Kawasaki

KZ200



MOTORCYCLE SERVICE MANUAL

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Foreword

This manual is designed primarily for use by motorcycle mechanics in a properly equipped shop, although it contains enough detail and basic information to make it useful to the motorcycle user who desires to carry out his own basic maintenance and repair work. Since a certain basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily; the adjustments, maintenance, and repair should be carried out only by qualified mechanics whenever the owner has insufficient experience, or has doubts as to his ability to do the work, so that the motorcycle can be operated safely.

In order to perform the work efficiently and to avoid costly mistakes, the mechanic should read the text, thoroughly familiarizing himself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment is specified, makeshift tools or equipment should not be used. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation of the motorcycle.

Whenever you see the symbols shown below, heed their instructions! Always follow safe operating and maintenance practices.

WARNING **This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.**

CAUTION **This cautions symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to, or destruction of equipment.**

"NOTE" indicates points of particular interest for more efficient and convenient operation.

This manual is divided into the following sections:

(1) Adjustment

The adjustment section gives the procedure for all adjustments which may become necessary periodically and which do not involve major disassembly.

(2) Disassembly

This section shows the best method for the removal, disassembly, assembly, and installation which are necessary for maintenance and repair. Since assembly and installation are usually the reverse of disassembly and removal, assembly and installation are not explained in detail in some cases. Instead, assembly notes and installation notes are provided to explain special points.

(3) Maintenance

The procedures for inspection and repair are described in detail in this section.

Since the Service Manual is based on the first production units of the KZ200, there may be minor discrepancies between some vehicles and the illustrations and text in this manual. Major changes and additions pertaining to later year units will be explained in a supplement following the appendix or by a new edition, as required.

QUICK REFERENCE GUIDE

To use, bend the manual back and match the desired section below against the black spot showing at the edge of these pages.

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Specifications

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SPECIFICATIONS

Dimensions		
Overall length	US	1,920 mm
	European	1,980 mm
Overall width	US	780 mm
	European	700 mm
Overall height	US	1,050 mm
	European	1,030 mm
Wheelbase		1,280 mm
Road clearance		150 mm
Dry weight		126 kg
Fuel tank capacity		9.3 ℓ
Performance		
Climbing ability		33°
Braking distance		12 m @50 kph
Minimum turning radius		1.9 m
Engine		
Type		OHC 1 cylinder, 4 stroke, air-cooled
Bore and stroke		66 x 58 mm
Displacement		198 cc
Compression ratio		9.0
Maximum horsepower		18 HP @8,000 rpm
Maximum torque		1.68 kg-m @7,000 rpm
Valve timing		
Inlet	Open	36° BTDC
	Close	56° ABDC
	Duration	272°
Exhaust	Open	71° BBDC
	Close	21° ATDC
	Duration	272°
Carburetor		Keihin PW26
Lubrication system		Forced lubrication (wet sump)
Engine oil		SAE 10W40
Engine oil capacity		1.4 ℓ
Starting system		Electric and kick
Ignition system		Battery and coil
Ignition timing		From 10° BTDC @1,500 rpm to 40° BTDC @3,000 rpm
Spark plug		NGK B8ES or ND W24ES
Transmission		
Type		5-speed, constant mesh, return shift
Clutch		Wet, multi disc
Gear ratio:	1st	2.64 (29/11)
	2nd	1.73 (26/15)
	3rd	1.30 (26/20)
	4th	1.05 (21/20)
	5th	0.90 (19/21)
Primary reduction ratio		3.29 (69/21)
Final reduction ratio		2.67 (40/15)
Overall drive ratio		7.93 (Top gear)

Electrical Equipment

Generator (Dynamo)		Kokusan GP9301
Regulator/Rectifier		Shindengen SH-221-12B
Ignition coil		Toyo Denso ZC003-12V
Battery		Yuasa 12N10-3B (12V 10AH)
Starter		Mitsuba SM-223C
Headlight type	US	Sealed beam
	European	Semi-sealed
Headlight	US	12V 35/25W
	European	12V 35/35W
Tail/Brake light	US	12V 8/27W
	European	12V 5/21W
Speedometer light		12V 3.4W
Tachometer light		12V 3.4W
Neutral indicator light		12V 3.4W
High beam indicator light		12V 3.4W
Turn signal lights	US	12V 23W
	European	12V 21W
Turn signal indicator light		12V 3.4W
Horn		12V 2A
City light	European	12V 4W

Frame

Type		Tubular, single cradle
Steering angle		45° to either side
Castor		64°
Trail		88 mm
Tire size	Front	2.75-18 4PR
	Rear	3.25-17 6PR
Suspension	Front	Telescopic fork
	Rear	Swing arm
Suspension stroke	Front	120 mm
	Rear	70 mm
Front fork oil capacity (each fork)		SAE 5W20
Front fork oil type		145~155 cc

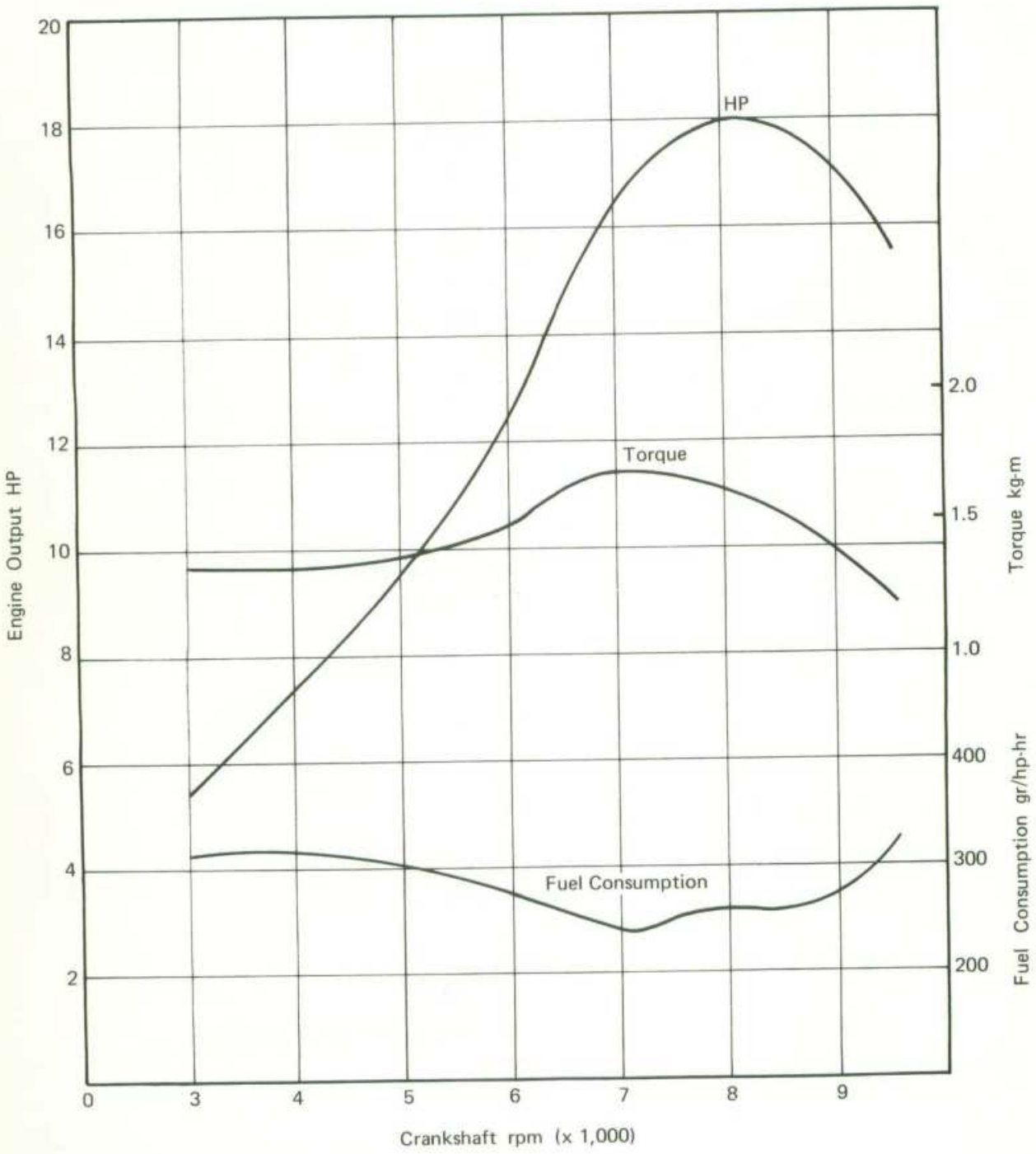
Brakes

Type	Front	Disc brake
	Rear	Internal expansion, leading-trailing
Effective disc diameter		206 mm
Brake drum inside diameter and width		130 x 28 mm

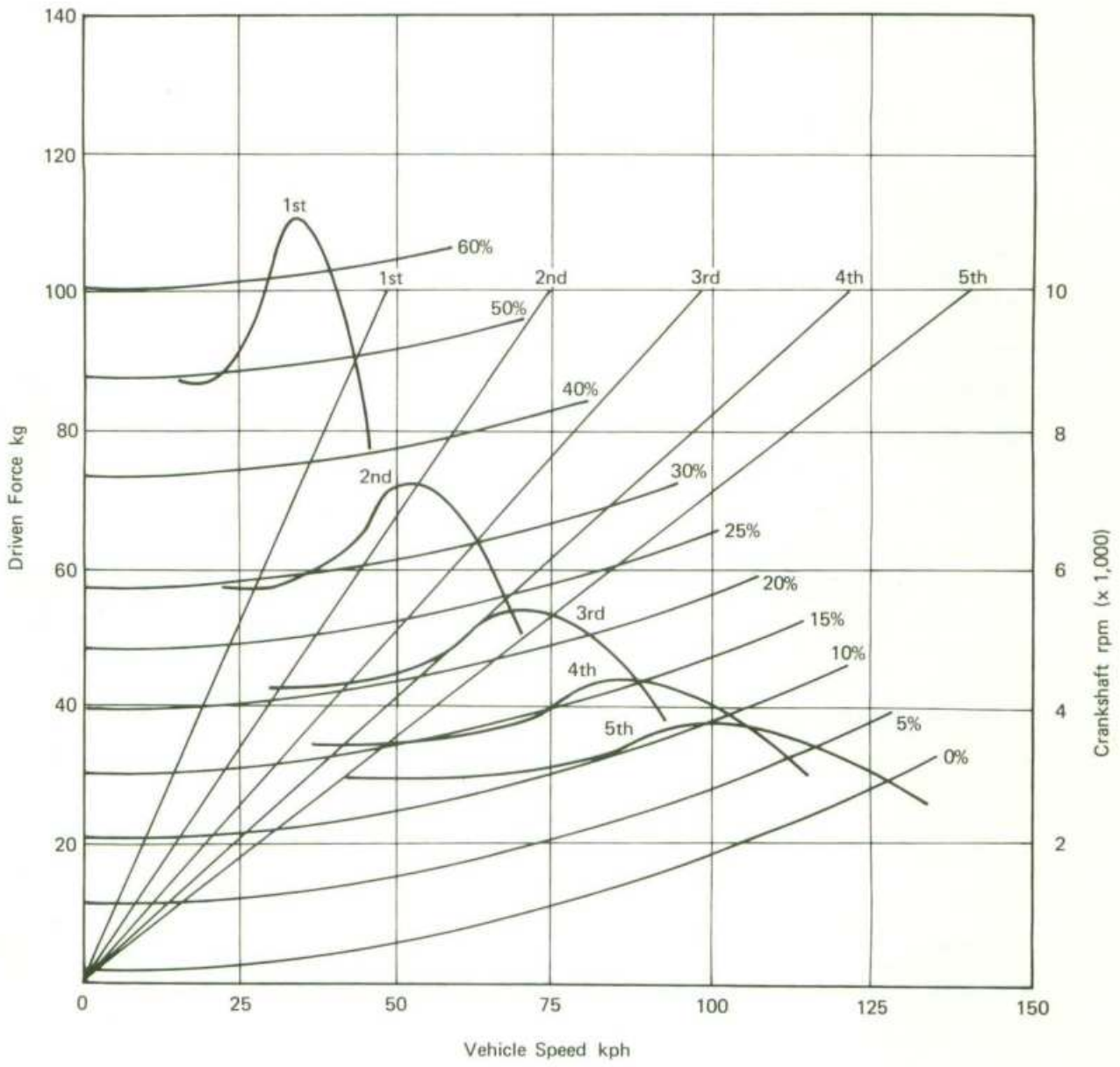
Specifications subject to change without notice, and may not apply to every country.

8 SPECIFICATIONS

ENGINE PERFORMANCE CURVES



RUNNING PERFORMANCE CURVES



PERIODIC MAINTENANCE CHART

Operation \ Frequency	After initial 800 km	After initial 5,000 km	Every subsequent 5,000 km	Every subsequent 10,000 km	See Page
Check, adjust brakes	•	•	•		23
Check, adjust clutch	•	•	•		17
Check, adjust carburetor	•	•	•		16
Check, adjust throttle cable	•	•	•		16
Check spoke tightness and rim runout	•	•	•		159
Clean fuel system	•	•	•		19
Clean, set spark plug gap	•	•	•		12
Adjust camshaft chain	•		•		15
Check, adjust points, timing	•		•		12
Check valve clearance	•		•		16
Check steering play	•			•	24
Tighten bolts and nuts	•			•	33~36
Check tire pressure and tread wear	•	•	•		156
Check drive chain wear		•	•		161
Clean air cleaner element		•	•		123
Perform general lubrication		•	•		27
Change engine oil	•	Every subsequent 3,000 km			18
Change oil filter element	•	Every subsequent 6,000 km			153
Lubricate drive chain	Every 300 km				161
Check, adjust drive chain	Every 800 km				22
Check brake wear	Every 10,000 km				163, 164
Change front fork oil	Every 10,000 km				169
Lubricate timing advancer	Every 10,000 km				182
Change air cleaner element	*Every 10,000 km or after cleaning 5 times				123
Lubricate swing arm	*Every year or 10,000 km				172
Regrease wheel bearings	*Every 2 years or 20,000 km				160
Regrease speedometer gear housing	*Every 2 years or 20,000 km				160
Regrease brake camshaft	*Every 2 years or 20,000 km				166
Lubricate steering stem bearings	*Every 2 years or 20,000 km				167

* Whichever occurs first.

Adjustment – Engine

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SPARK PLUG

Neglecting the spark plug eventually leads to difficult starting and poor performance. During normal operation, the electrodes gradually burn away and carbon builds up along the insulator. In accordance with the Periodic Maintenance Chart (Pg. 10), the plug should be removed for inspection, cleaning, and to reset the gap. If the center electrode is fairly worn down, install a new one with the proper gap.

- Remove the spark plug using a spark plug wrench.
- Clean off the electrodes, and measure the gap with a wire-type thickness gauge. If the gap is incorrect, carefully bend the outer electrode with a suitable tool, to obtain the correct gap.

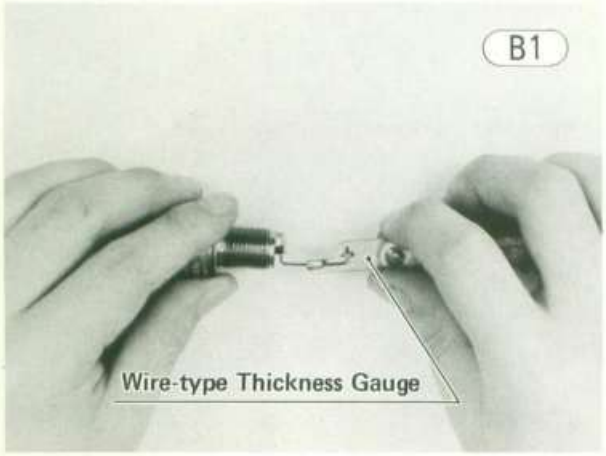


Table B1 Spark Plug

Plug	NGK B8ES, ND W24ES
Gap	0.7~0.8 mm
Tightening Torque	2.8 kg-m (20 ft-lbs)

- Tighten the spark plug in the cylinder head with 2.8 kg-m (20 ft-lbs) of torque.

NOTE: Refer to electrical maintenance section, Pg. 183, for detailed spark plug information.

IGNITION TIMING

Incorrect ignition timing can cause poor performance, knocking, overheating, and serious engine damage. Periodic adjustment will be necessary to compensate for wear of parts, and the ignition timing must be checked whenever ignition related parts have been disassembled or replaced.

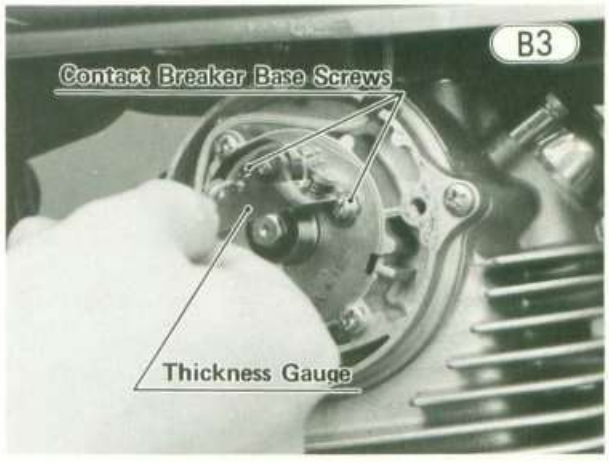
Correct ignition timing is achieved by first obtaining the correct contact breaker point gap (this can also be achieved by adjusting the dwell angle to the specified amount) and then changing the position of the contact breaker base. Often the first step returns the timing very close to the correct original setting. Once the timing has been adjusted, it may be checked for accuracy by the use of a strobe light.

Point Gap Adjustment (using a thickness gauge):

- Remove the contact breaker cover.
- Clean the points with clean paper or cloth, using an oil-free solvent. A business card soaked in trichloroethylene can be used to remove traces of oil. To repair light damage, use emery cloth or an oilstone. If the points are badly worn down or damaged, or if the spring is weak, replace the contact breaker.
- Lubricate the point cam oil felt sparingly with a suitable point cam lubricant. Do not overlubricate. Replace the oil felt if it is worn.
- Remove the dynamo cover.



- Using a 14 mm wrench on the crankshaft, turn the engine counterclockwise until the contact breaker points are at their widest opening.
- Measure the size of the point gap with a thickness gauge. The proper gap is 0.3 ~ 0.4 mm.



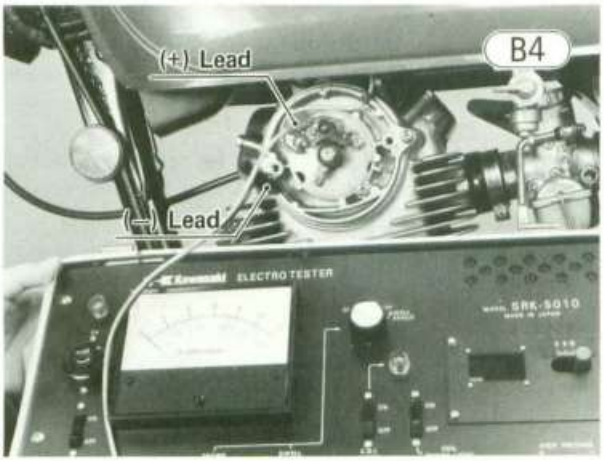
- If the gap is incorrect, loosen the contact breaker base screws (2) just enough to allow the base to move. Open the points using a slot screwdriver on the contact breaker base pry point, and insert a 0.35 mm thickness gauge between the points. Tighten the contact breaker base screws (2), and remove the blade. Again turn the crankshaft, and recheck the point gap.
- Perform the timing test.

Point Gap Adjustment (using a dwell angle tester):

The most precise means to set the point gap is to use a dwell angle tester instead of a thickness gauge. If a dwell angle tester is available, adjust the dwell angle (point gap) in the following manner.

NOTE: The dwell angle is the angular range for which the contact breaker points are closed. This allows the current to flow in the ignition coil primary winding.

- Remove the contact breaker cover.
- Clean the points with clean paper or cloth, using an oil-free solvent. A business card soaked in trichloroethylene can be used to remove traces of oil. To repair light damage use emery cloth or a point file. If the points are badly worn down or damaged, or if the spring is weak, replace the contact breaker.
- Lubricate the point cam oil felt sparingly with a suitable point cam lubricant. Do not over lubricate. Replace the oil felt if it is worn.
- Connect the dwell angle tester (–) lead to chassis ground (such as the frame or crankcase) and the (+) lead to the contact breaker terminal.



- If the dwell angle tester is calibrated in degrees, turn the selector knob to the lowest cam lobe setting.
- Start the engine, and let it idle (below 1,100 rpm).

WARNING **Make sure that no tools, clothes, or meter leads touch the spinning camshaft. Touching the camshaft of a running engine could cause an injury.**

- Note the reading on the tester. The dwell angle specification is 103~107° for a tester calibrated in degrees and 28.6~29.7 % for one calibrated in percentage. If the tester setting is for more than one cam lobe, the reading on the tester must be multiplied by the cam lobe number to obtain the true dwell angle (Table B2).
- If the dwell angle is not the same as the specification, loosen the contact breaker base screws (2) just enough so that a solt screwdriver at the contact breaker pry point will be able to change the gap (Fig. B3). Adjust the gap until the dwell angle specification is obtained. Tighten the screws (2).
- Stop the engine, disconnect the tester.
- Perform the timing test.

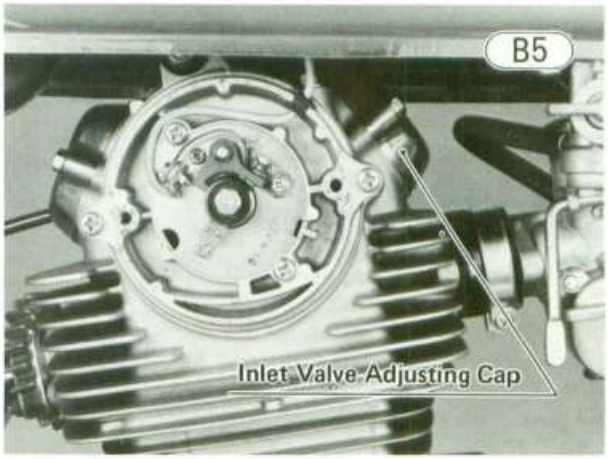
Table B2 Relation between Selector Knob Setting and Meter Reading†

Selector Knob Setting	Dwell Angle Tester Reading
1 cyl.	103.0~107.0° (28.6~29.7%)
2 cyls.	51.5~53.5° (14.3~14.9%)
3 cyls.	34.3~35.7° (9.5~9.9%)
4 cyls.	25.8~26.8° (7.2~7.4%)

† Running the engine at idle speed.

Timing Test (Static):

- Turn the ignition switch off.
- Turn the engine stop switch off.
- Remove the contact breaker cover and the inlet valve adjusting cap.



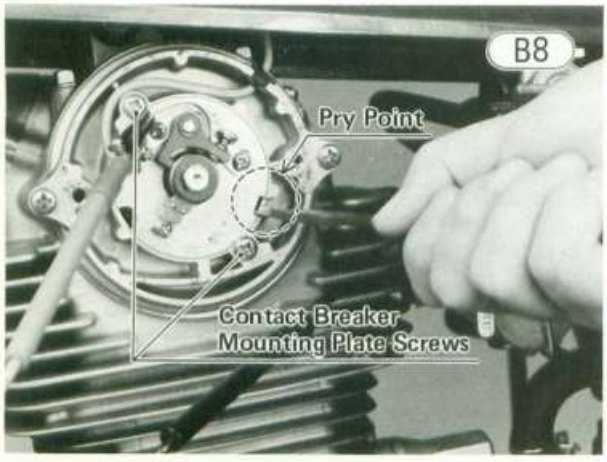
- Remove the dynamo cover.
- Turn the crankshaft counterclockwise while watching the movement of the inlet valve (the valve to the rear). When the valve has just finished opening and closing (moving downward and returning upward), turn the crankshaft in the same direction (counterclockwise) for about another ½ turn until the "F" mark on the dynamo flywheel aligns with the timing mark as shown.



- Set an ohmmeter to the R x 1 range and connect it across the points, one lead to the wire coming from the points (or to the spring leaf), and the other ohmmeter lead to chassis ground (engine, frame, contact breaker mounting, etc.). Make sure that both leads are securely connected.
- Loosen the contact breaker base screws (2), and turn the base using a screwdriver in the pry points so that the contacts are just at the point of opening. This point can be found by watching the ohmmeter needle, which will flicker just when the points begin to open or close.



