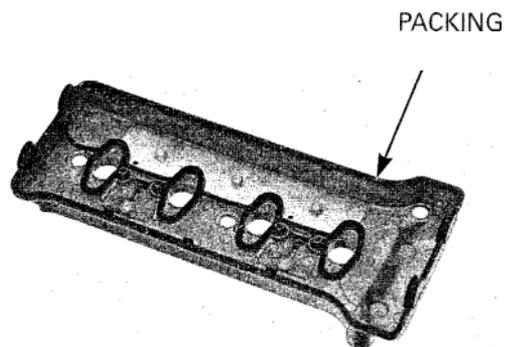


Install the PAIR check valves into the cylinder head cover.

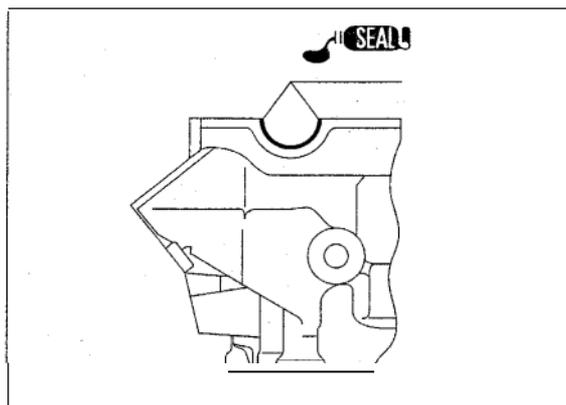


## CYLINDER HEAD COVER INSTALLATION

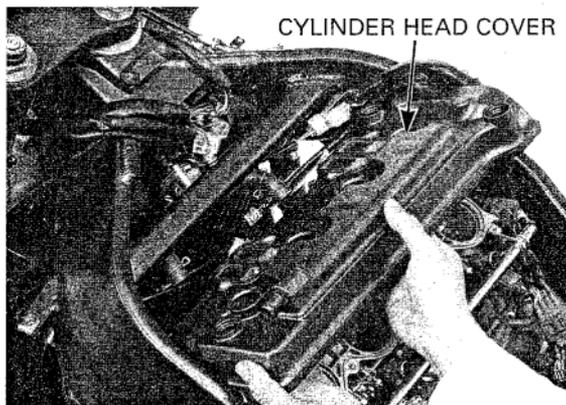
Install the cylinder head packing into the groove of the cylinder head cover.



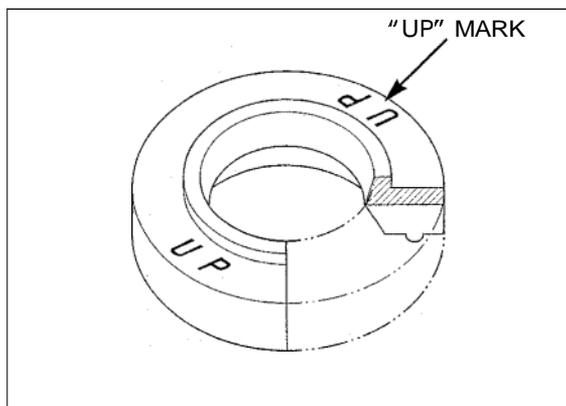
Apply sealant to the cylinder head semi-circular cut-outs as shown.



Install the cylinder head cover onto the cylinder head.

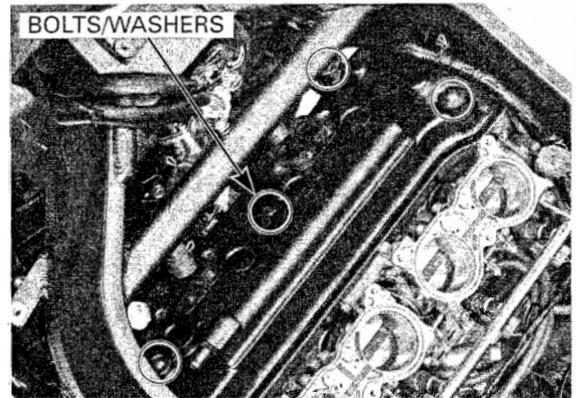


Install the washers with their "UP" mark facing up.



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

**TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)**

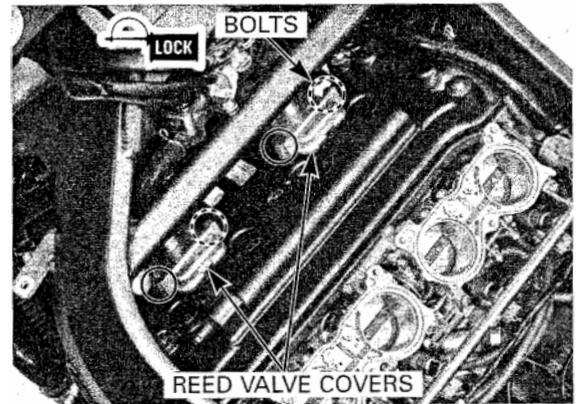


Install the PAIR reed valve covers onto the cylinder head cover.

