

ENGINE

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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

PARTS	REMOVAL	INSTALLATION
Generator motor	3-31	3-82
Gearshift	3-31	3-80

ENGINE RIGHT SIDE

PARTS	REMOVAL	INSTALLATION
Clutch cover	3-28	3-89
Clutch	3-28	3-86
Oil pump driven gear	3-29	3-86
Primary drive gear	3-30	3-83
Cam drive idle gear/sprocket	3-29	3-84
Gear position switch	3-28	3-85
Oil sump filter	3-29	3-85
Oil pressure switch	3-67	3-67
Oil jet	3-67	3-69, 94

ENGINE CENTER

PARTS	REMOVAL	INSTALLATION
Cylinder head cover	3-19, 22	3-111
Camshaft	3-20, 23	3-106
Cylinder head (Front)	3-20	3-95
Cylinder (Front)	3-21	3-94
Piston (Front)	3-22	3-92
Cam chain tension adjuster	3-20, 23	3-101, 104
Oil filter	3-25	3-92
Starter motor	3-21	3-112

ENGINE REMOVAL AND INSTALLATION

ENGINE REMOVAL

Before taking the engine out of the frame, wash the engine using a steam cleaner. Engine removal is sequentially explained in the following steps. Reinstall the engine by reversing the removal procedure.

- Drain engine oil. (CJ7-2-13)
- Drain engine coolant. (CJ7-2-18)
- Remove the seal. (CJ7-6-4)
- Disconnect the battery (-) lead wire.



- Remove the engine under cover (1).



- Remove the fuel tank side covers (2), cowlings (3) and inner cowling. (CJ7-6-6)



- Remove the radiator and water hoses.



- Remove the fuel tank (1).



- Remove the air cleaner



- Remove the throttle body



- Remove the spark plug caps
- Remove the camshaft position sensor lead wire coupler (1).



- Disconnect the gear position switch lead wire coupler (2).



- Disconnect the generator lead wire coupler (1) and signal generator lead wire coupler (2) by removing the screw (A).



- Remove the gearshift lever link.



- Remove the engine coolant temperature sensor lead wire coupler (3).



- Bind the clutch lever with a rubber band to prevent the clutch release cylinder piston from coming out.



- Remove the clutch release cylinder (4).



- Remove the push rod (1).
- Remove the engine sprocket cover (2).



- Remove the speed sensor (3).



- Remove the engine sprocket nut and washer while depressing the brake pedal.



- Remove the cotter pin (For E-03, 2B, 23)
- Loosen the rear axle nut (4).
- Loosen the chain adjusters (5) by loosening the lock nuts (6).



- Remove the engine sprocket (7).



- Disconnect the engine ground lead wire 1.



- Disconnect the O₂ sensor lead wire couplers 2, 3.



- Remove the mufflers. (L. & R)



- Loosen the front exhaust pipe mounting bolts.



- Remove the front exhaust pipe.



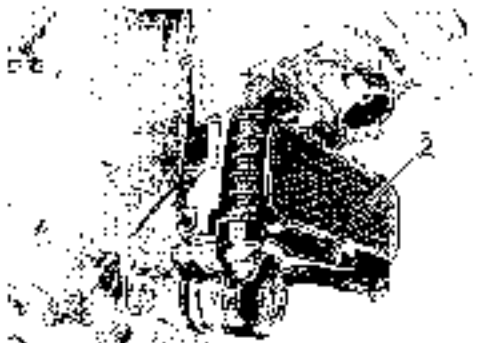
- Remove the mud guard (1).
- Remove the rear exhaust pipe.



- Remove the right footrest bracket and brake pedal.



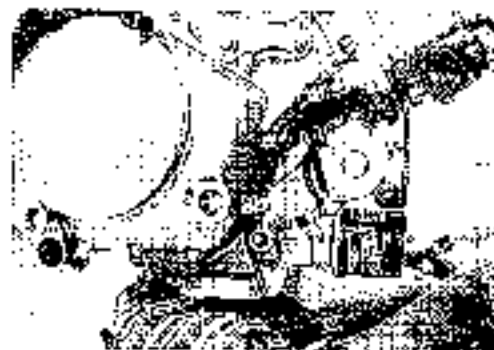
- Remove the oil cooler (2).



- Disconnect the starter motor lead wire (3) and oil pressure switch lead wire (4).



- Support the engine with an engine jack



- Remove the engine mounting nut (1) and bolt;
- Loosen the engine mounting thrust adjuster lock nut with the special tool.

 09940-14990: Engine mounting thrust adjuster socket wrench



- Loosen the engine mounting thrust adjuster.

 09940-14990: Engine mounting thrust adjuster socket wrench



- After removing the pinch bolt (2), remove the engine mounting bolt (3)



- Remove the engine mounting bolt (4).
- Remove the engine mounting bracket (5).



- Remove the ignition coil lead wires.



- Remove the engine mounting nut (1).



- Loosen the engine mounting thrust adjuster lock nut.

 09940-14990: Engine mounting thrust adjuster socket wrench



- Loosen the engine mounting thrust adjuster (2).



- Loosen the pitch to trial.



- Gradually lower the engine assembly by removing the bolt (1), (2).

CAUTION

Be careful not to damage the frame and engine when removing the engine from the frame.



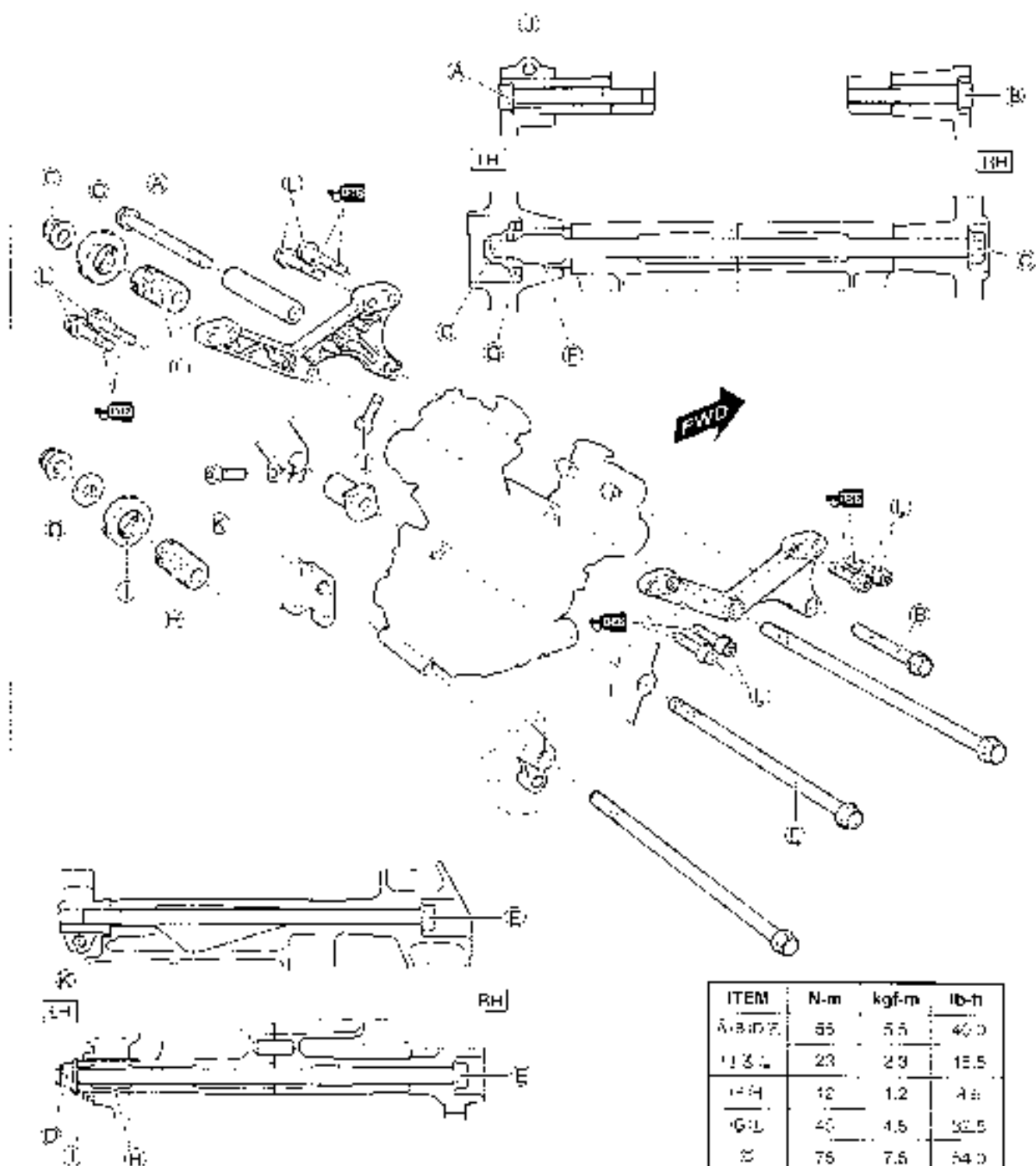
ENGINE INSTALLATION

Reinstall the engine in the reverse order of engine removal.

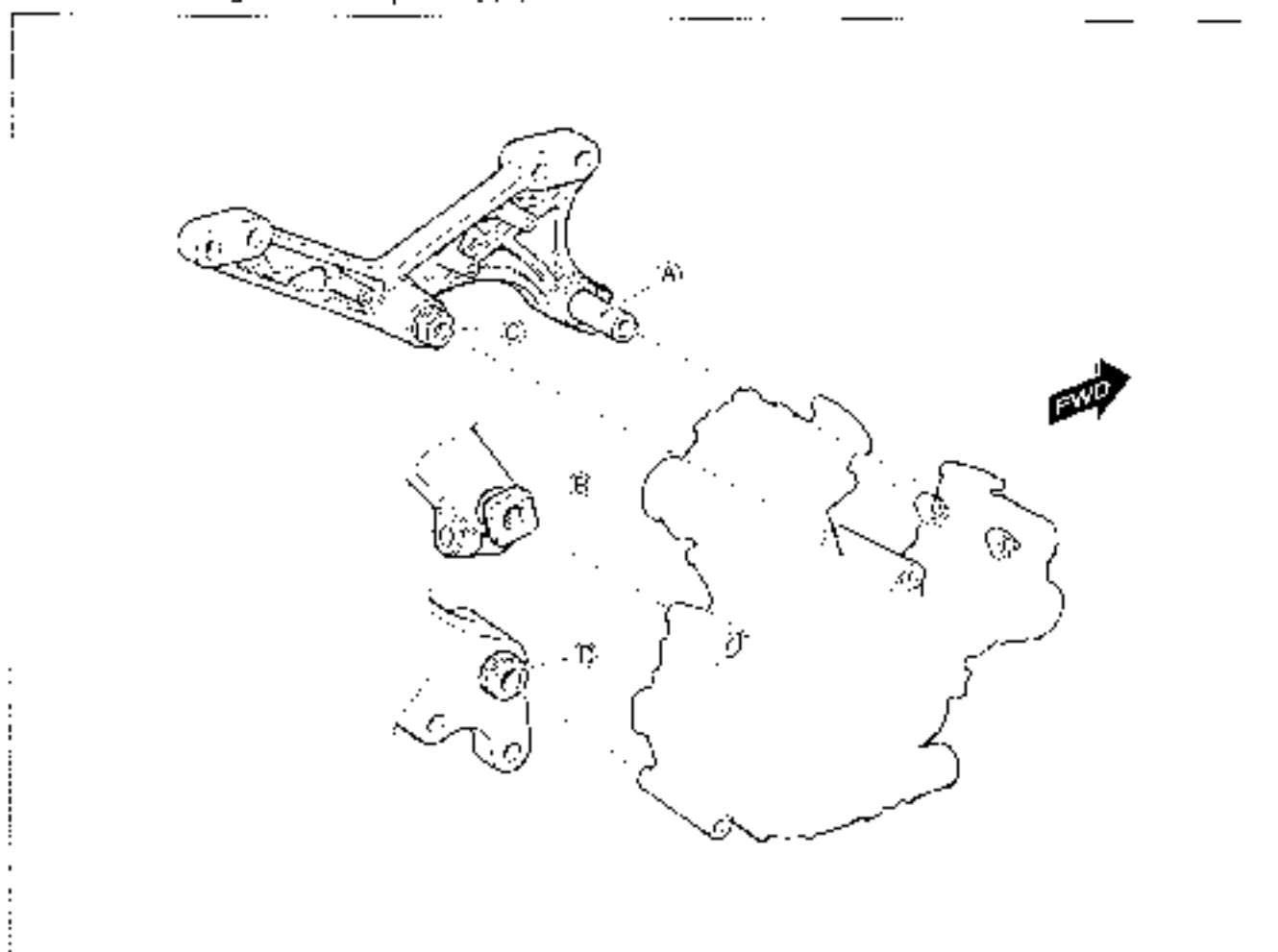
Pay attention to the following points:

NOTE:

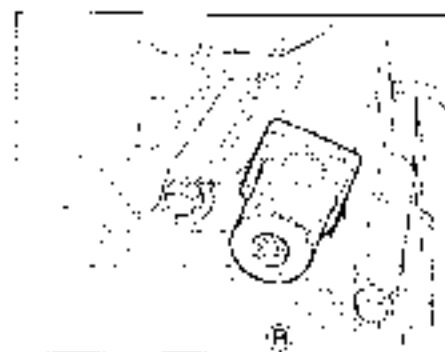
- * The engine mounting nuts are self locking.
- * Once the nut has been removed, it is no longer of any use. Be sure to use new nuts and then tighten them to its specified torque.



