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SERVICING ENGINE

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COMPRESSION CHECK

The compression of a cylinder is a good indicator of its internal condition. The decision to overhaul the cylinders is often based on the results of a compression test. Periodic maintenance records kept at your dealership should include compression readings for each maintenance service.

COMPRESSION

Standard	Limit	Difference
1 000 – 1 400 kPa (10 – 14 kg/cm ²)	800 kPa (8 kg/cm ²)	200 kPa (2 kg/cm ²)

Low compression pressure can indicate any of the following conditions:

- Excessively worn cylinder wall
- Worn-down piston or piston rings
- Piston rings stuck in the grooves
- Poor seating of valves
- Ruptured or otherwise defective cylinder head gasket

Overhaul the engine in the following cases:

- Compression pressure in one of the cylinders is less than 800 kPa (8 kg/cm²).
- Difference in compression pressure between any two cylinders is more than 200 kPa (2 kg/cm²).
- All compression pressure are below 1 000 kPa (10 kg/cm²) (standard) even when they measure more than 800 kPa (8 kg/cm²).

COMPRESSION TEST PROCEDURE

NOTE:

- Before testing the compression of the engine, make sure that the cylinder head nuts and bolt are tightened to specified torque values and valves are properly adjusted.
- Warm up the engine before testing.

- Remove the fuel tank. (Refer to page 3-30).
- Remove the all spark plugs.
- Fit the compression gauge (1) in one of the plug hole, while taking care that the connection is tight.
- Twist the throttle grip full open.
- Crank the engine a few seconds with the starter, and record the maximum gauge reading as the compression of that cylinder.
- Repeat this procedure with the other cylinders.

09915-64510	Compression gauge
09915-63210	Adapter



ENGINE COMPONENTS REMOVABLE WITH ENGINE IN PLACE

The parts listed below can be removed and reinstalled without removing the engine from the frame. Refer to the page listed in this section for removal and reinstallation instructions.

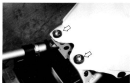
ENGINE LEFT SIDE		ENGINE CENTER		ENGINE RIGHT SIDE	
	See page		See page		See page
Camshaft cover	3-7	Exhaust pipe and muffler	3-8	Signal generator	3-16
Engine sprocket cover	3-7	Oil cooler	3-8	Clutch cover	3-17
Engine sprocket and drive chain	3-7	Oil filter	3-8	Clutch pressure, drive and	
Gear position indicator switch body	3-21	Oil pan	3-22	drive plates	3-17
Generator cover	3-20	Oil pressure switch	3-23	Oil pump drive gear	3-29
Generator rotor	3-20	Sump filter	3-22	Oil pump and y	3-19
Generator stator	3-25	Tachometer driven gear	3-13	Primary driven gear	3-18
Starter clutch	3-24	Cylinder head breather cover	3-5	Gear shifting shaft	3-10
Starter clutch life gear	3-25	Carburetor	3-5	Gear shifting bowl and	
		Throttle cable and starter cable	3-5	cam driven gear	3-18
		Cam chain tensioner	3-13		
		Cylinder head cover	3-13		
		Camshaft	3-14		
		Cylinder head	3-15		
		Cylinder	3-15		
		Piston	3-15		
		Starter motor	3-19		

ENGINE REMOVAL AND REINSTALLATION

ENGINE REMOVAL

Before taking the engine out of the frame, wash the engine with a steam cleaner and drain engine oil, etc. The procedure of engine removal is sequentially explained in the following steps, and engine installation is effected by reversing the removal procedure.

- Place an oil pan under the engine and remove the oil drain plug to drain out engine oil.
- Remove the seat and remove the left and right frame covers.
- Disconnect the battery $\ominus$ and $\oplus$ lead wires from the battery terminals.
- Remove the battery from the battery holder.
- Remove the two bolts at the rear of the fuel tank.
- Shift the fuel hose clip sideways and disconnect the two hoses (fuel ① and vacuum ②) from fuel cocks.
- Disconnect the fuel level gauge sending unit lead wires, and draw the fuel tank backward.



- Disconnect the igniter couplers (1), then remove the igniter by removing the screws.
- Disconnect the turn signal relay (2) and fuse box (3) from battery holder.
- Loosen the two belts (4) and remove the battery holder upward.
- Disconnect various lead wires.
 - * Generator lead wires (yellow) (5).
 - * Battery $\ominus$ lead wire (coupler) (6).
 - * Starter relay $\ominus$ lead wire (7).
 - * Oil pressure switch lead wire (8).
 - * Side stand check switch lead wires (coupler) (9).
 - * Gear position indicator switch lead wires (coupler) (10) and neutral indicator switch lead wire (11).



- Remove the air cleaner case mounting bolts.



- Loosen the respective clamps for right and left carburetors.
- Shift the air cleaner case backward.



- Remove the carburetors from right side after removing the throttle cable ① and starter cables ②.



- Shift the breather hose clip sideways and disconnect the hose from cylinder head breather cover.



- Pull out the spark plug caps.
- Remove the tachometer cable from cylinder head cover.
(Only for G55500)



- Remove the eight exhaust pipe clamp bolts with 8-mm hexagon wrench.

00914-25811

8 mm "T" type hexagon
wrench

- Remove the left and right muffler mounting bolts with 8-mm hexagon wrench.



- Remove the exhaust pipe connector bolts.
- Remove the exhaust pipes with mufflers.



- Remove the gearshift lever by removing the bolt.



- Remove the engine sprocket cover by removing bolts.



- Flatten the engine sprocket lock washer and remove the engine sprocket nut while depressing the rear brake pedal.



- Loosen the rear axle nut (1) after pulling out the cotter pin (2), then loosen the chain adjuster bolts (3).
- Push the rear wheel forward and disengage the drive chain and engine sprocket from the drive shaft.



- Remove the rear brake pedal by removing the bolt.



- Place an oil pan under the engine and remove the two oil cooler hoses by removing union bolts (1).



