

# 7. CYLINDER HEAD/VALVES

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## CYLINDER HEAD/VALVES

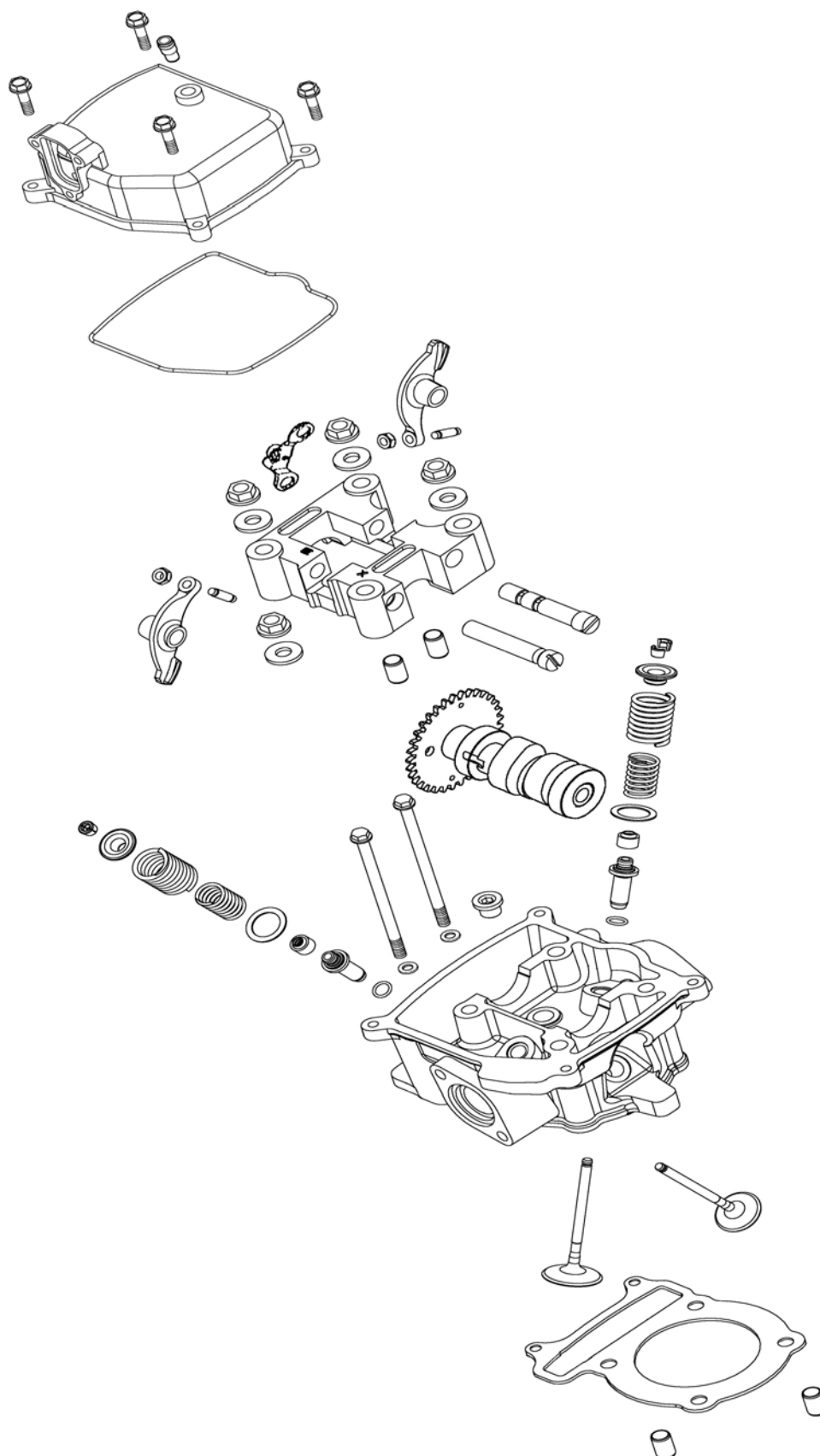
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## 7. CYLINDER HEAD/VALVES

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## 7. CYLINDER HEAD/VALVES

### SERVICE INFORMATION

#### GENERAL INSTRUCTIONS

- The cylinder head can be serviced with the engine installed in the frame.
- When assembling, apply molybdenum disulfide grease or engine oil to the valve guide movable parts, valve arm and camshaft sliding surfaces for initial lubrication.
- The camshaft is lubricated by engine oil through the cylinder head engine oil passages. Clean and unclog the oil passages before assembling the cylinder head.
- After disassembly, clean the removed parts and dry them with compressed air before inspection.
- After removal, mark and arrange the removed parts in order. When assembling, install them in the reverse order of removal.