Apply a locking agent to the PAIR reed valve cover mounting bolt threads.

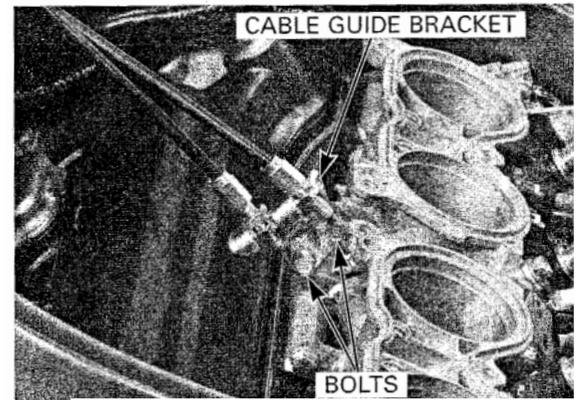
Install and tighten the bolts to the specified torque.

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



Connect the throttle cables from the throttle drum. Install and tighten the throttle cable guide bracket mounting bolts to the specified torque.

**TORQUE: 3 N·m (0.3 kgf·m, 2.2 lbf·ft)**

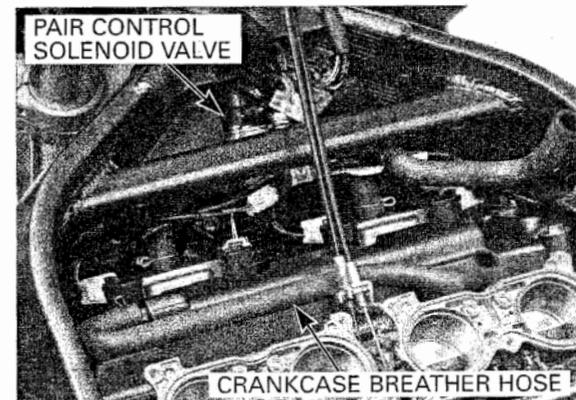


Install the direct ignition coils and spark plug sub-harness (page 17-5).

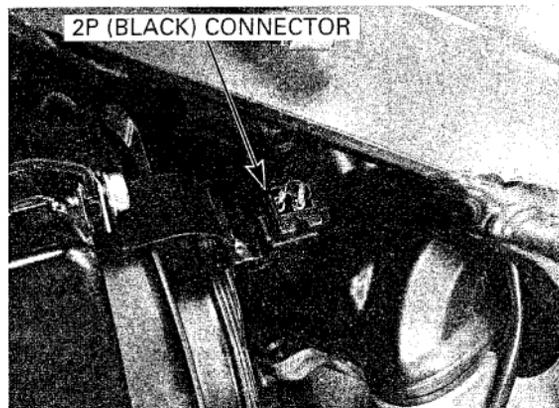
Connect the cam pulse generator 2P (Natural) connector (page 5-83).

Install the PAIR solenoid valve assembly (page 5-88). Install and tighten the PAIR solenoid valve mounting bolt.

Connect the crankcase breather hose.

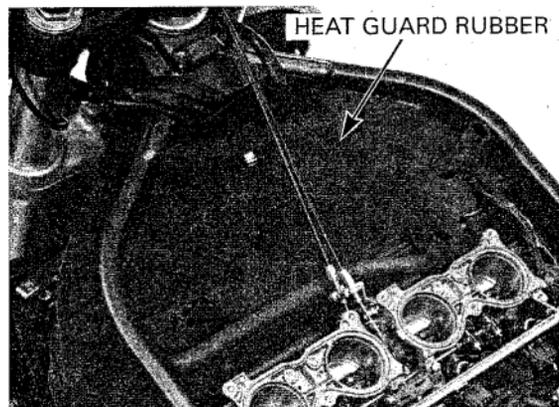


Connect the fan motor 2P (Black) connector.



Install the heat guard rubber onto the cylinder head cover.

Install the air cleaner housing (page 5-65).

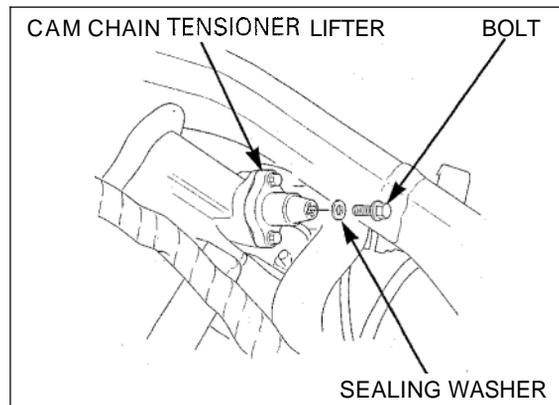


## CAM CHAIN TENSIONER LIFTER

### REMOVAL

Remove the fuel tank (page 5-59).  
Remove the throttle body (page 5-67).

