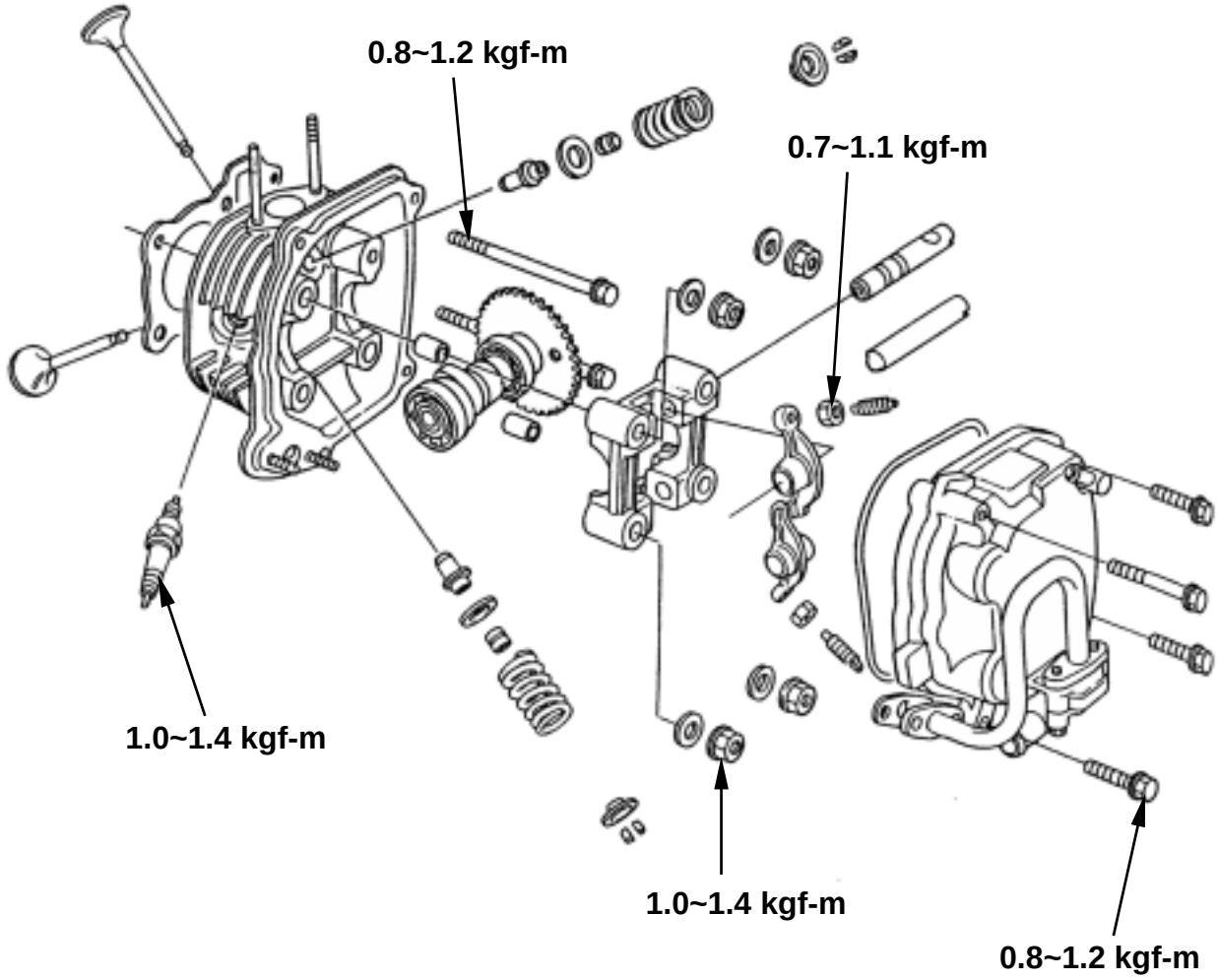
MECHANISM DIAGRAM



PRECAUTIONS IN OPERATION

General Information

- This chapter is contained maintenance and service for cylinder head, valve, and camshaft as well as valve rocker arm.
- Cylinder head service cannot be carried out when engine is in frame.

Specification **unit: mm**

Item			Standard	Limit
Compression pressure			12 kg/cm²	-
Camshaft	Height of cam lobe	Intake	25.686~25.786	25.29
		Exhaust	25.50~25.60	25.12
Rocker arm	ID of valve rocker arm		10.000~10.015	10.10
	OD of valve rocker arm shaft		9.972~9.987	9.910
Valve	OD of valve stem	Intake	4.975~4.99	4.90
		Exhaust	4.955~4.97	4.90
	OD of Guide		5.00	5.030
	Clearance between valve stem and guide	Intake	0.010~0.037	0.080
		Exhaust	0.030~0.057	0.100
	Free length of valve spring		35.25	-

Torque Value

Cylinder head cover bolt	0.8~1.2kgf-m
Cylinder head bolt (LH)	0.8~1.2kgf-m
Bolt of timing chain auto-adjuster	0.8~1.2kgf-m
Spark plug	1.0~1.4kgf-m
Cam holder nut	1.0~1.4kgf-m
Valve adjustment fixing nuts	1.0~1.4kgf-m

TOOLS

Special service tools

Valve reamer: 5.0mm
Valve guide driver: 5.0mm
Valve spring compressor

TROUBLE SHOOTING

Engine performance will be effected by troubles on engine top end. The troubles usually can be determinate or by performing cylinder compression test and judging the abnormal noise generated.

Rough Idle

Low compression pressure.

Low compression pressure

1. Valve

- Improper valve adjustment.
- Burnt or bended valve.
- Improper valve timing.
- Valve spring damaged.
- Valve carbon.
- Poor sealing on valve seat.
- Improper spark plug installation.

2. Cylinder head

- Cylinder head gasket leaking or damage.
- Tilt or crack cylinder surface.

3. Piston

- Piston ring worn out.

High compression pressure

- Too much carbon deposit on combustion chamber or piston head.

Noise

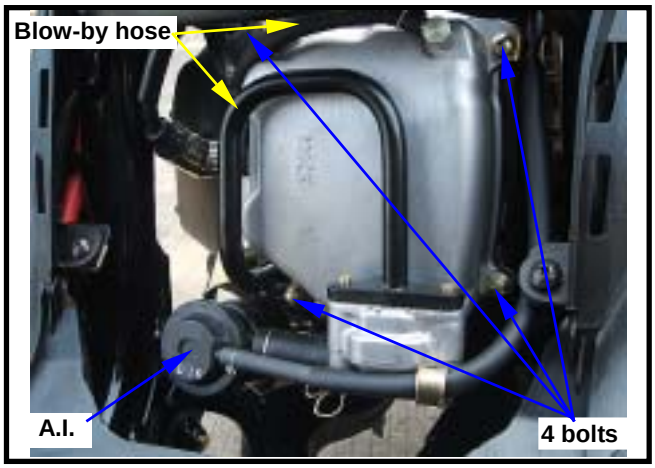
- Improper valve clearance adjustment
- Burnt valve or damaged valve spring
- Camshaft wear out or damage
- Cam chain wear out or looseness
- Auto-adjuster wear out or damage of cam chain
- Camshaft sprocket wear out
- Rocker arm or rocker arm shaft wear out

White smoke

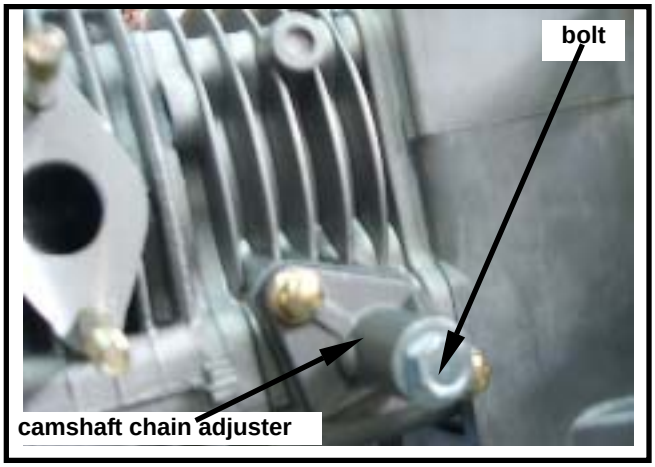
- Valve guide or valve stem wear out
- Valve stem seal wear out

CAMSHAFT REMOVAL

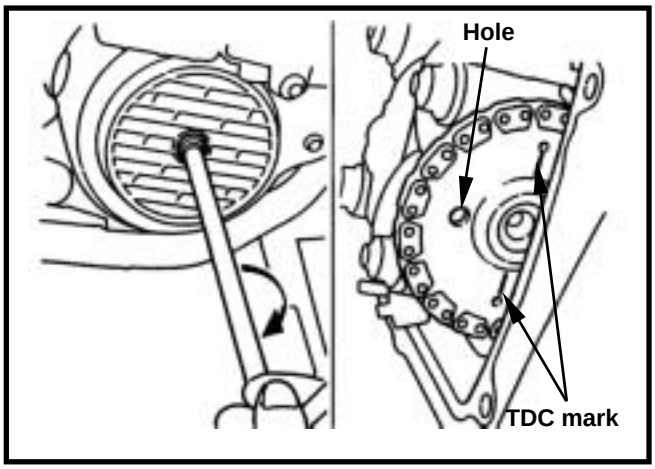
Remove the shroud of the engine.
Remove the crankcase blow-by system hose from the cylinder head.
Remove the cylinder head bolts and then remove the cylinder head (4 bolts).



Loosen the bolt of camshaft chain adjuster and remove O-ring.
With a flat screwdriver to tighten the screw of camshaft chain adjuster in a clockwise motion for release adjuster.



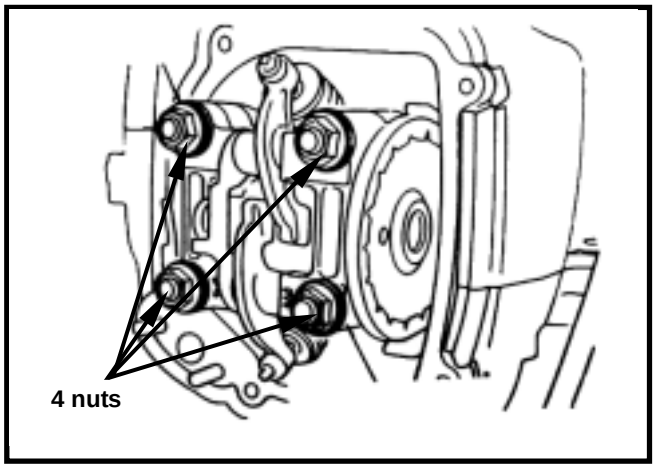
Turn the flywheel in counter clockwise motion with T type wrench until the “T” mark on flywheel aligned with the mark on the crankcase so that the hole on the camshaft sprocket is forward up and piston is at TDC position.