#### SPECIFICATIONS

Unit mm (in)

Item		Standard	Service Limit
Valve clearance (cold)	IN	0.1 (0.004)	—
	EX	0.1 (0.004)	—
Cylinder head compression pressure		16±2 kgf/cm <sup>2</sup> (1600 kPa, 227 psi)	
Cylinder head warpage		—	0.05 (0.0002)
Camshaft cam height	IN	34.287 (1.3715)	34.15 (1.366)
	EX	34.1721 (1.3669)	34.05 (1.362)
Valve rocker arm to shaft clearance		0.034~0.09 (0.0014~0.0036)	0.1 (0.004)
Valve stem-to-guide clearance	IN	0.01~0.037 (0.004~0.0015)	0.06 (0.0024)
	EX	0.025~0.052 (0.001~0.0021)	0.08 0.0032)
Valve spring free length	IN	30.9 (1.236)	29.4 (1.176)
	EX	41 (1.64)	39 (1.56)
Valve spring compressed force	IN	10.20~11.84kg(at 18.05mm)	—
	EX	19.14~22.02kg(at 21.5mm)	—
Valve spring tilt	IN	0.8 (0.032)	—
	EX	1.07 (0.0428)	—

## 7. CYLINDER HEAD/VALVES

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### TORQUE VALUES

Cylinder head cover bolt	1 kgf-m ( 10 Nm, 7.2 lbf-ft)	
Cam shaft hold nut	2.5 kgf-m (25 Nm, 18 lbf-ft)	Apply engine oil to threads
Tappet adjusting nut	0.9 kgf-m (9 Nm, 6.5 lbf-ft)	

### SPECIAL TOOLS

Valve spring compressor	E040
Tappet adjuster	E012

### TROUBLESHOOTING

- The poor cylinder head operation can be diagnosed by a compression test or by tracing engine top-end noises.

#### Poor performance at idle speed

- Compression too low

#### Compression too low

- Incorrect valve clearance adjustment
- Burned or bend valves
- Incorrect valve timing
- Broken valve spring
- Poor valve and seat contact
- Leaking cylinder head gasket
- Warped or cracked cylinder head
- Poorly installed spark plug

#### Compression too high

- Excessive carbon build-up in combustion chamber

#### White smoke from exhaust muffler

- Worn valve stem or valve guide
- Damaged valve stem seal

#### Abnormal noise

- Incorrect valve clearance adjustment
- Sticking valve or broken valve spring
- Damaged or worn camshaft
- Worn cam chain guide
- Worn camshaft and rocker arm

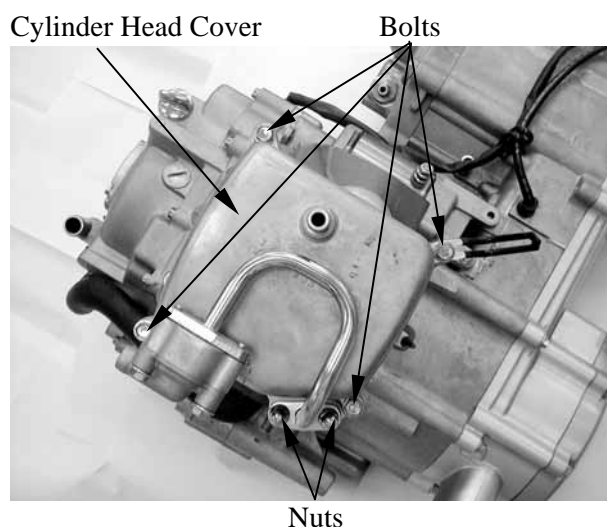
## 7. CYLINDER HEAD/VALVES

### CYLINDER HEAD COVER

#### REMOVAL

Remove fuel tank. (Refer to the chapter 5)  
Disconnect the crankcase breather hose and pair control valve hose from the cylinder head cover. (Refer to the chapter 6)

Remove the four bolts at the cylinder head cover, then remove the cylinder head cover.