- Remove the engine mounting bolts and brackets.
- Gradually lift up the engine and lower the engine assembly on the right side making sure that it does not make contact with the frame. Remove the engine through the right side of the frame.

NOTE:

If it is difficult to remove the engine, remove the cylinder head breather cover to provide additional clearance.



ENGINE REINSTALLATION

Reinstall the engine in the reverse order of engine removal.

- After inserting the engine mounting bolts, tighten the engine mounting bracket bolts and engine mounting bolts. Insert the all three long bolts from left side. Install the brackets, spacer, bushers, bolts and nuts properly as shown in the following illustration.

NOTE:

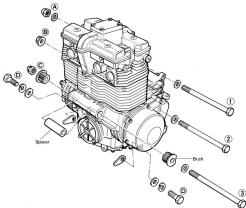
The engine mounting nuts are self-lock nuts. Once the nut has been removed, it is no longer of any use. Be sure to use new nuts and tighten them to the specified torque.

TIGHTENING TORQUE

ITEM	kg-m	ft-lb
(A) (C)	6.7 – 8.0	49.5 – 58.0
(B) (D)	8.0 – 7.2	43.5 – 52.0

LENGTH

(1)	160 mm
(2)	165 mm
(3)	195 mm
(4)	35 mm





- The nut (a) takes its position in the place indicated.
- Oil cooler hose guides are installed on the front-upper engine mounting brackets (b), as shown in the figure.



- Locate the copper washers on the both sides of union and tighten the union bolt to the specified torque.

Tightening torque	25 – 30 N·m
	$\left(\begin{array}{l} 2.5 - 3.0 \text{ kg-m} \\ 18.0 - 21.5 \text{ lb-ft} \end{array} \right)$



- When installing the brake pedal, align the slit with the punched mark.



- The engine sprocket should be installed on the drive shaft as shown in the figure at the same time of the installation of drive chain. If it is difficult to assemble the engine sprocket, remove the rear axle cotter pin, loosen the axle nut and chain adjuster bolts to push the wheel forward, and give the drive chain some play. When replacing the engine sprocket nut, stepped side should be faced inside. After completing tightening of the engine mounting bolts, adjust free play of the drive chain. (see page 2-11).



TIGHTENING TORQUE

ITEM	kg-m	lb-ft
Engine sprocket nut	10.0 – 15.0	72.5 – 108.5
Rear axle nut	5.0 – 8.0	36.0 – 58.0
Exhaust pipe bolt	0.9 – 1.2	6.5 – 8.5
Exhaust pipe connector bolt	0.9 – 1.2	6.5 – 8.5
Muffler mounting bolt	2.2 – 3.5	16.0 – 25.5

- Replace the plug caps on the spark plugs so that their code markings correspond to the cylinder numbers arranged in the order of ①, ②, ③ and ④ from the left.



- Install 3.1L of engine oil SAE10W/40 under API classification SF into the engine. Several minutes after starting and stopping engine, check that the oil level remains between the marks of oil inspection windows.

Change	2 400 ml (2.6 us qt)
Filter change	2 800 ml (3.1 us qt)
Overhaul	3 100 ml (3.3 us qt)

- After remounting the engine, route wiring harness, cables and hoses properly by referring to the sections, for wire routing, cable routing and hose routing. (see page 3-10, 14 and 16)
Adjust the following items to the specification.

	page
* Clutch cable	3-10
* Throttle cable	3-9
* Drive chain	3-11
* Idling adjustment	3-9
* Balancing carburetors	4-15

ENGINE DISASSEMBLY

- Remove the two oil hoses by removing the union bolts.



- Loosen the lock nut ① and tighten the stop screw ②, and then remove two cam chain tensioner mounting bolts ③.

NOTE:

Screw ② locks the spring loaded tensioner push rod inside.



- Remove the tachometer sleeve securing bolt, and then pull out the tachometer driven gear shaft with sleeve.
(Only for GS650E)



- Remove the cylinder head cover and its gasket.

09914-25811

6 mm "T" type hexagon
wrench



- Remove the signal generator cover.



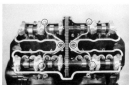
- Remove the two oil pipes by removing the union bolts and allen bolts.

08911-73730

5 mm "T" type hexagon wrench

NOTE:

These two union bolts are different in shape, replace them in their original positions. (see page 3-79)



- Remove the ten camshaft holders by removing the bolts.

NOTE:

Be sure to loosen camshaft holder bolts evenly by shifting the wrench diagonally.



- Remove the two camshafts, intake and exhaust.

- Pull out the cam chain guide.

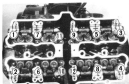


- The cylinder head becomes free for removal when its one 6-mm bolt (B) and twelve 8-mm nuts are removed.

00011-74520	Long socket 12 mm
00014-24510	T handle

NOTE:

When loosening the cylinder head nuts, break each nut loose a little at a time in a descending order according to the numbers cast on a cylinder head.



- Firmly grip the cylinder block at both ends, and lift it straight up. If the block does not come off, lightly tap on the finless portions of the block with a plastic mallet to shake the gasketed joint loose.

NOTE:

Cylinder removal from crankcase is made easier by the use of the cylinder disassembling tool.

00012-34510	Cylinder disassembling tool
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CAUTION:

Be careful not to damage the fins when removing or handling the cylinder block. This precaution applies to the cylinder head also.



- Scribe the cylinder No. on the head of the respective pistons.

- Place a cloth beneath the piston so as not to drop the parts in the crankcase, and remove the circlip (1) with pliers.



- Draw out the piston pin with the special tool. Place each piston pin in the same piston that it was removed from.

09910-34510

Piston pin puller



- Remove the rotor mounting bolt.
- Remove the signal generator rotor.

09914-26811

6 mm "T" type hexagon wrench



- Remove two mounting screws for signal generator assembly, and then remove the assembly.