- If the contact breaker base will not travel far enough to allow correct timing adjustment, loosen the contact breaker mounting plate screws (2) and turn the plate to provide more room for adjustment.



- Turning the crankshaft counterclockwise, check to see if the "F" mark is aligned with the timing mark when the needle jumps. If not, readjust.
- Tighten all the screws that were loosened. Tightening torque for the mounting plate screws is 0.45 kg-m (39 in-lbs).
- Disconnect the ohmmeter leads.
- Install the dynamo cover.

CAUTION **Before installing the dynamo cover screws (3), plate the O rings under the screw heads to prevent O ring damage and oil leaks.**



- Install the inlet valve adjusting cap with the "UP" mark on the cap pointing upward.
- Install the contact breaker cover with the "UP" mark on the cover pointing upward.

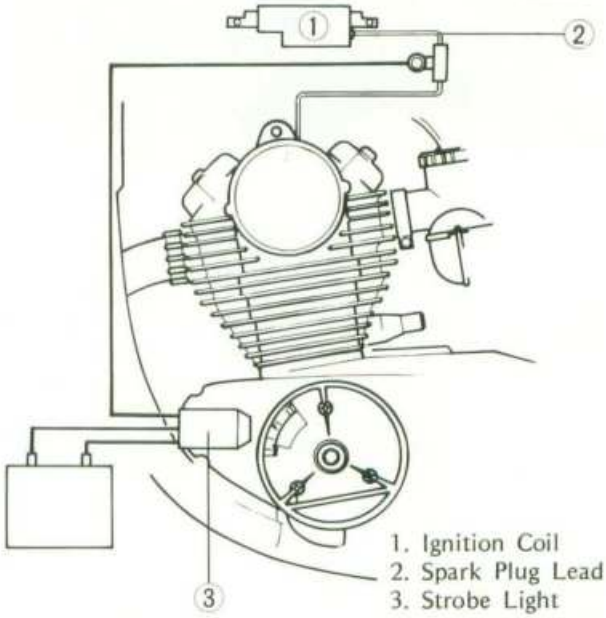
Timing Test (Dynamic):

- Remove the dynamo cover, and install the timing inspection cover (special tool) with 15 ~ 18 mm length screws (3).

CAUTION **Do not use the dynamo cover screws to install the special tool. This may cause the dynamo wiring damage because the screws are too long.**

- Connect a strobe light in the manner prescribed by the manufacturer in order to check the ignition timing under operation conditions.

Dynamic Ignition Timing Test



- Start the engine, and direct the light at the timing mark through the inspection window. At low engine speed the timing mark and the "F" mark on the dynamo flywheel must be aligned for correct low rpm ignition timing (Fig. B6). At high engine speed the timing mark and the pair of lines on the dynamo flywheel must be aligned for correct high rpm ignition timing

as shown in Fig. B11. If both low and high rpm ignition timing are incorrect, adjust the timing as just explained. If either low or high rpm ignition timing is correct but the other is not, examine the timing advancer mechanism (Pg. 182).



Table B3 Timing Advancing

	Engine Speed
Timing Advancing Begins	1,200~1,800 rpm
Timing Advancing Finishes	2,800~3,200 rpm

- Remove the timing inspection cover, and install the dynamo cover.

CAUTION **Before installing the dynamo cover screws (3), place the O rings under the screw heads to prevent O ring damage and oil leaks (Fig. B9).**

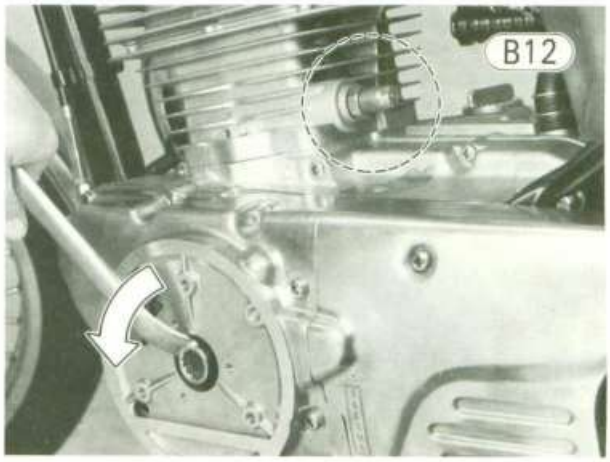
CAMSHAFT CHAIN

Camshaft chain and chain guide wear cause the chain to develop slack, which will cause noise and may result in engine damage. To keep the chain from making noise, periodic adjustment is necessary in accordance with the Periodic Maintenance Chart (Pg. 10).

However, if the adjustment fails to keep the chain from making noise, the camshaft chain or chain guides have probably worn past their service limits and will need to be replaced.

WARNING **To avoid a serious burn, never touch a hot engine or exhaust pipe during camshaft chain adjustment.**

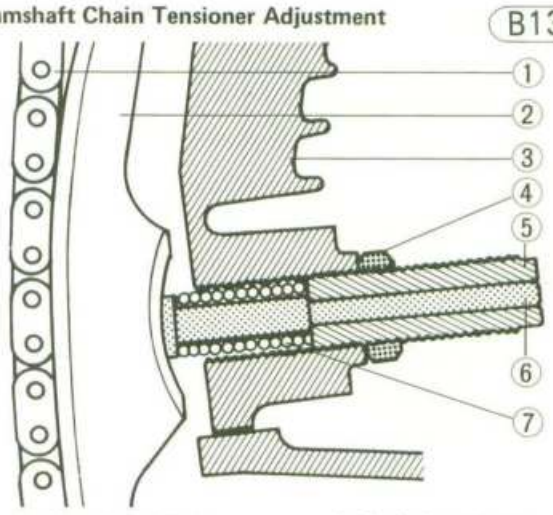
- Remove the chain tensioner cap and O ring.
- Remove the dynamo cover.
- Turn the crankshaft counterclockwise while watching the push rod (in the center of the push rod guide) move in and out. Continue turning the crankshaft counterclockwise until the push rod again reaches the innermost position, and then stop.



NOTE: Do not turn the crankshaft backwards (clockwise). Turning the crankshaft backwards may cause improper adjustment.

- Loosen the locknut, and turn in the push rod guide until the ends of the push rod guide and push rod are flush.

Camshaft Chain Tensioner Adjustment



1. Camshaft Chain
2. Chain Guide
3. Cylinder Block
4. Locknut
5. Push Rod Guide
6. Push Rod
7. Spring

CAUTION **Be sure that the ends are flush. If the push rod guide is overtightened so that the push rod sticks out even 1.2 mm, the tensioner or chain may become damaged.**

- Tighten the locknut with 1.8 kg-m (13.0 ft-lbs) of torque, and install the chain tensioner cap and O ring with 1.5 kg-m (11.0 ft-lbs) of torque.
- Install the dynamo cover.

CAUTION **Before installing the dynamo cover screws (3), place the O rings under the screw heads to prevent O ring damage and oil leaks (Fig. B9).**

VALVE CLEARANCE

Valve and valve seat wear decreases valve clearance, upsetting valve timing. If valve clearance is left unadjusted, the wear will eventually cause the valves to remain partly open; which lowers performance, burns the valves and valve seats, and may cause serious engine damage.

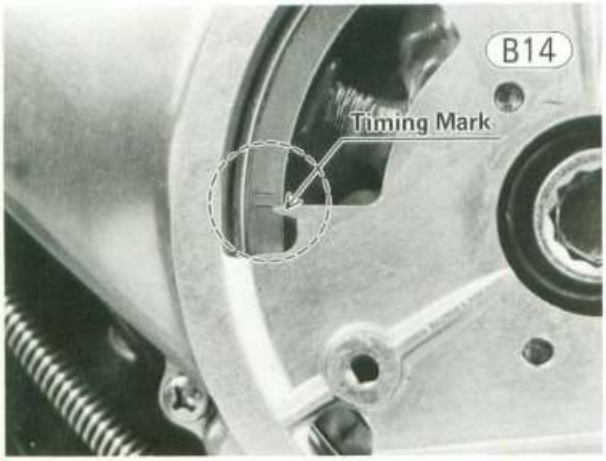
Valve clearance for each valve should be checked and adjusted if incorrect, in accordance with the Periodic Maintenance Chart (Pg. 10) and any time clearance may have been affected by disassembly.

When carrying out adjustment, be careful to adjust within the specified clearance. Adjusting to a larger value will both disturb valve timing and cause engine noise.

NOTE: Valve clearance must be checked when the engine is cold.

To check and adjust the valve clearance:

- Remove the fuel tank (Pg. 39).
- Remove the valve adjusting caps.
- Remove the dynamo cover.
- Turn the crankshaft counterclockwise while watching the movement of the inlet valve (the valve to the rear). When the valve has just finished opening and closing (moving downward and returning upward), turn the crankshaft in the same direction (counterclockwise) for about another ½ turn until the "T" mark on the dynamo flywheel aligns with the timing mark on the left engine cover as shown.

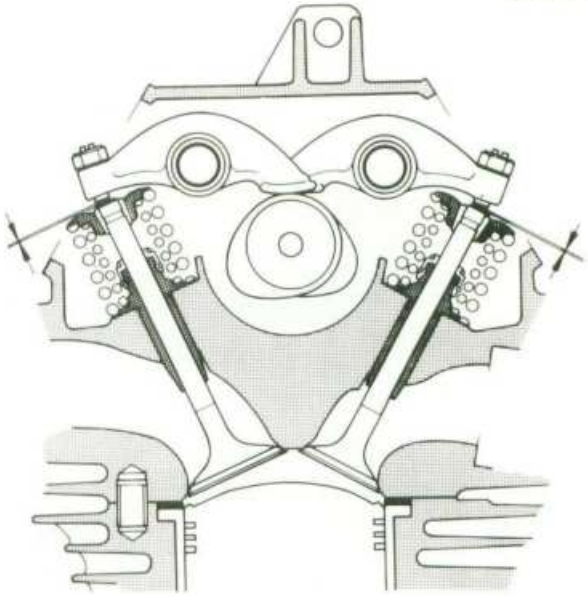


- Measure the clearance of each valve by inserting a thickness gauge between the adjusting screw and the valve stem. The correct clearance for the inlet valve is 0.08~0.13 mm, and for the exhaust valve is 0.17~0.22 mm (Fig. B15).
- If a valve clearance is incorrect, loosen its adjusting screw locknut, turn the adjusting screw until correct clearance is obtained.
- Tighten the locknut with 1.5 kg-m (11.0 ft-lbs) of torque.
- Install the valve adjusting caps.
- Install the dynamo cover.

CAUTION **Before installing the dynamo cover screws (3), place the O rings under the screw heads to prevent O ring damage and oil leaks (Fig. B9).**

- Install the fuel tank (Pg. 39).

Valve Clearance Measurement B15

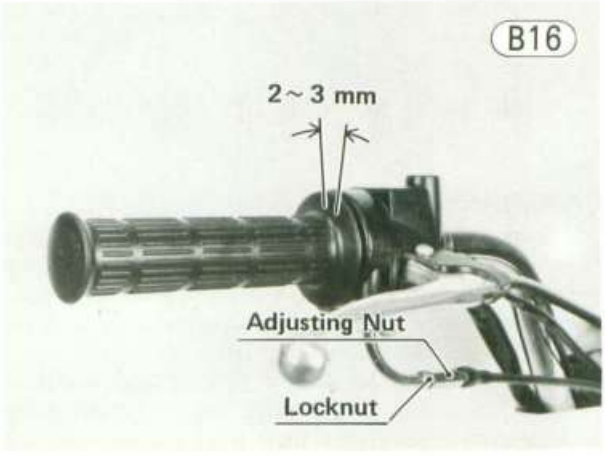


THROTTLE CABLE

The throttle cable controls the carburetor throttle valve. Excessive play in the throttle grip will cause a delay in throttle response, especially at low rpm. Also, the throttle valve may not open fully at full throttle. On the other hand, if there is no play, the throttle will be hard to control, and the idling speed will be erratic.

To adjust the throttle cable play:

- Loosen the locknut at the throttle grip end of the throttle cable.
- Turn the adjusting nut until 2~3 mm of throttle grip play is obtained. Tighten the locknut.



CARBURETOR

Although some internal carburetor parts can be adjusted by replacement, repositioning, etc., these adjustments are covered in the maintenance section of this manual. The following procedure covers the

idling adjustment, which should be inspected during periodic maintenance or whenever the idle setting has been disturbed.

When the idle speed is too low, the engine may stall; when the idle speed is too high, fuel consumption becomes excessive, and the resulting lack of engine braking may make the motorcycle difficult to control.

The following procedure consists of two parts: preliminary checks and idling adjustment.

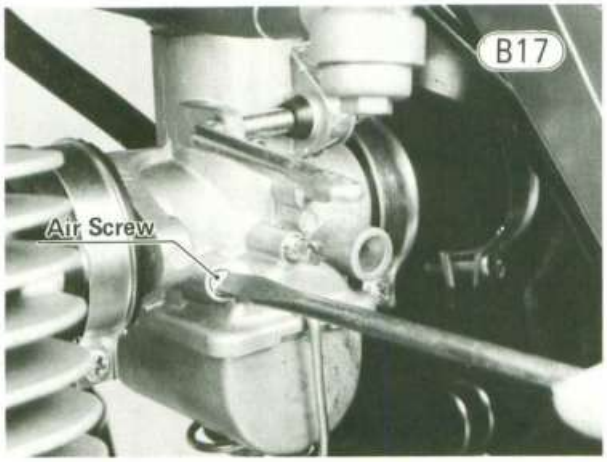
Preliminary Checks:

- In order to obtain correct idling adjustment, first check the following and correct if necessary.

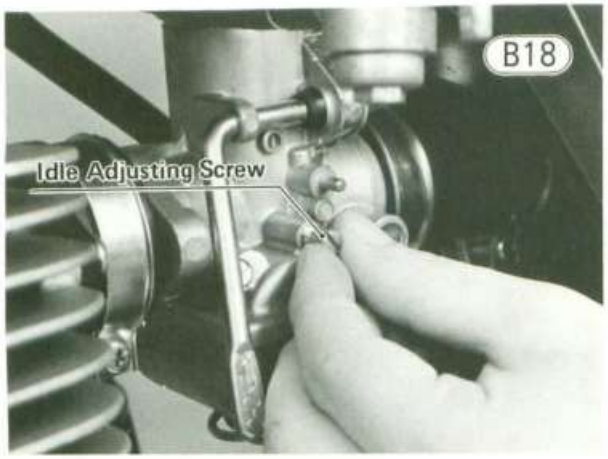
Engine Oil (Pg. 18)
Spark Plug (Pg. 12)
Ignition Timing (Pg. 12)
Throttle Cable (Pg. 16)
Cylinder Compression (Pg. 137)
Air Cleaner Element (Pg. 123)
Air Cleaner Duct and Carburetor Holder Leakage (Pg. 40)
Camshaft Chain (Pg. 15)
Valve Clearance (Pg. 16)

Idling Adjustment:

- Turn in the air screw until it seats lightly, and then back it out 1¼ turns.



- Start the engine, and warm it up for 5 minutes.
- Adjust idle speed to 1,100 ~ 1,300 rpm by turning the idle adjusting screw



- Open and close the throttle a few times to make sure that the idle speed does not change. Readjust if necessary.

NOTE: With the engine idle, turn the handlebar to each side. If handlebar movement changes idle speed, the throttle cable may be improperly adjusted or incorrectly routed, or it may be damaged.

WARNING **Operation with an improperly adjusted, incorrectly routed, or damaged cable could result in an unsafe riding condition.**

CLUTCH

Clutch cable stretch causes the clutch lever to develop excessive play. Too much play will prevent complete disengagement and may result in shifting difficulty and possible clutch and transmission damage. Most of the play must be adjusted out, but a small amount must remain so that the clutch release lever will function properly.

Clutch plate wear also causes the clutch to go out of adjustment. This wear causes the play between the push rod and the rack to gradually diminish until the push rod touches the rack. When this play is lost, the clutch will not engage fully, causing the clutch to slip.

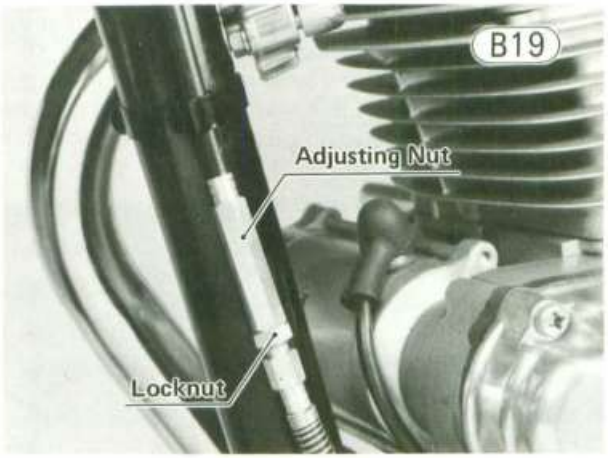
NOTE: Even though the proper amount of play exists at the clutch lever, clutch lever play alone cannot be used to determine whenever or not the clutch requires adjustment.

The following adjustment procedure follows compensates for both cable stretch and plate wear.

WARNING **To avoid a serious burn, never touch a hot engine or exhaust pipe during clutch adjustment.**

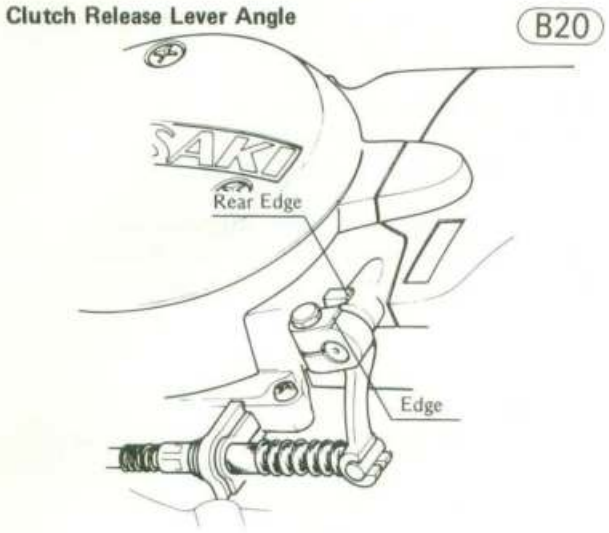
To adjust the clutch:

- Turn in fully the locknut and adjusting nut at the center of the clutch cable to give the cable plenty of play.

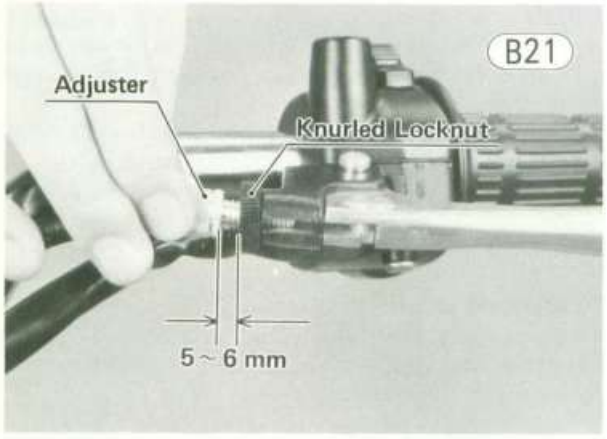


- Turn the clutch release lever until it becomes hard to turn. This is the point where the clutch is just starting to release. Check that the edge on the clutch release lever is directly below the rear edge on the left engine cover boss (Fig. B20).

Clutch Release Lever Angle



- If it does not, remove the clutch release lever bolt, and remount the clutch release lever at a new position on the shaft to obtain the proper angle.
- Loosen the knurled locknut at the clutch lever just enough so that the adjuster will turn freely, and then turn the adjuster to make a 5 ~ 6 mm gap between the adjuster and locknut.

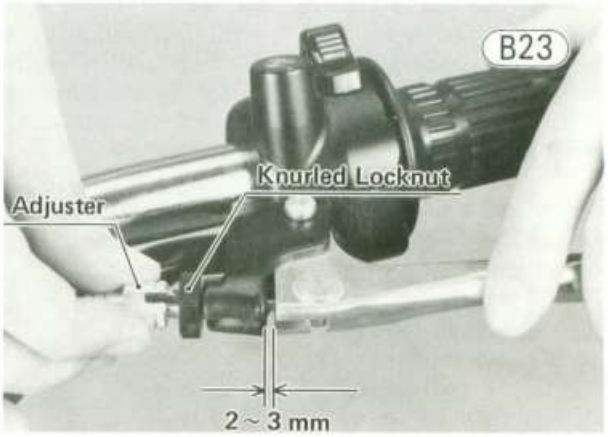


- Take up all the cable play with the adjusting nut at the center of the cable, and then tighten the locknut.

WARNING **Be sure the cable is fully seated in the left engine cover bracket, or it could slip into place later, creating enough cable play to prevent clutch disengagement.**



- Turn the adjuster at the clutch lever so that the clutch lever will have 2 ~ 3 mm of play, and tighten the knurled locknut.



ENGINE OIL

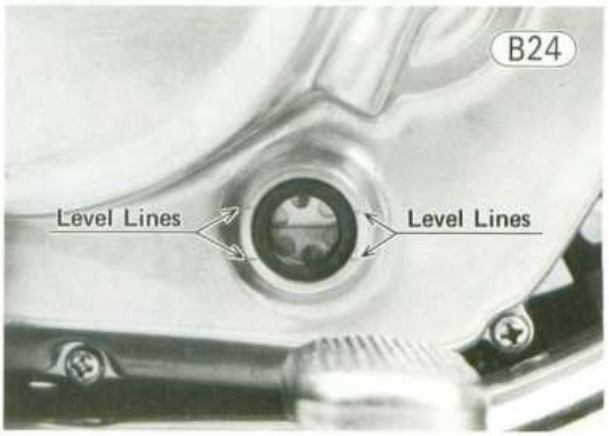
In order for the engine, transmission, and clutch to function properly; maintain the engine oil at the proper level, and change the oil in accordance with the Periodic Maintenance Chart (Pg. 10). Motorcycle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine or transmission seizure.

Oil Level

- Situate the motorcycle so that it is perpendicular to the ground (on its center stand).
- If the oil has just been changed, start the engine and run it for several minutes at idle speed. This fills the oil filter with oil. Stop the engine, then wait several minutes until the oil settles.

CAUTION **Run the engine at idle speed for several minutes. Racing the engine before the oil reaches every part can cause engine seizure.**

- If the motorcycle has just been used, wait several minutes for all the oil to drain down.
- Check the engine oil level through the inspection window in the lower right side of the engine. With the motorcycle held level or on the center stand, the oil level should come up between the lines next to the window.



- If the oil level is too high, remove the excess oil, using a syringe or some other suitable device.
- If the amount of oil is insufficient, add the correct amount of oil through the oil filler opening. Use the same type and make of oil that is already in the engine.

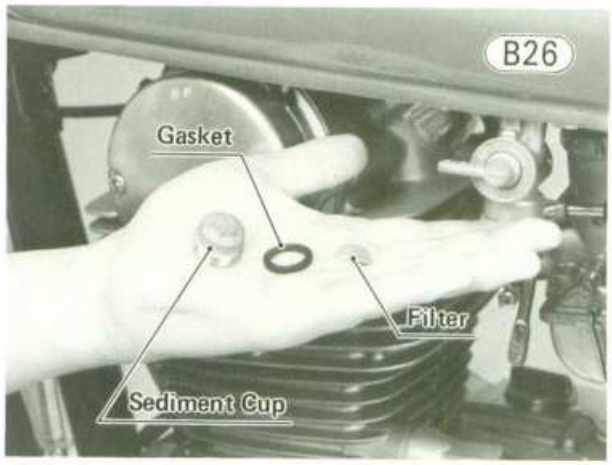
Oil and Oil Filter Change

- Warm up the engine thoroughly, and then stop the engine.
- Set the motorcycle up on its center stand, place an oil pan beneath the engine, and remove the engine drain plug.