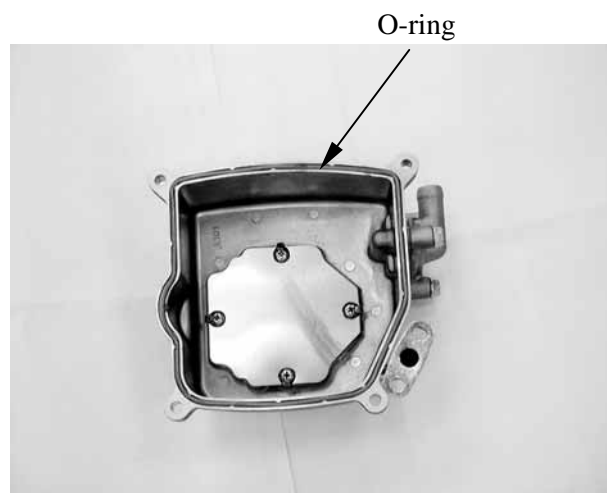


#### INSTALLATION

Install a new cylinder head cover O-ring and install the cylinder head cover.  
Install and tighten the cylinder head cover bolts.

**Torque:** 1 kgf-m (10 Nm, 7.2 lbf-ft)

\* Be sure to install the O-ring into the groove properly.

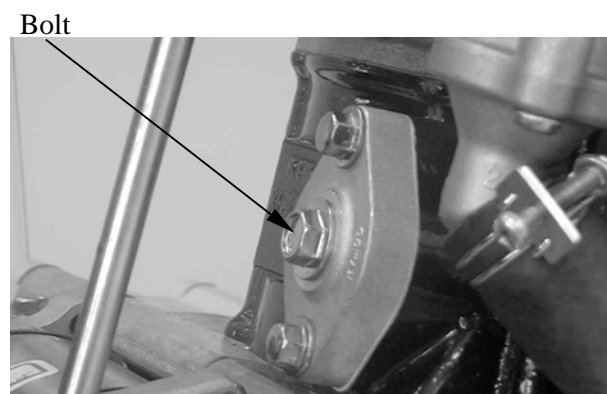


### CAMSHAFT/CAMSHAFT HOLDER

#### REMOVAL

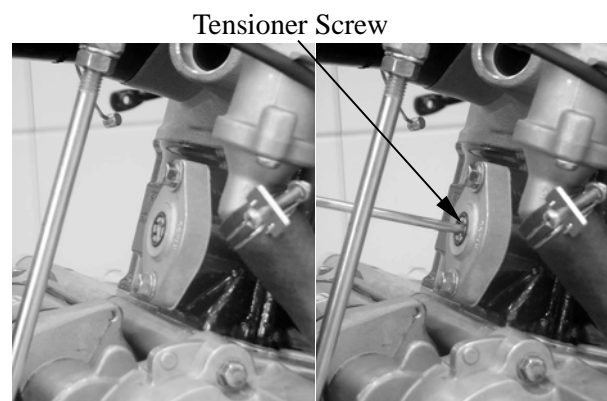
Remove the cylinder head cover. (Refer to the cylinder head cover removal)

Remove the cam chain tensioner cap bolt and the O-ring.



## 7. CYLINDER HEAD/VALVES

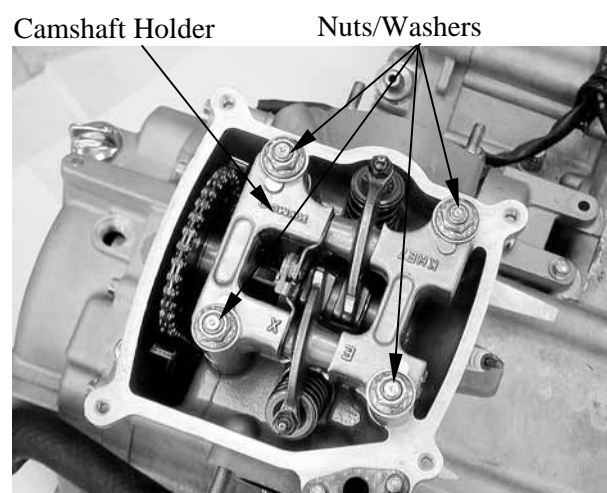
Turn the cam chain tensioner screw clockwise to tighten it.



