

## **6. CYLINDER HEAD/VALVES**

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### **CYLINDER HEAD/VALVES**

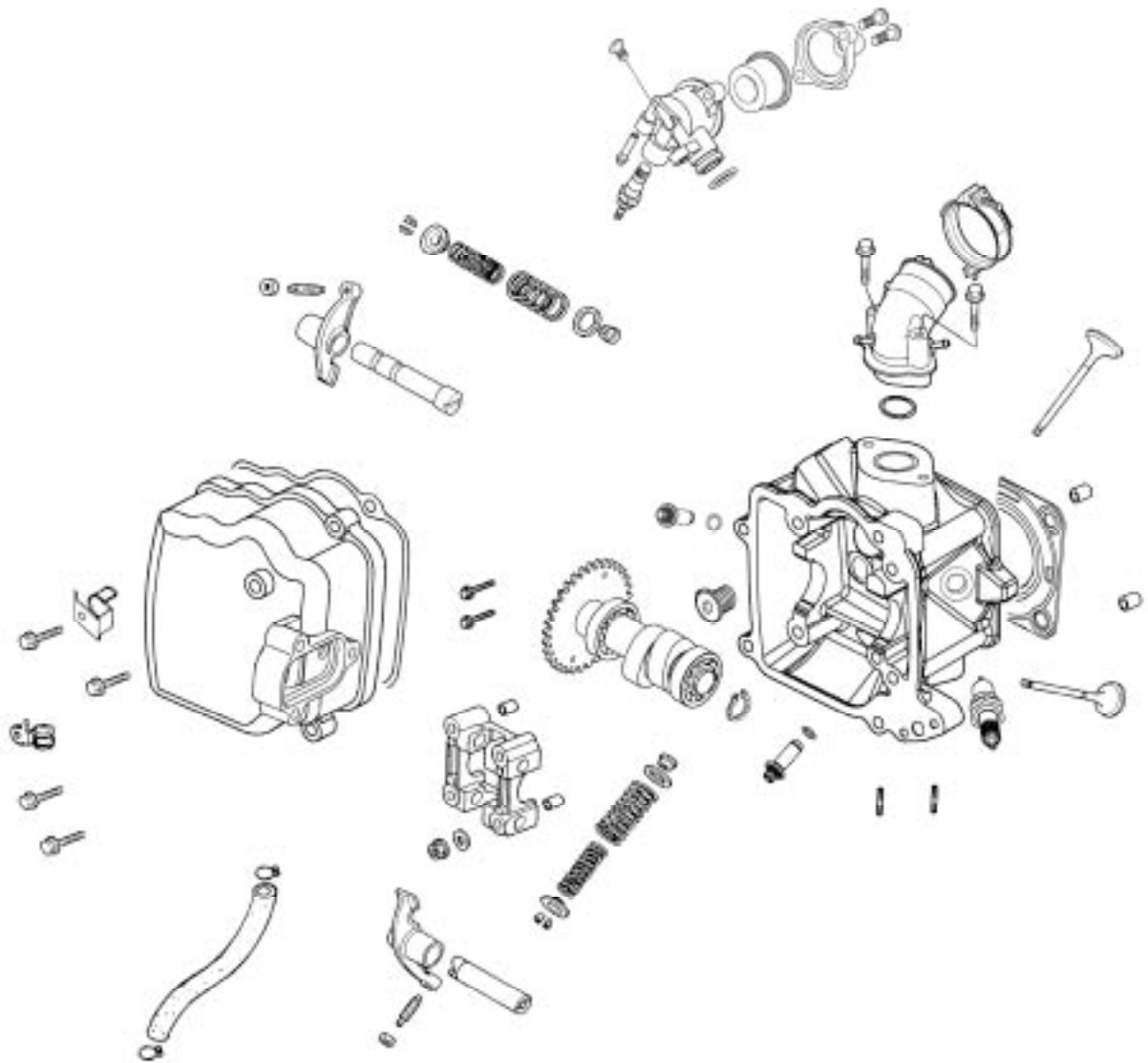
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## **6. CYLINDER HEAD/VALVES**

