COMPONENT LOCATION .............................................. 7-2
SERVICE INFORMATION ............................................ 7-3
TROUBLESHOOTING .................................................. 7-5
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CAMSHAFT REMOVAL ................................................... 7-6
CYLINDER HEAD ....................................................... 7-7
CAMSHAFT INSTALLATION ......................................... 7-18
'04 and '05:
12 N·m (1.2 kgf-m, 9 lbf-ft)
After '05:
16 N·m (1.6 kgf-m, 12 lbf-ft)

11 N·m (1.1 kgf-m, 8 lbf-ft)

8.8 N·m (0.9 kgf-m, 6.5 lbf-ft)
SERVICE INFORMATION

GENERAL

- This section covers service of the cylinder head, valves and camshaft.
- The cylinder head, valves and camshaft services can be done with the engine installed in the frame.
- 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 cylinder head.
- Be careful not to damage the mating surfaces when removing the cylinder head cover and cylinder head.
- Refer to page 10-6 for cam chain tensioner service.

SPECIFICATIONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>STANDARD</th>
<th>SERVICE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder compression</td>
<td>981 - 1,177 kPa (10.0 - 12.0 kgf/cm², 142 - 171 psi) at 1,000 rpm</td>
<td></td>
</tr>
<tr>
<td>Cylinder head warpage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve and valve guide</td>
<td>Valve clearance: IN/EX 0.05 ± 0.02 (0.002 ± 0.001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve stem O.D.: IN 4.970 - 4.985 (0.1957 - 0.1963)</td>
<td>4.92 (0.194)</td>
</tr>
<tr>
<td></td>
<td>EX 4.955 - 4.970 (0.1951 - 0.1967)</td>
<td>4.92 (0.194)</td>
</tr>
<tr>
<td></td>
<td>Valve guide I.D.: IN/EX 5.000 - 5.012 (0.1969 - 0.1973)</td>
<td>5.03 (0.198)</td>
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<tr>
<td></td>
<td>Stem-to-guide clearance: IN 0.015 - 0.042 (0.0006 - 0.0017)</td>
<td>0.08 (0.003)</td>
</tr>
<tr>
<td></td>
<td>EX 0.030 - 0.057 (0.0012 - 0.0022)</td>
<td>0.10 (0.004)</td>
</tr>
<tr>
<td></td>
<td>Valve seat width: IN/EX 1.0 - 1.3 (0.04 - 0.06)</td>
<td>2.0 (0.08)</td>
</tr>
<tr>
<td></td>
<td>Valve spring free length: IN/EX 33.34 (1.313)</td>
<td>31.8 (1.25)</td>
</tr>
<tr>
<td>Rocker arm/shaft</td>
<td>Rocker arm I.D.: IN/EX 10.000 - 10.015 (0.3937 - 0.3943)</td>
<td>10.10 (0.398)</td>
</tr>
<tr>
<td></td>
<td>Rocker arm shaft O.D.: IN/EX 9.978 - 9.987 (0.3928 - 0.3932)</td>
<td>9.91 (0.390)</td>
</tr>
<tr>
<td>Camshaft</td>
<td>Cam lobe height: IN 20.003 - 20.123 (0.7875 - 0.7922)</td>
<td>19.66 (0.774)</td>
</tr>
<tr>
<td></td>
<td>EX 19.994 - 20.114 (0.7872 - 0.7919)</td>
<td>19.65 (0.774)</td>
</tr>
</tbody>
</table>

TORQUE VALUES

- Cylinder head cover nut/cap nut: 11 N-m (1.1 kgf-m, 8 lbf-ft)
- Cylinder head right side cover bolt: 9.8 N-m (1.0 kgf-m, 7 lbf-ft)
- Cam sprocket bolt: 8.8 N-m (0.9 kgf-m, 6.5 lbf-ft)
## CYLINDER HEAD/VALVES
### TOOLS