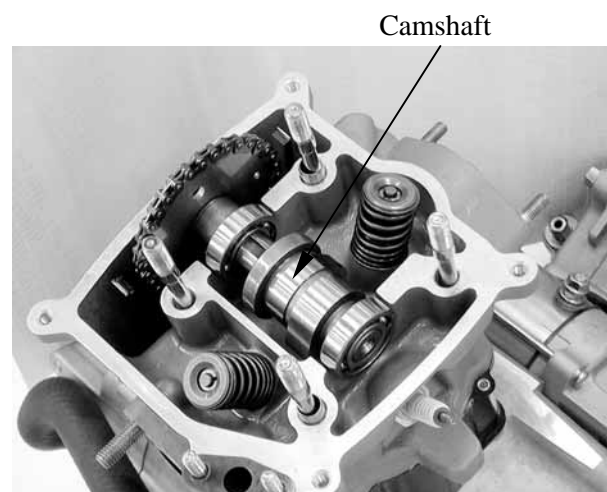
Remove the four camshaft holder nuts and washers.

\* Diagonally loosen the cylinder head nuts in 2 or 3 times.

Remove the camshaft holder and dowel pins.



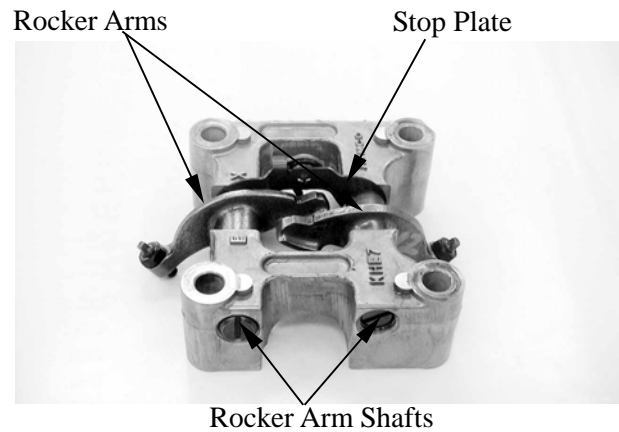
Remove the camshaft gear from the cam chain and remove the camshaft.



## 7. CYLINDER HEAD/VALVES

### CAMSHAFT HOLDER DISASSEMBLY

Take out the valve rocker arm shafts.  
Remove the valve rocker arms, arm shafts and stop plate.

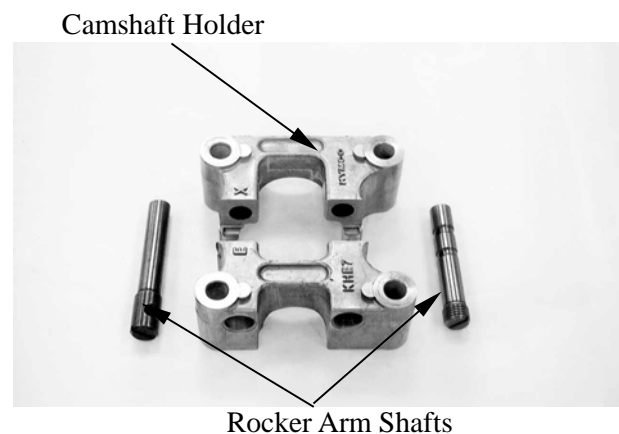


### CAMSHAFT HOLDER INSPECTION

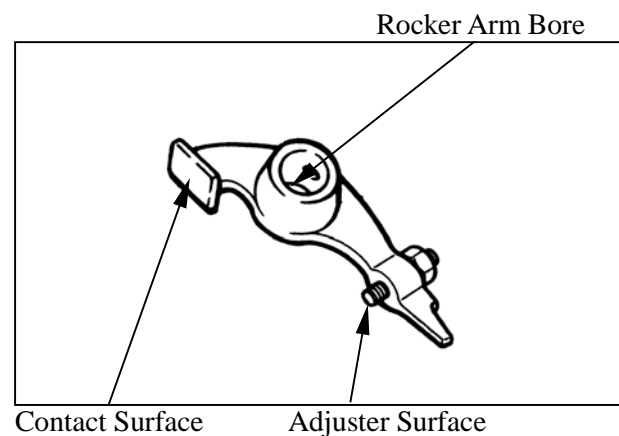
Inspect the camshaft holder for wear or damage.

Inspect the rocker arm shaft for blue discoloration or grooves.

If any defects are found, replace the rocker arm shaft with a new one, then inspect lubrication system.



