Engine Shop Manual

SCORPA MOTORCYCLES

SY250

POWERED BY

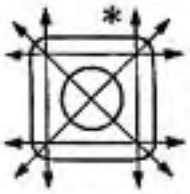
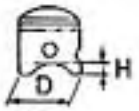
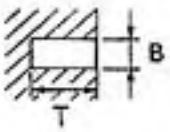
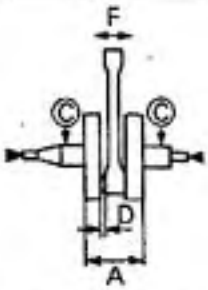
YAMAHA

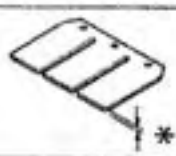
CHAMPION

Specifications subject to change without notice.

MAINTENANCE SPECIFICATIONS

ENGINE

Model	TY250Z
Cylinder head: Warp limit 	<0.03 mm (0.0012 in)> *Lines indicate straightedge measurement.
Cylinder: Bore size Wear limit Taper limit Out of round limit	74.000~74.014 mm (2.9134~2.9139 in) 74.1 mm (2.917 in) <0.05 mm (0.0020 in)> <0.01 mm (0.0004 in)>
Piston: Piston size "D" Measuring point "H" Piston clearance <Limit> Piston offset 	73.967~73.982 mm (2.9121~2.9127 in) 10 mm (0.39 in) 0.030~0.035 mm (0.0012~0.0014 in) <0.1 mm (0.004 in)> 0.5 mm (0.02 in)/EX-side
Piston pin: Piston pin outside diameter/<Limit>	15.995~16.000 mm (0.6297~0.6299 in)/ <15.975 mm (0.6289 in)>
Piston ring: Sectional sketch  End gap (installed)/<Limit> Side clearance (installed)/<Limit>	Plain B=1.2 mm (0.047 in) T=2.79 mm (0.110 in) 0.30~0.45 mm (0.012~0.018 in)/ <0.75 mm (0.030 in)> 1st: 0.045~0.080 mm (0.0018~0.0031 in)/ <0.1 mm (0.004 in)> 2nd: 0.035~0.070 mm (0.0014~0.0028 in)/ <0.1 mm (0.004 in)>
Crankshaft:  Crank width "A" Run out limit "C" Connecting rod big end side clearance "D" Small end free play "F"	57.90~57.95 mm (2.280~2.281 in) <0.05 mm (0.0020 in)> 0.2~0.7 mm (0.008~0.028 in) 0.4~1.0 mm (0.016~0.039 in)

Model		TY250Z
Clutch:		
Friction plate thickness/Quantity		2.9~3.1 mm (0.114~0.122 in) × 7
<Wear limit>		<2.7 mm (0.106 in)>
Clutch plate thickness/Quantity		1.5~1.7 mm (0.059~0.067 in) × 6
<Warp limit>		<0.2 mm (0.008 in)>
Clutch spring free length/Quantity		36.4 mm (1.43 in)×5
<Limit>		<35.4 mm (1.39 in)>
Clutch housing thrust clearance		0.15~0.23 mm (0.0059~0.0091 in)
Clutch housing radial clearance		0.016~0.042 mm (0.0006~0.0017 in)
Clutch release method		Inner push, cam push
Transmission:		
Main axle deflection limit		<0.01 mm (0.0004 in)>
Drive axle deflection limit		<0.01 mm (0.0004 in)>
Shifter:		
Shifting type		Cam drum and guide bar
Guide bar bending limit		<0.05 mm (0.0020 in)>
Kick starter:		
Type		Kick and mesh type
Kick clip friction force		P=0.8~1.2 kg (1.8~2.6 lb)
Air filter oil grade (oiled filter):		Foam-air-filter oil or engine mixing oil
Carburetor:		
Type/Manufacturer		Y26P/TEIKEI
I.D. mark		4GG00
Main jet	(M.J.)	#165
Air jet	(A.J.)	ϕ2.5
Jet needle-clip position	(J.N.)	5C77-3
Main nozzle	(N.J.)	ϕ2.585 (S85)
Throttle valve	(C.A.)	2.0
Pilot jet	(P.J.)	#40
Pilot air screw	(P.A.S.)	1-1/2
Valve seat size	(V.S.)	ϕ2.0
Starter jet	(G.S.)	ϕ0.7
Float height	(F.H.)	21~23 mm (0.83~0.91 in)
Reed valve:		
Thickness*		0.34 mm (0.0134 in)
Valve bending limit		0.2 mm (0.008 in)

MAINTENANCE INTERVALS

The following schedule is intended as a general guide to maintenance and lubrication. Bear in mind that such factors as weather, terrain, geographical location, and individual usage will alter the required maintenance and lubrication intervals. If you are a doubt as to what intervals to follow in maintaining and lubricating your machine, consult your Yamaha dealer.

Item	After break-in	Every race	Every 3 months	Every 6 months	Every 1 year	As required	Remarks
PISTON Inspect and clean Replace				●	●		Inspect crack Remove carbon
PISTON RING Inspect Replace				●	●		Check ring end gap
PISTON PIN, SMALL END BEARING Inspect Replace				●	●		
CYLINDER HEAD Inspect and clean Retighten	● ●		●				Remove carbon Check gasket
CYLINDER Inspect and clean Replace Retighten	●			●		●	Seizure Wear
CLUTCH Inspect and adjust Replace				●		●	Inspect friction plate, clutch plate and spring
TRANSMISSION Replace oil Inspect transmission	●		●			●	SAE 10W30 SE motor oil
SHIFT FORK, SHIFT CAM, GUIDE BAR Inspect						●	Inspect wear
ROTOR NUT Retighten	●				●		
MUFFLER Inspect Clean Replace	●	●	●	●	●		
CRANK Inspect and clean Replace				●		●	
CARBURETOR Inspect, adjust and clean	●	●				●	
SPARK PLUG Inspect and clean Replace	●					● ●	
DRIVE CHAIN Lubricate, slack, alignment Replace	●	●				●	Use chain lube Chain slack: 20 ~ 30 mm (0.8~1.2 in)

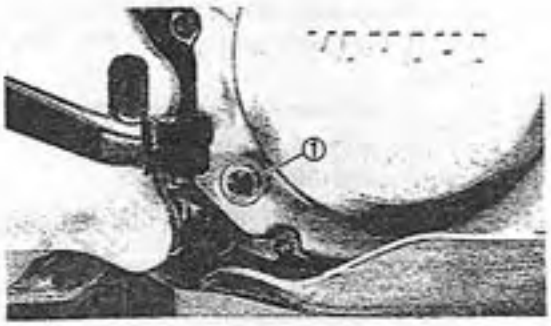
MAINTENANCE INTERVALS

INSP ADJ

Item	After break-in	Every race	Every 3 months	Every 6 months	Every 1 year	As required	Remarks
COOLING SYSTEM							
Check coolant level and leakage	●	●					
Check radiator cap operation						●	
Replace coolant						●	Every two years
Inspect hoses		●					
OUTSIDE NUTS AND BOLTS							Refer to "STARTING AND BREAK-IN" section in the CHAPTER 1. GENERAL INFORMATION.
Retighten	●	●				●	
AIR FILTER							
Clean and lubricate	●	●				●	Use foam air-filter oil or engine mixing oil
Replace						●	
FRAME							
Clean and inspect	●	●					
FUEL TANK, COCK							
Clean and inspect	●		●				
BRAKES							
Adjust free play	●	●					
Lubricate pivot point						●	
Check fluid level and leakage	●	●					
Retighten brake disc bolts, caliper bolts and union bolts	●	●				●	
Replace brake fluid					●		
Replace pads						●	
Replace collar (brake disc)					●	●	
FRONT FORKS							
Inspect and adjust	●	●				●	
Replace oil				●			Suspension oil "01"
Replace oil seal						●	
REAR SHOCK							
Inspect and adjust	●					●	
Lube and retighten	●	●					Lithium base grease
CHAIN TENSIONER							
Inspect and replace						●	Wear
SWINGARM							
Inspect and retighten	●	●					
Lubricate		●	●				
RELAY ARM, CONNECTING ROD							
Inspect and lube	●	●	●				Lithium base grease
STEERING HEAD							
Inspect free play and retighten	●					●	
Clean and lube				●			
Replace bearing						●	Lithium base grease
TIRE, WHEELS							
Inspect air pressure, wheel run-out, tire wear and spoke looseness	●	●					
Retighten sprocket bolt	●	●					
Inspect bearings	●	●					
Replace bearings						●	
Lubricate			●				
THROTTLE, CONTROL CABLE							
Check routing and connection	●	●					
Lubricate	●	●				●	SAE 10W30 motor oil
ENGINE GUARD							
Retighten	●	●				●	

TRANSMISSION OIL LEVEL CHECK

1. Start the engine, warm it up for several minutes and wait for five minutes.
2. Place the machine on a level place and hold it up on upright position by placing the suitable stand under the engine.



3. Check:
   - Transmission oil level

Transmission oil level checking steps:
- Remove the checking bolt ①.
- Inspect the oil level.

NOTE:

Be sure the machine is positioned straight up when inspecting the oil level.

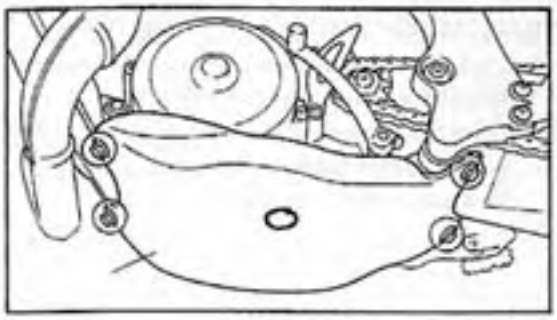
⚠ WARNING

Never attempt to remove the checking bolt just after high speed operation. The heated oil could spout out, causing danger. Wait until the oil cools down.

Oil flows out→Oil level is correct.
Oil does not flow out→Oil level is low. Add transmission oil until oil flows out.

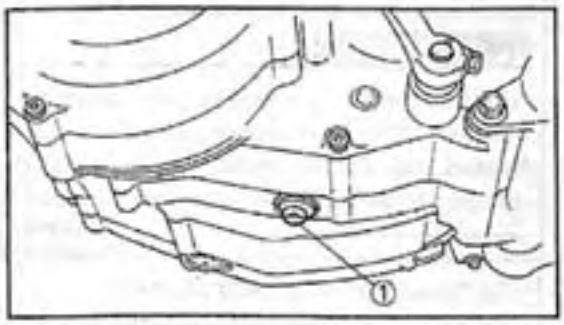
- Inspect the gasket (checking bolt), replace if damaged.
- Tighten the checking bolt.

Checking bolt:
10 Nm (1.0 m•kg, 7.2 ft•lb)



TRANSMISSION OIL REPLACEMENT

Start the engine and warm it up for several minutes and wait for five minutes.
Place the machine on a level place and hold it on upright position by placing the suitable stand under the engine.
Place a suitable container under the engine.



Remove:
- Drain bolt ①
- Oil filler cap ②

Drain the transmission oil.
Install:
- Drain bolt

Drain bolt:
20 Nm (2.0 m•kg, 14 ft•lb)

Fill:
- Transmission oil

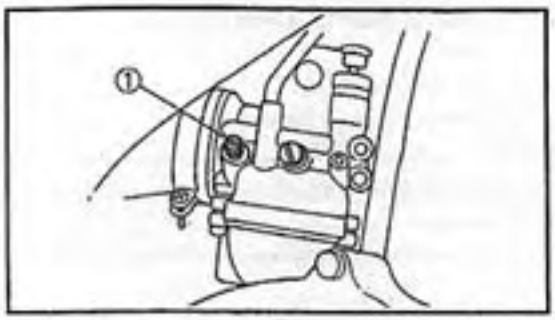
Recommended oil:
10W-30 type SE motor oil
Oil capacity
(periodic oil change):
0.60 L

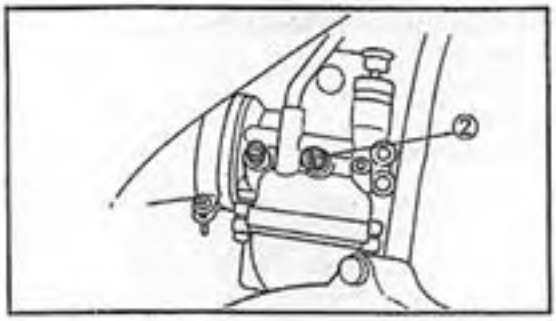
Check:
- Oil leakage

Check:
- Transmission oil level

Install:
- Oil filler cap
- Engine guard

Bolt (engine guard):
32 Nm (3.2 m•kg, 23 ft•lb)





IDLE SPEED ADJUSTMENT

1. Start the engine and warm it up for a few minutes.
2. Adjust:
   - Idle speed

Idle speed adjusting steps:
- Screw in the pilot air screw ① until it is lightly seated.
- Back out by the specified number of turns.

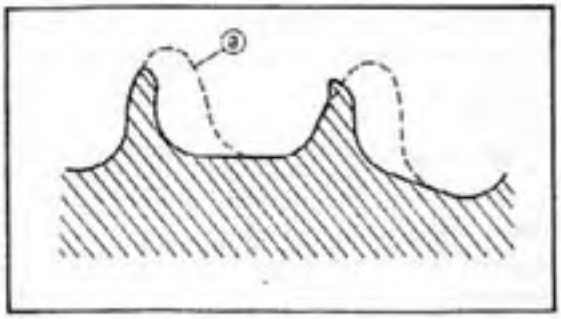
Pilot air screw:
1 3/4 turns out

- Turn the screw ② until the idle is at the desired rpm.

Standard idle speed:
1,150 – 1,250 r/min

- Turn the pilot air screw ① in or out in 1/8-turn increments to achieve the highest rpm with just the pilot screw.
- Once again, turn the throttle stop screw ② to attain the desired idle rpm.

The throttle response off idle should be crisp and clean, without any hesitation. If the engine is completely warmed up and hesitates off idle, turn the pilot air screw in or out in 1/8-turn increments until the problem is eliminated.

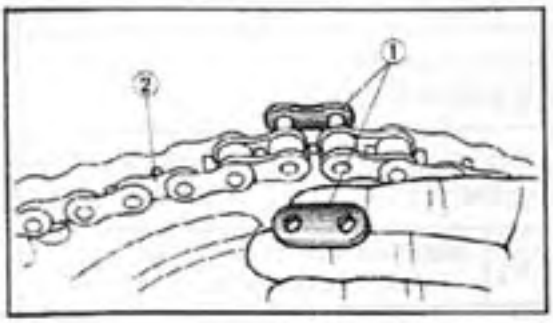


SPROCKETS INSPECTION

1. Inspect:
   - Sprocket teeth ③
     Excessive wear → Replace.

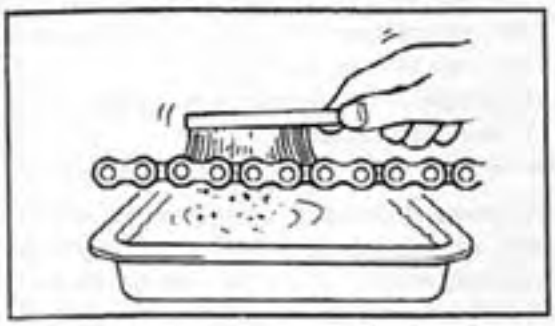
NOTE:

Replace the drive, driven sprockets and drive chain as a set.

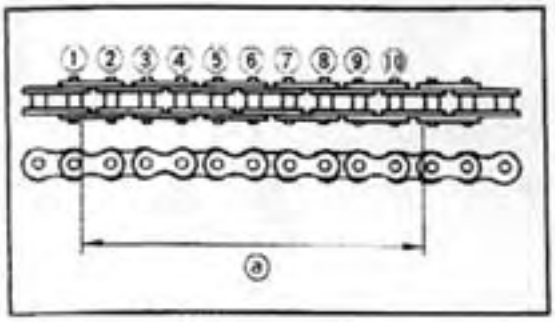


DRIVE CHAIN INSPECTION

1. Remove:
   - Master link clip
   - Joint ①
   - Drive chain ②

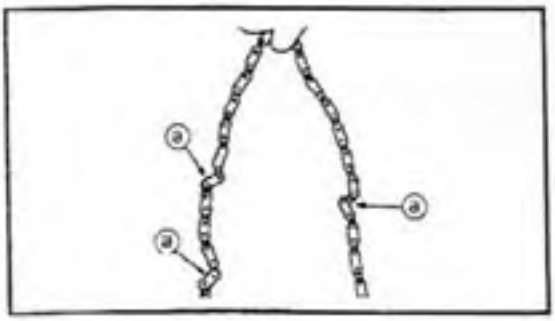


2. Clean:
   - Drive chain
     Place it in kerosene, and brush off as much dirt as possible. Then remove the chain from the kerosene and dry the chain.



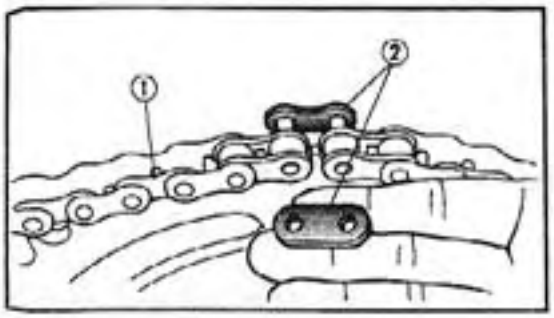
3. Measure:
   - Drive chain length (10 links) ③
     Out of specification → Replace.

	Drive chain length (10 links): **Limit: 153.0 mm (6.02 in)**



4. Check:
   - Drive chain stiffness ③
     Clean and oil the chain and hold as illustrated.
     Stiff → Replace drive chain.

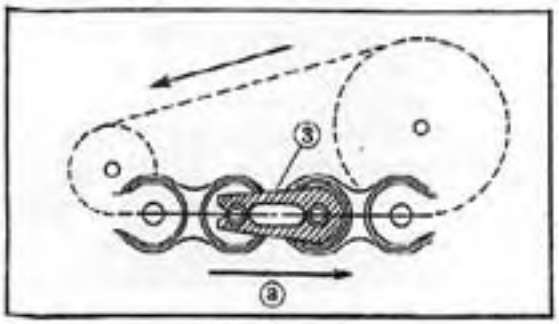
DRIVE CHAIN SLACK ADJUSTMENT



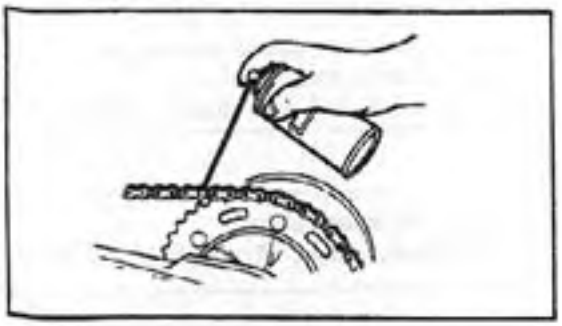
5. Install:
   - Driven chain ①
   - Joint ②
   - Master link clip ③

NOTE:

During reassembly, the master link clip must be installed with the rounded end facing the direction of travel.

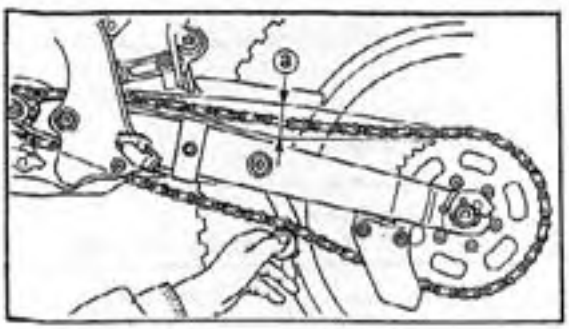


ⓐ Turning direction



6. Lubricate:
   - Drive chain

Drive chain lubricant:
SAE 10W30 motor oil or suitable chain lubricants



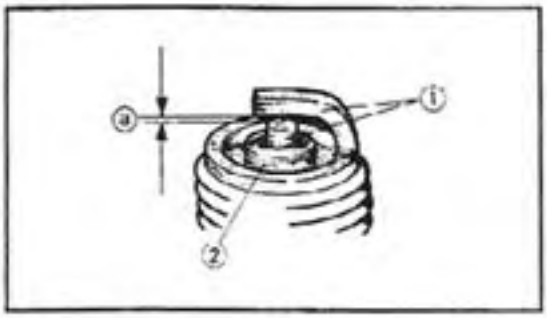
DRIVE CHAIN SLACK ADJUSTMENT

1. Elevate the rear wheel by placing the suitable stand under the engine.
2. Check:
   - Drive chain slack ⓐ
     Out of specification→Adjust.

Drive chain slack:
20 ~ 30 mm (0.8 ~ 1.2 in)

NOTE:

Before checking and/or adjusting, rotate the rear wheel through several revolutions and check the slack several times to find the tightest point. Check and/or adjust chain slack with rear wheel in this "tight chain" position.



SPARK PLUG INSPECTION

1. Remove:
   - Spark plug
2. Inspect:
   - Electrode ①
     Wear/Damage → Replace.
   - Insulator color ②
     Normal condition is a medium to light tan color.
     Distinctly different color → Check the engine condition.

NOTE:

When the engine runs for many hours at low speeds, the spark plug insulator will become sooty, even if the engine and carburetor are in good operating condition.

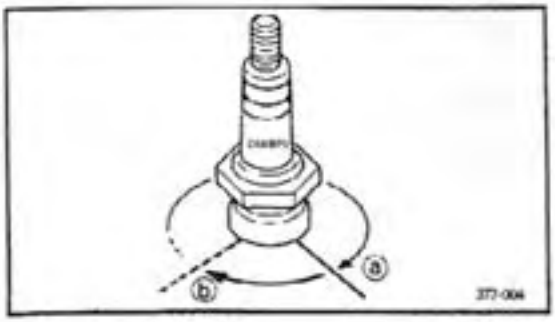
3. Measure.
   - Plug gap ⓐ
     Use a wire gauge or thickness gauge.
     Out of specification → Regap.

Spark plug gap:
0.7 – 0.8 mm (0.028 – 0.031 in)

Standard spark plug:
CHAMPION RC 89PYC

4. Clean the plug with a spark plug cleaner if necessary.
5. Tighten:
   - Spark plug

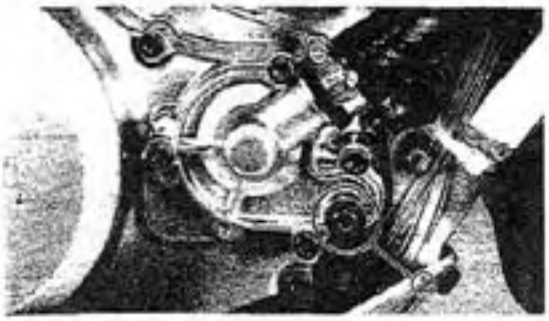
Spark plug:
25 Nm (2.5 m·kg, 18 ft·lb)



NOTE:

- Before installing a spark plug, clean the gasket surface and plug surface.
- Finger-tighten ⓐ the spark plug before torquing to specification ⓑ.

INSP ADJ



CAUTION:

Take care so that coolant does not splash on painted surfaces. If it splashes, wash it away with water.