- Before installing the engine assembly, install the spacer **A**, collar **B** and engine thrust adjuster **C**, **D**.



- Install the collar **B** onto the crankcase properly as shown.



- Apply TI-THREAD LOCK "1342" to the engine mounting bracket bolts.
- Tighten the bolts to the specified torque.

Engine mounting bracket bolt:

23 N·m (2.3 kgf-m, 16.5 lb-ft)

 99000-32050: THREAD LOCK "1342"



- Put the drive chain on the driveshaft.



- Gradually raise the engine assembly and align all the bolt holes.
- Install the engine mounting bolts and bracket bolts, and tighten them temporarily.
- Tighten the engine mounting thrust adjuster and its lock nut to the specified torque with the special tool.



-  **Engine mounting thrust adjuster: 12 N·m (1.2 kgf-m, 8.5 lb-ft)**
Engine mounting thrust adjuster lock nut:
45 N·m (4.5 kgf-m, 32.5 lb-ft)

-  **09940-14990: Engine mounting thrust adjuster socket wrench**



- After tightening the engine mounting bolt A, tighten the pinch bolt B.

-  **Engine mounting bolt A: 55 N·m (5.5 kgf-m, 40.0 lb-ft)**
Engine mounting pinch bolt B:
23 N·m (2.3 kgf-m, 5.5 lb-ft)



- Tighten the engine mounting bolt to the specified torque.

-  **Engine mounting bolt C: 55 N·m (5.5 kgf-m, 40.0 lb-ft)**



- Tighten the engine mounting nut (A, B) to the specified torque.

 Engine mounting nut $\bar{A}$: 75 N·m (7.5 kgf-m, 54.0 lb-ft)
Engine mounting nut $\bar{B}$: 55 N·m (5.5 kgf-m, 40.0 lb-ft)



- After tightening the bolt (C), tighten the pinch bolt (D) to the specified torque.

 Engine mounting bolt (C) : 55 N·m (5.5 kgf-m, 40.0 lb-ft)
Engine mounting pinch bolt (D) :
23 N·m (2.3 kgf-m, 16.5 lb-ft)



- Install the washers and tighten the union bolt to the specified torque.

 Oil hose union bolt: 23 N·m (2.3 kgf-m, 16.5 lb-ft)



- Install the new gaskets.



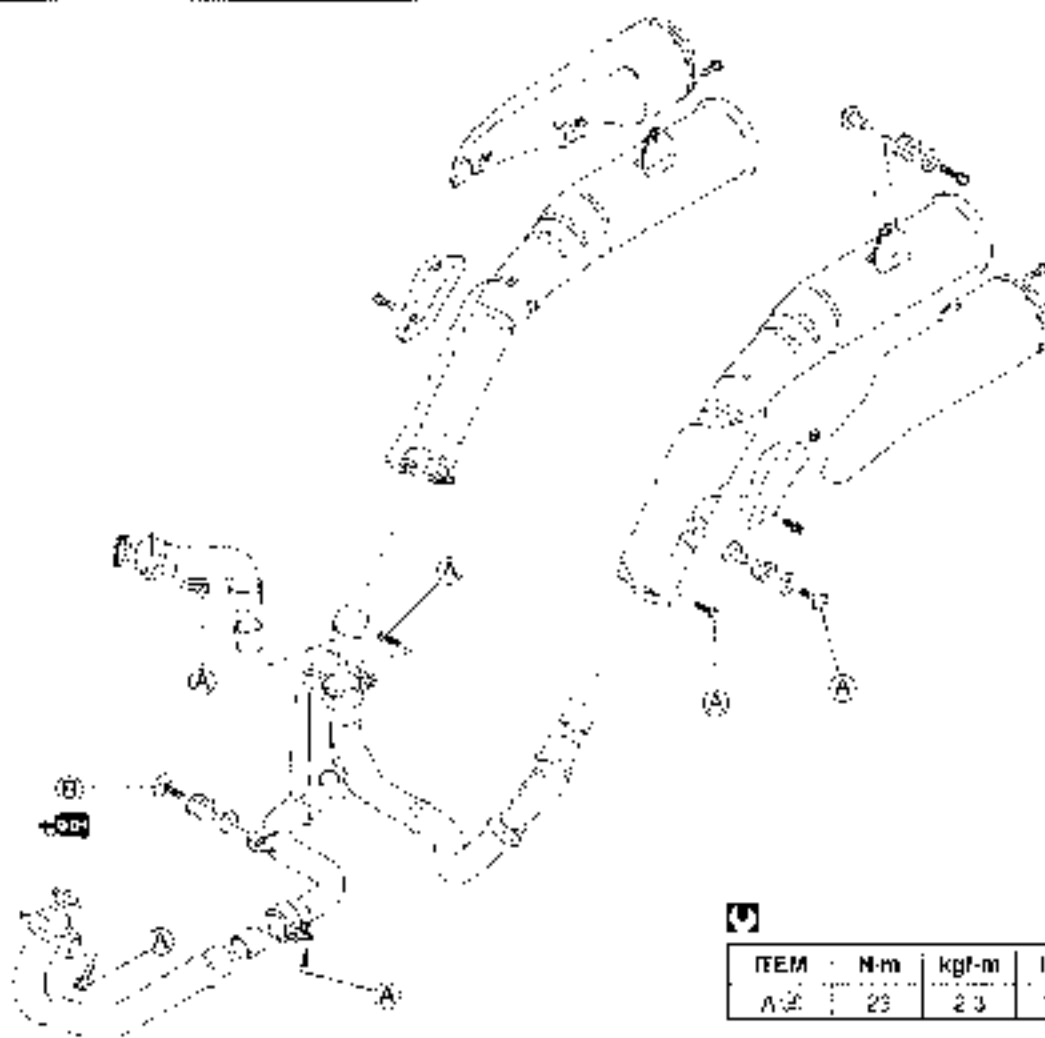
- Install the exhaust pipes and mufflers.

NOTE:

Apply THREAD LOCK "1342" to the bolt $\bar{E}$

 99000-32050: THREAD LOCK "1342"





ITEM	N·m	kgf·m	lb·ft
A-2	23	2.3	16.5

- Adjust the brake pedal height.

DATA Brake pedal height A
Standard: 20 – 30 mm (0.8 – 1.2 in)



- Install the gearshift arm as shown.

DATA Gearshift arm angle A: Approx. 60°



- Adjust the gearshift lever as shown.

DATA Gearshift lever height $\bar{A}$
Standard: 20 – 30 mm (0.8 – 1.2 in)



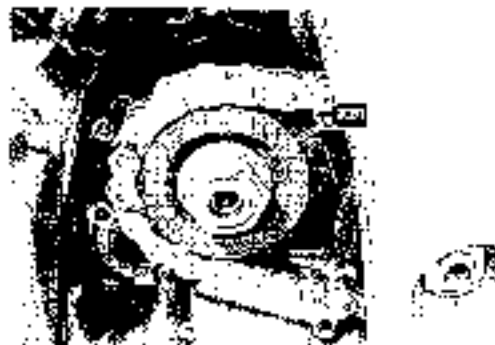
- Install the engine sprocket.



- Apply THREAD LOCK SUPER "1303" to the engine sprocket nut and tighten it to the specified torque while depressing the brake pedal.

T Engine sprocket nut: 115 N·m (11.5 kgf·m, 83.0 lb-ft)

1303 99000-32030: THREAD LOCK SUPER "1303"



- Tighten the speed sensor rotor bolt to the specified torque.

T Speed sensor rotor bolt: 18 N·m (1.8 kgf·m, 13.0 lb-ft)



- Apply SUZUKI SUPER GREASE "A" to the push rod pin and install it.
- Install the clutch release cylinder.

1 99000-25030: SUZUKI SUPER GREASE "A" (USA)
99000-25010: SUZUKI SUPER GREASE "A" (Others)



- After installing the engine, route the wire harness, cables and hoses properly. (CJ2-8-14)
- Adjust the following items:
 - Engine oil (CJ2-13)
 - Engine coolant (CJ2-18)
 - Engine idle speed (CJ2-15)
 - Throttle cable play (CJ2-15)

DATA Engine oil capacity

Oil change: 2.7 L (2.9/2.4 US/Imp qt)

Oil and filter change: 2.9 L (3.1/2.6 US/Imp qt)

Engine overhaul: 3.3 L (3.5/2.9 US/Imp qt)

ENGINE DISASSEMBLY

ENGINE TOP SIDE

- Remove the thermostat.



- Remove the valve timing inspection plug (1) and generator cover plug (2).



FRONT CYLINDER HEAD COVER

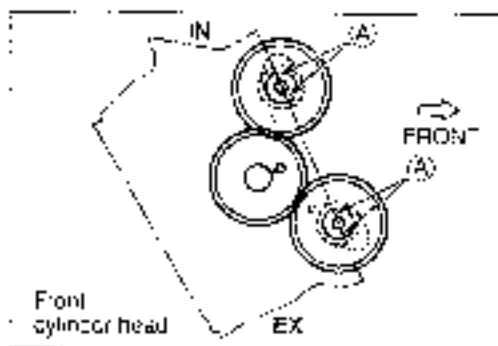
- Remove the front cylinder head cover (1).



- Turn the crankshaft to bring the "F / T" line on generator rotor to the index mark of the valve inspection hole and also to bring the cams to the position as shown.

NOTE:

At the above condition, the No.1 (Front) cylinder is at TDC of compression stroke and also the engraved lines A on the camshafts are parallel with the mating surface of the cylinder head cover.

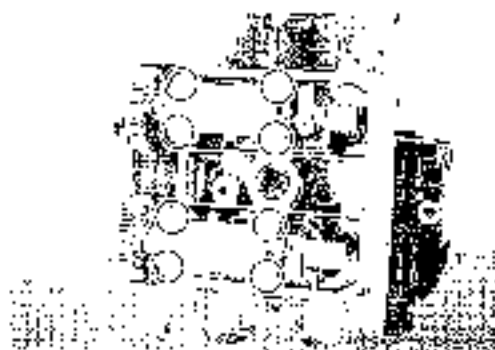


FRONT CYLINDER CAMSHAFT

- Remove the camshaft journal holders.

CAUTION:

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



- Remove the camshafts.

NOTE:

Do not drop the dowel pins into the crankcase.



FRONT CAM CHAIN TENSION ADJUSTER

- After loosening the spring holder bolt (1), remove the cam chain tension adjuster.



FRONT CYLINDER HEAD

- Remove the cam drive idle gear/sprocket (1) by removing its shaft with the copper washer and the thrust washer (2).

NOTE:

Do not drop the thrust washer (2) into the crankcase.



- Remove the cylinder head bolts and cam chain tensioner mounting bolt.
- Remove the cam chain tensioner.