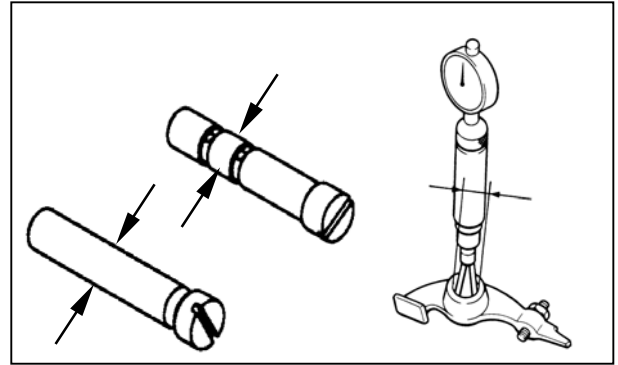
Inspect the rocker arm bore, cam lobe contact surface and adjuster surface for wear/pitting/scratches/blue discoloration.  
If any defects are found, replace the rocker arm shaft with a new one, then inspect lubrication system.



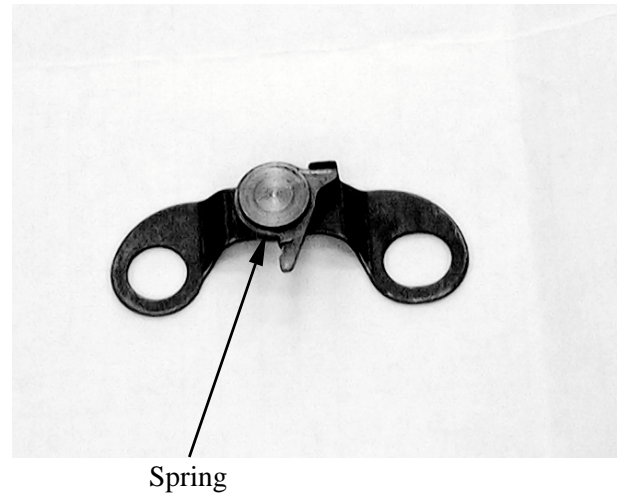
## 7. CYLINDER HEAD/VALVES

Measure each rocker arm shaft O.D.  
 Measure the I.D. of each valve rocker arm.  
 Measure arm to shaft clearance.  
 Replace as a set if out of specification.

**Service limits:** 0.1 mm (0.004 in)



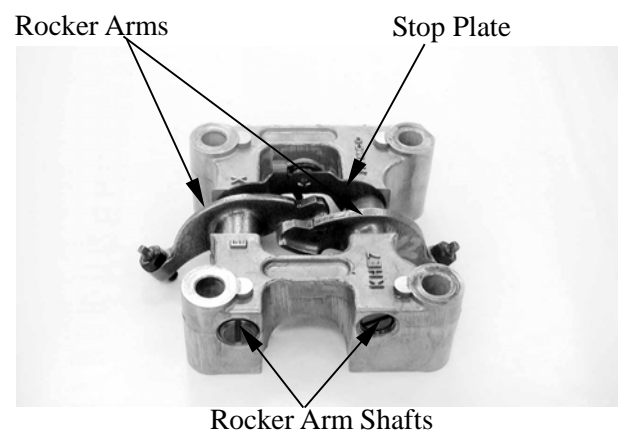
Check the stop plate spring for damage.  
 Replace the stop plate assembly with a new one if the spring is damaged.



### CAMSHAFT HOLDER ASSEMBLY

Reverse the "CAMSHAFT HOLDER DISASSEMBLY" procedures.

- \* Align the cross cutout on the exhaust valve rocker arm shaft with the bolt of the camshaft holder.

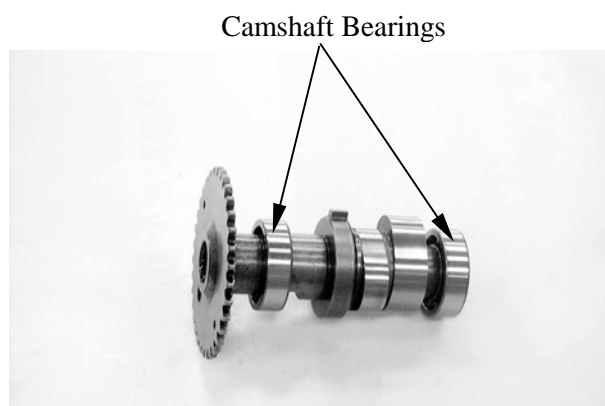




## 7. CYLINDER HEAD/VALVES

### CAMSHAFT INSPECTION

Check each camshaft bearing for play or damage. Replace the camshaft assembly with a new one if the bearings are noisy or have excessive play.



Inspect camshaft lobes for pitting/scratches/blue discoloration.

