



HONDA
CB650

6. CYLINDER HEAD/VALVE

73

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SERVICE INFORMATION

GENERAL INSTRUCTIONS

- All cylinder head maintenance and inspection can be accomplished without removing the engine.
- During assembly, apply molybdenum disulfide grease to the camshaft bearing to provide initial lubrication.

SPECIAL TOOLS

Special Tools

Valve Guide Reamer	07984-2000000
Cylinder Head Bolt Wrench	07906-3230000

Common Tools

Valve Guide Remover (5.5 mm)	07742-0010100
Valve Guide Driver (B)	07742-0020200
Valve Spring Compressor	07757-0010000

TORQUE VALUES

Cylinder head cover	0.8-1.2 kg-m (6-9 ft-lb)
Valve adjusting nut	1.2-1.6 kg-m (9-12 ft-lb)
Rocker arm shaft cotter pin	1.0-1.4 kg-m (7-10 ft-lb)
Rocker arm shaft cap bolt	0.9-1.2 kg-m (6-9 ft-lb)
Cylinder head bolt: 8 mm	2.4-3.0 kg-m (17-22 ft-lb)
6 mm	1.0-1.4 kg-m (7-10 ft-lb)
Spark plug	1.2-1.6 kg-m (9-12 ft-lb)
Cam sprocket	1.4-1.8 kg-m (10-13 ft-lb)
Cam chain tensioner	1.0-1.4 kg-m (7-10 ft-lb)


SPECIFICATIONS

			STANDARD	SERVICE LIMIT
Compression pressure			12 ± 2 kg/cm ² (170 ± 28 psi)	—
Camshaft	Cam height	IN	35.627–35.787 mm (1.4026–1.4089 in)	35.6 mm (1.40 in)
		EX	35.314–35.474 mm (1.3903–1.3966 in)	35.3 mm (1.39 in)
	Runout		—	0.1 mm (0.004 in)
	End clearance		0.035–0.050 mm (0.0013–0.0020 in)	0.1 mm (0.004 in)
	Oil clearance		0.160–0.202 mm (0.0063–0.0080 in)	0.21 mm (0.008 in)
Rocker arm	Rocker arm I. D.		12.000–12.018 mm (0.4724–0.4731 in)	12.05 mm (0.474 in)
	Shaft O. D.		11.973–11.984 mm (0.4714–0.4718 in)	11.94 mm (0.470 in)
Valve	Valve stem O. D.	IN	5.475–5.490 mm (0.2156–0.2161 in)	5.47 mm (0.215 in)
		EX	5.455–5.470 mm (0.2148–0.2154 in)	5.45 mm (0.214 in)
	Valve guide I. D.		5.500–5.515 mm (0.2165–0.2171 in)	5.55 mm (0.219 in)
	Stem-to-guide clearance	IN	0.010–0.040 mm (0.0004–0.0016 in)	0.08 mm (0.003 in)
		EX	0.030–0.050 mm (0.0012–0.0020 in)	0.10 mm (0.004 in)
	Valve stem runout		—	0.05 mm (0.002 in)
	Valve length	IN	90.2 mm (3.55 in)	89.7 mm (3.53 in)
		EX	88.7 mm (3.49 in)	88.0 mm (3.47 in)
Valve spring	Valve seat width		1.2 mm (0.05 in)	1.5 mm (0.06 in)
	Free length	Inner	39.2 mm (1.54 in)	37.9 mm (1.49 in)
		Outer	44.8 mm (1.77 in)	43.3 mm (1.70 in)
	Preload /length	Inner	21.85–25.15 kg/25.9 mm (48.17–48.83 lb/1.02 in)	20.8 kg/25.9 mm (45.9 lb/1.02 in)
		Outer	50.22–57.78 kg/30.6 mm (110.7–123.0 lb/1.20 in)	47.2 kg/30.6 mm (1.40 lb/1.20 in)
Cylinder head	Warpage		—	0.25 mm (0.010 in)

TROUBLESHOOTING

Engine top-end problems usually affect engine performance. These can be diagnosed by a compression test, or by tracing noises to the top-end with a sounding rod or stethoscope.

Low compression
1. Valves

- Incorrect valve adjustment
- Burned or bent valves
- Incorrect valve timing
- Broken valve spring

2. Cylinder head

- Leaking or damaged head gasket
- Warped or cracked cylinder head

3. Cylinder and piston (Refer to Section 7.)
Compression too high

1. Excessive carbon build-up on piston or combustion chamber

Excessive noise

1. Incorrect valve adjustment
2. Sticking valve or broken valve spring
3. Damaged or worn camshaft
4. Loose or worn cam chain
5. Worn or damaged cam chain tensioner
6. Worn cam sprocket teeth
7. Worn rocker arm and/or shaft

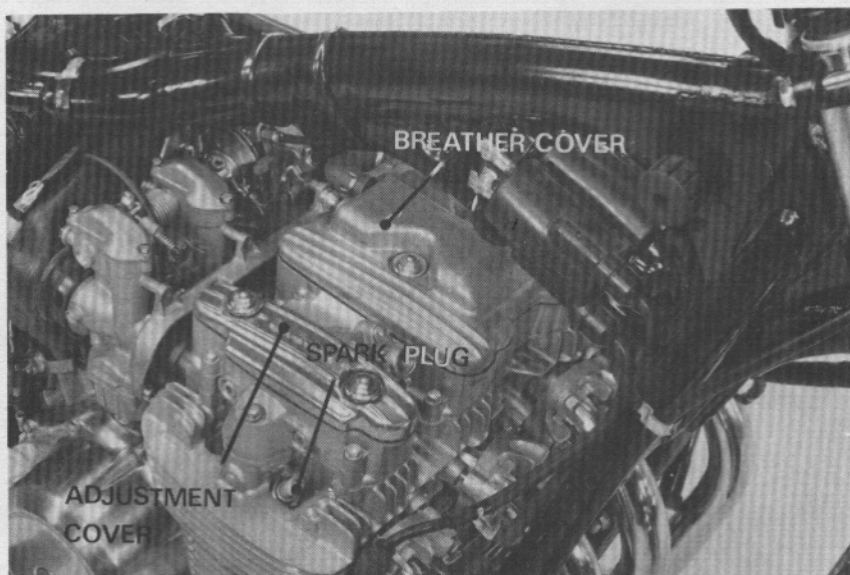


CYLINDER HEAD COVER REMOVAL

Disconnect the tachometer cable.
Disconnect the breather tube.
Remove the spark plug caps.



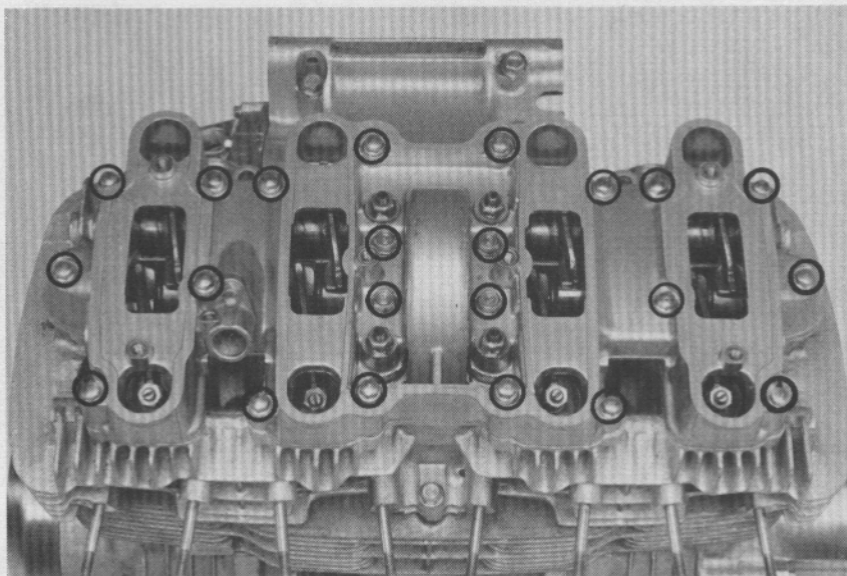
Remove the spark plugs.
Remove the right and left adjustment covers and breather cover.



Loosen the cylinder head cover bolts evenly and remove the cylinder head cover.

CAUTION

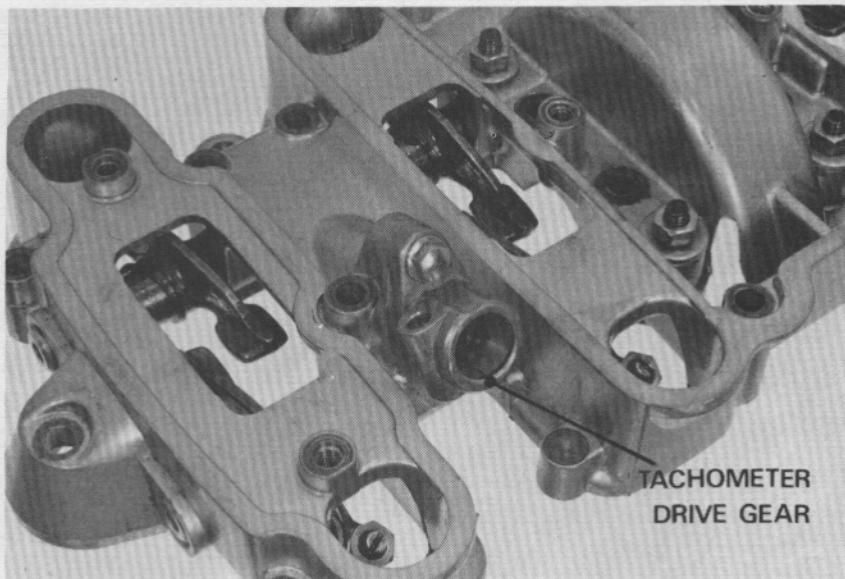
Remove the bolts in 2-3 steps in a crisscross pattern to prevent warpage.