1. Place a container under the engine.
2. Remove:
   - Coolant drain bolt ①
3. Remove:
   - Radiator cap

   Drain the coolant completely.
4. Clean:
   - Cooling system

   Thoroughly flush the cooling system with clean tap water.
5. Install:
   - Copper washer
   - Coolant drain bolt

NOTE:

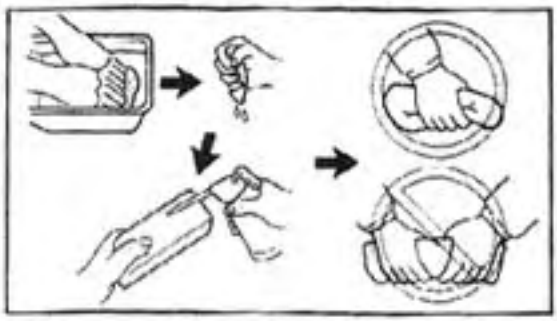
Always use a new copper washer.

Coolant drain bolt:
16 Nm (1.6 m·kg, 11 ft·lb)

6. Fill:
   - Radiator
   - Engine

   To specified level.

Recommended coolant:
High quality ethylene glycol anti-freeze containing anti-corrosion for aluminum engine
Coolant ① and water (soft water) ② mixing ratio:
50%/50%
Coolant capacity:
0.6 L (0.53 Imp qt, 0.63 US qt)



2. Clean:
   • Air filter element
   Clean them with solvent.

NOTE:

After cleaning, remove the remaining solvent by squeezing the element.

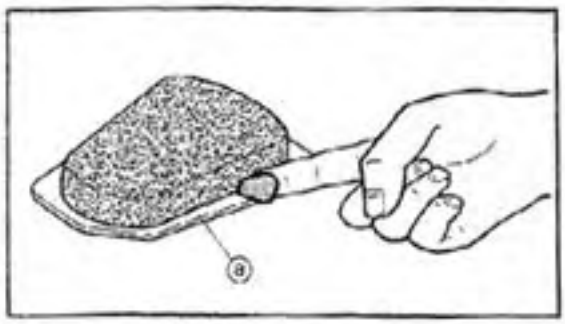
CAUTION:

Do not twist the element when squeezing the element.

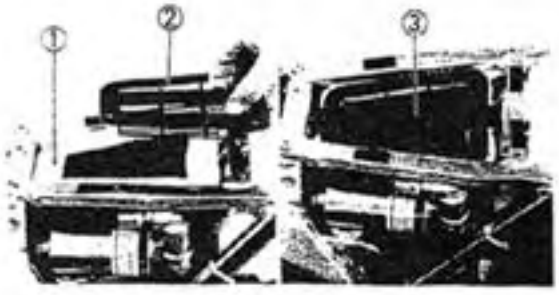
3. Inspect:
   • Air filter element
   Damage → Replace.
4. Apply:
   • Foam-air-filter oil or engine mixing oil
   To the element.

NOTE:

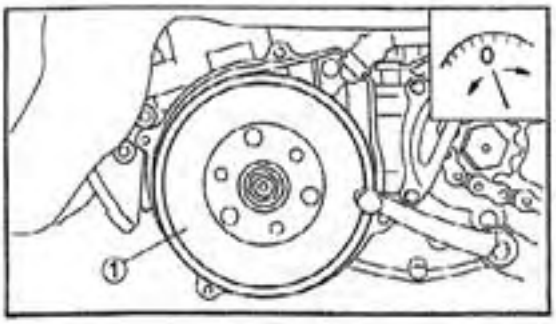
Squeeze out the excess oil. Element should be wet but not dripping.



5. Apply:
   • Lithium soap base grease
   On to the matching surface ⓐ on air filter element.



6. Install:
   • Air filter element ①
   • Filter guide ②
   • Band ③
   • Seat



IGNITION TIMING CHECK

1. Remove:
   - Spark plug
   - Engine guard
   - Crankcase cover (left)
2. Attach:
   - Dial gauge ①
   - Dial gauge stand ②

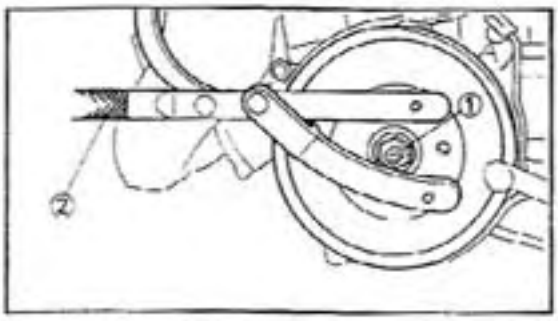
	Dial gauge and stand: **90890-01252**

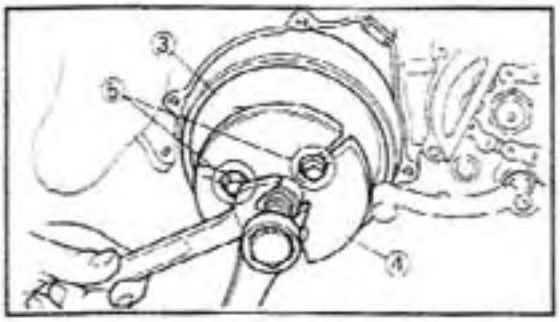
3. Rotate the magneto rotor ① until the piston reaches top dead center (TDC). When this happens, the needle on the dial gauge will stop and reverse directions even though the rotor is being turned in the same direction.
4. Set the dial gauge to zero at TDC.
5. From TDC, rotate the rotor clockwise until the dial gauge indicates that the piston is at a specified distance from TDC.

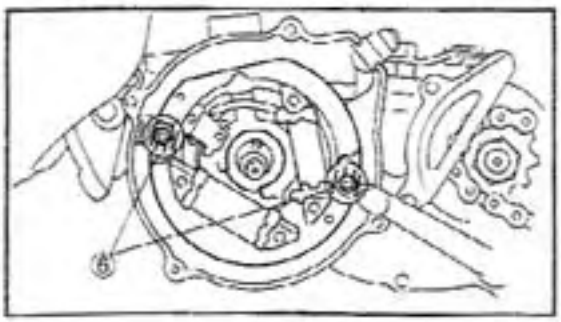
	Ignition timing: **1.6 mm (0.063 in)**

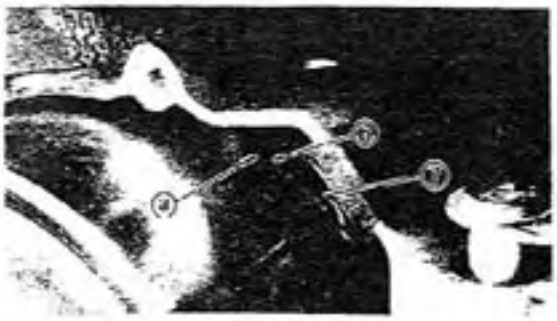
6. Check:
   - Ignition timing

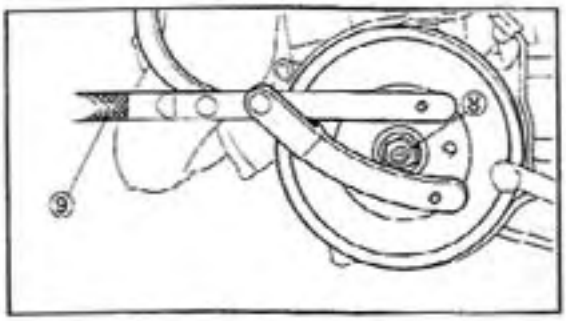
   Punch mark ⓐ on rotor should be aligned with punch mark ⓑ on stator.
   Not aligned→Adjust.











7. Adjust:
   •Ignition timing

Adjustment steps:
•Remove the nut ① and washer.
Use the rotor holding tool ②.

Rotor holding tool:
90890-01235

•Remove the rotor ③.
Use the flywheel puller ④.

CAUTION:

Do not turn in the flywheel puller installation bolt ⑤ more than 10 mm (0.39 in) to avoid its contact with the stator.

Flywheel puller:
90890-01362

•Loosen the screws (stator) ⑥.
•Install the rotor.

NOTE:

•Clean the tapered portions of the crankshaft and rotor.
•When installing the rotor, make sure the woodruff key is properly seated in the key-way of the crankshaft.

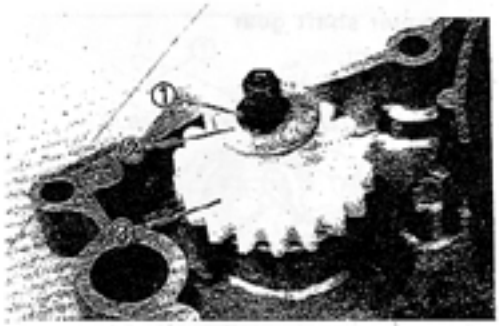
•Align the punch mark ⓐ on the rotor with punch mark ⓑ on the stator by moving the stator ⑦.
•Remove the rotor.
•Tighten the screws (stator).

Screw (stator):
8 Nm (0.8 m•kg, 5.8 ft•lb)

•Install the rotor and washer.
•Tighten the nut ⑧.
Use the rotor holding tool ⑨.

Rotor holding tool:
90890 01235

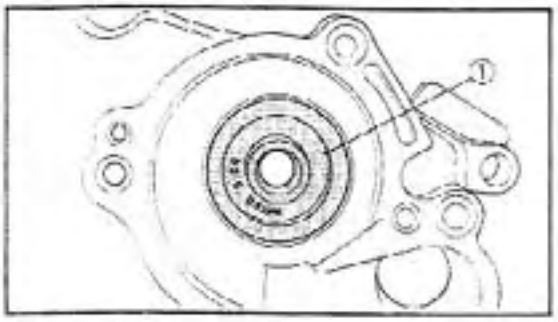
Nut:
80 Nm (8.0 m•kg, 58 ft•lb)



Impeller shaft

1. Remove:
   - Circlip ①
   - Plain washer ②
   - Impeller shaft gear ③

2. Remove:
   - Dowel pin ①
   - Plain washer ②
   - Impeller shaft ③

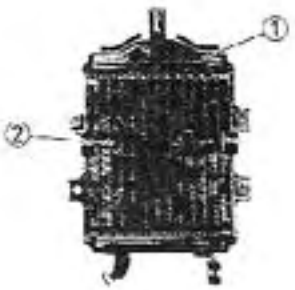


Oil seal

NOTE:

It is not necessary to disassemble the water pump, unless there is an abnormality such as excessive change in coolant level, discoloration of coolant, or milky transmission oil.

1. Remove:
   - Oil seal ①



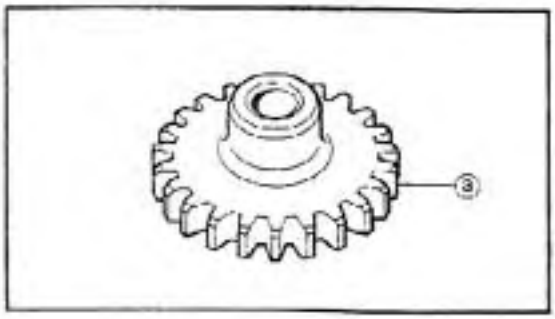
INSPECTION

Radiator

1. Inspect:
   - Radiator core ①
     Obstruction → Blow out with compressed air through rear of the radiator.
     Bent fin → Repair/replace.
   - Fan ②
     Crack/Damage → Replace.

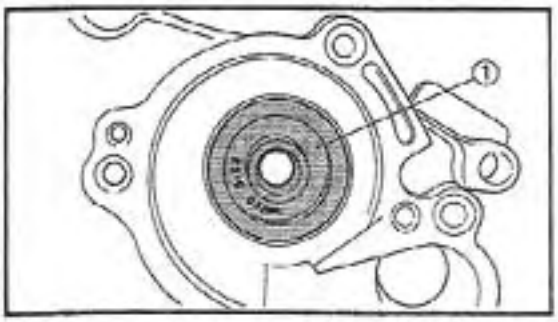
Impeller shaft

1. Inspect:
   - Impeller shaft ①
     Bend/Wear/Damage → Replace.
     Fur deposits → Clean.



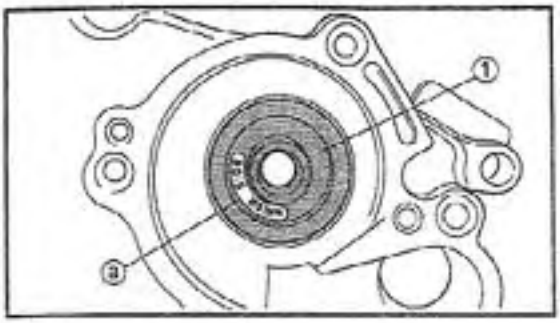
Impeller shaft gear

1. Inspect:
   - Gear teeth ⓐ
     Wear/Damage → Replace.



Oil seal

1. Inspect:
   - Oil seal ①
     Wear/Damage → Replace.



ASSEMBLY AND INSTALLATION

Oil seal

1. Install:
   - Oil seal ①

NOTE:

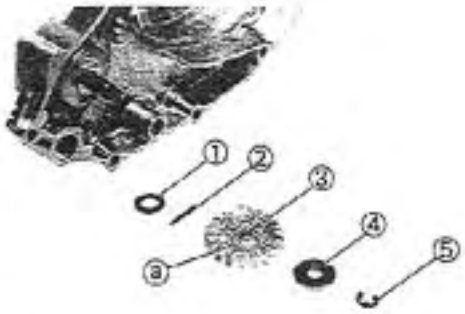
- Always use a new oil seal.
- Install the oil seal with the "WATER SIDE" mark ⓐ on the outside.

Impeller shaft

1. Install:
   - Impeller shaft ①

NOTE:

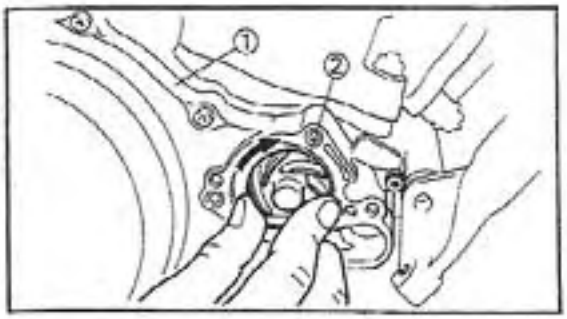
- Take care so that the oil seal lip is not damaged or the spring does not slip off its position.
- When installing the impeller shaft, apply the lithium soap base grease on the oil seal lip and impeller shaft. And install the shaft while turning it.



2. Install:
   - Plain washer [D=ø18 mm (0.71 in)] ①
   - Dowel pin ②
   - Impeller shaft gear ③
   - Plain washer [D=ø23 mm (0.91 in)] ④
   - Circlip ⑤

NOTE:

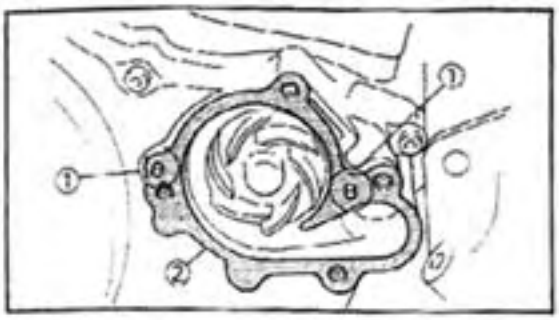
- Make sure the dowel pin fits into the groove ⓐ in the impeller shaft gear.
- Always use a new circlip.



3. Install:
   - Crankcase cover (right) ①

NOTE:

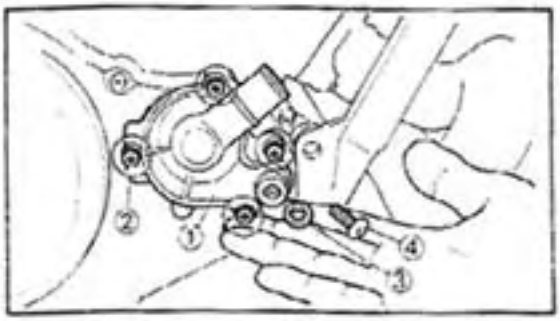
Mesh the impeller shaft gear and oil pump drive gear by turning the impeller shaft ②.



4. Install:
   - Dowel pin ①
   - Gasket (water pump housing cover) ②

NOTE:

Always use a new gasket.



5. Install:
   - Water pump housing cover ①
   - Bolt (water pump housing cover) ②
   - Copper washer (coolant drain bolt) ③
   - Coolant drain bolt ④

NOTE:

Always use a new copper washer.

Bolt (water pump housing cover):
12 Nm (1.2 m·kg, 8.7 ft·lb)
Coolant drain bolt:
16 Nm (1.6 m·kg, 11 ft·lb)

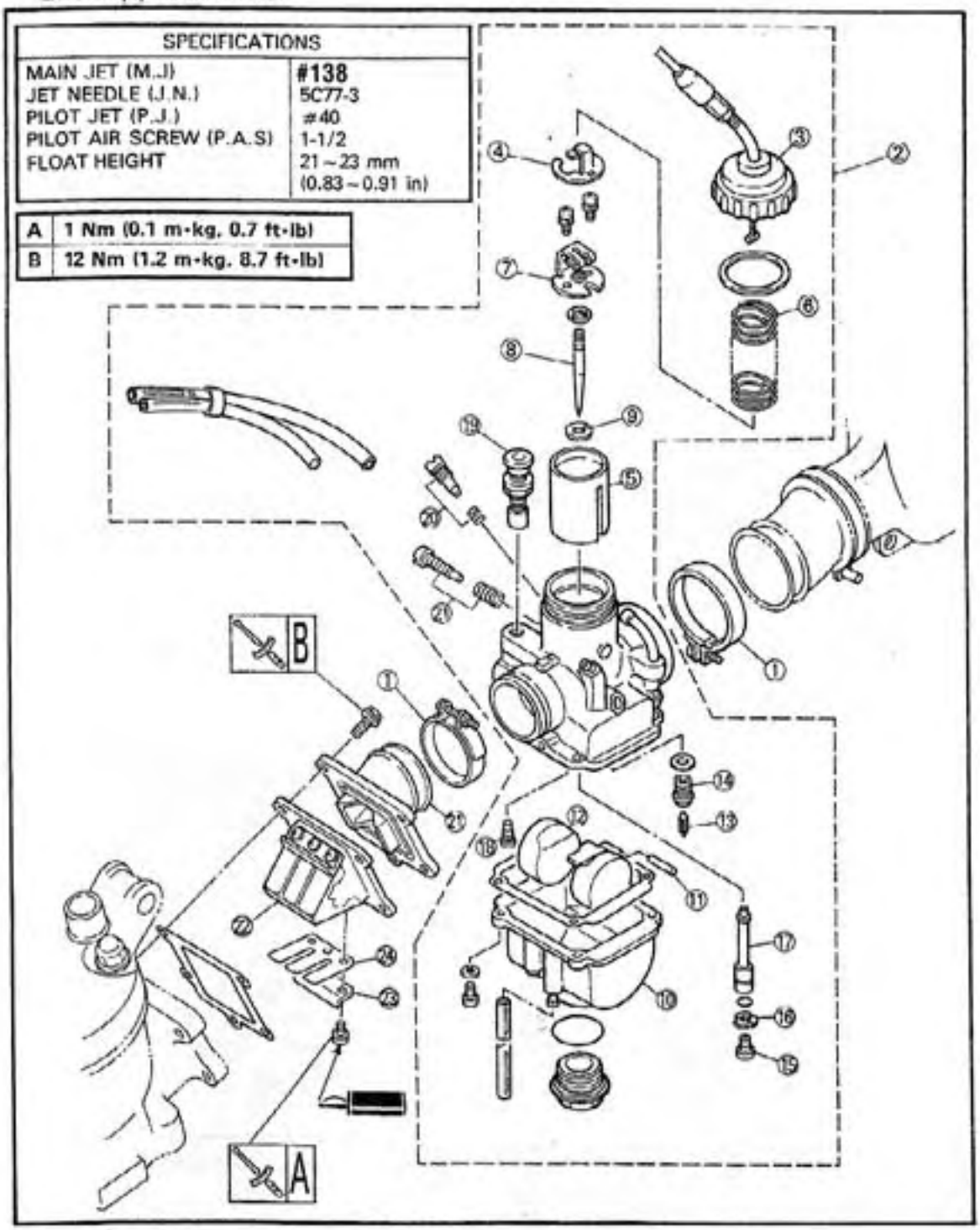
CARBURETOR AND REED VALVE

PREPARATION FOR REMOVAL

*Turn the fuel cock to "OFF".
*Disconnect the fuel hose at fuel cock side.
*Remove the following parts:
- Seat
- Exhaust pipe and silencer

SPECIFICATIONS	
MAIN JET (M.J)	#138
JET NEEDLE (J.N.)	5C77-3
PILOT JET (P.J.)	#40
PILOT AIR SCREW (P.A.S)	1-1/2
FLOAT HEIGHT	21 ~ 23 mm (0.83 ~ 0.91 in)

A	1 Nm (0.1 m·kg, 0.7 ft·lb)
B	12 Nm (1.2 m·kg, 8.7 ft·lb)

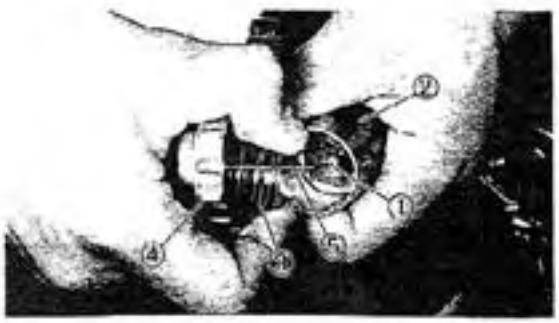


NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the machine and take care so that foreign material does not enter the engine.
- Remove the gasket adhered on the contacting surface.
- Before inspection, the removed parts should be cleaned and blow out all passages and jets with compressed air.
- After removing the carburetor, cover teh carburetor joint not to enter foreign material.

Extent of removal: ① Carburetor removal ② Carburetor disassembly
③ Reed valve removal and disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
①, ③	1	Clamp (carburetor joint)	2	Loosen the screws (carburetor joint).
	2	Carburetor	1	
	3	Mixing chamber top	1	
	4	Spring seat	1	
	5	Throttle valve	1	Refer to "REMOVAL POINTS".
②	6	Spring (throttle valve)	1	
	7	Needle holder	1	
	8	Jet needle	1	
	9	Needle receive	1	
	10	Float chamber	1	
	11	Float pin	1	
	12	Float	1	
	13	Needle valve	1	
	14	Valve seat	1	
	15	Main jet	1	
	16	Fuel damper	1	
	17	Main nozzle	1	
	18	Pilot jet	1	
	19	Starter plunger	1	
	20	Throttle stop screw	1	
③	21	Pilot air screw	1	
	22	Carburetor joint	1	
	23	Reed valve assembly	1	
	24	Stopper (reed valve)	2	
	25	Reed valve	2	



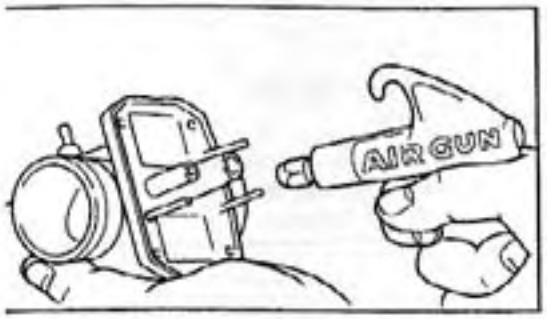
REMOVAL POINTS

Throttle valve

1. Remove:
   - Spring seat ①
   - Throttle valve ②
   - Spring (throttle valve) ③
   - Mixing chamber top ④
   - Throttle cable ⑤

NOTE:

While compressing the spring (throttle valve), disconnect the throttle cable.