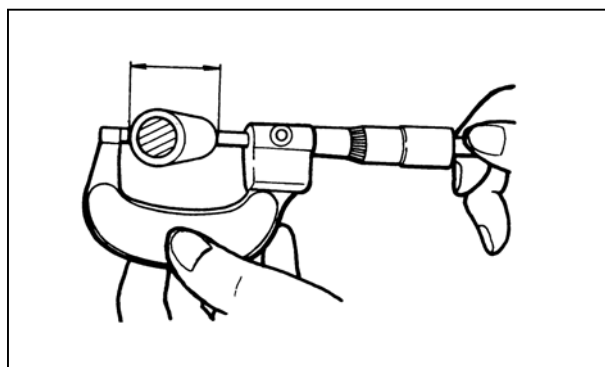
Measure the cam lobe height.

**Service Limits** (replace if below):

IN : 34.15 mm (1.366 in)

EX: 34.05mm (1.362 in)

If any defects are found, replace the camshaft with a new one, then inspect lubrication system.



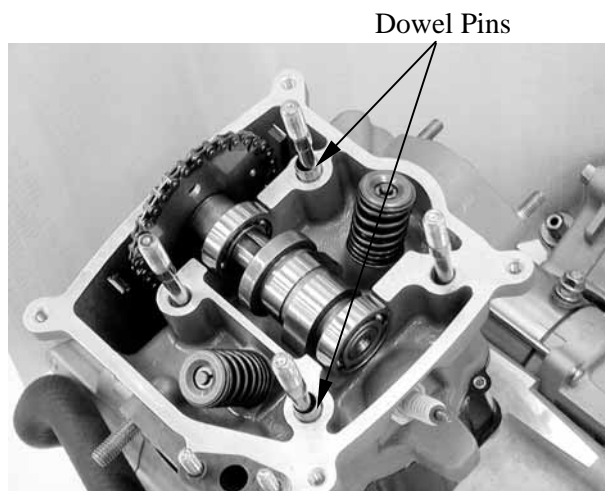
### INSTALLATION

Reverse the “CAMSHAFT REMOVAL” procedures.

Note the following points:

1. Turn the flywheel so that the “T” mark on the flywheel aligns with the index mark on the crankcase.

Keep the round hole on the camshaft gear facing up and align the punch marks on the camshaft gear with the cylinder head surface (Position the intake and exhaust cam lobes down.) and install the camshaft onto the cylinder head. (Refer to the “VALVE CLEARANCE” section in the chapter 3)



## 7. CYLINDER HEAD/VALVES

Install the camshaft dowel pins and holder.  
Install the washers and nuts and tighten the nuts.

- \*
  - Apply engine oil to the threads of the cylinder head nuts.
  - Diagonally tighten the cylinder head nuts in 2~3 times.

### **Torque:**

Cam shaft hold nut (Apply engine oil to threads): 2.5 kgf-m (25 Nm, 18 lbf-ft)

2. Turn the cam chain tensioner screw counter-clockwise to release it.  
Apply engine oil to a new O-ring and install it.  
Tighten the cam chain tensioner cap bolt.

- \*
  - Be sure to install the O-ring into the groove properly.



3. Adjust the valve clearance. (Refer to the “VALVE CLEARANCE” section in the chapter 3)

## 7. CYLINDER HEAD/VALVES

### CYLINDER HEAD

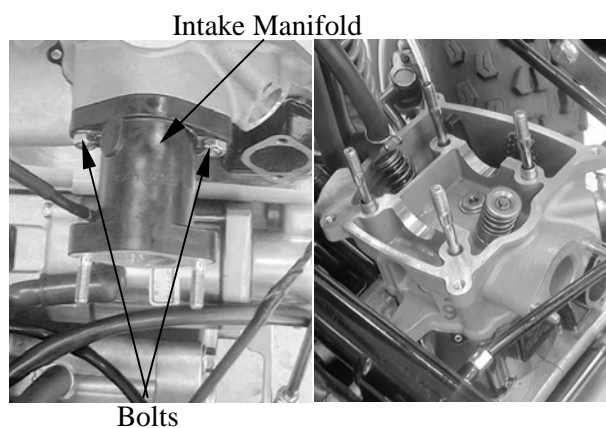
#### REMOVE

Remove the camshaft. (Refer to the “camshaft remove” section in the chapter 7)

Remove the carburetor. (Refer to the “carburetor remove” section in the chapter 5)