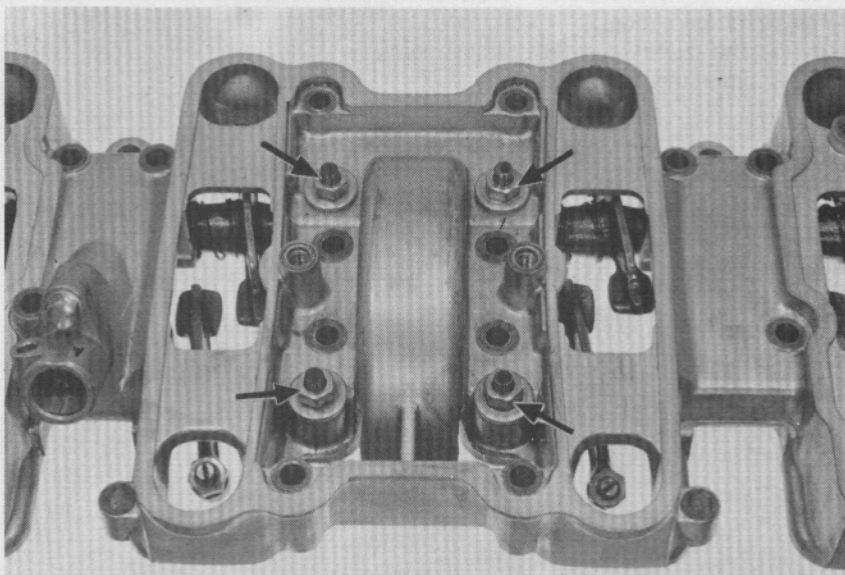


CYLINDER HEAD COVER DISASSEMBLY

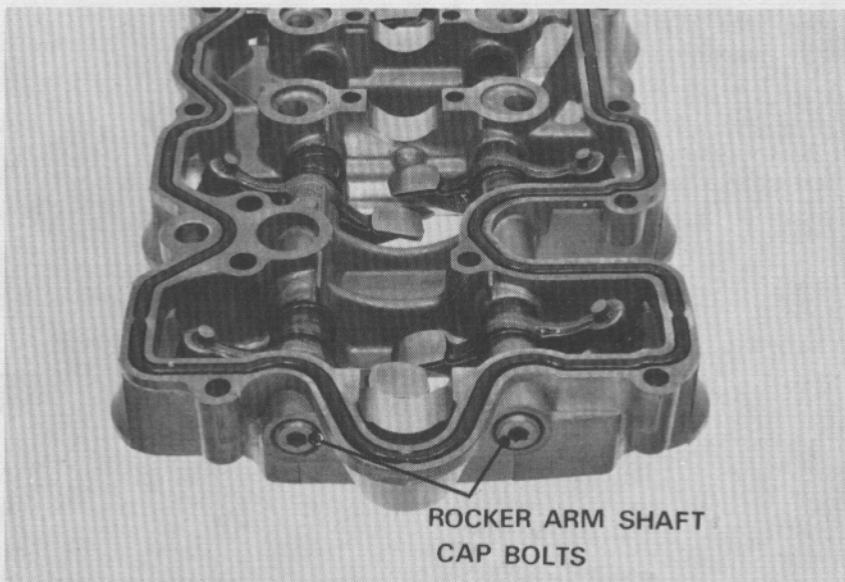
Remove the tachometer drive gear attaching bolt and drive gear.



Remove the rocker arm shaft cotter pin nuts.
Drive the cotter pins out.



Remove the rocker arm shaft cap bolts.



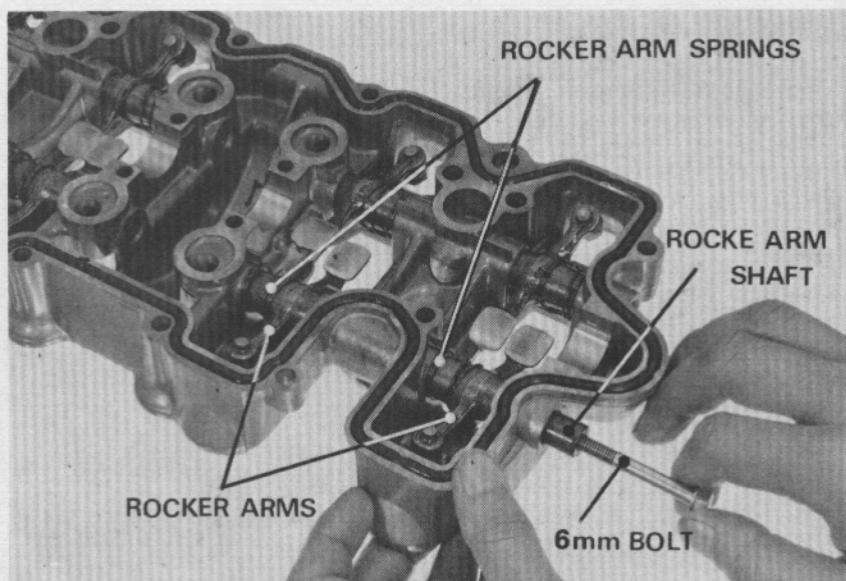


Screw a 6 mm bolt in the rocker arm shaft and pull the rocker arm shaft out.

Remove the rocker arms and springs.

NOTE

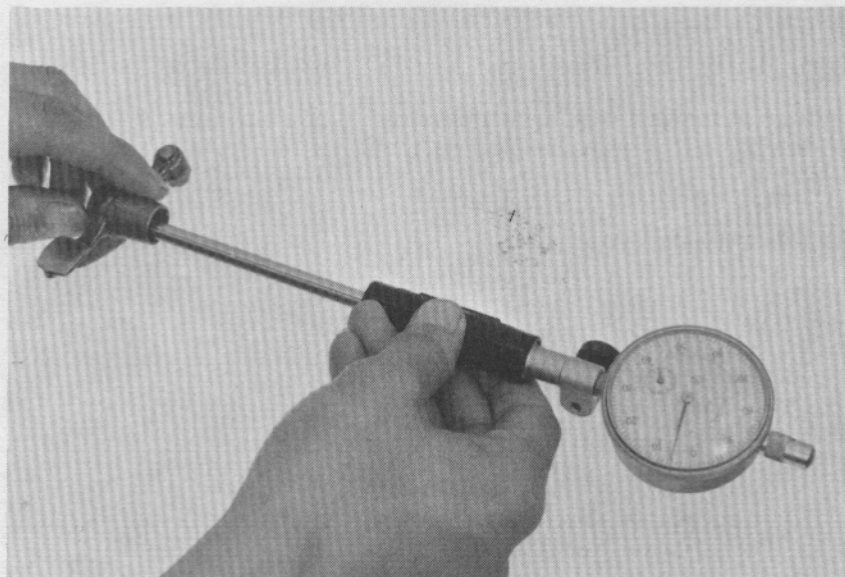
Mark all disassembled parts to ensure correct assembly.



ROCKER ARM BORE I. D. MEASUREMENT

Measure rocker arm bore I. D.

SERVICE LIMIT: 12.05 mm (0.474 in)



ROCKER ARM SHAFT O. D. MEASUREMENT

Measure rocker arm shaft O. D.

SERVICE LIMIT: 11.94 mm (0.470 in)





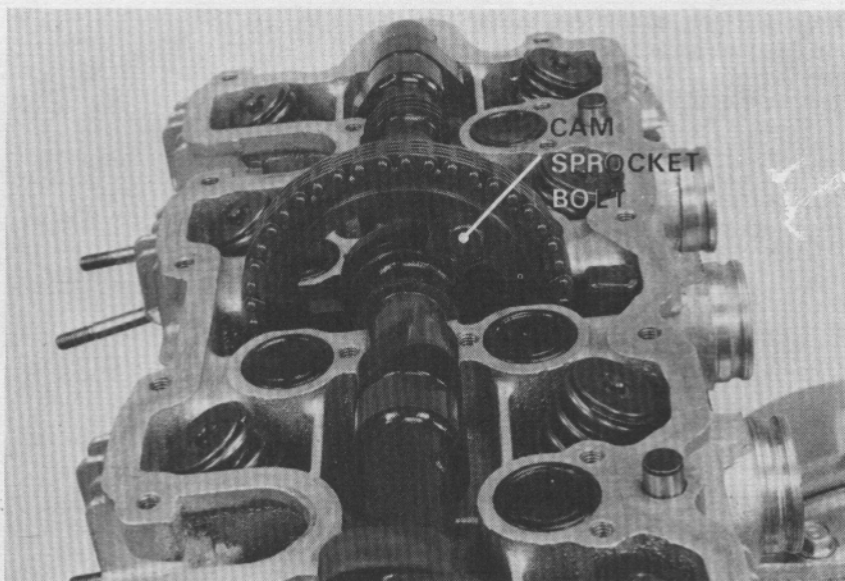
CAMSHAFT REMOVAL

Remove the pulser generator cover.
 Remove one cam sprocket bolt.

Turn the crankshaft clockwise and remove the other cam sprocket bolt.

NOTE

Do not allow bolts to fall into the crankcase.

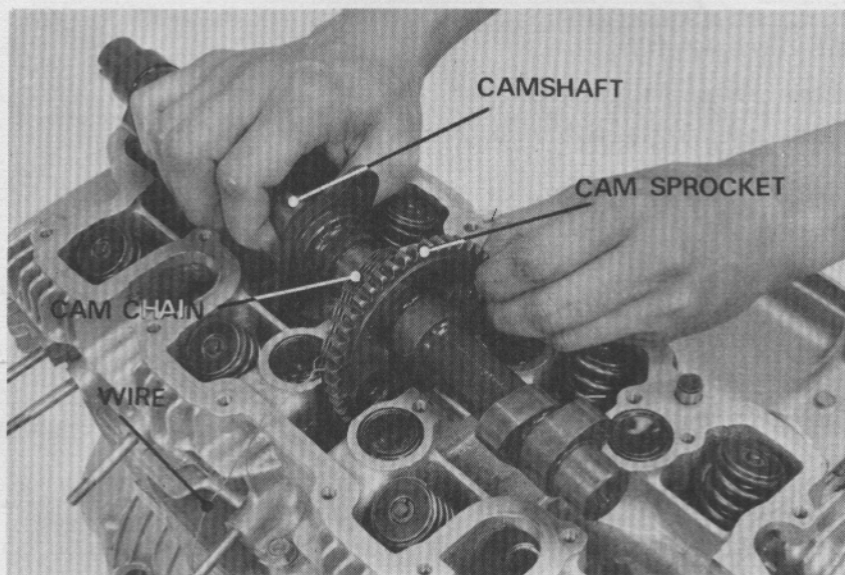


Remove the camshaft.

NOTE

Suspend the cam chain with a piece of wire to keep it from falling into the engine.

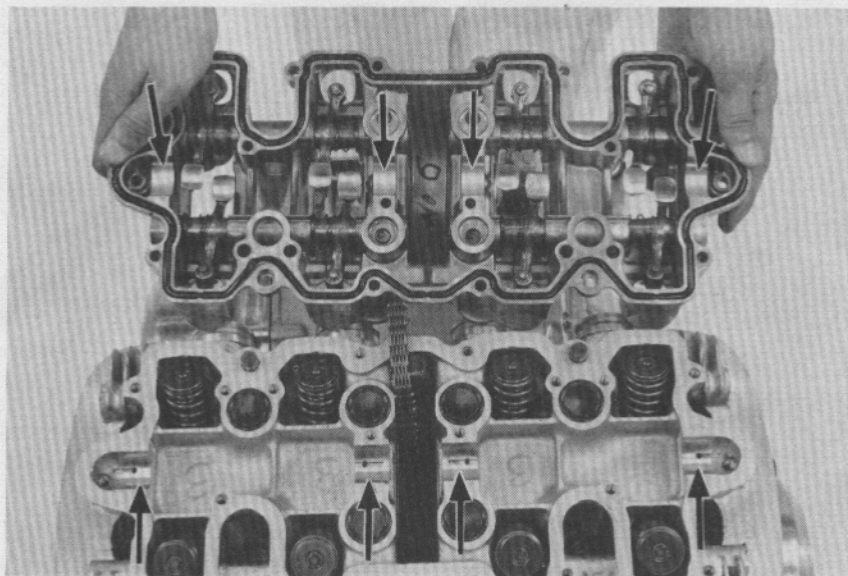
Remove the cam sprocket.