INSPECTION

Carburetor

1. Inspect:
   - Carburetor body
     Contamination→Clean.

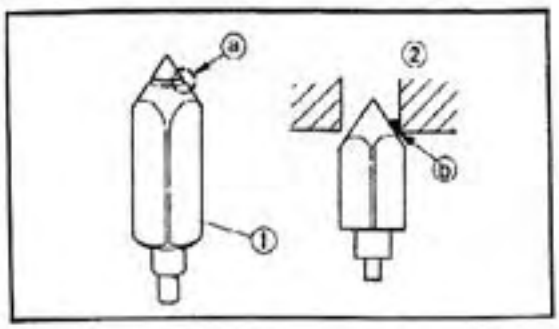
NOTE:

- Use a petroleum based solvent for cleaning. Blow out all passages and jets with compressed air.
- Never use a wire.

2. Inspect:
   - Main jet ①
   - Main nozzle ②
   - Pilot jet ③
     Contamination→Clean

NOTE:

- Use a petroleum based solvent for cleaning. Blow out all passages and jets with compressed air.
- Never use a wire.

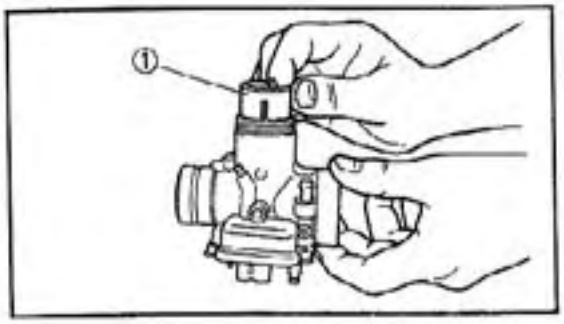


Needle valve

1. Inspect:
   - Needle valve ①
   - Valve seat ②
     Grooved wear ⓐ→Replace.
     Dust ⓑ→Clean.

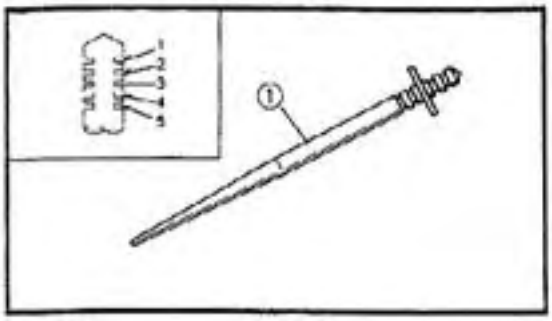
NOTE:

Always replace the needle valve and valve seat as a set.



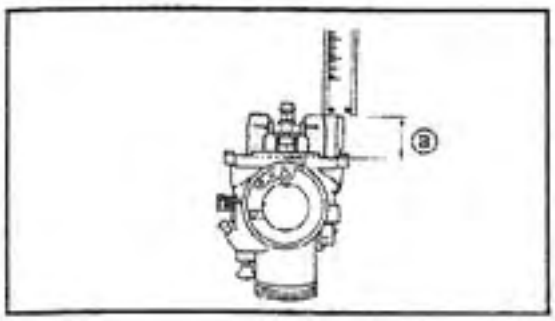
Throttle valve

1. Check:
   - Free movement
     Stick→Repair or replace.
     Insert the throttle valve ① into the carburetor body, and check for free movement.



2. Inspect:
   - Jet needle ①
     Bends/Wear→Replace.
   - Clip position

Standard clip position:
No. 3 Groove



Float height

1. Measure:
   - Float height ⓐ
     Measure the distance between the top surface of the float chamber and the top surface of the float using vernier calipers.
     Out of specification→Adjust the tab ⓑ of float arm.

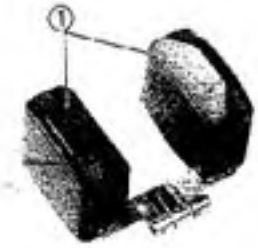
Float height:
21 – 23 mm (0.83 – 0.91 in)

Measurement and adjustment steps:
- Hold the carburetor in an upside down position.
- Measure the distance between the mating surface of the float chamber (gasket removed) and top of the float using a vernier caliper.

NOTE:

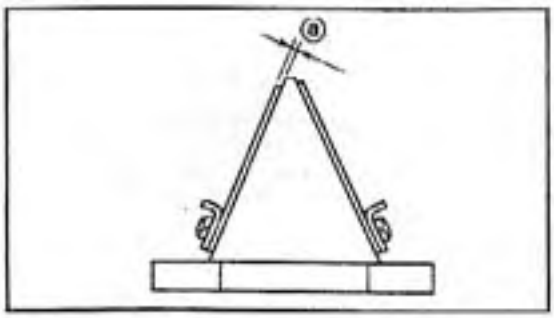
The float arm should be resting on the needle valve, but not compressing the needle valve.

- If the float height is not within specification, inspect the valve seat and needle valve.
- If either is worn, replace them both.
- If both are fine, adjust the float height by bending the float tab ⓑ on the float.
- Recheck the float height.



Float

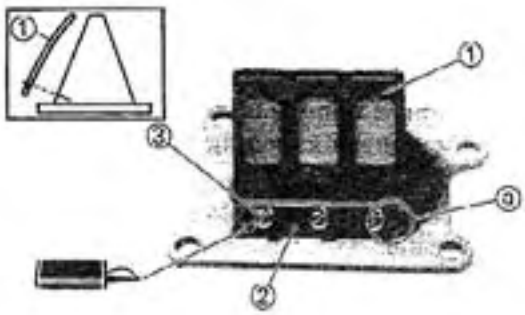
1. Inspect:
   - Float ①
     Damage→Replace.



Reed valve

1. Measure:
   - Reed valve bending ⓐ
     Out of specification→Replace.

Reed valve bending limit:
0.2 mm (0.008 in)



ASSEMBLY AND INSTALLATION

Reed valve

1. Install:
   - Reed valve ①
   - Stopper (reed valve) ②
   - Screw (read velve) ③

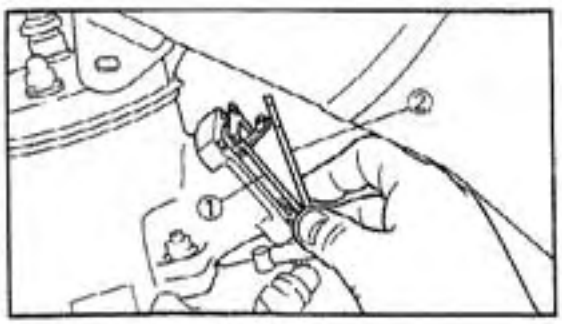
NOTE:

- Install the reed valve with the reed valve bending as shown.
- Note the cut ⓐ in the lower corner of the reed and stopper plate.

Screw (reed valve):
1 Nm (0.1 m•kg, 0.7 ft•lb)
LOCTITE®

CAUTION:

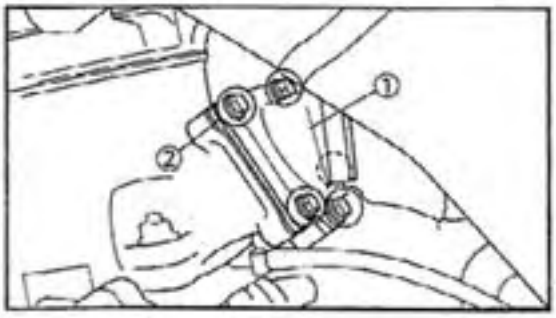
Tighten each screw gradually to avoid warping.



2. Install:
   - Gasket (reed valve assembly) ①
   - Reed valve assembly ②

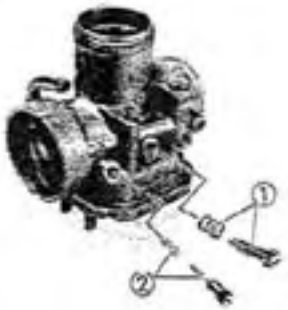
NOTE:

Always use a new gasket.



3. Install:
   - Carburetor joint ①
   - Bolt (carburetor joint) ②

	Bolt (carburetor joint): **12 Nm (1.2 m·kg, 8.7 ft·lb)**



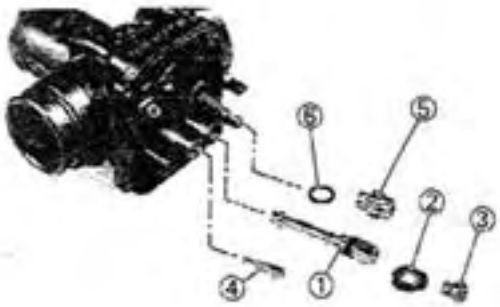
Carburetor

1. Install:
   - Throttle stop screw ①
   - Pilot air screw ②

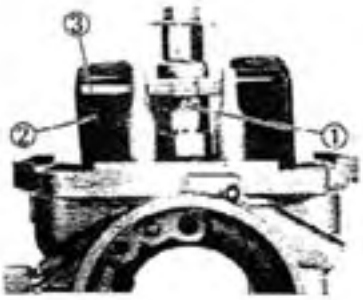
Note the following installation points:
- Screw in the pilot air screw until it is lightly seated.
- Back out it by the specified number of turns.

	Pilot air screw: **1-1/2 turns out**

2. Install:
   - Starter plunger ①



3. Install:
   - Main nozzle ①
   - Fuel damper ②
   - Main jet ③
   - Pilot jet ④
   - Valve seat ⑤
   - Valve seat washer ⑥



4. Install:
   - Needle valve ①
   - Float ②
   - Float pin ③

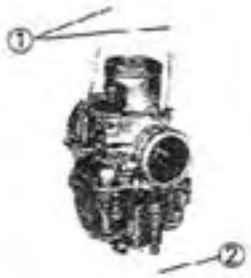
NOTE:

Check the float for smooth movement.

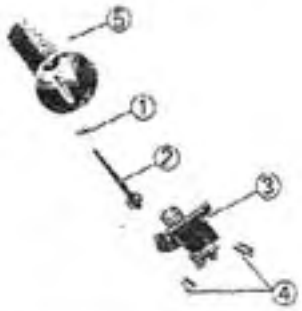
5. Install:
   - Gasket (float chamber) ①
   - Float chamber ②
   - Screw ③

NOTE:

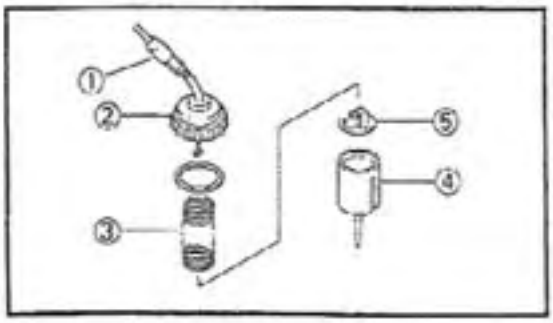
Always use a new gasket.



6. Install:
   - Air vent hose ①
   - Overflow hose ②



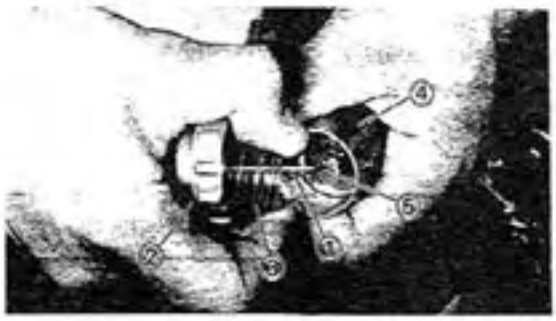
7. Install:
   - Needle receive ①
   - Jet needle ②
   - Needle holder ③
   - Screw (needle holder) ④
     To throttle valve ⑤.

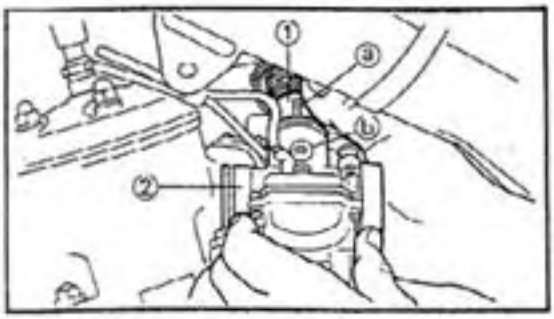


8. Install:
   - Throttle cable ①
   - Mixing chamber top ②
   - Spring (throttle valve) ③
   - Throttle valve ④
   - Spring seat ⑤

NOTE:

While compressing the spring, connect the throttle cable.



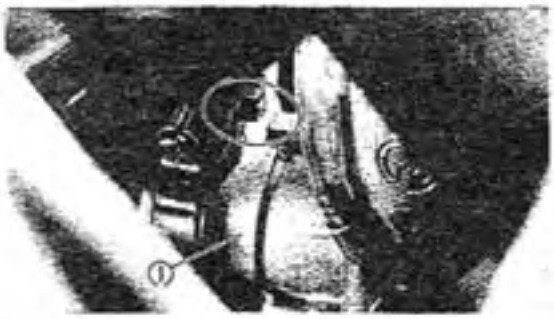


Carburetor installation

1. Install:
   - Throttle valve ①
     To carburetor ②.

NOTE:

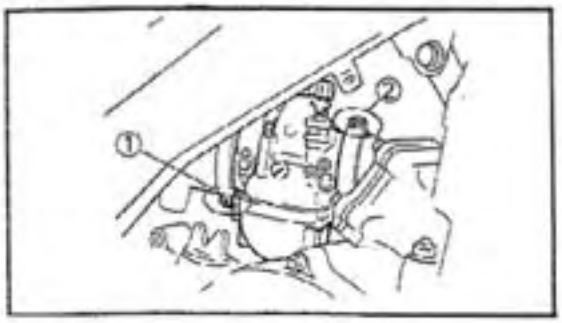
- When installing the throttle valve, make sure the groove ⓐ in the throttle valve fits on the projection ⓑ of the carburetor.
- After installing the throttle valve, check the smooth movement of it.



2. Install:
   - Carburetor ①

NOTE:

Install the projection between the carburetor joint slots.



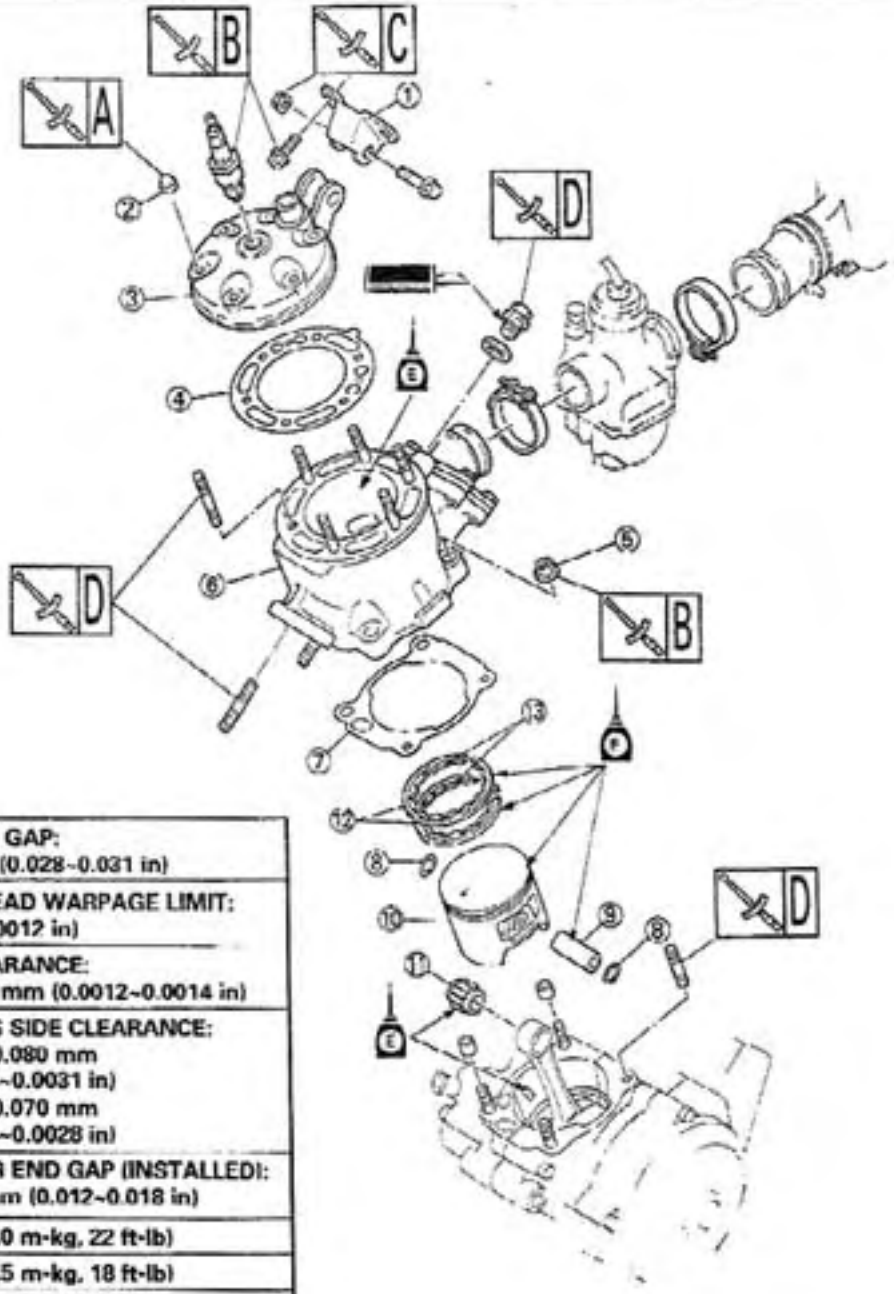
3. Tighten:
   - Screw (air cleaner joint) ①
   - Screw (carburetor joint) ②

4. Adjust:
   - Idle speed
     Refer to "IDLE SPEED ADJUSTMENT" section in the CHAPTER 3.

CYLINDER HEAD, CYLINDER AND PISTON

PREPARATION FOR REMOVAL

* Drain the coolant.
* Remove the following parts:
  - Seat
  - Fuel tank
  - Plug cap and spark plug
  - Exhaust pipe and silencer
  - Carburetor
  - Carburetor joint
  - Radiator hose 2
  - Radiator



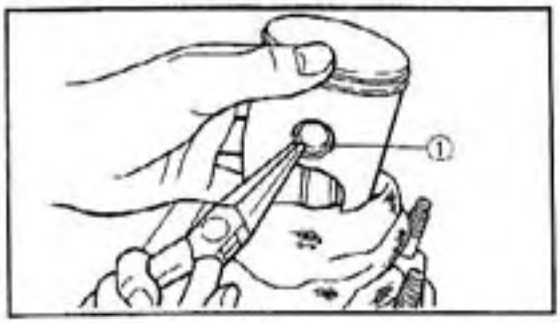
SPARK PLUG GAP: 0.7~0.8 mm (0.028~0.031 in)	
CYLINDER HEAD WARPAGE LIMIT: 0.03 mm (0.0012 in)	
PISTON CLEARANCE: 0.030~0.035 mm (0.0012~0.0014 in)	
PISTON RING SIDE CLEARANCE: 1st: 0.045~0.080 mm (0.0018~0.0031 in) 2nd: 0.035~0.070 mm (0.0014~0.0028 in)	
PISTON RING END GAP (INSTALLED): 0.30~0.45 mm (0.012~0.018 in)	
A	30 Nm (3.0 m•kg, 22 ft•lb)
B	25 Nm (2.5 m•kg, 18 ft•lb)
C	32 Nm (3.2 m•kg, 23 ft•lb)
D	13 Nm (1.3 m•kg, 9.4 ft•lb)

NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the parts, and take care so that the foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.
- Take care not to scratch the contacting surface when removing the cylinder and cylinder head.
- Take care not to scratch the cylinder and piston surface.
- For reassembly, the removed parts should be cleaned with solvent, and apply the engine oil onto the sliding surface.
- Take care so that the coolant does not enter the crankcase. If the coolant enter the crankcase, clean the inside of the crankcase and apply oil on it.
- When removing the cylinder head, the piston should be positioned at TDC (top dead center).

Extent of removal: ① Cylinder head removal ② Cylinder removal ③ Piston and piston ring removal

Extent of removal	Order	Part name	Q'ty	Remarks
① ② ③	1	Rear upper bracket	1	
	2	Nut (cylinder head)	6	Loosen each nut 1/4 turn, and remove them after all nuts are loosened.
	3	Cylinder head	1	
	4	Gasket (cylinder head)	2	
	5	Nut (cylinder)	1	
	6	Cylinder	1	
	7	Gasket (cylinder)	1	
	8	Piston pin clip	2	Refer to "REMOVAL POINTS".
	9	Piston pin	1	
	10	Piston	1	
	11	Small end bearing	1	
	12	Piston ring	2	
	13	Expander	2	



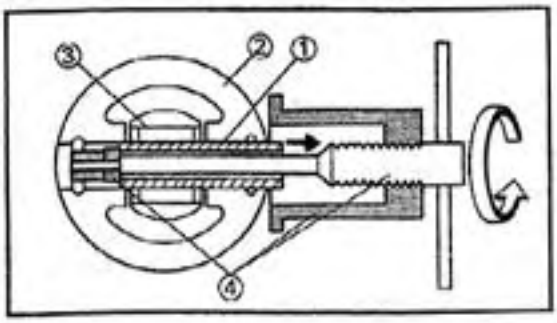
REMOVAL POINTS

Piston and piston ring

1. Remove:
   - Piston pin clip ①

NOTE:

Before removing piston pin clip, cover crankcase with a clean rag to prevent piston pin clip from falling into crankcase cavity.



2. Remove:
   - Piston pin ①
   - Piston ②
   - Small end bearing ③

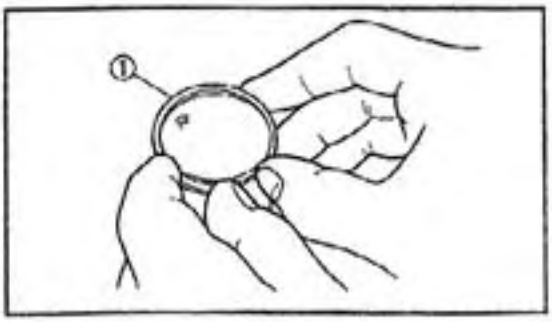
NOTE:

Before removing the piston pin, deburr the clip groove and pin hole area. If the piston pin groove is deburred and piston pin is still difficult to remove, use the piston pin puller ④.

	Piston pin puller: **90890-01304**

CAUTION:

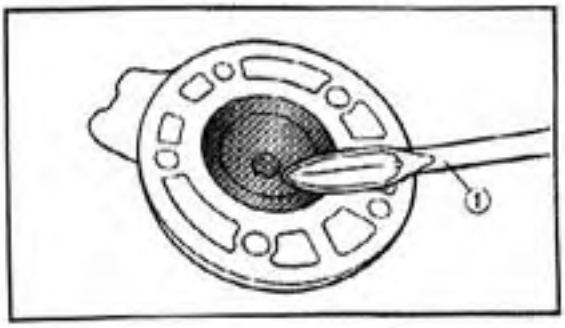
Do not use a hammer to drive the piston pin out.



3. Remove:
   - Piston ring ①
   - Expander

NOTE:

Take care not to scratch the piston and damage the piston ring.