Remove camshaft holder nut and washer.

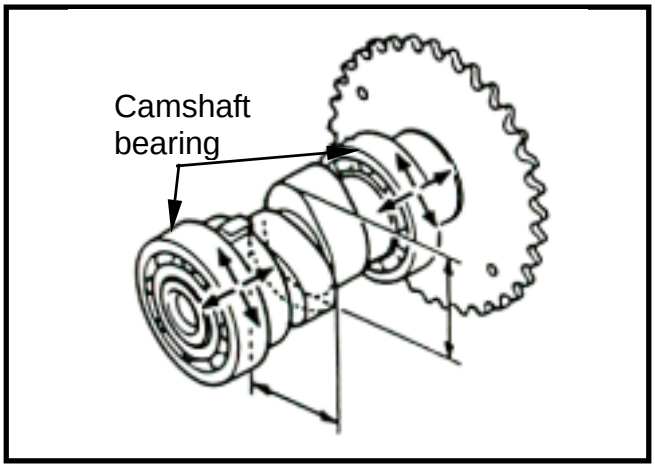
Caution

Loosen the nuts diagonally by 2-3 sequences.

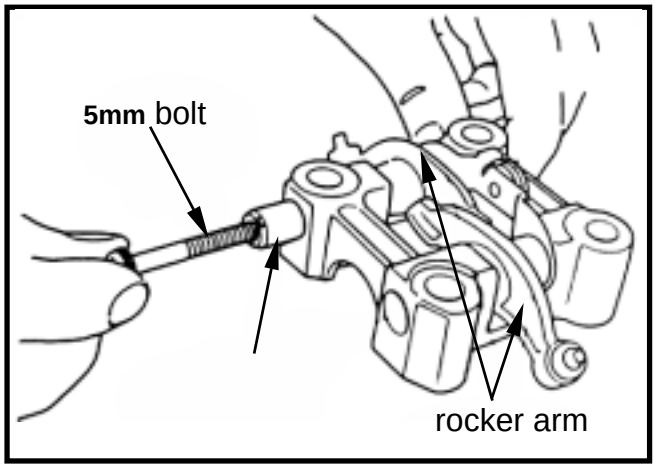


Remove the camshaft holder and rocker arm set.
Remove the camshaft chain from the camshaft sprocket.
Remove the camshaft.

Camshaft Inspection
Inspect cam lobe height for damaged.
Service Limit
IN: Replacement when less than 25.29 mm
EX: Replacement when less than 25.12 mm
Inspect the camshaft bearing for looseness or wear out. If any, replace whole set of camshaft and bearing.



Disassembly Of Camshaft Holder
With a 5 mm bolt to screw in the cam rocker arm shaft so that take it out.
Remove cam rocker arm.



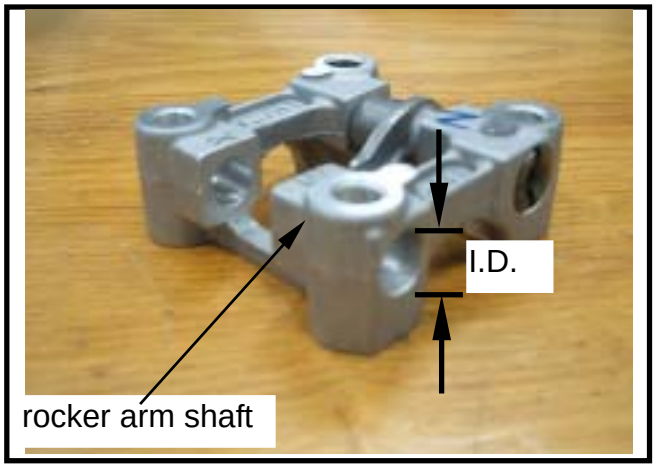
Inspection Of Camshaft Holder
Check if the camshaft holder, cam rocker arm and rock arm shaft for wearing out or damage.

Caution

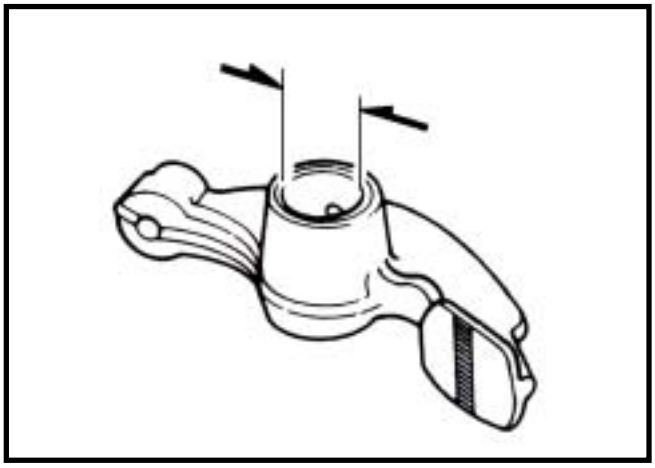
- Further check is necessary if any wear is found on the moveable surface of cam rocker arm.
- Check if the camshaft bearing mounting surface for wear or damage.

Measure the I.D. of the camshaft holder.

Service Limit: Replace when it is above 10.10 mm

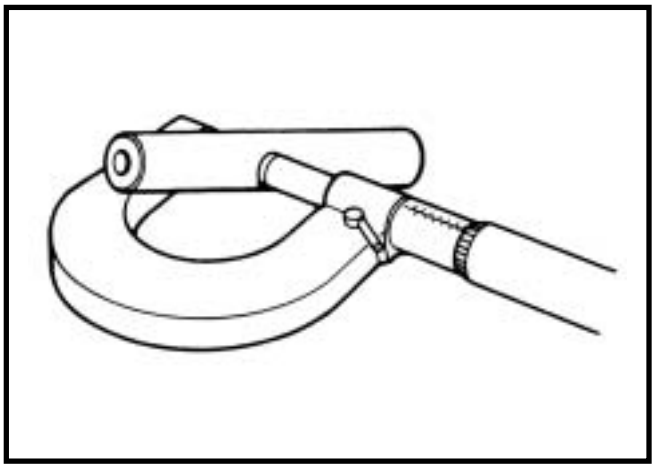


Measure the valve rocker arm I.D.
Service Limit: Replace when it is above 10.100 mm



Measure the active O.D. of the valve rocker arm shaft and valve rocker arm.
Service Limit: Replace when it is above 9.910 mm

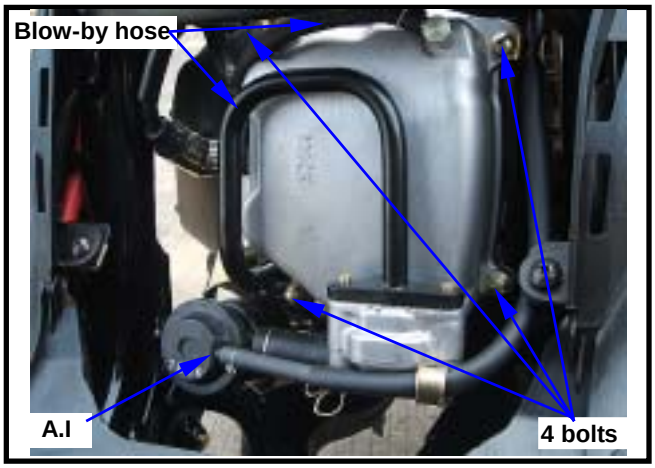
Calculate the clearance between the rocker arm shaft and the rocker arm.
Service Limit: Replace when it is above 0.10 mm



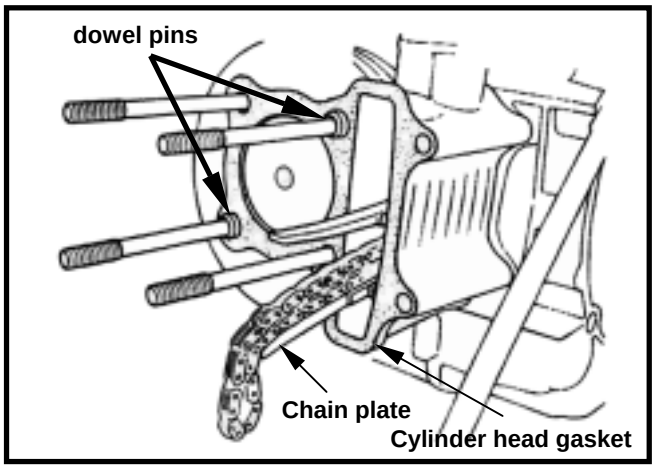
CYLINDER HEAD REMOVAL

Remove double seat, luggage box and front center cover.
Remove the engine (refer to Chapter 5).
Remove the cooling fan cover.
Remove the engine shroud (L:2 bolts R:3 bolts).

Remove the camshaft.



Remove the 2 cylinder head mounting bolts from cylinder head left side cover.
Remove cylinder head gasket and 2 dowel pins.
Remove chain plate.
Clean up residues from the matching surfaces of cylinder and cylinder head.



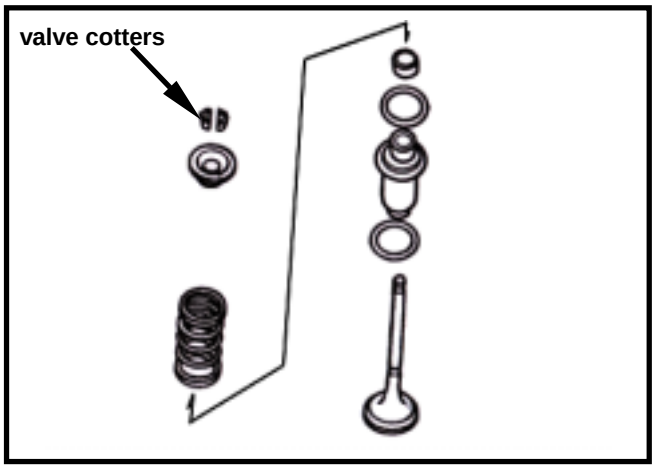
⚠ Caution

- Do not damage the matching surfaces of cylinder and cylinder head.
- Avoid residues of gasket or foreign materials falling into crankcase as cleaning.

CYLINDER HEAD DISASSEMBLY

Use a valve compressor to press the valve spring.

After removed valve cotters, release the compressor and then take out spring retainer, valve spring and valves.

