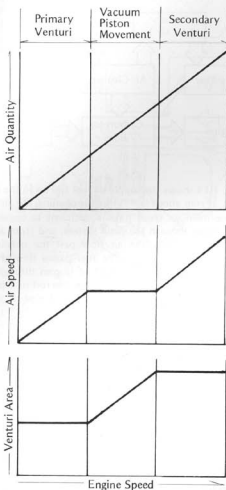


greater. The force of the spring and the weight of the piston are overcome, and the piston rises to an extent corresponding to this pressure difference. The diaphragm is made of rubber and absorbs the vibration caused by engine intake pulsing to prevent the vacuum piston from wearing.

Venturi Principle

H15



As shown in Fig. H15 the quantity of air drawn in by the engine intake is in direct proportion to engine rpm, and the speed of the air flow is constant while the vacuum piston rises from $\frac{1}{4}$ to $\frac{3}{4}$ throttle. Were the size of the air passage above the needle jet to change simultaneously with throttle movement rather than with engine intake (demand), the speed of the air flow in the air passage might even drop during a rapid increase in throttle due to the Venturi effect, causing a slight stall in acceleration. However, the vacuum piston-butterfly valve arrangement controls both the air and fuel supply at sudden throttle for smooth and immediate engine response.

At $\frac{3}{4}$ throttle the vacuum piston reaches its highest position, forming the "secondary venturi" to permit maximum engine output. At near full throttle openings,

the cross-sectional area of the needle to jet clearance becomes greater than the cross-sectional area of the main jet. At these openings, the fuel drawn up into the carburetor bore is limited by the size of the main jet rather than the needle to jet clearance.

Trouble in the main system is usually indicated by poor running or lack of power at high speeds. Dirty or clogged main jets will cause the mixture to become too lean. An overly rich mixture could be caused by clogging of the main air jets, its air passage, or the air holes in the main jet bleed pipe and needle jet holder; by needle jet or needle wear (increasing clearance); by loose main air jets; or by a loose needle jet.

Cleaning and adjustment (See cautions Pg. 152)

Disassemble the carburetor, and wash the main jets, main jet bleed pipe, needle jet holder, needle jet, jet needle, main air jets, and air passage with a high flash-point solvent, blowing them clean with compressed air. If necessary, use a bath of automotive type carburetor cleaner.

Visually inspect the diaphragm. If there is any tear or other damage, the diaphragm should be replaced. A worn needle jet or jet needle should be replaced.

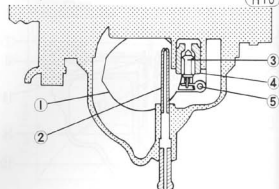
If the engine still exhibits symptoms of overly rich or lean carburetion after all maintenance and adjustments are correctly performed, the secondary main jet can be replaced with a smaller or larger one. A smaller numbered jet gives a leaner mixture and a larger numbered jet a richer mixture.

Float System

Fig. H16 shows the float system, which consists of the float ①, float valve needle ③, float valve seat ④, float pin ⑤, and overflow pipe ②.

Float System

H16



- | | |
|------------------|---------------|
| 1. Float | 4. Valve Seat |
| 2. Overflow Pipe | 5. Float Pin |
| 3. Valve Needle | |

The float system serves to keep a more or less fixed level of fuel in the carburetor float chamber at all times so that the fuel mixture to the engine will be stable. If the fuel level in the float chamber is set too low, it will be more difficult for fuel to be drawn up into the carburetor bore, resulting in too lean a mixture. If the level is set too high, the fuel can be drawn up too easily, resulting too in rich a mixture.

The fuel level is defined as the vertical distance from the center of the carburetor bore to the surface of the fuel in the float chamber. The fuel level is maintained at a constant value by the action of the float valve, which opens and closes according to the fuel level. As fuel flows through the float valve into the chamber, the fuel level rises. The float, rising with the fuel level, pushes up on the valve needle. When the fuel reaches a certain level, the valve needle is pushed completely into the valve seat, which closes the valve so that no more fuel may enter the chamber. As the fuel is drawn up out of the float chamber, the fuel level drops, lowering the float. The needle no longer blocks the float valve, and fuel once again flows through the float valve into the chamber.

NOTE: It is impractical to measure the actual design fuel level. Service fuel level is defined as the vertical distance from the bottom edge of the carburetor body to the surface of the fuel in the float chamber. Measuring the service fuel level is an indirect method of inspecting for correct design fuel level.

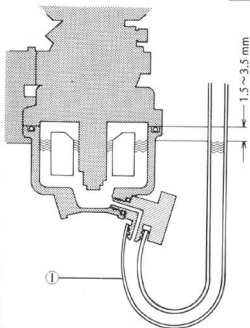
Service fuel level measurement and adjustment

Secure the motorcycle in a true vertical position. Turn the fuel tap to the "ON" or "RES" position, and remove the drain plug from the bottom of the float bowl. Install the fuel level gauge (special tool). Hold the plastic tube against the side of the carburetor so that the "0" line is even with the bottom edge of the carburetor body. Turn the fuel tap to the "PRI" position. Read the service fuel level in the plastic tube.

***NOTE:** Measure the service fuel level keeping the carburetors fully perpendicular to the ground.

Service Fuel Level Measurement

H17



1. Fuel Level Gauge
(57001-208)

Table H5 Service Fuel Level

Standard
1.5 ~ 3.5 mm below from the bottom edge of the carburetor body to the fuel level

If the fuel level is incorrect, remove the carburetor, and then remove the float bowl and float. Bend the tang on the float a very slight amount to change the fuel level. Bending it up toward the valve closes the valve sooner and lowers the fuel level; bending it down raises the level.

After adjustment, measure the service fuel level again, and readjust if necessary.



A. Tang

Cleaning and replacement (See cautions Pg. 152)

If dirt gets between the needle and seat, the float valve will not close and fuel will overflow. Overflow can also result if the needle and seat become worn. If the needle sticks closed, no fuel will flow into the carburetor.

Remove the carburetor, and take off the float bowl and float. Wash the bowl and float parts in a high flash-point solvent. Use carburetor cleaner if necessary on the float bowl and metal parts. Blow out the fuel overflow pipe with compressed air.