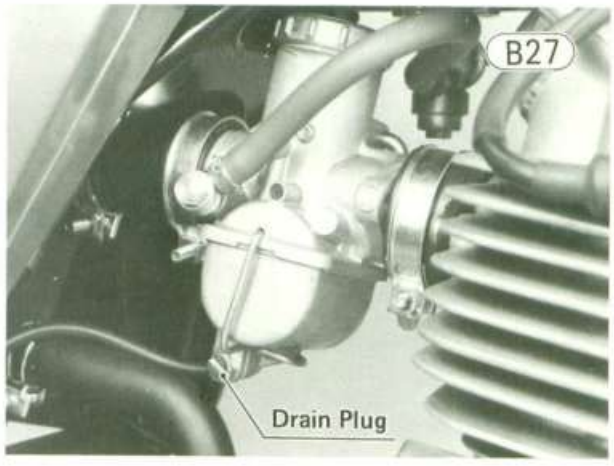


- If the oil filter is to be changed, remove the oil filter (Pg. 61), and replace it with a new one.
- Install the oil filter (Pg. 62).
- After the oil has completely drained out, install the drain plug and a new aluminum washer. Proper torque for the engine drain plug is 1.5 kg-m (11.0 ft-lbs).
- Fill the engine up to the upper level with SE class SAE 10W40, 10W50, 20W40, or 20W50 motor oil. It will take about 1.4 liters when the filter is changed. When the filter is not changed, a refill takes about 1.1 liters.

NOTE: After the engine has been run and then stopped for a few minutes, the oil level should be between the upper and lower marks.



- If there was water inside the sediment cup, there may also be some in the fuel tank. Holding a container under the fuel tap, turn the tap to the reserve position to drain the tank until only gasoline comes out, and then close the tap.
- Install the gasket and the sediment cup. Make sure that the gasket is in the tap and that the filter is not damaged during installation.
- Remove the drain plug from the bottom of the carburetor float bowl to drain the bowl.



FUEL SYSTEM

Water or dirt anywhere in the fuel system can cause starting difficulty, poor running, and lack of power.

Clean out the fuel system as follows:

- Turn the fuel tap to the "OFF" position. Unscrew the sediment cup at the bottom of the tap, and clean out the water or dirt from it. Clean any dirt out of the fuel tap filter.

Adjustment – Chassis

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REAR SHOCK ABSORBERS

The rear shock absorbers can be adjusted to one of five positions to suit riding conditions. They can be left soft for average riding but should be adjusted harder for high speed riding, or riding with a passenger. Shock absorbers adjusted either too soft or too hard adversely affect riding comfort and stability.

To adjust the rear shock absorbers:

- Turn the adjusting sleeve on each shock absorber to the desired position with a hook spanner. The higher the adjusting sleeve is positioned, the stronger the spring tension, and the harder the ride.



- Check to see that both adjusting sleeves are turned to the same relative position.

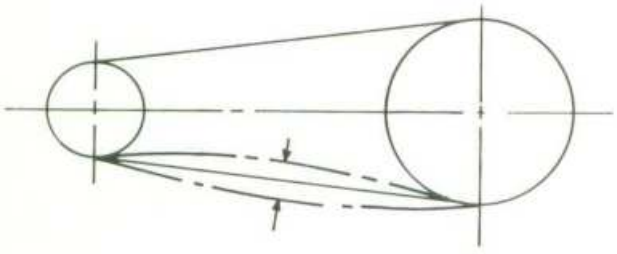
WARNING **If the shock absorber sleeves are not adjusted to the same position, an unsafe riding condition may result.**

DRIVE CHAIN

Chain and sprocket wear causes the chain to loosen, which results in power loss, accelerated chain and sprocket wear, and increased noise. A chain that has been adjusted too loose may be thrown off the sprockets. A chain that has been adjusted too tight will wear excessively and possibly break.

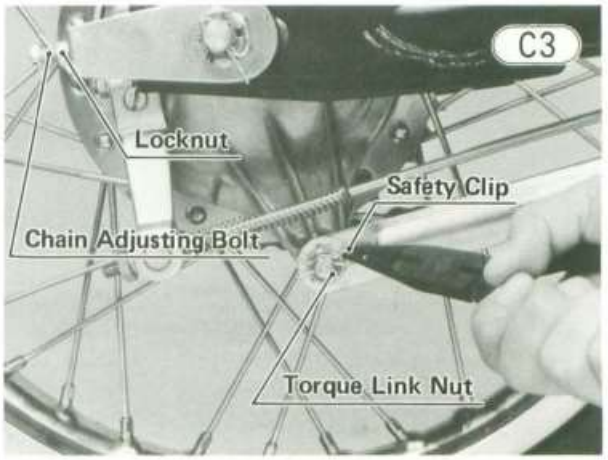
- To determine whether or not the chain requires adjustment, first set the motorcycle up on its center stand. Rotate the rear wheel to find the position where the chain is tightest, and measure the vertical movement midway between the sprockets. If it is less than 15 mm or more than 35 mm, adjust the chain so that the vertical movement will be about 20~30 mm.

Drive Chain Slack C2

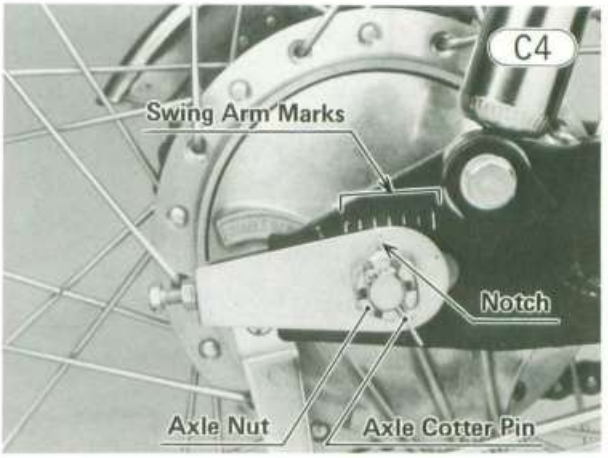


WARNING **A chain worn past the service limit (Pg. 161) must be replaced. Such wear cannot be adequately compensated for by adjustment.**

- Remove the safety clip, and loosen the nut at the rear end of the torque link.



- Loosen the left and right chain adjuster locknuts.
- Remove the axle cotter pin, and loosen the axle nut.



- If the chain is too tight, back out the left and right chain adjusting bolts evenly, and kick the wheel forward until the chain is too loose.
- Turn the left and right chain adjusting bolts evenly until the drive chain has the correct amount of slack. To keep the chain and wheel aligned, the notch on the left chain adjuster should align with the same swing arm mark that the right chain adjuster notch aligns with.

NOTE: Wheel alignment can also be checked using the straightedge or string method.

WARNING **Misalignment of the wheel will result in abnormal wear, and may result in an unsafe riding condition.**

- Tighten both chain adjuster locknuts (Make sure the axle stays aligned).
- Center the brake panel assembly in the brake drum. This is done by tightening the axle lightly, spinning the wheel, and depressing the brake pedal forcefully. The partially tightened axle allows the brake panel assembly to center itself within the brake drum.

NOTE: This procedure can prevent a soft, or "spongy feeling" brake.

- Tighten the axle nut with 9 kg-m (65 ft-lbs) of torque.
- Rotate the wheel, measure the vertical movement again at the tightest position, and readjust if necessary.
- Insert a new cotter pin through the axle nut and axle, and spread its ends.
- Tighten the torque link rear nut with 3.0 kg-m (22 ft-lbs) of torque, and then insert the safety clip.

BRAKES

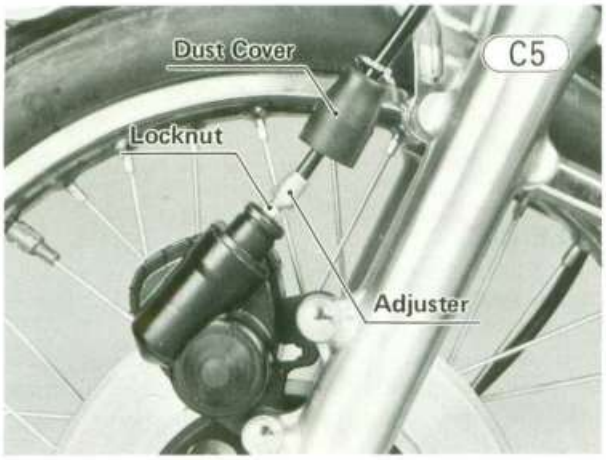
Front Brake

Disc and disc pad wear is automatically compensated for and has no effect on the brake lever action. However, the brake lever may occasionally require adjustment due to stretch of the brake cable. Excessive play must be taken up to keep the lever from vibrating and to keep the braking action lag time to a minimum, but enough play must be left to ensure a full braking stroke.

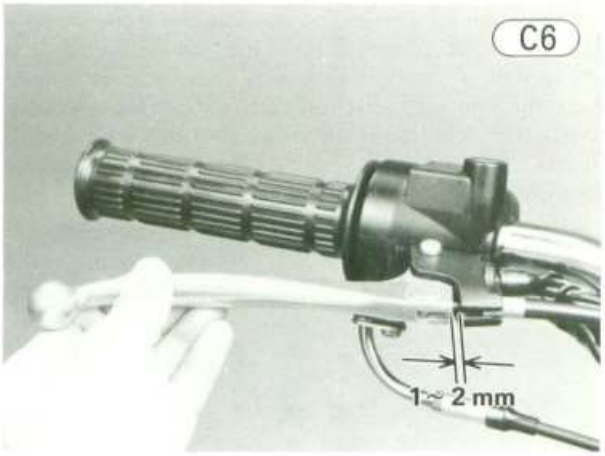
NOTE: Adjustment after the pad replacement or caliper disassembly is explained in each procedure.

To adjust the brake lever:

- Slide the dust cover, and loosen the locknut at the caliper.



- Turn the adjuster at the caliper so that the brake cable has 1~2 mm of play and tighten the locknut.



- Slide back the dust cover.

Rear Brake

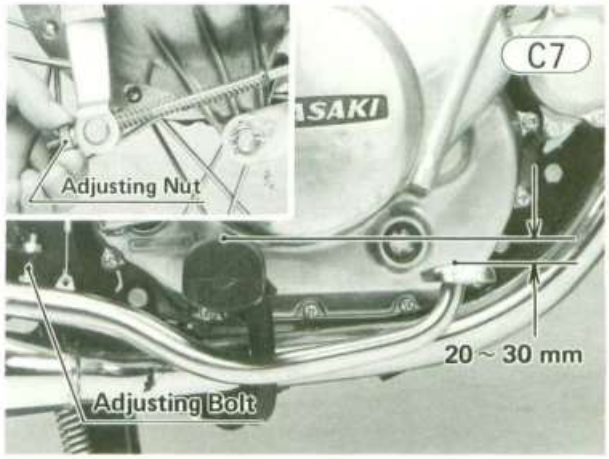
Brake lining and drum wear causes the rear brake to go out of adjustment, increasing pedal play and decreasing braking effectiveness. Rear brake adjustment to compensate for this actually consists of three successive adjustments: brake pedal position, cam lever angle, and brake pedal travel.

If brake drag is detected during brake adjustment, disassemble the brake (Pg. 102), and inspect for wear or damage (Pg. 164). Also, if the brake pedal does not return to its rest position quickly upon release, inspect the brake for wear or damage. If the brake has a soft, or "spongy feeling", make sure the brake panel is properly centered (Pg. 22).

On the outside of the rear brake panel there is a brake lining wear indicator. Whenever the indicator has gone past USABLE RANGE, the brake shoes must be immediately replaced and the other brake parts examined. Adjustment alone cannot compensate for the wear of a brake worn past USABLE RANGE.

Brake Pedal Position

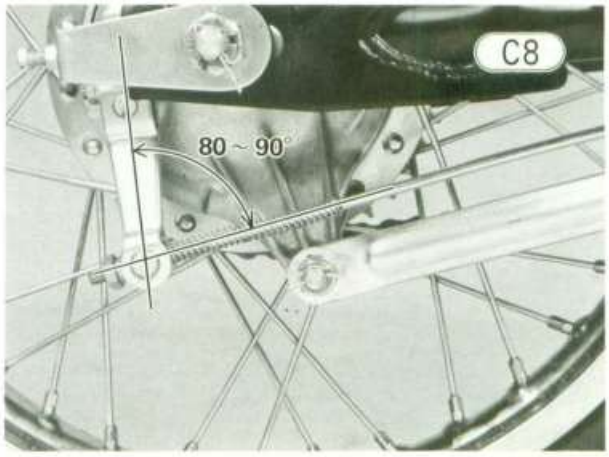
- When the brake pedal is in its rest position, it should be 20~30 mm lower than the top of the footpeg. If it is too high, turn out the adjusting nut to give the brake pedal plenty of play. If it is too low, go to the next step.



- Loosen the brake pedal adjusting bolt locknut, turn the adjusting bolt to obtain the correct pedal position, and tighten the locknut.

Cam Lever Angle

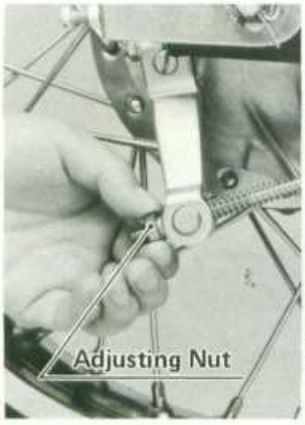
- When the brake is fully applied, the brake cam lever should come to an 80~90° angle with the brake rod. If it does not, remove the cam lever, and then remount it at a new position on the shaft for the proper angle.



WARNING **Since a cam lever angle greater than 90° reduces braking effectiveness, this adjustment should not be neglected. When remounting the lever, be sure that the position of the indicator on the serrated shaft is not altered. A change in cam lever angle is caused by wear of internal brake parts. Whenever the cam lever angle is adjusted, also check for drag and proper pedal operation, taking particular note of the brake lining wear indicator position. In case of doubt as to braking effectiveness, disassemble and inspect all internal brake parts. Worn parts could cause the brake to lock or fail.**

Brake Pedal Travel

- Turn the adjusting nut on the end of the brake rod so that the brake pedal has 20~30 mm of travel from the rest position to the fully applied position when the brake pedal is pushed down lightly by hand.



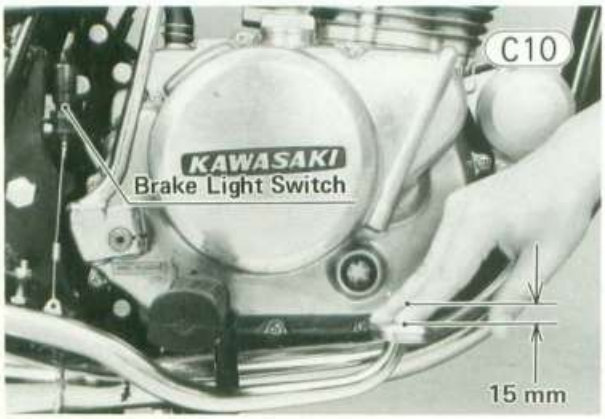


- Rotate the rear wheel to check for brake drag.
- Operate the pedal a few times to see that it returns to its rest position immediately upon release.
- Check the rear brake light switch operation.

BRAKE LIGHT SWITCH

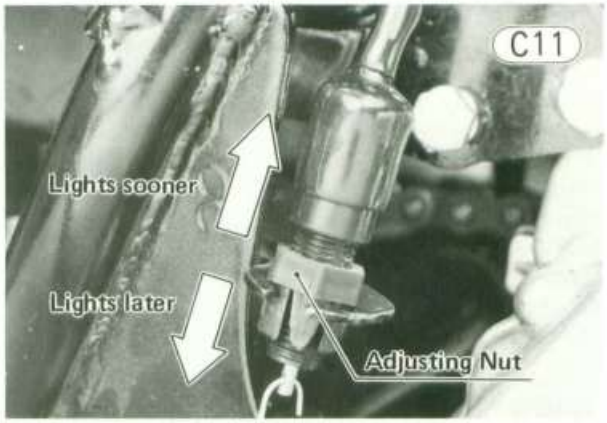
The front brake light switch, mounted on the front brake lever bracket, is operated by simple electrical contact and should not need adjustment. However, the rear brake light switch, activated by a spring attached to the brake pedal, requires periodic adjustment to compensate for any change in spring tension or brake adjustment.

- Check the operation of the switch by turning on the ignition switch and depressing the brake pedal. The brake light should go on after 15 mm of pedal travel.



- Adjust the switch so that the brake light will go on after the proper amount of brake pedal travel. Raising the switch will make the light go on after less travel; lowering it will require more travel. Adjustment is made by altering the position of the adjusting nut on the brake switch body.

CAUTION **To avoid damaging the electrical connections inside the switch, do not turn the switch body during adjustment.**

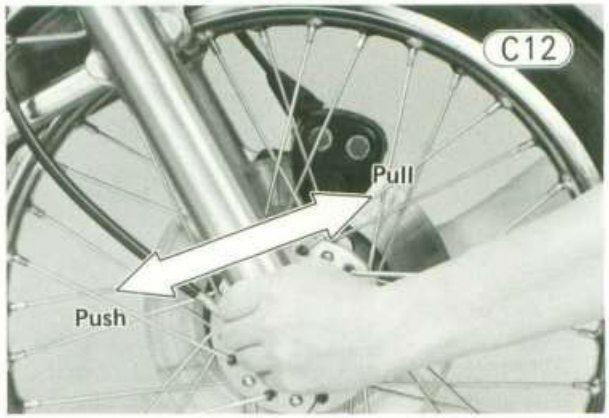


STEERING

For safety, the steering should always be kept adjusted so that the handlebar will turn freely but have no play.

If the steering is too tight; it will be difficult to turn the handlebar quickly, the motorcycle may pull to one side, and the steering stem bearings may become damaged. If the steering is too loose; the handlebar will vibrate and the motorcycle will be unstable and difficult to steer in a straight line.

To check the steering adjustment, first place a stand or block under the engine so that the front wheel is raised off the ground. Push the handlebar lightly to either side; if it continues moving under its own momentum, the steering is not too tight. Squatting in front of the motorcycle, grasp the lower ends of the front fork at the axle, and push and pull the fork end back and forth; if play is felt, the steering is too loose.



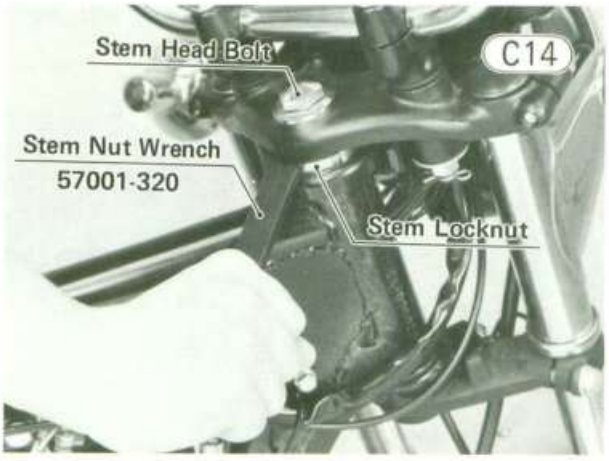
To adjust the steering:

- Put the motorcycle up on its center stand, and jack or prop up the engine so that the front wheel is off the ground.
- Remove the fuel tank (Pg. 39) to avoid damaging the painted surface.
- Loosen the front fork lower clamp bolts (2) to free the fork tubes from the steering stem during adjustment.



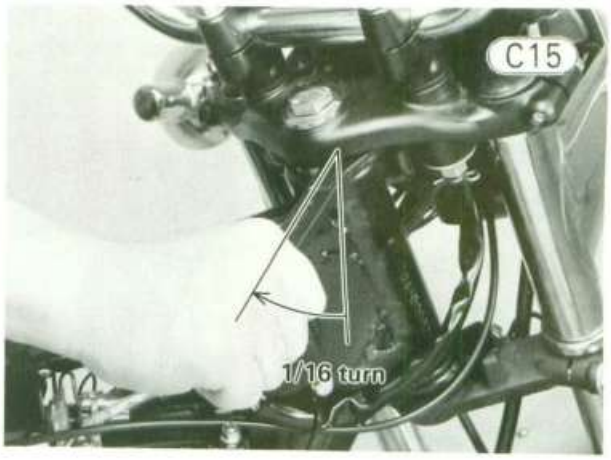
- Loosen the steering stem head bolt, and back out the steering stem locknut using the stem nut wrench (special tool) 1 or 2 turns until it turns without drag.

NOTE: Do not back out the steering stem locknut more than a couple of turns. An excessive turning back of the stem locknut may up set the steering stem bearing ball arrangement, and may need steering stem removal and installation to correct the bearing ball disposition.



- Tighten the stem locknut with 2.0 kg-m (14.5 ft-lbs) of torque.

NOTE: If a suitable torque wrench is not available, successful result is obtained to torque the steering stem locknut by the following procedure. Tighten the steering stem locknut lightly by turning until it just becomes hard to turn, and then continue for another 1/16 turn (about 20° travel) from that point.



- Tighten the steering stem head bolt with 2.5 kg-m (18.0 ft-lbs) of torque.
- Tighten the lower clamp bolts(2) with 3.0 kg-m (22 ft-lbs) of torque.
- Check the steering again. If the steering is too tight or too loose in spite of correct adjustment, inspect the steering stem parts according to the maintenance section (Pg. 166).
- Remount the fuel tank (Pg. 39).

WHEEL BALANCE

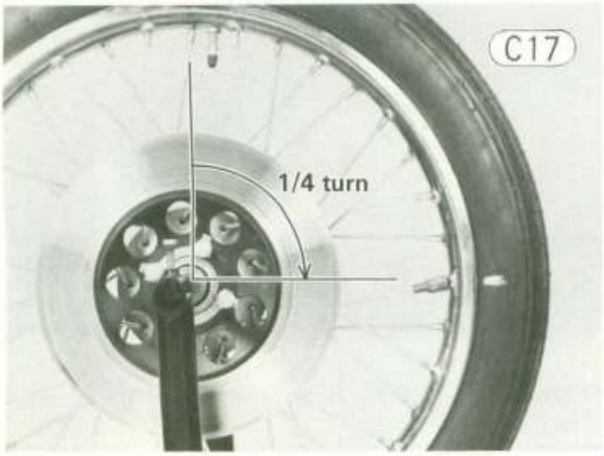
To improve stability and decrease vibration at high speed, the front and rear wheels must be kept balanced.

Check and balance the wheels when required, or when a tire is replaced with a new one:

- Remove the wheel (Pgs. 95, 101).
- Check that all the spokes are tightened evenly and the rim runout is within the service limit (Pg. 159).
- Suspend the wheel so that it can be spun freely.
- Spin the wheel lightly, and mark the spoke at the top when the wheel stops.
- Repeat this procedure several times. If the wheel stops of its own accord in various positions, it is well balanced.
- However, if the wheel always stops in one position, attach a balance weight loosely to the marked spoke.



•Rotate the wheel ¼ turn, and see whether or not the wheel stays in this position. If it does, the correct balance weight is being used.



•If the wheel rotates and the weight goes up, replace the weight with the next heavier size. If the wheel rotates and the weight goes down, replace the weight with the next lighter size. Repeat these steps until the wheel remains at rest after being rotated ¼ turn.
•Rotate the wheel another ¼ turn and then another ¼ turn to see if the wheel is correctly balanced.
•Repeat the entire procedure as many times as necessary to achieve correct wheel balance, and then clamp on the balance weights firmly using pliers.
•Mount the wheel back onto the motorcycle (Pgs. 95, 101).

NOTES: 1. Balance weights are available from Kawasaki Dealers in 5, 10, 20, and 30 gram sizes. An imbalance of less than 10 grams will not usually affect running stability.
2. When removing a tire from a rim, mark the valve stem location on the tire so that it can be installed in the same position.
3. When installing a new tire, be sure to go through the balancing procedure.
4. If a new tire is installed, the yellow paint mark on the tire should be aligned with the valve stem for best balancing results.

HEADLIGHT

The headlight beam is adjustable both horizontally and vertically. If not properly adjusted horizontally, the beam will point to one side rather than straight ahead. If adjusted too low vertically, neither low nor high beam will illuminate the road far enough ahead. If adjusted too high vertically, high beam will fail to illuminate the road close ahead, and low beam will blind oncoming drivers.

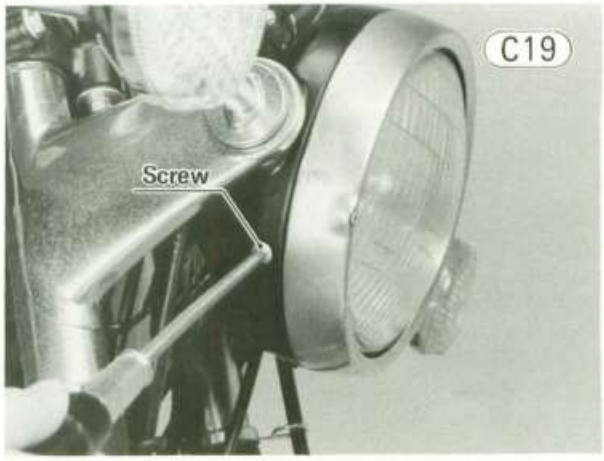
Horizontal Adjustment:

•Turn the small screw on the headlight rim in or out until the beam points straight ahead. Turning the adjusting screw clockwise makes the headlight beam point to the left.