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Part Number</th>
<th>Special Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve spring compressor</td>
<td>07757-0010000</td>
<td></td>
</tr>
<tr>
<td>Valve spring compressor attachment</td>
<td>07959-KM30101</td>
<td></td>
</tr>
<tr>
<td>Valve guide reamer, 5.0 mm</td>
<td>07984-MA60001</td>
<td>or 07984-MA6000D (U.S.A only)</td>
</tr>
<tr>
<td>Valve guide driver, 5.0 mm</td>
<td>07942-MA60000</td>
<td></td>
</tr>
<tr>
<td>Valve seat cutter, 24 mm (45°IN)</td>
<td>07780-0010600</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
<tr>
<td>Valve seat cutter, 20.5 mm (45°EX)</td>
<td>07780-0011000</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
<tr>
<td>Flat cutter, 21.5 mm (32°EX)</td>
<td>07780-0012800</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
<tr>
<td>Flat cutter, 24 mm (32°IN)</td>
<td>07780-0012500</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
<tr>
<td>Interior cutter, 22 mm (60°IN/EX)</td>
<td>07780-0014202</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
<tr>
<td>Cutter holder, 5 mm</td>
<td>07781-0010400</td>
<td>or equivalent commercially available in U.S.A.</td>
</tr>
</tbody>
</table>
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 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 (page 8-5).

Compression too low, hard starting or poor performance at low speed
- Valves:
  - Incorrect valve clearance
  - 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 (page 8-5)

Compression too high, overheating or knocking
- Excessive carbon build-up on piston crown or combustion chamber

Excessive smoke
- Cylinder head:
  - Worn valve stem or valve guide
  - Damaged stem seal
- Worn cylinder, piston or piston rings (page 8-5)

Excessive noise
- Cylinder head:
  - Incorrect valve clearance
  - 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 (page 10-7)
  - Worn cam sprocket teeth
  - Worn rocker arm and/or shaft
- Worn cylinder, piston or piston rings (page 8-5)

Rough idle
- Low cylinder compression
**CYLINDER HEAD/VALVES**

**CYLINDER COMPRESSION**

Warm up the engine to normal operating temperature.
Stop the engine and remove the spark plug (page 3-8).
Install a compression gauge.
Shift the transmission in neutral and open the choke lever.
Open the throttle all the way and crank the engine with the kickstarter until the gauge reading stops rising.

**COMPRESSION PRESSURE:**

981 – 1,177 kPa (10.0 – 12.0 kgf/cm², 142 – 171 psi)

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

**CAMSHAFT REMOVAL**

Drain the engine oil (page 3-11)
Remove the following:
- Valve adjuster hole caps (page 3-9)
- Left crankcase cover (page 10-4)
- Sealing bolt, tensioner spring and tensioner push rod to loosen the cam chain tensioner (page 10-6)

Disconnect the spark plug cap.
Loosen the cylinder head side cover 6 mm bolt.
Tap the head of the 6 mm bolt and release the cylinder head left side cover from the cylinder head.
Remove the 6 mm bolt, sealing washer and cylinder head left side cover.

Turn the crankshaft counterclockwise, and align the "O" mark on the cam sprocket with the index notch on the cylinder head.

Remove the bolts, cam sprocket and dowel pin.

*Secure the cam chain with a piece of wire to prevent it from falling into the cylinder.*
Loosen the valve adjusting screw fully to make a valve clearance maximum (page 3-10). Temporarily install the cam sprocket bolts into the camshaft and remove the camshaft from the cylinder head while holding the rocker arms.

**INSPECTION**

Turn the outer races of the each camshaft bearing with your finger. The outer race should turn smoothly and quietly. Also check that the bearing inner race fits tightly on the camshaft. Replace the camshaft assembly if the outer race does not turn smoothly and quietly, or if it fits loosely on the camshaft.

Using a micrometer, measure each cam lobe height.

**SERVICE LIMITS:**

<table>
<thead>
<tr>
<th></th>
<th>IN: 19.66 mm (0.774 in)</th>
<th>EX: 19.65 mm (0.774 in)</th>
</tr>
</thead>
</table>

**CYLINDER HEAD**

**REMOVAL**

Remove the following:
- Muffler (page 2-5)
- Camshaft (page 7-6)

Remove the intake manifold bolts.
Remove the O-ring.
Remove the following:
- Cap nuts/sealing washers
- Nut/sealing washers
- Cylinder head cover
- Gasket

Remove the cylinder head mounting bolt and cylinder head.

Remove the following:
- Gasket
- Dowel pins
- Collar
- O-ring

DISASSEMBLY
Remove the spark plug (page 3-8).
Remove the bolts and cylinder head right side cover.