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### **SCHEMATIC DRAWING**



## 6. CYLINDER HEAD/VALVES

### SERVICE INFORMATION

#### GENERAL INSTRUCTIONS

- The cylinder head can be serviced with the engine installed in the frame. Coolant in the radiator and water jacket must be drained first.
- When assembling, apply molybdenum disulfide grease or engine oil to the valve guide movable parts and valve arm sliding surfaces for initial lubrication.
- The valve rocker arms are 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

		Standard (mm)	Service Limit (mm)
Item		SH40AA	SH40AA
Valve clearance (cold)	IN	0.10	—
	EX	0.10	—
Cylinder head compression pressure		15kg/cm	—
Cylinder head warpage		—	0.05
Camshaft cam height	IN	30.8763	30.75
	EX	30.4081	30.26
Valve rocker arm I.D.	IN	10.00 10.018	10.10
	EX	10.00 10.018	10.10
Valve rocker arm shaft O.D.	IN	9.972 9.987	9.9
	EX	9.972 9.987	9.9
Valve seat width	IN	1.2	1.8
	EX	1.2	1.8
Valve stem O.D.	IN	4.990 4.975	4.925
	EX	4.970 4.955	4.915
Valve guide I.D.	IN	5.00 5.012	5.03
	EX	5.00 5.012	5.03
Valve stem-to-guide clearance	IN	0.010 0.037	0.08
	EX	0.030 0.057	0.10

#### TORQUE VALUES

Cylinder head cap nut	19.6N-m	Apply engine oil to threads
Valve clearance adjusting nut	8.8N-m	Apply engine oil to threads
Cylinder head cover bolt	7.8_ 11.8N-m	

#### SPECIAL TOOLS

Valve spring compressor	
Valve seat cutter, 24.5mm	45° IN-EX
Valve seat cutter, 25mm	Plane cutter 37.5° EX
Valve seat cutter, 22mm	Plane cutter 37.5° EX
Valve seat cutter, 26mm	Plane cutter 63.5° IN/EX
Cutter clip	
Valve guide driver	
Valve guide reamer	

## **6. CYLINDER HEAD/VALVES**

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### **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 bent 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 oil seal

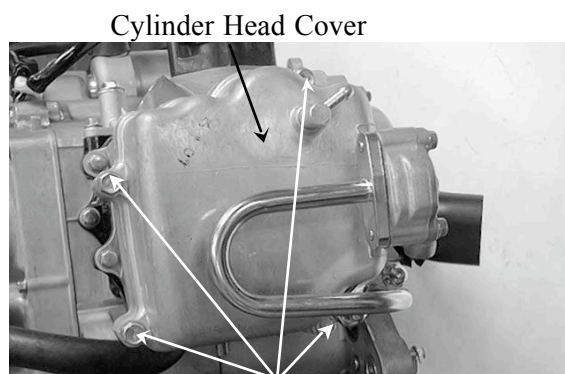
#### **Abnormal noise**

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

## 6. CYLINDER HEAD/VALVES

### CYLINDER HEAD COVER REMOVAL

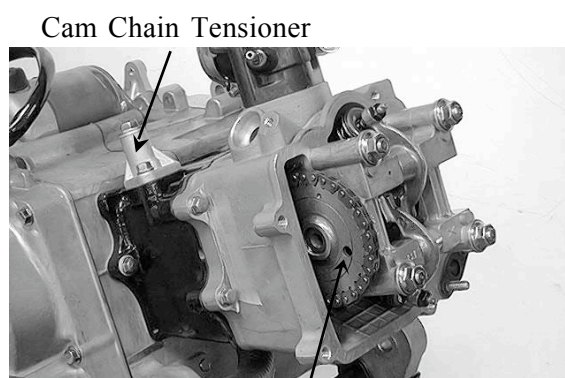
Remove the center cover. (⇒2-3)  
 Remove the met-in box. (⇒2-3)  
 Remove the cylinder head cover four bolts and then remove the cylinder head cover.