INSPECTION

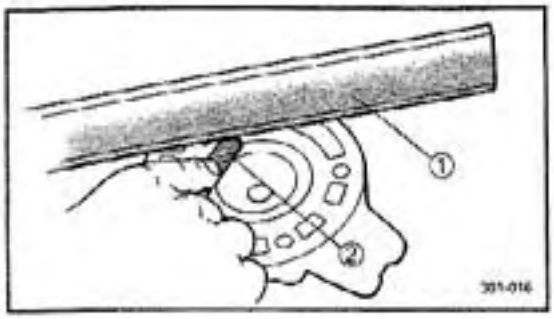
Cylinder head

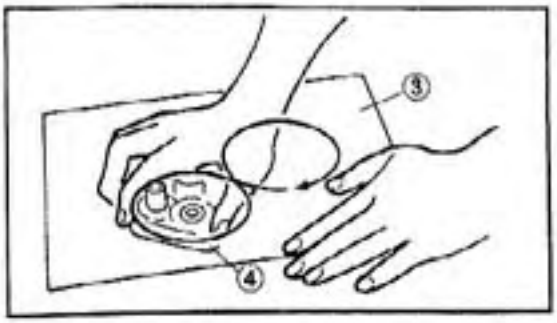
1. Remove:
   - Carbon deposits

   Use a rounded scraper ①.

NOTE:

Take care to avoid damaging the spark plug threads. Do not use a sharp instrument. Avoid scratching the aluminum.





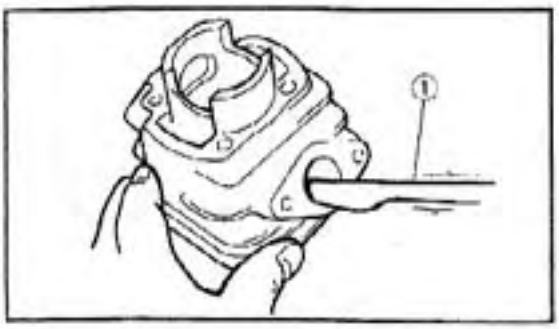
2. Inspect:
   - Cylinder head water jacket
     Crust of minerals/Rust→Remove.
   - Cylinder head warpage
     Out of specification→Re-surface.

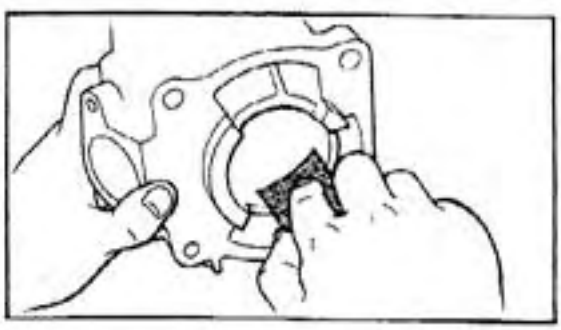
Warpage measurement and re-surfacement steps:
- Attach a straightedge ① and a thickness gauge ② on the cylinder head.
- Measure the warpage.

Warpage limit:
0.03 mm (0.0012 in)

- If the warpage is out of specification, resurface the cylinder head.
- Place a 400 – 600 grit wet sandpaper ③ on the surface plate, and re-surface the head ④ using a figure-eight sanding pattern.

NOTE:
Rotate the head several times to avoid removing too much material from one side.





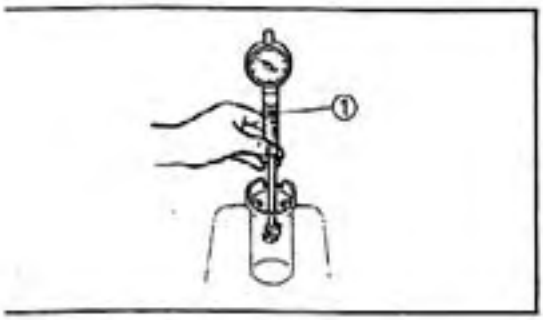
Cylinder

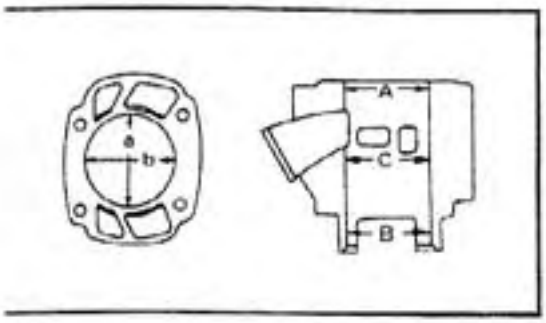
1. Remove:
   - Carbon deposits
     Use a rounded scraper ①.

NOTE:
Do not use a sharp instrument. Avoid scratching the aluminum.

2. Inspect:
   - Cylinder inner surface
     Score marks→Repair or replace.
     Use #400–600 grit wet sandpaper.

CAUTION:
Do not rebore the cylinder.



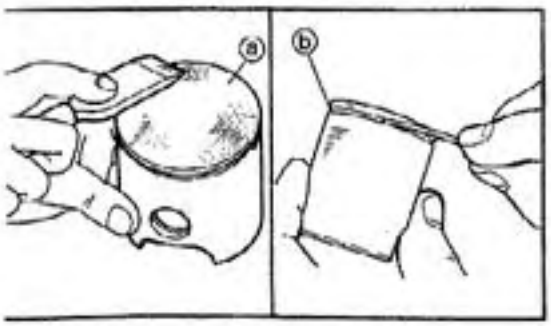


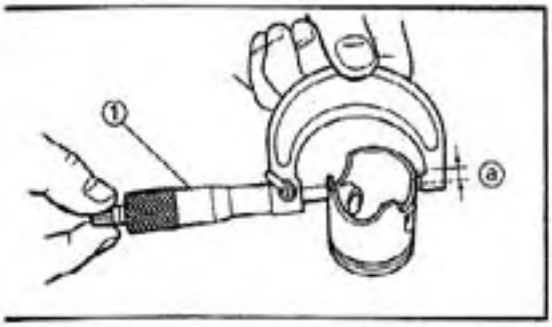
3. Measure:
   - Cylinder bore "C"
     Use cylinder gauge ①.
     Out of limit→Replace.

NOTE:

Measure the cylinder bore "C" in parallel (A, B, C) to and at right angles to the crankshaft (a, b). Then, find the average of the measurements.

	Standard	Wear limit
Cylinder bore "C"	74.000–74.014 mm (2.9133–2.9139 in)	74.1 mm (2.917 in)
Taper "T"	–	0.05 mm (0.0020 in)
C = Maximum Aa – Cb T = (Maximum Aa, or Ab) – (Maximum Ba, or Bb)		

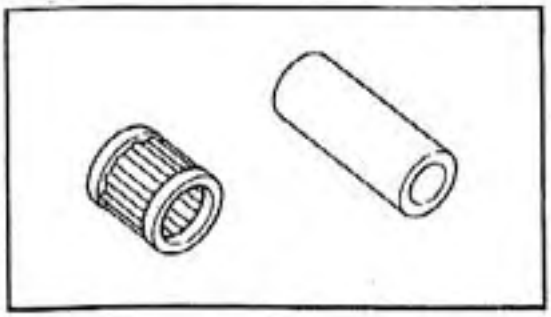




Piston

1. Remove:
   - Carbon deposits
     From the piston crown ⓐ and ring groove ⓑ.
2. Inspect:
   - Piston wall
     Score marks→Repair or replace.
3. Measure:
   - Piston skirt diameter
     Use Micrometer ①.
     Measure specific distance ⓐ from the bottom edge.
     Out of specification→Replace.

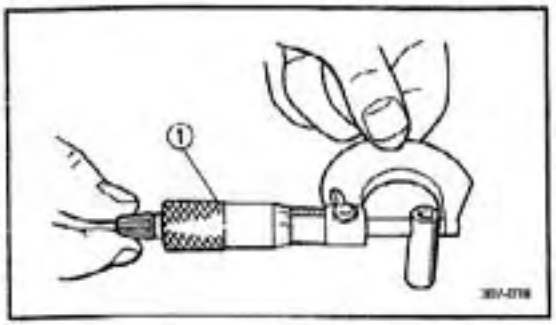
Distance ⓐ	Piston diameter
10 mm (0.39 in)	73.967–73.982 mm (2.9121–2.9127 in)



Piston pin and small end bearing

1. Inspect:
   - Piston pin
   - Small end bearing

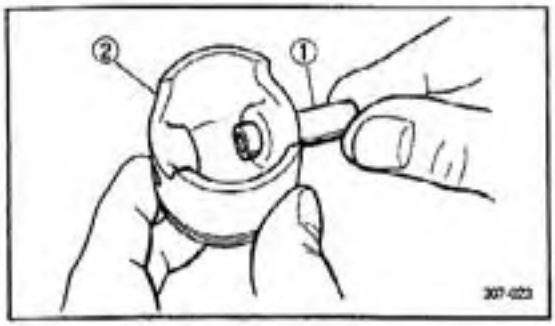
   Signs of heat discoloration→Replace.



2. Measure:
   - Piston pin outside diameter

   Use micrometer ①.
   Out of limit→Replace.

Piston pin outside diameter:	
Standard	<Limit>
15.995 – 16.000 mm (0.6297 – 0.6299 in)	15.975 mm (0.6289 in)

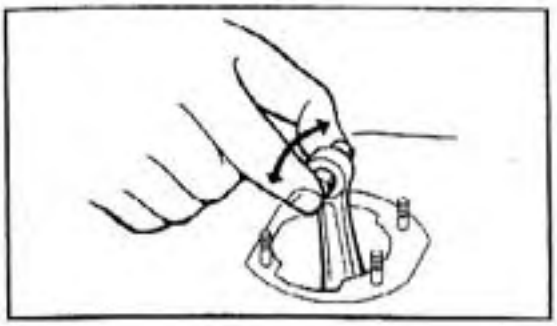


3. Check:
   - Free play (when the piston pin ① is in place in the piston ②)

   There should be no noticeable for the play.
   Free play exists →Replace piston pin and/or piston.

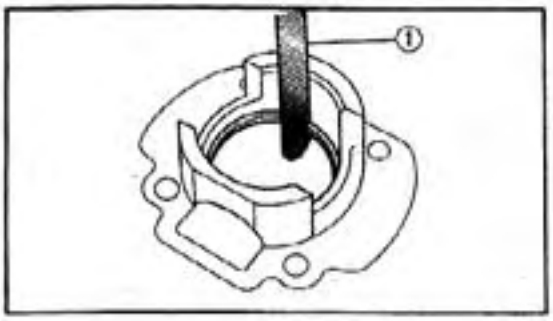
4. Install:
   - Small end bearing
   - Piston pin

   Into the small end of connecting rod.



5. Check:
   - Free play

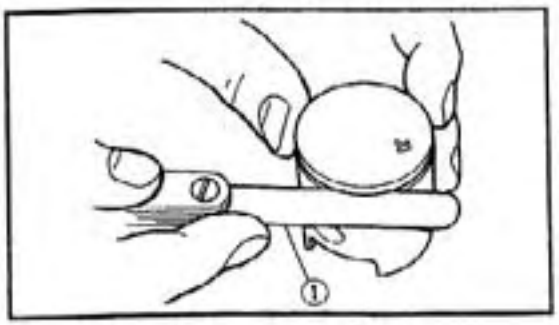
   There should be no noticeable free play.
   Free play exists→Inspect the connecting rod for wear/Replace the pin and/or connecting rod as required.

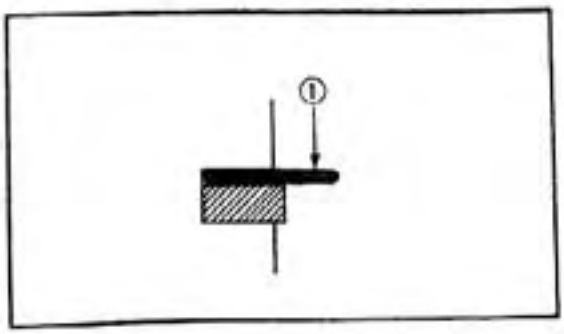


Piston ring

1. Install:
   - Piston ring
     Into the cylinder.
     Push the ring with the piston crown.
2. Measure:
   - End gap
     Out of specification → Replace rings as a set.
     Using a thickness gauge ①.

Ring end gap (Installed):	
Standard	<Limit>
0.30 ~ 0.45 mm (0.012 ~ 0.018 in)	0.75 mm (0.030 in)





3. Measure:
   - Side clearance
     Use a thickness gauge ①.
     Out of limit → Replace piston and/or ring.

Side clearance:		
	Standard	<Limit>
1st	0.045 ~ 0.080 mm (0.0018 ~ 0.0031 in)	0.1 mm (0.004 in)
2nd	0.035 ~ 0.070 mm (0.0014 ~ 0.0028 in)	0.1 mm (0.004 in)

NOTE:

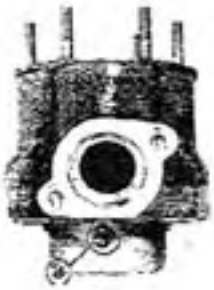
Check at several points.

Piston clearance

1. Calculate:
   - Piston clearance
     Out of limit → Replace piston, and piston ring and/or cylinder.
     Refer to "CYLINDER" and "PISTON".

PISTON CLEALANCE = CYLINDER BORE − PISTON DIAMETER

Piston Clearance:	
Standard	<Limit>
0.030 – 0.035 mm (0.0012 – 0.0014 in)	0.1 mm (0.004 in)



Combination of piston and cylinder

1. Check:
   - Cylinder mark ⓐ

Cylinder mark ⓐ	Cylinder size
A	74.000 – 74.002 mm (2.9134 – 2.9135 in)
B	74.004 – 74.006 mm (2.9135 – 2.9136 in)
C	74.008 – 74.010 mm (2.9137 – 2.9138 in)
D	74.012 – 74.014 mm (2.9138 – 2.9139 in)

2. Check:
   - Piston mark ⓐ

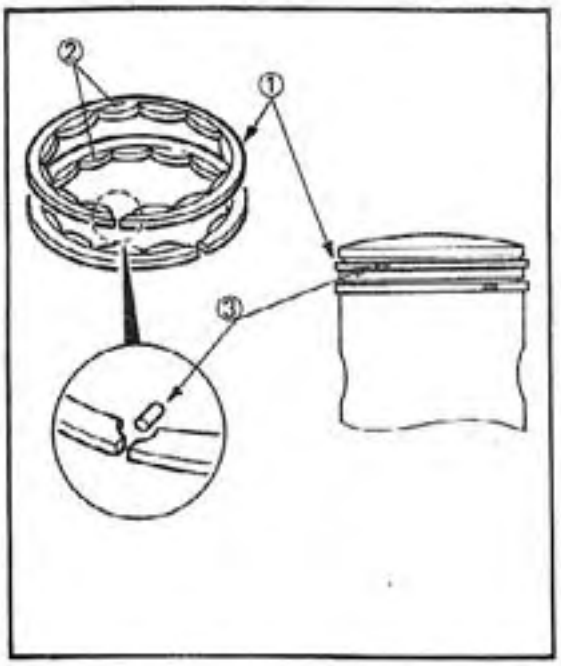
Piston mark ⓐ	Piston size
A	73.967 – 73.970 mm (2.9121 – 2.9122 in)
B	73.971 – 73.974 mm (2.9122 – 2.9124 in)
C	73.975 – 73.978 mm (2.9124 – 2.9125 in)
D	73.979 – 73.982 mm (2.9126 – 2.9127 in)

3. Combination:
   Combine the piston and cylinder by the following chart.

Cylinder mark	Piston mark (color)
A	A (red)
B	B (orange)
C	C (green)
D	D (purple)

NOTE:

When you purchase a cylinder, you cannot designate its size. Choose the piston that matches the above chart.



ASSEMBLY AND INSTALLATION

Piston ring and piston

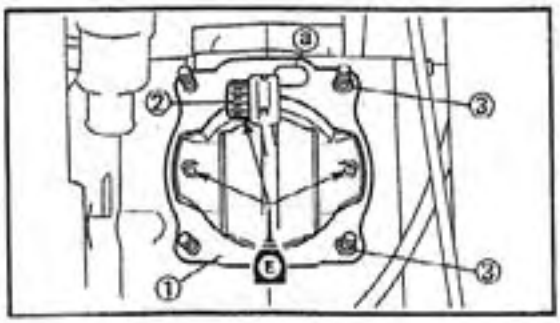
1. Install:
   - Piston ring ①
   - Expander ②

NOTE:

- Align the piston ring gap with the pin ③.
- After installing the piston ring, check the smooth movement of it.
- Replace the piston ring and the expander as a set.

CAUTION:

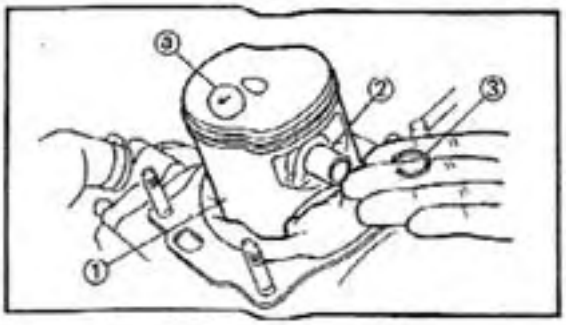
Take care not to scratch the piston and damage the piston ring.



2. Install:
   - Gasket (cylinder) ①
   - Small end bearing ②
   - Dowel pin ③

NOTE:

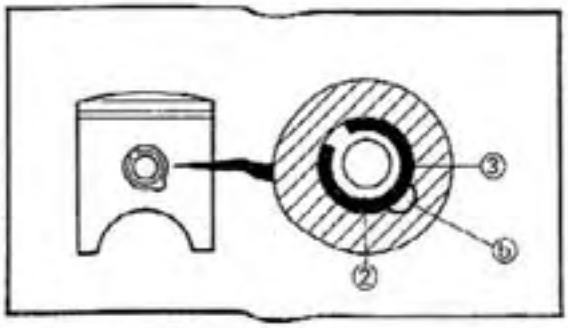
- When installing the gasket, align its coolant passage ⓐ with the crankcase coolant passage.
- Apply the engine mixing oil onto the bearing (crankshaft and connecting rod).
- Always use a new gasket.



3. Install:
   - Piston ①
   - Piston pin ②
   - Piston pin clip ③

NOTE:

- The arrow ⓐ on piston dome must face forward.
- Before installing piston pin clip, cover crankcase with a clean rag to prevent piston pin clip from falling into crankcase cavity.



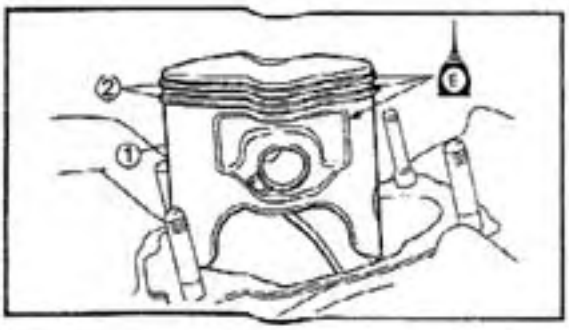
CAUTION:

- **Do not allow the clip open ends to meet the piston slot (ⓑ).**
- **Always use a new piston pin clip.**

Cylinder head and cylinder

1. Apply:
   - Engine oil

   To piston ①, piston ring ② and cylinder surface.



2. Install:
   - Cylinder ①

CAUTION:

Make sure the rings are properly positioned. Install the cylinder with one hand while compressing the piston ring with the other hand.

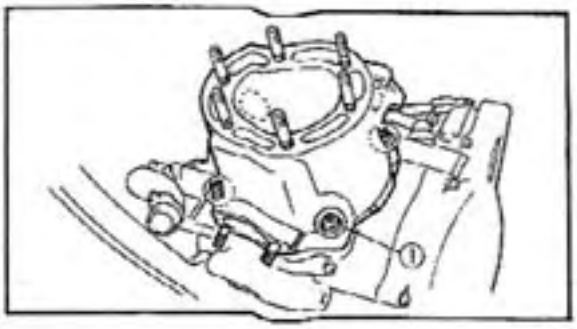
NOTE:

After installing, check the smooth movement of the piston.

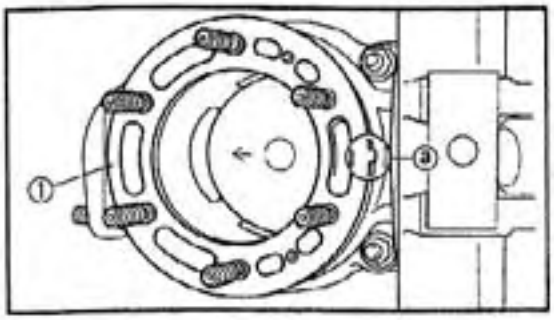
3. Install:
   - Nut (cylinder) ①

NOTE:

Tighten the nuts in stage, using a crisscross pattern.



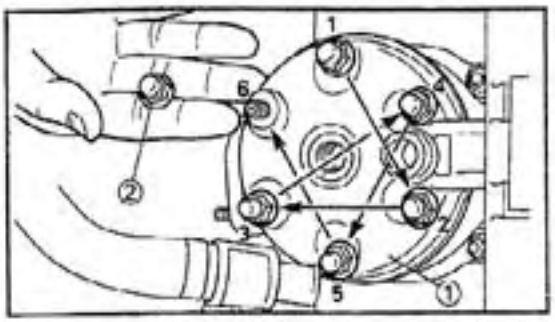
	Nut (cylinder): **25 Nm (2.5 m·kg, 18 ft·lb)**



4. Install:
   - Gasket (cylinder head) ①

NOTE:

- Always use a new gasket.
- The projection ⓐ of gasket must face backward.

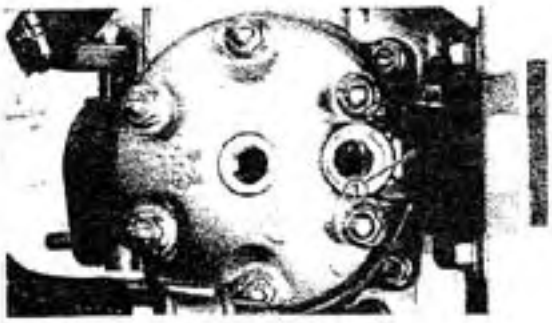


5. Install:
   - Cylinder head ①
   - Nut (cylinder head) ②

NOTE:

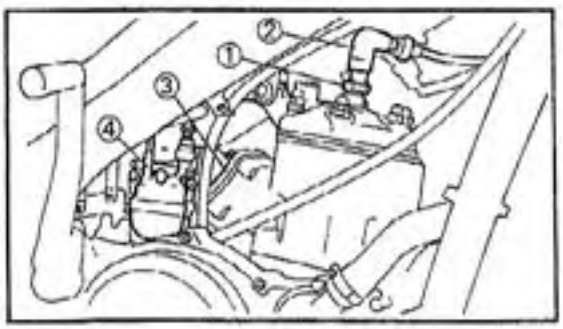
Tighten the nuts (cylinder head) in stage, using a crisscross pattern.

	Nut (cylinder head): **30 Nm (3.0 m·kg, 22 ft·lb)**



6. Install:
   - Rear upper bracket ①

	Bolt (rear upper bracket-frame): **25 Nm (2.5 m·kg, 18 ft·lb)** **Nut (rear upper bracket-engine):** **32 Nm (3.2 m·lb, 23 ft·lb)**



7. Install:
   - Spark plug ①
   - Spark plug cap ②
   - Gasket (reed valve assembly)
   - Reed valve assembly
   - Carburetor joint ③
   - Carburetor ④

NOTE:

Always use a new gasket.