STARTER MOTOR

- Remove the starter motor



- Remove the cylinder head nut.
- Loosen the cylinder nuts



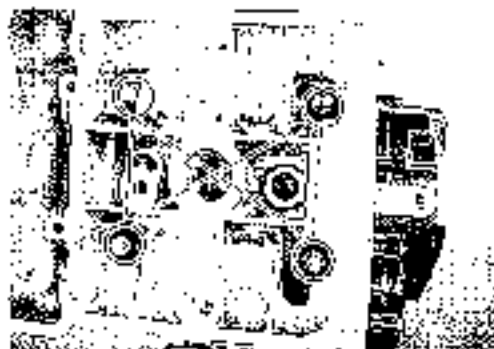
- Remove the oil cooler mounting bracket (1).



- Remove the cylinder head bolts
- Remove the cylinder head.

NOTE:

- When loosening the cylinder head bolts, loosen each bolt little by little diagonally.
- To identify each cylinder head, mark the cylinder as the front and rear; cylinder head uses the same part.

**FRONT CYLINDER**

- Remove the cylinder.

NOTE:

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



- Remove the cylinder base gasket and dowel pins.



FRONT PISTON

- Place a clean rag over the cylinder base so as not to drop the piston pin circlip into the crankcase.
- Remove the piston pin circlip.
- Remove the piston by driving out the piston pin.

NOTE:

Scribe the cylinder number on the head of the piston.



REAR CYLINDER HEAD COVER

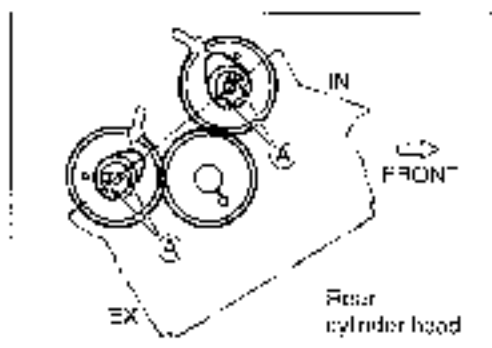
- Remove the rear cylinder head cover (1).



- Turn the crankshaft to bring the "F | T" line mark on generator rotor to the index mark of the valve inspection hole and also to bring the cams to the position as shown.

NOTE:

At the above condition, the rear cylinder is at ATDC 90° on expansion stroke and also the engraved base "A" on the camshafts are parallel with the mating surfaces of the cylinder head cover.



CAUTION

Pull the front cam chain upward, or the chain will be caught between the crankcase and cam drive idle gear/sprocket when turning the crankshaft.

**REAR CYLINDER CAMSHAFT**

- Remove the two camshaft journal holders.

CAUTION

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



- Remove the camshafts.

NOTE:

Do not drop the dowel pins into the crankcase.

**REAR CAM CHAIN TENSION ADJUSTER**

- After loosening the spring holder bolt 1, remove the cam chain tension adjuster.

**REAR CYLINDER HEAD**

- Remove the cam drive idle gear/sprocket 1 by removing its shaft, the copper washer and the thrust washer 2.

NOTE:

Do not drop the thrust washer 2 into the crankcase.



- Remove the cylinder head bolts and cam chain tensioner mounting bolt.
- Remove the cam chain tensioner.



- Remove the cylinder head nuts (1).



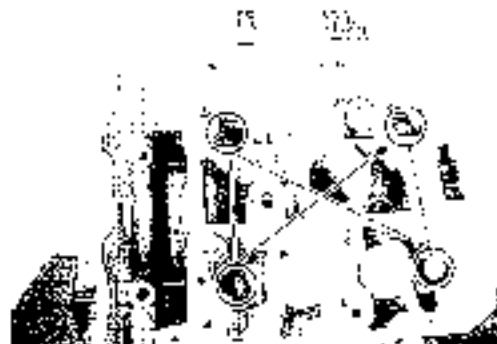
- Remove the cylinder head nut (2).
- Loosen the cylinder nuts (3).



- Remove the cylinder head bolts.
- Remove the cylinder head.

NOTE:

- * When loosening the cylinder head bolts, loosen each bolt little by little diagonally.
- * To identify each cylinder head, mark the cylinder as the Front and Rear.



REAR CYLINDER

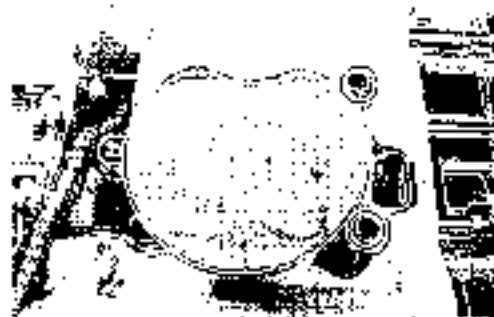
- Remove the rear cylinder.

NOTE:

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



- Remove the cylinder base gasket and dowel pins.



REAR PISTON

- Place a clean rag over the cylinder base so as not to drop the piston pin circlip into the crankcase.
- Remove the piston pin circlip.
- Remove the piston by driving out the piston pin.

NOTE:

Scribe the cylinder number on the head of the piston.



ENGINE BOTTOM SIDE

OIL FILTER

- Remove the oil filter with the special tool.

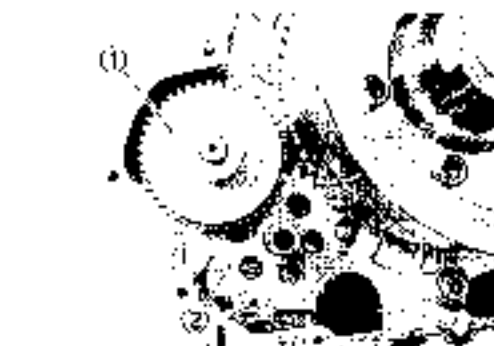
 09915-40610: Oil filter wrench



- Remove the generator cover.



- Remove the starter torque limiter (1) and starter idle gear (2).



- Remove the bushings (1) from the crankcase and generator cover.



CLUTCH COVER

- Remove the water pump case.

WATER PUMP DISASSEMBLY: YC/3-13



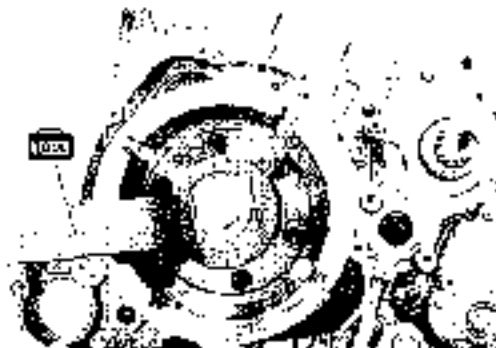
CLUTCH

- Remove the clutch cover.

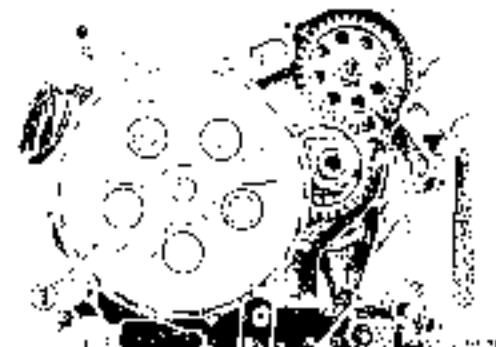


- Hold the generator rotor with the special tool

 09930-44541: Rotor holder



- While holding the generator rotor, remove the clutch spring set bolts and springs diagonally.
- Remove the pressure plate (1).



- Remove the clutch push piece, bearing and thrust washer.



- Remove the clutch push rod (1).
- Remove the clutch drive and driven plates.



- Remove the wave washer (2) and wave washer seat (3).



- Unlock the clutch sleeve hub nut.



- While holding the clutch sleeve hub with the special tool, remove the clutch sleeve hub nut.

 09920-53740: Clutch sleeve hub holder



- Remove the washer (1) and (2).
- Remove the clutch sleeve hub (3).



- Remove the thrust washer (4).
- Remove the primary driven gear assembly.

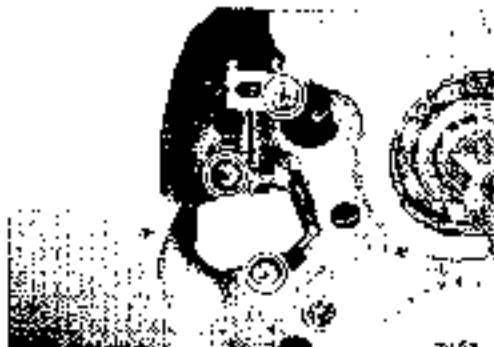


- Remove the needle roller bearing, spacer and thrust washer.



GEAR POSITION SWITCH

- Remove the gear position switch.



- Remove the gear position switch contacts (1) and springs (2).



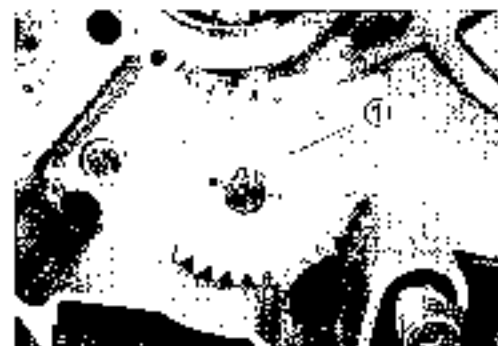
OIL SUMP FILTER

- Remove the oil sump filter.

**OIL PUMP**

- Remove the oil pump driven gear (1) by removing the snap ring.

 09900-06107: Snap ring pliers



- Remove the pin (2) and washer (3).

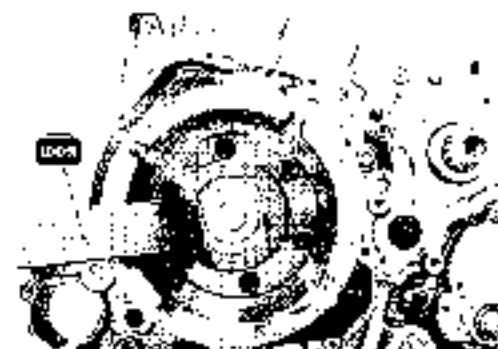
NOTE:

Do not drop the snap ring, pin and washer into the crankcase.



- Hold the generator rotor with the special tool.

 09930-44541: Rotor holder

**CAM DRIVE IDLE GEAR/SPROCKET**

- While holding the generator rotor, remove the cam drive idle gear/sprocket nut.



- Insert a suitable bar into the holes of primary drive gears to align the teeth of scissors gears.
- Remove the cam drive idle gear/sprocket and cam chain.



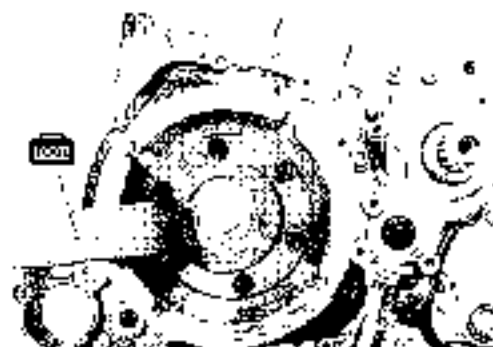
- Remove the key 1.



PRIMARY DRIVE GEAR

- Hold the generator rotor with the special tool

 09930-44541: Rotor holder



- While holding the generator rotor, remove the primary drive gear nut.

CAUTION

This bolt has left-hand thread. Turning it counter-clockwise may cause damage.



- Remove the washer 1.
- Remove the primary drive gear assembly 2.



- Remove the key 1. and thrust washer 2.



GENERATOR ROTOR

- While holding the generator rotor with the special tool, remove its bolt.

 09930-44541: Rotor holder



- Install the special tool to the boss.
- Remove the generator rotor by turning the special tool while holding the generator rotor with the special tool.

 09930-30450: Generator rotor remover bolt



- Remove the key (1) and starter driven gear (2).



GEARSHIFT

- Remove the gearshift cover.



- Draw out the gearshift shaft 1.



- Remove the gearshift cam plate 2
- Remove the gearshift cam stopper 3.



- Remove the engine sprocket spacer 4.