Bolt

### CAMSHAFT REMOVAL

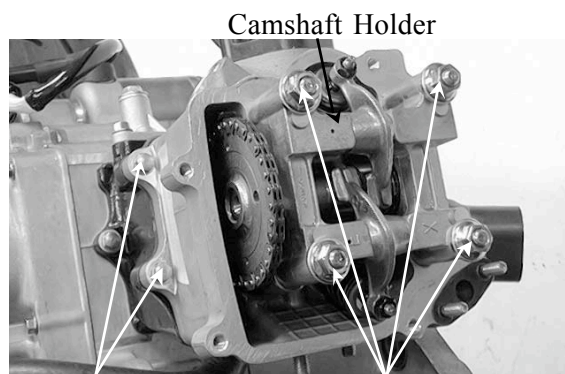
Turn the A.C. generator flywheel so that the "T" mark on the flywheel aligns with the index mark on the crankcase.  
 Hold the round hole on the camshaft gear facing up and the location is the top dead center on the compression stroke.  
 Remove the two bolts attaching cam chain tensioner and the tensioner.



Round Hole

First remove the two bolts between the cylinder head and cylinder.  
 Then, remove the four cap nuts attaching the cylinder head.

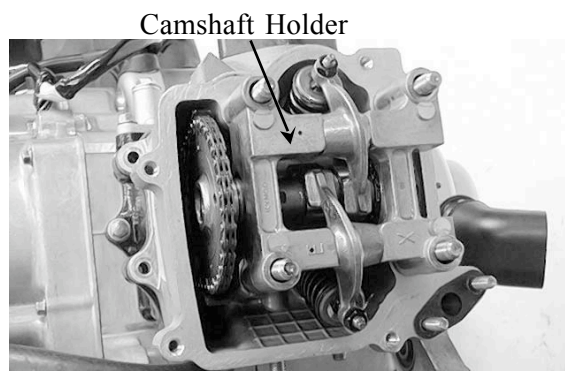
- Diagonally loosen the cylinder head cap nuts in 2 or 3 times.



Bolts

Cap Nuts

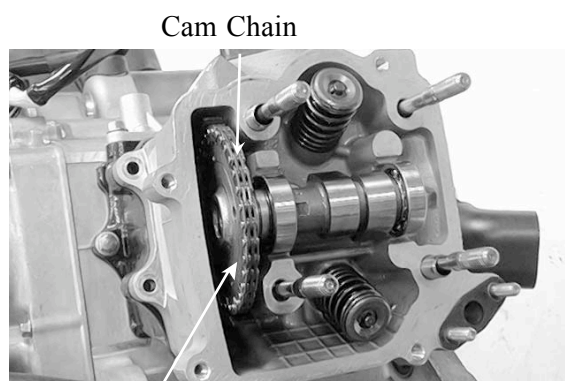
Remove the camshaft holder and dowel pins.



Camshaft Holder

## 6. CYLINDER HEAD/VALVES

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



Cam Chain

Camshaft Gear

### CAMSHAFT INSPECTION

Check each cam lobe for wear or damage.  
Measure the cam lobe height.

#### Service Limits:

**SH40AA** IN: 30.75mm replace if below



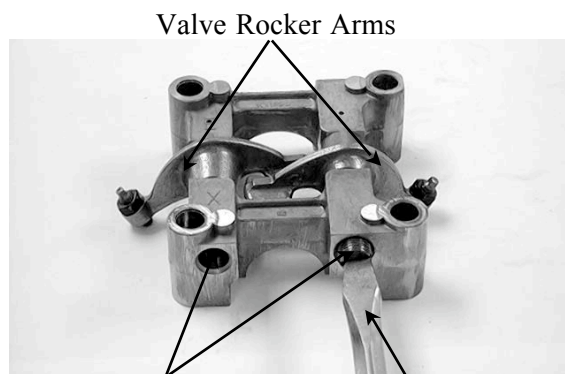
Check each camshaft bearing for play or damage. Replace the camshaft assembly with a new one if the bearings are noisy or have excessive play.