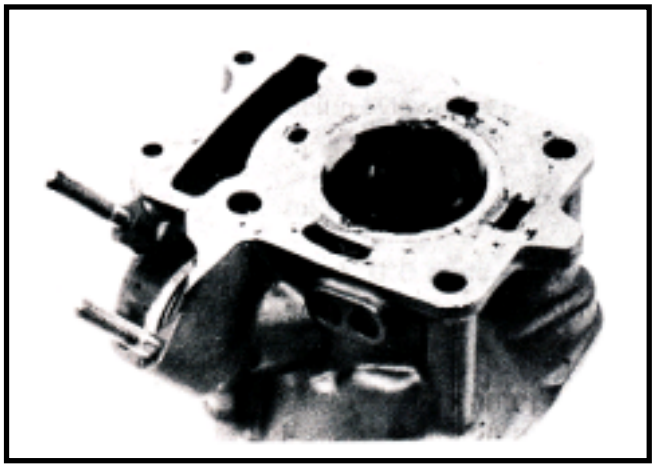


⚠ Caution

In order to avoid to loosing spring tension, do not compress the spring too much. Its length is based on the installation of latch.

Special Service Tool: Valve spring compressor.

Remove valve stem guide seal.
Clean carbon deposits in combustion chamber.
Clean residues and foreign materials on cylinder head matching surface.

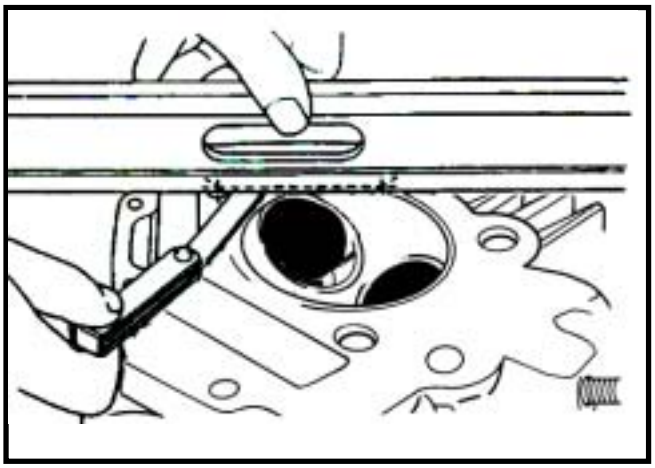


⚠ Caution

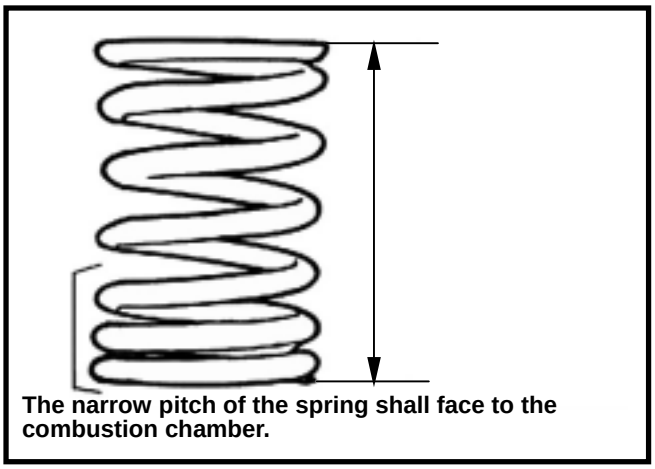
Do not damage the matching surface of cylinder head.

CYLINDER HEAD INSPECTION

Check if spark plug and valve holes are crack.
Measure cylinder head flat with a straightedge and flat feeler gauge.
Service limit: 0.05mm

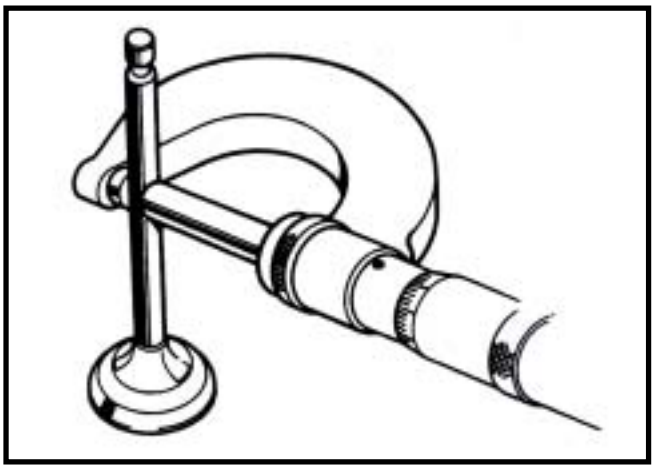


Valve spring free length
Measure the free length of intake and exhaust valve springs.
Standard:
35.250 mm



The narrow pitch of the spring shall face to the combustion chamber.

Valve stem
Check if valve stems are bend, crack or burn.
Check the operation condition of valve stem in valve guide, and measure & record the valve stem outer diameter.
Service Limit: IN→ 4.900mm
EX→ 4.900mm

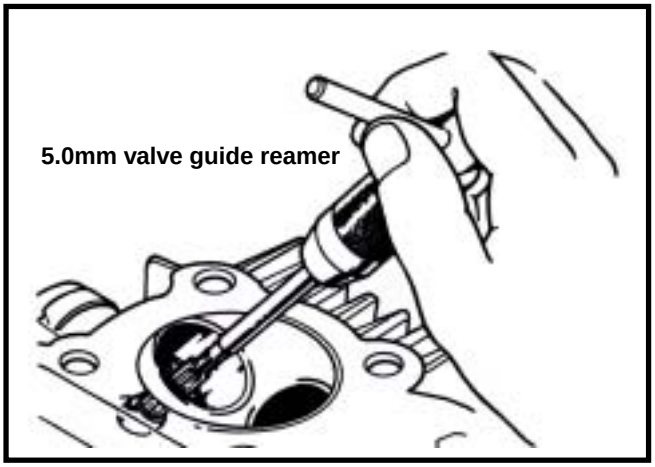


Valve guide

⚠ Caution

Before measuring the valve guide, clean carbon deposits with reamer.

Special Service Tool: 5.0mm valve guide reamer
Measure and record each valve guide inner diameters.
Service limit: 5.030mm
The difference that the inner diameter of valve guide deducts the outer diameter of valve stem is the clearance between the valve stem and valve guide.
Service Limit: IN→ 0.08mm
EX→ 0.10mm

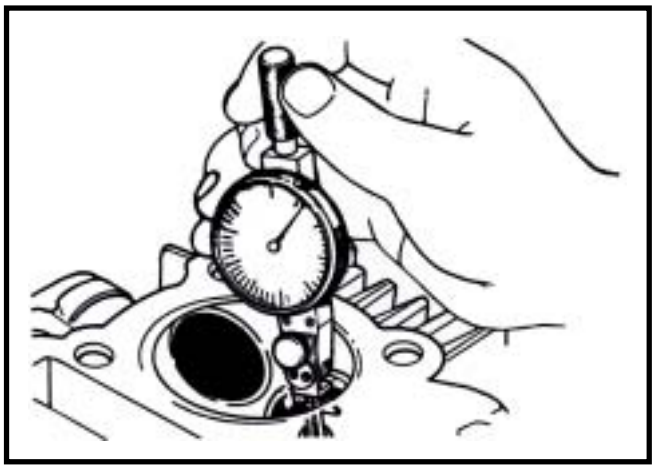


5.0mm valve guide reamer

Caution

If clearance between valve stem and valve guide exceeded service limit, check whether the new clearance that only replaces new valve guide is within service limit or not. If so, replace valve guide.

Correct it with reamer after replacement.
If clearance still exceeds service limit after replaced valve guide, replace valve stem too.



Caution

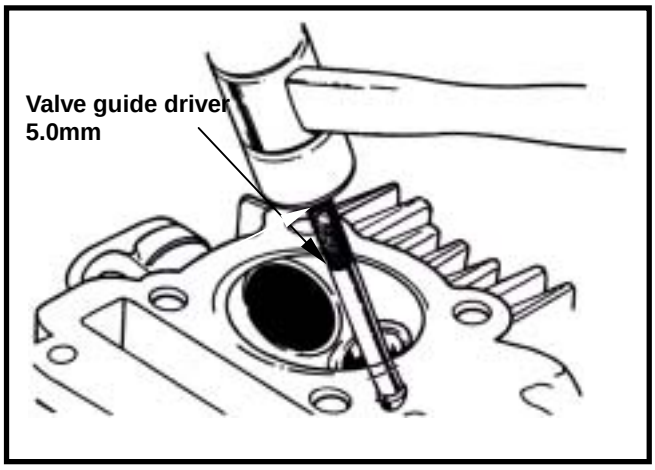
It must correct valve seat when replacing valve guide.

Valve guide replacement

Heat up cylinder head to 100~150 ℃ with heated plate or toaster.

Caution

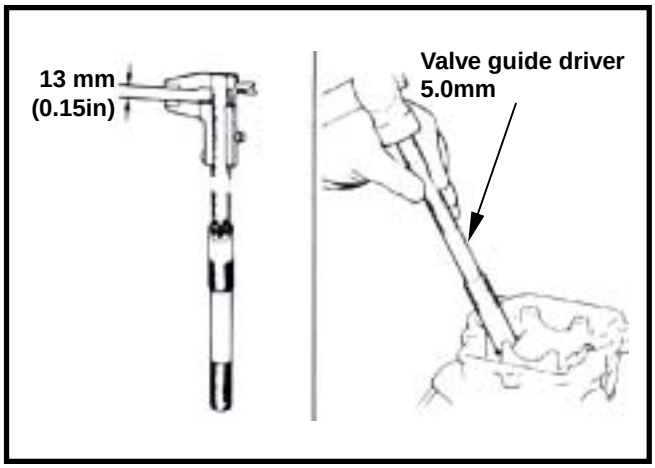
- Do not let torch heat cylinder head directly. Otherwise, the cylinder head may be deformed as heating it.
- Wear on a pair of glove to protect your hands when operating.



Hold the cylinder head, and then press out old valve guide from combustion chamber side.
Tool: Valve guide driver 5 mm

Caution

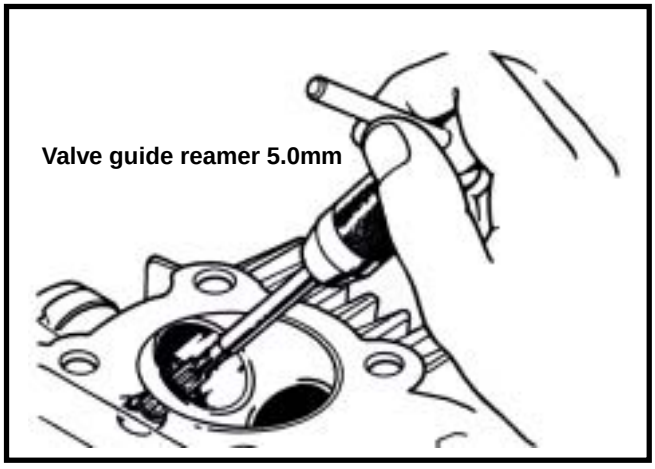
- Check if new valve guide is deformation after pressed it in.
- When pressing in the new valve guide, cylinder head still must be kept in 100~150 ℃.