- Remove the clutch cover and gasket.



- By holding the crankshaft with conrod stopper, remove the clutch spring mounting bolts in a cross-cross manner.

08910-20118

Conrod stopper



- After removal of several clutch driven and drive plates, flatten clutch sleeve hub nut lock washer by using chisel.
- Firmly secure clutch sleeve hub to remove mounting nut with clutch sleeve hub holder, and then remove the clutch sleeve hub.

08630-53710

Clutch sleeve hub holder



- Remove the thrust washer ①.



- Run two 4-mm screws into the primary driven gear spacer to ease out the spacer by pulling. With the spacer removed, the primary driven gear (integral with the clutch housing) is free to disengage from the primary drive gear.



- Remove the thrust washers ① and ② from the countershaft.



- Remove the clip and washer from the gearshift shaft.



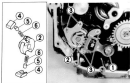
- Extract the gearshift shaft ①, and then remove the cam driven gear ② by removing the screws ③.

09900-09003

Impact driver set

NOTE:

When removing the cam driven gear, do not lose gear shifting pawl ④, pin ⑤ and spring ⑥.



- Remove the countershaft bearing retainer ① by removing the three screws.

00000-00000

Impact driver set



- Using snap ring pliers, remove the oil pump driven gear, drive pin and washers. Then remove the oil pump with O-ring by removing the three oil pump securing bolts.

00000-00107

Snap ring pliers



- Remove the starter motor cover and starter motor by removing the bolts.



- Remove the generator cover and gasket.



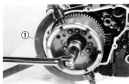
- Remove the starter idle gear shaft and idle gear.



- Using rotor holder ①, remove the rotor securing bolt.

09930-44911

Rotor holder



- Install the rotor remover attachment ② and sliding hammer assembly ③ into the base of rotor and remove rotor with starter clutch assembly while sliding the remover.

NOTE:

Do not hit the rotor with a hammer.

09930-30102

Rotor remover slide shaft

09930-30180

Attachment E



- Remove the gear position indicator switch body by removing the screws.

NOTE:

Do not miss the O-ring, switch contact and its spring.



- Flatten the lock portion of oil seal retainer and remove the oil seal retainer securing bolts.



- Remove the oil filter cap by removing the three cap nuts.



- Remove the crankcase securing bolts from upper crankcase.



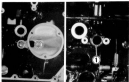
- Remove the oil pan by removing the bolts.



- Remove the O-ring (1) and oil pump filter (2).



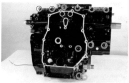
- Remove the oil guide by removing the bolts and take off the O-ring (1).



- Remove the overhose securing bolts from lower crankcase.

NOTE:

Loosen the bolts in a criss-cross manner.



- Removes the crankcase securing nut from lower crankcase.



- When removing the crankshaft tightening bolts, loosen them in the descending order of numbers assigned to these bolts.

NOTE:

Two allen bolts are used for tightening crankshaft at the portion (B) .



09914-25811

6 mm "T" type hexagon wrench

- Make sure that all bolts are removed without fail. Hammer lightly the lower crankcase side with a plastic hammer to separate the upper and lower crankcase halves and then lift the latter.

**NOTE:**

Separating the crankcases is made easier by the use of the cylinder disassembling tool.

09913-34510

Cylinder disassembling tool

**CAUTION:**

Do not drop the crankshaft journal bearings from the lower crankcase.

- Remove the crankshaft assembly from the upper crankcase.

NOTE:

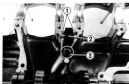
Bear in mind that the crankshaft thrust bearings ① are located between shaft and case.



- Pull out the two dampers ① and chain guide ②.
- Remove the O-ring ③ and washer ④.
- Remove the countershaft assembly ⑤ and drive shaft assembly ⑥.

NOTE:

Do not lose the dampers ①, O-ring ③, washer ④, C-rings ②, bearing pins ⑤ and oil jets ⑥.



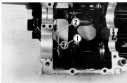
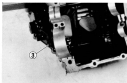
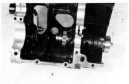
- Hold the gear shifting forks by hand to extract the gear shifting fork shaft from the lower crankcase.



- Unhook the cam stopper spring ① from the lower crankcase.
- Remove the spring ② and neutral stopper ③ by removing neutral stopper bolt ④.



- Extract the gear shifting cam from the lower crankcase.
- Remove the circlip ①, and then remove the cam stopper arm ② by removing the bolt ③.



ENGINE COMPONENTS INSPECTION AND SERVICING

CYLINDER HEAD SERVICING

CAUTION:

Be sure to identify each removed part as to its location, and lay the parts out in groups designated as "No. 1", "No. 2", "Exhaust", "Inlet", so that each will be restored to the original location during assembly.

NOTE:

- When removing rocker arm shaft, remove the rocker arm shaft stop bolt ① and Allen bolt ②, and screw 6 mm bolt into the rocker arm shaft end and pull it out.
- After installing the stop bolt ① with applying thread-lock "1381A".
- Removal of valves completes ordinary disassembling work. If valve guides have to be removed for replacement after inspecting related parts, carry out the steps shown in valve guide servicing.

099104-32020

Thread lock super "1381A"

- Using the special tools, compress the valve springs and take off the two cotter halves ① from the valve stem.

099116-14510

Valve lifter

099116-14910

Valve lifter attachment

099116-84510

Tweezers

- Take out the spring retainer, inner and outer springs.
- From the other side, pull out the valve.



CYLINDER HEAD DISTORTION

- Decarbonize the combustion chambers.
- Check the gasketed surface of the cylinder head for distortion with a straightedge and thickness gauge, taking a clearance reading at several places indicated. If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder head.

09900-20800	Thickness gauge
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Service Limit	0.2 mm (0.008 in)
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**VALVE STEM RUNOUT**

- Support the valve with "V" blocks, as shown, and check its runout with a dial gauge.

The valve must be replaced if the runout exceeds the limit.