Camshaft Bearings

### CAMSHAFT HOLDER DISASSEMBLY

Take out the valve rocker arm shafts using a 6mm bolt and screwdriver.  
Remove the valve rocker arms.



Valve Rocker Arms

Rocker Arm Shafts

Screwdriver

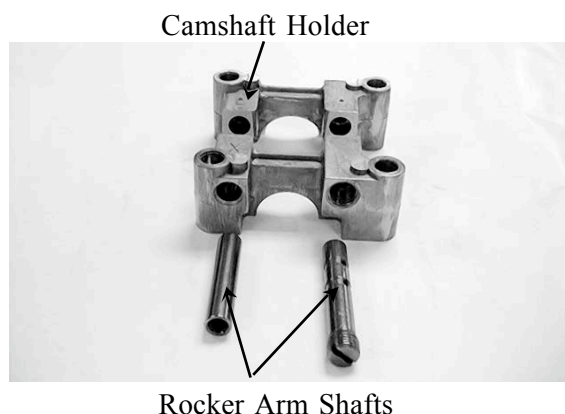


## 6. CYLINDER HEAD/VALVES

### CAMSHAFT HOLDER INSPECTION

Inspect the camshaft holder, valve rocker arms and rocker arm shafts for wear or damage.

- ° If the valve rocker arm contact surface is worn, check each cam lobe for wear or damage.



Measure the I.D. of each valve rocker arm.

**Service Limits:** IN: 10.10mm replace if over

EX: 10.10mm replace if over

Measure each rocker arm shaft O.D.

**Service Limits:** IN: 9.90mm replace if below

EX: 9.90mm replace if below



### CYLINDER HEAD REMOVAL

First drain the coolant from the radiator and water jacket, then remove the thermostat water hose.

Remove the camshaft. (⇒6-4)

Remove the carburetor and intake manifold.

Remove the bolt attaching the thermostat housing and the thermostat housing.

Remove the cylinder head.

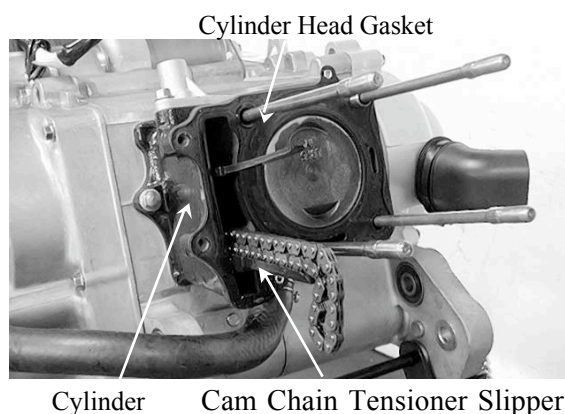


Remove the dowel pins and cylinder head gasket.

Remove the cam chain guide.

Remove all gasket material from the cylinder head mating surface.


- ° Be careful not to drop any gasket material into the engine.




## 6. CYLINDER HEAD/VALVES

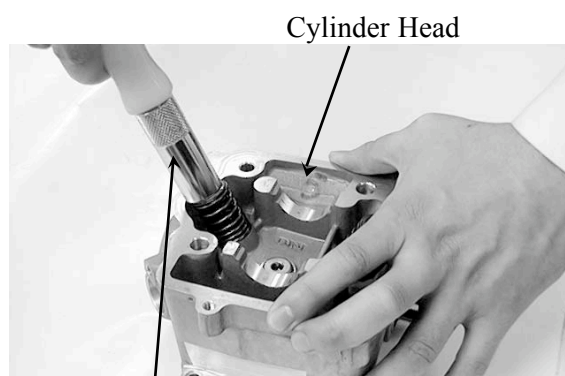
### CYLINDER HEAD DISASSEMBLY

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

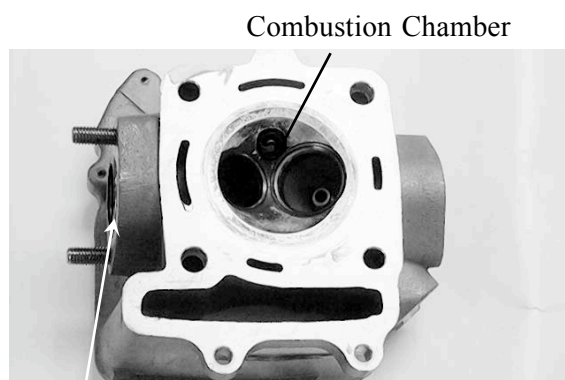
- °  Be sure to compress the valve springs with a valve spring compressor.
- Mark all disassembled parts to ensure correct reassembly.