Adjust the valve guide driver and let valve guide height is in 13mm.
Press in new valve guide from rocker arm side.
Tool: Valve guide driver 5 mm
Wait for the cylinder head cooling down to room temperature, and then correct the new valve guide with reamer.

Caution

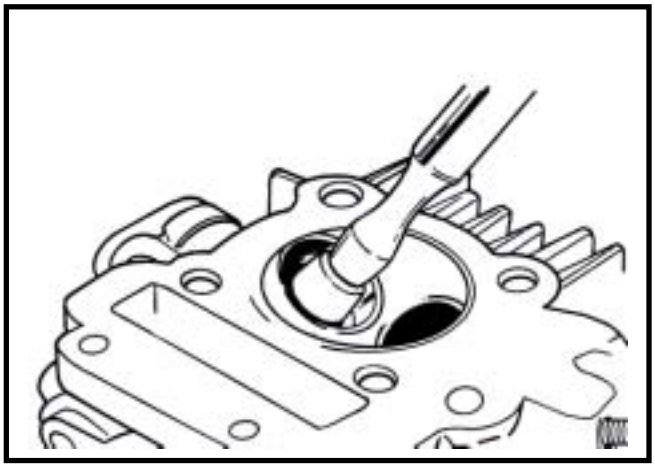
- Using cutting oil when correcting valve guide with a reamer.
- Turn the reamer in same direction when it be inserted or rotated.



Correct valve seat, and clean up all metal residues from cylinder head.
Special tool: Valve guide reamer 5 mm

VALVE SEAT INSPECTION AND SERVICE

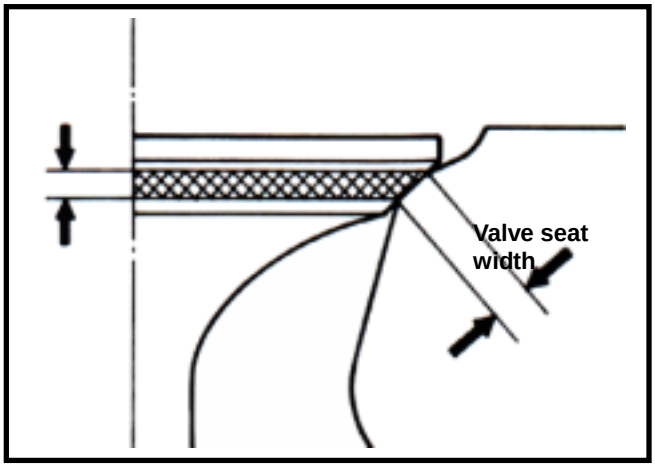
Clean up all carbon deposits onto intake and exhaust valves.
Apply with emery slightly onto valve contact face. Grind valve seat with a rubber hose or other manual grinding tool.



Caution

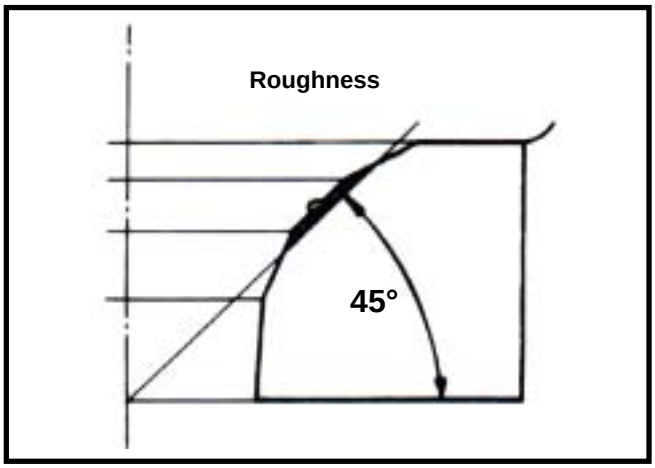
- Do not let emery enter into between valve stem and valve guide.
- Clean up the emery after corrected, and apply with red paint onto contact faces of valve and valve seat.

Remove the valve and check its contact face.



Caution

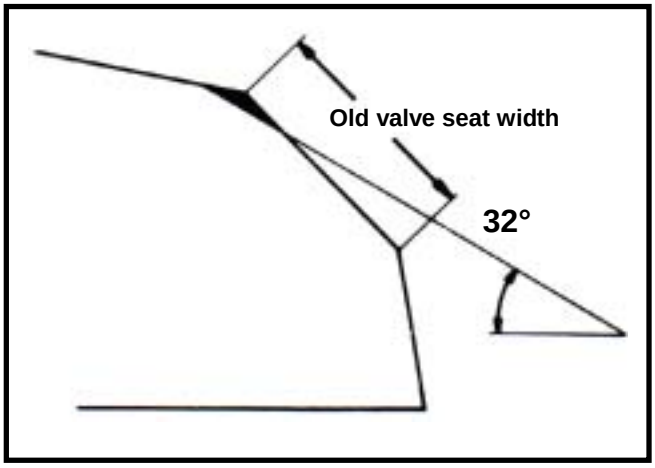
Replace the valve with new one if valve seat is roughness, wear out, or incomplete contacted with valve seat.
If the valve and the valve seat still can not be matched sealing after grinded, replace it with new one.



Valve seat inspection
If the valve seat is too width, narrow or rough, correct it.

Valve seat width
Service limit: 1.6mm
Check the contact condition of valve seat.

Valve seat grinding
The worn valve seat has to be grinded with valve seat chamfer cutter.
Use 45° valve seat chamfer cutter to cut any rough or uneven surface from valve seat.

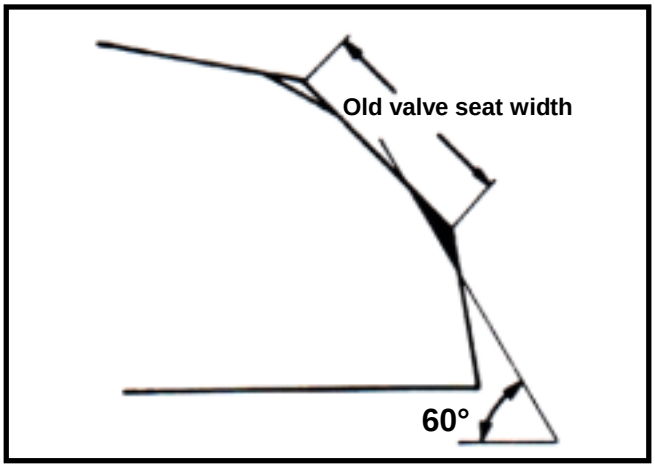


Caution

After valve guide had been replaced, it has to be grinded with 45° valve seal chamfer cutter to correct its seat face.

Use 32° cutter to cut a quarter upper part out.

Use 60° cutter to cut a quarter lower part out. Remove the cutter and check new valve seat.

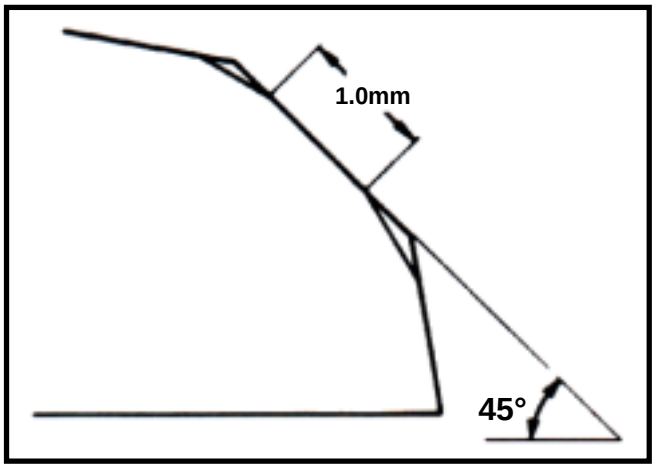


Use 45° cutter to grind the valve seat to specified width.

Caution

Make sure that all roughness and uneven faces had been grinded.

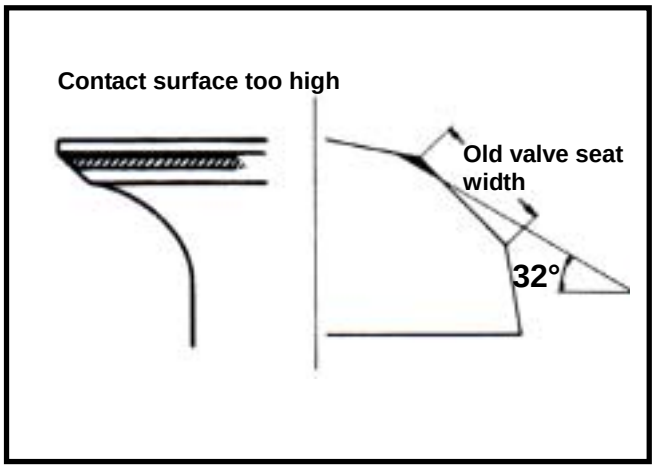
Grind valve seat again if necessary.



Coat the valve seat surface with red paint. Install the valve through valve guide until the valve contacting with valve seat, slightly press down the valve but do not rotate it so that a seal track will be created on contact surface.

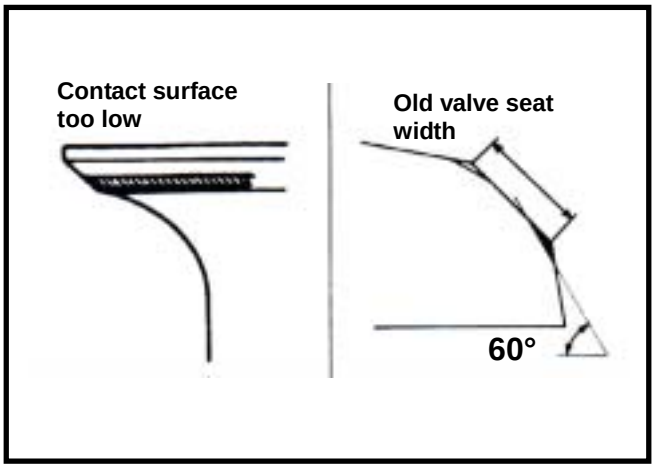
Caution

The contact surfaces of valve and valve seat are very important to the valve sealing capacity.