Examine the float, and replace it if it is damaged. If the needle is worn as shown in the diagram, replace it. If the seat is worn, the entire carburetor must be replaced.

Valve Needle

H19



Good



Bad

ROCKER ARMS, SHAFTS

There are four rocker arms and shafts in the cylinder head cover. The two arms and shafts to the front control the two exhaust valves, while the two to the rear control the two inlet valves. The rocker arms are made of a special steel alloy for durability, and each arm surface which makes contact with the cam and the valve stem has been heat-treated to achieve superior surface hardness. An oil hole in each rocker arm enables oil to lubricate between the arm and shaft.

Excessive clearance between a rocker arm and shaft results in engine noise.

Rocker arm/shaft wear

Visually inspect where the cam and valve stem wear on each arm. If there is any damage or uneven wear, replace the arm.

Measure the inside diameter of each arm with a cylinder gauge. If it exceeds the service limit, replace the arm.

Measure the diameter of each shaft where the arm fits. If the diameter is less than the service limit, replace the shaft.

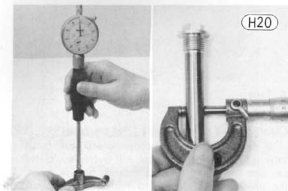


Table H6 Rocker Arm Inside Diameter

Standard	Service Limit
13.000~13.018 mm	13.05 mm

Table H7 Rocker Shaft Diameter

Standard	Service Limit
12.966~12.984 mm	12.94 mm

CAMSHAFT

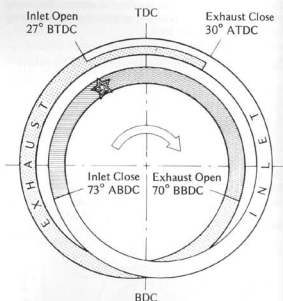
The engine has an overhead camshaft (OHC) at the top of the cylinder head. The camshaft has four cams, two for the two inlet valves and two for the two exhaust valves. There is a sprocket at the center of the crankshaft and at the center of the camshaft. A chain placed over these sprockets enables the crankshaft to turn the camshaft so that the valves will be opened and closed at the proper times during each rotation of the engine.

The sprocket has a mark so that valve timing (the time that each valve is opened) can be reset correctly any time the camshafts are removed for inspection or repairs (See Pg. 54).

However, since the time, amount, and duration that each valve is opened (valve timing) changes with cam wear and journal wear, the camshaft should be inspected periodically and whenever timing trouble is suspected. If the valves do not open at the right times or if they do not open the correct amount or for the proper duration, there will be a decrease in combustion efficiency, causing a loss of engine power and leading to serious engine trouble.

Valve Timing

(H21)



Cam wear

Remove the camshaft, and measure the height of each cam with a micrometer. If the cams are worn down past the service limit, replace the camshaft.

Cam Height Measurement

(H22)

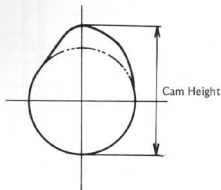


Table H8 Cam Height

Standard	Service Limit
38.339 ~ 38.479 mm	38.25 mm

Journal, bearing wear

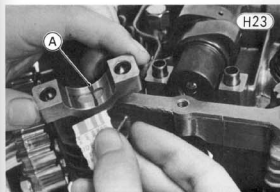
The journal wear is measured using plastigauge (press gauge), which is inserted into the clearance to be measured. The plastigauge indicates the clearance by the amount it is compressed and widened when the parts are assembled.

Remove the cylinder head cover and camshaft caps, and wipe each journal and camshaft cap surface clean of oil. Cut strips of plastigauge to journal width. Place a strip on each journal parallel to the camshaft and so that the plastigauge will be compressed between the journal and camshaft cap.

Now, tighten the camshaft cap bolts in the correct sequence to the specified torque (Pg. 37).

Next, remove the camshaft cap again, and measure the plastigauge width to determine the clearance between each journal and the camshaft cap.

If any clearance exceeds the service limit, measure the diameter of the camshaft journal. If camshaft replacement does not bring the journal clearance within the service limit, replace the cylinder head and camshaft caps.



A. Plastigauge

Table H9 Camshaft Journal/Camshaft Cap Clearance

Standard	Service Limit
0.130 ~ 0.240 mm	0.29 mm

Measure the diameter of each camshaft journal with a micrometer. If the diameter of any journal is less than the service limit, replace the camshaft.

Table H10 Camshaft Journal Diameter

Standard	Service Limit
24.950 ~ 24.970 mm	24.93 mm



Camshaft runout

Remove the camshaft and take the sprocket off the shaft.

Set the shaft on V blocks at the outside journals as shown in the figure. Measure runout with a dial gauge at the sprocket mounting location, and replace the shaft if the runout exceeds the service limit.

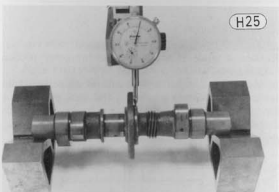


Table H11 Camshaft Runout

Standard	Service Limit
under 0.01 mm	0.1 mm

CAMSHAFT CHAIN, GUIDES, TENSIONER

The camshaft chain, which is driven by the crankshaft sprocket, drives the camshaft at one-half crankshaft speed. For maximum durability, it is an endless-type chain with no master link.

Camshaft chain, sprocket, and chain guide wear cause noise, accelerate wear, and could possibly lead to serious damage to the engine. If the chain tensioner can no longer be adjusted by the chain tensioner, either the camshaft chain or the chain guides must be replaced.

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Camshaft chain wear

Remove the camshaft chain, hold the chain taut with a force of about 5 kg in some manner such as the one shown in Fig. H26, and measure a 20-link length. Since the chain may wear unevenly, take measurements at several places. If any measurement exceeds the service limit, replace the chain.

Camshaft Chain Length Measurement

H26

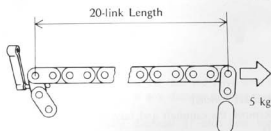


Table H12 Camshaft Chain 20-link Length

Standard	Service Limit
160.0~160.3 mm	162.4 mm

Chain guide wear

Remove the chain guides, and inspect them visually. Replace a guide if the rubber or any other portion is damaged.