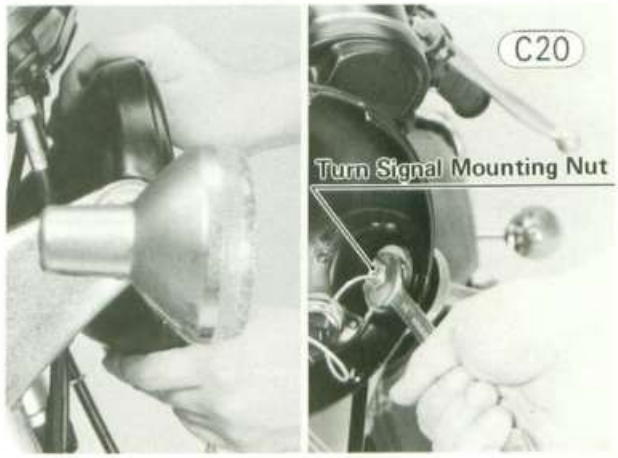


Vertical Adjustment:

•Remove the two screws from the lower side of the headlight housing, and drop out the headlight unit.



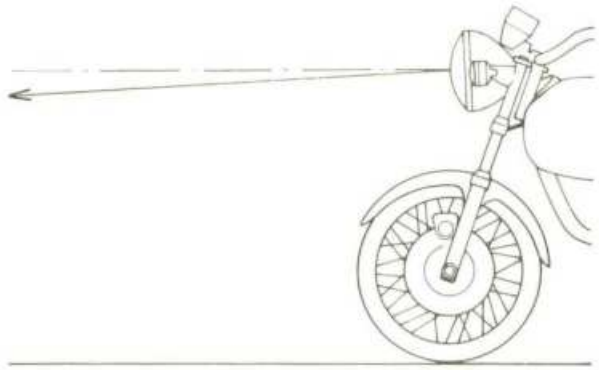
•Loosen the turn signal mounting nuts, and adjust the headlight vertically.

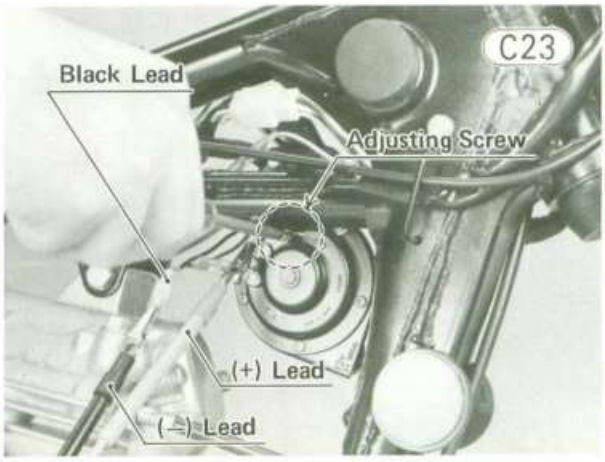


NOTE: On high beam, the brightest point should be slightly below horizontal. Adjust the headlight to the proper angle according to the regulation that applies to its operation.

•Tighten the turn signal mounting nuts and remount the headlight unit.

Headlight Vertical Adjustment C21





HORN

The horn contacts wear down after long use and may need to be adjusted from time to time. Turning in the adjusting screw compensates for contact wear. If satisfactory horn performance cannot be obtained by this adjustment when the rest of the electrical system is functioning properly, the horn must be replaced. It cannot be disassembled.

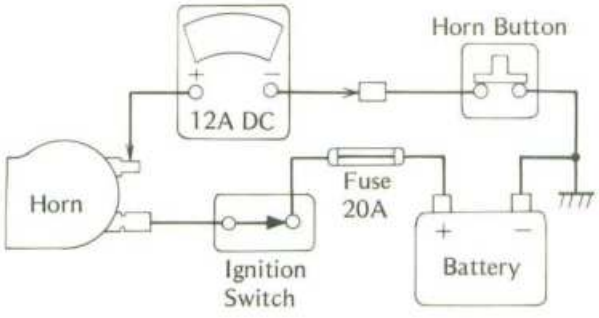
WARNING **To avoid serious burns, never touch the hot engine or exhaust pipe during horn adjustment.**

CAUTION **Do not turn the adjusting screw in too far, since doing so will increase horn current with the possibility of burning out the horn coil.**

To adjust the horn:

- Remove the fuel tank (Pg. 39).
- Remove the ignition coil (Pg. 40).
- Disconnect the horn black lead, and connect an ammeter in series to the horn circuit. The + ammeter lead goes to the horn terminal and the – ammeter lead to the black lead.

Horn Current Measurement C22



- Turn on the ignition switch, and keep the horn button pressed while turning the horn adjusting screw. Adjust for the best horn sound while keeping the current between 1.5~2.0 amperes.

NOTE: The horn will not sound properly if it is mounted incorrectly or if any cable or other part is touching it.

- Reconnect the horn lead.
- Install the ignition coil (Pg. 39).
- Install the fuel tank (Pg. 40).

LUBRICATION

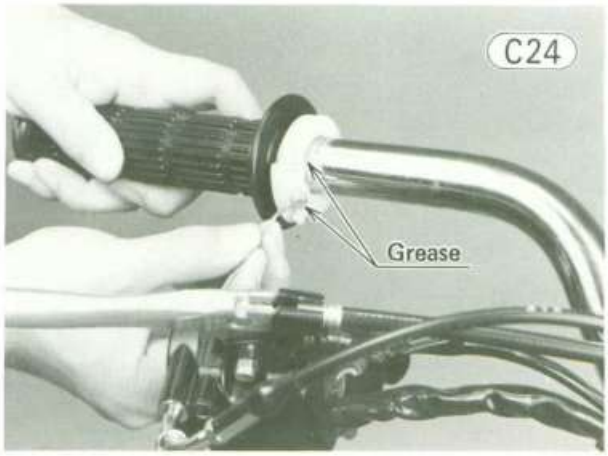
Lubrication of exposed parts subject to rust with either motor oil or regular grease should be carried out periodically and whenever the vehicle has been operated under wet or rainy conditions. Before lubricating each part, clean off any rusty spots with rust remover and wipe off old grease, old oil, and any dirt or grime.

Throttle Grip

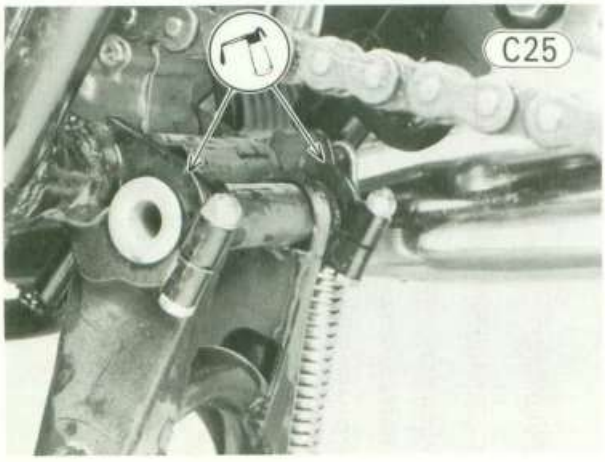
Apply grease to the handlebar where the throttle grip turns.

Apply a light coat of grease to the exposed portion of the throttle grip inner cable and its catch in the throttle grip.

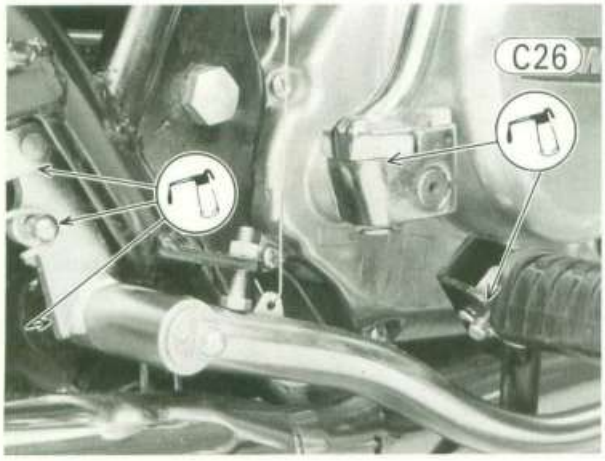
Fit the throttle cable into the throttle grip. Refer to throttle cable installation (Pg. 108).



Center Stand

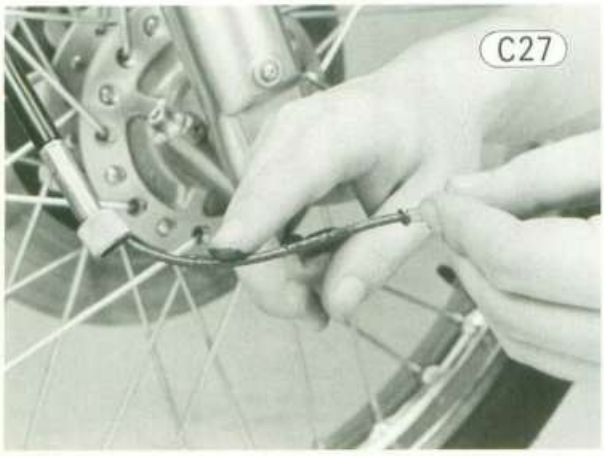


Kickstarter Pedal, Right Footpeg, Brake Pedal, and Brake Push Rod



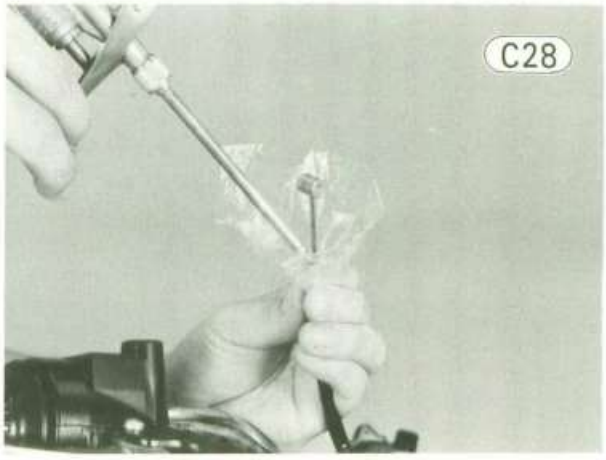
Speedometer and Tachometer Cables

Apply grease sparingly to their inner cables.

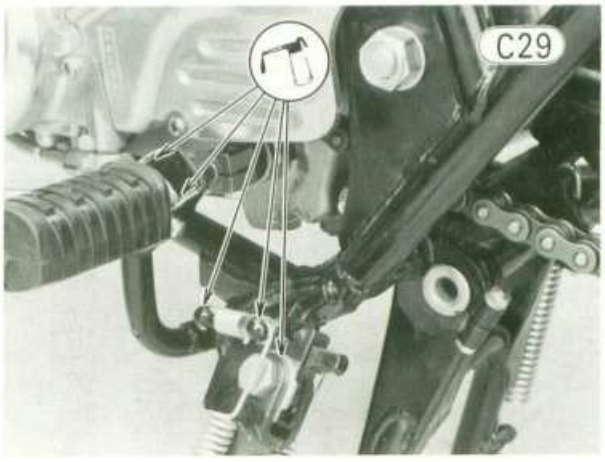


Clutch, Brake, and Throttle Cables

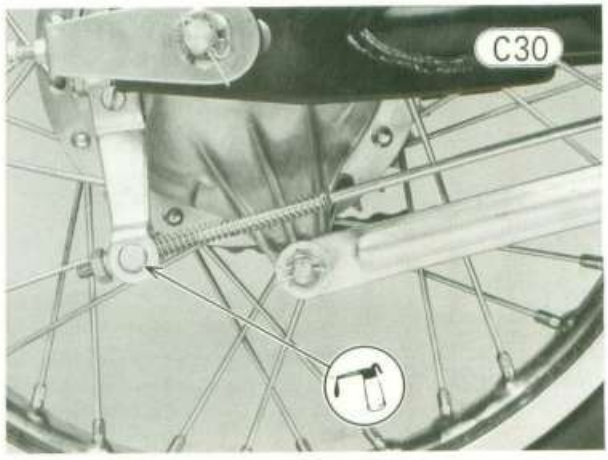
Lubricate the clutch cable, brake cable, and throttle cable, as shown in the figure. Refer to Pgs. 105, 106, and 107 for cable removal.



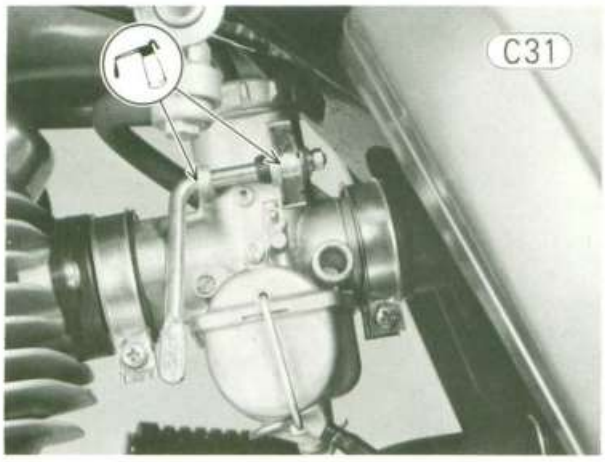
Left Footpeg, Side Stand



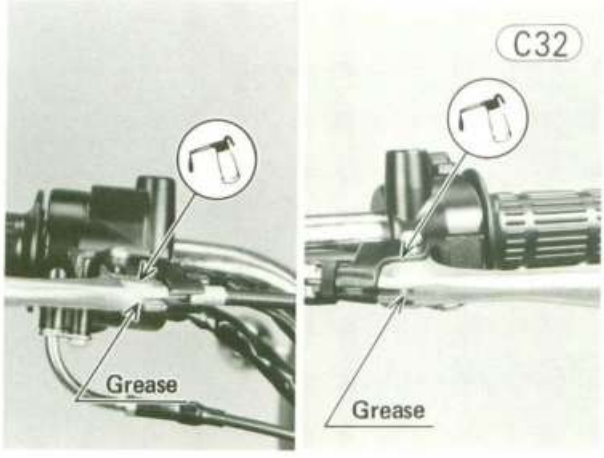
Brake Rod Joint



Carburetor Choke Lever



Clutch and Brake Levers



Others

Lubricate the drive chain, wheel bearings, speedometer gear housing, and steering stem bearings as explained in the Maintenance Section.

NOTE: A few drops of oil will help keep bolts and nuts from resting and sticking. This makes future removal easier. Badly rusted nuts, bolts etc. should be replaced with new ones.

Disassembly – Introduction

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D

INTRODUCTION TO DISASSEMBLY

Detail has not been spared in this section in order that the motorcycle can not only be taken apart but also put back together properly as well. Photographs, diagrams, notes, cautions, warnings, and detailed descriptions have been included wherever necessary. Nevertheless, even a detailed account has limitations; a certain amount of basic knowledge is also required for successful work.

Especially note the following:

(1) Edges

Watch for sharp edges, especially during major engine disassembly and assembly. Protect your hands with gloves or a piece of thick cloth when lifting the engine or turning it over.

(2) Dirt

Before removal and disassembly, clean the motorcycle. Any dirt entering the engine, carburetor or other parts will work as an abrasive and shorten the life of the motorcycle. For the same reason, before installing a new part, clean off any dust or metal filings.

(3) Tightening Sequence

Where there is a tightening sequence indication in this Service Manual; the bolts, nuts, or screws must be tightened in the order and method indicated. When installing a part with several bolts, nuts, or screws; they should all be started in their holes and tightened to a snug fit. Then tighten them evenly, according to the tightening sequence, to the specified torque. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely when loosening the bolts, nuts, or screws; loosen all of them about a quarter of turn and then remove them.

(4) Torque

The torque values given in this Service Manual should always be adhered to. Either too little or too much torque may lead to serious damage. Use a good quality, reliable torque wrench.

(5) Force

Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic-faced mallet. Use an impact driver for screws (particularly for the removal of screws held by a locking agent) in order to avoid damaging the screw heads.

(6) Lubricant

Don't use just any oil or grease. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended.

(7) Battery Ground

Before performing any disassembly operations on the motorcycle, remove the ground (–) lead from the battery to prevent the possibility of accidentally turning the engine over while partially disassembled.

(8) Engine Rotation

When turning the crankshaft by hand, always turn it in the direction of normal rotation; which is clockwise, viewed from the right side of the engine. This will ensure proper adjustments.

(9) Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have an adequate lubricative film. During assembly, oil should be applied to any bearing surface which has lost its lubricative film. Old grease and dirty oil should be cleaned off. Deteriorated grease has lost its lubricative quality and may contain abrasive foreign particles.

(10) Press

A part installed using a press or driver, such as a wheel bearing, should first be coated with oil on its outer or inner circumference so that it will go into place smoothly.

(11) Oil Seal, Grease Seal

An oil seal guide is required for certain oil seals during installation to avoid damage to the oil seal lips. Before a shaft passes through an oil seal, apply a little oil, preferably high temperature grease on the lips to reduce rubber to metal friction.

(12) Gasket, O Ring

When in doubt as to the condition of a gasket or O ring, replace it with a new one. The mating surfaces around the gasket should be free of foreign matter and perfectly smooth to avoid oil or compression leaks.

(13) Liquid Gasket, Non-permanent Locking Agent

Before using liquid gasket or non-permanent locking agent, wash or wipe the surfaces where liquid gasket or non-permanent locking agent are applied. Do not apply them excessively, because excessive amounts could block the engine oil passages and cause serious engine damage.

(14) Ball Bearing, Oil Seal, Grease Seal Installation

When installing a ball bearing, the bearing race which is affected by friction should be pushed by a suitable driver. This prevents severe stress on the balls and races, and prevents races and balls from being dented. Press a ball bearing until it stops at the stopper in the hole or on the shaft. Seals should be pressed into place using a suitable driver, which contacts evenly with the side of the seal until the face of the seal is even with the end of the hole.

TORQUE AND LOCKING AGENT

Tighten all bolts and nuts to the proper torque using an accurate torque wrench. If insufficiently tightened, a bolt or nut may become damaged or fall off, possible resulting in damage to the motorcycle and injury to the rider. A bolt or nut which is overtightening may become damaged, strip an internal thread, or break and then fall out. The following table lists the tightening torque for the major bolts and nuts, and the parts requiring use of a non-permanent locking agent:

When checking the tightening torque of the bolts and nuts, first loosen the bolt or nut by half a turn and then tighten to specified torque.

Engine Part	Locking Agent (•)	Quantity	Metric (kg-m)	English (ft-lbs)	See Pg.
Camshaft chain guide bolt (rear) ϕ6 P1.0	–	1	0.90	78 in-lbs	80
Camshaft chain tensioner cap	–	1	1.5	11.0	15
Camshaft chain tensioner locknut ϕ14 P1.5	–	1	1.8	13.0	15
Camshaft sprocket bolts ϕ6 P1.0	–	2	1.5	11.0	46,85
Clutch spring bolts ϕ6 P1.0	–	5	1.0	87 in-lbs	65,82

Engine Part	Locking Agent (•)	Quantity	Metric (kg-m)	English (ft-lbs)	See Pg.
Contact breaker mounting plate screws ϕ6 P1.0	–	2	0.45	39 in-lbs	14,86
Crankshaft nut (right) ϕ16 P1.5	–	1	6.0	43	65,81
Cylinder bolt ϕ6 P1.0	–	1	1.2	8.5	49,85
Cylinder head bolts ϕ8 P1.25	–	4	2.6	19.0	49,85
Cylinder head bracket bolts ϕ8 P1.25	–	3	1.8	13.0	49,74
Dynamo flywheel bolt ϕ10 P1.25	–	1	6.0	43	58,81
Engine drain plug ϕ12 P1.5	–	1	1.5	11.0	19,61,72
Engine mounting bolts ϕ10 P1.25	–	2	3.0	22	74
ϕ8 P1.25	–	2	1.8	13.0	74
Engine mounting bracket bolts ϕ8 P1.25	–	4	1.8	13.0	74
Engine sprocket nut ϕ16 P1.5	–	1	8.0	58	54,84
Neutral indicator switch ϕ10 P1.25	–	1	1.5	11.0	60,80
Ratchet gear stop bolts ϕ6 P1.0	•	2	0.90	78 in-lbs	68
Shift drum bearing holder bolt ϕ8 P1.25	•	1	1.7	13.5	88
Spark plug ϕ14 P1.25	–	1	2.8	20	12
Starter clutch Allen bolts ϕ8 P1.25	•	3	3.5	25	58
Timing advancer bolt ϕ6 P1.0	–	1	0.90	78 in-lbs	44,85
Valve clearance adjusting screw locknuts ϕ6 P0.8	–	2	1.5	11.0	16

Frame Part	Locking Agent (•)	Quantity	Metric (kg-m)	English (ft-lbs)	See Pg.
Brake pedal pivot cap nut ϕ8 P1.25	–	1	1.8	13.0	–
Caliper holder shafts ϕ10 P1.25	–	2	3.1	22	99,100
Caliper mounting bolts ϕ10 P1.25	–	2	4.0	29	98,99,116
Caliper plug ϕ27 P1.0	–	1	2.5	18.0	107
Disc mounting bolts ϕ8 P1.0	–	4	2.0	14.5	96
Front axle clamp nuts ϕ8 P1.25	–	2	1.8	13.0	95
Front axle nut ϕ14 P1.5	–	1	8.0	58	95
Front brake adjusting screw locknut ϕ8 P1.25	–	1	0.90	78 in-lbs	98,99
Front fork bottom Allen bolts ϕ10 P1.0	•	2	1.8	13.0	118
Front fork clamp bolts					
upper ϕ8 P1.25	–	2	1.8	13.0	115,116,118
lower ϕ10 P1.25	–	2	3.0	22	25,115 116,118
Handlebar clamp bolts ϕ8 P1.25	–	4	1.8	13.0	113
Pad mounting screw ϕ6 P1.0	•	1	–	–	98,100
Rear axle nut ϕ14 P1.5	–	1	9.0	65	23
Rear shock absorber mounting bolts, nuts ϕ10 P1.5	–	4	3.0	22	119,120
Rear sprocket nuts ϕ8 P1.25	–	6	2.2	16.0	103
Spokes	–	72	0.30	26 in-lbs	105,159
Steering stem head bolt ϕ12 P1.25	–	1	2.5	18.0	25,115
Steering stem locknut ϕ25 P1.0	–	1	2.0	14.5	25
Swing arm pivot shaft nut ϕ14 P1.5	–	1	8.0	58	120
Torque link nuts ϕ10 P1.25	–	2	3.0	22	23,120

36 DISASSEMBLY–INTRODUCTION

The table below, relating tightening torque to thread diameter and pitch, lists the basic torque for the bolts and nuts used on Kawasaki Motorcycles. However, the actual torque that is necessary may vary among bolts and nuts with the same thread diameter and pitch. The bolts and nuts listed on Pg. 33 ~ 35 vary to a greater or lesser extent from what is given in this table. Refer to this table for only the bolts and nuts not included in the table on Pg. 33 ~ 35. All of the values are for use with dry solvent-cleaned threads.