	Spark plug: **25 Nm (2.5 m·kg, 18 ft·lb)** **Bolt (carburetor joint):** **12 Nm (1.2 m·kg, 8.7 ft·lb)**

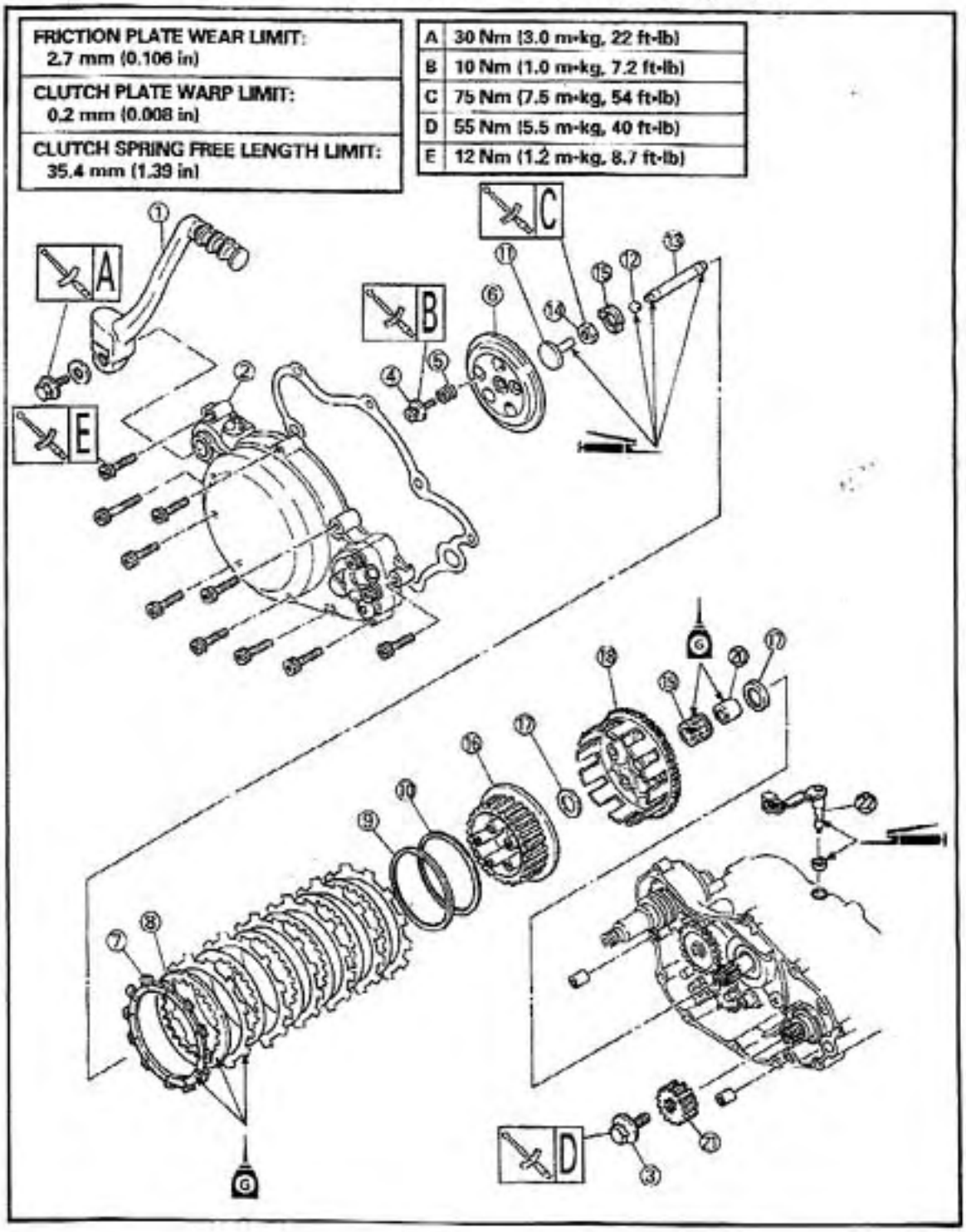
CLUTCH, PRIMARY DRIVEN GEAR AND PRIMARY DRIVE GEAR

PREPARATION FOR REMOVAL

* Remove the engine guard.
* Drain the coolant.
* Drain the transmission oil.
* Remove the exhaust pipe and silencer.
* Disconnect the clutch cable at engine side.
* Disconnect the radiator hose 1 at engine side.

FRICTION PLATE WEAR LIMIT: 2.7 mm (0.106 in)
CLUTCH PLATE WARP LIMIT: 0.2 mm (0.008 in)
CLUTCH SPRING FREE LENGTH LIMIT: 35.4 mm (1.39 in)

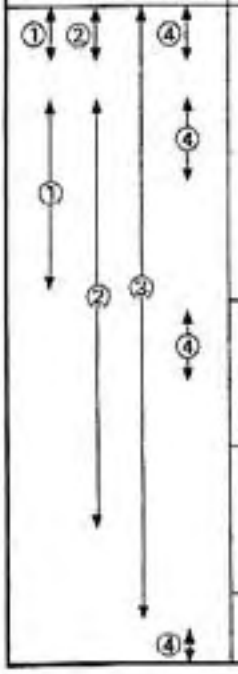
A	30 Nm (3.0 m•kg, 22 ft•lb)
B	10 Nm (1.0 m•kg, 7.2 ft•lb)
C	75 Nm (7.5 m•kg, 54 ft•lb)
D	55 Nm (5.5 m•kg, 40 ft•lb)
E	12 Nm (1.2 m•kg, 8.7 ft•lb)

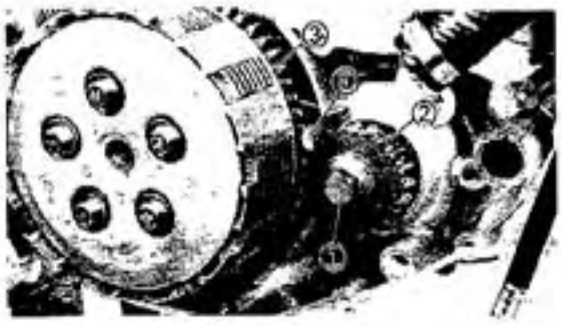


NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the parts; and take care so that foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.
- For reassembly, the removed parts should be cleaned with solvent, and apply the transmission oil onto the sliding surface.

Extent of removal: ① Clutch plate and friction plate ② Primary driven gear ③ Primary drive gear ④ Push rod and push lever removal

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Kick starter	1	
	2	Crankcase cover (right)	1	
	3	Bolt (primary drive gear)	1	Refer to "REMOVAL POINTS".
	4	Screw (clutch spring)	6	
	5	Clutch spring	5	
	6	Pressure plate	1	
	7	Friction plate	7	
	8	Clutch plate	6	
	9	Cushion spring	1	
	10	Seat plate	1	
	11	Push rod 1	1	
	12	Ball	1	
	13	Push rod 2	1	
	14	Nut (clutch boss)	1	Use special tool.
	15	Lock washer	1	
	16	Clutch boss	1	Refer to "REMOVAL POINTS".
	17	Plain washer	2	
	18	Primary driven gear	1	
	19	Bearing	1	
	20	Spacer	1	
	21	Primary drive gear	1	
	22	Push lever axle	1	



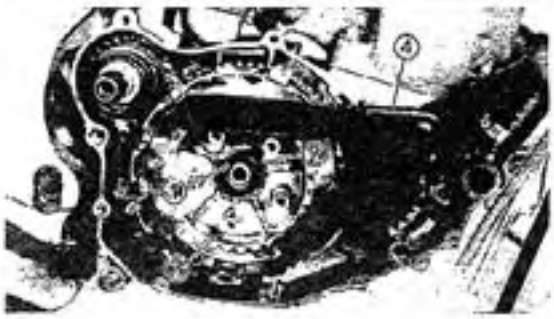
REMOVAL POINTS

Primary drive gear

1. Loosen:
   - Bolt (primary drive gear) ①

NOTE:

Place an aluminium plate ⑧ between the teeth of the primary drive gear ② and driven gear ③.



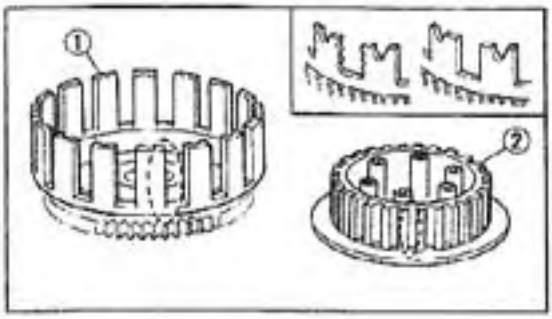
Clutch boss

1. Remove:
   - Nut (clutch boss) ①
   - Lock washer ②
   - Clutch boss ③

NOTE:

Straighten the lock washer tab and use the clutch holding tool ④ to hold the clutch boss.

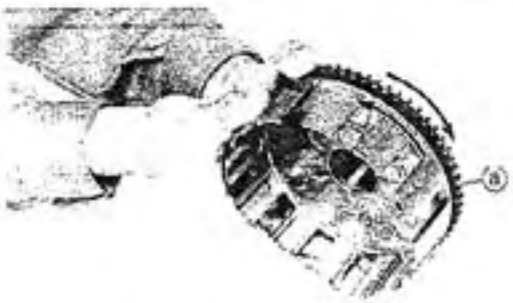
	Clutch holding tool: **90809-04086**



INSPECTION

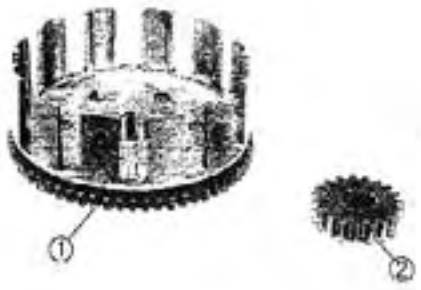
Clutch housing and boss

1. Inspect:
   - Clutch housing ①
     Cracks/Wear/Damage → Replace.
   - Clutch boss ②
     Scoring/Wear/Damage → Replace.



Primary driven gear

1. Check:
   - Circumferential play
     Free play exists → Replace.
   - Gear teeth ③
     Wear/Damage → Replace.

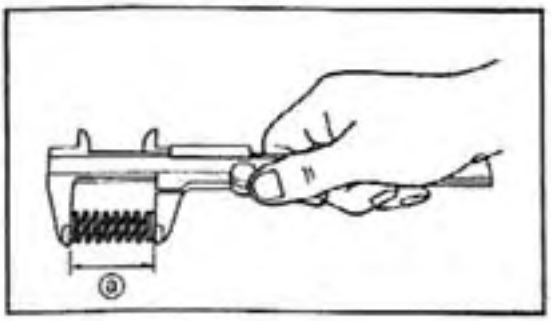


Primary drive gear and driven gear

1. Inspect:
   - Primary driven gear ①
   - Primary drive gear ②
     Wear/Damage → Replace.

NOTE:

Replace the primary drive gear and primary driven gear as a set.

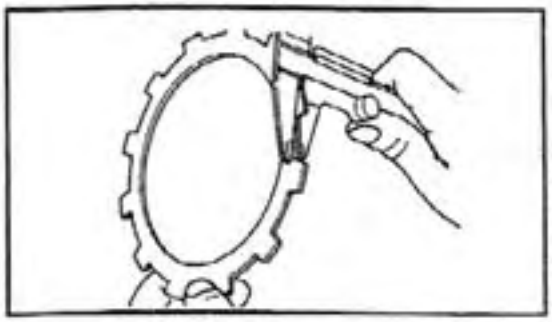


Clutch spring

1. Measure:
   - Clutch spring free length ⓐ

   Out of specification → Replace spring as a set.

Clutch spring free length:	
Standard	<Limit>
36.4 mm (1.43 in)	35.4 mm (1.39 in)



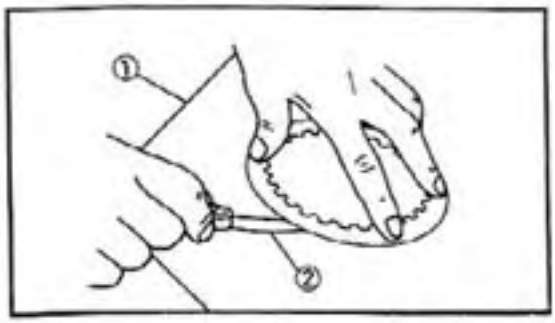
Friction plate

1. Measure:
   - Friction plate thickness

   Out of specification → Replace friction plate as a set.

   Measure at all four points.

Friction plate thickness:	
Standard	<Limit>
2.9~3.1 mm (0.114~0.122 in)	2.7 mm (0.106 in)



Clutch plate

1. Measure:
   - Clutch plate warpage

   Out of specification → Replace clutch plate as a set.

   Use a surface plate ① and thickness gauge ②.

Warp limit: 0.2 mm (0.008 in)

Push lever axle

1. Inspect:
   - Push lever axle ①

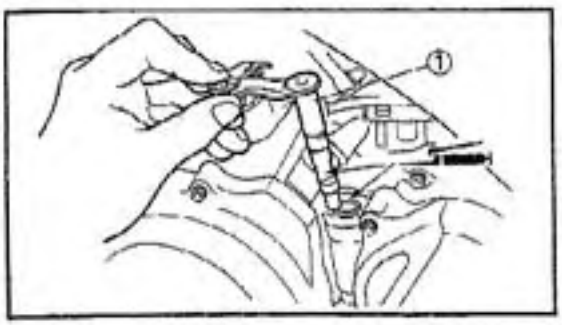
   Wear/Damage→Replace.

Push rod axle

1. Inspect:
   - Push rod 1 ①
   - Ball ②
   - Push rod 2 ③

   Wear/Damage/Bend→Replace.

ASSEMBLY AND INSTALLATION

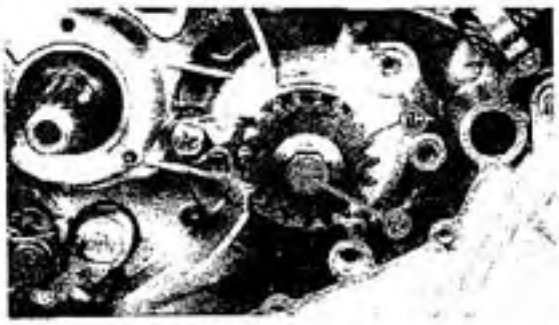


Push lever axle

1. Install:
   - Push lever axle ①

NOTE:

Apply the lithium soap base grease onto the oil seal lip and push lever axle.

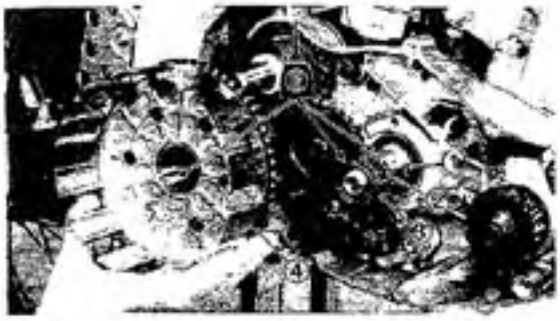


Clutch

1. Install:
   - Primary drive gear ①
   - Bolt (primary drive gear) ②

NOTE:

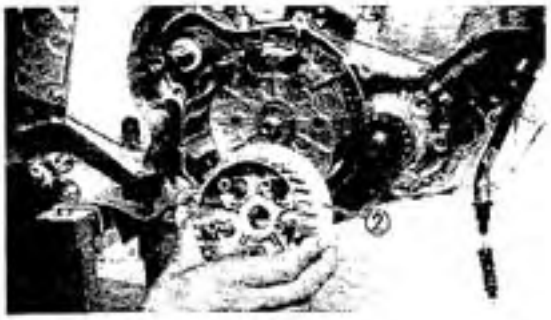
Temporarily tighten the bolt at this point.



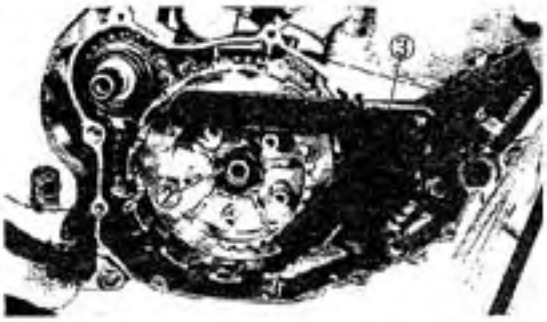
2. Install:
   - Plain washer ①
   - Spacer ②
   - Bearing ③
   - Primary driven gear ④

NOTE:

Apply the transmission oil onto the bearing and primary driven gear inner circumference.



3. Install:
   - Plain washer ①
   - Clutch boss ②



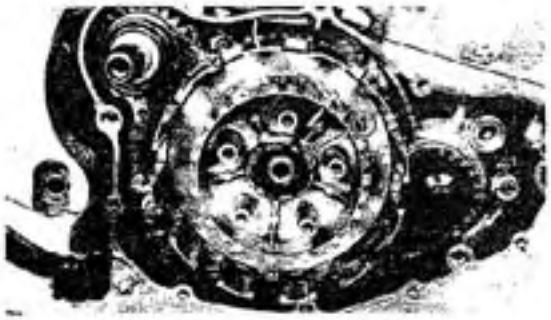
4. Install:
   - Lock washer ①
   - Nut (clutch boss) ②

NOTE:

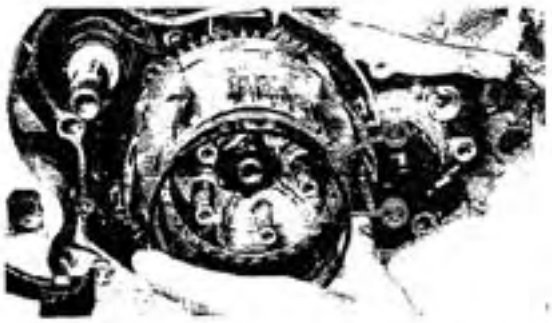
- Always use a new lock washer.
- Use the clutch holding tool ③ to hold the clutch boss.

	Clutch holding tool: 90890-04086

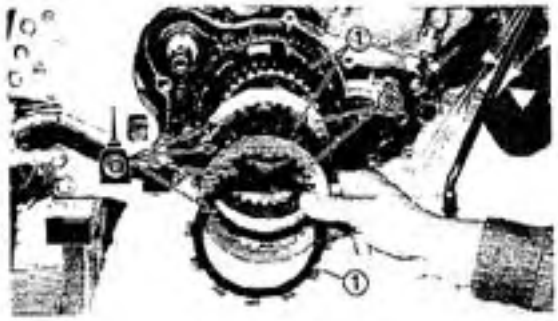
	Nut (clutch boss): 75 Nm (7.5 m·kg, 54 ft·lb)



5. Bend the lock washer ① tab.



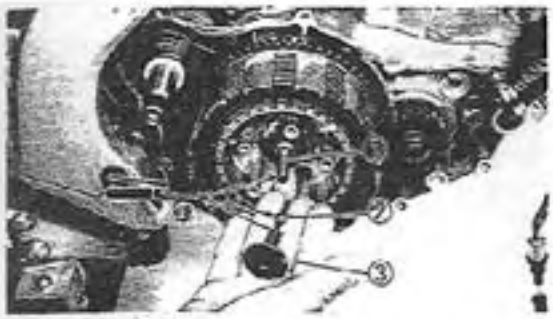
6. Install:
   - Seat plate ①
   - Cushion spring ②



7. Install:
   - Friction plates ①
   - Clutch plates ②

NOTE:

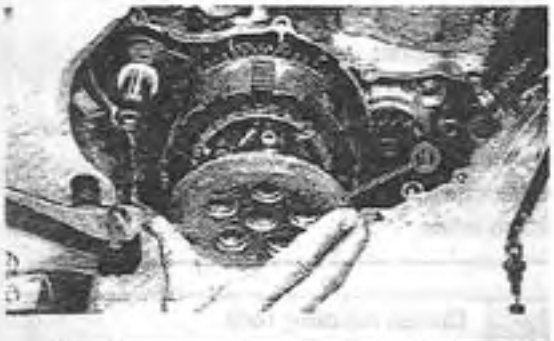
- Install the clutch plates and friction plates alternately on the clutch boss, starting with a friction plate and ending with a friction plate.
- Apply the transmission oil onto the friction plates and clutch plates.



8. Install:
   - Push rod 2 ①
   - Ball ②
   - Push rod 1 ③

NOTE:

Apply the lithium soap base grease the push rod 1,2 and ball.



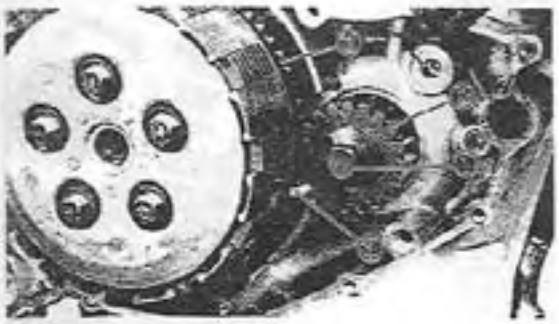
9. Install:
   - Pressure plate ①

10. Install:
    - Clutch spring ①
    - Screw (clutch spring) ②

NOTE:

Tighten the screws in stage, using a crisscross pattern.

	Screw (clutch spring): 10 Nm (1.0 m•kg, 7.2 ft•lb)

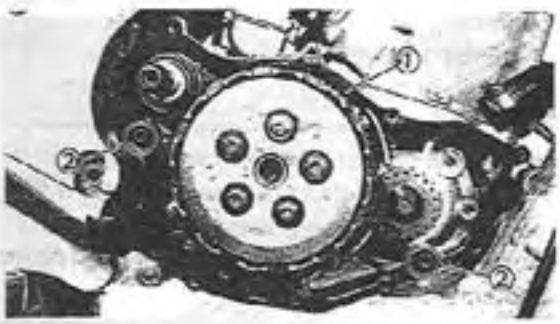


11. Tighten:
    - Bolt (primary drive gear) ①

	Bolt (primary drive gear): 55 Nm (5.5 m•kg, 40 ft•lb)

NOTE:

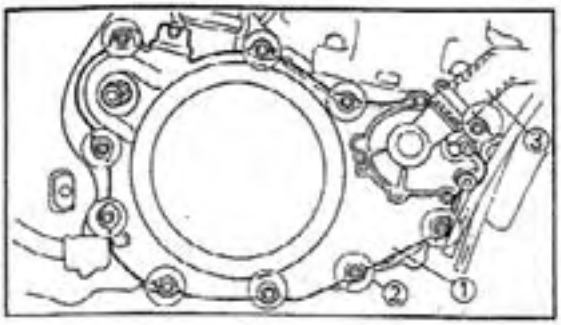
Place an aluminum plate ⓐ between the teeth of the primary drive gear ② and driven gear ③.



12. Install:
    - Gasket (crankcase cover right) ①
    - Dowel pin ②

NOTE:

Always use a new gasket.

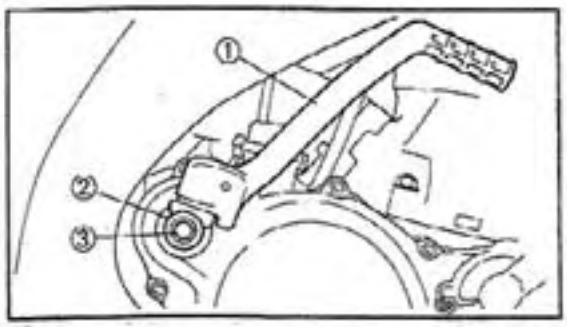


13. Install:
- Crankcase cover (right) ①
- Bolt (crankcase cover right) ②
- Radiator hose 1 ③

NOTE:

Tighten the bolts in stage, using a crisscross pattern.