Measure the depth of the grooves where the chain links run. Replace a guide if the wear exceeds the service limit.

Chain Guide Rubber Wear

H27

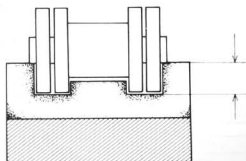


Table H13 Camshaft Chain Guide Wear

	Service Limit
Front	1.5 mm
Rear	2.5 mm

Chain tensioner inspection

Remove the camshaft chain tensioner. Visually inspect the push rod, and check that it moves smoothly in the guide, with the spring removed. If there is any damage or abnormal operation, replace the tensioner with a new one.

Measure the spring free length. Replace the spring if the free length exceeds the service limit.

H28

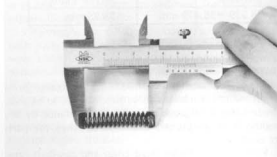


Table H14 Chain Tensioner Spring Free Length

Standard	Service Limit
about 44.2 mm	42 mm

CYLINDER HEAD, VALVES

The valves are mounted in the head; they are pushed open by the rocker arms and cams, and closed by the valve springs.

Valve guides and valve seats are pressed into the cylinder head. The valve seat, which is cut to the angles shown in Fig. H42, prevents compression leakage by fitting snugly against the valve. It also prevents the valve from overheating by allowing efficient heat transfer.

Cylinder Head

The cylinder head is made of aluminum alloy, used for its high heat conductivity, and is finned on the outside to aid dissipation of the heat generated in the combustion chambers. Carbon built up inside the combustion chambers interferes with heat dissipation and increases the compression ratio; which may result in preignition, detonation, and overheating. Trouble can also arise from improper head mounting or mounting torque, which may cause compression leakage.

Cleaning and inspection

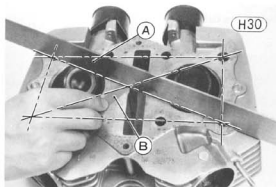
Remove the cylinder head (Pg. 54) and valves (Pg. 56). Scrape out any carbon, and wash the head with a high flash-point solvent.

H29



Cylinder head warp

Lay a straightedge across the lower surface of the head at several different points, and measure warp by inserting a thickness gauge between the straightedge and the head. If warp exceeds the service limit, repair the mating surface. Replace the cylinder head if the mating surface is badly damaged.



A. Straightedge B. Thickness Gauge

Table H15 Cylinder Head Warp

Service Limit
0.05 mm

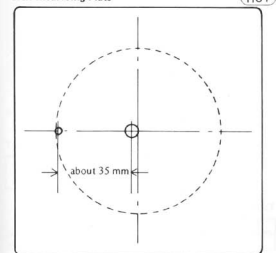
Combustion chamber volume measurement

The combustion chamber volume should be measured any time that compression measurement results in compression pressures well below or above the standard.

NOTES:

1. Another person will be needed to help expel air bubbles out of the combustion chamber.
2. Prepare a piece of transparent plastic plate which has a flat surface and two holes about 35 mm apart in its center portion. One hole should be about 6 mm in diameter, the other about 3 mm in diameter. The plate must be oil resistant, about 120 mm square, and at least 3 mm thick.

Plastic Measuring Plate

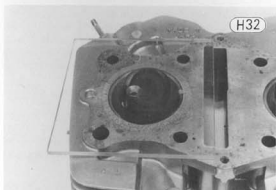


3. Obtain a burette or syringe which is calibrated at one-cc or smaller graduations. Fill it with thin oil.

Prior to the combustion chamber volume measurement, clean off any carbon in the combustion chamber, and remove any gasket flakes on the cylinder head mating surface. The standard spark plug should be installed in the chamber to be measured.

NOTE: The valves must seat well to prevent the oil from leaking out.

Apply a thin coat of grease to the cylinder head mating surface and place the plastic plate over the cylinder head combustion chamber, fitting its small hole near the edge of the combustion chamber.



Place the cylinder head on a level surface. Through the large hole, fill the combustion chamber with light oil such as 2-stroke oil until the chamber is completely but not overly filled. Tilt the cylinder head slightly so that air bubbles come out through the small hole. The oil should just rise to the bottom edge of the holes in the plate.

The amount of oil used to fill the chamber is the combustion chamber volume.



Table H16 Combustion Chamber Volume

Standard
36.0 ~ 37.0 cc

If the combustion chamber volume is too small, it is possible that the cylinder head was modified for higher compression. Make sure that all carbon deposits have been cleaned out of the chamber.

If the combustion chamber volume is too large, it is possible that the valves and valve seats have been resurfaced so much that the volume is increased. Make sure that the spark plug is the standard type and that it is fully tightened.

Valve, Valve Guide, Valve Seat

Valve face deformation or wear, stem bending or wear, and valve guide wear can cause poor valve seating. Poor seating can also be caused by the valve seat itself, if there is heat damage or carbon build-up. The result of poor valve seating is compression leakage and a loss of engine power.

In addition, valve and valve seat wear causes deeper valve seating and a decrease in valve clearance. In sufficient clearance upsets valve timing and may eventually prevent the valve from seating fully. So that wear never progresses this far, adjust the valve clearance in accordance with the Periodic Maintenance Chart (Pg. 10).

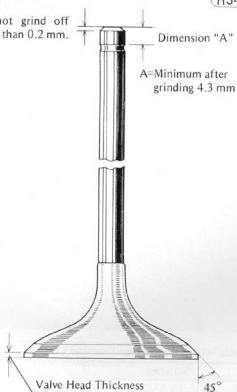
Valve inspection

Visually inspect the valve face, and replace the valve if it shows deformation or uneven wear.

Measure the thickness of the valve head using vernier caliper, and replace the valve if the thickness is under the service limit.

Valve Shape

Do not grind off more than 0.2 mm.



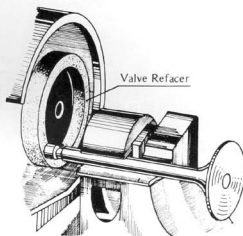
H34

If the seating surface of the valve or the end of the valve stem is damaged or badly worn, repair the valve with a valve refacer. The angle of the seating surface is 45° (Fig. H34).