Remove carbon deposits from the exhaust port and combustion chamber.

- °  Be careful not to damage the cylinder head mating surface.



Valve Spring Compressor



Exhaust Port



## 6. CYLINDER HEAD/VALVES

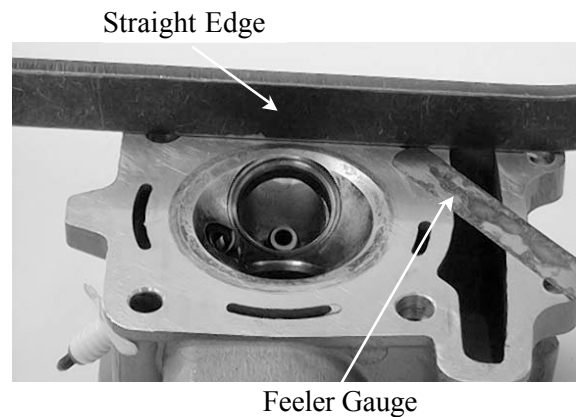
### INSPECTION

#### CYLINDER HEAD

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 FREE LENGTH

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

**Service Limits:**

Inner (IN, EX) : 29.3mm replace if below

Outer (IN, EX): 32.0mm replace if below



#### VALVE /VALVE GUIDE

Inspect each valve for bending, burning, scratches or abnormal stem wear.

Check valve movement in the guide.

Measure each valve stem O.D.

**Service Limits:** IN: 4.925mm replace if below  
EX: 4.915mm replace if below

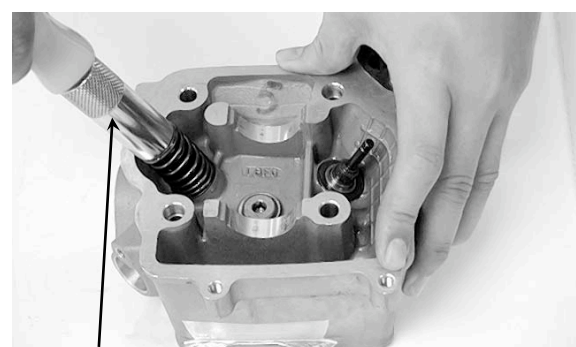


### CYLINDER HEAD ASSEMBLY

Install the valve spring seats and stem seals.

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


Be sure to install new valve stem seals.

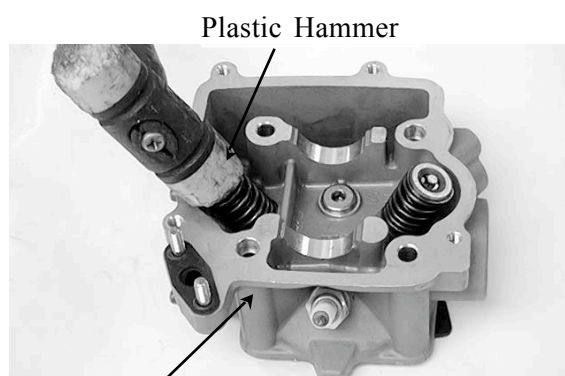


Valve Spring Compressor

## 6. CYLINDER HEAD/VALVES

Tap the valve stems gently with a plastic hammer to firmly seat the cotters.

- °  Be careful not to damage the valves.