CAM BEARING SURFACE INSPECTION

Inspect the cam bearing surfaces for scoring, scratches, or evidence of insufficient lubrication.

Inspect the bearing surface of the camshaft holders.



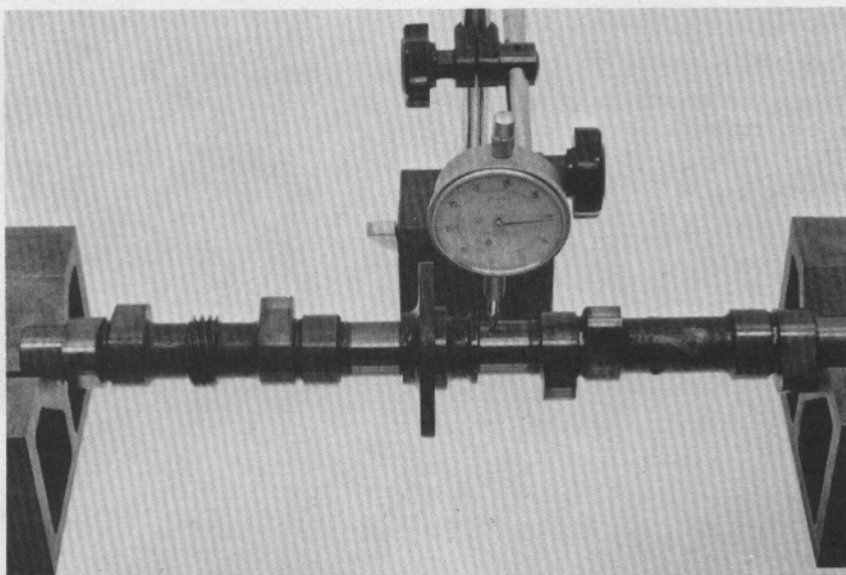


CAMSHAFT RUNOUT

Check the camshaft runout with a dial indicator.

Support both ends of the camshaft with V-blocks.

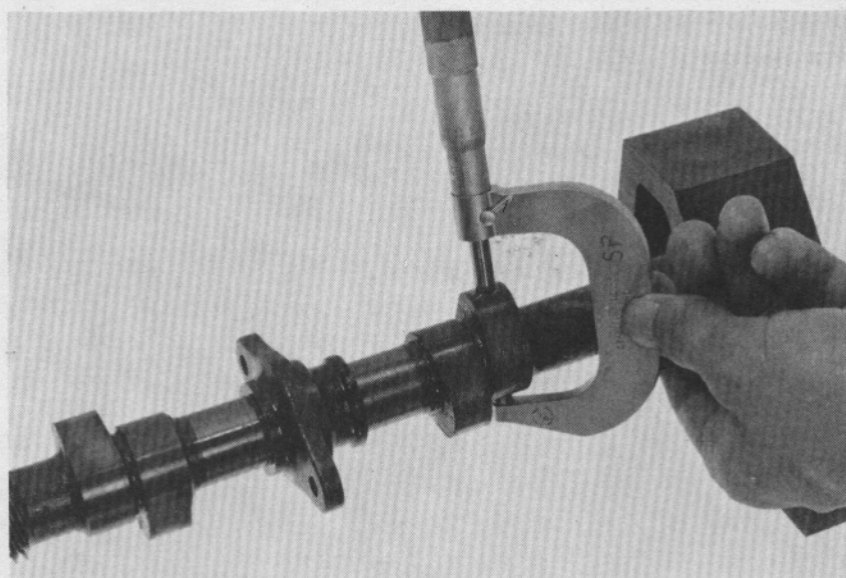
SERVICE LIMIT: 0.1 mm (0.004 in)



CAMSHAFT LOBE INSPECTION

Using a micrometer, measure each cam lobe. Check for wear or damage.

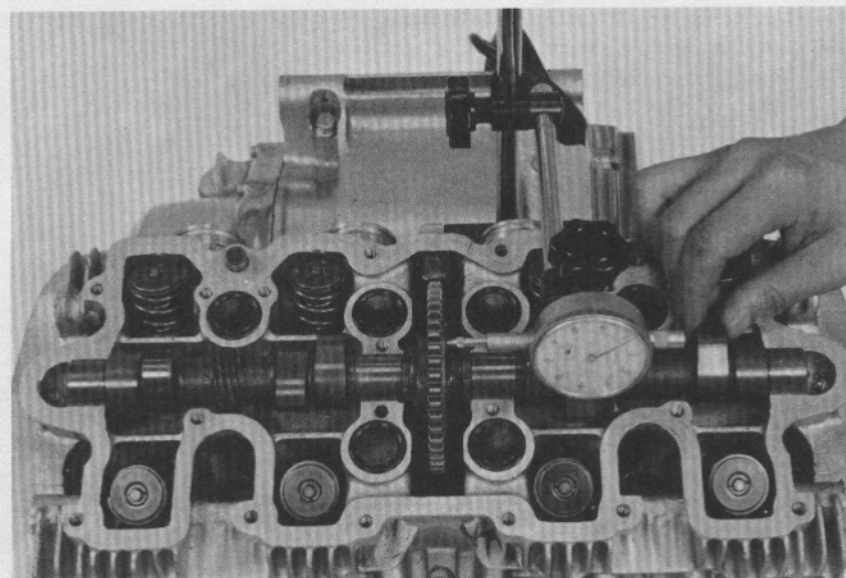
SERVICE LIMITS: IN: 35.6 mm (1.40 in)
EX: 35.3 mm (1.39 in)



CAMSHAFT END CLEARANCE

Using a dial indicator, measure camshaft end clearance.

SERVICE LIMIT: 0.1 mm (0.004 in)

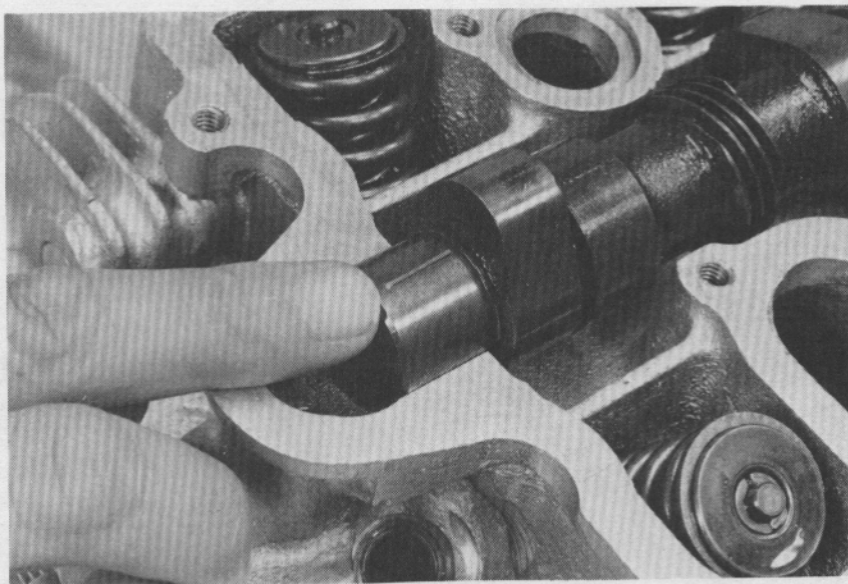




CAMSHAFT OIL CLEARANCE

Wipe off any oil from the journals.

Lay a strip of plastigauge lengthwise on top of each camshaft journal.

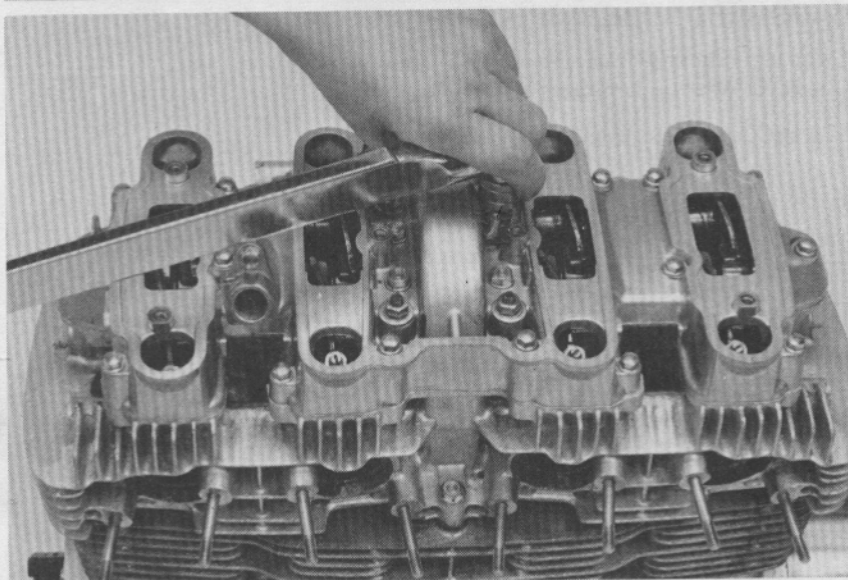


Install the cylinder head cover, and tighten in a crisscross pattern.

NOTE

Do not rotate the camshaft when using plastigauge.

TORQUE: 0.8–1.2 kg-m (6–9 ft-lb)

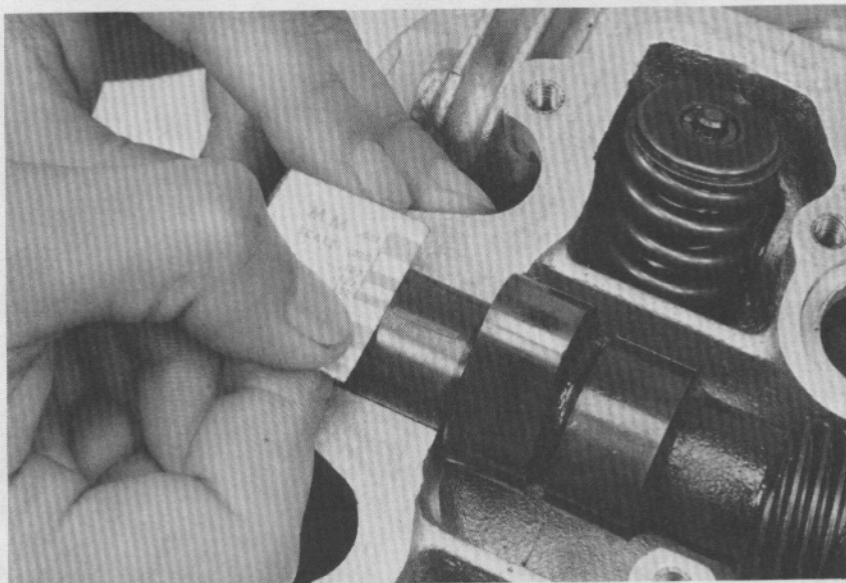


Remove the cylinder head cover and measure the width of each plastigauge. The widest part determines the oil clearance.