CAUTION If the valve stem is ground down, be sure to leave at least 4.3 mm of stem end above the wide groove portion.

Valve Stem Grinding

H35



Position the valve in V blocks at each end of the straight portion of the stem, and set dial gauge against the center of the stem. See the example shown in Fig. H36.

Turning the valve, read the variation in the dial gauge. Replace the valve if it is bent more than the service limit.

Valve Stem Bend

H36

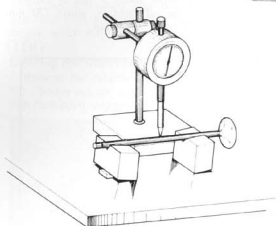


Table H17 Valve Head Thickness

Standard	Service Limit
1.0 mm	0.5 mm

Table H18 Valve Stem Bend

Standard	Service Limit
under 0.01 mm	0.05 mm

Measure the diameter of the valve stem with a micrometer. Since the stem wears unevenly, take measurements at four places up and down the stem, keeping the micrometer at right angles to the stem.

Replace the valve if the stem is worn to less than the service limit.

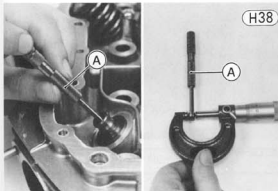


Table H19 Valve Stem Diameter

	Standard	Service Limit
Inlet	6.965~6.980 mm	6.90 mm
Exhaust	6.950~6.970 mm	6.90 mm

Valve guide inspection

Remove the valve, and measure the inside diameter of the valve guide using a small bore gauge and micrometer. Since the guide wears unevenly, measure the diameter at four places up and down the guide. If any measurement exceeds the service limit, replace the guide.



A. Bore Gauge

Table H20 Valve Guide Inside Diameter

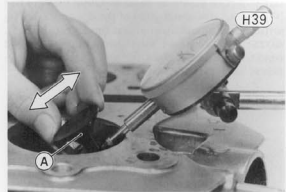
Standard	Service Limit
7.000~7.018 mm	7.08 mm

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method, as indicated below.

Insert a new valve into the guide and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface. Move the stem back and forth to measure valve/valve guide clearance. Repeat the measurement in a direction at a right angle to the first.

If the reading exceeds the service limit, replace the guide.

NOTE: The reading is not actual valve/valve guide clearance because the measuring point is above the guide.



A. Valve

Table H21 Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Inlet	0.053~0.139 mm	0.26 mm
Exhaust	0.075~0.169 mm	0.25 mm

Valve seat repair

The valve must seat evenly around the circumference over the specified area. If the seat is too wide, the seating pressure per unit or area is reduced, which may result in compression leakage and carbon accumulation on the seating surface. If the seating area is too narrow, heat transfer from the valve is reduced and the valve will overheat and warp. Uneven seating or seat damage will cause compression leakage.

Valve Seating Width

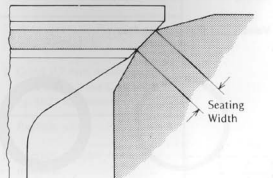
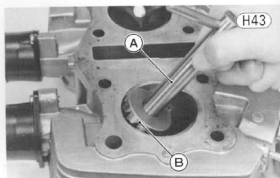
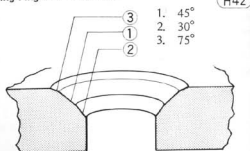


Table H22 Valve Seating Width

Standard
0.5 ~ 1.0 mm

To determine whether or not the valve seat requires repair, first remove the valve, apply machinist's dye to the valve seat, and then use a lapper to tap the valve lightly into place. Remove the valve, and note where the dye adheres to the valve seating surface. The valve seating surface should be in the middle of the valve face (Fig. H40). The distribution of the dye on the seating surface gives an indication of seat condition (Fig. H45). **NOTE:** The valve and valve guide must be in good condition before this check will give an accurate indication of valve seat condition.

Cutting Angle of Valve Seat

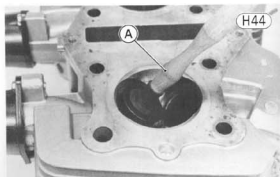


A. Valve Seat Cutter Holder (57001-106)

B. Valve Seat Cutter (57001-101, 102, 360, 361)

After cutting, lap the valve to properly match the valve and valve seat surfaces. Start with coarse lapping compound, and finish with fine compound.

Apply compound to the valve seat, and tap the valve lightly into place while rotating it. Repeat this until a smooth, matched surface is obtained.



A. Lapper

A. Valve Seating Surface

A valve seat which requires repair is cut with a set of valve seat cutters (special tools). Four cutters are required for complete repair; one 30°, one 45°, and two 75° cutters, one for the inlet and the other for the exhaust.

First, cut the seating surface of the valve seat with the 45° cutter. Cut only the amount necessary to make a good surface; overcutting will reduce the valve clearance, possibly making it no longer adjustable.

Next, use the 30° cutter to cut the surface inside the seating surface, and then use the 75° cutter to cut the outermost surface. Cut these two surfaces so that the seating surface will have a specified width.

Valve/Valve Seat Contact Area



Good



Too Wide



Too Narrow



Uneven

H42

H43

H41

H44

H45

When lapping is completed, be sure to mark each valve so it will be properly matched to its corresponding valve seat during assembly.

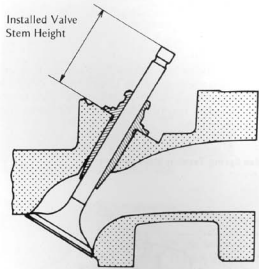
The valve clearance adjusting screw, installed in the rocker arm, is used to adjust the valve clearance. There is, however, a limit to the amount of adjustment possible turning the adjusting screw. Resurfacing of the valve face and valve seat inevitably drops the valve deeper into the valve seat, allowing the valve stem end to come closer to the adjusting screw. Consequently, the adjusting screw must be turned out to compensate for the reduced valve clearance. If the valve seat, face, and/or stem end are resurfaced, measure the installed valve height from the cylinder head upper surface which the valve guide contacts with to the end of the valve stem with a vernier caliper before assembling the cylinder head. Refer to Table H23 for the recommended repair.