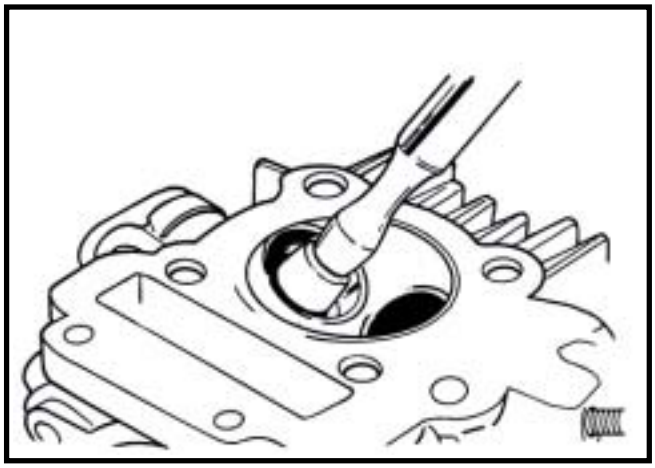


If the contact surface too high, grind the valve seat with 32° cutter.
Then, grind the valve seat with 45° cutter to specified width.

If the contact surface too low, grind the valve seat with 60° cutter.
Then, grind the valve seat with 45° cutter to specified width.



After the valve seat grinded, coat valve seat surface with emery and then slightly press the grinded surface.
Clean up all emery coated onto cylinder and valve after grinded.

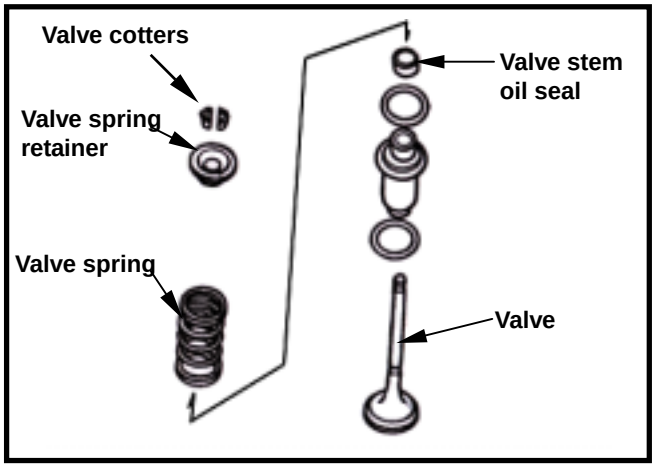


CYLINDER HEAD REASSEMBLY

Lubricate valve stem with engine oil, and then insert the valve into valve guide.
Install new valve stem oil seal.
Install valve springs and retainers.

⚠ Caution

The closed coils of valve spring should face down to combustion chamber.



Use valve spring compressor to press valve spring.
Install valve split locks and release the valve compressor.

⚠ Caution

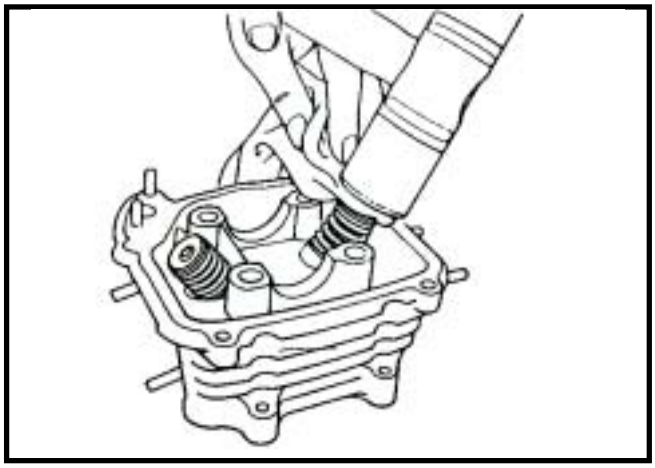
In order to avoid to loosing spring tension, do not compress the spring too much. Its length is based on the installation of latch.

Special tool: valve spring compressor

Tap valve stem to make valve retainer and valve stem sealing properly.

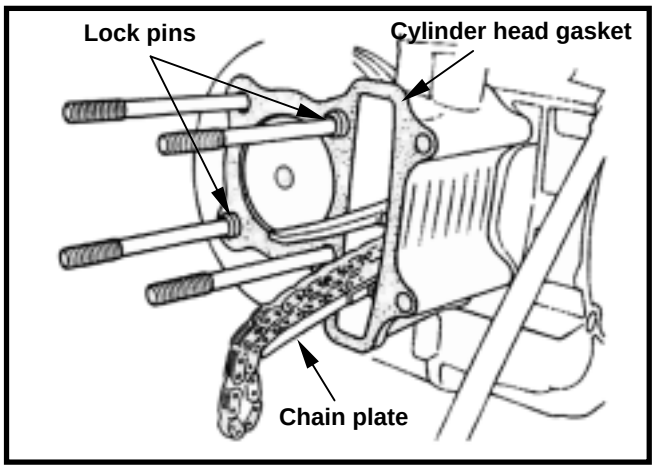
⚠ Caution

Place and hold cylinder head on to working table so that can prevent from valve damaged.

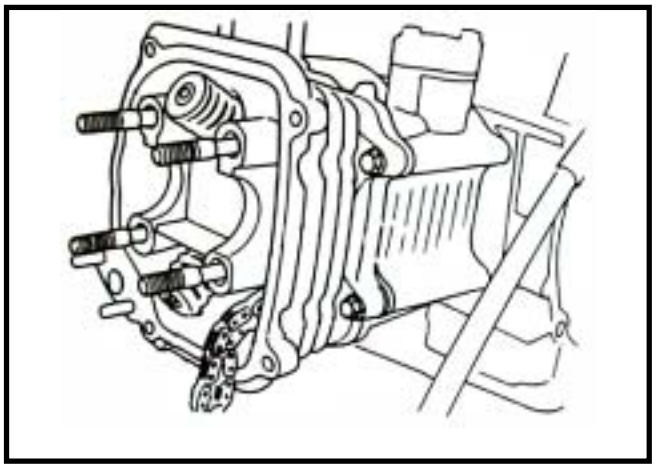


CYLINDER HEAD INSTALLATION

Install the lock pins and new cylinder head gasket onto the cylinder head.
Install the camshaft chain plate.



Install the cylinder head.

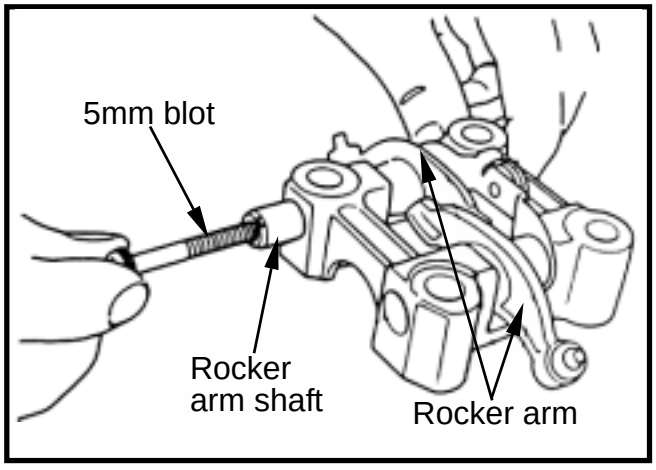


CAMSHAFT INSTALLATION

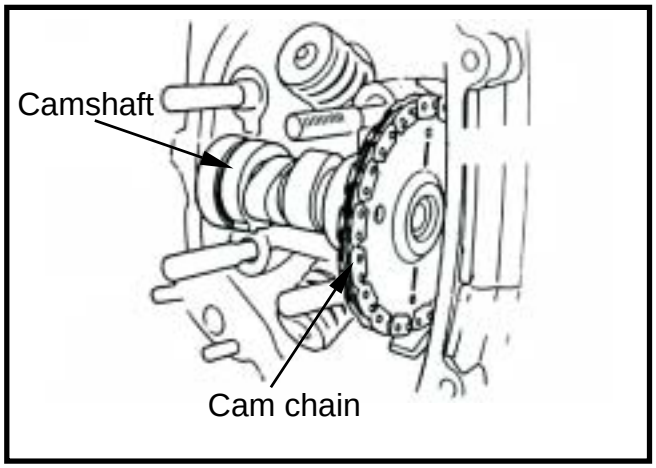
Assemble the camshaft holder.
Install the exhaust valve rocker arm set onto the camshaft holder showing “EX” mark.
Install intake valve rocker arm and rocker arm shaft.

⚠ Caution

The tangent of rocker shaft of intake valve should match with the bolt hole of camshaft mounting seat.



With T type wrench to turn crankshaft in a clockwise motion so that the “T” mark on the flywheel aligns with the mark on crankcase. (piston is at TDC position)
Place the TDC marks of the cam sprocket at same level of the top-end of cylinder head. The other single hole of the cam sprocket is in upward. Then, install the cam chain onto the cam sprocket.



Install the lock pins.
Install the camshaft holder, gasket and nut onto the cylinder head.
Tighten the cylinder head nuts. (4 nuts)
At first, tighten the 4 nuts on the cylinder top and then tighten the 2 bolts on the left side of cylinder head.
Torque value: 1.8~2.2 kgf-m
Install the spark plug and tighten it.
Torque value: 1.0~1.4 kgf-m

Caution

- Apply with oil onto the thread of cylinder head bolts and tighten the bolts in diagonally for 2-3 sequences.
- Do not over tightening the bolts to avoid the cylinder head deformation, noise created or leaking so that effects motorcycle's performance.

VALVE CLEARANCE ADJUSTMENT

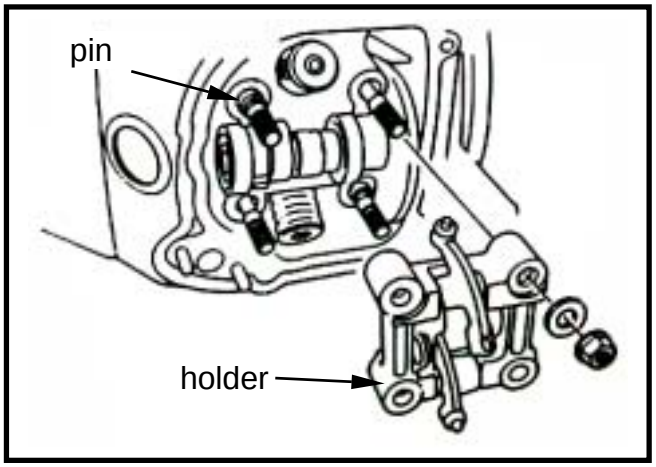
Loosen valve clearance adjustment nuts and bolts located on valve rocker arm.
Measure and adjust valve clearance with feeler gauge.
After valve clearance had been adjusted to standard value, hold adjustment bolt and then tighten the adjustment nut.
Standard Value: IN/EX 0.03/0.05±0.02mm
With flat screwdriver, turn the cam sprocket adjuster in counter-clockwise motion so that the adjuster is pushed out to contact the cam chain plate tightly. Apply with oil onto a new O-ring and then install it onto the adjuster hole. Tighten the bolt cap of the adjuster adjustment hole.