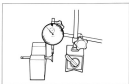
Service Limit	0.05 mm (0.002 in)
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**VALVE HEAD RADIAL RUNOUT**

- Place the dial gauge at right angles to the valve head face, and measure the valve head radial runout.

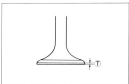
If it measures more than the limit, replace the valve.

Service Limit	0.03 mm (0.001 in)
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**VALVE FACE WEAR**

- Visually inspect each valve for wear of its seating face. Replace any valve with an abnormally worn face.
- The thickness ① decreases as the wear of the face advances. Measure the thickness and, if the thickness is found to have been reduced to the limit, replace it.

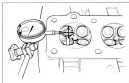
Service Limit ①	0.5 mm (0.02 in)
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VALVE GUIDE-VALVE STEM CLEARANCE

Measure the clearance in two directions, "X" and "Y", perpendicular to each other, by positioning the dial gauge as shown. If the clearance measured exceeds the limit, (see below) then determine whether the valve or the guide should be replaced to reduce the clearance to the standard range:

Valve	Service Limit
Intake valves	0.35 mm (0.014 in)
Exhaust valves	0.35 mm (0.014 in)



VALVE STEM WEAR

If the valve stem is worn down to the limit, as measured with a micrometer, where the clearance is found to be in excess of the limit indicated, replace the valve; if the stem is within the limit, then replace the guide. After replacing valve or guide, be sure to recheck the clearance.

09900-20005	Micrometer (0 – 25 mm)
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Valve	Standard
Intake valves	4.980 – 4.975 mm (0.1963 – 0.1960 in)
Exhaust valves	4.945 – 4.960 mm (0.1947 – 0.1963 in)

VALVE GUIDE SERVICING

- Using the valve guide remover ①, drive the valve guide out toward intake or exhaust camshaft side.

09916-44310	Valve guide remover
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NOTE:

- Discard the removed valve guide sub-assemblies.
- Only oversized valve guides are available as replacement parts.



- Re-finish the valve guide holes in cylinder head with the reamer and handle.

09916-34580	Valve guide reamer
09916-34541	Reamer handle



- Fit a ring to each valve guide. Be sure to use new rings and valve guides. Reuse of rings and valve guides removed during disassembly is prohibited. Remember that both valve guides for intake and exhaust and both oil seals are identical in shape.

11116-43470	Intake valve guide
11116-43470	Exhaust valve guide
09089-06007	Valve guide oil seal

- Oil the stem hole, too, of each valve guide and drive the guide into the guide hole with the valve guide remover and attachment.

09916-44310	Valve guide remover/installer
09916-44620	Attachment

CAUTION:

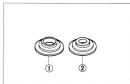
Failure to oil the valve guide hole before driving the new guide into place may result in a damaged guide or head.

- After fitting the valve guides, re-finish their guiding bores with the reamer. Be sure to clean and oil the guide after reaming.

09916-34570	Valve guide reamer
09916-34541	Reamer handle



- Install the valve spring lower seat (1). Be careful not to confuse the lower seat with the spring retainer (2).



- Oil each oil seal, and drive them into position with the finger tip.

NOTE:

Do not use the oil seals removed once. Use new seals.



VALVE SEAT WIDTH

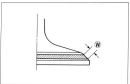
- Coat the valve seat with Prussian blue uniformly. Fit the valve and tap the coated seat with the valve face in a rotating manner, in order to obtain a clear impression of the seating contact. In this operation, use the valve lifter to hold the valve head.
- The ring-like dye impression left on the valve face must be continuous—without any break—and, in addition to this requirement, the width of the dye ring, which is the visualized seat “width”, must be within the following specifications:



Valve seat width

Seat width	Standard
⊙	0.9 – 1.1 mm (0.035 – 0.043 in)

If either requirement is not met, correct the seat by servicing it as follows:



VALVE SEAT SERVICING

The valve seats for both the intake and exhaust valves are machined to two different angles. The seat contact surface is cut 45° and the area above the contact surface (closest to the combustion chamber) is cut to 15° .

Valve seat cutter (N-116)

Valve seat cutter (N-120)

Valve seat cutter (N-121)

Valve seat cutter (N-130)

Solid pilot (N-100-5-01)

	Intake side	Exhaust side
45°	N-116	N-121
15°	N-120	N-130

NOTE:

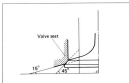
The valve seat contact area must be inspected after each cut.

- Insert the solid pilot ① with a slight rotation. Seat the pilot snugly. Install the 45° cutter, attachment and T handle.
- Using the 45° cutter, descand and clean up the seat with one or two turns.
- Inspect the seat by the previously described seat width measurement procedure. If the seat is pitted or burned, additional seat conditioning with the 45° cutter is required.

NOTE:

Get only the minimum amount necessary from the seat to prevent the possibility of the valve stem becoming too close to the rocker arm for correct valve contact angle.

If the contact area is too high on the valve, or if it is too wide, use a 15° cutter to lower and narrow the contact area.



Contact area too high and too wide on face of valve



If the contact area is too low or too narrow, use the 45° cutter to raise and widen the contact area.

Contact area too low and too narrow on face of valve



- After the desired seat position and width is achieved, use the 45° cutter very lightly to clean up any burrs caused by the previous cutting operations. **DO NOT** use lapping compound after the final cut is made. The finished valve seat should have a velvety smooth finish and not a highly polished or shiny finish. This will provide a soft surface for the final seating of the valve which will occur during the first few seconds of engine operation.



- Clean and assemble the head and valve components. Fill the intake and exhaust ports with gasoline to check for leaks. If any leaks occur, inspect the valve seat and face for burrs or other things that could prevent the valve from sealing.

WARNING:

Always use extreme caution when handling gasoline.