Over a period of long use and repeated resurfacing, the valve may drop so far into the valve seat that even the adjusting screw cannot give adequate clearance. In this case, it is possible to grind the end of the valve stem to reduce the valve installed height and so gain the needed clearance (See Caution in Pg. 162).

If the valve drops so far into the valve seat that the installed height becomes quite large, either by a resurfacing error or heavy wear, it may be necessary to replace the valve and remeasure the installed height. If this is not successful, it will be necessary to replace the cylinder head. Replacement valve seats are not available.

Valve Stem Height

H46



Valve Springs

When the valve is not being pushed open by the rocker arm, the valve springs press the valve against the seat to prevent compression leakage. An inner spring is used with each outer spring to prevent spring surge,

Table H23 Valve Installed Height

MEASUREMENT	PROBABLE CAUSE	RECOMMENDATION
Less than 36.76 mm	Valve stem previously ground	<ol style="list-style-type: none"> 1. Be sure to leave at least 4.3 mm of stem end above the groove. See Pg. 162. 2. Move valve to deeper cut seat. Remeasure. 3. Grind valve face to drop it farther into seat. Remeasure. 4. Replace valve. Remeasure.
36.77 ~ 37.84 mm	Normal acceptable	
37.85 ~ 38.04 mm	Wear or valve face and seat grounding have dropped valve too far into seat.	<ol style="list-style-type: none"> 1. Move valve to shallower cut seat. Remeasure. 2. Grind 0.2 mm maximum off valve stem. See CAUTION, Pg. 162. Remeasure.
More than 38.05 mm	Valve face or seat worn out or ground excessively.	<ol style="list-style-type: none"> 1. Replace valve. Remeasure. 2. Replace cylinder head. Remeasure.

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which may cause valve float at high rpm. If the springs weaken or break, compression leakage and valve noise will result, dropping engine power.

Spring tension

Remove the springs, and set them one at a time, on a spring tension testing device. Compress the spring, and read the tension at the test length. If the spring tension at the specified length is weaker than the service limit, replace the spring.

Valve Spring Tension Measurement

H47

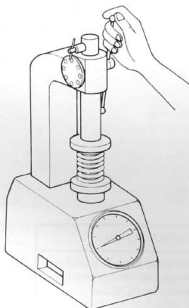


Table H24 Valve Spring Tension

	Length	Standard	Service Limit
Inner	22.2 mm	28.5 ~ 31.5 kg	27.3 kg
Outer	25.7 mm	53.2 ~ 58.8 kg	51.4 kg

Squareness

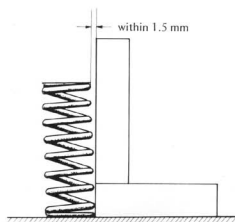
Measure the squareness of each spring by standing each end on a surface plate and setting a square against it. Replace any spring for which the distance between the top of the spring and the square is greater than the service limit.

Table H25 Valve Spring Squareness

Standard	Service Limit
under 1.0 mm	1.5 mm

Valve Spring Squareness

H48



Oil Seals

The oil seal around each valve stem prevents oil from leaking down into the combustion chamber. If an oil seal is damaged or deteriorated, oil consumption will increase, and carbon may build up in the combustion chambers. This may be indicated by white exhaust smoke.

If an oil seal appears damaged or deteriorated or if there is any doubt as to its condition, replace it with a new one.

CYLINDER BLOCK, PISTONS

The cylinder block is subjected to extremely high temperatures. Since excessive heat can seriously distort the shape of a cylinder or cause piston seizure, the cylinder block is made of aluminum alloy for good heat conduction and the outside is finned to increase the heat-radiating surface for better cooling efficiency. To minimize distortion from heat and to maximize durability, a wear resistant iron sleeve is cold-pressed into each cylinder.

Each piston is made from an aluminum alloy, which expands and distorts slightly from heat during engine operation. So that the piston will become cylindrical after heat expansion, it is designed such that, when cold, it is tapered in towards the head and is elliptical rather than perfectly round. The piston diameter is made so that there is enough clearance between the piston and cylinder to allow for expansion.

Three rings are fitted into grooves near the top of each piston to prevent compression leakage into the crankcase and to stop oil from getting up into the combustion chambers. The top two rings are compression rings, and the bottom ring is an oil ring.

The full floating type of piston pin is used to connect each piston to its connecting rod. The middle part of

the piston pin passes through the small end of the connecting rod, and a snap ring is fitted at each end of the piston pin in a groove to prevent the pin from coming out. Since the pin is the full floating type, a small amount of clearance exists between the piston pin and the piston when the engine is at normal operating temperatures.

Proper inspection and maintenance of the cylinder block and the pistons include checking the compression; removing carbon from the piston heads, piston ring grooves, and cylinder head exhaust ports; and checking for wear and proper clearance during top end overhaul. A worn cylinder, worn piston, or worn or stuck piston rings may cause a loss of compression from gas blowby past the rings. Blowby may result in difficult starting, power loss, excessive fuel consumption, contaminated engine oil, and possibly engine destruction. Oil leakage into the combustion chambers causes carbon to build up on top of the pistons; which may result in preignition, overheating, and detonation. A worn piston pin causes piston slap, which may cause accelerated piston and cylinder wear. It is evidenced by a knocking sound in the engine.

Engine problems may be caused not only by carbon deposits and wear or damage to the engine itself; but also by poor quality fuel or oil, improper oil, improper fuel/air mixture, improper supply of oil, or incorrect ignition timing. Whenever knocking, pinging, piston slap, or other abnormal engine noise is heard; the cause should be determined as soon as possible. Neglect of proper maintenance will result in reduced engine power and may lead to accelerated wear, overheating, detonation, piston seizure, and engine destruction.

Compression measurement

A compression test is useful in determining the condition of the engine. Low compression may be due to cylinder wear; worn piston ring grooves; worn, broken, or sticking piston rings; poor valve seating; cylinder head leaks; or damage to the engine such as piston seizure. Too high compression may be due to carbon build-up on the piston heads and cylinder head. Difference in compression between the cylinders may cause poor running.