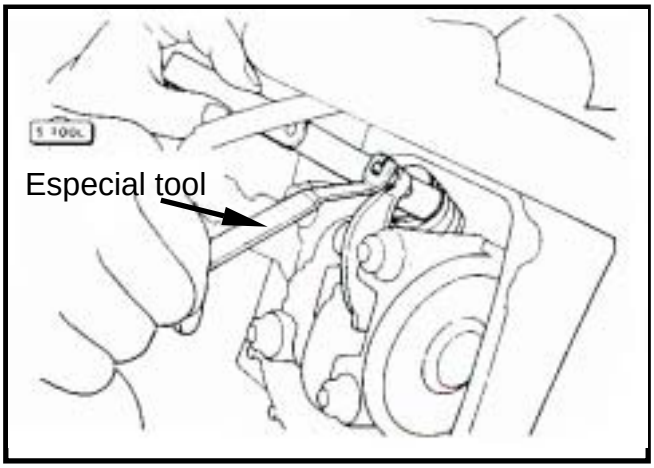
Caution

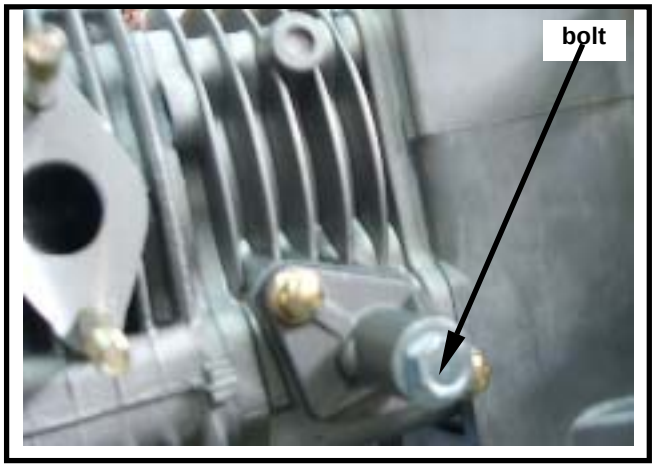
The O-ring must be installed into glove.

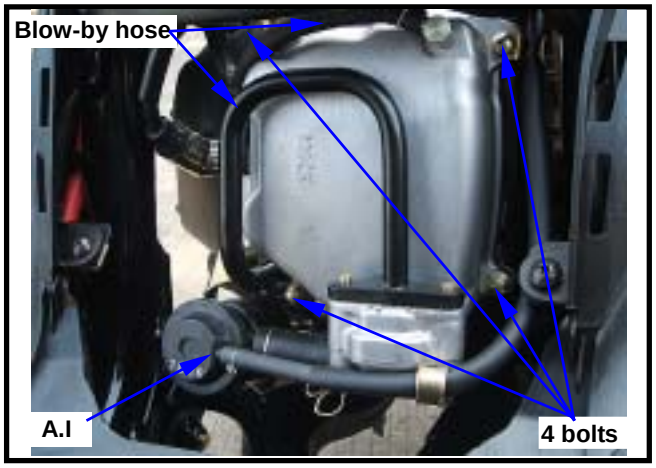
Replace the O-ring of the cylinder head with new one. Install the cylinder head.

Tighten the cylinder head lock bolts.
Connect the blow-by hose onto the cylinder head.
Tighten the 2nd air injection (AI) nut.
Install the engine onto the engine frame. (Refer to Chapter 5)

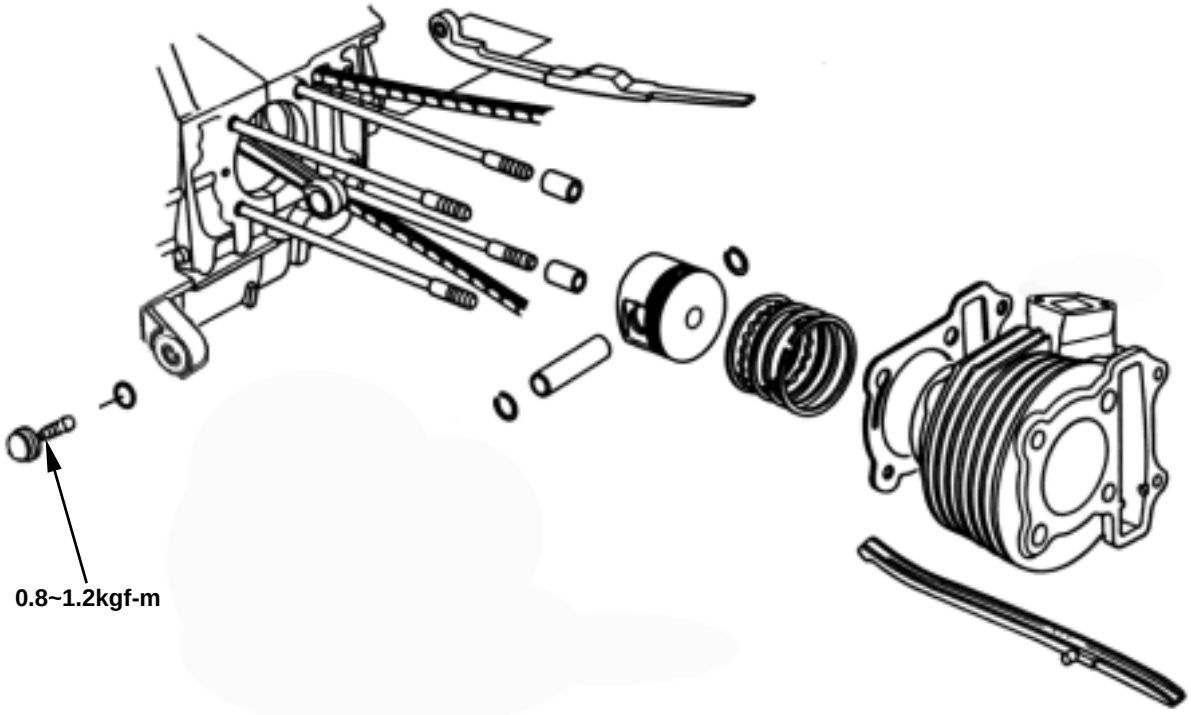








MECHANISM DIAGRAM



PRECAUTIONS IN OPERATION

General Information

- Both cylinder and piston service cannot be carried out when engine mounted on frame.

Specification **unit: mm**

Item			Standard	Limit
Cylinder	ID		39.00	-
	Bend/wrap age		—	0.050
	Roundness		0.005	0.050
	Cylindrical		0.005	0.050
Piston/ Piston ring	Clearance between piston rings	Top ring	0.025~0.060	0.090
		2nd ring	0.015~0.050	0.090
	Ring-end gap	Top ring	0.200~0.400	0.500
		2nd ring	0.250~0.400	0.650
		Oil ring	0.200~0.700	-
	OD of piston		38.970~38.990	-
	Clearance between piston and cylinder		0.025~0.040	0.100
	ID of piston pin hole		13.002~13.008	13.040
OD of piston pin			12.994~13.000	12.980
Clearance between piston and piston pin			0.002~0.014	0.018
ID of connecting rod small-end			13.005~13.020	13.040

TROUBLE DIAGNOSIS

Low Or Unstable Compression Pressure
Cylinder or piston ring worn out.
Compress pressure to high.
Too much carbon deposited in combustion chamber and piston.

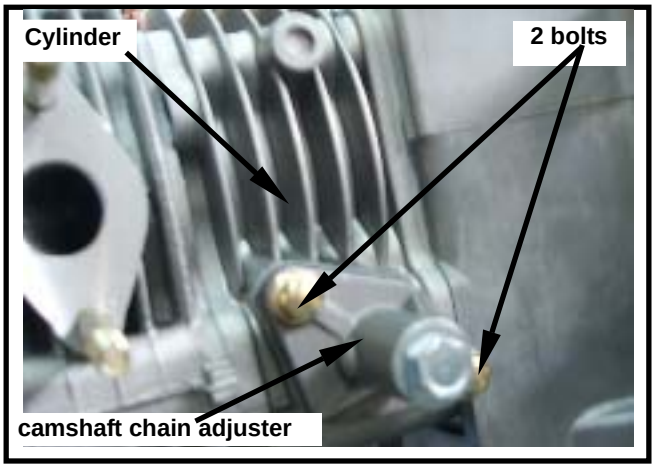
Knock or Noise
Cylinder or piston ring worn out.
Carbon deposits on cylinder head top-side.
Piston pin hole and piston pin wear out.

Smoking in Exhaust Pipe
Piston or piston ring worn out.
Piston ring installation improperly.
Cylinder or piston damage.

Engine Overheat
Carbon deposits on cylinder head top side.

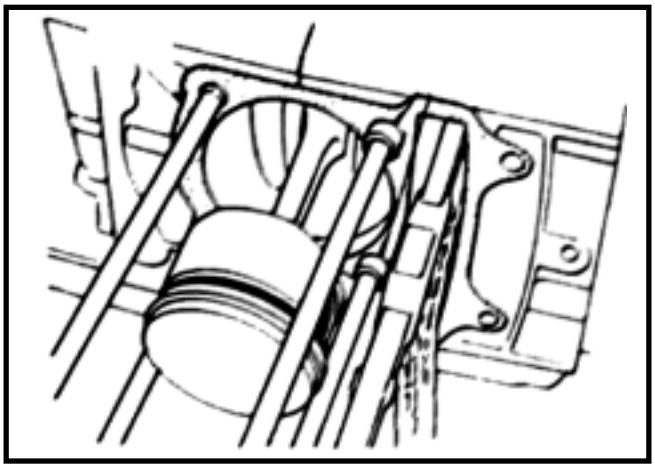
CYLINDER REMOVAL

Remove cylinder head. (refer to chapter 6)
Remove 2 bolts and then take out the cam chain auto-adjuster.



Remove cam chain plate.
Remove cylinder.