SERVICE LIMIT: 0.21 mm (0.008 in)

If the service limits are exceeded, replace the camshaft and recheck the oil clearance.

Replace the cylinder head and cylinder head cover if the clearance still exceeds service limits.





CYLINDER HEAD REMOVAL

Remove the carburetor assembly (Page 4-2).
Remove the exhaust system (Page 5-3).
Remove the cylinder head cover.
Remove the six rubber seals.

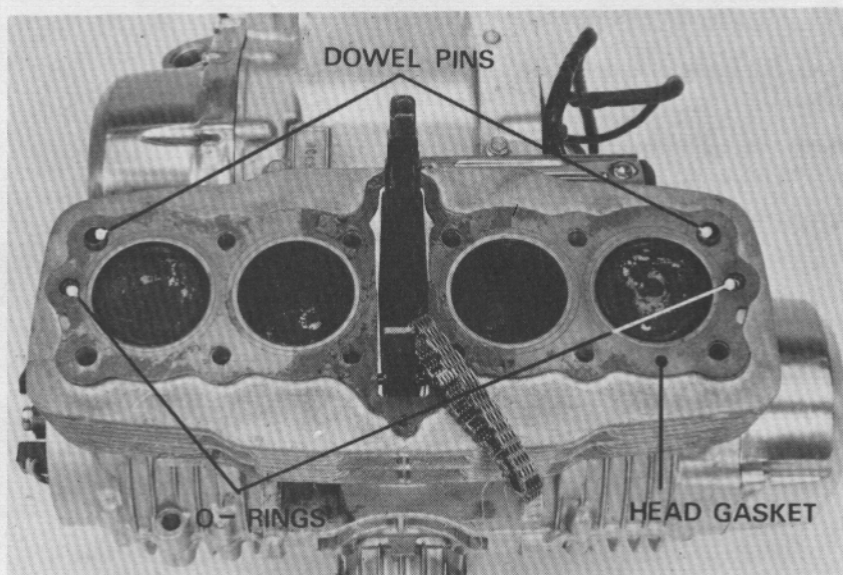
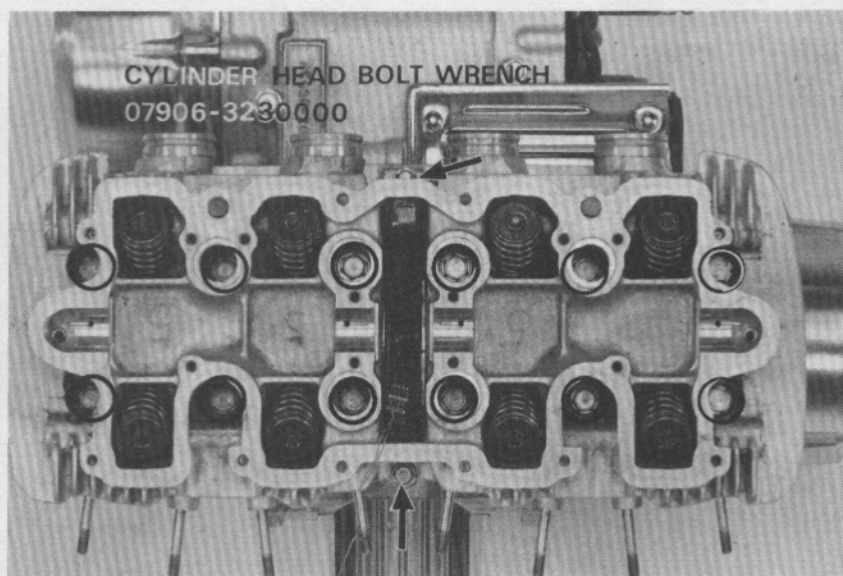
Remove the cam chain tensioner set bolt.
Remove the 14 cylinder head bolts.

NOTE

Remove the bolts in 2-3 steps in a criss-cross pattern to prevent warpage.

Remove the cylinder head.

Remove the cylinder head gasket, dowel pins and O-rings.



CYLINDER HEAD DISASSEMBLY

Remove the valve spring cotters, retainers, springs and valves.

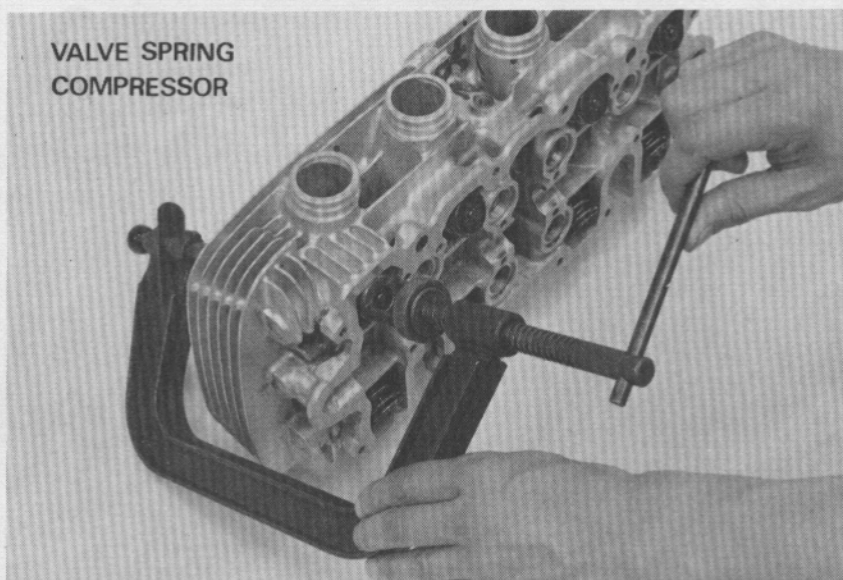
CAUTION

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

NOTE

Mark all disassembled parts to ensure original assembly.

Remove the valve stem seals.



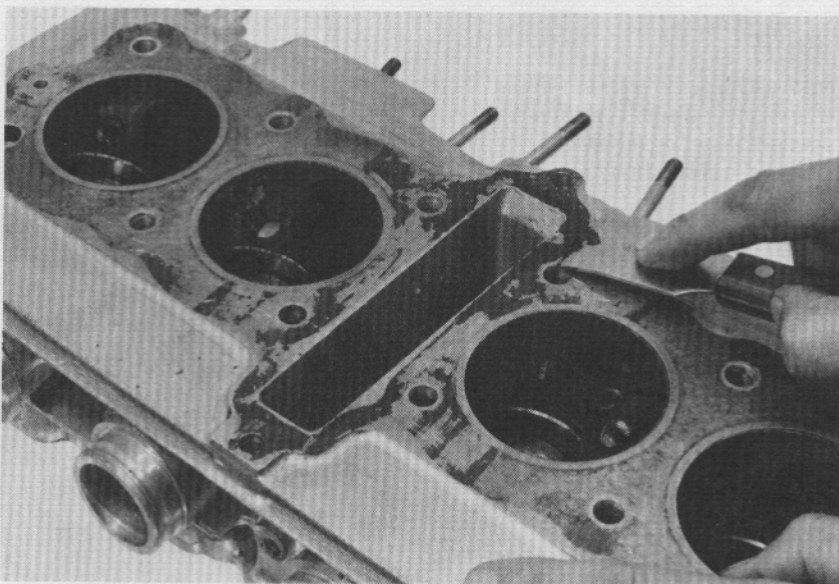


Remove the carbon deposits from the combustion chamber.

Clean off the head gasket surfaces.

NOTE

- Avoid damaging the gasket surfaces.
- The gasket will come off easier if soaked in solvent.

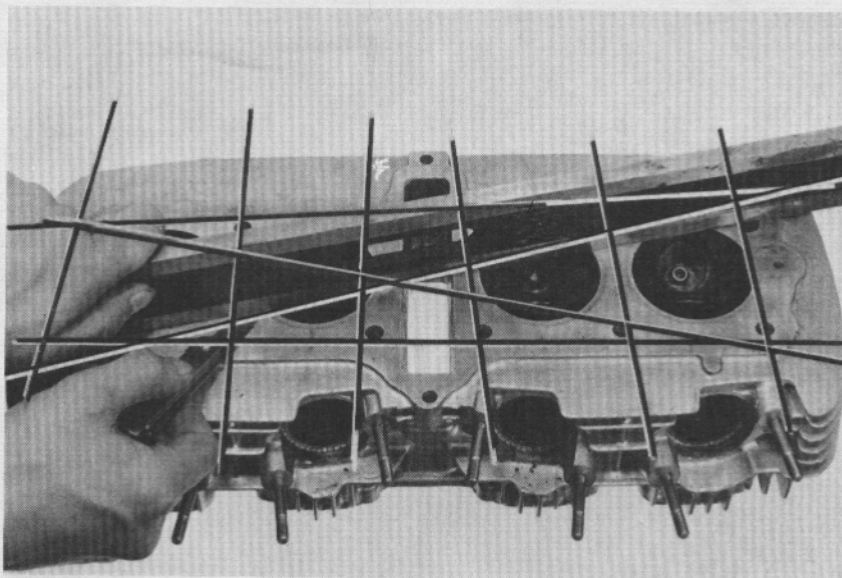


CYLINDER HEAD INSPECTION

Check the spark plug holes and valve areas for cracks.

Check the cylinder head for warpage with a straight edge and a feeler gauge.

SERVICE LIMIT: 0.25 mm (0.010 in)

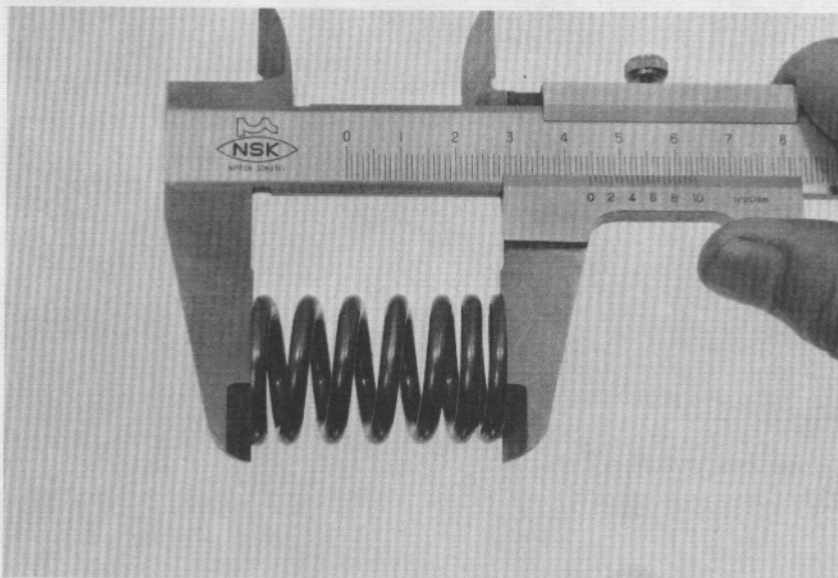


VALVE SPRING FREE LENGTH INSPECTION

Measure the length of the inner and outer valve springs.