Before measuring compression, check that the cylinder head is tightened down to the specified torque (Pg. 37) (and that the battery is fully charged, Pg. 218 for KZ400-B), and thoroughly warm up the engine so that engine oil between the pistons and cylinder walls will help seal compression as it does during normal running. While the engine is running, check that there is no gas leakage from around the cylinder head gasket and from the spark plugs.

Stop the engine, remove the spark plugs, and attach the compression gauge (special tool) firmly into one spark plug hole. For KZ400-B, using the starter motor, and for KZ400-C, using the kickstarter several times, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable. Repeat the measurement for the other cylinder.



A. Compression Gauge (57001-123)

Table H24 Cylinder Compression†

Standard	Service Limit
11 kg/cm ² (156 psi)	7.7 kg/cm ² (109 psi) and less than 1 kg/cm ² (14 psi) difference between the cylinder

†Engine hot, spark plugs removed, throttle fully opened, cranking the engine with the starter motor (with the kickstarter for KZ400-C).

If cylinder compression is higher than the standard value, check the following:

1. Carbon build-up on the piston head and cylinder head — clean off any carbon on the piston head and cylinder head.
2. Cylinder head gasket, cylinder base gasket — use only the proper gasket for the cylinder head. The use of a gasket of incorrect thickness will change the compression.
3. Valve stem oil seals and piston rings — rapid carbon accumulation in the combustion chambers may be caused by damaged valve stem oil seals and/or damaged piston oil rings. This may be indicated by white exhaust smoke.
4. Cylinder head volume (Pg. 161).

If cylinder compression is lower than the service limit, check the following:

1. Gas leakage around the cylinder head — replaced the damaged gasket and check the cylinder head warp (Pg. 161).
2. Condition of the valve seating (Pg. 163).
3. Valve clearance (Pg. 14).
4. Piston/cylinder clearance, piston seizure
5. Piston ring, piston ring groove

Cylinder, piston wear

Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the 3 locations (total of 6 measurements) shown in Fig. H50. If any of the cylinder inside diameter measurements exceeds the service limit,

the cylinder will have to be bored to oversize and then honed. However, if the amount of boring necessary would make the inside diameter greater than 64.99 mm, the cylinder block must be replaced.

Cylinder Inside Diameter Measurement

H50

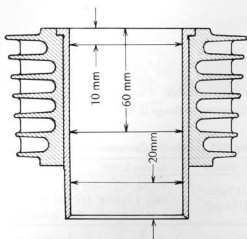


Table H27 Cylinder Inside Diameter

Standard	Service Limit
64.000 ~ 64.012 mm, and less than 0.01 mm difference between any two measurements	64.10 mm, or more than 0.05 mm difference between any two measurements

Measure the outside diameter of each piston 5 mm up from the bottom of the piston at a right angle to the direction of the piston pin. If the measurement is under the service limit, replace the piston.

NOTE: Abnormal wear such as a marked diagonal pattern across the piston skirt may mean a bent connecting rod or crankshaft.

Piston Diameter Measurement

H51

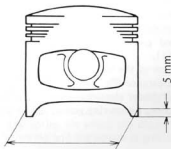


Table H28 Piston Diameter

Standard	Service Limit
63.948 ~ 63.963 mm	63.80 mm

Table H27 applies only to a cylinder that has not been bored to oversize, and Table H28 applies only to the standard size piston. In the case of a rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus 0.1 mm and the service limit for the piston is the oversize piston original diameter minus 0.15 mm. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.

NOTE: Whenever a piston or cylinder block has been replaced with a new one, the motorcycle must be broken in the same as with a new machine.

Piston/cylinder clearance

The piston-to-cylinder clearance is measured whenever a piston or the cylinder block is replaced with a new one, or whenever a cylinder is rebored and an oversize piston installed. The standard piston-to-cylinder clearance must be adhered to whenever the cylinder block is replaced or a cylinder rebored. If only a piston is replaced, the clearance may exceed the standard slightly. But it must not be less than the minimum, in order to avoid piston seizure.

The most accurate way to find the piston clearance is by making separate piston and cylinder diameter measurements and then computing the difference between the two values. Measure the piston diameter as just described, and measure the cylinder diameter at the very bottom of the cylinder.

Table H29 Piston/Cylinder Clearance

Standard
0.037 ~ 0.064 mm

Boring, honing

When boring and honing a cylinder, note the following:

1. Before boring a cylinder, first measure the exact diameter of the oversize piston, and then, in accordance with the standard clearance given in Table H28, determine the diameter of the rebore.
2. Cylinder inside diameter must not vary more than 0.01 mm at any point.
3. There are two sizes of oversize pistons available: 0.5 mm and 1.0 mm. Oversize pistons require oversize rings.
4. Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.

Piston/cylinder seizure

Remove the cylinder block and pistons to check the damage. If there is only slight damage, the piston may be smoothed with #400 emery cloth, and any aluminum deposits removed from the cylinder with either #400 emery cloth or light honing. However, in most cases, the cylinder will have to be bored to oversize and honed, and an oversize piston installed.

Piston Cleaning

Built-up carbon on the piston head reduces the cooling capability of the piston and raises compression, leading to overheating which could possibly even melt the top of the piston. To decarbonize the piston head, remove the piston (Pg. 59), scrape off the carbon, and then lightly polish the piston with fine emery cloth.



Carbon accumulated in the piston ring grooves can cause the rings to stick. Remove the rings, and clean out any carbon deposits using an end of a broken piston ring or some other suitable tool.



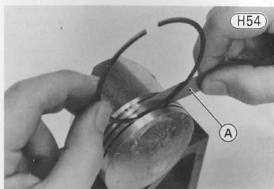
CAUTION

1. When removing carbon, take ample care not to scratch the side of the piston, or the piston ring grooves.
2. Never clean the piston heads with the engine assembled. If the carbon is scraped from the piston heads with the cylinder left in place, carbon particles will unavoidably drop between the pistons and cylinder walls onto the rings and eventually find their way into the crank chamber. Carbon particles, which are very abrasive, drastically shorten the life of the rings, pistons, cylinders, crankshaft bearings, and oil seals.

Piston ring, piston ring groove wear

Visually inspect the piston rings and the piston ring grooves. If the rings are worn unevenly or damaged, they must be replaced. If the piston ring grooves are worn unevenly or damaged, the piston must be replaced and fitted with new rings.