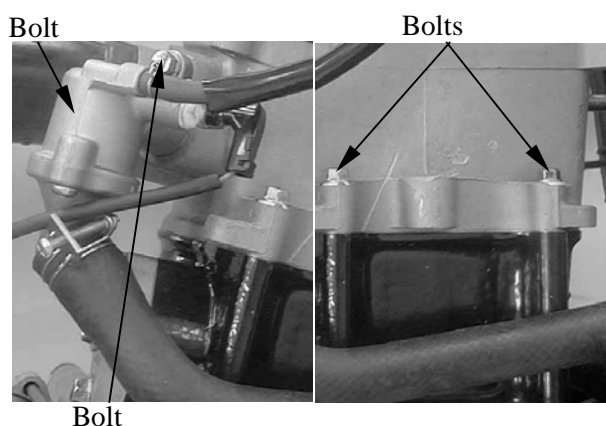
Remove the exhaust muffler. (Refer to the “exhaust muffler remove” section in the chapter 2)

Remove the two bolts and then remove the carburetor intake manifold.



Remove the bolt and disconnect the thermostat.

Remove the two cylinder head bolts.  
Remove the cylinder head.



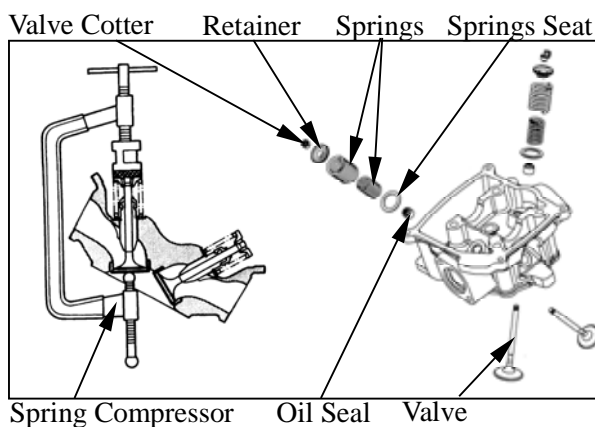
### CYLINDER HEAD DISASSEMBLY

Remove the valve spring cotters, retainers, springs, spring seats, oil seals and valves using a valve spring compressor.

- \***
- Be sure to compress the valve springs with a valve spring compressor.
  - Mark all disassembled parts to ensure correct reassembly.

**Special**

Valve Spring Compressor E040



## 7. CYLINDER HEAD/VALVES

### VALVE /VALVE GUIDE INSPECTION

Inspect each valve for bending, burning, scratches or abnormal stem wear.  
If any defects are found, replace the valve with a new one.

Check valve movement in the guide.

Measure each valve stem O.D.

Measure each valve guide I.D.

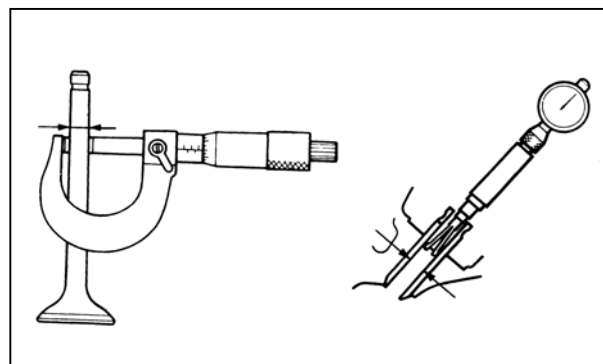
Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

**Service limits** (replace if over):

IN : 0.06 mm (0.0024 in)

EX: 0.08 mm (0.0032 in)

\* If the stem-to-guide clearance exceeds the service limits, replace the cylinder head is necessary.

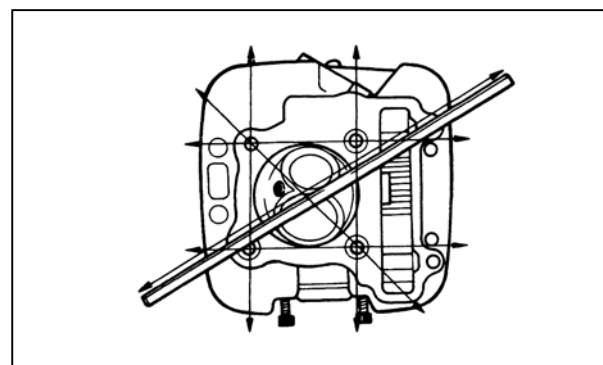


### CYLINDER HEAD INSPECTION

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:** 0.05mm repair or replace if over