	Bolt (crankcase cover right): 12 Nm (1.2 m•kg, 8.7 ft•lb)



14. Install:
- Kick starter ①
- Plain washer ②
- Bolt (kick starter) ③

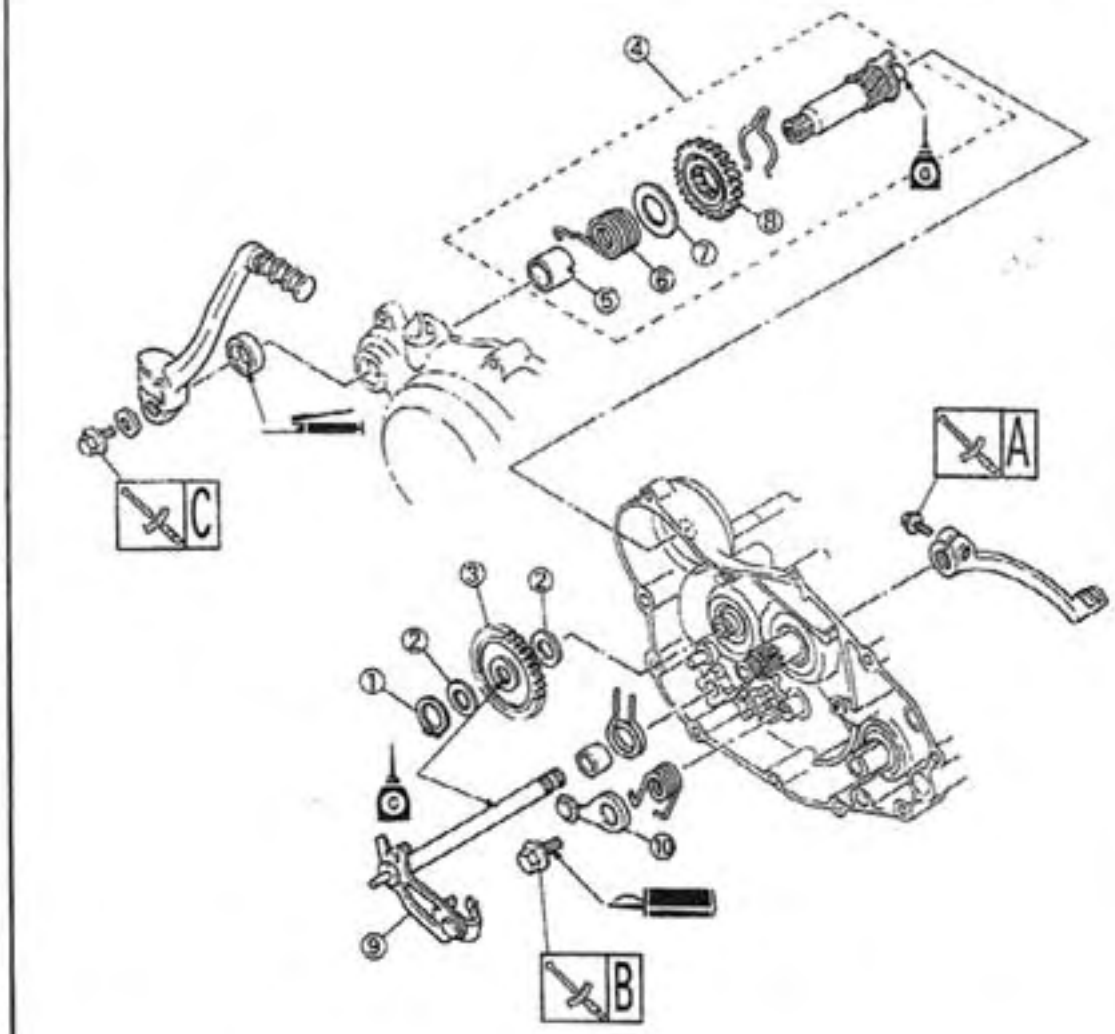
	Bolt (kick starter): 30 Nm (3.0 m•kg, 22 ft•lb)

KICK AXLE AND SHIFT SHAFT

PREPARATION FOR REMOVAL

✻Remove the engine guard.
✻Drain the coolant.
✻Drain the transmission oil.
✻Remove the following parts.
- Shift pedal
- Kick starter
- Crankcase cover (right)
- Primary driven gear

KICK CLIP FRICTION FORCE: 0.8~1.2 kg (1.8~2.6 lb)	
A	10 Nm (1.0 m•kg, 7.2 ft•lb)
B	14 Nm (1.4 m•kg, 10 ft•lb)
C	30 Nm (3.0 m•kg, 22 ft•lb)

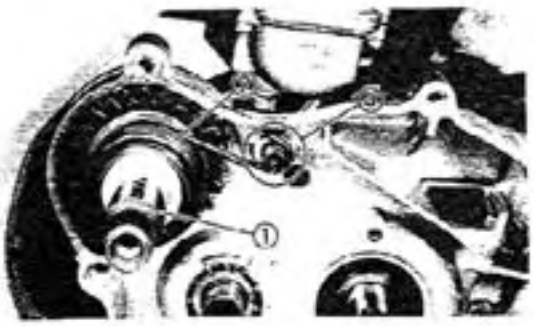


NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the parts, and take care so that foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.
- For reassembly, the removed parts should be cleaned with solvent, and apply the transmission oil onto the sliding surface.

Extent of removal: ① Kick gear and kick idle gear removal
② Shift shaft and stopper lever removal

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Circlip	1	
	2	Plain washer	2	
	3	Kick idle gear	1	
	4	Kick axle assembly	1	Refer to "REMOVAL POINTS".
	5	Spring guide	1	
②	6	Torsion spring	1	
	7	Plain washer	1	
	8	Kick gear	1	
	9	Shift shaft	1	
	10	Stoper lever	1	



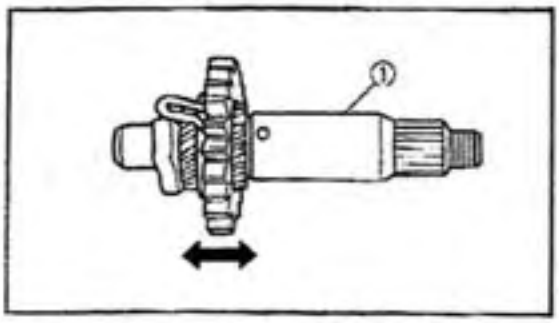
REMOVAL POINTS

Kick axle assembly

1. Remove:
   - Kick axle assembly ①

NOTE:

Unhook the torsion spring ② from the stopper ⓐ in the crankcase.

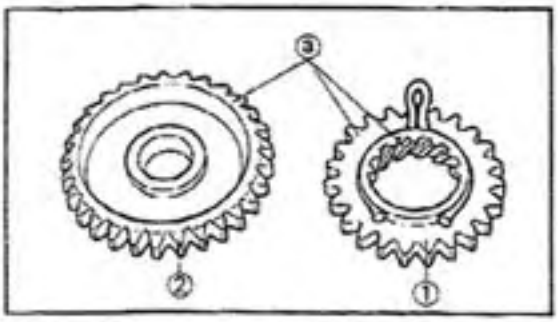


INSPECTION

Kick axle and kick gear

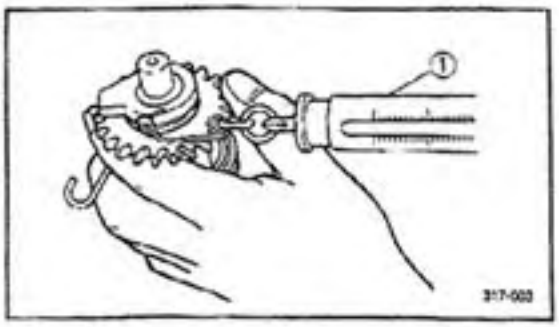
1. Check:
   - Kick gear smooth movement
     Unsmooth movement → Replace.

2. Inspect:
   - Kick axle ①
     Wear/Damage → Replace.



Kick gear and kick idle gear

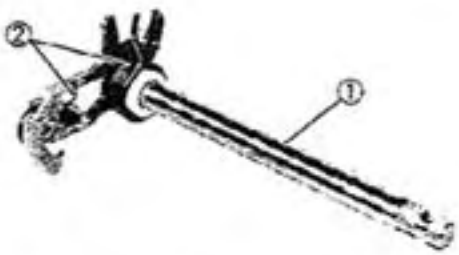
1. Inspect:
   - Kick gear ①
   - Kick idle gear ②
   - Gear teeth ③
     Wear/Damage → Replace.



Kick gear clip

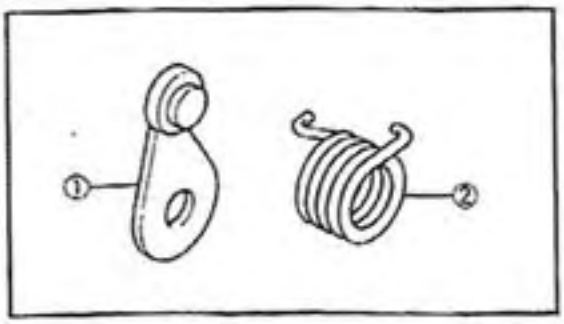
1. Measure:
   - Kick clip friction force
     Out of specification → Replace.
     Use a spring gauge ①.

	Kick clip friction force: **0.8~1.2 kg (1.8~2.6 lb)**



Shift shaft

1. Inspect:
   - Shift shaft ①
     Bend/Damage → Replace.
   - Spring ②
     Broken → Replace.



Stopper lever

1. Inspect:
   - Stopper lever ①
     Wear/Damage → Replace.
   - Torsion spring ②
     Broken → Replace.

ASSEMBLY AND INSTALLATION

Stopper lever

1. Install:
   - Torsion spring ①
   - Stopper lever ②
   - Bolt (stopper lever) ③

NOTE:

Align the stopper lever roller with the slot on segment.

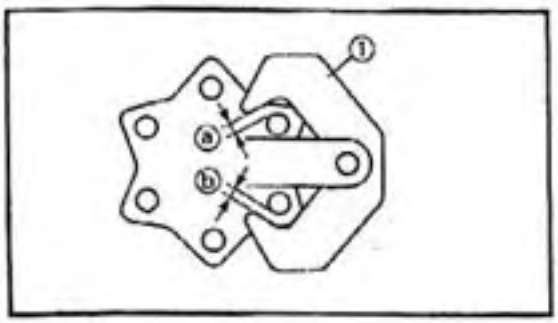
	Bolt (stopper lever): **14 Nm (1.4 m·kg, 10 ft·lb)** **LOCTITE®**

Shift shaft

1. Install:
   - Shift shaft ①

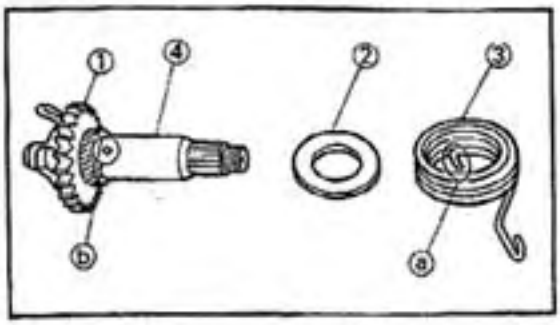
NOTE:

Apply the transmission oil onto the shift shaft.



2. Check:
   - Shift lever ① position

   Gaps ⓐ and ⓑ are not equal → Replace the shift shaft.



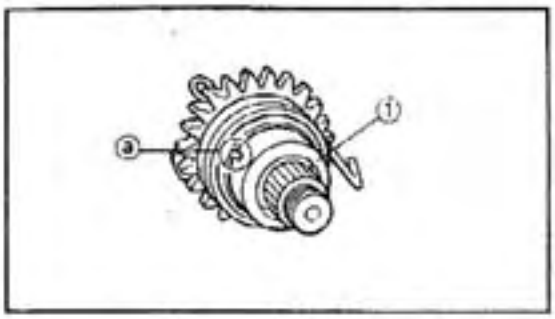
Kick axle assembly

1. Install:
   - Kick gear ①
   - Plain washer ②
   - Torsion spring ③

   To kick axle ④.

NOTE:

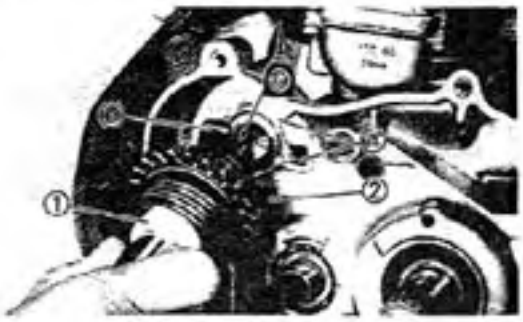
Make sure the stopper ⓐ of the torsion spring fits into the hole ⓑ on the kick axle.



2. Install:
   •Spring guide ①

NOTE:

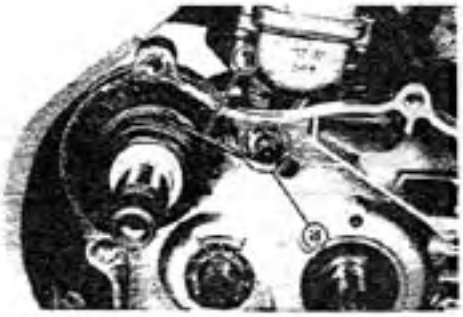
Slide the spring guide into the kick axle, make sure the groove ⓐ in the spring guide fits on the stopper of the torsion spring.



3. Install:
   •Kick axle assembly ①

NOTE:

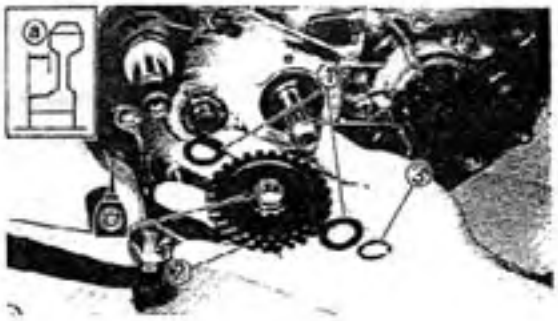
•Apply the transmission oil into the kick axle.
•Slide the kick axle assembly into the case, make sure the clip ② and kick axle stopper ⓑ fit into their home positions ⓐ.



4. Hook:
   •Torsion spring ①

NOTE:

Turn the kick starter return spring clockwise and hook onto the stopper ⓐ on the crankcase.



Kick idle gear

1. Install:
   •Plain washer ①
   •Kick idle gear ②
   •Circlip ③

NOTE:

•Install the kick idle gear with the side ⓐ facing the transmission.
•Always use a new circlip.
•Apply the transmission oil onto the kick idle gear inner circumference.

2. Install:
   •Clutch
   •Crankcase cover (right)
   Refer to "CLUTCH, PRIMARY DRIVEN GEAR AND PRIMARY DRIVE GEAR" section.

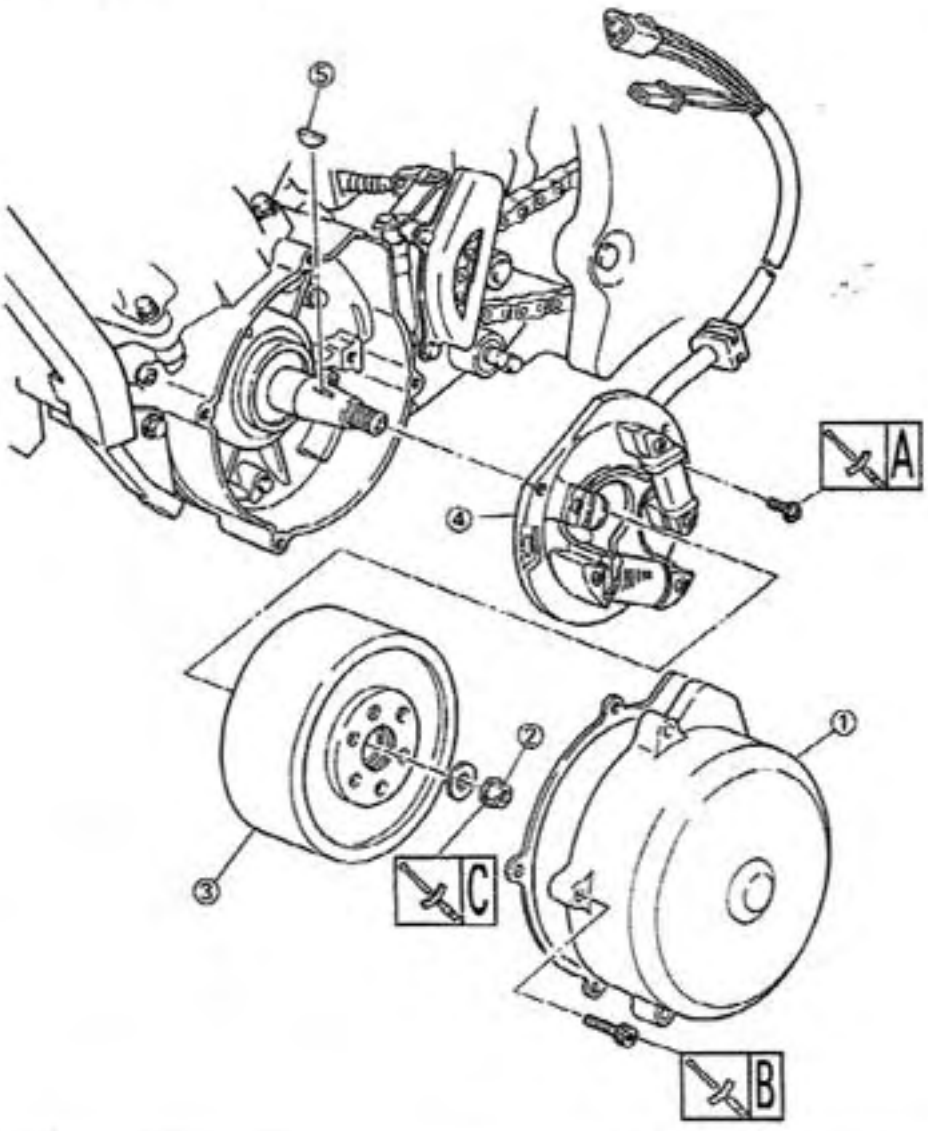
CDI MAGNETO

PREPARATION FOR REMOVAL

✻Remove the following parts.
- •Engine guard
- •Seat
- •Fucl tank

✻Disconnect the CDI magneto lead.

IGNITION TIMING: 1.6 mm (0.063 in)	
A	8 Nm (0.8 m•kg, 5.8 ft•lb)
B	12 Nm (1.2 m•kg, 8.7 ft•lb)
C	80 Nm (8.0 m•kg, 58 ft•lb)

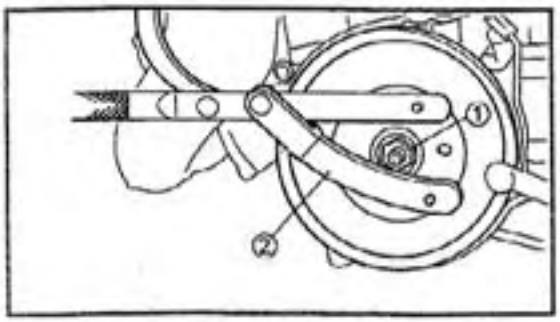


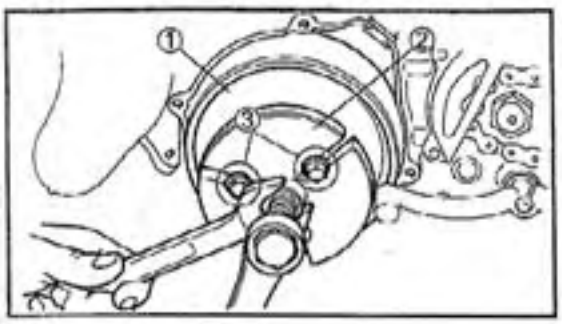
NOTE ON REMOVAL AND REASSEMBLY

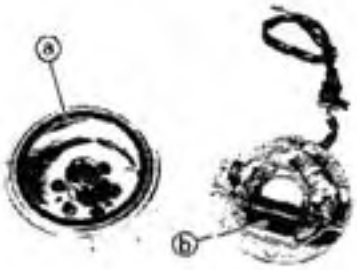
- Before servicing, clean the parts, and take care so that foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.

Extent of removal: ① CDI magneto removal

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Crankcase cover (left)	1	
	2	Nut (rotor)	1	Use special tool. Refer to "REMOVAL POINTS".
	3	Rotor	1	
	4	Stator	1	
	5	Woodruff key	1	







REMOVAL POINTS

Rotor

1. Remove:
   - Nut (rotor) ①
     Use the rotor holding tool ②.

	Rotor holding tool: 90890-01235

2. Remove:
   - Rotor ①
     Use the flywheel puller ②.

	Flywheel puller: 90890-01362

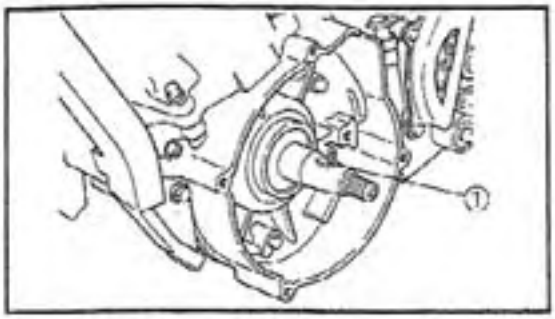
CAUTION:

Do not turn in the flywheel puller installation bolt ③ more than 10 mm (0.39 in) to avoid its contact with the stator.

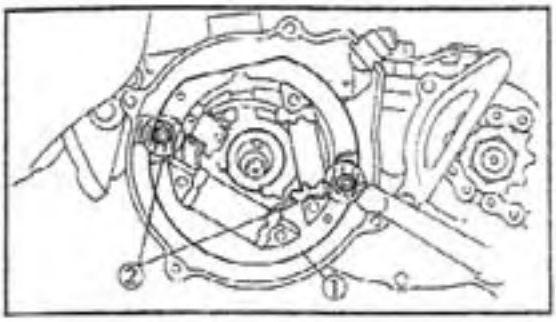
INSPECTION

CDI magneto

1. Inspect:
   - Rotor inner surface ⓐ
   - Stator outer surface ⓑ
     Damage → Inspect the crankshaft runout and crankshaft bearing.
     If necessary, replace CDI magneto/stator.



2. Inspect:
   - Woodruff key ①
     Damage → Replace.



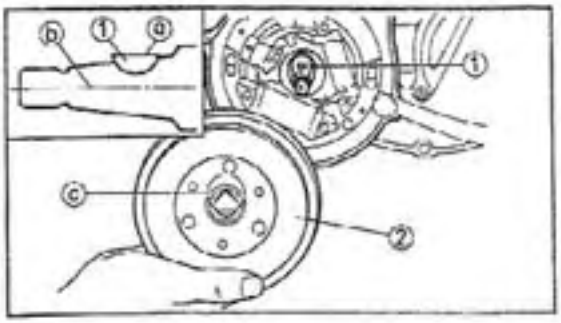
ASSEMBLY AND INSTALLATION

CDI magneto

1. Install:
   - Stator ①
   - Screw (stator) ②

NOTE:

Temporarily tighten the screw (stator) at this point.



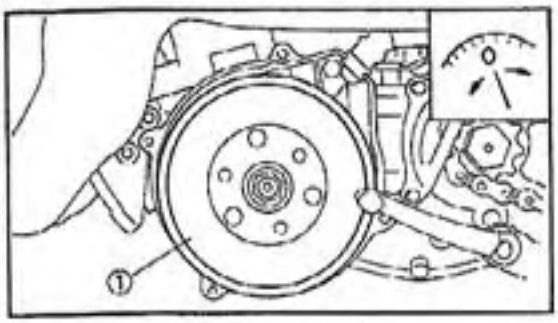
2. Install:
   - Woodruff key ①
   - Rotor ②

NOTE:

- Clean the tapered portions of the crankshaft and rotor.
- When installing the woodruff key, make sure that its flat surface ⓐ is in parallel with the crankshaft center line ⓑ.
- When installing the rotor, aline the keyway ⓒ of the rotor with the woodruff key.