SERVICE LIMITS:

Inner: IN., EX. 37.9 mm (1.49 in)
 Outer: IN., EX. 43.3 mm (1.70 in)





VALVE STEM-TO-GUIDE CLEARANCE

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

Check valve movement in the guide.

Measure and record each valve stem O. D.

SERVICE LIMITS:

IN: 5.47 mm (0.215 in)

EX: 5.45 mm (0.214 in)

Measure valve stem runout.

SERVICE LIMIT: 0.05 mm (0.002 in)

Measure the valve length.

SERVICE LIMITS: IN. 89.7 mm (3.53 in)

EX. 88.0 mm (3.47 in)

NOTE

Ream the guides to remove any carbon build-up before checking clearance.

Measure and record each valve guide I. D. using a ball gauge or inside micrometer.

SERVICE LIMITS: IN. 5.55 mm (0.219 in)

EX. 5.55 mm (0.219 in)

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

SERVICE LIMITS: IN. 0.08 mm (0.003 in)

EX. 0.10 mm (0.004 in)

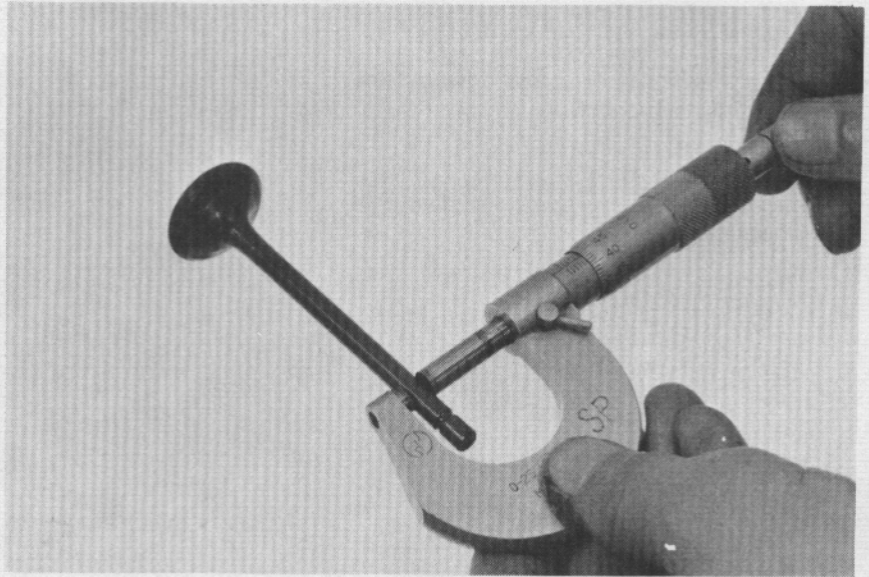
NOTE

If the stem-to-guide clearance exceeds the service limits, determine if a new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guides as necessary and ream to fit.

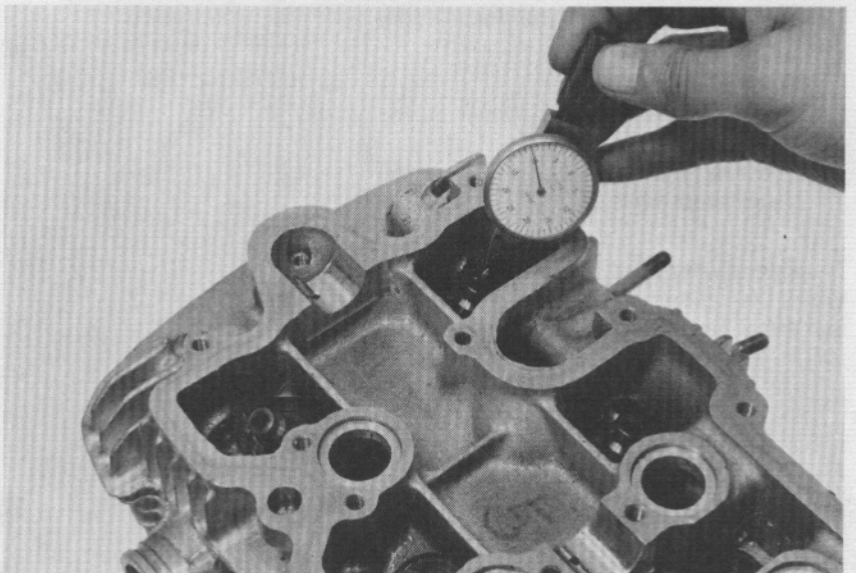
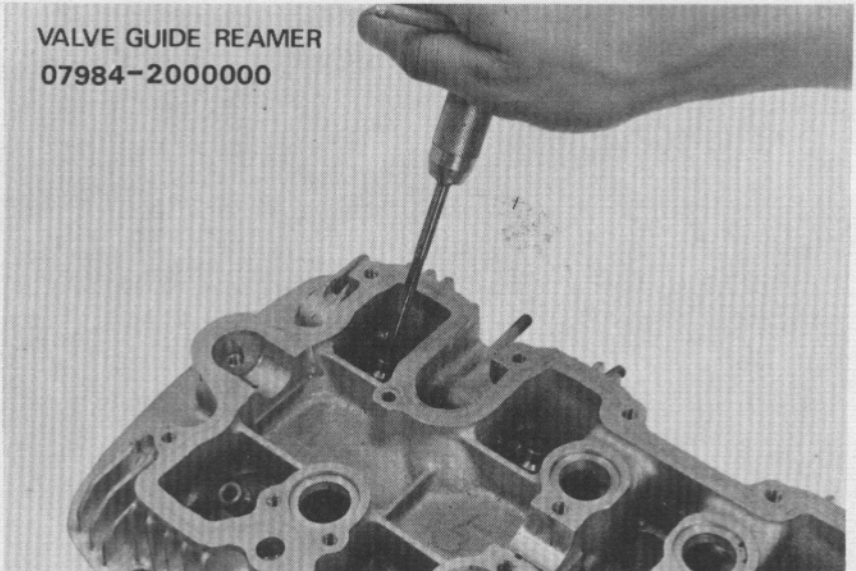
If the stem-to-guide clearance exceeds the service limit with a new guide, replace the valve and guides.

NOTE

Reface the valve seats whenever the valve guides are replaced (Page 6-12).



VALVE GUIDE REAMER
07984-2000000



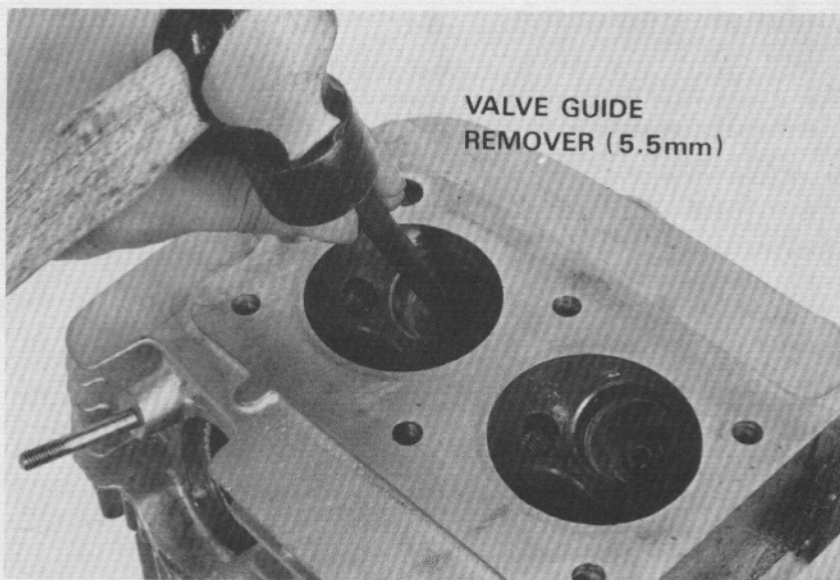


VALVE GUIDE REPLACEMENT

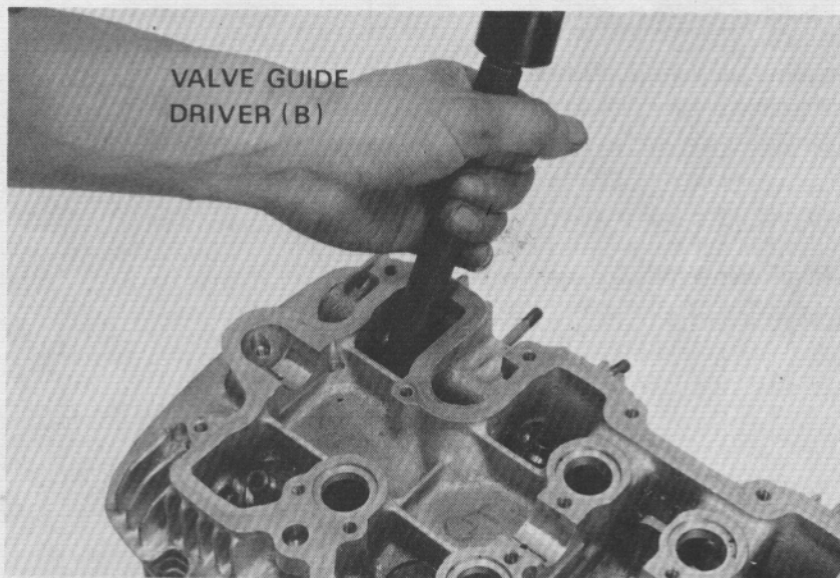
Support the cylinder head and drive out the guide from the valve port.

NOTE

When driving out the valve guide, do not damage the head.



Install an oversize valve guide from the top of the head.



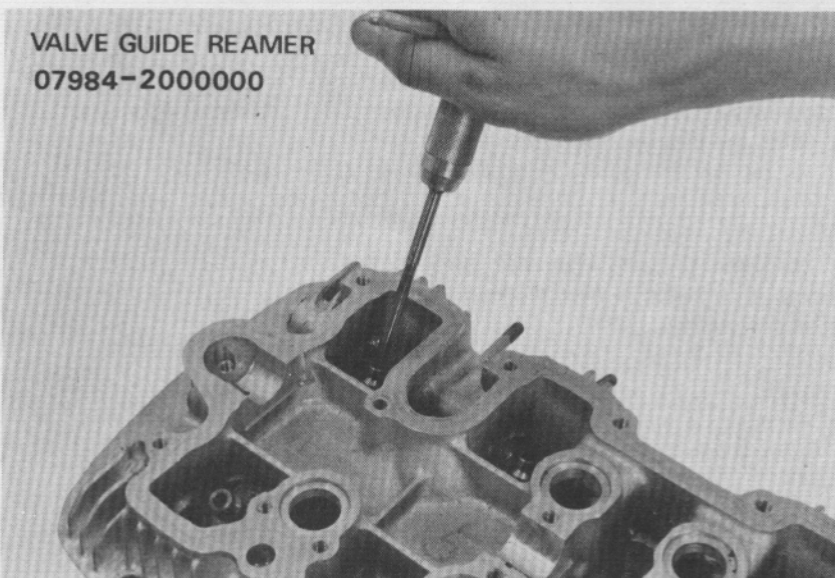
Ream the new valve guide after installation.