- Remove the cam drive idle gear shaft 5.
- Remove the crankcase bolts

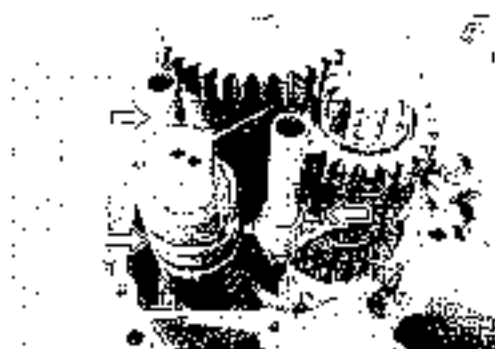


- Separate the crankcase into 2 parts, right and left with the crankcase separating tool.

 09920-13120- Crankcase separating tool

NOTE:

- Fit the crankcase separating tool, so that the tool arms are in parallel with the side of crankcase.
- The crankshaft and transmission components should remain in the left crankcase half.
- When separating the crankcase, tap the end of the countershaft with a plastic hammer.
- Remove the gearshift fork shafts, gearshift forks and gearshift cam



- Remove the countershaft and driveshaft;



- Remove the crankshaft



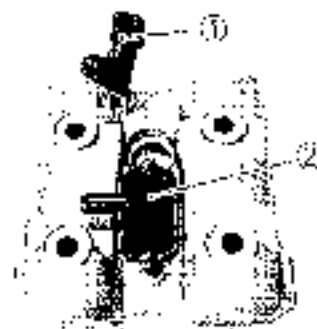
ENGINE COMPONENTS INSPECTION AND SERVICING CYLINDER HEAD COVER

DISASSEMBLY

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", "Intake", so that each will be restored to the original location during assembly.

- Remove the camshaft position sensor. 1
- Remove the PAIR reed valve cover. 2



INSPECTION

- Inspect the PAIR reed valve for the carbon deposit.
- If the carbon deposit is found in the reed valve, replace it with a new one.



REASSEMBLY

- Apply SUZUKI SUPER GREASE "A" to the O-ring and install it.

 99000-25030: SUZUKI SUPER GREASE "A" (USA)
99000-25010: SUZUKI SUPER GREASE "B" (Others)



- Apply THREAD LOCK "1342" to the thread and install the PAIR reed valve cover.

 99000-32050: THREAD LOCK "1342"



CAMSHAFT/CYLINDER HEAD

CAUTION

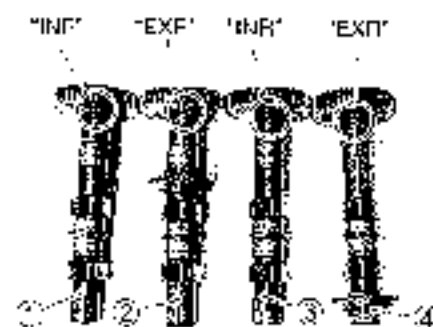
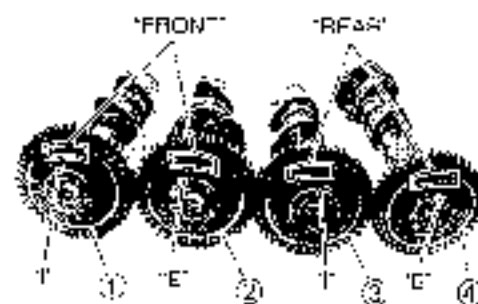
Be sure to identify each removed part as to its location, and lay the parts out in groups designated as "No.1", "No.2", "Exhaust", "Intake", so that each will be restored to the original location during assembly.

CAMSHAFT

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

The camshafts can be identified by the engraved letter.

- 1 No.1 (Front) intake camshaft ("INF" and "I": Intake)
- 2 No.1 (Front) exhaust camshaft ("EXF" and "E" Exhaust)
- 3 No.2 (Rear) intake camshaft ("INR" and "I": Intake)
- 4 No.2 (Rear) exhaust camshaft ("EXR" and "E" Exhaust)



CAM WEAR

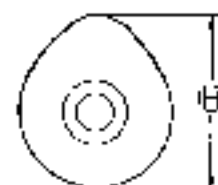
Worn-down cams are often the cause of mistimed valve operation resulting in reduced power output.

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 camshaft if it wears worn down to the limit.

DATA Cam height H

Service Limit (IN) : 35.98 mm (1.417 in)
(EX) : 35.38 mm (1.393 in)

TOOL 09900-20202: Micrometer (25 - 50 mm)



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 the Plastigauge **A** to read the clearance at the widest portion, which is specified as follows.

DATA Camshaft journal oil clearance

Service Limit (IN & EX): 0.150 mm (0.0059 in)

-  09800-22301: Plastigauge
09800-22302: Plastigauge

NOTE:

Install camshaft journal holder to their original positions.

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

-  Camshaft journal holder bolt: 10 N·m (1.0 kgf·m, 7.0 lb-ft)

NOTE:

Do not rotate the camshaft with the plastigauge in place.

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

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

DATA Camshaft journal holder I.D.

Standard (IN & EX):

22.012 – 22.025 mm (0.8666 – 0.8671 in)

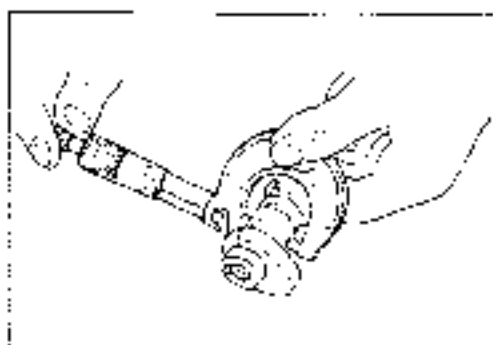
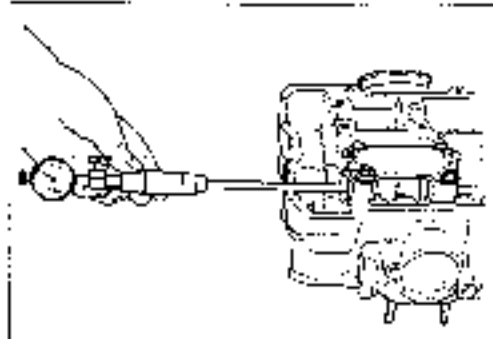
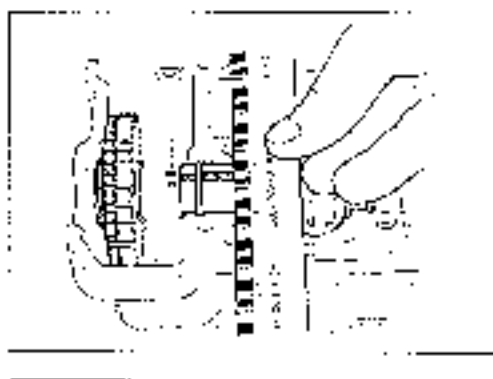
-  09900-20502: Dial gauge (1/1000, 1 mm)
09900-22403: Small bore gauge (18 – 35 mm)

DATA Crankshaft journal O.D.

Standard (IN & EX):

21.972 – 21.993 mm (0.8650 – 0.8659 in)

-  09900-20205: Micrometer (0 – 25 mm)



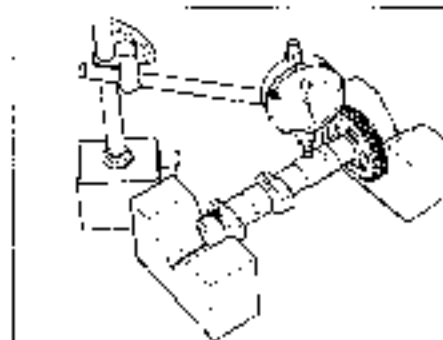
CAMSHAFT RUNOUT

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

CAUTION Camshaft runout

Service Limit (IN & EX): 0.10 mm (0.004 in)

- 09900-20607: Dial gauge (1/100 mm, 10 mm)
- 09900-20701: Magnetic stand
- 09900-21304: V-block (100 mm)

**CAM GEAR AND AUTOMATIC-DECOMP.**

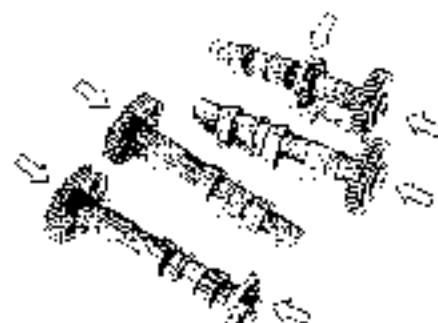
Inspect the cam gear teeth for wear and damage.

Inspect the automatic-decomp. for damage and smooth operation.

If there are unusual, replace the camshaft assembly and cam chain as a set.

CAUTION

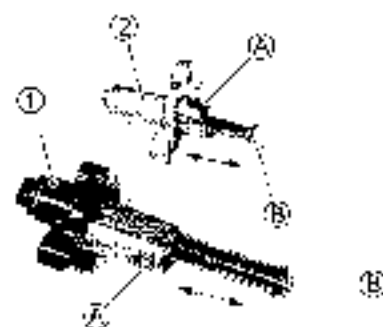
Do not attempt to disassemble the cam gears and automatic-decomp. assembly. They are unserviceable.

**CAM CHAIN TENSION ADJUSTER**

The cam chain tension adjusters are maintained at the proper cam chain tension automatically.

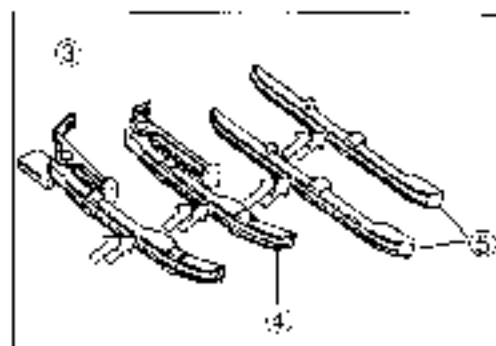
Unlock the ratchet A, and move the push rod B in place to see if it slides smoothly. If any stickiness is noted or ratchet mechanism is faulty, replace the cam chain tension adjuster assembly with a new one.

- 1: Front cam chain tension adjuster
- 2: Rear cam chain tension adjuster

**CAM CHAIN GUIDE AND CAM CHAIN TENSIONER**

Check the cam chain guide and tensioner for wear and damage. If they are found to be damaged, replace them with the new ones.

- 3: Front cam chain tensioner
- 4: Rear cam chain tensioner
- 5: Front and Rear cam chain guide



CYLINDER HEAD

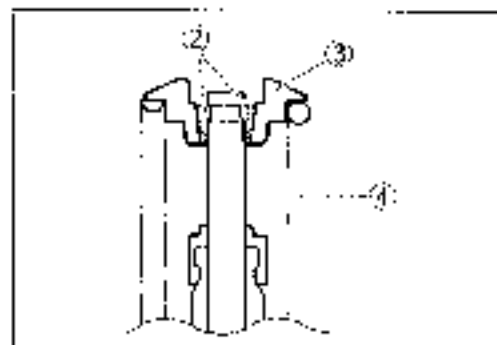
- Remove the tappets and shims (1) by fingers or magnetic hand.



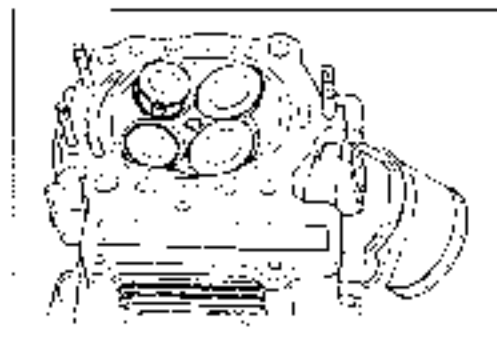
- Using special tools, compress the valve spring and remove the two outer halves (2) from the valve stem.

-  09916-14510: Valve lifter
- 09916-14910: Valve lifter attachment
- 09916-84511: Tweezers

- Remove the valve spring retainer (3) and valve spring (4).



- Pull out the valve from the other side.



- Remove the oil seals 1 and the spring seats 2.

CAUTION

Do not reuse the removed oil seals.

**CYLINDER HEAD DISTORTION**

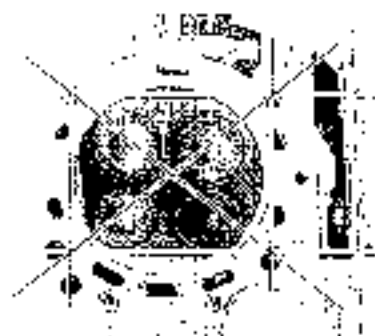
Decarbonize the combustion chambers.