With the piston rings in their grooves, make several measurements with a thickness gauge to determine piston ring/groove clearance. If the clearance exceeds the service limit, measure the thickness of the piston rings and the width of the ring grooves. If the ring has worn down to less than the service limit, replace the ring; if the groove width exceeds the service limit, replace the piston.



A. Thickness Gauge

Table H30 Piston Ring/Groove Clearance

	Standard	Service Limit
Top	0.040~0.080 mm	0.18 mm
2nd	0.010~0.045 mm	0.14 mm
Oil	0.020~0.055 mm	0.15 mm

Table H31 Piston Ring Thickness

	Standard	Service Limit
Top Ring	1.170~1.190 mm	1.10 mm
2nd Ring	1.475~1.490 mm	1.40 mm
Oil Ring	2.475~2.490 mm	2.40 mm

Table H32 Piston Ring Groove Width

	Standard	Service Limit
Top Ring	1.23~1.25 mm	1.33 mm
2nd Ring	1.50~1.52 mm	1.60 mm
Oil Ring	2.51~2.53 mm	2.61 mm

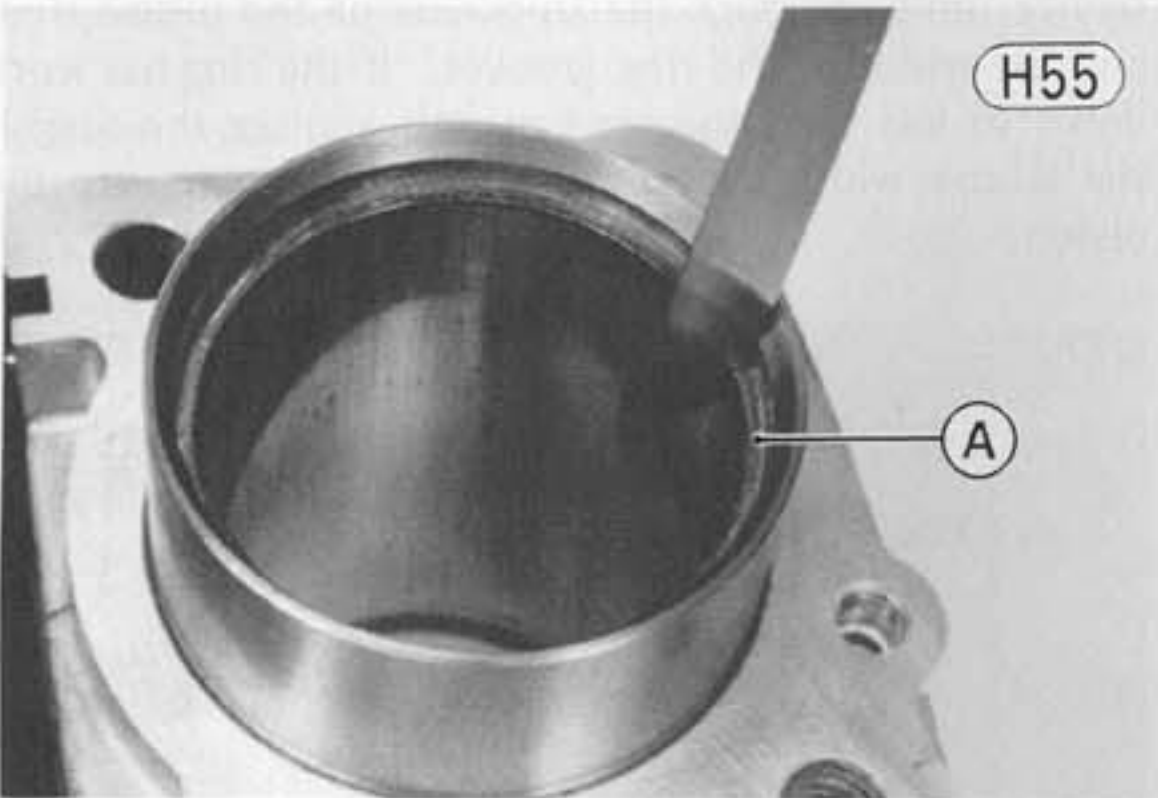
When new rings are being fitted into a used piston, check for uneven groove wear by inspecting the ring seating. The rings should fit perfectly parallel to the groove surfaces. If not, the piston must be replaced.

Piston ring end gap

Place the piston ring inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low. Measure the gap between the ends of the ring

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with a thickness gauge. If the gap is wider than the service limit, the ring is overworn and must be replaced.