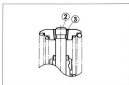
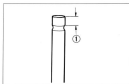


NOTE:

After servicing the valve seats, be sure to adjust the valve clearance after the cylinder head has been reinstalled. (see page 3-45)

CAUTION:

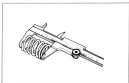
- Refacing valve stem and face is permissible when the length ① will not be reduced to less than 2.9 mm. If this length becomes shorter than 2.9 mm (0.11 in), then the valve must be replaced.
- After installing the valve whose stem end has been ground off as above, check that the face ② of valve stem and is above the valve cutter ③.

**VALVE SPRINGS**

- The force of the two coil springs keeps the valve seat tight. Weakened springs result in reduced engine power output, and often account for the chattering noise coming from the valve mechanism.
- Check the valve springs for proper strength by measuring their free length and also by the force required to compress them. If the spring length is less than the service limit, or if the force required to compress the spring does not fall within the range specified, replace both the inner and outer springs as a set.

CAUTION:

Replace both the valve springs, inner and outer, at a time, if any one of these is found to be beyond the limit.

**Valve spring free length**

Spring	Service Limit
INNER	21.6 mm (1.24 in)
OUTER	35.1 mm (1.38 in)

Valve spring tension

Spring	Standard
INNER	5.0 – 5.88 kg/28 mm (11.0 – 12.96 lbs/1.1 in)
OUTER	8.37 – 9.83 kg/31.5 mm (18.45 – 21.67 lbs/1.24 in)



REASSEMBLY

- Insert the valves, with their stems coated with high quality molybdenum disulfide lubricant (SUZUKI MOLY PASTE) all around and along the full stem length without any break.

CAUTION:

When inserting each valve, take care not to damage the lip of the stem seal.



09000-25140

SUZUKI Moly Paste

- Install the valve springs with the small pitch portion (B) facing cylinder head.
(A) : Large-pitch portion.



- Put on the valve retainer and, using the valve lifter, press down the springs, fit the cotter halves to the stem end, and release the lifter to allow the cotter (1) to wedge in between retainer and stem. Be sure that the rounded lip (2) of the cotter fits snugly into the groove (3) in the stem end.

09915-14510

Valve lifter

09915-14910

Valve lifter attachment

09915-84510

Tweezers

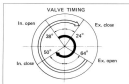


CAUTION:

Be sure to restore each spring and valve to their original positions.

CAMSHAFT

- Both camshafts should be checked for runout and also for wear of cams and journals if the engine has been noted as giving abnormal noise or vibration or lack power output. Any of these conditions may be caused by camshafts worn down or distorted to the service limit.



- The exhaust camshaft can be distinguished from that of the intake by the tachometer drive gear (1) (for exhaust).

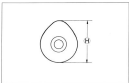


CAM WEAR

- Worn-down cams are often the cause of inaccurate valve operation, resulting in reduced power output. The limit of cam wear is specified for both intake and exhaust cams in terms of cam height (H), which is to be measured with a micrometer. Replace camshafts if found worn down to the limit.

Cam height

Height (H)	Service Limit
Intake cam	34.640 mm (1.3636 in)
Exhaust cam	34.060 mm (1.3409 in)



CAMSHAFT JOURNAL WEAR

- Determine whether or not each journal is worn down to the limit by measuring the oil clearance with the camshaft installed in place. Use plastigauge ① to read the clearance at the widest portion, which is specified as follows:

Camshaft—Journal oil clearance (IN & EX)

Service Limit	0.15 mm (0.006 in)
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NOTE:

Install each holder to their original positions.

- Tighten the camshaft holder bolts evenly and diagonally to the specified torque.

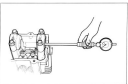
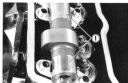
Tightening torque	8 – 12 N·m (0.8 – 1.2 kg·m) 6.0 – 8.5 lb·ft
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NOTE:

Do not rotate the camshafts with plastigauge in place.

- Remove the camshaft holders, and read the width of compressed plastigauge with envelope scale. This measurement should be taken at the widest part.

- If the camshaft journal oil clearance measured exceed the limit, measure the inside diameter of camshaft journal holder and outside diameter of the camshaft journal. Replace the camshaft or cylinder head depending on which one exceeds the specification.



09900-20205	Micrometer (0 – 25 mm)
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	Standard
Journal holder I.D. (In & Ex)	22.012 – 22.026 mm (0.8666 – 0.8671 in)
Camshaft journal O.D. (In & Ex)	21.959 – 21.980 mm (0.8646 – 0.8654 in)

Only for center journals

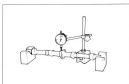
Journal holder I.D. (In & Ex)	22.030 – 22.043 mm (0.8673 – 0.8678 in)
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CAMSHAFT RUNOUT

- Measure the runout with a dial gauge. Replace the camshaft if the runout exceeds the limit.

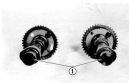
Camshaft runout (IN & EX)

Service Limit	0.1 mm (0.004 in)
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CAM SPROCKET REASSEMBLY

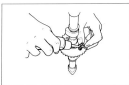
- It is very important that each sprocket be positioned angularly on its camshaft as illustrated. Its correct position is determined by arrow mark "3" (on INTAKE sprocket) or arrow marks "1" and "2" (on EXHAUST sprocket) located (as shown) in reference to the notch ① in the camshaft right end.



- Apply THREAD LOCK SUPER "1363A" to the threads of cam sprocket bolts, and tighten them to the following torque value:

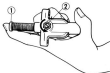
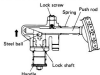
99104-32000	Thread lock super "1363A"
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Tightening torque	24 – 26 N·m (2.4 – 2.6 kg-m) (17.5 – 19.0 lb-ft)
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CAM CHAIN TENSIONER DISASSEMBLY

- The tension adjuster used in the G5250 is an automatic type that adjusts itself to apply a constant tensioning force to the chain by compensating for the stretch of the chain.
- The spring-loaded pushrod exerts a constant pressure on the camshaft chain. As the chain stretches, it yields to this pressure and remains in a state of tension. Once the adjuster is set after installation, there is no need to make any further adjustment.
- The pushrod effectively contends with the tendency of the camshaft chain tension to vary during driving condition as it may move to one direction only.
- While pushing the push rod ①, loosen the lock screw ② and extract the push rod.