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.

DATA Cylinder head distortion

Service Limit: 0.05 mm (0.002 in)

TOOL 09900-20603: Thickness gauge

**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.

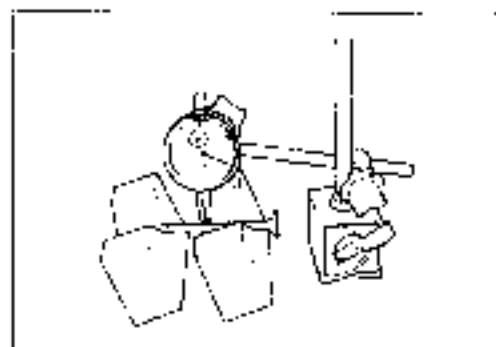
DATA Valve stem runout

Service Limit: 0.05 mm (0.002 in)

TOOL 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

09900-21304: V-block (100 mm)

**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.

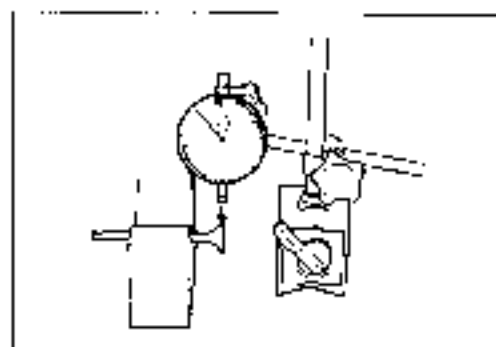
DATA Valve head radial runout

Service Limit: 0.03 mm (0.001 in)

TOOL 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

09900-21304: V-block (100 mm)



VALVE FACE WEAR

Visually inspect each valve for wear of its seating face. Replace any valve with an abnormally worn face. The thickness T 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.

DATA Valve head thickness T :

Service Limit: 0.5 mm (0.02 in)

 09900-20101: Vernier calipers

**VALVE STEM DEFLECTION**

Lift the valve about 10 mm (0.39 in) from the valve seat.

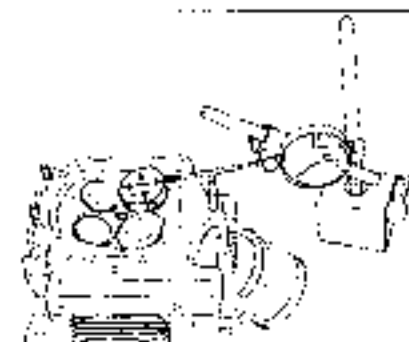
Measure the valve stem deflection in two directions, "X" and "Y", perpendicular to each other, by positioning the dial gauge as shown. If the deflection measured exceeds the limit, (see below) then determine whether the valve or the guide should be replaced with a new one.

DATA Valve stem deflection (IN & EX)

Service Limit: 0.35 mm (0.014 in)

 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

**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.

DATA Valve stem O.D.

Standard (IN) : 5.475 – 5.490 mm (0.2156 – 0.2161 in)

(EX): 5.455 – 5.470 mm (0.2148 – 0.2154 in)

 09900-20205: Micrometer (0 – 25 mm)

NOTE:

If valve guides have to be removed for replacement after inspecting related parts, carry out the steps shown in valve guide servicing.

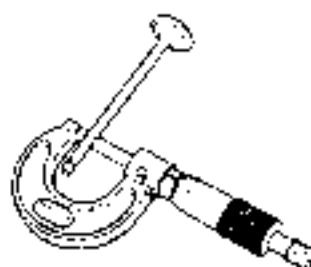
VALVE GUIDE SERVICING

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

 09916-44910: Valve guide remover/installer

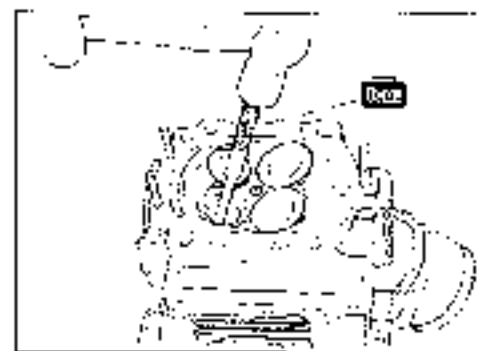
NOTE:

- Discard the removed valve guide subassemblies.
- Only oversized valve guides are available as replacement parts. (Part No. 11115-32E70)



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

 **09916-34580: Valve guide reamer**
09916-34542: Reamer handle

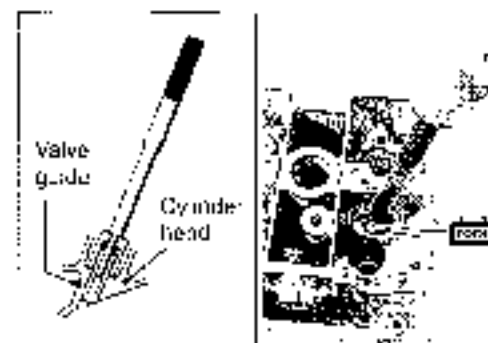


- Oil the stem hole, top, of each valve guide and drive the guide into the guide hole with the valve guide installer and attachment.

 **09916-44910: Valve guide remover/installer**
09916-53340: Attachment

CAUTION

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

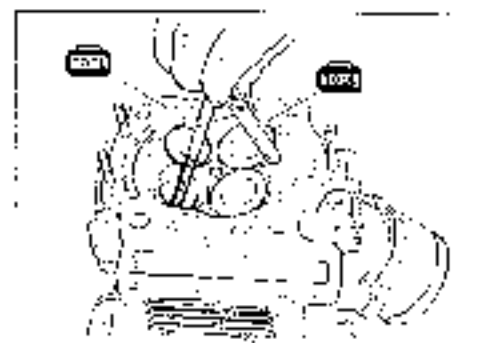


- After fitting the valve guides, re-finish their guiding bonus with the reamer. Be sure to clean and oil the guides after reaming.

 **09916-34550: Valve guide reamer**
09916-34542: Reamer handle

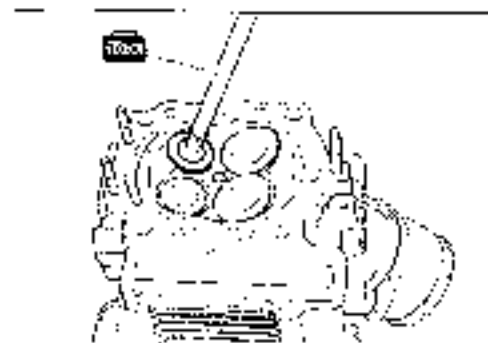
NOTE

Insert the reamer from the combustion chamber end and always turn the reamer handle clockwise.



VALVE SEAT WIDTH

- Coat the valve seat uniformly with Prussian blue. 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. In addition, the width of the dye ring, which is the visualized seat "width", must be within the following specification:

DATA Valve seat width (mm)

Standard: 0.9 – 1.1 mm (0.035 – 0.043 in)

09916-10911: Valve lapper set

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

VALVE SEAT SERVICING

The valve seats for both intake and exhaust valves are machined to four different angles. (The seat contact surface is cut 45°.)

	INTAKE	EXHAUST
45°	N-615 or N-626	N-615 or N-626
60°	N-211	N-211
15°		N-615
30°	N-626	

NOTE:

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

09916-21111: Valve seat cutter set

09916-24210: Valve seat cutter (N-615)

09916-24480: Solid pilot (N-140-5.5)

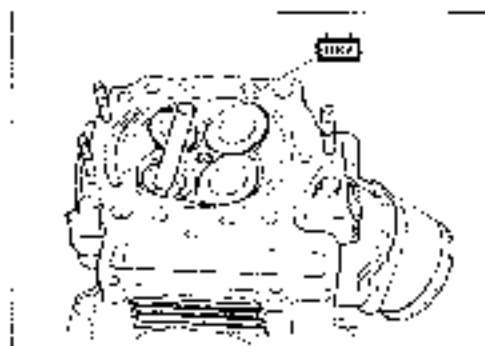
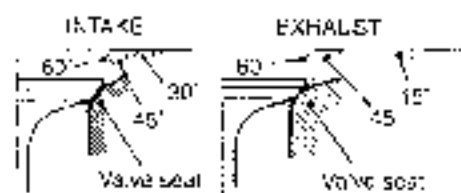
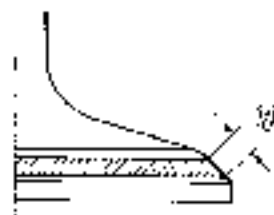
09916-24810: Valve seat cutter (N-626)

09916-27710: Valve seat cutter (N-211)

- Insert the solid pilot with a slight rotation. Seat the pilot snugly. Install the 45° cutter, attachment and T-handle.
- Using the 45° cutter, descale 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.

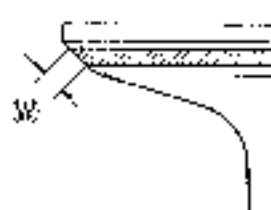
NOTE:

Cut only the minimum amount necessary from the seat to prevent the possibility of the tappet stem replacement.



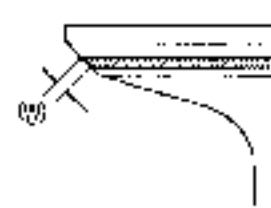
If the contact area is too high on the valve, or if it is too wide, use the 15°/60° cutters (for exhaust side) and 30°/60° cutters (for intake side) to lower and narrow the contact area.

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.

CAUTION

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 check the tappet clearance after the cylinder head has been reinstalled (CT 2-8)



VALVE SPRING

The force of the coil spring keeps the valve seat tight. Weakened spring results 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 it.

 09900-20102: Vernier calipers

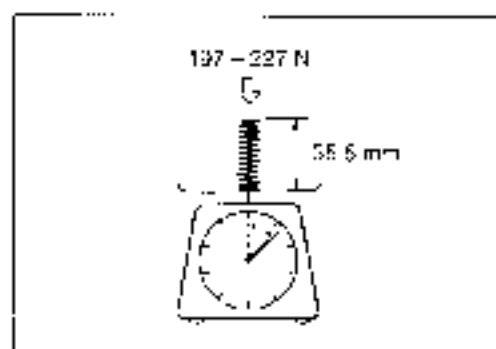
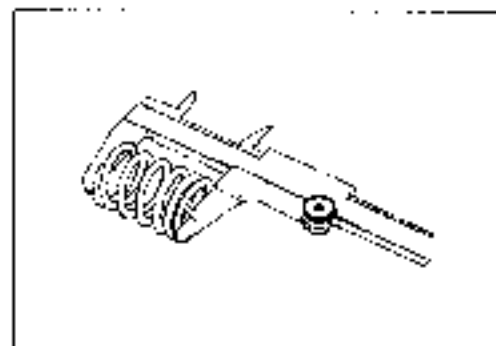
DATA Valve spring free length (IN & EX)

Service Limit: 39.6 mm (1.56 in)

Valve spring tension (IN & EX)

Standard: 197 – 227 N/35.6 mm

(20.1 – 23.1 kgf/35.6 mm, 44.3 – 51.0 lbf/1.40 in)

**CAM DRIVE IDLE GEAR/SPROCKET THRUST CLEARANCE**

Install the cam drive idle gear/sprocket (1), its shaft (2), copper washer (3) and thrust washer (4) to each cylinder head. Tighten the shaft (2) to the specified torque. Use a thickness gauge to measure the thrust clearance between the cylinder head and the thrust washer (4).