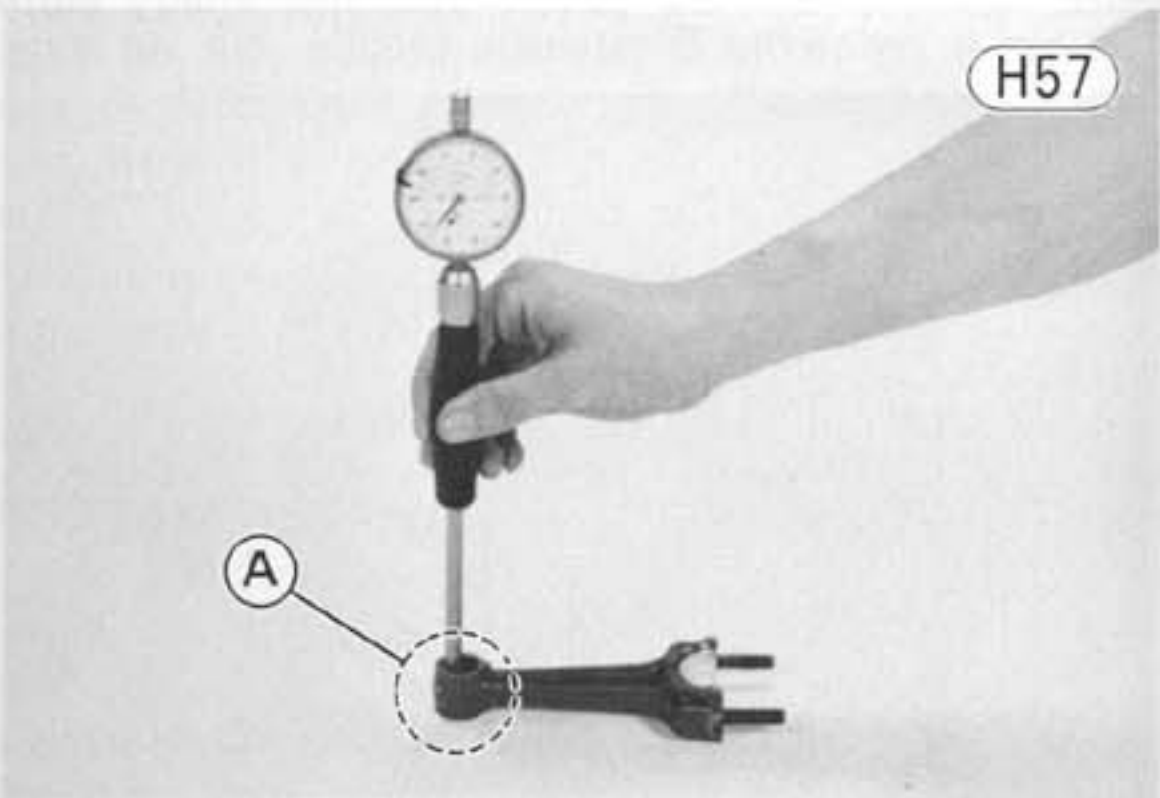


A. Piston Ring

Table H33 Ring End Gap

Standard	Service Limit
0.20~0.40 mm	0.7 mm

Measure the inside diameter of the connecting rod small end. If the diameter exceeds the service limit, replace the connecting rod.



A. Connecting Rod Small End

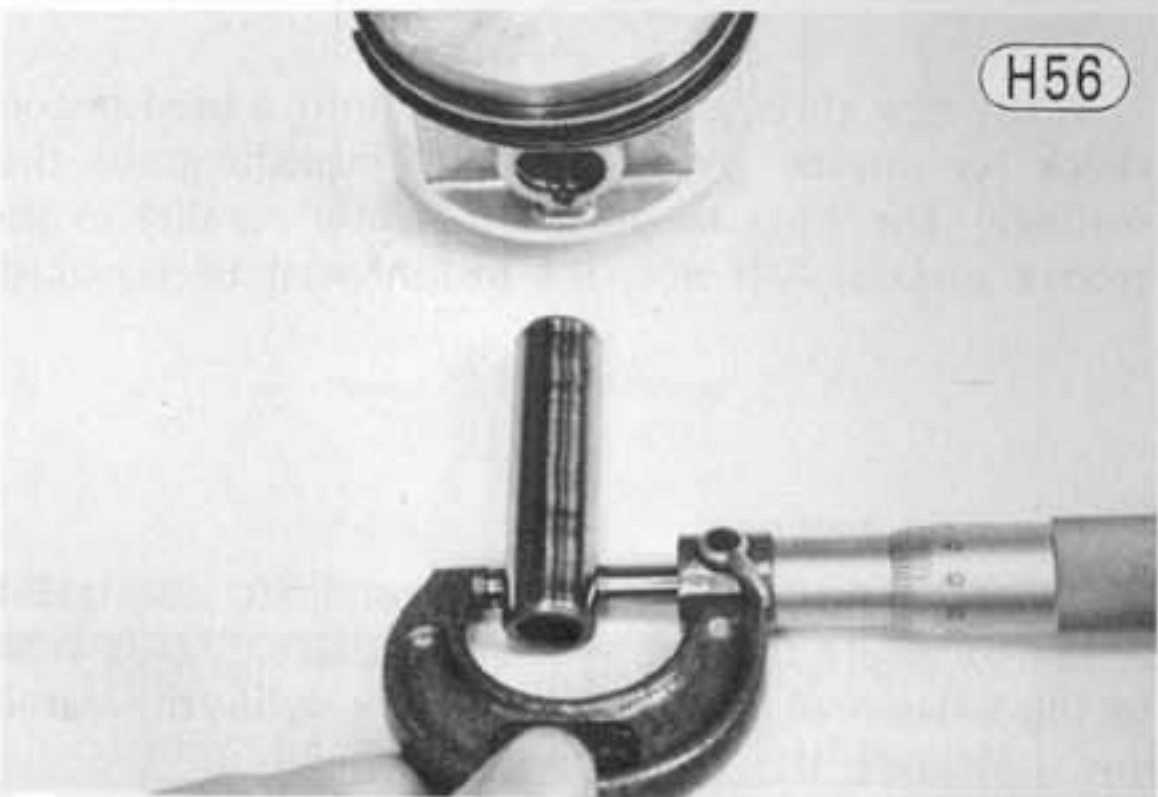
Table H35 Piston Pin, Piston Pin Hole, Small End Diameter

	Standard	Service Limit
Piston Pin	14.994 ~ 14.998 mm	14.96 mm
Pin Hole	15.004 ~ 15.009 mm	15.08 mm
Small End	15.003 ~ 15.014 mm	15.05 mm

NOTE: When a new piston or pin is used, also check that piston-to-pin clearance is 0.006 ~ 0.015 mm, and that pin to small end clearance is within 0.005 ~ 0.020 mm.

Piston, piston pin, connecting rod wear

Measure the diameter of the piston pin with a micrometer, and measure the inside diameter of both piston pin holes in the piston. If the piston pin diameter is less than the service limit at any point, replace the piston pin. If either piston pin hole diameter exceeds the service limit, replace the piston.



CRANKSHAFT, CONNECTING RODS

The crankshaft changes the reciprocating motion of the pistons into rotating motion, which is transmitted to the rear wheel when the clutch is engaged. The connecting rods connect the pistons to the crankshaft. Crankshaft or connecting rod trouble, such as worn crankshaft journals or a bent connecting rod, will multiply the stress caused by the intermittent force on the pistons. This results in not only rapid crankshaft bearing wear, but also noise, power loss, vibration, and shortened engine life. A defective crankshaft or connecting rod should always be detected at an early stage and then replaced immediately.

The following explanation concerns the most common crankshaft and connecting rod problems, giving the procedure for detecting damage and measuring wear and runout.