Remove cylinder gasket and lock pins

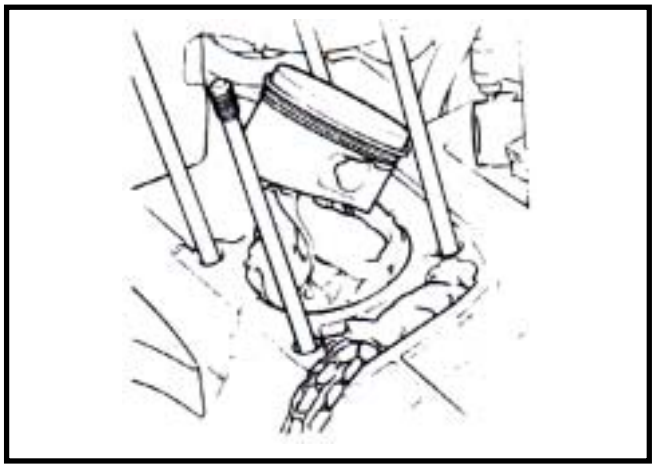


Clean the residues attached onto the matching surfaces of cylinder and crankcase.

Cover the holes of crankcase and cam chain with a piece of cleaning cloth.
Clean up all residues or foreign materials from the two matching surfaces of cylinder and crankcase.

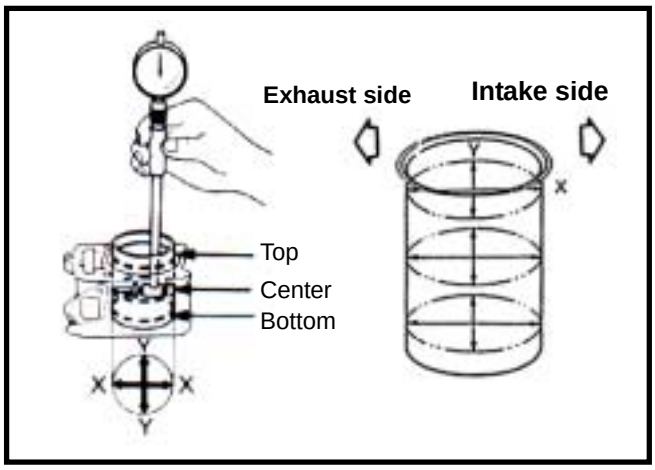
⚠ Caution

To soap the residues into solvent so that the residues can be removed more easily.

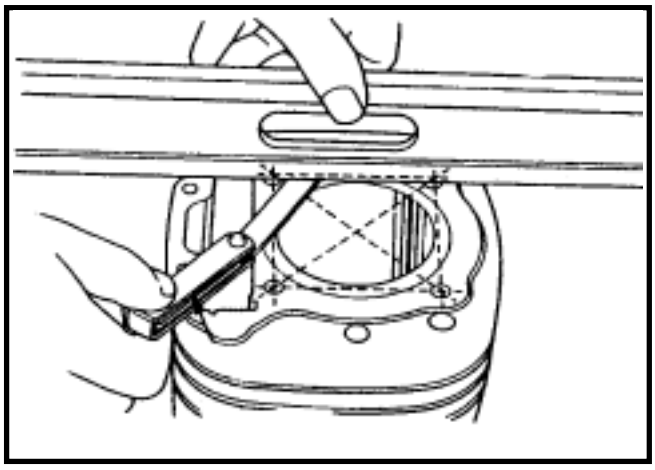


INSPECTION

Check if the inner diameter of cylinder is worn out or damaged.
In the 3 positions (top, center and bottom) of cylinder, measure the X and Y direction values respective in the cylinder.
Service limit: 39.047mm
Calculate both the real roundness (the difference between X and Y motion values) and the cylindrical roundness (the difference in the top, center or bottom positions of X or Y motion values.). Then, determinate by the max. value.
Service limit
Real roundness: correct or replace as over 0.05 mm
Cylindrical roundness: correct or replace as over 0.05 mm

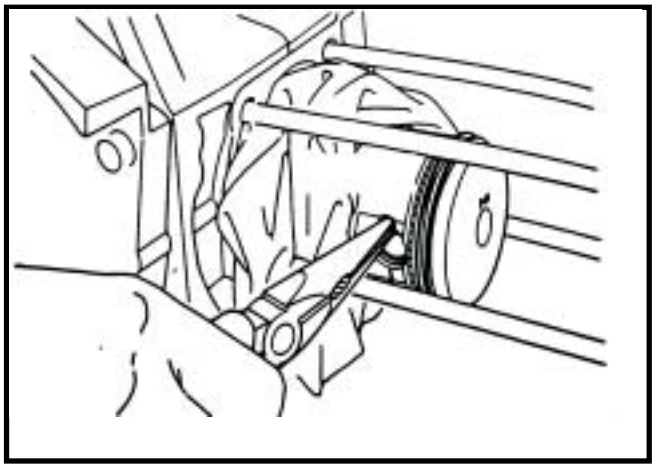


Check Cylinder flat.
Service limit: correct or replace as over 0.05 mm



PISTON REMOVAL

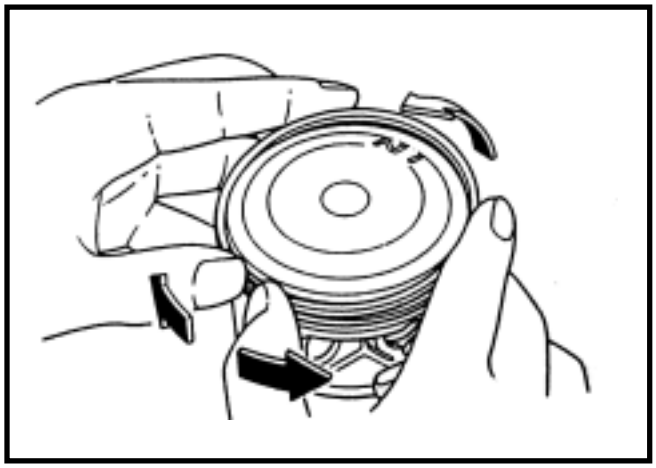
Plug crankcase opening with a cleaning cloth to prevent from piston pin snap ring or other parts falling into crankcase when disassembling.
Hold another snap ring with pliers.
Push out the piston pin from the side that not removed the snap ring.



Remove piston rings.

Caution

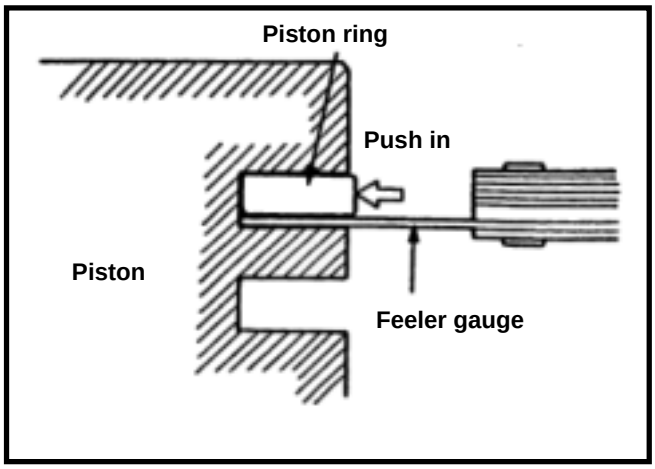
Pay attention to remove piston rings because they are fragile.



Disassemble the piston rings.
Check if the piston rings are damaged or its grooves are worn.
Cleaning the carbon in piston ring grooves.

Install the piston rings and then measure clearance between piston ring and its grooves.

Service Limit: Top ring: replace if over 0.09mm
2nd ring: replace if over 0.09mm

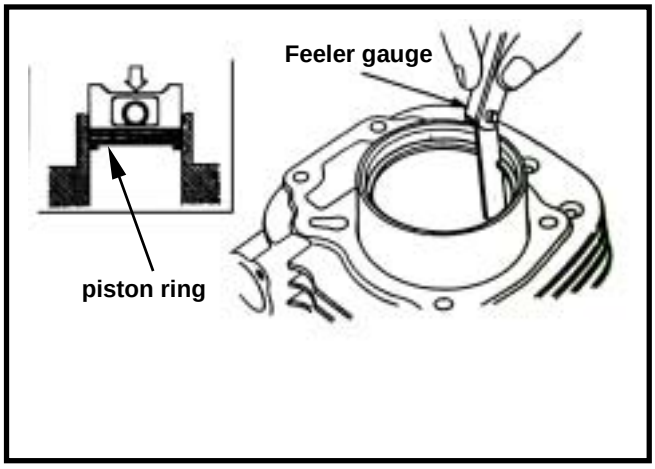


Take out the piston rings and place them respective into cylinder below 20mm of cylinder top. Measure each piston ring gaps.

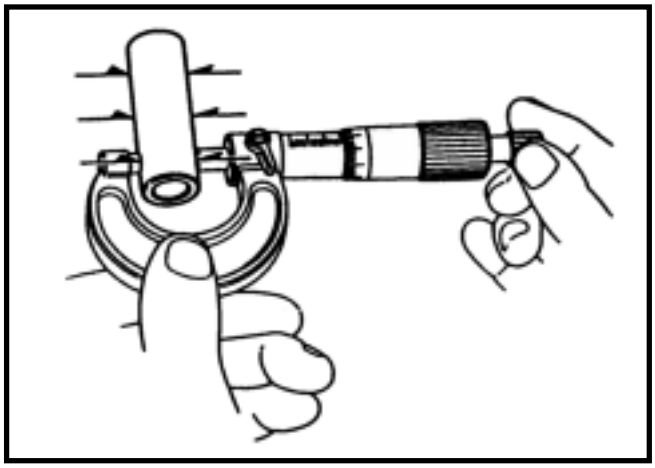
Caution

Push the piston rings into cylinder with piston top-end in parallel motion.