NOTE

- Use cutting oil on the reamer during this operation.
- Rotate the reamer when inserting and removing it.

Reface the valve seat. (Page 6-13)

Clean the cylinder head thoroughly to remove any metal particles.





VALVE SEAT INSPECTION / REFACING

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

Apply a light coat of valve lapping compound to each valve face. Lap each valve and seat using a rubber hose or other hand-lapping tool.

NOTE

Take care not to allow the compound to get between the valve stem and guide. After lapping, wash out the compound completely and apply a coat of engine oil to the valve face and seat.

Remove the valve and inspect the face.

CAUTION

The valves cannot be ground. If the valve face is rough, worn unevenly, or contacts the seat improperly, the valve must be replaced.

Insert the valve seat.

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

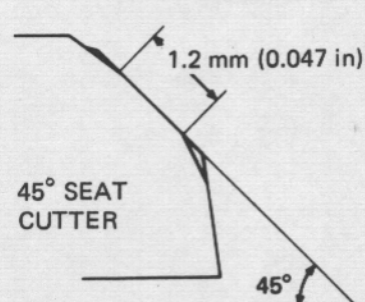
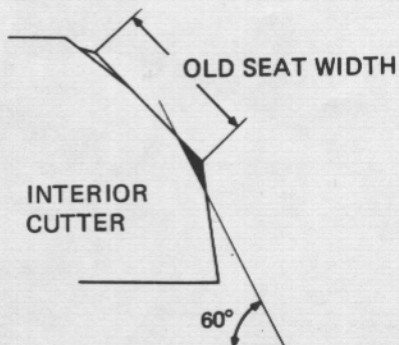
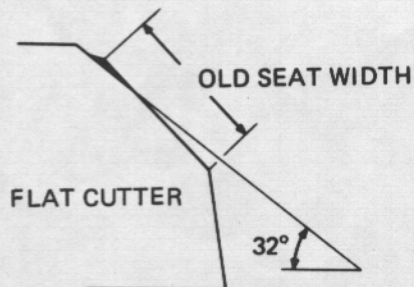
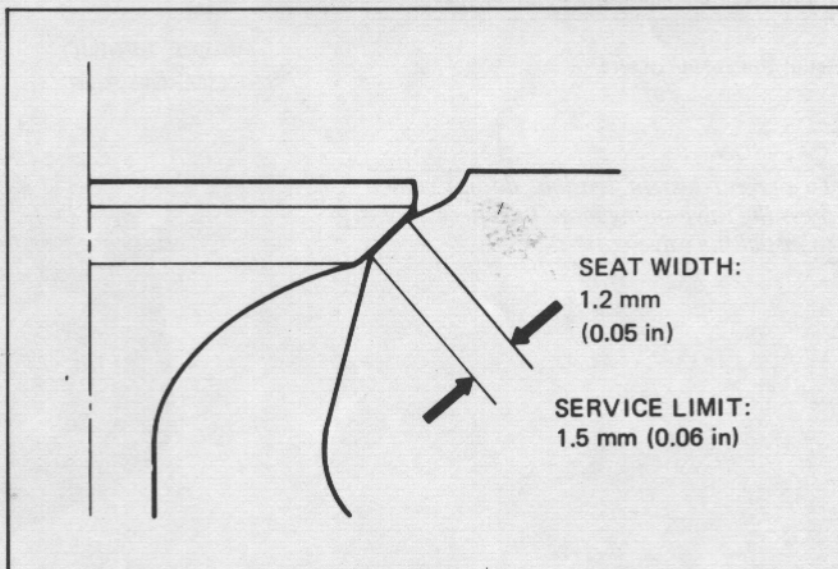
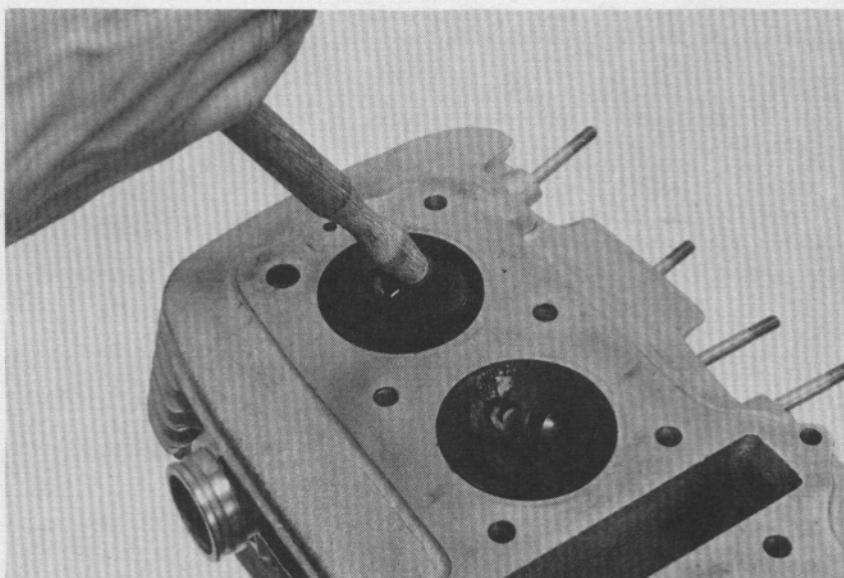
NOTE

Follow the refacer manufacturer's operating instructions.

SERVICE LIMIT: 1.5 mm (0.06 in)

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

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





CYLINDER HEAD ASSEMBLY

NOTE

Install new valve stem seals when assembling.

Lubricate each valve stem with molybdenum disulfide grease and insert the valve into the valve guide.

NOTE

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

Install the valve springs and retainers.

NOTE

Install the valve springs with the tightly wound coils facing the cylinder head.

Install the valve cotters.

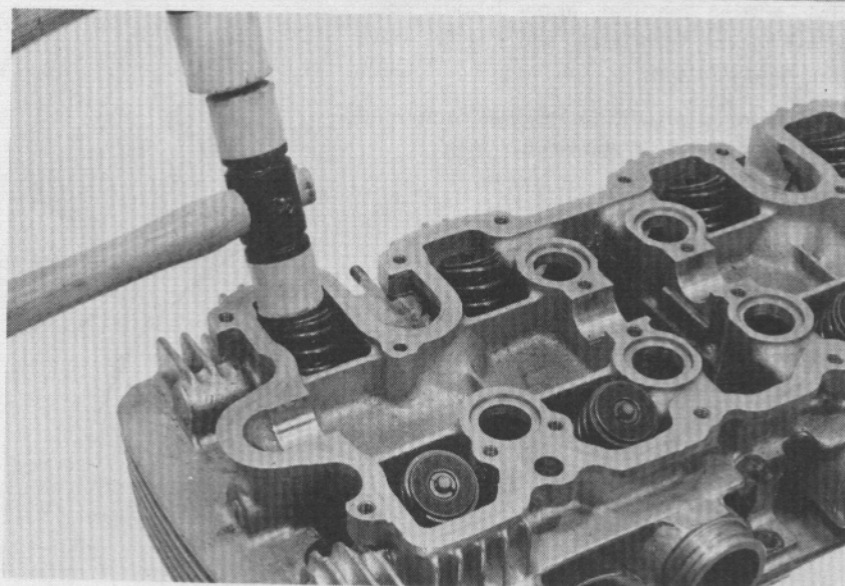
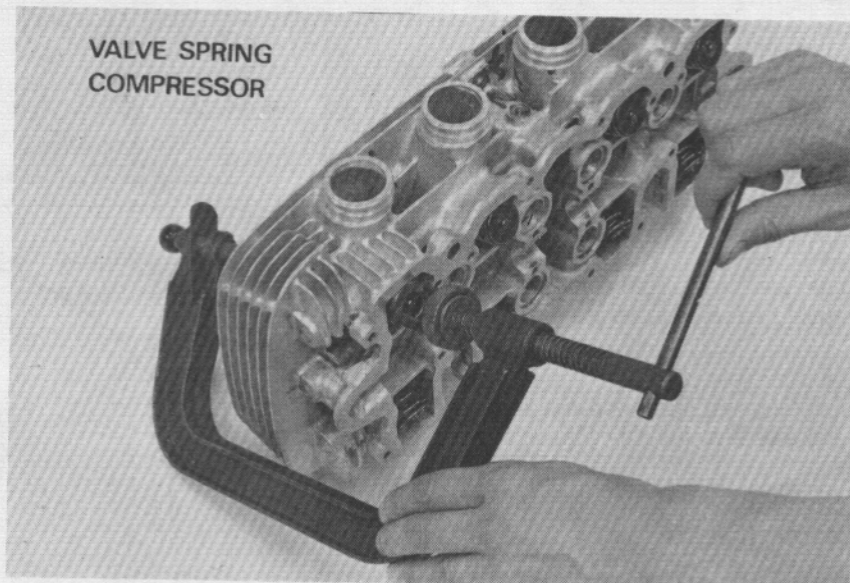
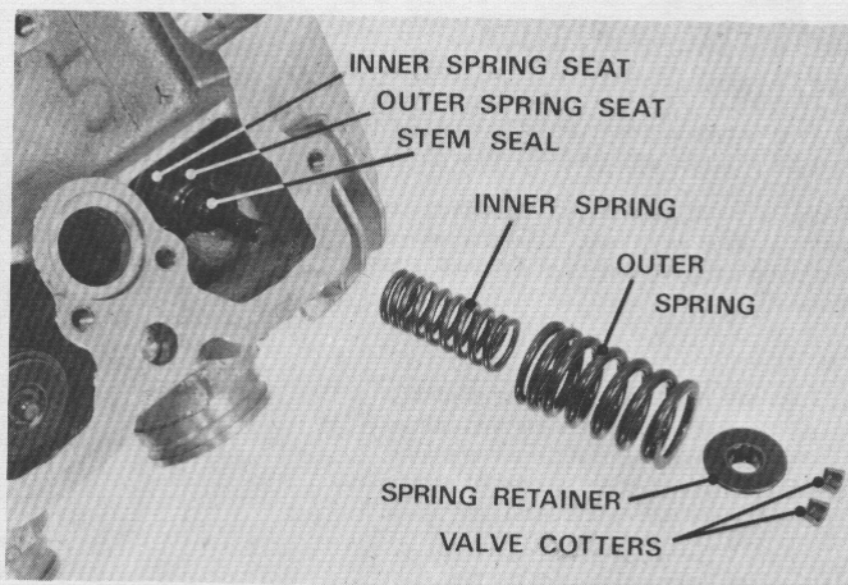
CAUTION