Coarse threads

dia (mm)	pitch (mm)	kg-m	ft-lbs
5	0.90	0.35 ~ 0.50	2.5 ~ 3.5
6	1.00	0.6 ~ 0.9	4.5 ~ 6.5
8	1.25	1.6 ~ 2.2	11.5 ~ 16.0
10	1.50	3.1 ~ 4.2	22 ~ 30
12	1.75	5.4 ~ 7.5	39 ~ 54
14	2.00	8.3 ~ 11.5	60 ~ 83
16	2.00	13 ~ 18	94 ~ 130
18	2.50	18 ~ 25	130 ~ 181
20	2.50	26 ~ 35	188 ~ 253

Fine threads

dia (mm)	pitch (mm)	kg-m	ft-lbs
5	0.50	0.35 ~ 0.50	2.5 ~ 3.5
6	0.75	0.6 ~ 0.8	4.5 ~ 5.5
8	1.00	1.4 ~ 1.9	10.0 ~ 13.5
10	1.25	2.6 ~ 3.5	19.0 ~ 25
12	1.50	4.5 ~ 6.2	33 ~ 45
14	1.50	7.4 ~ 10.2	54 ~ 74
16	1.50	11.5 ~ 16	83 ~ 116
18	1.50	17 ~ 23	123 ~ 166
20	1.50	23 ~ 33	166 ~ 239

Disassembly – Engine Installed

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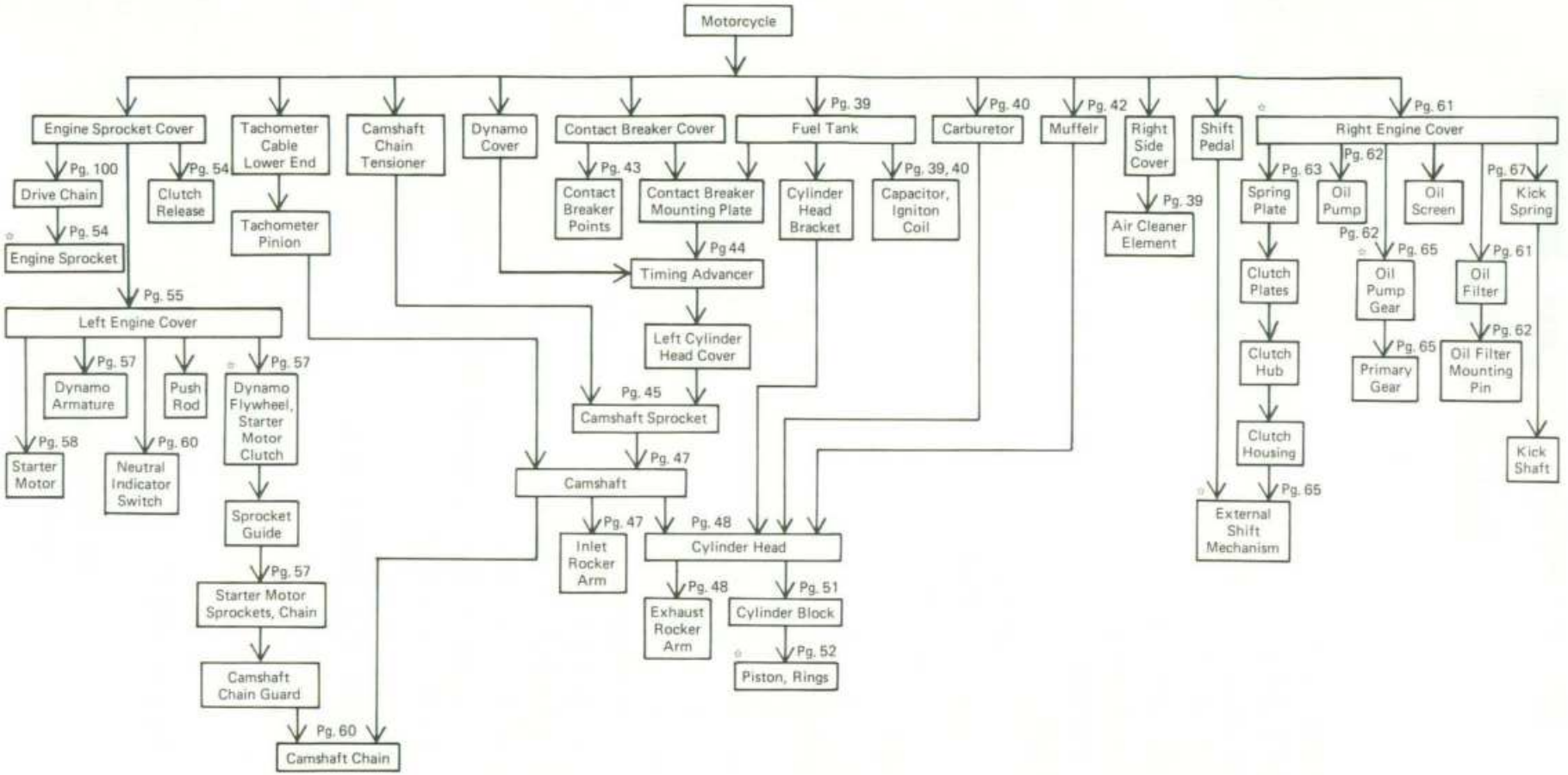
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E

FLOW CHART
Disassembly – Engine Installed

The following chart is intended to be aids to proper removal. Select the component you wish to remove and follow the arrows to that point on the chart.

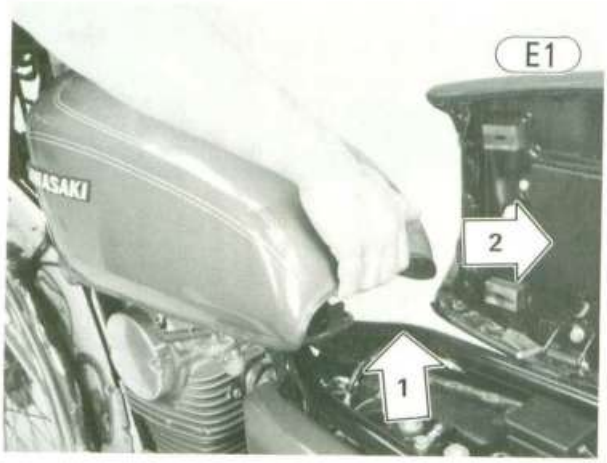


NOTES: 1. Before performing any disassembly operations, remove the ground (–) lead from the battery to prevent the possibility of accidentally turning the engine over.
2. Action with mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

FUEL TANK

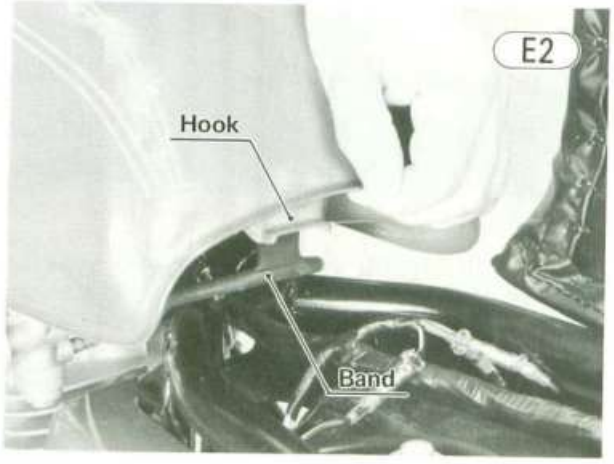
Removal:

- Turn the fuel tap to the "OFF" position, slide down the hose clamp, and pull the fuel hose off the tap.
- Unlock the seat, and swing it open.
- Unhook the rubber retaining band, lift up the rear end of the tank about 30 mm, and then pull the fuel tank off towards the rear.



Installation:

- Put on the fuel tank, and hook its retaining band.



- Fit the fuel hose back onto the fuel tap, and slide the clamp back into place.
- Push the seat back down.

AIR CLEANER ELEMENT

Removal:

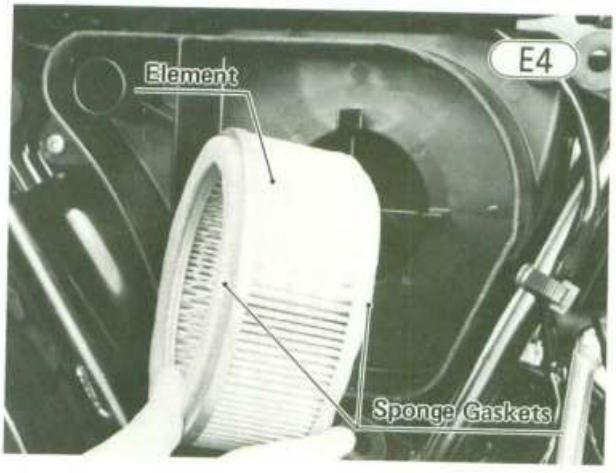
- Pull off the right side cover.
- Remove the wing nut, and pull off the air cleaner cover.



- Pull out the element.

Installation Note:

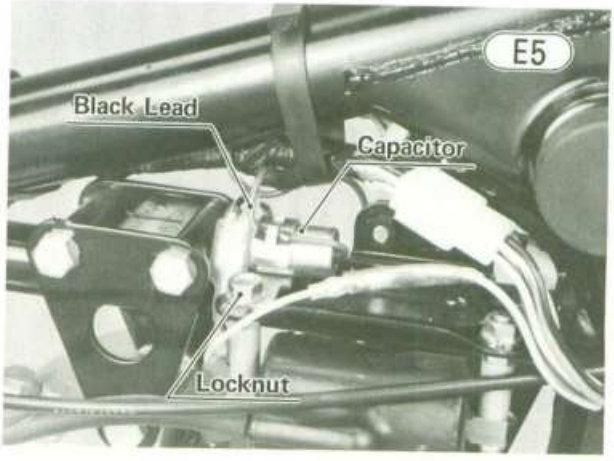
- Check to see that the sponge gasket is intact on each side.



CAPACITOR

Removal:

- Remove the fuel tank.
- Disconnect the capacitor black lead.



•Remove the locknut from the ignition coil mounting rear screw, and take off the capacitor.

IGNITION COIL

Removal:

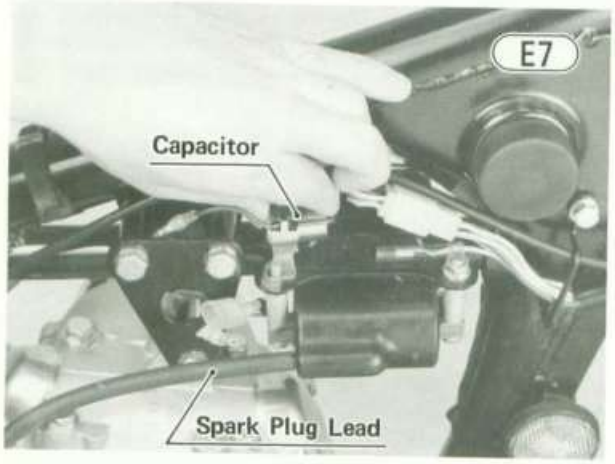
•Remove the fuel tank (Pg. 39).
•Disconnect the spark plug lead.
•Disconnect the yellow/red lead and the black leads.



•Remove the locknuts (2) and take off the ignition coil.

Installation:

•Install the ignition coil with the locknuts (2) so that the spark plug lead points to the rear. The capacitor should be installed with the rear locknut.



•Connect the spark plug lead to the spark plug.
•Connect the ignition coil leads to the yellow/red lead and black leads.
•Install the fuel tank (Pg. 39).

CARBURETOR

Removal:

•Remove the fuel tank (Pg. 39).
•Loosen the carburetor holder clamp screw and air cleaner duct clamp screw, and slip off the duct clamp.



•Slip the carburetor out of place.
•Remove the carburetor cap, and pull out the throttle valve.



NOTE: If the throttle valve is not removed from the cable, wrap a clean cloth around it to avoid damage.

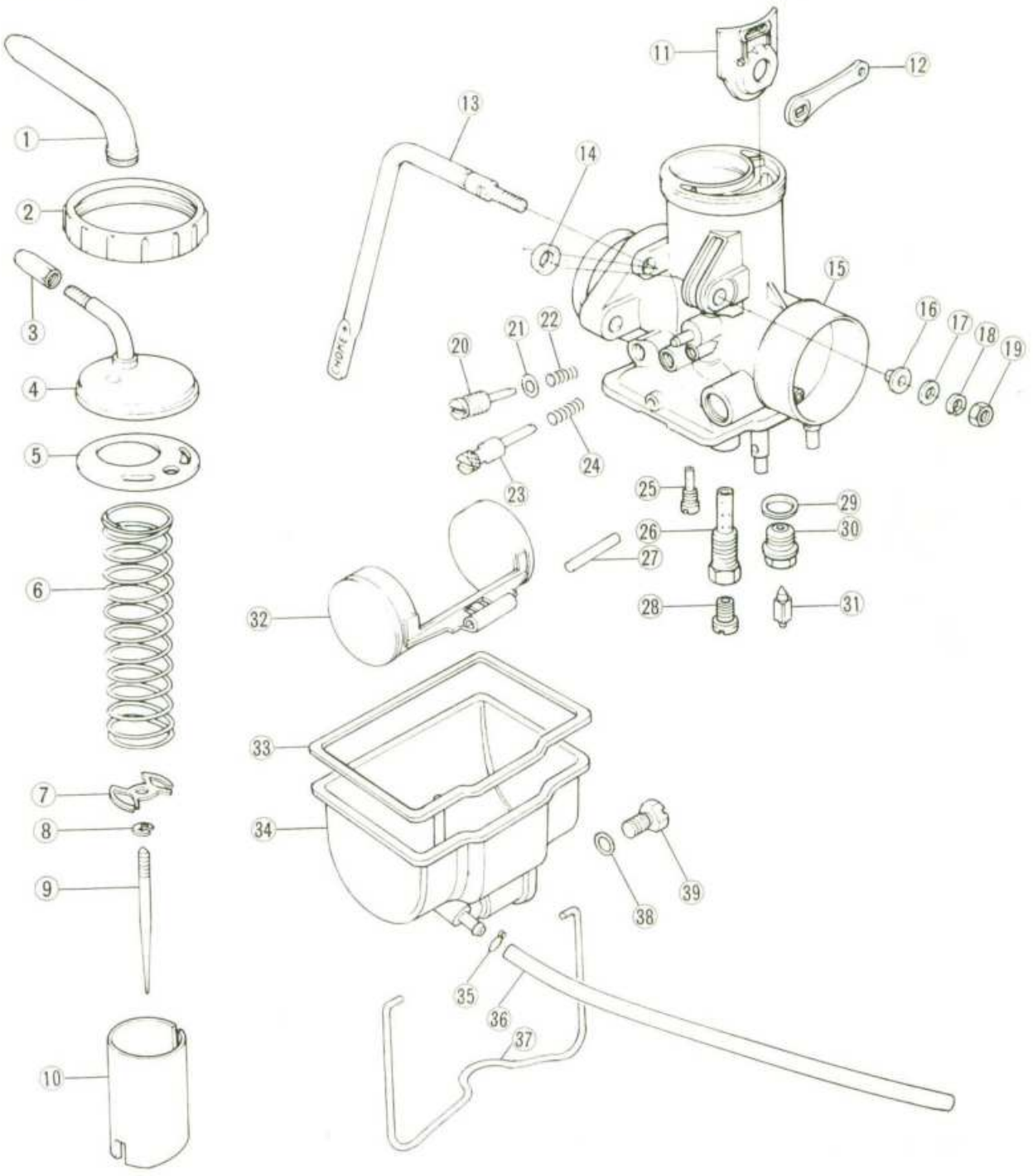
Installation:

•Align the groove on the side of the throttle valve with the guide pin in the carburetor body. Check to see that the throttle valve goes all the way down into the carburetor body, and slides smoothly.



E11

Carburetor



1. Rubber Cap
2. Carburetor Cap
3. Cable Adjuster
4. Mixing Chamber Top
5. Top Gasket
6. Throttle Valve Spring
7. Jet Needle Stop
8. Clip
9. Jet Needle
10. Throttle Valve
11. Choke Valve
12. Link
13. Choke Lever
14. Rubber Seal
15. Carburetor Body
16. Dust Seal
17. Flat Washer
18. Lockwasher
19. Nut
20. Air Screw
21. **O** Ring
22. Spring
23. Idle Adjusting Screw
24. Spring
25. Pilot Jet
26. Air Bleed Pipe
27. Float Pin
28. Main Jet
29. Gasket
30. Valve Seat
31. Valve Needle
32. Float
33. Gasket
34. Float Bowl
35. Clip
36. Overflow Tube
37. Float Bowl Retainer
38. **O** Ring
39. Drain Plug

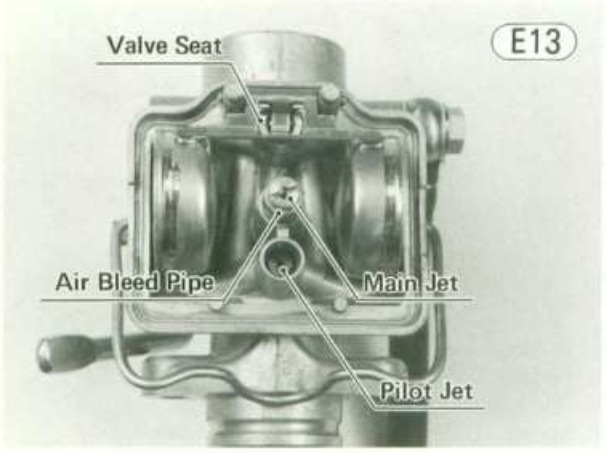
- Fit the tongue on the mixing chamber top into the groove of the carburetor body, and tighten the carburetor cap.
- Check that the duct clamp and holder clamp are in place, and install the carburetor.
- Slip back the duct holder, and tighten the clamp screws.
- Install the fuel tank (Pg. 39).
- Adjust the throttle cable (Pg. 16).
- Adjust the carburetor (Pg. 16).

Carburetor Body Disassembly:

- Remove the *idle adjusting* screw ㉓ and spring ㉔



- Remove the air screw ⑳ and **O** ring ㉑, and remove the spring ㉒.
- Remove the float bowl ㉞ and gasket ㉝.
- The main jet ㉘, air bleed pipe ㉖, and pilot jet ㉕ can now be removed.



- To remove the float valve seat ㉚, first push out the float pin ㉗, remove the float ㉜, and pull out the float valve needle ㉛.
- Remove the float valve seat ㉚ and gasket ㉙.

Assembly Notes:

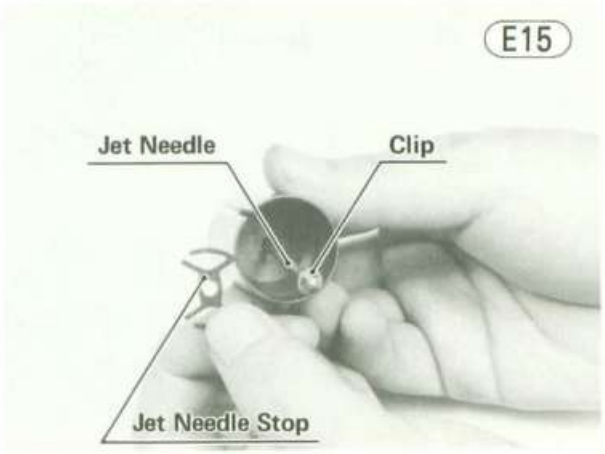
1. Replace any **O** rings and gaskets if damaged or deteriorated.
2. Install the drain plug ㊴ securely if it was removed.

Throttle Valve, Jet Needle Disassembly:

- To remove the throttle valve ⑩ from the cable, pull the spring ⑥ up from where it seats in the valve, and slip the tip of the inner cable out of the valve.



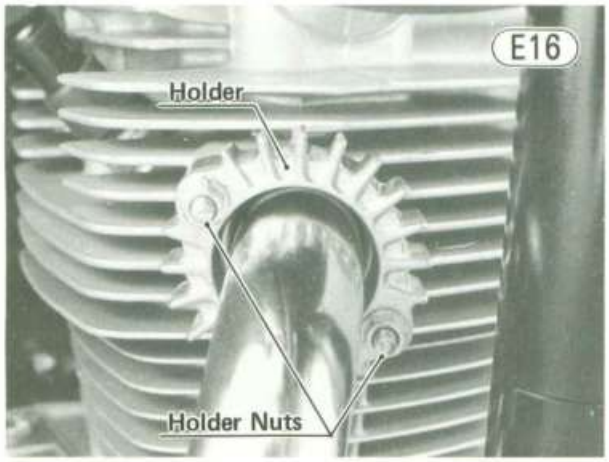
- Remove the jet needle stop ⑦, and pull the jet needle ⑨ with its clip ⑧ out of the throttle valve.



MUFFLER

Removal:

- Remove the exhaust pipe holder nuts (2), and slide the holder off the cylinder head studs.



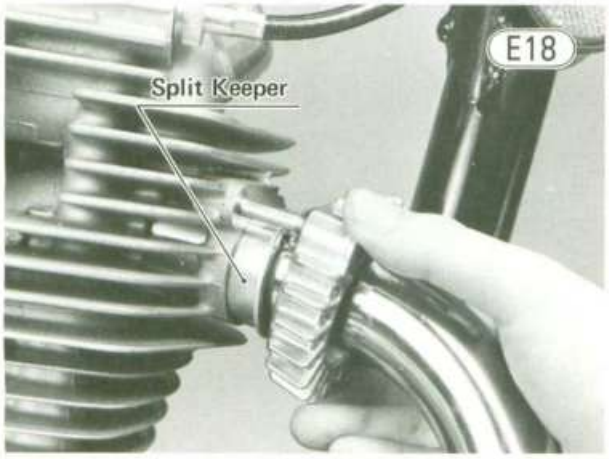
•Remove the muffler mounting bracket bolt, and take off the muffler. Also, remove the exhaust pipe holder, split keeper, and gasket.

Installation:

•Fit a gasket into the exhaust port, and place the exhaust pipe holder on the stud bolts.



•Fit the end of the exhaust pipe into the exhaust port.
•Attach the muffler to the frame with the muffler mounting bracket bolt finger tight.
•Fit the split keeper back into place, and then tighten the exhaust pipe holder nuts evenly to avoid an exhaust leak.

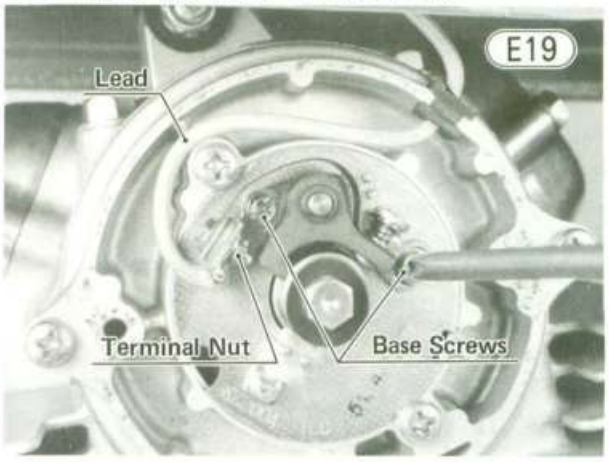


•Tighten the muffler mounting bracket bolt securely.

CONTACT BREAKER

Removal:

•Remove the contact breaker cover and gasket.
•Remove the contact breaker base screws (2). Each screw has a flat washer and lockwasher.

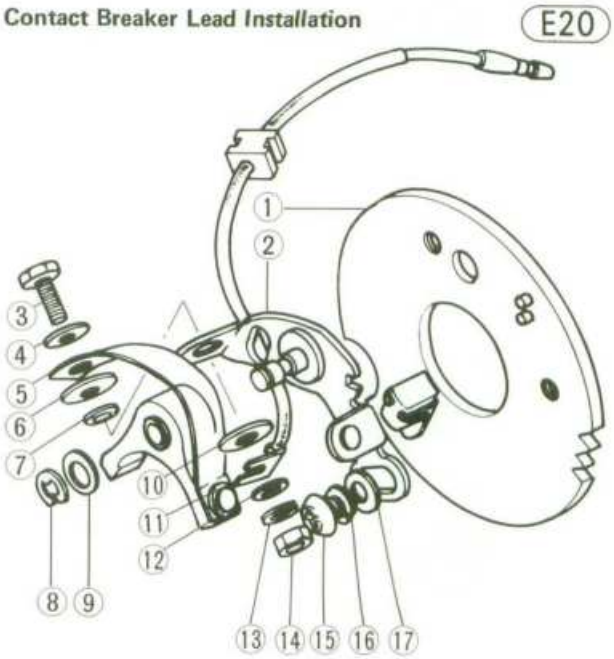


•Loosen the contact breaker terminal nut, and remove the lead.

Installation Notes:

1. The sequence of installation on the contact breaker bolt is bolt ③, flat washer ④, spring ⑤, large insulator ⑥, small insulator ⑦ (in contact breaker hole), large insulator ⑩, contact breaker lead ⑪, flat washer ⑫, lockwasher ⑬, and nut ⑭.

Contact Breaker Lead *Installation*



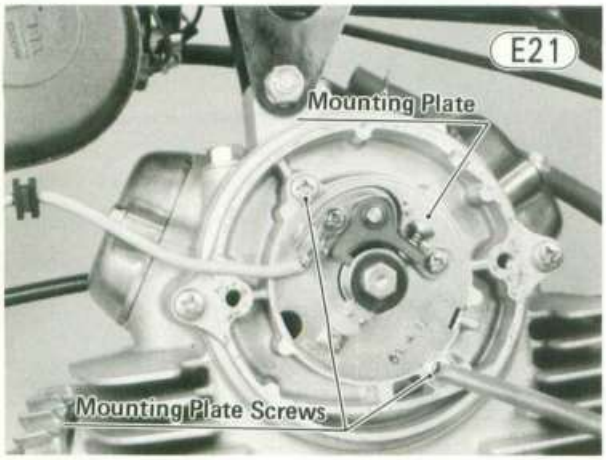
1. Contact Breaker Mounting Plate
2. Contact Breaker Base
3. Bolt
4. Flat Washer
5. Spring
6. Large Insulator
7. Small Insulator
8. **C** Ring
9. Flat Washer
10. Large Insulator
11. Contact Breaker Lead
12. Flat Washer
13. Lockwasher
14. Nut
15. Screw
16. Lockwasher
17. Flat Washer

2. After installation, adjust the ignition timing (Pg. 12).
3. Install the contact breaker cover with the "UP" mark on the cover pointing upward.