DATA Cam drive idle gear/sprocket thrust clearance

Standard: 0.15 – 0.29 mm (0.006 – 0.011 in)



 Cam drive idle gear/sprocket shaft:

40 N·m (4.0 kgf·m, 29.0 lb-ft)

 09900-20803: Thickness gauge



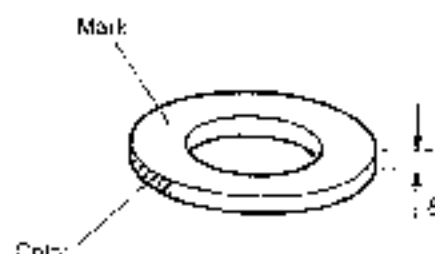
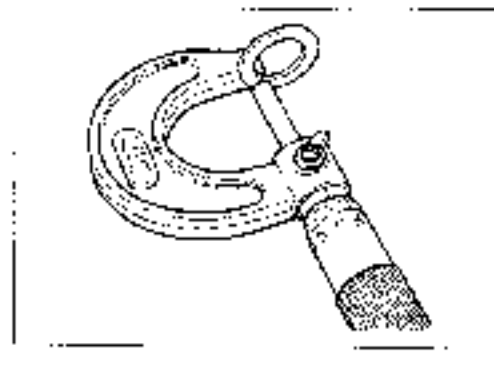
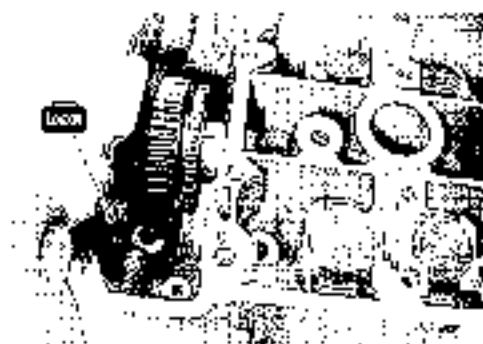
If the thrust clearance exceeds the standard range, adjust the thrust clearance by the following procedures.

- Remove the thrust washer, and measure its thickness with a micrometer.
- Change the thrust washer with the other washer if the thrust clearance is incorrect.
- Perform the thrust clearance measurement described above once again checking to make sure it is within standard.

 **09900-20205: Micrometer (0 – 25 mm)**

Unit: mm (in)

Color/Mark (Part No.)	Thrust washer thickness A
Blue (09191-15182)	1.38 – 1.42 (0.054 – 0.056)
Yellow (09191-15181)	1.26 – 1.32 (0.050 – 0.052)
Light blue (09181-15176)	1.18 – 1.22 (0.046 – 0.048)
Light green (09181-15172)	1.06 – 1.12 (0.043 – 0.044)
Brown (09191-15166)	0.98 – 1.02 (0.039 – 0.040)
'J' mark (09191-15164)	0.88 – 0.92 (0.035 – 0.036)



CYLINDER HEAD REASSEMBLY

- Install the valve spring seats.
- Oil each oil seal, and press-fit them into position with the valve guide installer.

 **09916-44910: Valve guide remover/installer**

CAUTION

Do not reuse the removed oil seals.

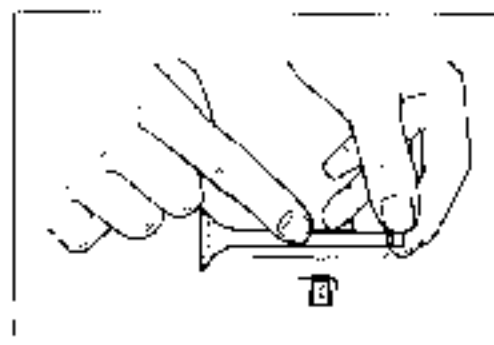


- Insert the valves, with their stems coated with molybdenum oil so that all around and along the full stem length without any break.

CAUTION

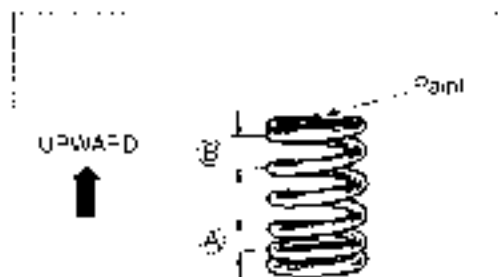
When inserting each valve, take care not to damage the lip of the oil seal.

 **MOLYBDENUM OIL**



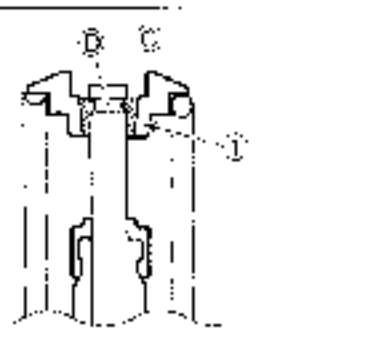
- Install the valve spring with the small-pitch portion (A) facing cylinder head.

(B) Large-pitch portion



- Put on the valve spring retainer, and using the valve lifter, press down the spring, fit the cotter halves to the stem end, and release the lifter to allow the cotter (i) to wedge in between retainer and stem. Be sure that the rounded tip (c) of the cotter fits snugly into the groove (D) in the stem end.

 09916-14510: Valve lifter
09916-14910: Valve lifter attachment
09916-84511: Tweezers



CAUTION

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



- Install the tappet shim and tappet to their original position.

NOTE:

- Apply engine oil to the shim and tappet before fitting them.
- When seating the tappet shim, be sure the figure printed on its face faces the tappet.



INTAKE PIPE/WATER UNION

- Remove the intake pipe



- Remove the water union.



- When installing the intake pipe, apply grease to the O-ring.

NOTE:

"UP" mark faces upward.

- 99000-25030: SUZUKI SUPER GREASE "A" (USA)
- 99000-25010: SUZUKI SUPER GREASE "A" (Others)

CAUTION

Use the new O-ring to prevent air from sucking through the joint.

- Apply engine coolant to the new O-ring and install the water union.



CYLINDER/PISTON INSPECTION

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.

DATA Cylinder distortion

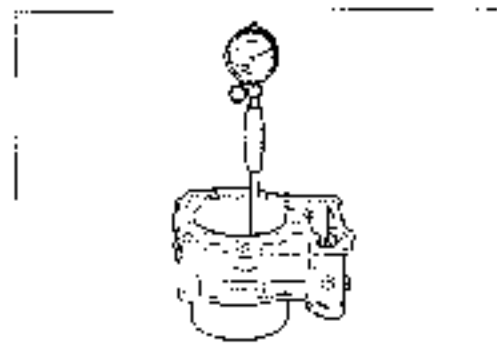
Service Limit: 0.05 mm (0.002 in)

- 09900-20803: Thickness gauge



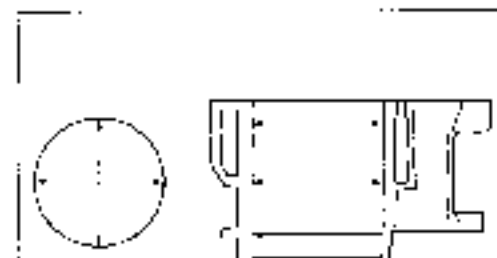
CYLINDER BORE

Inspect the cylinder wall for any scratches, nicks or other damage. Measure the cylinder bore diameter at six places.

**DATA** Cylinder bore

Standard: 98.000 - 98.015 mm (3.8583 - 3.8589 in)

 09900-20508: Cylinder gauge set

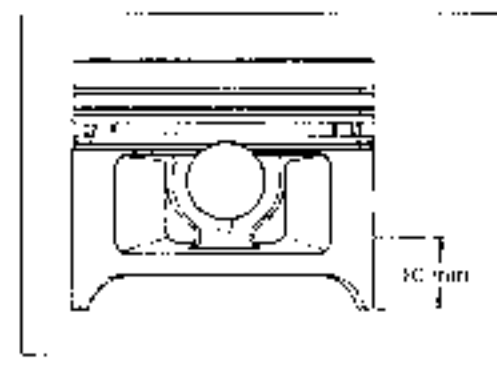
**PISTON DIAMETER**

Using a micrometer, measure the piston outside diameter at 10 mm (0.4 in) from the piston skirt end. If the measurement is less than the limit, replace the piston.

DATA Piston diameter

Service Limit: 97.880 mm (3.8535 in)

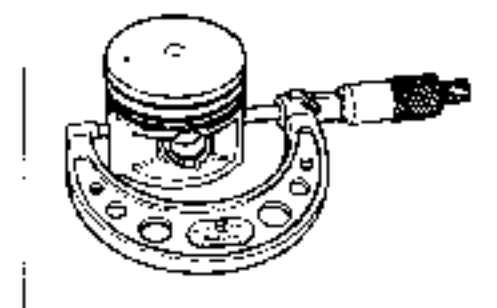
 09900-20204: Micrometer (75 - 100 mm)

**PISTON-TO-CYLINDER CLEARANCE**

As a result of the previous measurement, if the piston to cylinder clearance exceeds the following limit, replace both cylinder and piston.

DATA Piston to cylinder clearance

Service Limit: 0.12 mm (0.0047 in)



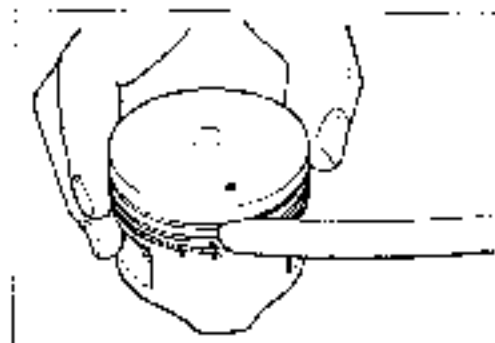
PISTON RING TO GROOVE CLEARANCE

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.

DATA Piston ring to groove clearance

Service Limit (1st) : 0.18 mm (0.0071 in)

(2nd) : 0.15 mm (0.0059 in)

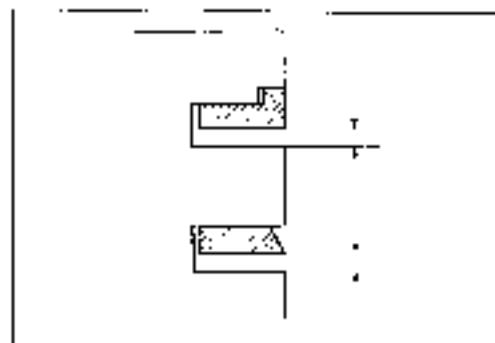
**DATA** Piston ring groove width

Standard (1st) : 0.93 – 0.95 mm (0.0366 – 0.0374 in)

1.55 – 1.57 mm (0.0610 – 0.0618 in)

(2nd) : 1.01 – 1.03 mm (0.0398 – 0.0406 in)

(Oil) : 2.51 – 2.53 mm (0.0988 – 0.0996 in)

**DATA** Piston ring thickness

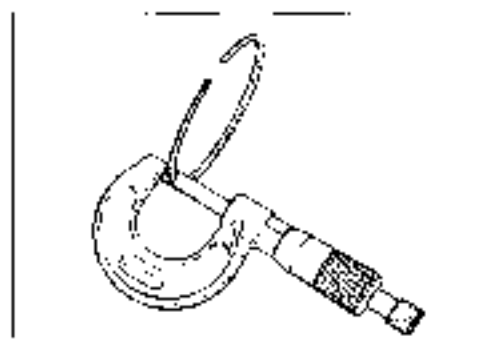
Standard (1st) : 0.86 – 0.91 mm (0.034 – 0.036 in)

1.38 – 1.40 mm (0.054 – 0.055 in)

(2nd) : 0.97 – 0.99 mm (0.038 – 0.039 in)

TOOL 09900-20803: Thickness gauge

09900-20205: Micrometer (0 – 25 mm)

**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.

DATA Piston ring free end gap

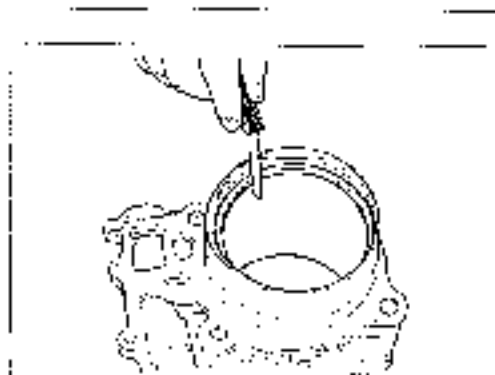
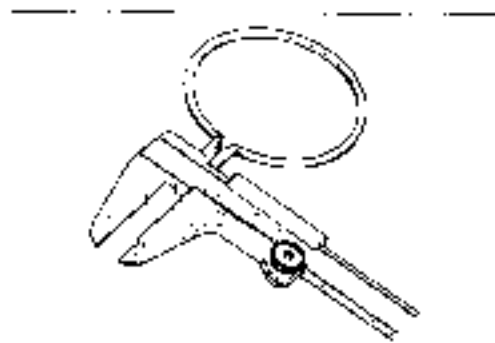
Service Limit (1st) : 7.0 mm (0.28 in)

(2nd) : 8.1 mm (0.32 in)

TOOL 09900-20101: Vernier caliper**DATA** Piston ring end gap

Service Limit (1st) : 0.5 mm (0.02 in)

(2nd) : 0.7 mm (0.03 in)

TOOL 09900-20803: Thickness gauge

PISTON PIN AND PIN BORE

Using a small bore gauge, measure the piston pin bore inside diameter, and 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.