3. Remove:
   - Spark plug
4. Attach:
   - Dial gauge ①
   - Dial gauge stand ②

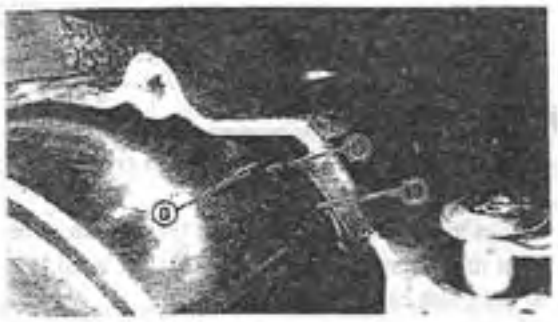
	Dial gauge and stand: **90890-01252**



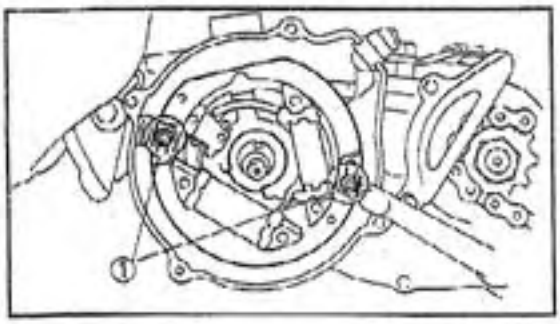
5. Rotate the magneto rotor ① until the piston reaches top dead center (TDC). When this happens, the needle on the dial gauge will stop and reverse directions even though the rotor is being turned in the same direction.
6. Set the dial gauge to zero at TDC.

7. From TDC, rotate the rotor clockwise until the dial gauge indicates that the piston is at a specified distance from TDC.

Ignition timing:
1.6 mm (0.063 in)

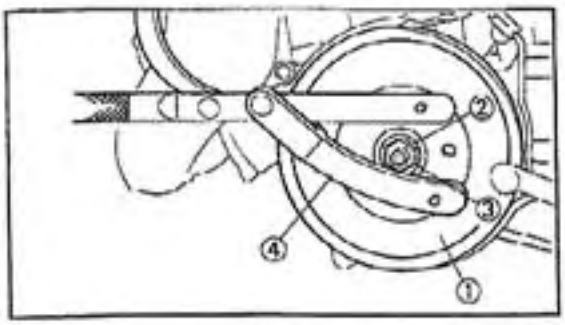


8. Align the punch mark ⓐ on the rotor with punch mark ⓑ on the stator by moving the stator ①.



9. Remove:
   - Rotor
10. Tighten:
    - Screw (stator) ①

Screw (stator):
8 Nm (0.8 m·kg, 5.8 ft·lb)

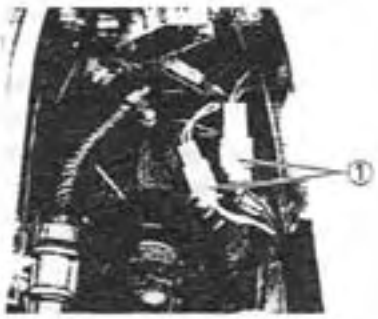


11. Install:
    - Rotor ①
    - Plain washer ②
    - Nut (rotor) ③

    Use the rotor holding tool ④.

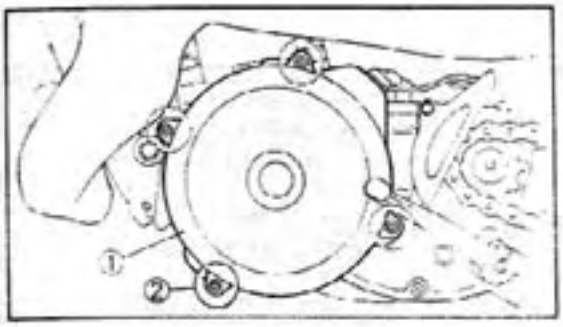
Rotor holding tool:
90890-01235

Nut (CDI magneto):
80 Nm (8.0 m·kg, 58 ft·lb)



12. Connect:
    - CDI magneto lead ①

    Refer to "CABLE ROUTING DIAGRAM" section in the CHAPTER 2.



13. Install:
    - Gasket (crankcase cover left)
    - Crankcase cover (left) ①
    - Bolt (crankcase cover left) ②

NOTE:

- Always use a new gasket.
- Tighten the bolts in stage, using a crisscross pattern.

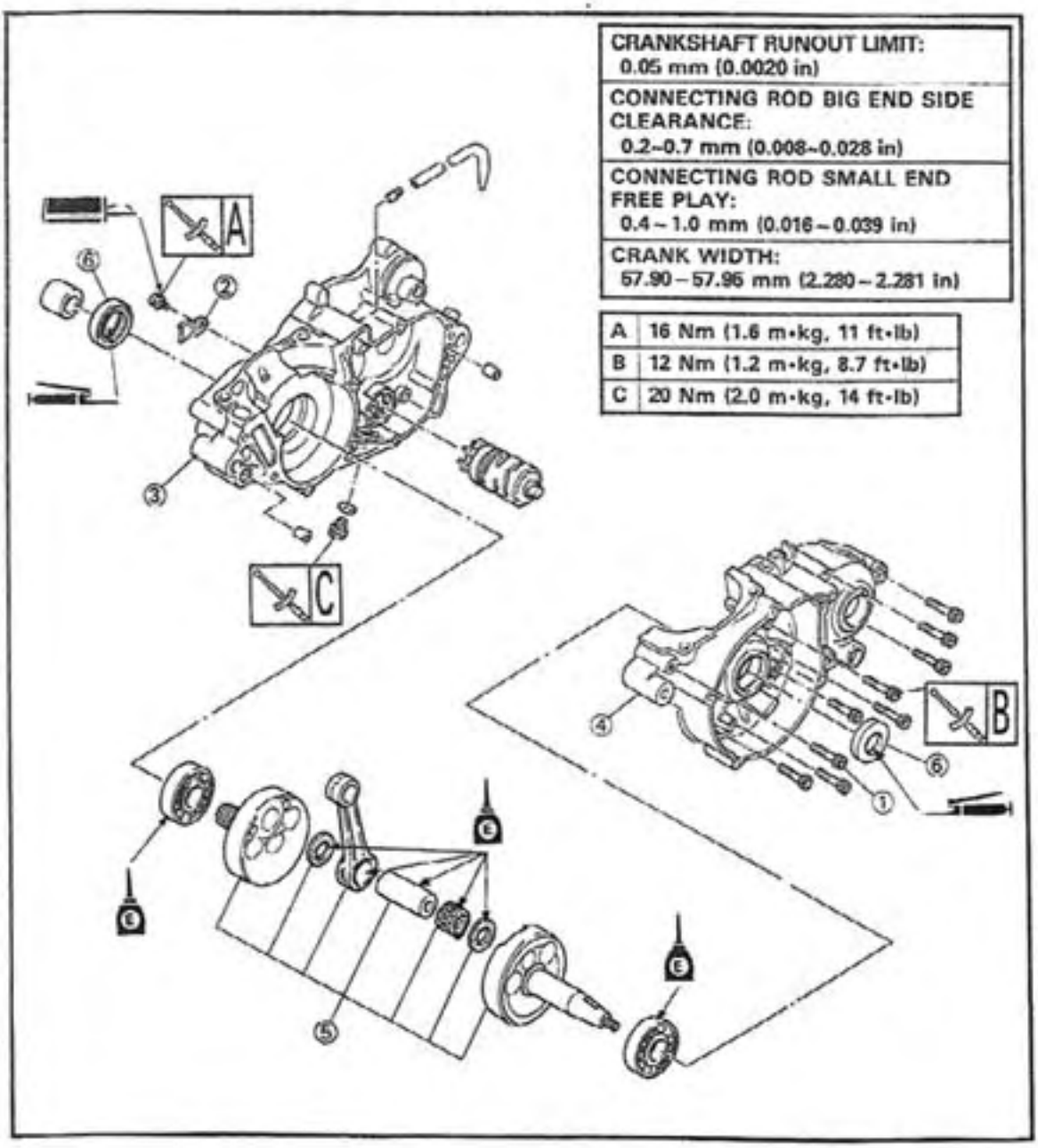
	Bolt (crankcase cover left): 12 Nm (1.2 m·kg, 8.7 ft·lb)

CRANKCASE AND CRANKSHAFT

PREPARATION FOR REMOVAL

*Remove the engine.
*Remove the following parts:

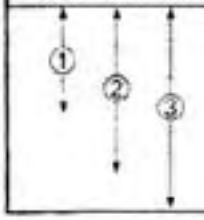
- Cylinder head
- Cylinder
- Piston
- Crankcase cover (left and right)
- Primary drive gear
- Primary driven gear
- Kick axle
- Kick idle gear
- Shift shaft
- Stopper lever
- Rotor and stator

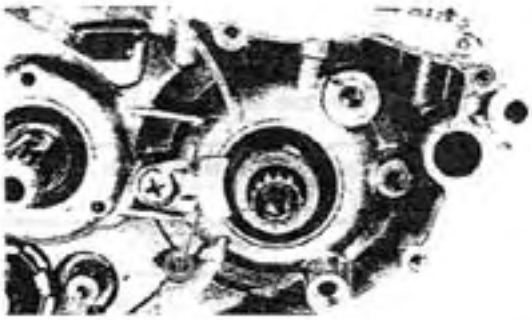


NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the parts, and take care so that foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.
- For assembly, the removed parts should he cleaned and apply the transmission oil onto the sliding surface.

Extent of removal: ① Separating crankcase ② Crankshaft removal ③ Oil seal removal

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Bolt (crankcase left and right)	10	
	2	Holder	1	Use special tool. Refer to "REMOVAL POINTS".
	3	Crankcase (right)	1	
	4	Crankcase (left)	1	
	5	Crankshaft	1	Use special tool. Refer to "REMOVAL POINTS".
	6	Oil seal	2	



REMOVAL POINTS

Crankcase

1. Remove:
   - Holder ①

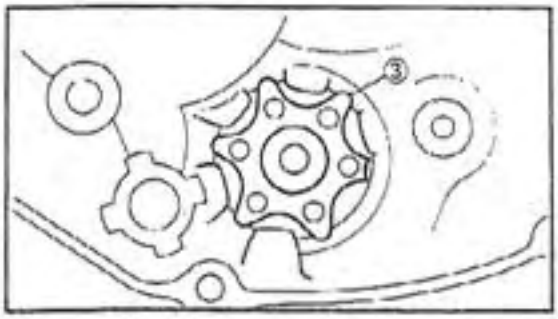
2. Remove:
   - Crankcase (right) ①

   Use the crankcase separating tool ②.

	Crankcase separating tool: 90890-01135

NOTE:

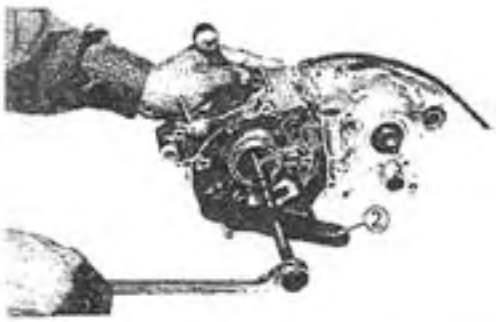
- Fully tighten the tool holding bolts, but make sure the tool body is parallel with the case. If necessary, one screw may be backed out slightly to level tool body.
- As pressure is applied, alternately tap on the front engine mounting boss and transmission shafts.



CAUTION:

•Turn the segment ③ to the position shown in the figure so that it does not contact the crankcase.

•Use soft hammer to tap on the case half. Tap only on reinforced portions of case. Do not tap on gasket mating surface. Work slowly and carefully. Make sure the case halves separate evenly. If one end "hangs up," take pressure off the push screw, realign, and start over. If the cases do not separate, check for a remaining case screw or fitting. Do not force.



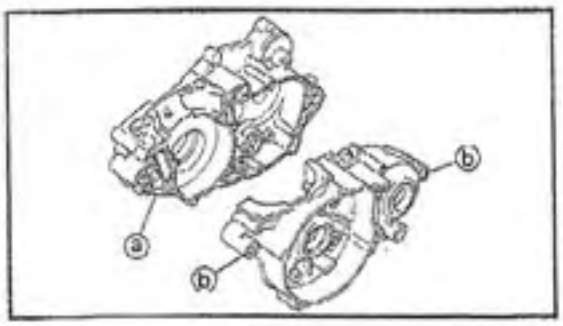
Crankshaft

1. Remove:
   •Crankshaft ①
   Use the crankcase separating tool ②.

	Crankcase separating tool: 90890-01135

CAUTION:

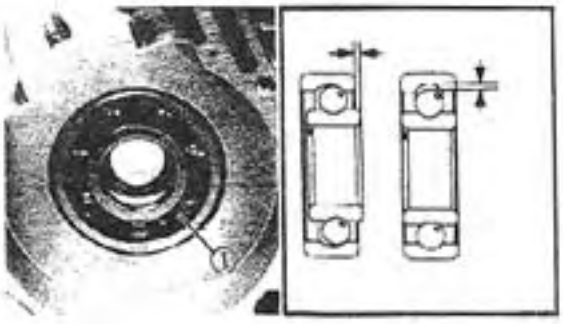
Do not use a hammer to drive out the crankshaft.



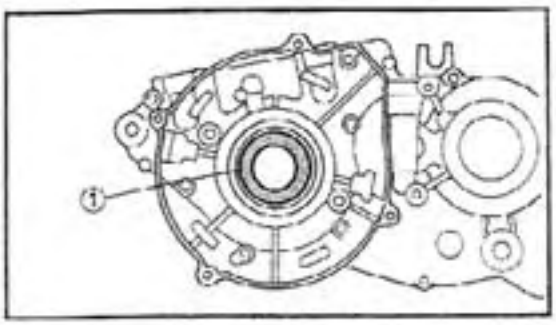
INSPECTION

Crankcase

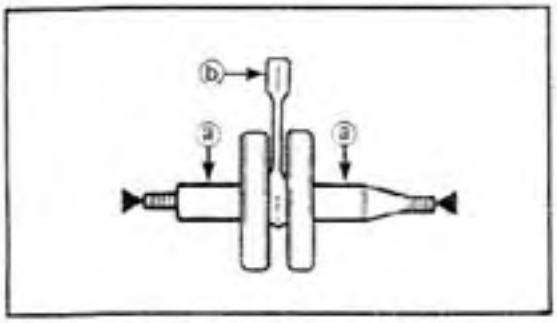
1. Inspect:
   •Contacting surface ⓐ
   Scratches→Replace.
   •Engine mounting boss ⓑ, crankcase
   Cracks/Damage→Replace.



2. Inspect:
   •Bearings ①
   Rotate inner race with a finger.
   Rough spot/Seizure →Replace.

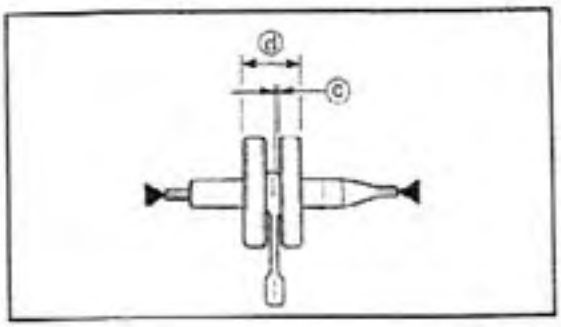


3. Inspect:
   - Oil seal ①
     Damage→Replace.



Crankshaft

1. Measure:
   - Runout limit ⓐ
   - Small end free play ⓑ
   - Connecting rod big end side clearance ⓒ
   - Crank width ⓓ
     Out of specification→Replace.
     Use the dial gauge and a thickness gauge



	Dial gauge: 90890-01252

	Standard	<Limit>
Runout limit:	0.03 mm (0.0012 in)	0.05 mm (0.0020 in)
Small end free play	0.4~1.0 mm (0.016~0.039 in)	—
Side clearance:	0.2~0.7 mm (0.008~0.028 in)	—
Crank width:	57.90~57.95 mm (2.280~2.281 in)	—

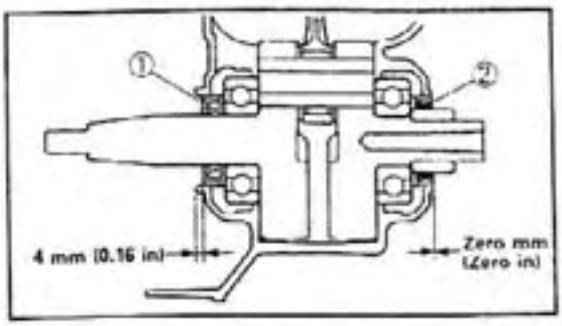
ASSEMBLY AND INSTALLATION

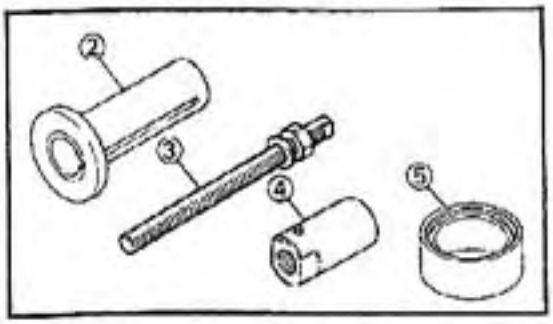
Oil seal

1. Install:
   - Oil seal (left) ①
   - Oil seal (right) ②

NOTE:

- Always use new oil seals.
- Apply the lithium soap base grease on the oil seal lip.
- Install the oil seal with its manufacture's marks or numbers facing outward.





Crankshaft

1. Install:
   - Crankshaft ①

   Use the crankshaft installing tool ②, ③, ④, ⑤.

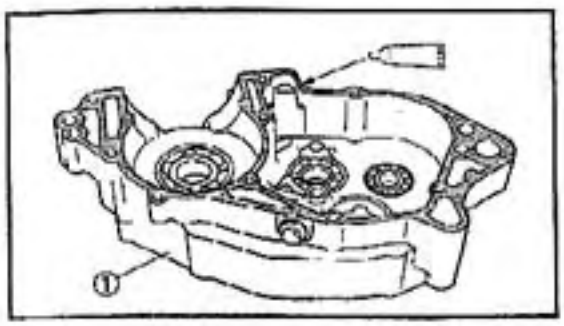
Crankshaft installing tool:
Pot ②: 90890-01274
Bolt ③: 90890-01275
Adapter ④: 90890-01278
Spacer ⑤: 90890-01288

NOTE:

- Hold the connecting rod at top dead center with one hand while turning the nut of the Installing Tool with the other. Operate the Installing Tool until the crankshaft bottoms against the bearing.
- Before installing the crankshaft, clean the contacting surface of crankcase.
- Apply the lithium soap base grease onto the oil seal lip.

2. Check:
   - Shifter operation
   - Transmission operation

   Unsmooth operation → Repair.



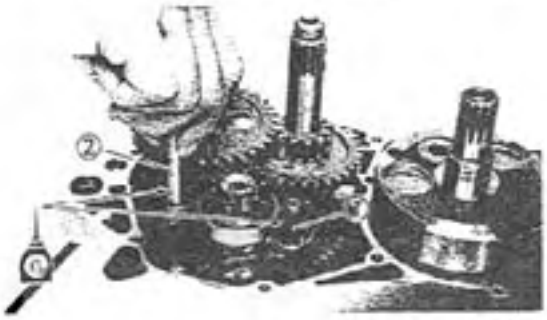
3. Apply:
   - Sealant

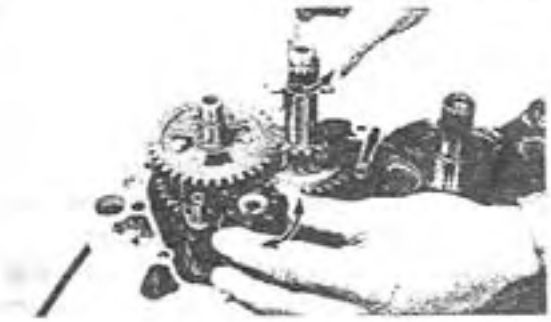
   Onto the crankcase (right) ①.

Yamaha bond No. 1215:
90890-85505

NOTE:

Clean the contacting surface of crankcase (left and right) before applying the sealant.





3. Install:
   - Guide bar (shorter) ①
   - Guide bar (lunger) ②

NOTE:

- Apply the transmission oil on the guide bars.
- Be sure the long bar is inserted into the shift forks #1 and #3 and the short one into #2.

4. Check:
   - Shifter operation
   - Transmission operation

   Unsmooth operation → Repair.

5. Install:
   - Crankcase (right)

   Refer to "CRANKCASE AND CRANKSHAFT" section.

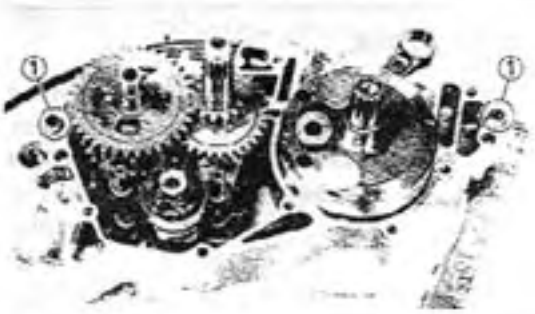
Carburetor setting

- The role of fuel is to cool the engine, and in the case of a two-stroke engine, to lubricate the engine in addition to power generation. Accordingly, if a mixture of air and fuel is too lean, abnormal combustion will occur, and engine seizure may result. If the mixture is too rich, spark plugs will get wet with oil, thus making it impossible to bring the engine into full play or if the worst comes to the worst, the engine may stall.
- The richness of the air-fuel mixture required for the engine will vary with atmospheric conditions of the day and therefore, the settings of the carburetor must be properly suited to the atmospheric conditions (air pressure, humidity and temperature).
- Finally, the rider himself must make a test run and check his machine for conditions (pick-up of engine speed, road surface conditions) and for the discoloration of the spark plug(s).
  After taking these into consideration, he must select the best possible carburetor settings.

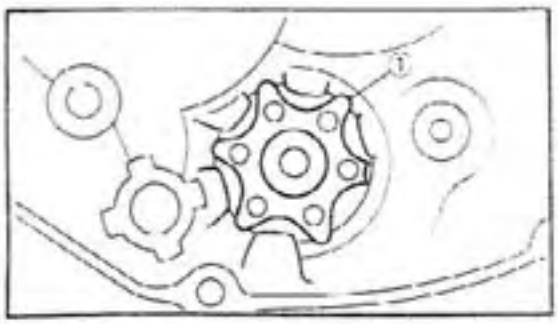
* It is advisable to make a note of settings, atmospheric conditions, road surface condition, etc. so that the memorandum can be used as a reference useful for future.

Weather conditions and examples of carburetor setting

Weather condition		Altitudes	Mixture	Setting
Air temp.	Humidity			
High	High	High	Richer	Leaner
Low	Low	Low	Leaner	Richer



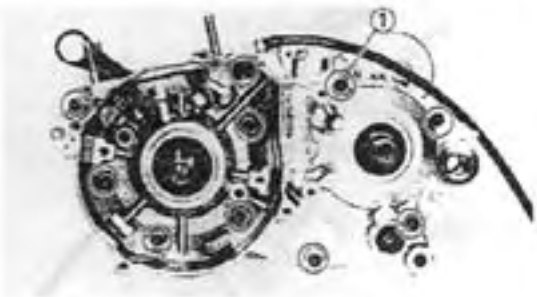
4. Install:
   •Dowel pin ①
   To crankcase (left).