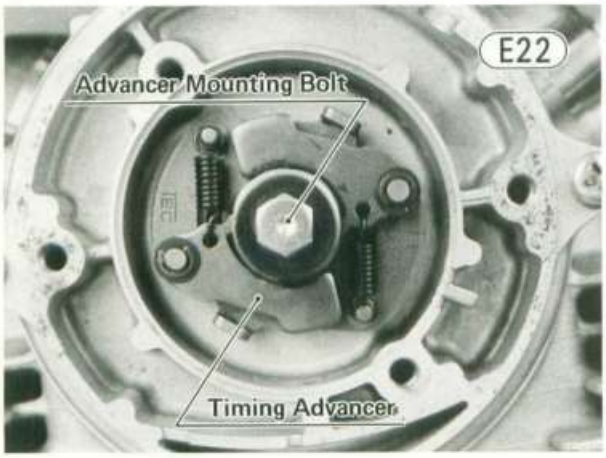
TIMING ADVANCER

Removal:

- Remove the fuel tank (Pg. 39).
- Disconnect the contact breaker black lead.
- Remove the contact breaker cover and gasket.
- Take out the contact breaker mounting plate screws (2), and remove the plate.

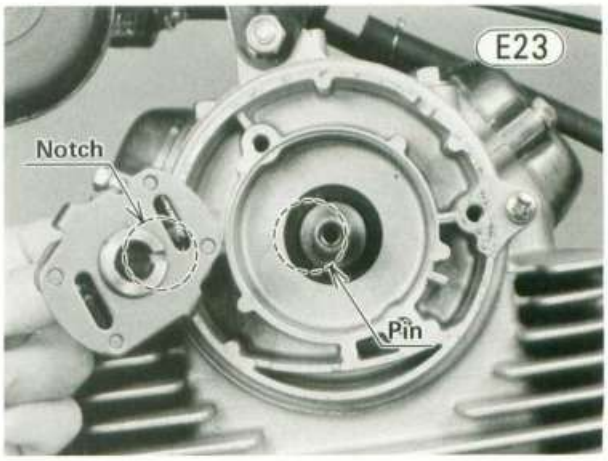


- Remove the dynamo cover screws (3) and dynamo cover.
- Keeping the crankshaft from turning with a wrench on the dynamo flywheel bolt, remove the advancer mounting bolt, and take off the washer and the timing advancer.

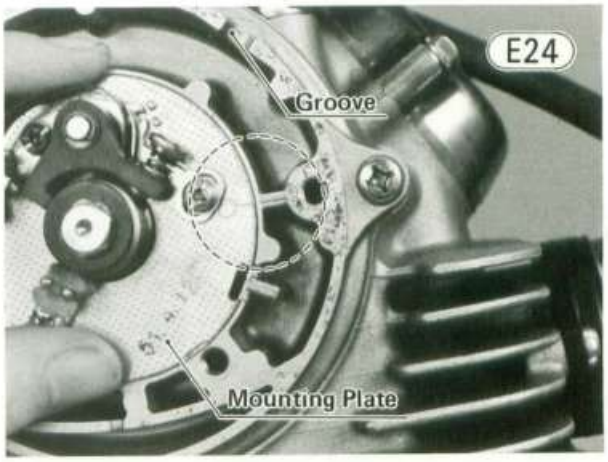


Installation:

- Fit the timing advancer onto the camshaft matching its notch with the pin on the camshaft. Install the bolt and flat washer and tighten the bolt with 0.9 kg-m (78 in-lbs) of torque.



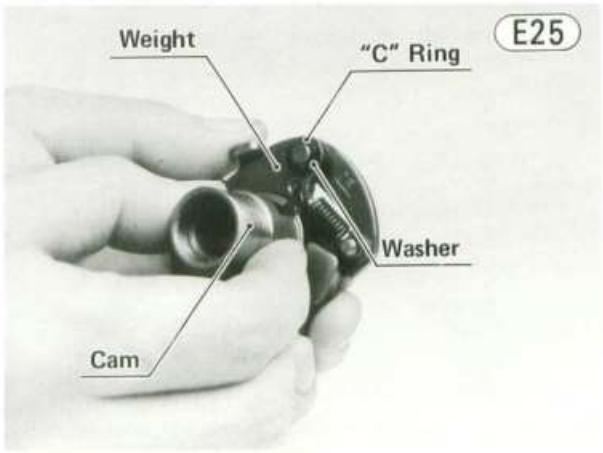
- Fit the contact breaker mounting plate aligning the line on the plate with the mark on the left cylinder head cover, and tighten its screws (2) loosely.



- Fit the grommet into the groove of the left cylinder head cover, and connect the contact breaker black lead.
- Install the fuel tank (Pg. 39).
- Adjust the ignition timing (Pg. 12).

Disassembly:

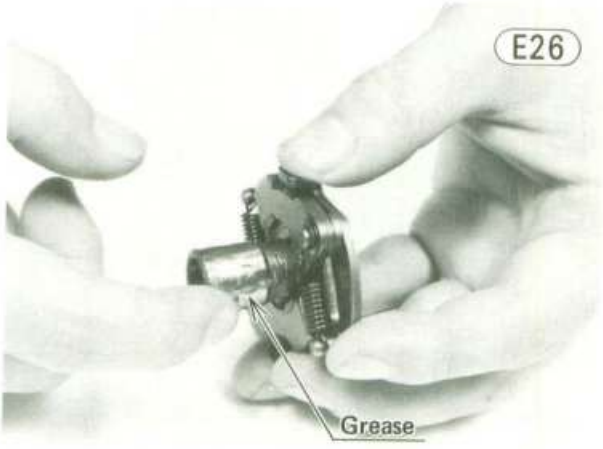
- Pull off the cam.



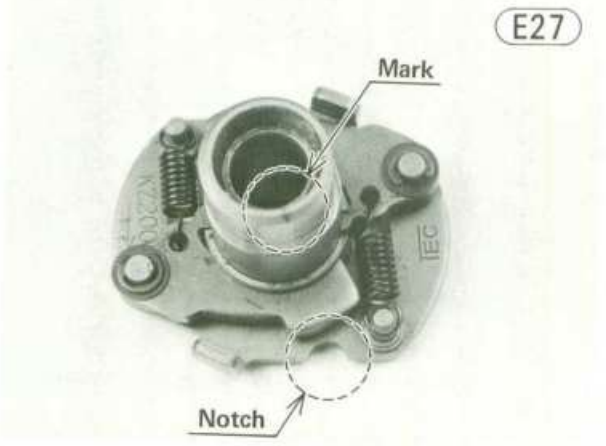
•Remove the **C** rings (2), washers (4), and weights (2).
•Remove the thrust washers (2) from the advancer body.

Assembly Notes:

1. Wipe the advancer clean, and fill the groove in the advancer body with grease.



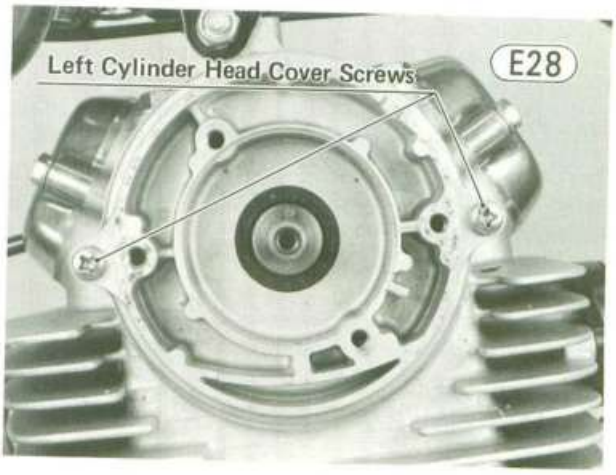
2. When installing the cam, align the mark on the cam with the notch on the advancer body.



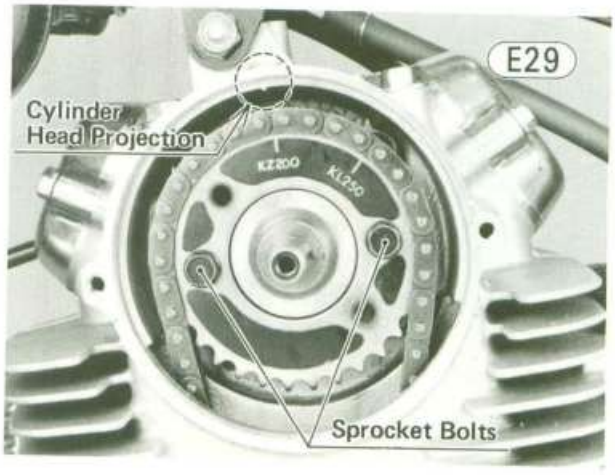
CAMSHAFT SPROCKET

Removal:

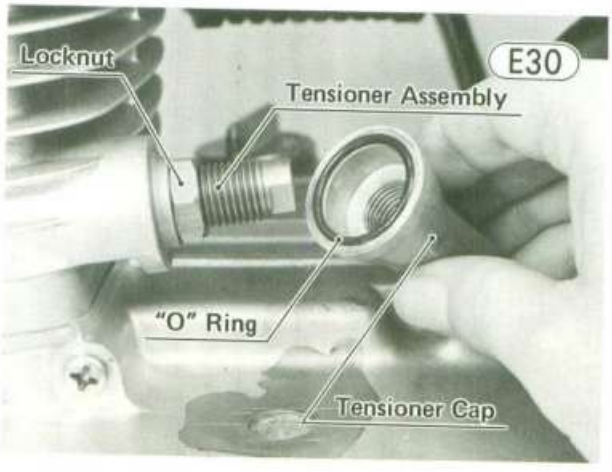
•Remove the fuel tank (Pg. 39).
•Remove the timing advancer (Pg. 44).
•Remove the left cylinder head cover screws (2), and pull off the left cylinder head cover with the **O** ring. If it is difficult to remove, pry at the gap in each side of the cover with a screwdriver.



•Turn the crankshaft counterclockwise until the line adjoining the KZ200 mark on the camshaft sprocket aligns with the cylinder head *projection*.



•Remove the chain tensioner cap and **O** ring, loosen the locknut, and then remove the chain tensioner assembly from the cylinder block.



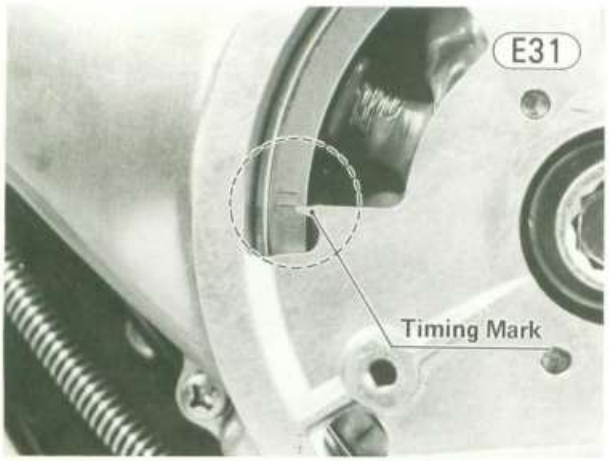
•With a wrench on the dynamo flywheel bolt to keep the shaft from turning, remove the camshaft sprocket bolts (2).

•Slide the sprocket off its position on the camshaft, and slip the chain off the sprocket.
•Remove the camshaft sprocket.

CAUTION **Always pull the camshaft chain taut while turning the crankshaft when the camshaft chain is loose. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.**

Installation:

•Check crankshaft position to see that the "T" mark on the dynamo flywheel aligns with the timing mark on the left engine cover, and readjust if necessary. Remember to pull the camshaft chain taut before rotating the crankshaft.

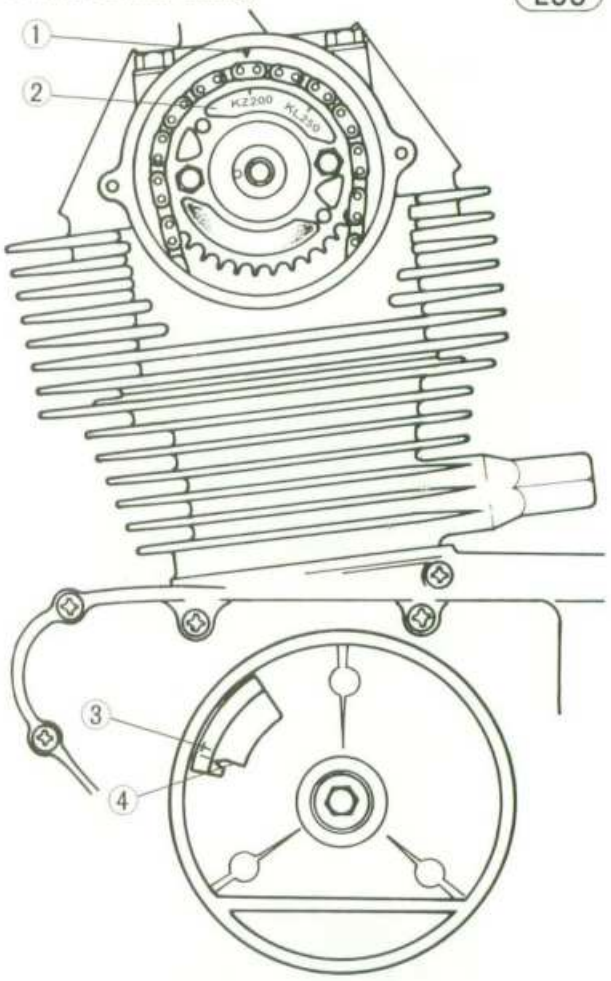


•Set the camshaft sprocket on the camshaft so that the line mark on the sprocket is facing out.
•Fit the camshaft chain onto the camshaft sprocket so that the line adjoining the KZ200 mark on the sprocket aligns with the cylinder head projection.



•Fit the sprocket up into place. Turn the camshaft, while holding the sprocket steady to align the bolt holes.
•Keep the crankshaft from turning by holding a wrench on the dynamo flywheel bolt. Tighten the sprocket bolts with 1.5 kg-m (11.0 ft-lbs) of torque.

Camshaft Chain Timing E33



1. Cylinder Head Projection
2. Camshaft Sprocket "KZ200" Mark
3. Dynamo Flywheel "T" Mark
4. Left Engine Cover Timing Mark

•Install the camshaft chain tensioner, and turn in the push rod guide until the end of the push rod guide and push rod are flush (Fig. B13).

CAUTION **Rotation of the crankshaft with improper camshaft timing could cause the valves to contact each other or the piston, and bend. If any resistance is felt when turning the crankshaft, stop immediately, and check the camshaft chain timing.**

•Turn the crankshaft over counterclockwise until the line adjoining the KZ200 mark on the camshaft sprocket is pointing upward, and recheck the camshaft timing. If the timing mark and the line are aligned (Fig. E33), the camshaft timing is correct.

CAUTION **Do not to try to turn the crankshaft and camshaft with a wrench on the camshaft sprocket.**

•Check that the large **O** ring is in place, and apply oil to the **O** ring and oil seal.
•Install the left cylinder head cover so that the grommet fitting groove is toward the top.
•Install the timing advancer (Pg. 44).
•Adjust the camshaft chain (Pg. 15), and install the camshaft chain tensioner cap and **O** ring.

CAMSHAFT

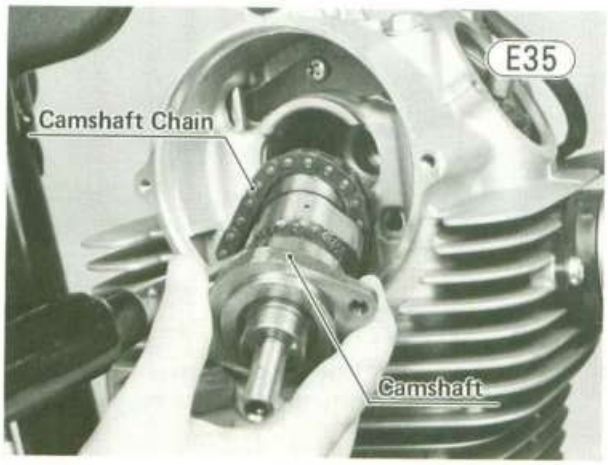
Removal:

- Remove the fuel tank (Pg. 39).
- Remove the timing advancer (Pg. 44).
- Remove the camshaft sprocket (Pg. 45).
- Unscrew the tachometer cable from the cylinder head, and take out the tachometer pinion.

CAUTION **Attempting to install the camshaft with the tachometer pinion left in the cylinder head may cause tachometer gear damage.**



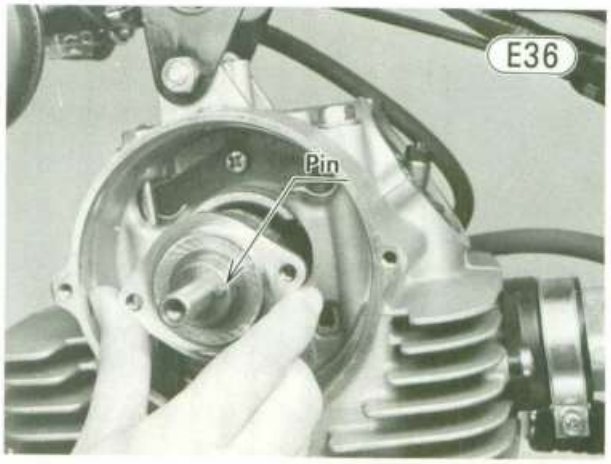
- Remove the valve clearance adjusting caps and O rings.
- Using a screwdriver or wire to keep the chain from falling down into the cylinder block, remove the camshaft.



Installation:

NOTE: If a new camshaft cylinder head, or valve is installed, check valve clearance (Pg. 16).

- Using compressed air, blow out any particles which may obstruct the oil passages.
- Check that the tachometer pinion is removed from the cylinder head.
- Apply clean engine oil to all cam parts.
- Insert the camshaft through the chain and remove the screwdriver. When the camshaft is inserted, the pin on the camshaft must be positioned as shown.

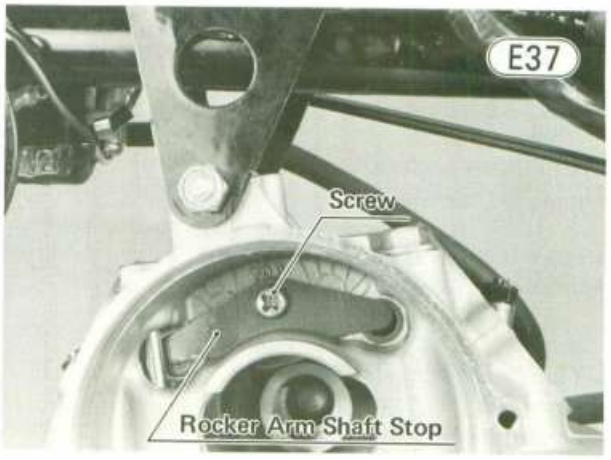


- Apply a small amount of high temperature grease to the tachometer pinion shaft, insert the tachometer pinion, and connect the tachometer cable.
- Install the camshaft sprocket (Pg. 46).
- Install the timing advancer (Pg. 44).
- Check the valve clearance, and adjust if necessary (Pg. 16).
- Install the valve clearance adjusting caps and O rings.
- Install the fuel tank (Pg. 39).

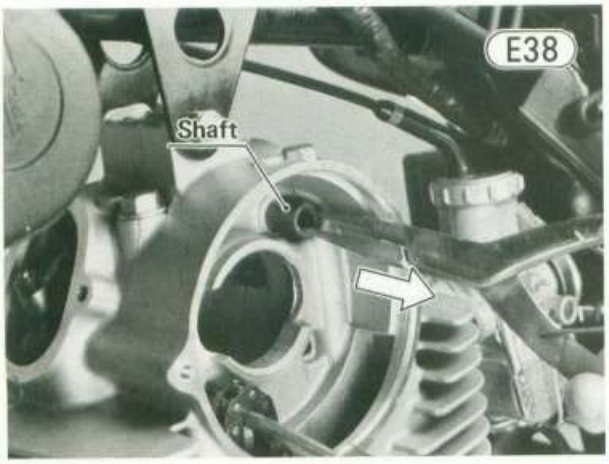
ROCKER ARM

Removal (inlet valve rocker arm):

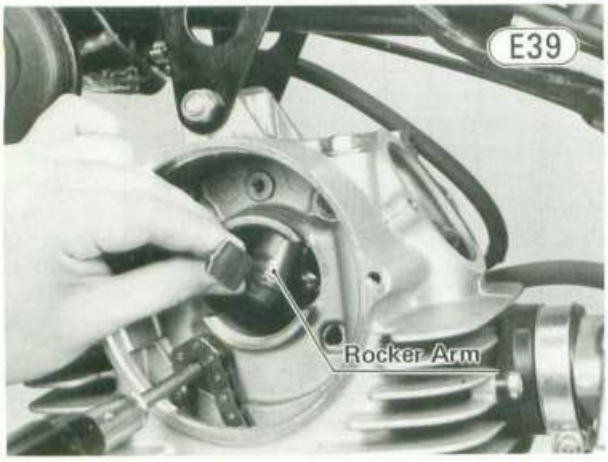
- Remove the fuel tank (Pg. 39).
- Remove the timing advancer (Pg. 44).
- Remove the camshaft sprocket (Pg. 45).
- Remove the camshaft.
- Remove the rocker arm shaft stop screw, and take off the stop.



•Using a suitable tool, pull out the shaft.



•Remove the rocker arm from the cylinder head.



Installation (inlet valve rocker arm):

•Apply a little engine oil to the rocker arm shaft, and insert the shaft, running it through the rocker arm.
•Install the stop, and tighten its screw.
•Install the camshaft (Pg. 47).
•Install the camshaft sprocket (Pg. 46).
•Install the timing advancer (Pg. 44).
•Install the fuel tank (Pg. 39).

Removal (exhaust valve rocker arm):

•Remove the cylinder head.
•Remove the rocker arm shaft stop screw, and take off the stop.
•Using a suitable tool, pull out the shaft.
•Remove the rocker arm from the cylinder head.

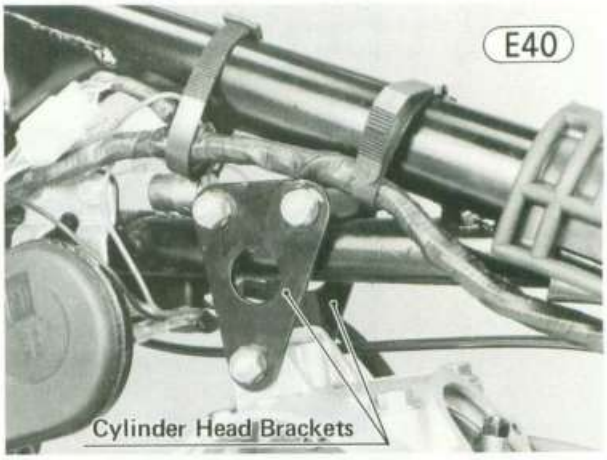
Installation (exhasut valve rocker arm):

•Apply a little engine oil to the rocker arm shaft, and insert the shaft, running it through the rocker arm.
•Install the rocker arm shaft stop, and tighten its screw.
•Install the cylinder head.

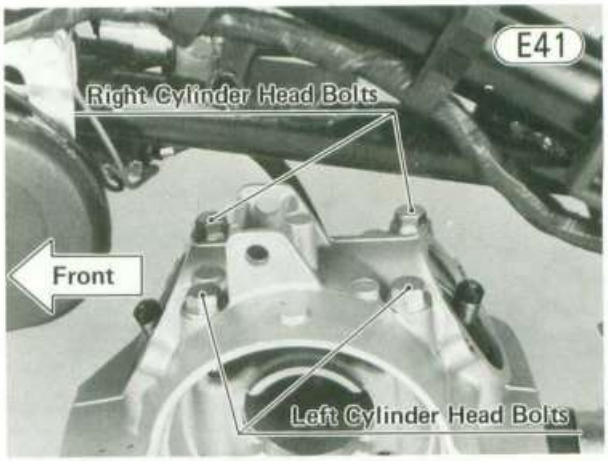
CYLINDER HEAD

Removal:

•Remove the fuel tank (Pg. 39).
•Pull the spark plug lead off the spark plug.
•Remove the carburetor (Pg. 40).
•Remove the muffler (Pg. 42).
•Remove the camshaft sprocket (Pg. 45).
•Remove the camshaft (Pg. 47).
•Remove the cylinder head bracket bolts and nuts (3 ea), and take off the brackets.