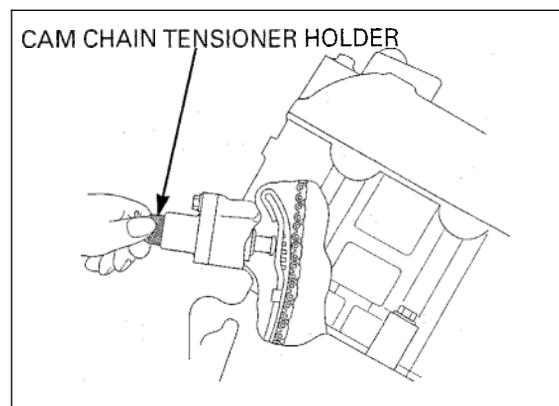
Remove the cam chain tensioner sealing bolt and sealing washer.



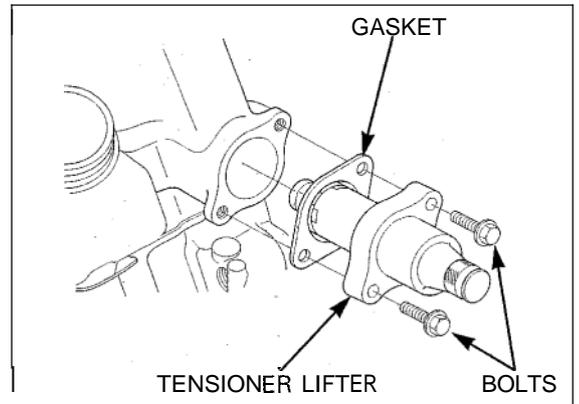
Turn the tensioner shaft fully in (clockwise) and secure it using the cam chain tensioner holder to prevent damaging the cam chain.

### TOOL

Cam chain tensioner holder      **07ZMG-MCAA400**  
(U.S.A. only)

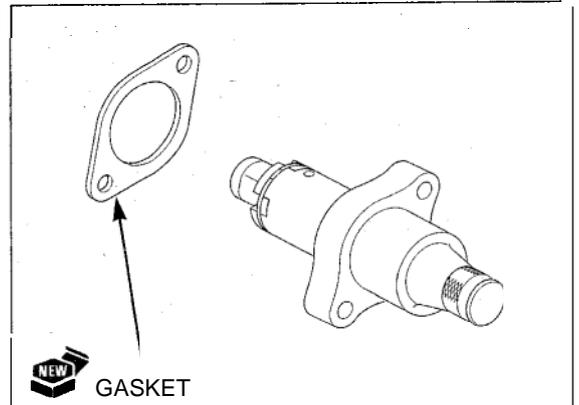


Remove the bolts and cam chain tensioner lifter.  
Remove the gasket.

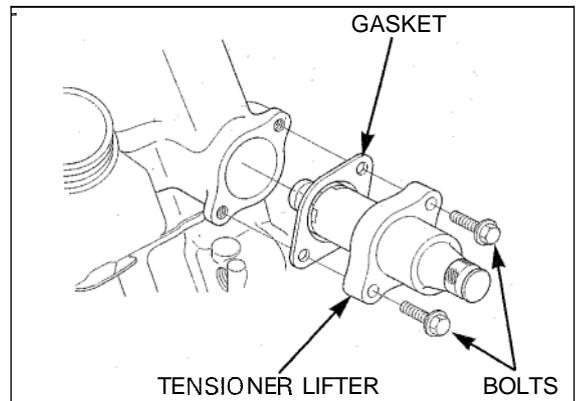


## INSTALLATION

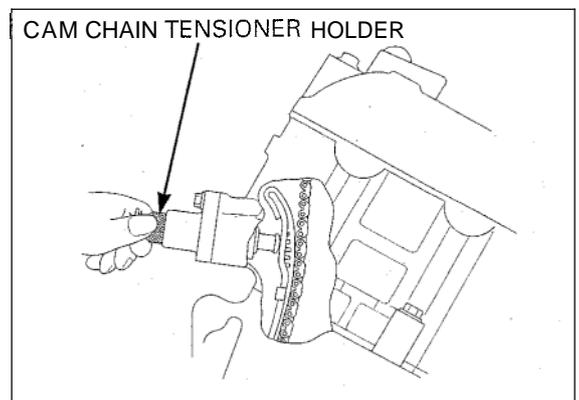
Install the new gasket onto the cam chain tensioner lifter.



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



Remove the cam chain tensioner holder.



## CYLINDER HEAD/VALVES

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

Install the throttle body (page 5-71).

Install the fuel tank (page 5-61).