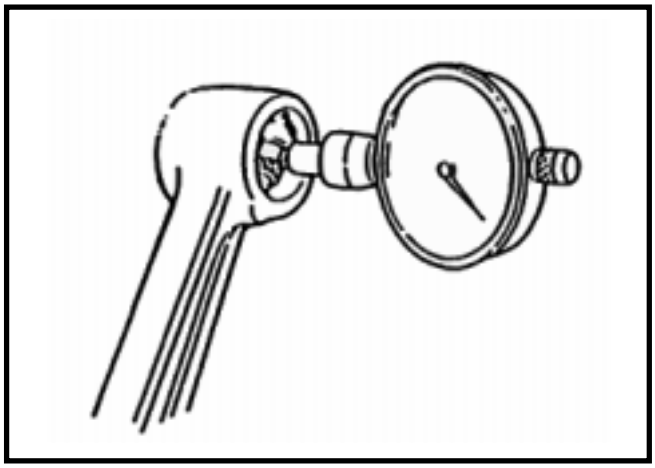
Service Limit: Top ring: replace if over 0.50mm
2nd ring: replace if over 0.650mm



Measure the outer diameter of piston pin.
Service Limit: 12.980mm

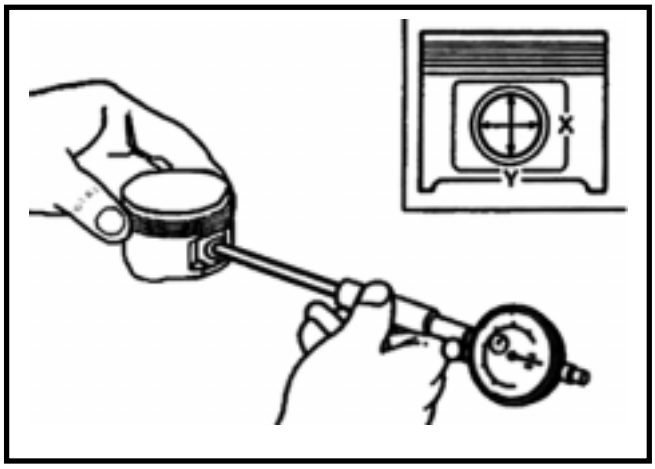


Measure the inner diameter of connecting rod small end.
Service Limit: 13.020mm



Measure the inner diameter of piston pin hole.
Service Limit: 13.040mm

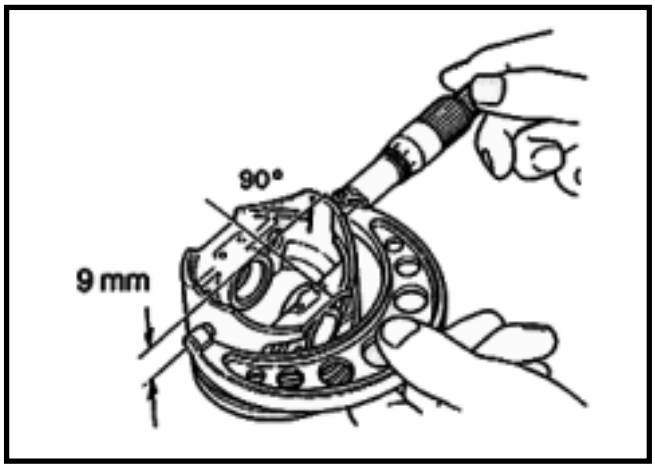
Calculate clearance between piston pin and its hole.
Service Limit: 0.02mm



Measure piston outer diameter.

⚠ Caution

The measurement position is 10 mm distance from piston bottom side, and 90° to piston pin.



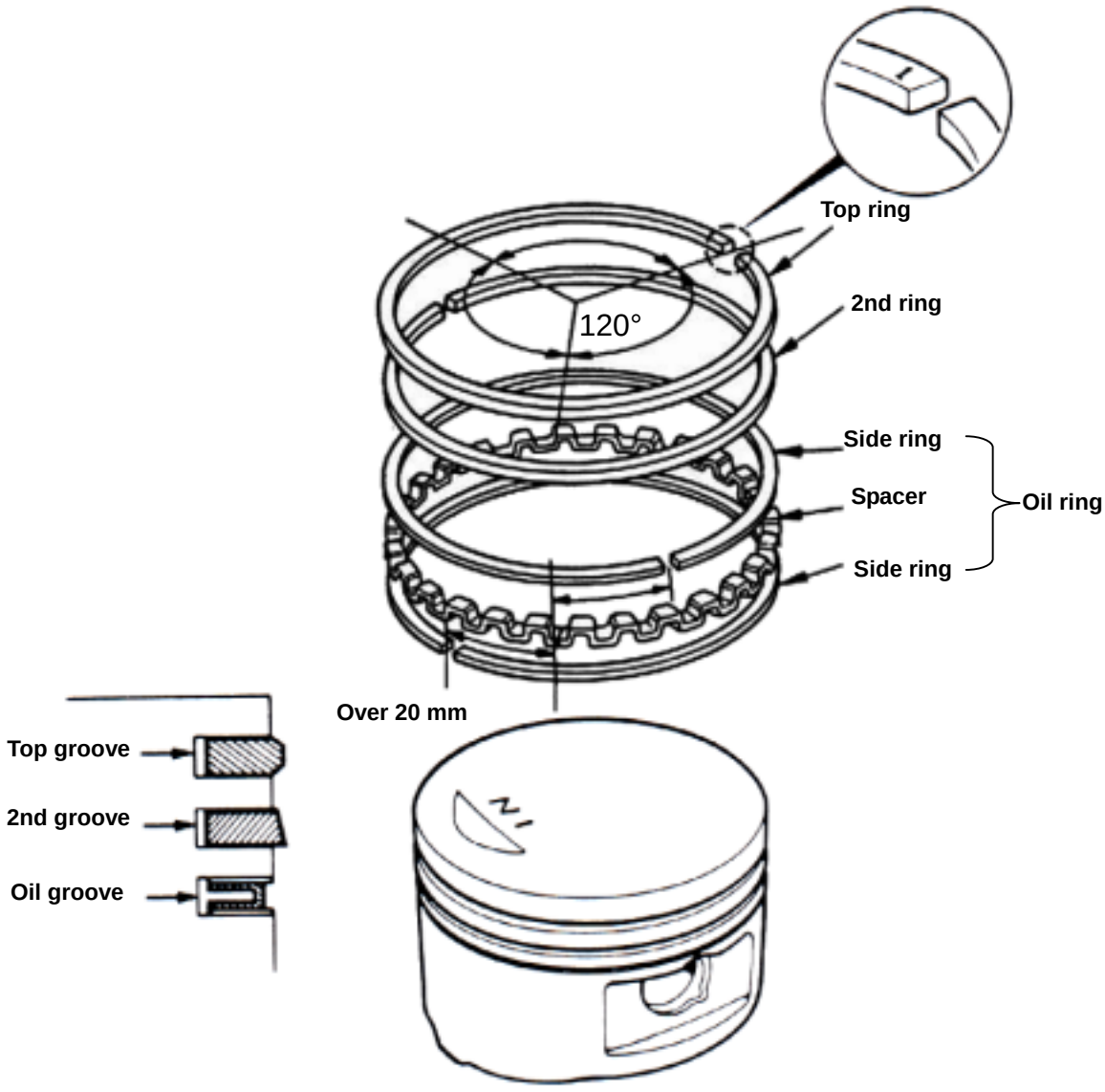
Service limit: 38.970mm
Compare measured value with service limit to calculate the clearance between piston and cylinder.

PISTON RING INSTALLATION

Clean up piston top, ring groove, and piston skirt.
Install the piston ring onto piston carefully.
Place the openings of piston ring as diagram shown.

Caution

- Do not damage piston and piston rings as installation.
- All marks on the piston rings must be forwarded to up side.
- Make sure that all piston rings can be rotated freely after installed.

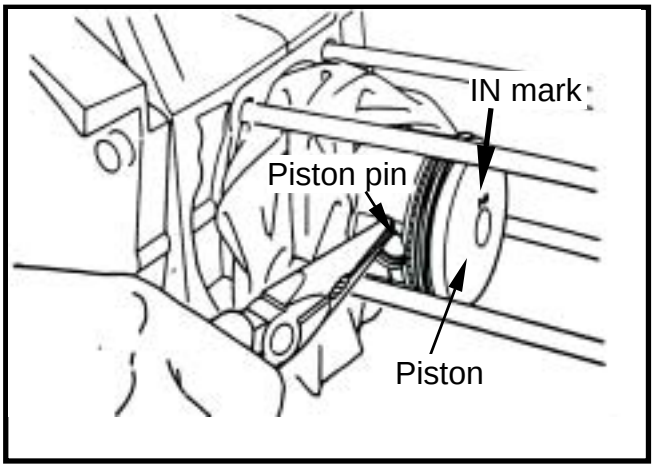


PISTON INSTALLATION

Install piston and piston pin, and place the IN mark on the piston top side forward to intake valve.
Install new piston pin snap ring.

Caution

- Do not let the opening of piston pin snap ring align with the opening piston ring.
- Place a piece of cleaning cloth between piston skirt section and crankcase in order to prevent snap ring from falling into crankcase as operation.

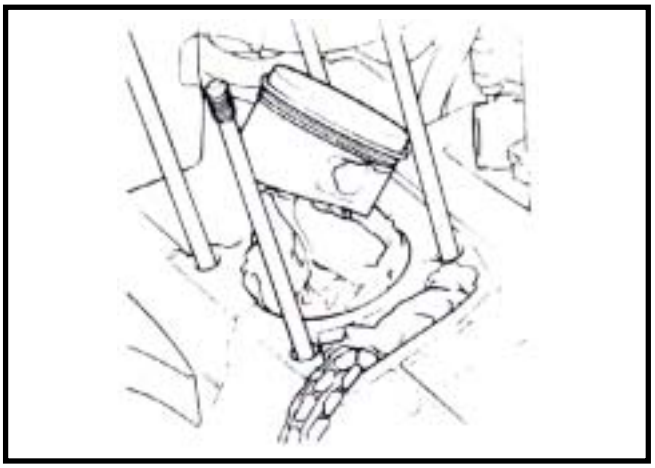


CYLINDER INSTALLATION

Clean up all residues and foreign materials on the matching surface of crankcase.
Pay attention to not let these residues and foreign materials fall into crankcase.

Caution

To soap the residues into solvent so that the residues can be removed more easily.

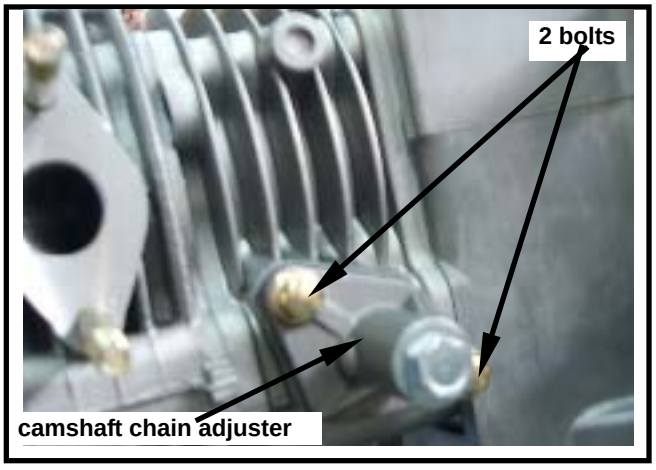


Install 2 lock pins and new gasket.

Coat engine oil to inside of cylinder, piston and piston rings.
Care to be taken when installing piston into cylinder. Press piston rings in one by one as installation.

Caution

Do not push piston into cylinder forcefully because this will cause the piston and the piston rings to be damaged.



Install the cam chain plate, the cylinder gasket and lock pins.
Install cylinder head. (refer to Chapter 6)
Install the cam chain auto-adjuster. (2 bolts)