5. Install:
   •Crankcase (right)
   To crankcase (left).

NOTE:

- Turn the shift cam ① to the position shown in the figure so that it does not contact the crankcase when installing the crankcase.
- Fit the crankcase (right) onto the crankcase (left). Tap lightly on the case with soft hammer.

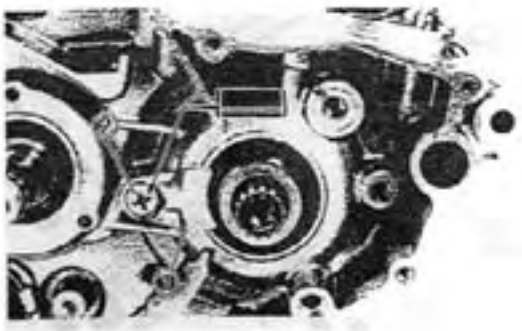


6. Tighten:
   •Bolt (Crankcase) ①

NOTE:

Tighten the crankcase tightening screws in stage, using a crisscross pattern.

	Bolt (crankcase): **12 Nm (1.2 m·kg, 8.7 ft·lb)**



7. Install:
   •Holder ①
   •Screw (holder) ②

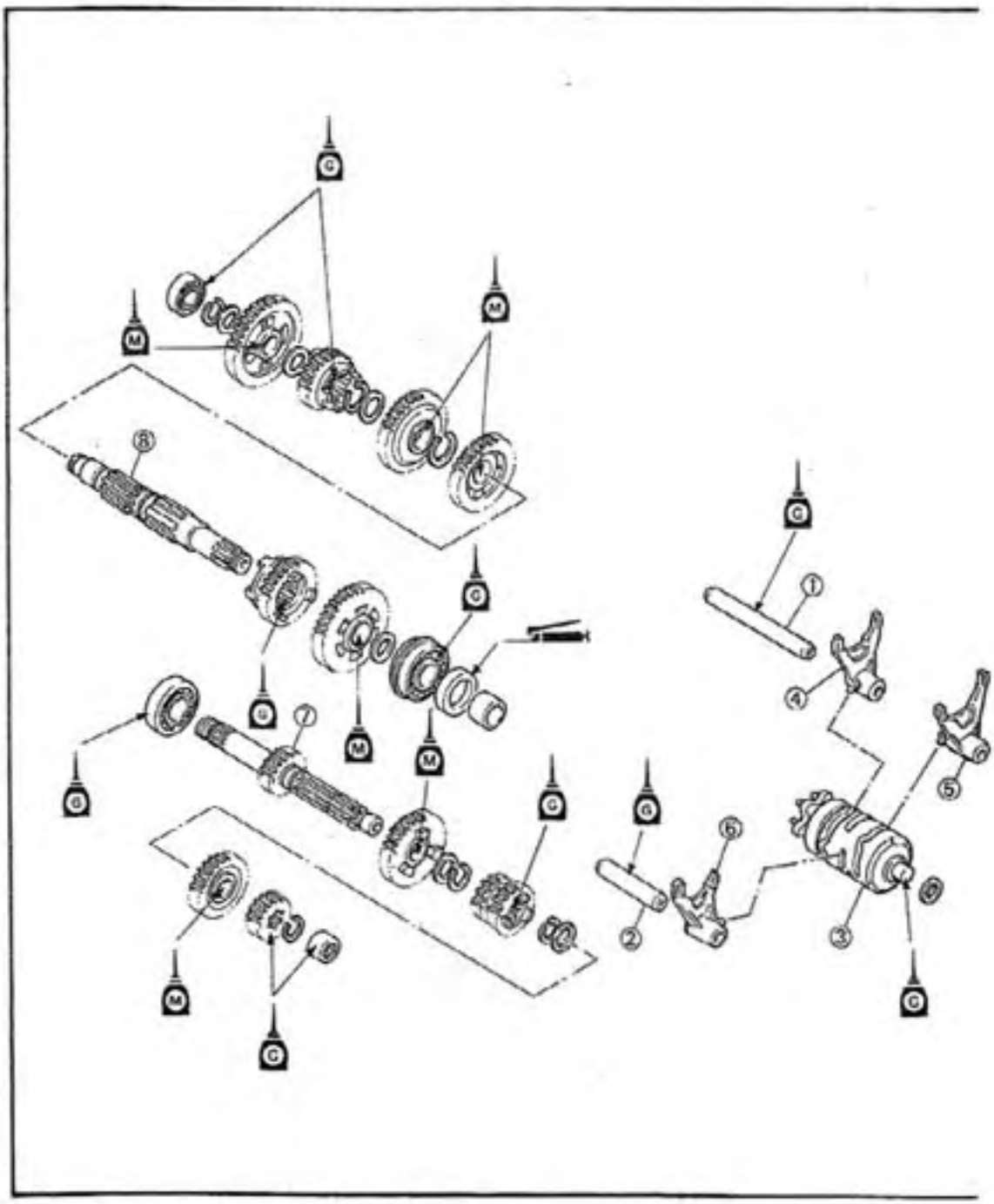
	Screw (holder): **16 Nm (1.6 m·kg, 11 ft·lb)** **LOCTITE®**

8. Remove:
   •Sealant
   Forced out on the cylinder mating surface.
9. Apply:
   •Engine oil
   To the crank pin, bearing and oil delivery hole.
10. Check:
    •Crankshaft and transmission operation
    Unsmooth operation → Repair.

TRANSMISSION, SHIFT CAM AND SHIFT FORK

PREPARATION FOR REMOVAL

*Remove the engine.
*Separate the crankcase.



NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the parts, and take care so that foreign material does not enter the crankcase.
- Remove the gasket adhered on the contacting surface.
- For reassembly, the removed parts should be cleaned and apply the transmission oil onto the sliding surface.

Extent of removal: ① Shift cam removal
② Main axle and drive axle removal

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Guide bar (long)	1	
	2	Guide bar (short)	1	
	3	Shift cam	1	
	4	Shift fork 3	1	
②	5	Shift fork 1	1	
	6	Shift fork 2	1	
	7	Main axle	1	Refer to "REMOVAL POINTS".
	8	Drive axle	1	

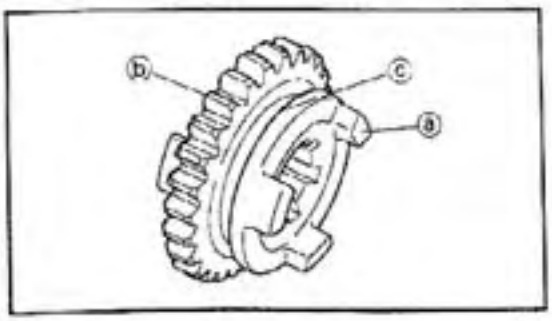
REMOVAL POINTS

Transmission

1. Remove:
   - Main axle ①
   - Drive axle ②

NOTE:

- Tap lightly on the transmission drive axle with a soft hammer to remove.
- Remove assembly carefully. Note the position of each part. Pay particular attention to the location and direction of shift forks.

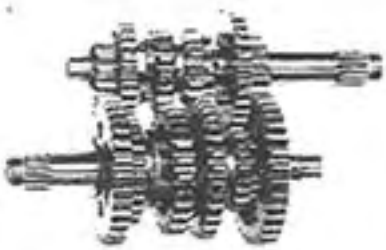


INSPECTION

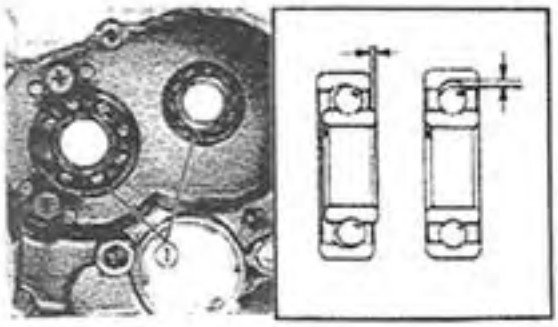
Gears

1. Inspect.
   - Matching dog ⓐ
   - Gear teeth ⓑ
   - Shift fork groove ⓒ

   Wear/Damage → Replace.

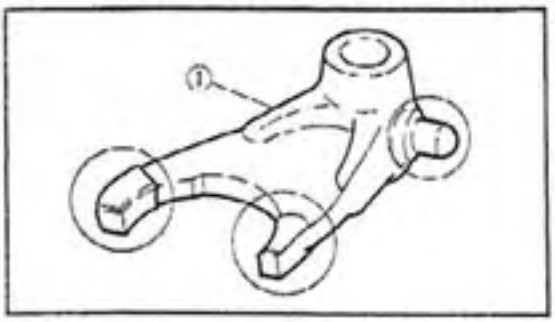


2. Check:
   • Gears movement
   Unsmooth movement → Repair or replace.



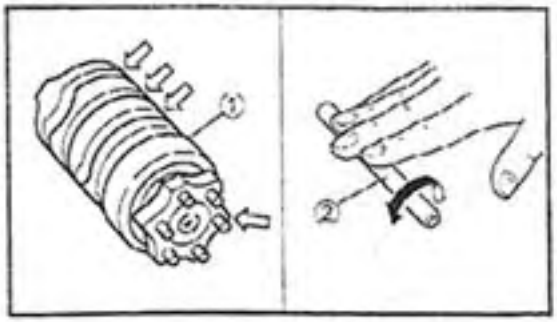
Bearing

1. Inspect:
   • Bearing ①
   Rotate inner race with a finger.
   Rough spot/Seizure → Replace.

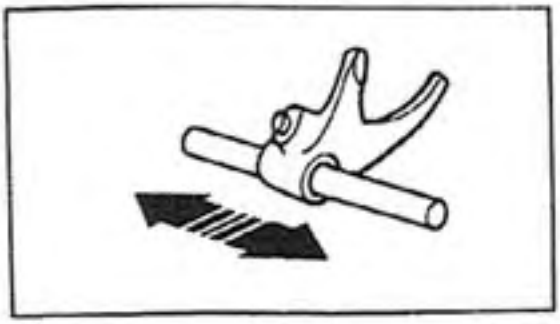


Shift fork and shift cam

1. Inspect:
   • Shift fork ①
   Wear/Damage/Scratches → Replace.



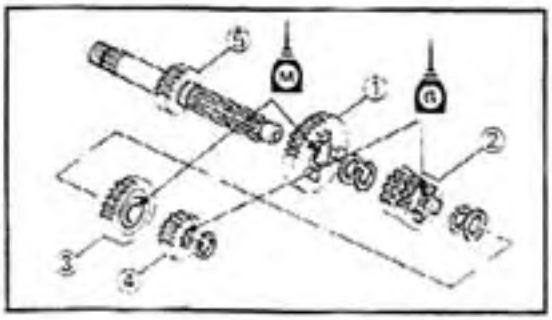
2. Inspect:
   • Shift cam ①
   • Guide bar ②
   Bend/Wear/Damage → Replace.

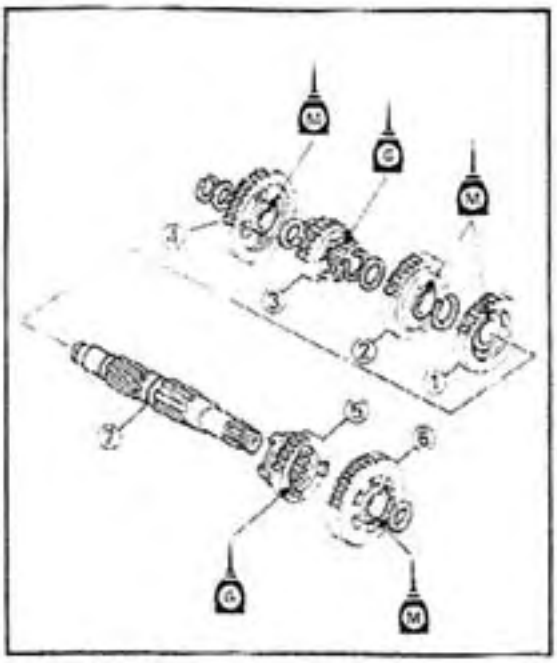


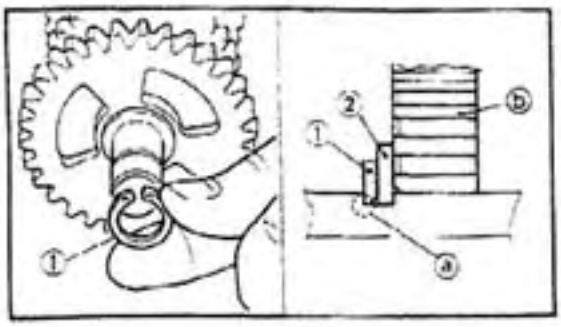
3. Check:
   • Shift fork movement
   On its guide bar.
   Unsmooth operation → Replace.
   Shift fork and/or guide bar.

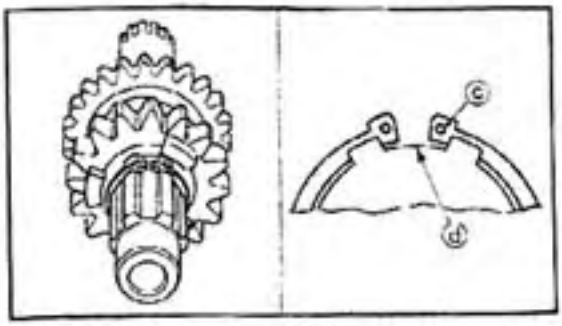
NOTE:

For a malfunctioning shift fork, replace not only the shift fork itself but the two gears each adjacing the shift fork.









ASSEMBLY AND INSTALLATION

Transmission

1. Install:
   - 6th pinion gear (32T) ①
   - 3rd/4th pinion gear (15/17T) ②
   - 5th pinion gear (26T) ③
   - 2nd pinion gear (13T) ④

   To main axle ⑤.

NOTE:

- Apply the molybdenum disulfide oil onto the 5th and 6th pinion gears inner circumference.
- Apply the transmission oil onto the 3rd/4th and 2nd pinion gears inner circumference.

2. Install:
   - 4th wheel gear (26T) ①
   - 3rd wheel gear (31T) ②
   - 6th wheel gear (20T) ③
   - 1st wheel gear (35T) ④
   - 5th wheel gear (26T) ⑤
   - 2nd wheel gear (33T) ⑥

   To drive axle ⑦.

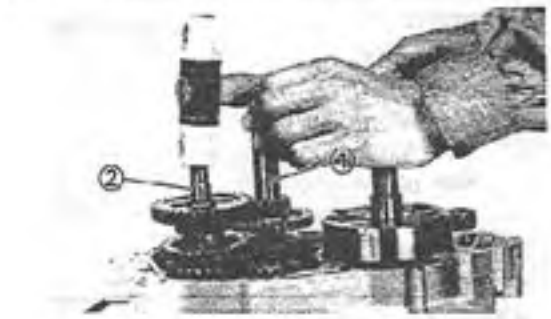
NOTE:

- Apply the molybdenum disulfide oil onto the 4th, 3rd, 1st and 2nd wheel gears inner circumference.
- Apply the transmission oil onto the 6th and 5th wheel gears inner circumference.

3. Install:
   - Circlip ①
   - Plain washer ②

NOTE:

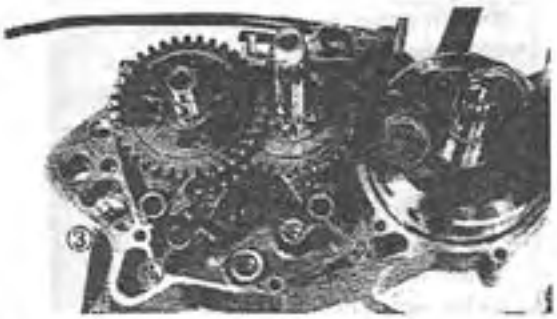
- Be sure the circlip sharp-edged corner ⓐ is positioned opposite side to the plain washer ② and gear ⓑ.
- Always use a new circlip.
- Be sure the circlip end ⓒ is positioned at axle spline groove ⓓ.



4. Install:
   - Main axle ①
   - Drive axle ②

NOTE:

- Apply the lithium soap base grease on the crankcase oil seal lip.
- When installing the drive axle into the crankcase, pay careful attention to the crankcase oil seal lip.

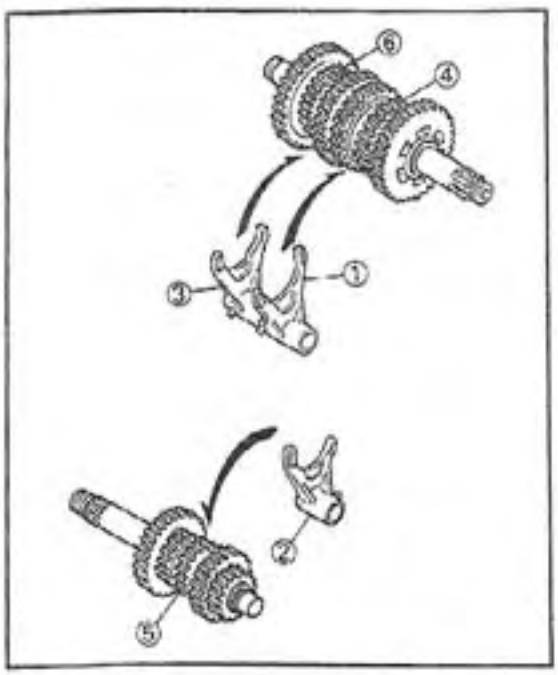


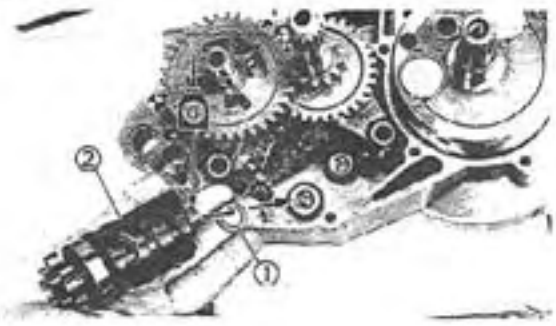
Shift cam and shift fork

1. Install:
   - Shift fork 1 ①
   - Shift fork 2 ②
   - Shift fork 3 ③

NOTE:

- Mesh the shift fork #1 with the 5th wheel gear ④ and #3 with the 6th wheel gear ⑥ on the drive axle.
- Mesh the shift fork #2 with the 3rd/4th pinion gear ⑤ on the main axle.

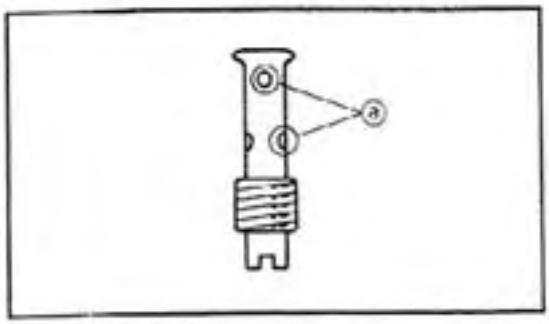




2. Install:
   - Plain washer ①
   - Shift cam ②

NOTE:

Apply the transmission oil onto the shift cam.



NOTE:

The pilot jet for the '88 or later models has four bleed holes ⓐ. Note that if you use the '87 or ealier model pilot jet (with two bleed holes) for the '88 or later model carburetor, the same size may result in a different setting.

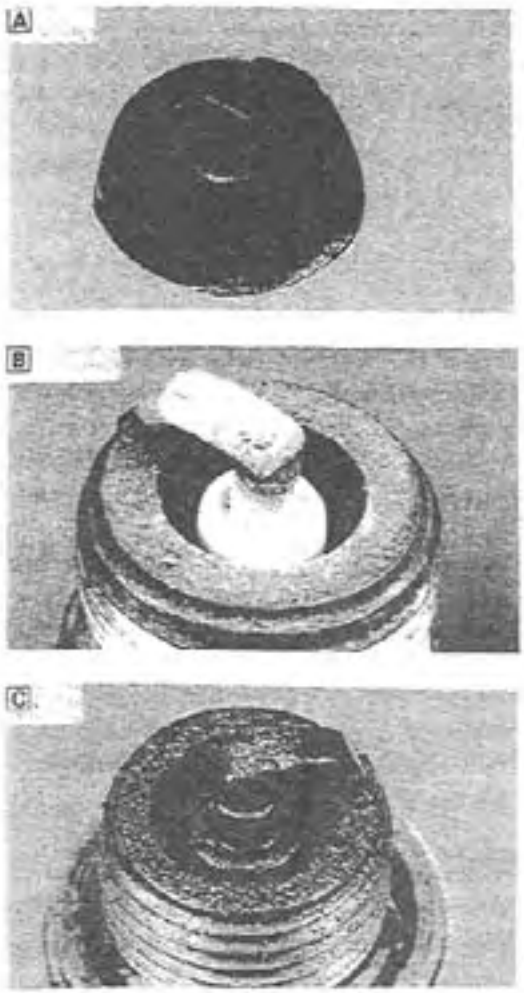
Change of the heat range of spark plugs

Judging from the discoloration of spark plugs, if they are found improper, it can be corrected by the following two methods; changing carburetor settings and changing the heat range of spark plug.

- In principle, it is advisable to first use spark plugs of standard heat range, and judging from the discoloration of spark plugs, adjust carburetor settings.
- If the calibration No. of the main jet must be changed by ±30, it is advisable to change the heat range of spark plugs and newly select the proper main jet.

NOTE:

- When checking the discoloration of spark plugs, be sure to stop the engine immediately after a run and check.
- Avoid racing.
- When changing the heat range of spark plugs, never attempt to change it more than ±1 rank.
- When using spark plugs other than standard, make sure of the difference in heat range and find the equivalent to the standard.
- Note that even if the discoloration seems proper, it may slightly vary with the spark plug maker and oil in use.

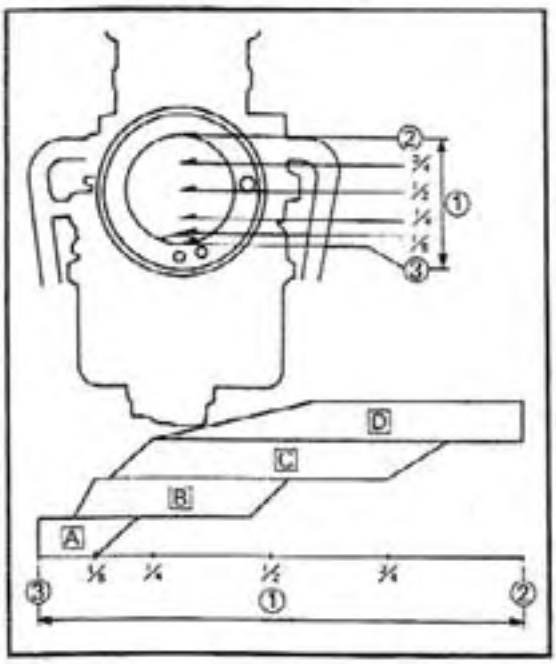


Test run

After warming up the engine equipped with the standard type carburetor(s) and spark plug(s), run on the circuit for 20~30 minutes and check the smooth operation of the engine and discoloration of spark plug(s).

Discoloration	Condition of spark plug
Normal	Insulator is dry and burnt brown.
Over burned (too lean)	Insulator is whitish.
Oil fouled (too rich)	Insulator is sooty and wet.

[A] **Normal**
[B] **Over burned (too lean)**
[C] **Oil fouled (too rich)**



Effect of setting parts in relation to throttle valve opening

[A] Pilot jet/Pilot air screw
[B] Main nozzle/Throttle valve
[C] Jet needle
[D] Main jet
① Throttle valve opening
② Full-open
③ Full-closed