INSPECTION

- Turn the handle ③ all the way counterclockwise after loosening the lock screw, and move the push rod ① in place to see if it slides smoothly. If any stickiness is noted, remove the rod for inspection. A bent or scratched push rod must be replaced.

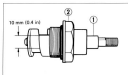


- Turn handle ③ all the way counterclockwise against the force of its coil spring and then turn it back as assisted by spring force to see if the handle returns to the original position ⑤ without exhibiting any sticking on the way. Repeat this process several times. If any excessive sticking is felt or if the self-adjusting action is faulty, replace the whole tensioner.

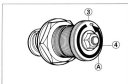
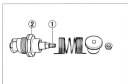


REASSEMBLING

- Apply engine oil to the lock shaft ①. Insert the shaft into the holder ②, and bring the two into the relative position indicated.



- Hook the spring onto the holder and handle ③, twist the spring by one complete rotation counterclockwise ⑥, fit the handle onto the shaft, and then tighten it by nut ④.



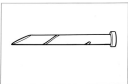
- After tightening the lock shaft nut ④, install the lock shaft assembly ③ on the tensioner body ⑤. Be sure to adhere to the following torque specifications:

Lock shaft nut ④ tightening torque	8 – 10 N·m (0.8 – 1.0 kg·m) (6.0 – 7.0 lb-ft)
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Shaft assembly ③ tightening torque	30 – 35 N·m (3.0 – 3.5 kg·m) (21.5 – 25.5 lb-ft)
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- Apply a high quality molybdenum disulfide lubricant (SUZUKI MOLY PASTE) to the push rod and engine oil to the push rod guide hole.

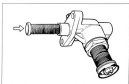
99000-25140	SUZUKI Moly Paste
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- Match the lock screw hole ① to the long groove ② in the push rod, as shown.
- Slide the push rod spring on the pushrod.



- While turning lock shaft handle counterclockwise, push in the pushrod all the way. Keep on turning the handle until it refuses to turn further.



- Tighten the lock screw to lock the pushrod, so that the pushrod will not plunge out.

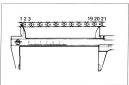


CAM CHAIN 20-PITCH LENGTH

Pull the chain tight to remove any slack, then using vernier calipers, measure the 20-pitch length of cam chain. If it measures more than the limit, replace the cam chain.

Service Limit

128.9 mm (5.07 in)



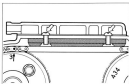
CAM CHAIN GUIDE

NOTE:

When replacing cam chain guide, apply SUZUKI Thread lock cement "1381A" to screw thread.

99104-32020

Thread lock super "1381A"



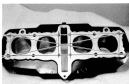
CYLINDER DISTORTION

Check the gasketed surface of the cylinder for distortion with a straightedge and thickness gauge, taking a clearance reading at several places as indicated. If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder.

Cylinder distortion specification

Service Limit

0.2 mm (0.008 in)



CYLINDER BORE

Measure the cylinder bore diameter at six places. If any one of the measurements exceeds the limit, overhaul the cylinder and replace the piston with an oversize, or replace the cylinder. Once the remaining cylinders must be also rebored accordingly. Otherwise, the imbalance might cause excess vibration.

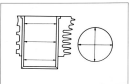


Cylinder bore

Service Limit

60.100 mm (2.3661 in)

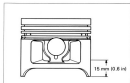
09900-20608

Cylinder gauge set
(40 - 80 mm)

PISTON DIAMETER

Using a micrometer, measure the piston outside diameter at the place shown in Fig. If the measurement is less than the limit, replace the piston.

Piston oversize	0.5, 1.0 mm
Service Limit	59.993 mm (2.3575 in)
09900-20203	Micrometer (50 – 75 mm)



PISTON-CYLINDER CLEARANCE

As a result of the above measurement, if the piston clearance exceeds the following limit, overhaul the cylinder and use an oversize piston, or replace both cylinder and piston.

Service Limit	0.120 mm (0.006 in)
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PISTON RING-GROOVE CLEARANCE

Using a thickness gauge, measure the side clearances of the 1st and 2nd rings. If any of the clearances exceeds the limit, replace both piston and piston rings.

09900-35803	Thickness gauge
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Piston ring-groove clearance

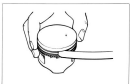
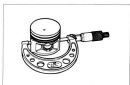
Piston ring	Service Limit
1st	0.18 mm (0.007 in)
2nd	0.15 mm (0.006 in)

Piston ring groove width

Piston ring	Standard
1st	1.01 – 1.03 mm (0.039 – 0.041 in)
2nd	1.21 – 1.23 mm (0.047 – 0.049 in)
Oil	2.51 – 2.53 mm (0.099 – 0.100 in)

Piston ring thickness

Piston ring	Standard
1st	0.975 – 0.990 mm (0.0384 – 0.0390 in)
2nd	1.175 – 1.190 mm (0.0461 – 0.0469 in)



PISTON RING FREE END GAP AND PISTON RING END GAP

Before installing piston rings, measure the free end gap of each ring using vernier calipers. Next, fit the ring in the cylinder, and measure each ring end gap using a thickness gauge.

If any ring has an excess end gap, replace the ring.

Piston ring free end gap

Piston ring	Service Limit
1st	0.0 mm (0.01 in)
2nd	0.5 mm (0.03 in)

09900-20101	Vernier calipers
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Piston ring end gap

Piston ring	Service Limit
1st & 2nd	0.7 mm (0.03 in)

09900-20803	Thickness gauge
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■ Oversize piston rings

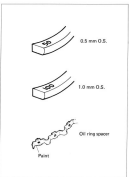
The following two types of oversize piston rings are used. They bear the following identification numbers.