•Remove the cylinder bolt from the left side of the cylinder base.
•Loosen the cylinder head bolts (4) completely and remove the right cylinder head bolts (2).



•With a large screwdriver, pry at the gap in the cylinder head base to free the cylinder head from the cylinder block.

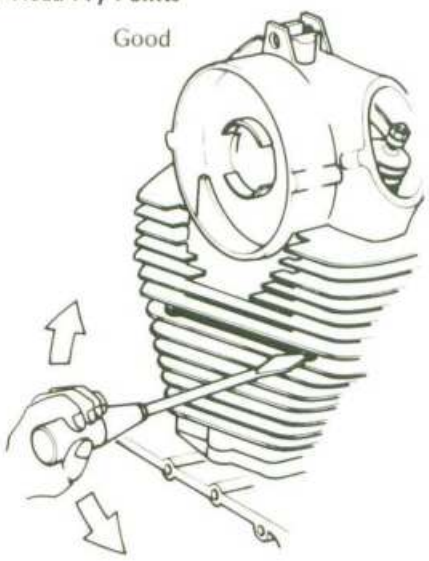
CAUTION **Do not hammer on the screwdriver while it is in the pry point as engine damage could result (Fig. E42).**

•Lift up the cylinder head slightly, and remove the left cylinder head bolts (2).
•Using a screwdriver or wire to keep the chain from falling down into the cylinder block, take off the cylinder head.
•Remove the cylinder head gasket and O rings.

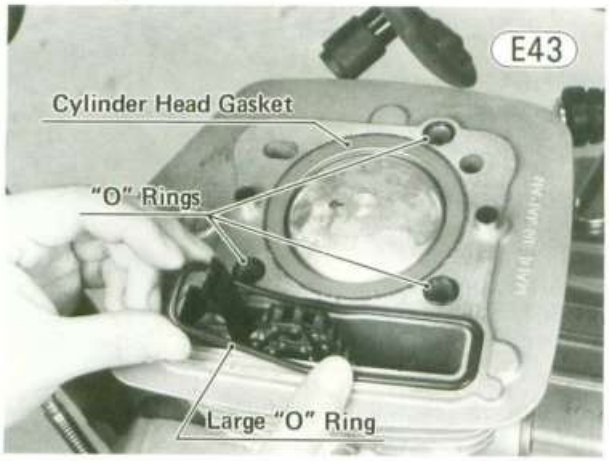
Installation:

•Using compressed air, blow out any particles which may obstruct the oil passages.
•Install a new cylinder head gasket.

Cylinder Head Pry Points



•Install new **O** rings (4). The large **O** ring must be fitted into the groove in the cylinder block.



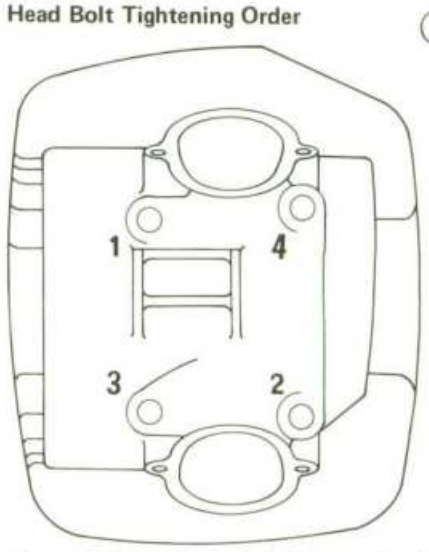
•Check to see that the front chain guide is in place.
•Check to see that the knock pins (2) are in place, and fit the cylinder head onto the cylinder block, using a screwdriver or wire to keep the chain from falling down into the cylinder block.
•Lift up the cylinder head slightly, insert the left cylinder head bolts (2), and then insert the right cylinder head bolts (2).





•Tighten the cylinder head bolts (4) first with about 2.0 kg-m (14.5 ft-lbs) of torque and finally with 2.6 kg-m (19.0 ft-lbs) of torque, following the tightening sequence as shown.

Cylinder Head Bolt Tightening Order



•Tighten the cylinder bolt with 1.2 kg-m (8.5 ft-lbs) of torque.
•Install the cylinder head brackets (2), and tighten the bracket bolts (3) with 1.8 kg-m (13.0 ft-lbs) of torque.
•Connect the spark plug lead to the spark plug.
•Install the camshaft (Pg. 47).
•Install the camshaft sprocket (Pg. 46).
•Install the timing advancer (Pg. 44).

NOTE: If a new camshaft, cylinder head, or valve was installed, check the valve clearance, and adjust if necessary (Pg. 16).

•Install the carburetor (Pg. 40).
•Install the muffler (Pg. 43).
•Install the fuel tank (Pg. 39).

VALVE, VALVE GUIDE

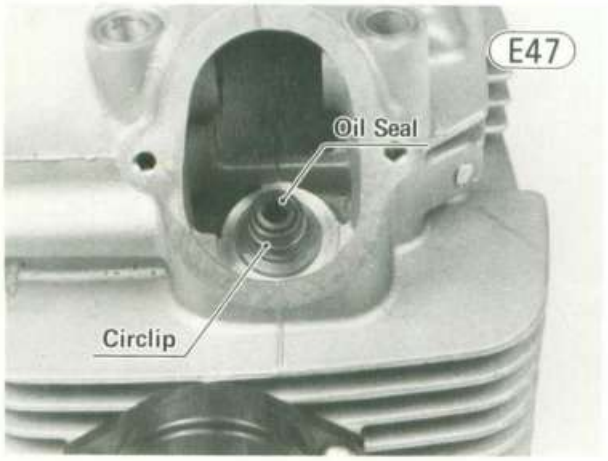
Removal (each valve and valve guide):

•Remove the cylinder head (Pg. 48).
•Remove the rocker arm (Pg. 47).

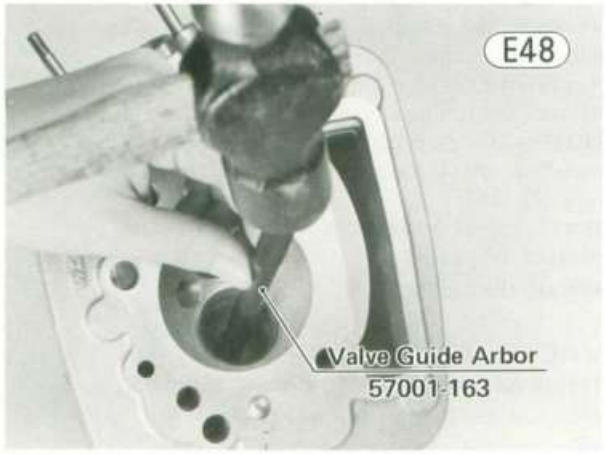
•Using the valve spring compressor assembly (special tool) to press down the valve spring retainer ⑥, remove the split keeper ③.



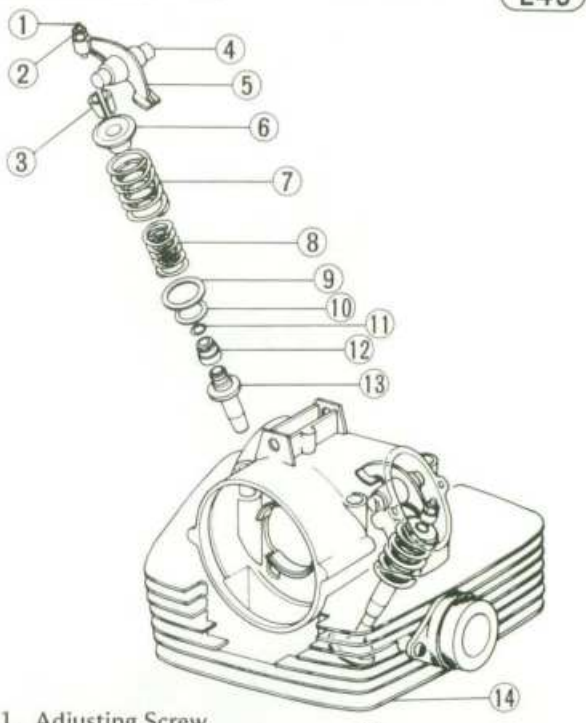
•Remove the tool, and then remove the spring retainer, outer spring ⑦, inner spring ⑧, inner spring seat ⑩, and outer spring seat ⑨.
•Push out the valve ⑮.
•Remove the clip ⑪ and pull off the oil seal ⑫.



•Heat the area around the guide to about 120～150°C (248～302°F), and hammer lightly on the valve guide arbor (special tool) to remove the guide out the top of the head.



Valve and Valve Guide

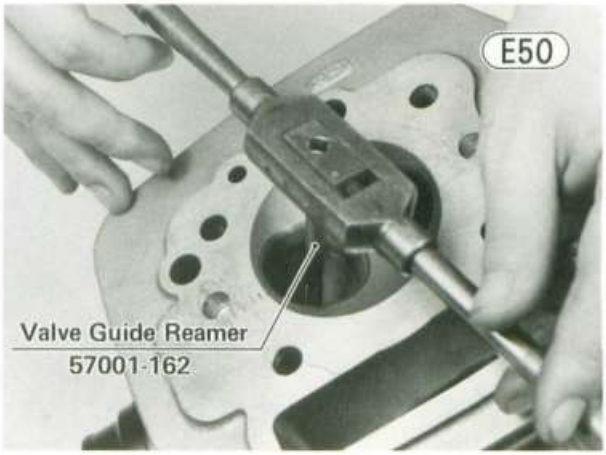


1. Adjusting Screw
2. Locknut
3. Split Keeper
4. Rocker Shaft
5. Rocker Arm
6. Spring Retainer
7. Outer Spring
8. Inner Spring
9. Outer Spring Seat
10. Inner Spring Seat
11. Clip
12. Oil Seal
13. Valve Guide
14. Cylinder Head
15. Valve

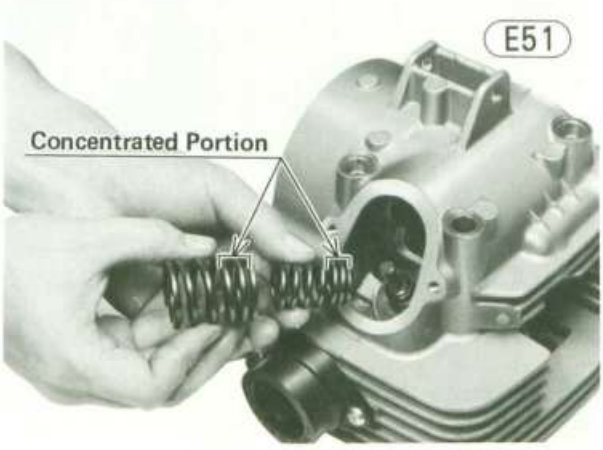
Installation (each valve and valve guide):

NOTE: If a new valve or valve guide is installed, check the valve/valve guide clearance (Pg. 135).

•Apply oil to the valve guide.
•Heat the area around the valve guide hole to about 120～150°C (248～302°F), and drive the valve guide in from the top of the head using the valve guide arbor (special tool).
•Ream the valve guide with the valve guide reamer (special tool) even if the old guide is reused.



- Lap the valve to check that it is seating properly. If it is uneven, refer to the Maintenance Section (Pg. 135).
- Push a new oil seal into place, and install its clip.
- Apply a thin coat of high temperature grease to the valve stem, insert the valve, and install the outer and inner spring seats and the outer and inner springs with the concentrated portion of each spring down as shown.

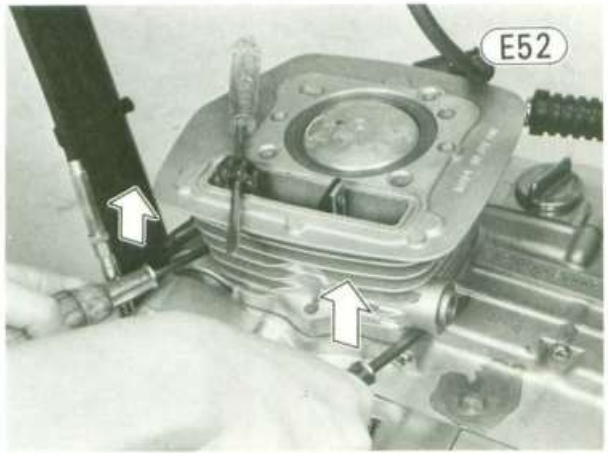


- Install the spring retainer, press it down with the valve spring compressor assembly (special tool), and put on the split keeper.
- After making sure that the split keeper, spring retainer, and valve stem are all properly fitted, remove the valve spring compressor assembly and adapter.
- Install the rocker arm (Pg. 48).
- Install the cylinder head (Pg. 48).
- Check the valve clearance, and adjust if necessary (Pg. 16).

CYLINDER BLOCK

Removal:

- Remove the cylinder head (Pg. 48).
- Remove the cylinder head gasket, small **O** rings (3), large **O** ring, knock pins (2), and front chain guide.
- With screwdrivers, pry at the front and rear of the cylinder base to free the cylinder block from the crankcase, and then lift off the cylinder block.



- Wrap a clean cloth around the base of the piston so that no parts or dirt will fall into the crankcase.

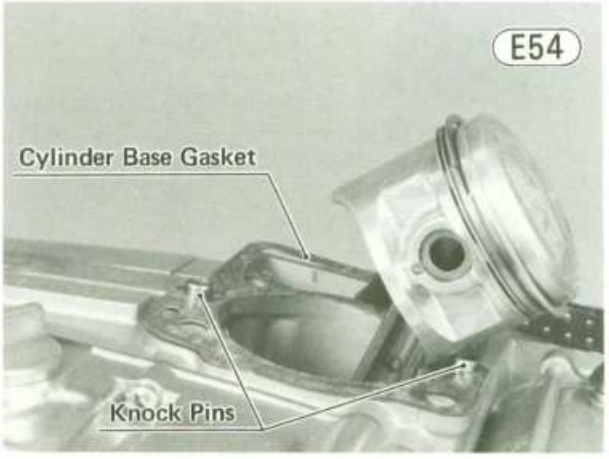
Installation:

NOTE: If the cylinder block is replaced with a new one, piston to cylinder clearance must be checked against the specified value (Pg. 139).

- With compressed air, blow out the oil passage to remove dirt or particles which may obstruct oil flow.

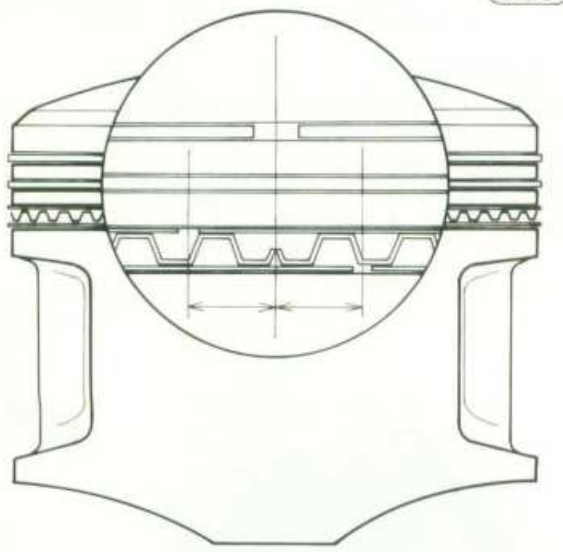


- Remove the cloth from under the piston.
- Install a new cylinder base gasket, and be sure that the knock pins (2) are properly fitted in the crankcase.



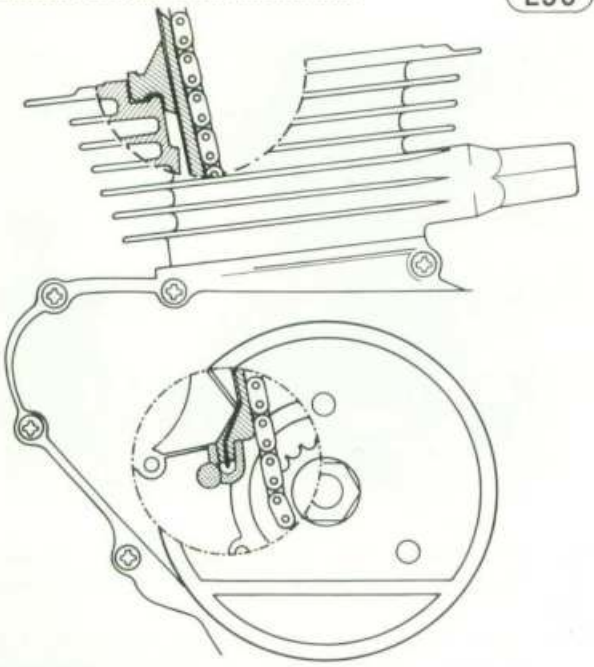
- Pull the camshaft chain taut to avoid kinking it, and use a 14 mm wrench on the crankshaft to set the piston at BDC.
- Position the piston rings so that the openings in the top ring and oil ring are facing forward, and the second ring opening faces the rear. The openings of the oil ring steel rails must be slipped to both directions about 30° from the opening of the expander (Fig. E55).
- Apply engine oil to the piston rings and the cylinder inside surface.
- Pull the camshaft chain up through the cylinder and insert a screwdriver through it to keep it from falling back into the engine. Place the rear chain guide inside the cylinder block.

Piston Rings E55



- Fit the bottom of the cylinder over the piston rings, pressing in on opposite sides of the rings as necessary. Take care that the rings do not slip out of their proper positions. If the cylinder block does not seat on the crankcase, lift it up slightly, pull out the camshaft chain, and press the cylinder block down.
- Install the front camshaft chain guide as shown. There is the "UP" mark on the top of the chain guide.

Camshaft Chain Guide Installation E56



- Install the cylinder head (Pg. 48).
- Adjust the camshaft chain (Pg. 15).

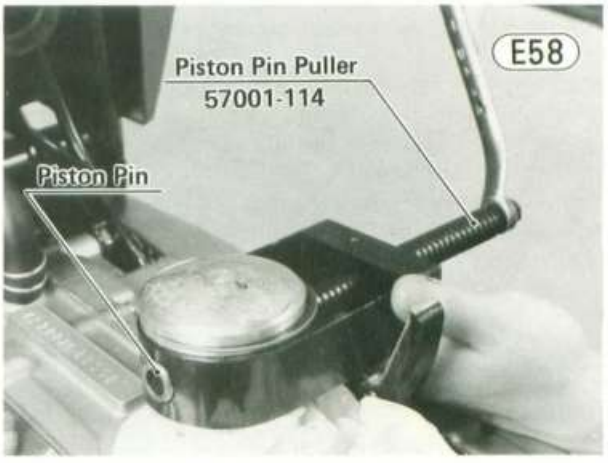
PISTON, PISTON RINGS

Removal:

- Remove the cylinder block (Pg. 51).
- Wrap a clean cloth around the base of the piston to secure it in position for removal and so that no parts or dirt will fall into the crankcase.
- Remove one of the piston pin snap rings from the piston.

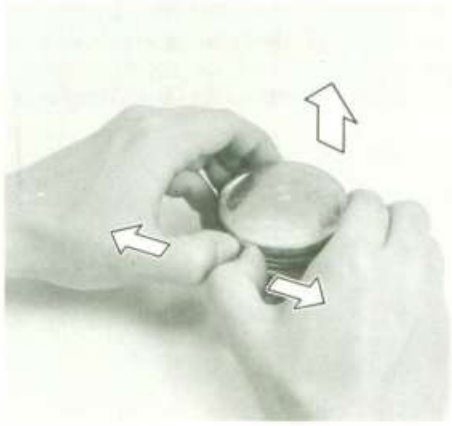


- Remove the piston by pushing the piston pin out the side from which the snap ring was removed. Use the piston pin puller (special tool) if necessary.

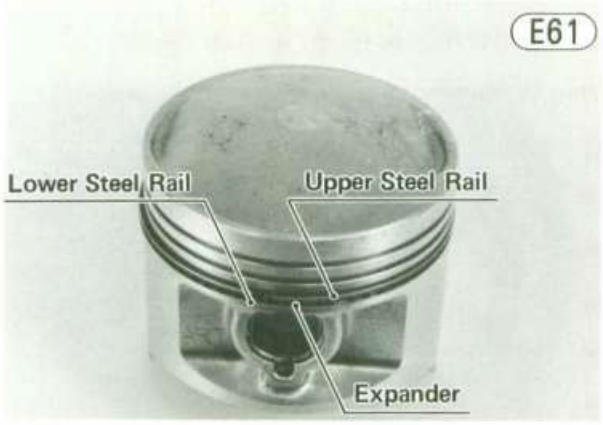


- Remove the top and second rings with the piston ring pliers (special tool). To remove a ring by hand, spread the ring open with both thumbs, and then push up on the opposite side.





•Remove the upper and lower oil ring steel rails, and then remove the expander.

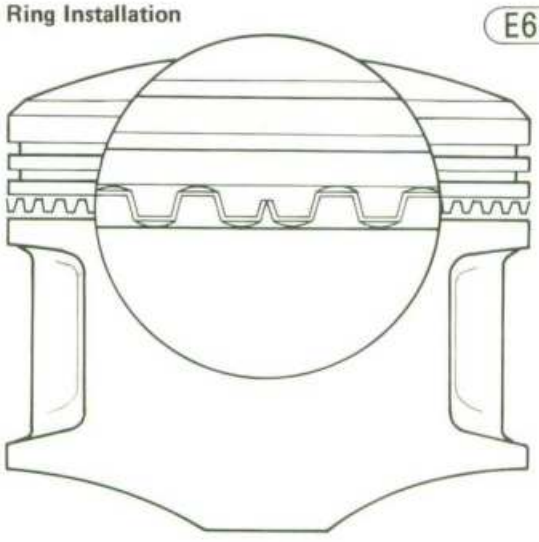


Installation:

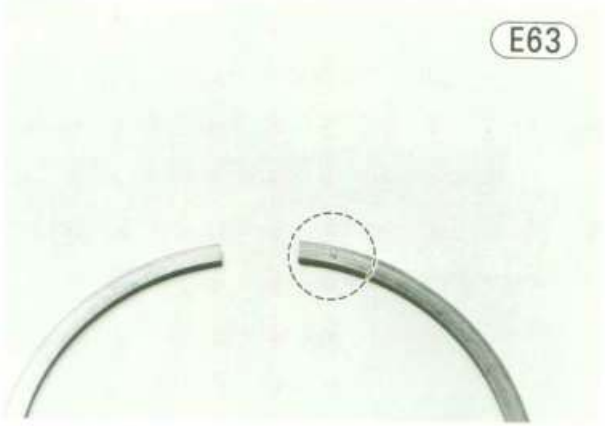
NOTE: If the piston is replaced with a new one, check that piston to cylinder clearance has the specified value (Pg. 139). Also, when a new piston or piston pin is installed, check that the piston to pin clearance has the specified value (Pg. 140).

•To install the oil ring, first install the expander so that the expander ends butt together, and then install the upper and lower steel rails. The two steel rails are identical. There is no "up" or "down" to the rails: they can be installed either way.

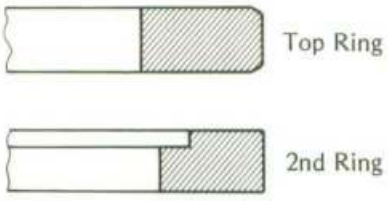
Oil Ring Installation



•Install the top and second rings so that the correct side (marked "N") faces up as shown. Do not mix up the top and second rings. The outer edges of the top rings are chamfered; the upper inner edge of the second ring is notched.

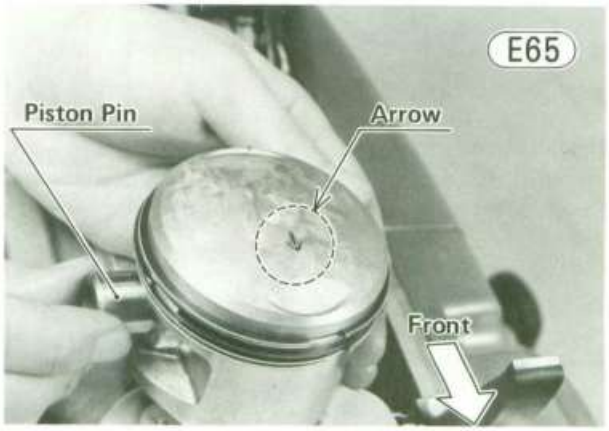


Piston Rings



•Turn the rings so that the end gaps in the top and oil rings face forward, and the gap in the second ring faces the rear. The openings of the oil ring steel rails must be slipped to both direction about 30°from the opening of the expander (Fig. E55).