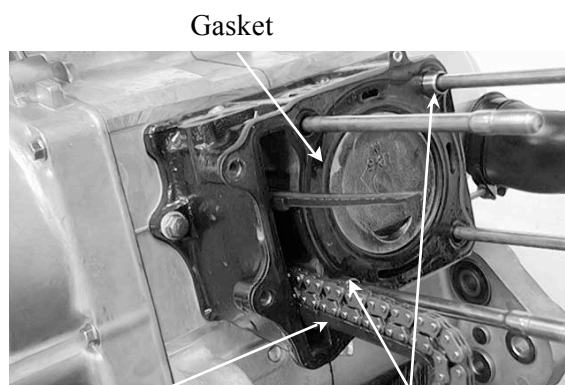


Cylinder Head

### CYLINDER HEAD INSTALLATION

Install the cam chain guide.

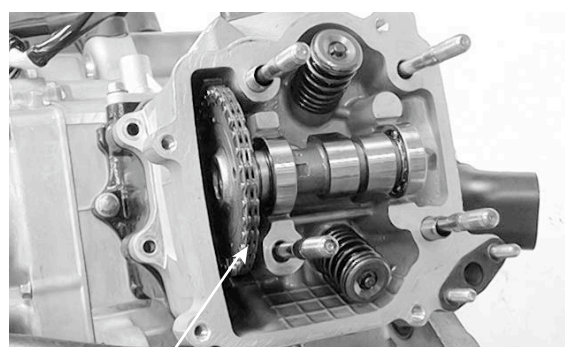
Install the dowel pins and a new cylinder head gasket.



Cam Chain Guide

Dowel Pins


Install the cylinder head and take out the cam chain

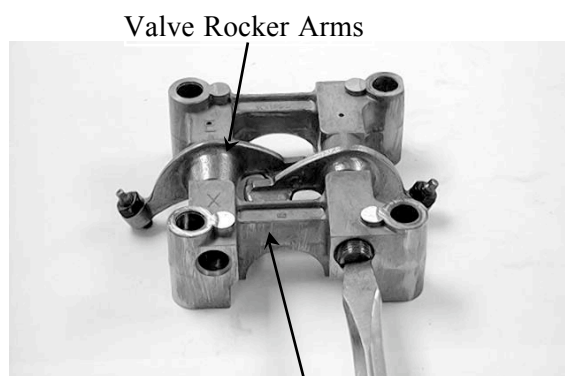


Cam Chain

Assemble the camshaft holder.

First install the intake and exhaust valve rocker arms; then install the rocker arm shafts.

- °  • Install the exhaust valve rocker arm shaft on the “EX” side of the camshaft holder and the exhaust rocker arm shaft is shorter.
- Clean the intake valve rocker arm shaft off any grease before installation.
- Align the cutout on the exhaust valve rocker arm shaft with the bolt of the camshaft holder.



Valve Rocker Arms

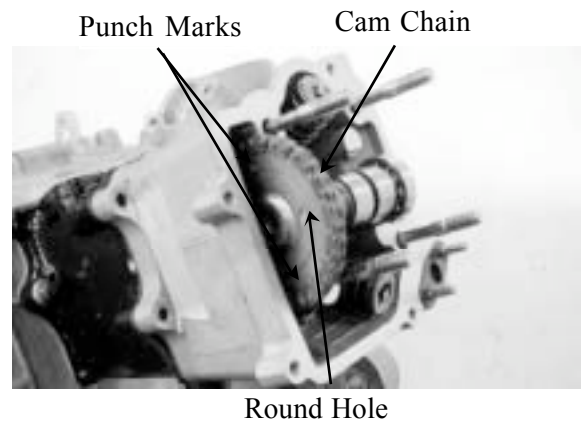
Camshaft Holder

## 6. CYLINDER HEAD/VALVES

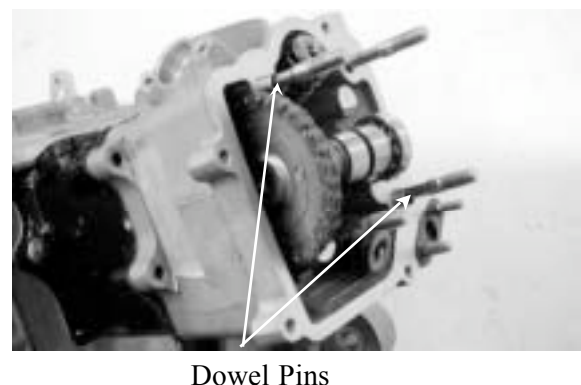
### CAMSHAFT INSTALLATION

Turn the A.C. generator 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 cam chain over the camshaft gear.