DATA Piston pin bore I.D.

Service limit: 22.030 mm (0.8673 in)

TOOLS 09900-20602: Dial gauge (1/1000 mm, 1 mm)

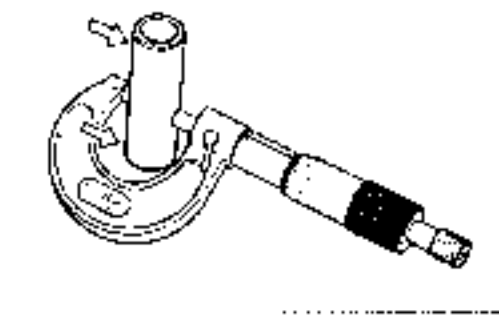
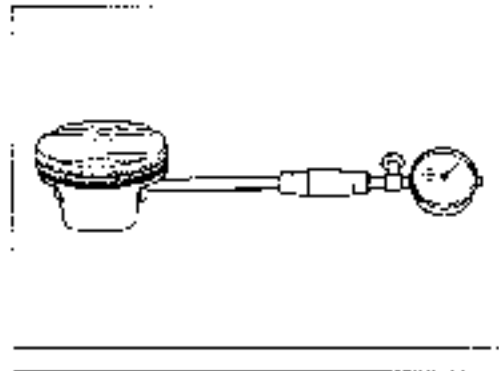
09900-22403: Small bore gauge (18 – 35 mm)

Using a micrometer, measure the piston pin outside diameter at three positions.

DATA Piston pin O.D.

Service Limit: 21.980 mm (0.8654 in)

TOOLS 09900-20205: Micrometer (0 – 25 mm)

**CONROD/CRANKSHAFT****CONROD SMALL END I.D.**

Using a small bore gauge, measure the inside diameter of the conrod small end.

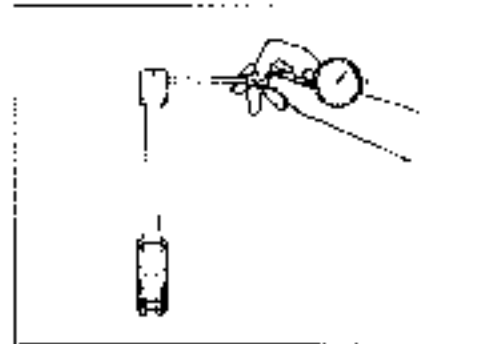
TOOLS 09900-20602: Dial gauge (1/1000 mm, 1 mm)

09900-22403: Small bore gauge (18 – 35 mm)

DATA Conrod small end I.D.

Service Limit: 22.040 mm (0.8677 in)

If the inside diameter of the conrod small end exceeds the limit, replace the conrod.

**CONROD BIG END SIDE CLEARANCE**

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

DATA Conrod big end side clearance

Service Limit: 0.50 mm (0.020 in)

TOOLS 09900-20803: Thickness gauge

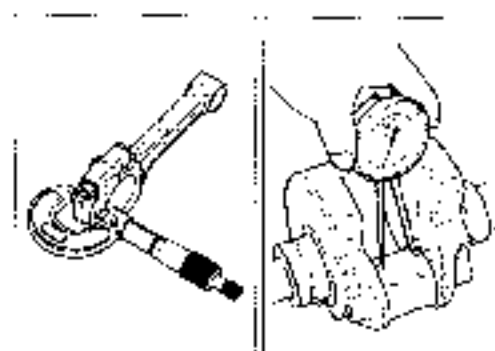


DATA Conrod big end width

Standard: 21.95 – 22.00 mm (0.864 – 0.866 in)

DATA Crank pin width

Standard: 44.17 – 44.22 mm (1.739 – 1.741 in)

TOOL 09900-20205: Micrometer (0 – 25 mm)**CONROD-CRANK PIN BEARING INSPECTION**

- Loosen the bearing cap bolts, and tap the bearing cap bolt lightly with plastic hammer to remove the bearing cap.

CAUTION

Never reuse the bearing cap bolt.



- Remove the conrods, and mark them to identify the cylinder position.
- Inspect the bearing surfaces for any sign of fusion, pitting, burn, or flaws. If any, replace them with a specified set of bearings.

**CONROD-CRANK PIN BEARING SELECTION**

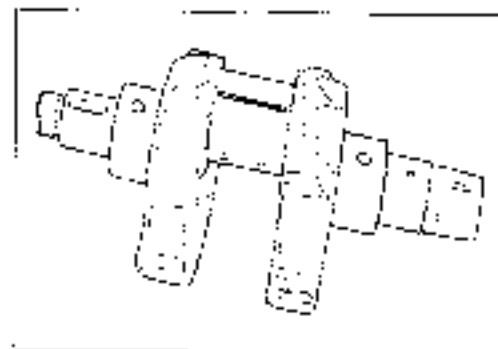
- Place plasti gauge axially on the crank pin avoiding the oil hole, at TDC or BDC side as shown.
- Tighten the bearing cap bolts as the specified manner.

TOOL 09900-22301: Plastigauge

09900-22302: Plastigauge

NOTE

Never rotate the crankshaft or conrod when a piece of plasti-gauge is in the clearance.



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

DATA Conrod big end oil clearance

Service Limit: 0.080 mm (0.0031 in)

- If oil clearance exceeds the service limit, select the specified bearings from the bearing selection table.

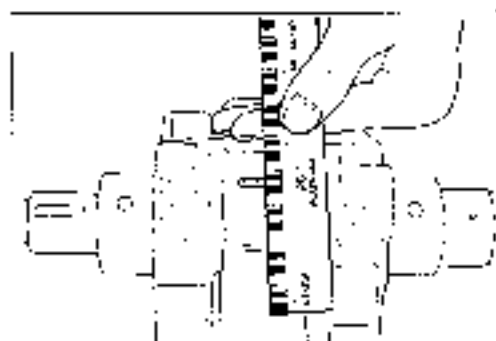
- Check the corresponding conrod I.D. code number (A: "1" or "2").
- Check the corresponding crank pin O.D. code number (B: "1", "2" or "3" stamped on the left crank web).

Bearing selection table

	Code	Crank pin O.D. B		
		1	2	3
Conrod I.D.	1	Green	Black	Brown
code A	2	Black	Brown	Yellow

DATA Conrod big end oil clearance

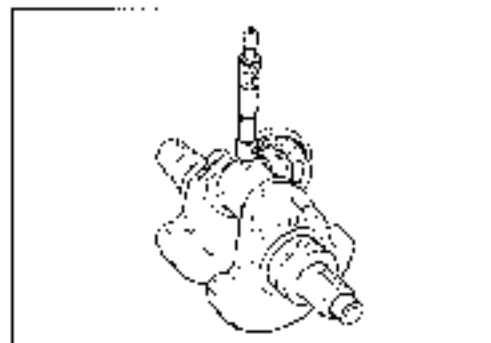
Standard: 0.040 – 0.064 mm (0.0016 – 0.0025 in)

**Conrod big end I.D. specification**

Code A	I.D. specification
1	46.000 – 46.008 mm (1.8098 – 1.8090 in)
2	48.000 – 48.016 mm (1.8900 – 1.8904 in)

Crank pin O.D. specification

Code B	O.D. specification
1	44.992 – 45.000 mm (1.7713 – 1.7717 in)
2	44.984 – 44.992 mm (1.7710 – 1.7713 in)
3	44.976 – 47.984 mm (1.7707 – 1.7710 in)

**09900-20202: Micrometer (25 – 50 mm)**

Bearing thickness

Color (Part No.)	Thickness
Green (12164-02F11-0A0)	1.476 – 1.480 mm (0.0581 – 0.0583 in)
Black (12164-02F11-0B0)	1.480 – 1.484 mm (0.0583 – 0.0584 in)
Brown (12164-02F11-0C0)	1.484 – 1.488 mm (0.0584 – 0.0586 in)
Yellow (12164-02F11-0D0)	1.488 – 1.492 mm (0.0586 – 0.0587 in)

CAUTION

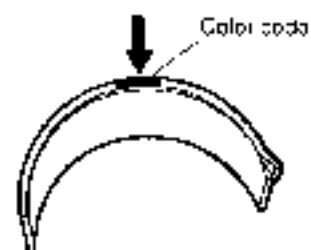
Bearing must be replaced as a set.

BEARING ASSEMBLY

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



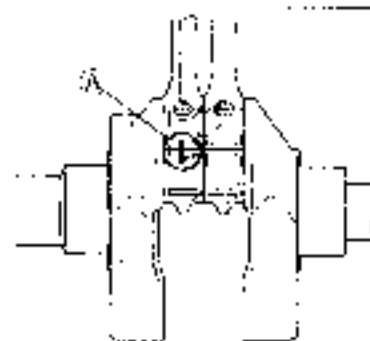
- Apply molybdenum oil solution to the crank pin and bearing surface.

MOLYBDENUM OIL

- When fitting the conrods on the crankshaft, make sure that I.D. codes of the conrods face each cylinder intake valve sides.

CAUTION

Never reuse the bearing cap bolt.



Apply engine oil to the bearing cap bolts

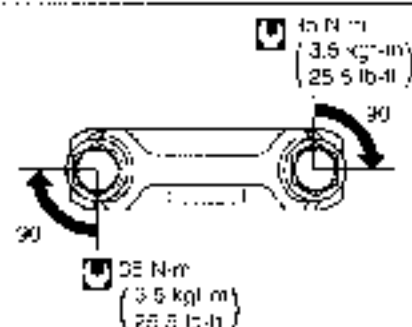
- Tighten the bearing cap bolts as following two steps.

1. Conrod bearing cap bolt

(Initial) : 35 N·m (3.5 kgf-m, 25.5 lb-ft)

(Final) : After tightening the bolts to the above torque, tighten them 1/4 of a turn (90°).

- Check the conrod movement for smooth turning

**CLUTCH****CLUTCH DRIVE PLATES****NOTE:**

Wipe off engine oil from the clutch drive plates with a clean rag.

Measure the thickness of drive plates with a vernier calipers. If each drive plate is not within the standard range, replace it with a new one.



Measuring thickness

DATA Drive plate thickness

Standard (No.1): 2.92 – 3.08 mm (0.115 – 0.121 in)

(No.2 & No.3): 3.72 – 3.88 mm (0.146 – 0.153 in)

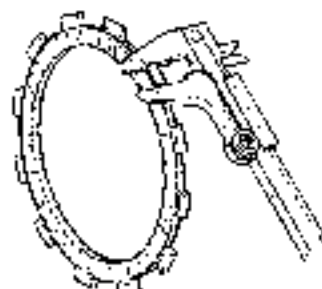
TOOL 08900-20102: Vernier calipers

Measure the claw width of drive plates with a vernier calipers. Replace the drive plates found to have worn down to the limit.

DATA Drive plate claw width (No.1 and No.2)

Standard (No.1): 13.85 – 13.96 mm (0.545 – 0.550 in)

(No.2 & No.3): 13.90 – 14.00 mm (0.547 – 0.551 in)

TOOL 08900-20102: Vernier calipers

Measuring claw width

CLUTCH DRIVEN PLATES

NOTE:

Wipe off engine oil from the clutch driven plates with a clean rag.

Measure each driven plate for distortion with a thickness gauge and surface plate.

Replace driven plates which exceed the limit.

DATA Driven plate distortion

Service Limit: 0.10 mm (0.004 in)

 09900-20803: Thickness gauge

CLUTCH SPRING FREE LENGTH

Measure the free length of each coil spring with a vernier calipers, and compare the length with the specified limit. Replace all the springs if any spring is not within the limit.