Temporarily install a 8 mm bolt to the rocker arm shaft and remove the rocker arm shafts and rocker arms.
To prevent loss of tension, do not compress the valve springs more than necessary to remove the cotters. Remove the valve spring cotters using the special tools as shown.

**TOOLS:**
- Valve spring compressor 07757-0010000
- Valve spring compressor attachment 07959-KM30101

Remove the following:
- Spring retainer
- Valve spring
- Valve
- Valve spring seat
- Stem seal

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

**INSPECTION**

**CYLINDER HEAD**
Remove carbon deposits from the combustion chamber.

Avoid damaging the gasket surface.
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:** 0.05 mm (0.002 in)
CYLINDER HEAD/VALVES

ROCKER ARM/SHAFT

If either rocker arm requires service or replacement, inspect the cam lobes for scoring, chipping or flat spots.

Inspect the rocker arm slipper surfaces for wear or damage. Also check that the oil holes are not clogged. Measure the rocker arm I.D.

SERVICE LIMIT: IN/EX: 10.10 mm (0.398 in)

Inspect the rocker arm shaft for wear or damage. Measure the O.D. of the rocker arm shaft.

SERVICE LIMIT: IN/EX: 9.91 mm (0.390 in)

VALVE SPRING

Measure the free length of the valve springs.

SERVICE LIMIT: IN/EX: 31.8 mm (1.25 in)

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

VALVE

Inspect each valve for bending, burning or abnormal stem wear. Check valve movement in the guide. Measure and record each valve stem O.D.

SERVICE LIMIT: IN/EX: 4.92 mm (0.194 in)
Ream the guides to remove any carbon deposits before measuring the guide. Insert the reamer from the combustion chamber side of the head and always rotate the reamer clockwise.

**TOOL:**
Valve guide reamer, 5.0 mm 07984-MA60001 or 07984-MA6000D (U.S.A. only)

Measure and record each valve guide I.D.

**SERVICE LIMIT:** IN/EX: 5.03 mm (0.198 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)

If the stem-to-guide clearance is out of specification, 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 specification with a new guide, also replace the valve.

**VALVE GUIDE REPLACEMENT**

Chill new valve guides in the freezer section of a refrigerator for about an hour.

Heat the cylinder head to 212 - 302 °F (100 - 150 °C) with a hot plate or oven.

Support the cylinder head and drive out the valve guides out of the cylinder head from the combustion chamber side.

**TOOL:**
Valve guide driver, 5.0 mm 07942-MA60000

Coat new O-rings with engine oil and install them onto new valve guides. While the cylinder is still heated, drive the new guides in the cylinder head from the camshaft side until they are fully seated.

**TOOL:**
Valve guide driver, 5.0 mm 07942-MA60000

Let the cylinder head cool to room temperature.
Ream the new valve guide after installation. Insert the reamer from the combustion chamber side of the head and always rotate the reamer clockwise.

**TOOL:**
Valve guide reamer, 5.0 mm 07984-MA60001 or 07984-MA6000D (U.S.A. only)

Clean the cylinder head thoroughly to remove any metal particles. Reface the valve seat (page 7-12).

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

Remove and inspect the valves. Inspect the width of each valve seat.

**STANDARD:** 1.0 - 1.3 mm (0.04 - 0.05 in)
**SERVICE LIMIT:** 2.0 mm (0.08 in)
If the seat is too wide, too narrow or has low spots, the seat must be ground.

**VALVE SEAT REFACING**
- Follow the refacing manufacturer's operating instructions.
- Be careful not to grind the seat more than necessary.
Use a 45° seat cutter to remove any roughness or irregularities from the seat.

**TOOLS:**
- Seat cutter, 24 mm (45° IN) 07780-0010600
- Seat cutter, 20.5 mm (45° EX) 07780-0011000
- Cutter holder, 5 mm 07781-0010400

or equivalent commercially available in U.S.A.

Use a 32° or 30° cutter to remove the top 1/4 of the existing valve seat material.

**TOOLS:**
- Flat cutter, 24 mm (32° IN) 07780-0012500
- Flat cutter, 21.5 mm (32° EX) 07780-0012800
- Cutter holder, 5 mm 07781-0010400

or equivalent commercially available in U.S.A.

Use a 60° cutter, remove 1/4 of the existing valve seat material.