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

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

NOTE

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

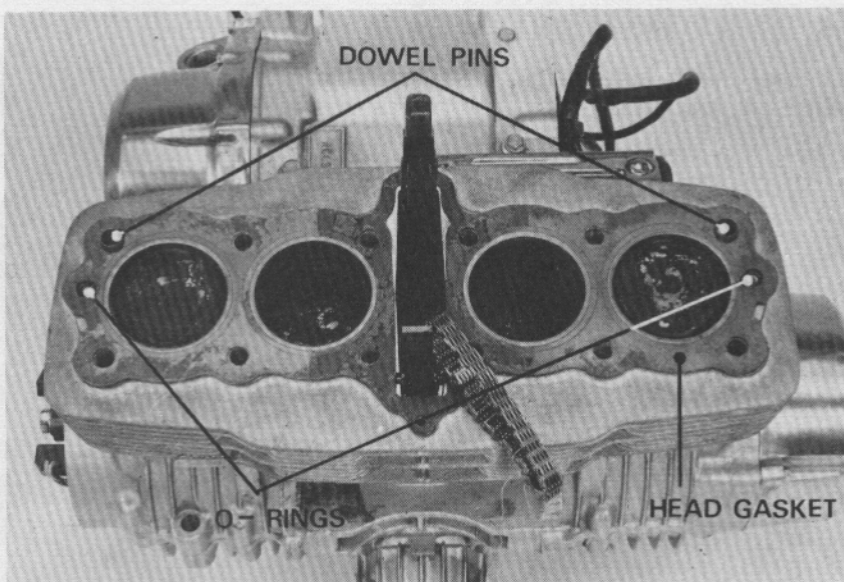




CYLINDER HEAD INSTALLATION

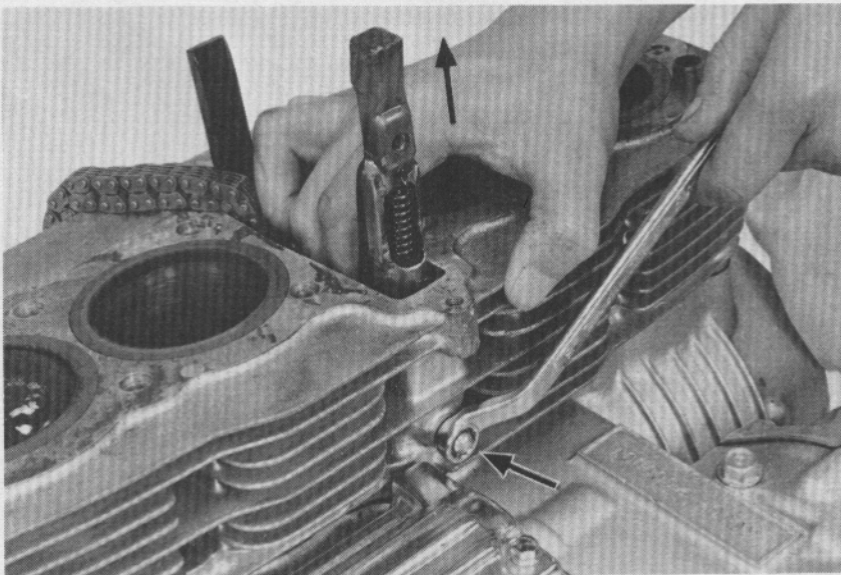
Clean the cylinder head surfaces of any gasket material.

Install the O-rings and dowel pins.
Install a new head gasket.



Loosen the cam chain tensioner lock nut and pull the tensioner up.

Tighten the lock nut.



Install the cylinder head assembly.

Tighten the cylinder head bolts in the sequence shown.

NOTE

Tighten the bolts in 2-3 steps.

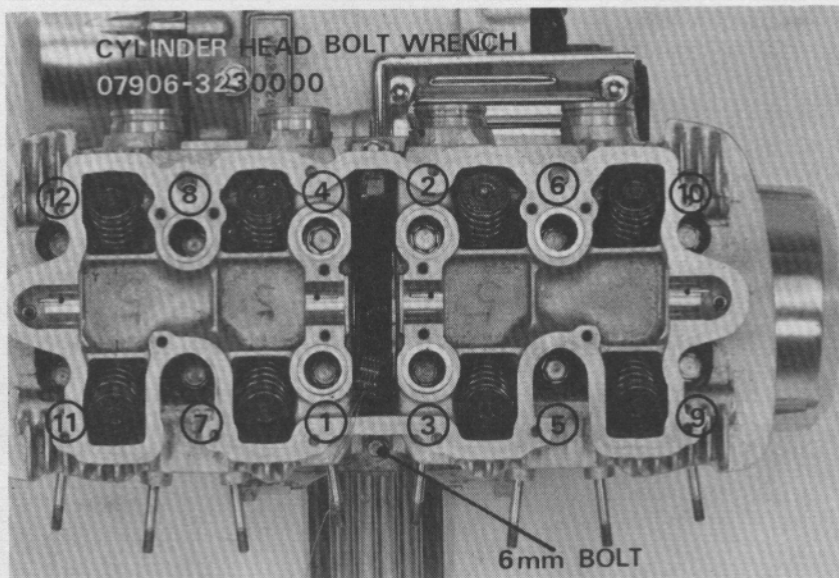
Tighten the 6 mm bolt.

TORQUES:

8 mm bolt: 2.4-3.0 kg-m (17-22 ft-lb)

6 mm bolt: 1.0-1.4 kg-m (7-10 ft-lb)

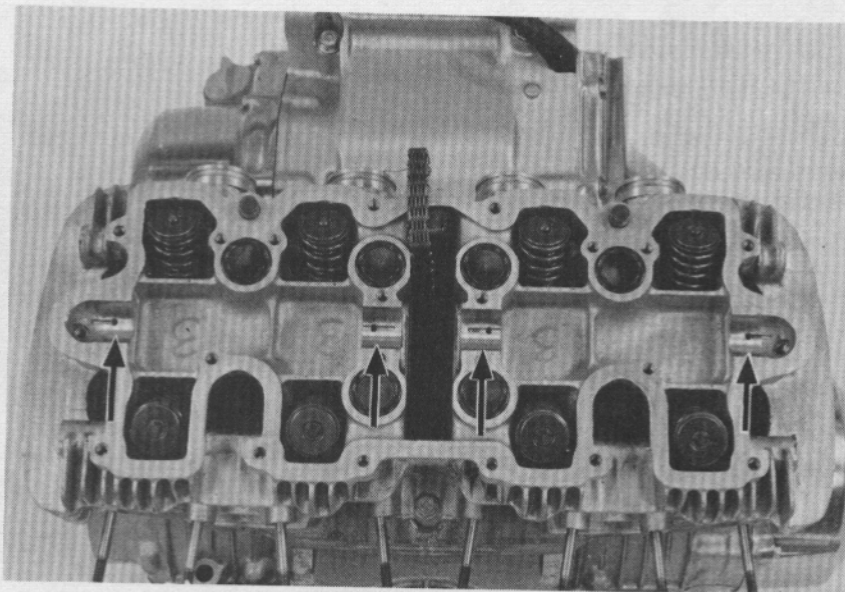
Install the rubber seals.



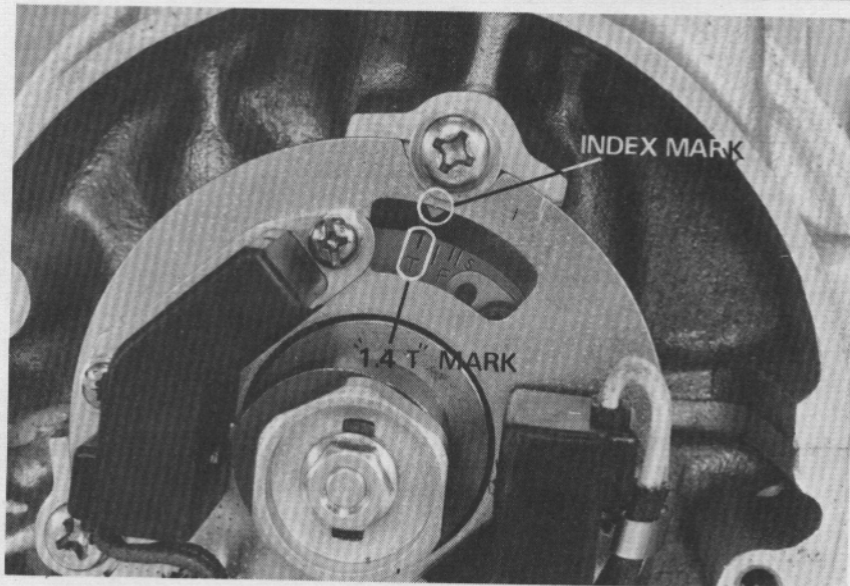


CAMSHAFT INSTALLATION

Lubricate the camshaft bearings with molybdenum disulfide grease.



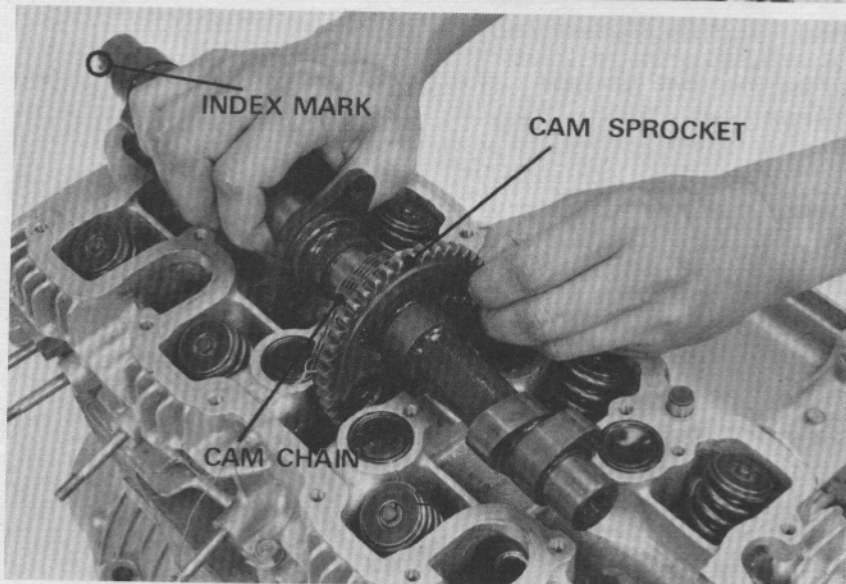
Turn the crankshaft clockwise until the "1.4 T" mark aligns with the index mark.



Place the cam chain over the cam sprocket and install the camshaft.

NOTE

Install the camshaft from the right side with the index mark end facing right.