	1st	2nd
0.5 mm	60	60
1.0 mm	100	100

■ Oversize oil rings

The following two types of oversize oil rings are available as optional parts. They bear the following identification marks.

SIZE	COLOR
STD	Painted red
0.5 mm O.S.	Painted blue
1.0 mm O.S.	Painted yellow



■ Oversize side rail

Just measure outside diameter to identify the size.

PISTON PIN AND PIN BORE

Using a small bore gauge, measure the piston pin bore inside diameter. Using a micrometer, measure the piston pin outside diameter. If the difference between these two measurements is more than the limits, replace both piston and piston pin.

Piston pin bore I.D.

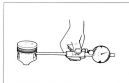
Service Limit	16.030 mm (0.6311 in)
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Using a micrometer, measure the piston pin outside diameter at three positions.

Piston pin O.D.

Service Limit	16.990 mm (0.6701 in)
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06900-20205	Micrometer 10 – 25 mm
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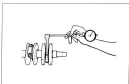
CONNECTING ROD SMALL END I.D.

Using a small bore gauge, measure the connecting rod small end inside diameter.

Connecting rod small end I.D.

Service Limit	16.040 mm (0.6315 in)
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- If the connecting rod small end inside diameter exceeds the abovementioned limit, replace the connecting rod.



CONNECTING ROD BIG END THRUST CLEARANCE

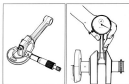
Check the connecting rod side clearance by using a thickness gauge. If the clearance exceeds the limit, replace connecting rod or crankshaft.

Service Limit	0.3 mm (0.01 in)
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06900-20900	Thickness gauge
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	Standard
Big end width	19.95 – 20.00 mm (0.785 – 0.787 in)
Crank pin width	20.10 – 20.15 mm (0.791 – 0.793 in)



CONNECTING ROD-CRANK PIN BEARING SELECTION

- Loosen bearing cap nuts, and tap the bolt and lightly with plastic hammer to remove bearing cap.
- Remove rods, and mark them to identify the cylinder position.
- Inspect bearing surfaces for any sign of fusion, pitting, burn, or flaws. If any, replace them with a specified set of bearings.

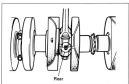
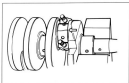
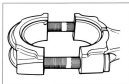
NOTE:

Never try to remove or loosen the connecting rod cap bolts due to their possible loosening in the rod. Once displaced, the bearing cap will not be fitted properly.

- Place plastigauge axially on the crank pin, avoiding oil hole end at the TDC or BDC side as shown.
- Tighten the bearing cap with two-step torque values.

NOTE:

When fitting bearing cap to crank pin, be sure to discriminate one end from the other, namely front and rear.



Initial tightening torque	16 – 22 N·m (1.6 – 2.2 kg-m) (11.5 – 16.0 lb-ft)
Final tightening torque	33 – 37 N·m (3.3 – 3.7 kg-m) (24.0 – 27.0 lb-ft)

NOTE:

Never rotate crankshaft or connecting rod when a piece of Plastigage is in the clearance.

- Remove the caps, and measure the width of compressed plastigage with envelope scale. This measurement should be taken at the widest part.

Standard	0.024 – 0.048 mm (0.0009 – 0.0019 in)
Service Limit	0.060 mm (0.0024 in)

- If oil clearance exceeds the service limit, select the specified bearings from the following table.
- Check the corresponding rod I.D. code number ①, "1" or "2".
- Check the corresponding crank pin O.D. code number ②, "1", "2" or "3".

Bearing selection table

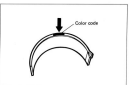
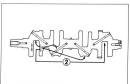
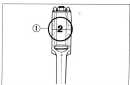
	Code	Crank pin O.D. ②		
		1	2	3
Connect. I.D. ①	1	Green	Black	Brown
	2	Black	Brown	Yellow

Crank pin bearing oil clearance

Standard	0.024 – 0.048 mm (0.0009 – 0.0019 in)
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Connecting rod I.D. specification

Code	I.D. specification
1	35.000 – 35.008 mm (1.3780 – 1.3783 in)
2	35.008 – 35.016 mm (1.3783 – 1.3788 in)



Crank pin O.D. specification

Code	O.D. specification
1	31.992 – 32.000 mm (1.2595 – 1.2598 in)
2	31.994 – 31.992 mm (1.2592 – 1.2595 in)
3	31.976 – 31.984 mm (1.2589 – 1.2592 in)

Bearing thickness

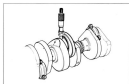
Color (Part No.)	Thickness
Green (12164-43400-010)	1.484 – 1.488 mm (0.0584 – 0.0586 in)
Black (12164-43400-020)	1.488 – 1.492 mm (0.0586 – 0.0587 in)
Brown (12164-43400-030)	1.492 – 1.496 mm (0.0587 – 0.0589 in)
Yellow (12164-43400-040)	1.496 – 1.500 mm (0.0589 – 0.0591 in)

CAUTION:

Bearing should be replace as a set.

BEARING ASSEMBLY

- When fitting the bearings to the bearing cap and conrod, be sure to fit the stopper part first, and press the other end.



- Apply engine oil or SUZUKI Moly Paste to the crank pin and bearing surface.

99000-26140

SUZUKI Moly Paste

- When mounting connecting rod on the crankshaft, make sure that numeral figure ① of the conrod faces rearward.
- Tighten the connecting rod fitting nuts with specified torque.

Tightening torque

33 – 37 N·m
 (3.3 – 3.7 kg-m)
 (24.0 – 27.0 lb-ft)

- Check the connecting rod for smooth turning.

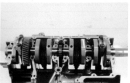
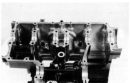
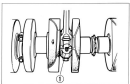
CRANKCASE-CRANKSHAFT BEARING SELECTION

- Inspect each bearing of upper and lower crank cases for any damage.