**TOOLS:**
- Interior cutter, 22 mm (60° IN/EX) 07780-0014202
- Cutter holder, 5 mm 07781-0010400

or equivalent commercially available in U.S.A.

Using a 45° seat cutter, cut the seat to the proper width.

**VALVE SEAT WIDTH:** 1.0 – 1.3 mm (0.04 – 0.05 in)

Make sure that all pitting and irregularities are removed.
CYLINDER HEAD/VALVES

If the contact area is too high on the valve, the seat must be lowered using a 32° or 30° flat cutter.
If the contact area is too low on the valve, the seat must be raised using a 60° interior cutter.

CONTACT TOO HIGH
OLD SEAT WIDTH
30°/32°

CONTACT TOO LOW
OLD SEAT WIDTH
60°

Excessive lapping pressure may deform or damage the seat. Do not allow lapping compound to enter the guides.

After cutting the seat, apply lapping compound and engine oil to the valve face, and lap the valve using light pressure.
Change the angle of lapping tool frequently to prevent uneven seat wear.
After lapping, wash all residual compound off the cylinder head and valve.

ASSEMBLY

CYLINDER HEAD

RIGHT SIDE COVER
9.8 N-m (1.0 kgf-m, 7 lbf-ft)
GASKET
ROCKER ARM SHAFT
ROCKER ARM
VALVE COTTERS

O-RING
VALVE GUIDE
SPRING SEAT
STEM SEAL
VALVE SPRING
SPRING RETAINER
EXHAUST VALVE
INTAKE VALVE
CAMSHAFT

7-14
Clean the cylinder head assembly with solvent and blow through all oil passages with compressed air.

Install the valve spring seats.
Install new stem seals.

Lubricate the valve stems with engine oil and insert the valve into the valve guide.
To avoid damage to the stem seal, turn the valve slowly when inserting.

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

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

Install the valve cotters using the special tool as shown.

**TOOLS:**
Valve spring compressor 07757-0010000
Valve spring compressor attachment 07959-KM30101

Support the cylinder head above the work bench so that the valve heads will not contact anything that cause damage.

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

Apply engine oil to the rocker arm inner and slipper surfaces.

Install the rocker arms and rocker arm shafts.
CYLINDER HEAD/VALVES

Install a new gasket onto the cylinder head right side cover.
Install the right side cover onto the cylinder head.

Install the right side cover bolts to the specified torque.
TORQUE: 9.8 N·m (1.0 kgf·m, 7 lbf·ft)

INSTALLATION
Clean off the gasket material from the cylinder surface.

Install the following:
- New O-ring
- Collar
- Dowel pins
- New gasket
Route the cam chain through the cylinder head and install the cylinder head.

Install a new gasket onto the cylinder head and then install the cylinder head cover.

Install the following:
- Cap nuts/new sealing washers
- Nut/new sealing washer
- Note the position of the washers and nuts.

Tighten the cylinder head cover nuts to the specified torque.

TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)

Install and tighten the cylinder head mounting bolt. If the cylinder was removed, tighten the cylinder mounting bolt.

Install a new O-ring into the groove in the intake manifold.

Install and tighten the intake manifold bolts.

Install the following:
- Spark plug (page 3-8)
- Muffler (page 2-5)
- Camshaft (page 7-18)
Apply clean engine oil to the camshaft lobes and bearings.

Install the camshaft into the cylinder head with its cam lobes facing the combustion chamber while holding the rocker arms.

Turn the crankshaft counterclockwise and align the "T" mark on the flywheel with the index notch on the left crankcase.

Install the dowel pin and cam sprocket.
Install the cam sprocket with its "O" mark with the index notch on the cylinder head.
Install and tighten the cam sprocket bolts to the specified torque.

**TORQUE: 8.8 N·m (0.9 kgf·m, 6.5 lbf·ft)**

Install the cylinder head left side cover onto the cylinder head with a new gasket.
Set the tab on the side cover against the left side of the stopper on the cylinder head.
Install the 6 mm bolt with a new sealing washer into the cylinder head and tighten it.
Tighten the two right side cover bolts if the cylinder head was disassembled.
TORQUE: 9.8 N-m (1.0 kgf·m, 7 lbf·ft)
Install the spark plug cap.

Install the tensioner push rod, spring and sealing bolt (page 10-7).
Adjust the valve clearance (page 3-10).
Pour the recommended engine oil (page 3-11).