Install the dowel pins.

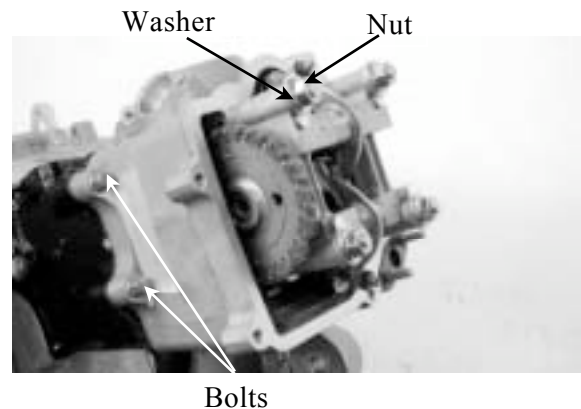


Install the camshaft holder, washers and nuts on the cylinder head.

Tighten the four cylinder head nuts and the two bolts between the cylinder head and cylinder.

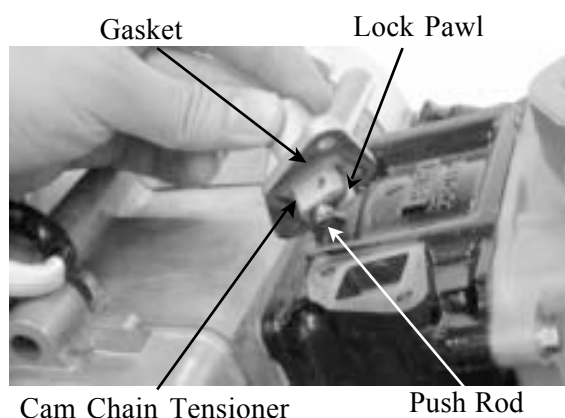
**Torque:** Cylinder head cap nut: 19.6N-m  
Cylinder & cylinder head bolt:  
7.8\_ 11.8N-m

- °C
- Apply engine oil to the threads of the cylinder head cap nuts.
  - Diagonally tighten the cylinder head cap nuts in 2\_ 3 times.
  - First tighten the cylinder head cap nuts and then tighten the bolts between the cylinder and cylinder head to avoid cracks.



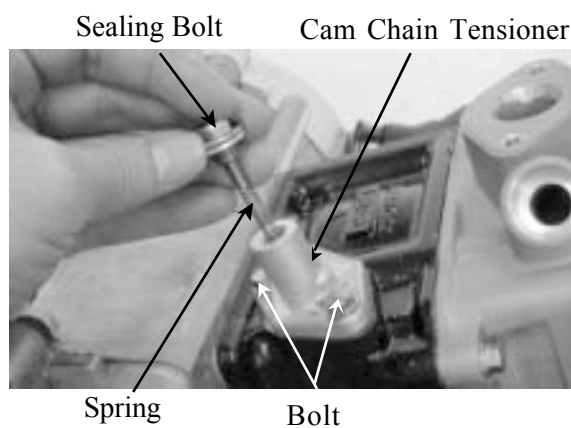
## 6. CYLINDER HEAD/VALVES

Install a new cam chain tensioner gasket.  
Release the lock pawl and push the push rod all the way in.



Install the cam chain tensioner and tighten the two bolts.  
Install the tensioner spring and tighten the sealing bolt.

**Torque:** 2.9\_ 5.8N-m



### CYLINDER HEAD COVER INSTALLATION

Adjust the valve clearance. (⇒3-6)  
Install a new cylinder head cover O-ring and install the cylinder head cover.

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

Install and tighten the cylinder head cover bolts.

**Torque:** 7.8\_ 11.8N-m