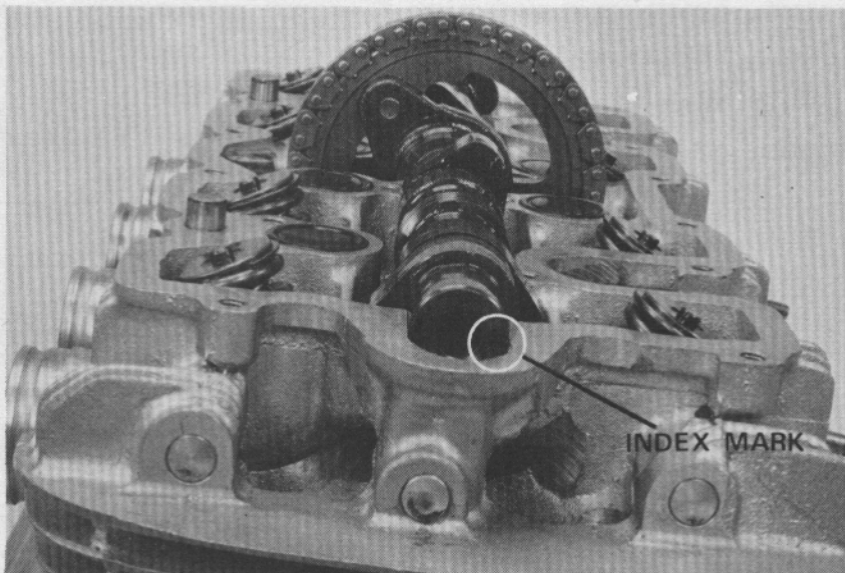




Align the center of the index mark on the camshaft right end with the cylinder head surface.

Align the camshaft sprocket bolts with the camshaft holes. Install the sprocket bolts and tighten to the specified torque.

TORQUE: 1.4–1.8 kg-m (10–13 ft-lb)

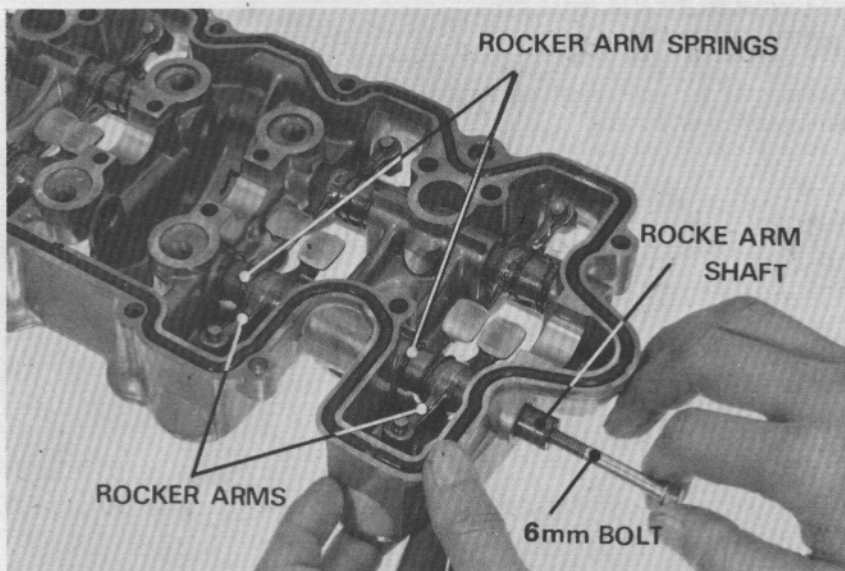


CYLINDER HEAD COVER ASSEMBLY

Install the rocker arms and springs and insert the rocker arm shaft.

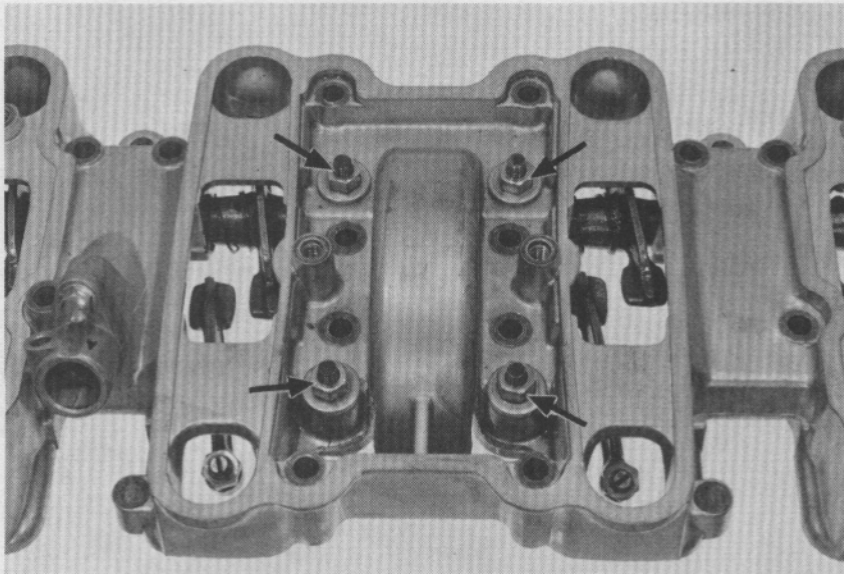
NOTE

- Install the rocker arms and shafts in their original position.
- Install the rocker arm shaft with the thread hole end facing out.



Install the rocker arm shaft cotter pins and tighten the nuts.

TORQUE: 1.0–1.4 kg-m (7–10 ft-lb)



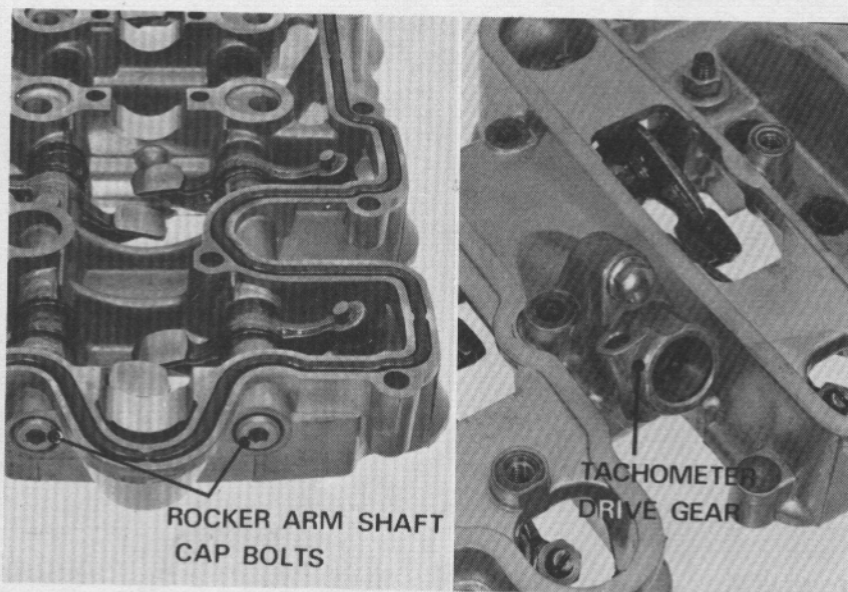


Install the rocker arm shaft cap bolts.

TORQUE: 0.8–1.2 kg-m (6–9 ft-lb)

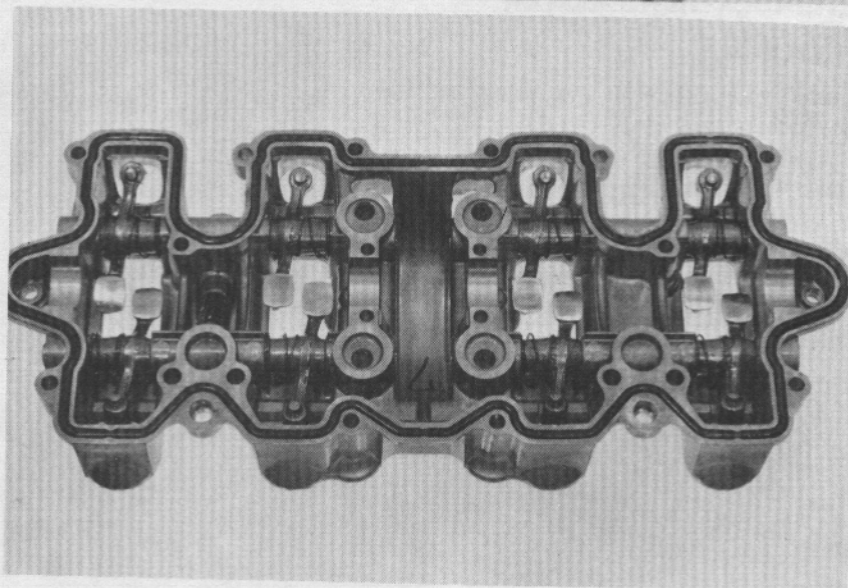
Install the tachometer drive gear.

TORQUE: 0.8–1.2 kg-m (6–9 ft-lb)

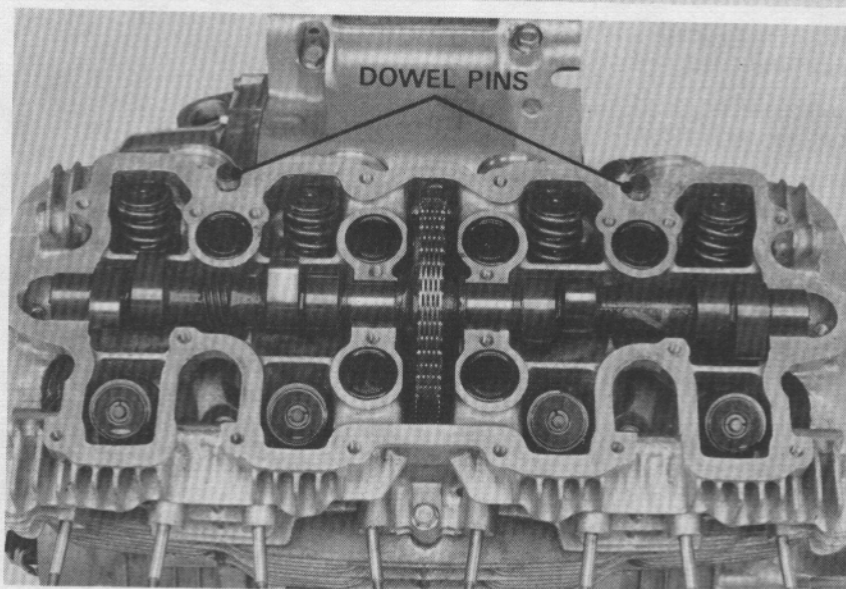


CYLINDER HEAD COVER INSTALLATION

Inspect the cylinder head cover gasket for damage or deterioration.



Install the dowel pins.





Loosen the valve adjusting screws fully and install the cylinder head cover.

Tighten the cylinder head cover bolts evenly in the sequence shown.

NOTE

Tighten the bolts in 5-6 steps.

TORQUE: 0.8-1.2 kg-m (6-9 ft-lb)

Adjust valve clearance (Page 3-6).
Install the right and left adjustment covers and breather cover.

Install the exhaust system. (Page 5-3)
Install the carburetor (Page 4-14).

Install the spark plugs.
Install the spark plug caps, tachometer cable and engine breather tube.

Install the pulser generator cover.

Adjust the cam chain tension (Page 3-7).
Adjust throttle cable free play (Page 3-7).