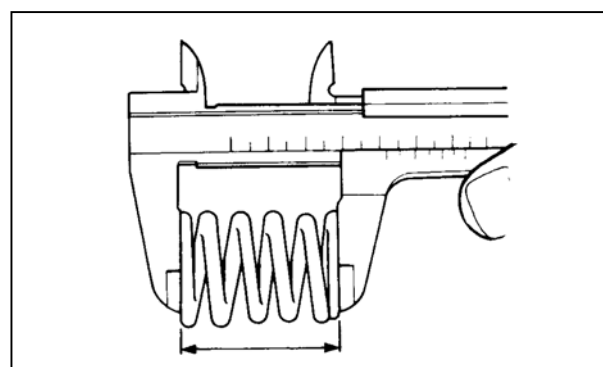
### VALVE SPRING INSPECTION

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

**Service Limit** (replace if below):

Inner: 29.4 mm (1.176 in)

Outer: 39 mm (1.56 in)



## 7. CYLINDER HEAD/VALVES

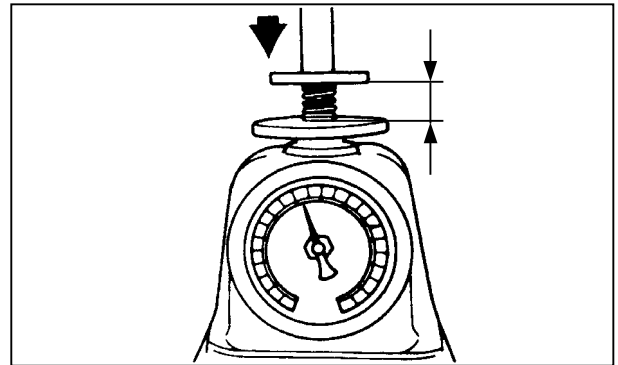
Measure compressed force (valve spring)  
and installed length.

Replace if out of specification.

**Standard:**

IN : 10.20 ~ 11.84kg(at 18.05mm)

EX : 19.14 ~ 22.02kg(at 21.5mm)

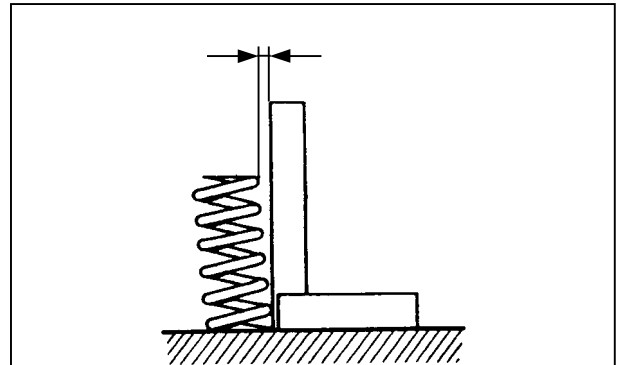


Measure the spring tilt.

Replace if out of specification.

**Standard:** IN : 0.8mm (0.032)

EX : 1.07mm (0.0428)



## 7. CYLINDER HEAD/VALVES

### ASSEMBLY

Install the valve spring seats and oil seal.

- \* Be sure to install new oil seal.

Lubricate each valve with engine oil and insert the valves into the valve guides.

Install the valve springs and retainers.

Compress the valve springs using the valve spring compressor, then install the valve cotters.

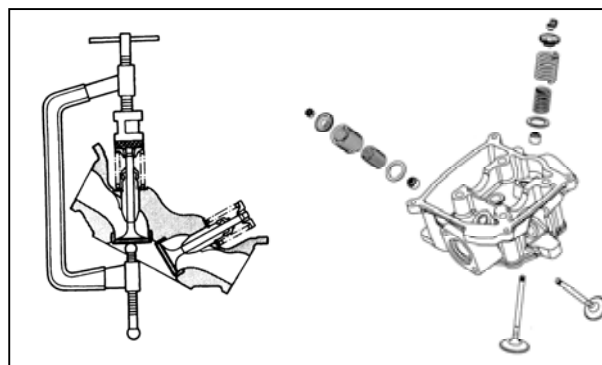
- \* • When assembling, a valve spring compressor must be used.
- Install the cotters with the pointed ends facing down from the upper side of the cylinder head.

**Special**

Valve Spring Compressor E040

Tap the valve stems gently with a plastic hammer for 2~3 times to firmly seat the cotters.

- \* Be careful not to damage the valves.



### INSTALLATION

Install the dowel pins and a new cylinder head gasket.

Reverse the “CYLINDER HEAD REMOVAL” procedures.

After camshaft holder is installed and tighten the nuts, then tighten cylinder head bolts.

#### Torque:

Cylinder head bolt:

1 kgf-m (10 Nm, 7.2 lbf-ft)