- Place plastigauge on each crankshaft journal in the equal manner.

NOTE:

Do not place the plastigauge on the oil hole, and do not rotate the shafts when plastigauge is in place.



- Mate the lower crankcase with the upper crankcase, and tighten the crankshaft tightening bolts with specified torque value in the indicated order.

Tightening torque	Initial Tightening	Final Tightening
8 mm bolt	13 N·m (1.3 kg·m) (9.5 lb·ft.)	20 – 24 N·m (2.0 – 2.4 kg·m) (14.5 – 17.5 lb·ft.)

- Remove the lower crankcase, and measure the width of compressed plastigauge in the usual manner.

Standard	0.030 – 0.044 mm (0.0008 – 0.0017 in.)
Service Limit	0.080 mm (0.0031 in.)

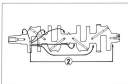
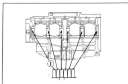
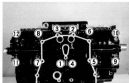
- If the width at the widest part exceeds the limit, replace the set of bearings with new ones by referring to the selection table.
- Check the corresponding crankcase journal I.D. code number ① "A" or "B" which are stamped on the rear of upper crankcase.
- Check the corresponding crankshaft journal O.D. code number ② "A", "B" or "C".

Bearing selection table

	Crankshaft O.D. ②			
	Code	A	B	C
Crankcase I.D. ①	A	Green	Black	Brown
	B	Black	Brown	Yellow

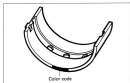
Crank journal bearing oil clearance

Standard	0.030 – 0.044 mm (0.0008 – 0.0017 in.)
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Crankcase I.D. specification

Code	I.D. specification
A	39.000 – 39.008 mm (1.5354 – 1.5357 in)
B	39.008 – 39.016 mm (1.5357 – 1.5361 in)



Crankshaft journal O.D. specification

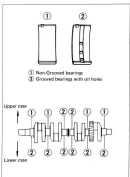
Code	O.D. specification
A	35.992 – 36.000 mm (1.4170 – 1.4173 in)
B	35.984 – 35.992 mm (1.4167 – 1.4170 in)
C	35.976 – 35.984 mm (1.4164 – 1.4167 in)

Bearing thickness specification
(Grooved bearings with oil holes)

Color (Part No.)	Specification
Green (12229-43400-010)	1.486 – 1.490 mm (0.0585 – 0.0587 in)
Black (12229-43400-020)	1.490 – 1.494 mm (0.0587 – 0.0588 in)
Brown (12229-43400-030)	1.494 – 1.498 mm (0.0588 – 0.0590 in)
Yellow (12229-43400-040)	1.498 – 1.502 mm (0.0590 – 0.0591 in)

NOTE:

* Non-Grooved bearings have the same specification as the Grooved bearings with oil holes.
These parts numbers are shown as follows.
12229-43410-XXX.

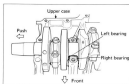


CRANKSHAFT THRUST CLEARANCE

- With the crankshaft, right-side thrust bearing and left-side thrust bearing inserted in the upper crankcase, use a thickness gauge to measure the thrust clearance on the left side.

NOTE:

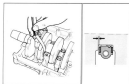
Push the crankshaft to the generator side, so that there is no clearance on the right-side thrust bearing.



Thrust clearance

Standard	0.045 – 0.100 mm (0.0018 – 0.0039 in.)
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If the thrust clearance exceeds the standard range, adjust the thrust clearance by the following procedures:



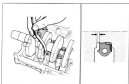
- Remove the right-side thrust bearing, and measure its thickness with a micrometer. If the thickness of the right-side thrust bearing is below standard, replace with a new bearing and once again perform the thrust clearance measurement listed above, checking to make sure it is within standards.

Right-side thrust bearing thickness

Standard	2.425 – 2.490 mm (0.0955 – 0.0980 in.)
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- If the right-side thrust bearing is within the standard range, reinsert the right-side thrust bearing, and remove the left-side thrust bearing.
- As shown in the illustration, use a thickness gauge to measure the clearance before inserting of the left-side thrust bearing, and select a left-side thrust bearing from the selection table.



Thrust bearing selection table

Clearance before inserting of left-side thrust bearing	Color (Part No.)	Thrust bearing thickness	Thrust clearance
2.420 – 2.445 mm (0.0953 – 0.0963 in)	Red (12228-43411)	2.360 – 2.375 mm (0.0925 – 0.0935 in)	0.045 – 0.095 mm (0.0018 – 0.0037 in)
2.445 – 2.470 mm (0.0963 – 0.0972 in)	Black (12228-43412)	2.375 – 2.400 mm (0.0935 – 0.0945 in)	
2.470 – 2.495 mm (0.0973 – 0.0982 in)	Blue (12228-43413)	2.400 – 2.425 mm (0.0945 – 0.0955 in)	
2.495 – 2.520 mm (0.0982 – 0.0992 in)	Green (12228-43414)	2.425 – 2.450 mm (0.0955 – 0.0965 in)	
2.520 – 2.545 mm (0.0992 – 0.1002 in)	Yellow (12228-43415)	2.450 – 2.475 mm (0.0965 – 0.0974 in)	
2.545 – 2.575 mm (0.1002 – 0.1014 in)	White (12228-43416)	2.475 – 2.500 mm (0.0974 – 0.0984 in)	0.045 – 0.100 mm (0.0018 – 0.0039 in)

- After selecting a left-side thrust bearing, insert it and again perform the thrust clearance measurement to make sure it falls within the standard range.

NOTE:

Right-side thrust bearing has the same specification as the green of left-side thrust bearing.

**CRANKSHAFT RUNOUT**

Support the crankshaft with "V" blocks as shown, with the two end journals resting on the blocks. Set up the dial gauge, as shown, and rotate the crankshaft slowly to read the runout. Replace the crankshaft if the runout is greater than the limit.

Crankshaft runout specification

Service Limit	0.05 mm (0.002 in)
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