DATA Clutch spring free length

Service Limit: 59.4 mm (2.34 in)

 09900-20102: Vernier calipers

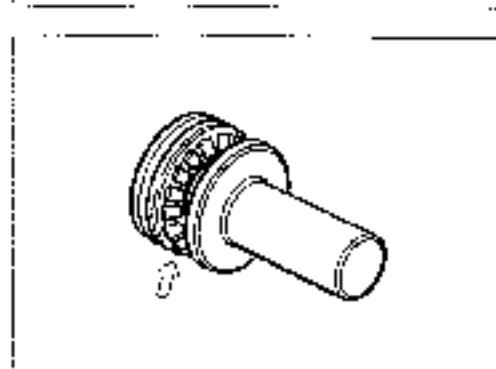
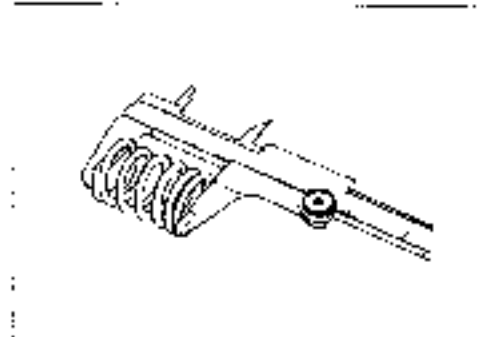
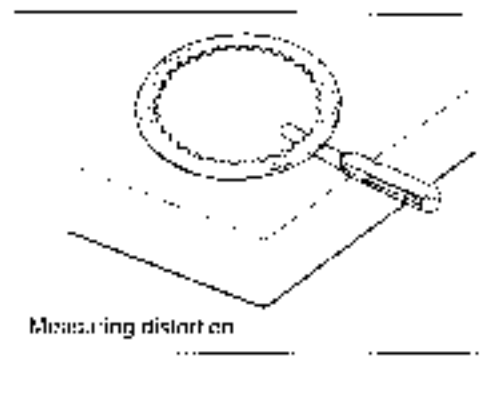
CLUTCH BEARING

Inspect the clutch release bearing for any abnormality, particularly cracks, to decide whether it can be reused or should be replaced.

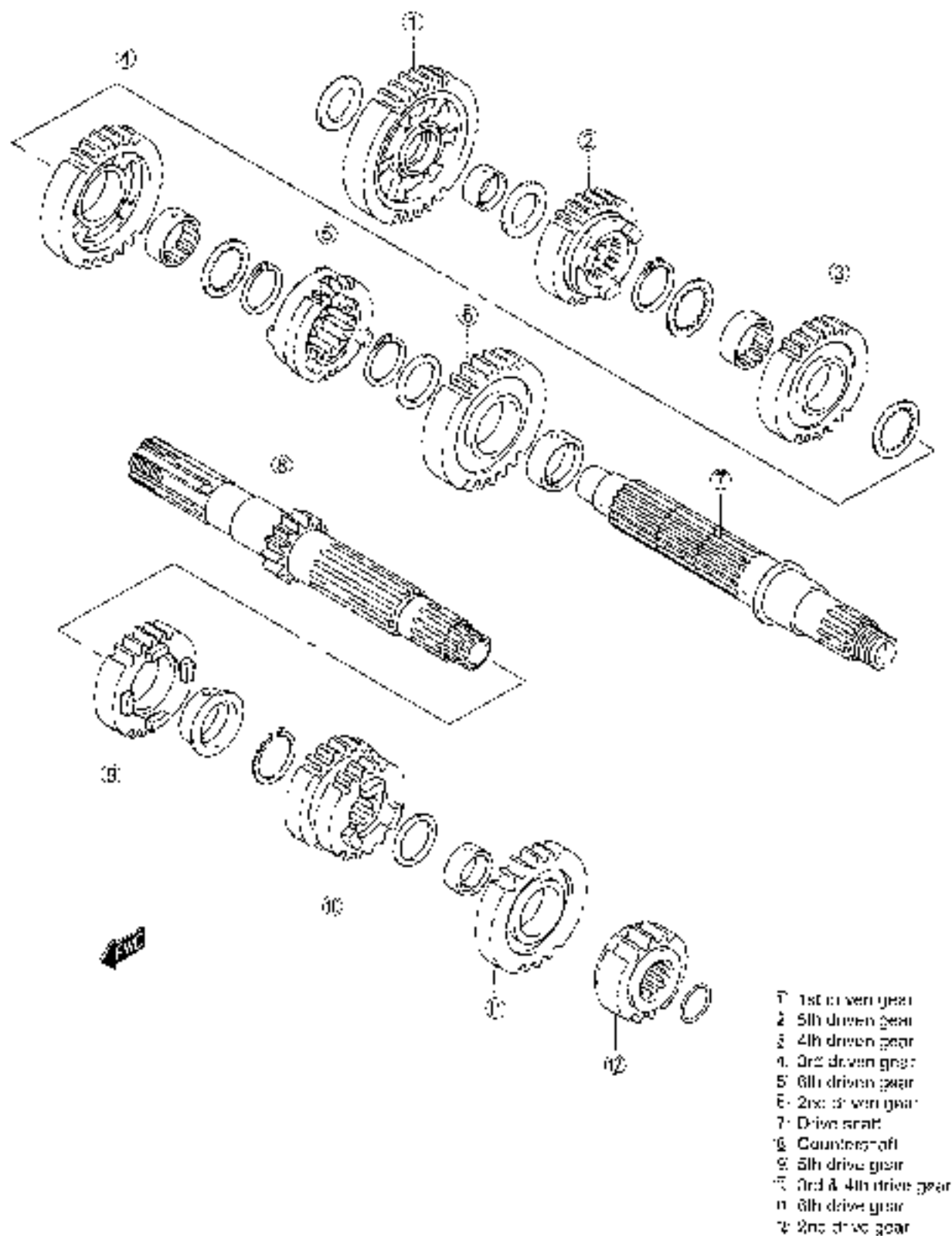
Smooth engagement and disengagement of the clutch depends on the condition of this bearing.

NOTE:

Thrust washer is located between the pressure plate and the bearing.



TRANSMISSION CONSTRUCTION



DISASSEMBLY

CAUTION

Be sure to identify each removed part as to its location, and lay the parts out in groups designated as "Drive" and "Driven", so that each will be restored to the original location during assembly.

Countershaft

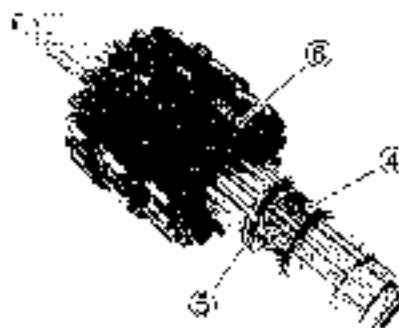
- Remove the O-ring (1), 2nd drive gear (2) and top drive gear (3).

CAUTION

The removed O-ring must be replaced with a new one.



- Remove the top drive gear bushing (4), washer (5), and 3rd/4th drive gears (6).



- Remove the snap ring with the special tool

 09900-06107: Snap ring pliers



- Remove the 5th drive gear (7) and its bushing (8).



Driveshaft

- Remove the low driven gear (1) and washer (2).



- Remove the low driven gear bushing (3), washer (4) and 5th driver gear (5).



- Remove the snap ring with the special tool

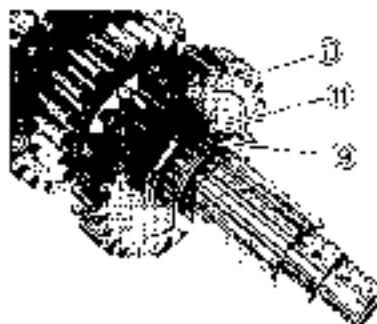
 09900-06107: Snap ring pliers



- Remove the washer (6), 4th driven gear (7) and its bushing (8).

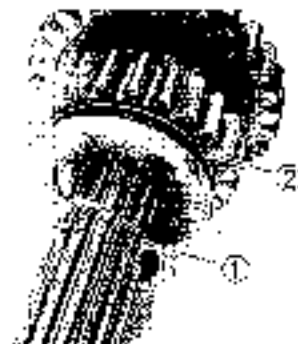


- Remove the washer (9), 3rd driver gear (10) and its bushing (11).



- Remove the washer (1).
- Remove the top driven gear (2) by removing the snap ring.

 09900-06107: Snap ring pliers

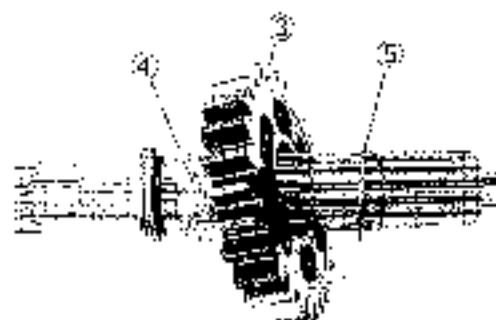


- Remove the snap ring with the special tool

 09900-06107: Snap ring pliers



- Remove the 2nd driven gear (3), its bushing (4) and washer (5).



REASSEMBLY

Assembly line transfer in the reverse order of disassembly. Pay attention to the following points.

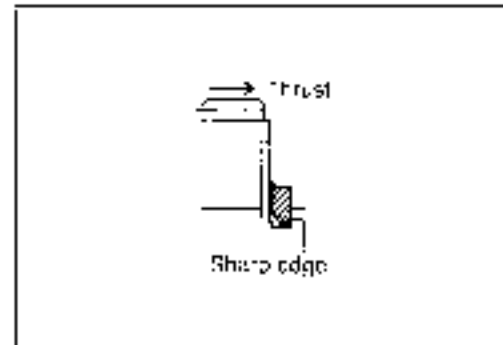
NOTE

- * Always use new snap rings.
- * Before installing the gears, coat lightly engine oil to the shafts and gears.

CAUTION

- * Never reuse a snap ring. After a snap ring has been removed from a shaft, it should be discarded and a new snap ring must be installed.
- * When installing a new snap ring, care must be taken not to expand the end gap larger than required to slip the snap ring over the shaft.
- * After installing a snap ring, always ensure that it is completely seated in its groove and securely fitted.

- When installing a new snap ring, pay attention to the direction of the snap ring. Fit it to the side where the thrust is as shown in the figure.

**CAUTION**

When installing the 3rd and 4th driven gear bushings on to the driveshaft, align the shaft oil holes (A) with the bushing oil hole (B).



GEARSHIFT FORK

GEARSHIFT FORK TO GROOVE CLEARANCE

Using a thickness gauge, check the gearshift fork clearance in the groove of its gear.

The clearance for each gearshift fork plays an important role in the smoothness and positiveness of the shifting action.

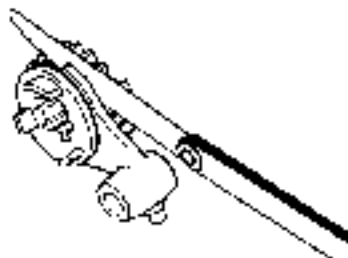
DATA Shift fork to groove clearance

Service Limit: 0.50 mm (0.020 in)

Tools: 09900-20803: Thickness gauge

09900-20102: Vernier calipers

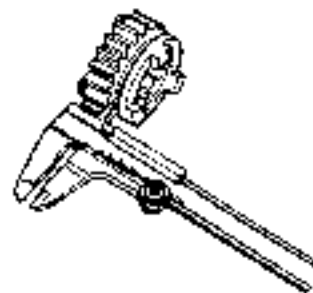
If the clearance checked is noted to exceed the limit specified, replace the fork or its gear, or both.



Checking clearance

DATA Shift fork groove width

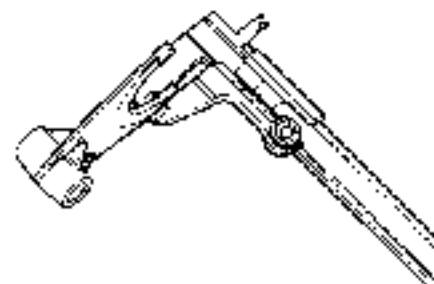
Standard: 5.0 – 5.1 mm (0.197 – 0.201 in)



Checking groove width

DATA Shift fork thickness

Standard: 4.8 – 4.9 mm (0.189 – 0.193 in)



Checking thickness