•Apply a little engine oil to the piston pin, and install the piston and piston pin. The arrow on the top of the piston must point towards the front.



•Fit a new piston pin snap ring into the side of the piston, taking care to compress it only enough to install it and no more. Check that the other snap ring is in place.

CAUTION **Do not reuse snap rings, as removal weakens and deforms the snap ring. It could fall out and score the cylinder wall.**

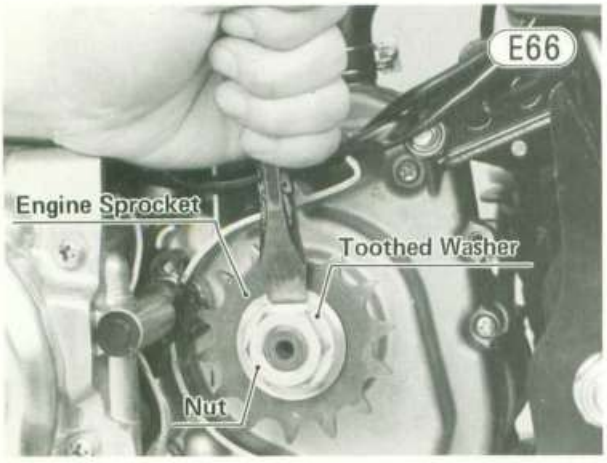
•Install the cylinder block (Pg. 51).

•Adjust the camshaft chain (Pg. 15).

ENGINE SPROCKET

Removal:

- Remove the drive chain (Pg. 100).
- Straighten the side of the toothed washer that is bent over the side of the engine sprocket nut.



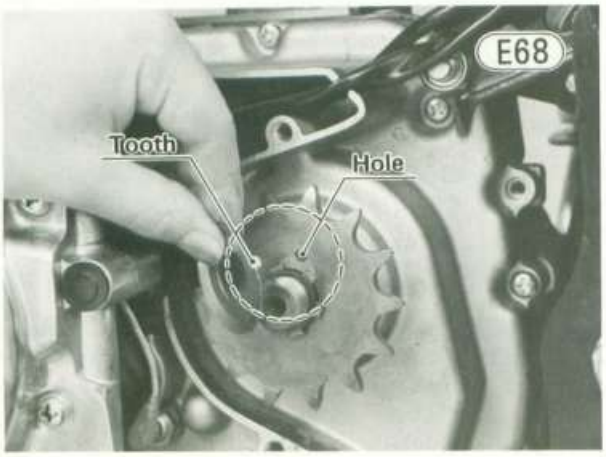
- Hold the engine sprocket steady using the engine sprocket holder (special tool), and remove the nut and toothed washer.



- Pull off the engine sprocket.

Installation:

- Mount the engine sprocket, and install the toothed washer fitting the tooth into the hole in the sprocket.

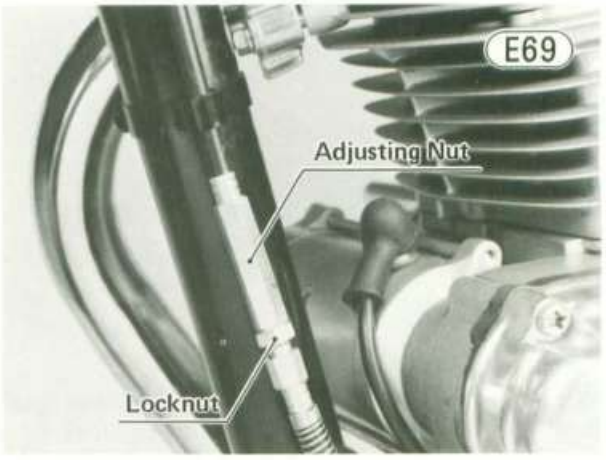


- Install the engine sprocket nut, and then tighten the nut with 8.0 kg-m (58 ft-lbs) of torque while using the engine sprocket holder to hold the sprocket steady.
- Bend one side of the toothed washer over the side of the nut.
- Install the drive chain (Pg. 100).

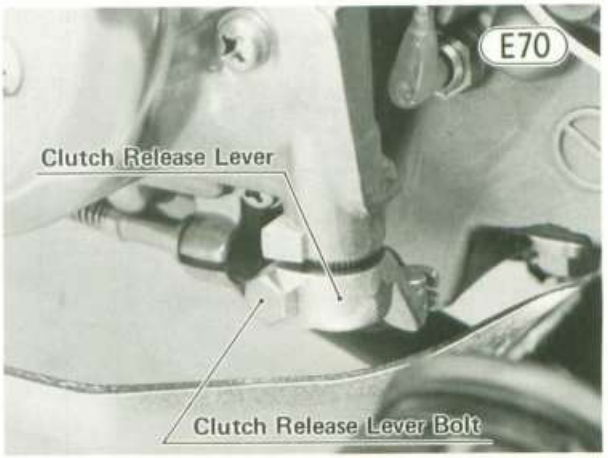
CLUTCH RELEASE

Removal:

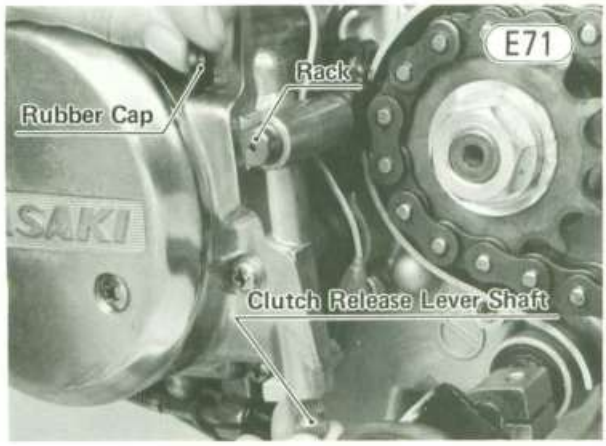
- Loosen the locknut, and turn in the adjusting nut at the center of the clutch cable fully to give the cable plenty of play.



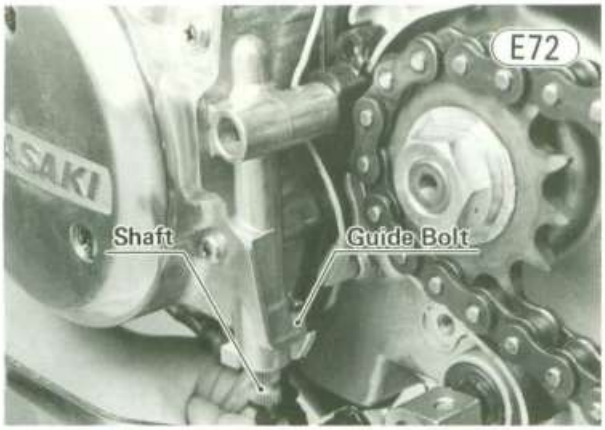
- Remove the engine sprocket cover screws (2), and take off the cover.
- Take out the clutch release lever bolt, and remove the clutch release lever.



- Free the clutch inner cable tip from the clutch release lever.
- Turn the clutch release lever shaft to remove the clutch release rack, and pull out the rack with the rubber cap.



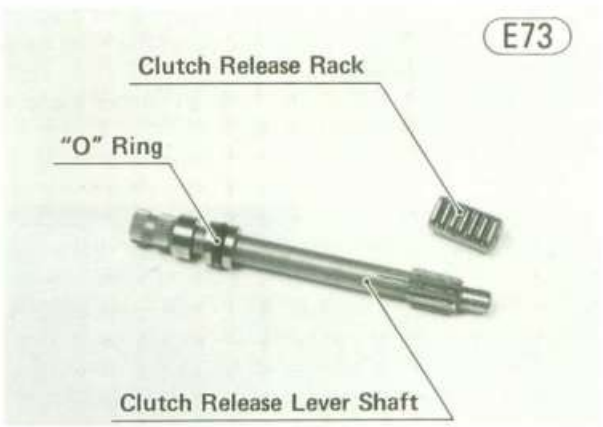
•Remove the clutch release lever shaft guide bolt, and pull out the shaft.



Installation:

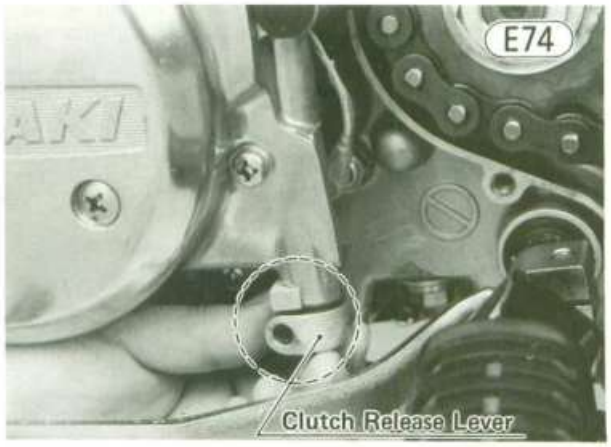
•Apply grease to the clutch release lever shaft and clutch release rack.

•Install the clutch release lever shaft with a new O ring, and tighten its guide bolt, checking that the shaft turns freely.



•Push the clutch release rack into the left engine cover. While pushing lightly on the rack, turn the clutch release lever shaft until it becomes hard to turn. Install the rubber cap.

•Install the clutch release lever, aligning the end of surface clutch release lever with the flat surface of the left engine cover projection, and tighten the bolt.



•Run the clutch cable into the left engine cover bracket, spring, and dust cover, and fit the tip of the inner cable into the clutch release lever.

•Install the engine sprocket cover, and tighten its screws (2).

•Adjust the clutch (Pg. 17).

LEFT ENGINE COVER

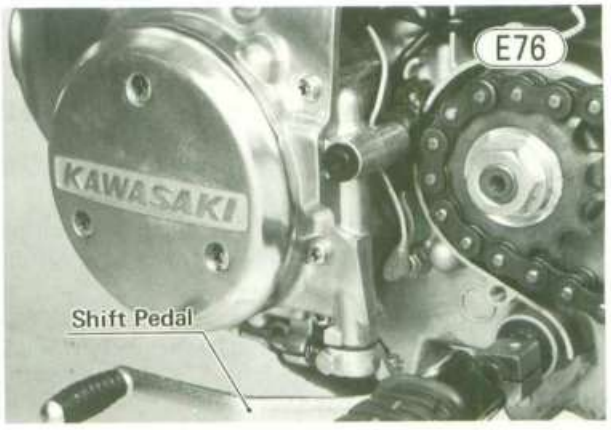
Removal:

•Remove the left side cover, and disconnect the dynamo wiring plug from the socket.

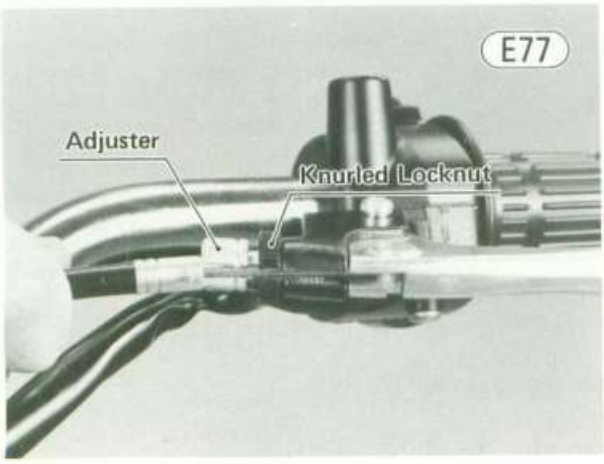


•Remove the engine sprocket cover screws (2), and take off the cover.

•Remove the shift pedal.



•Disconnect the neutral indicator switch lead from the switch terminal.
•Loosen the knurled locknut on the clutch lever. Turn in the adjuster, and line up the slots in the clutch lever, knurled locknut, and adjuster. Free the inner cable tip from the lever.

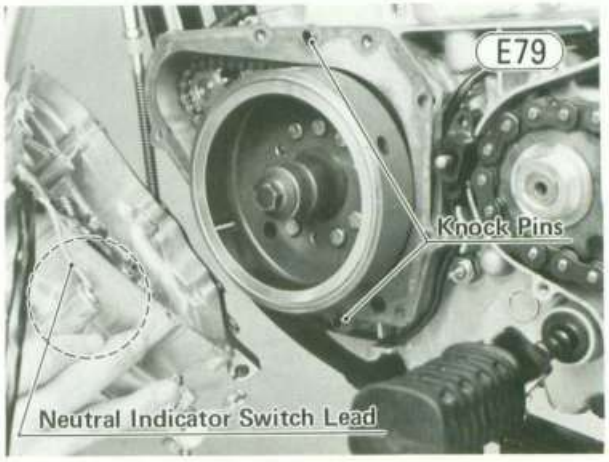


•Pull the lower end of the clutch cable from the left engine cover bracket and free the inner cable from the clutch release lever.
•Place an oil pan beneath the left engine cover.
•Remove the left engine cover screws (9), and pull off the left engine cover taking care not to damage the clutch push rod.



•Remove the gasket and knock pins (2) from the crankcase.

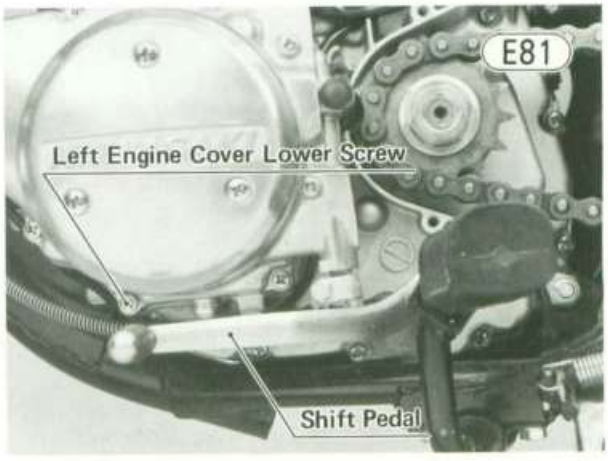
Installation:
•Check that the knock pins (2) and clutch push rod are in place, and fit a new left engine cover gasket on the crankcase.
•Check that the clutch release assembly is in place.
•Install the left engine cover, running the neutral indicator switch lead through the groove at the rear of the cover, and tighten the cover screws (9).



•Connect the neutral indicator switch lead to the switch terminal.
•Fit the dynamo wiring into the crankcase groove.



•Run the clutch cable into the left engine cover bracket, spring, and dust cover, and fit the tip of the inner cable into the clutch release lever.
•Install the shift pedal so that its end matches the level of the engine cover lower screw.



- Check that the clutch release rubber cap is in place.
- Install the engine sprocket cover, and tighten its screws (2).
- Connect the dynamo wiring plug, and install the left side cover.
- Fit the tip of the cable upper end back into the clutch lever.
- Check the oil level and add the oil as required (Pg. 18).
- Adjust the clutch (Pg. 17).

DYNAMO ARMATURE

Removal:

- Remove the left engine cover (Pg. 55).
- Remove the screw and take the dynamo wiring mounting plate off the cover.



- Remove the armature mounting screws ⑧ (3), and pull the armature ⑦ and the grommet ⑥ out of the cover.

Installation:

- Fit the grommet into the groove of the crankcase. Install the armature, and tighten the screws (3).
- Install the dynamo wiring mounting plate, and tighten the screw.
- Install the left engine cover (Pg. 56).

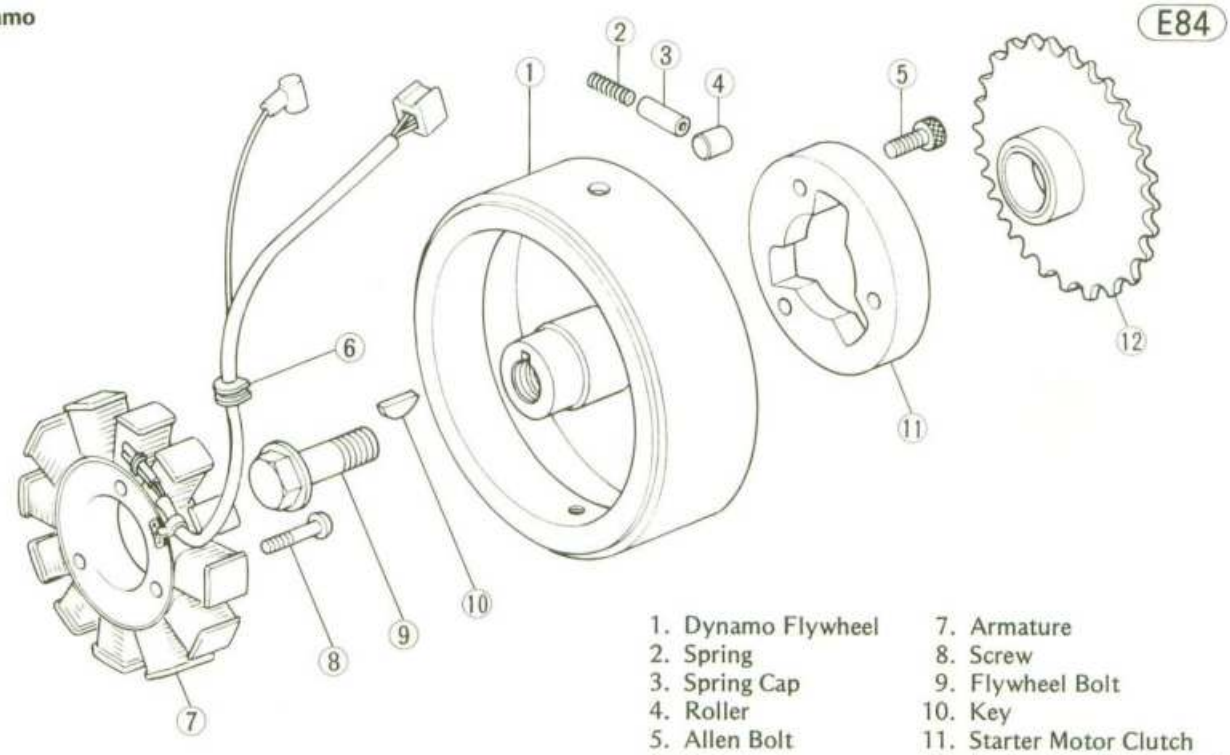
DYNAMO FLYWHEEL, STARTER MOTOR CLUTCH, SPROCKETS, CHAIN

Removal:

- Remove the left engine cover (Pg. 55).
- Hold the dynamo flywheel ① steady with the flywheel holder (special tool), and remove the bolt ⑨.

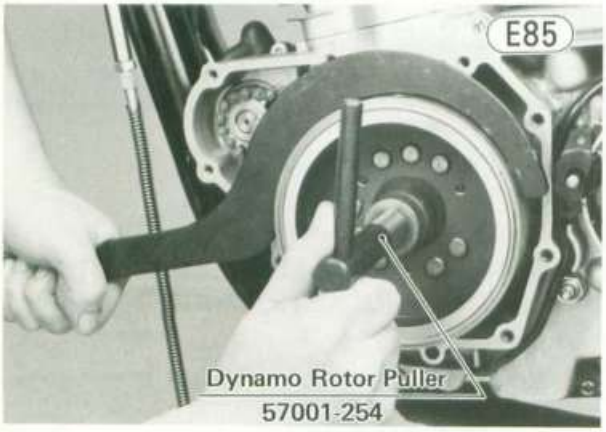


Dynamo

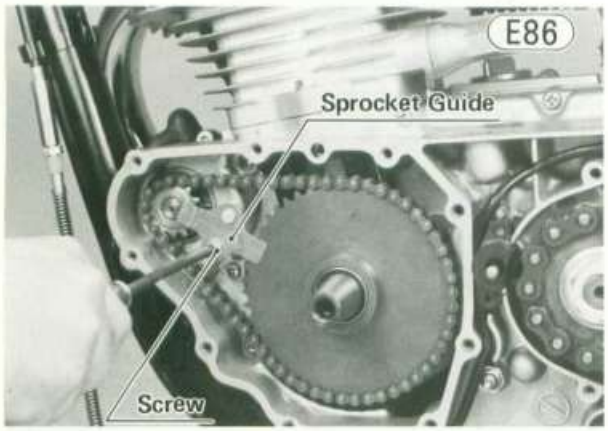


1. Dynamo Flywheel
2. Spring
3. Spring Cap
4. Roller
5. Allen Bolt
6. Grommet
7. Armature
8. Screw
9. Flywheel Bolt
10. Key
11. Starter Motor Clutch
12. Starter Clutch Sprocket

•Using the special tool to hold the flywheel steady, remove the flywheel and starter motor clutch assembly with the dynamo rotor puller (special tool).



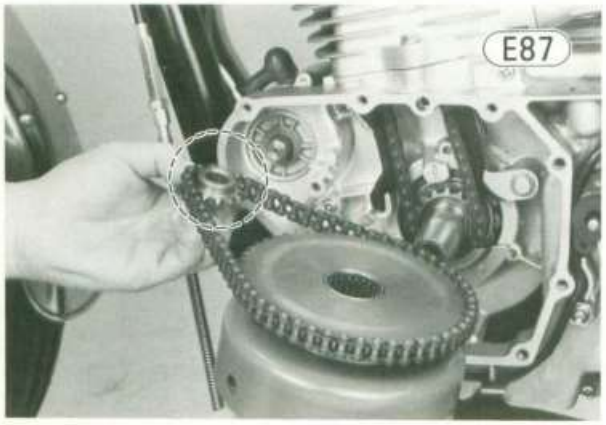
•Remove the screw and take off the sprocket guide.



•Pull off the starter motor chain and sprockets.

Installation:

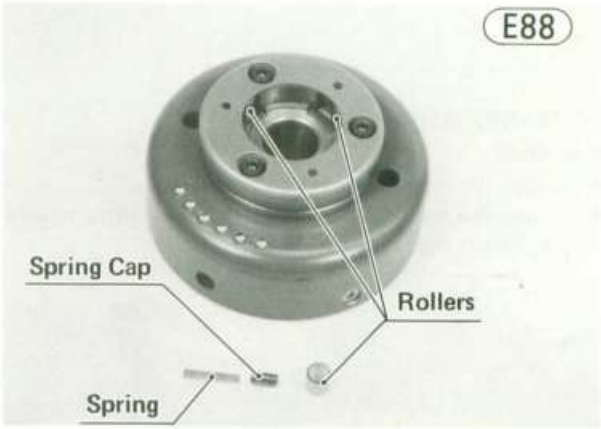
•Using a high flash-point solvent, clean off any oil or dirt that may be on the crankshaft taper or flywheel hub.
•Check to see that the key is fitted in its place on the crankshaft properly.
•Turning the large starter motor clutch sprocket, fit the sprocket into the starter motor clutch.
•Assemble the starter motor clutch, sprockets, and chain, and install them, fitting the crankshaft key into the groove in the flywheel hub. The protruding side of the starter motor sprocket must face in.



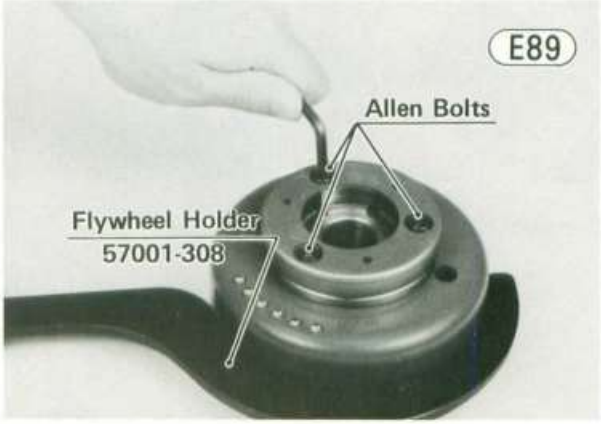
•Tighten the bolt with 6.0 kg-m (43 ft-lbs) of torque while holding the dynamo flywheel steady with the flywheel holder (special tool).
•Install the sprocket guide with the screw.
•Install the left engine cover (Pg. 56).

Disassembly:

•Remove the rollers ④, springs ②, and spring caps ③ (3 ea) from the starter motor clutch.



•Place the dynamo flywheel face down on the workbench. Holding the flywheel steady with the flywheel holder (special tool), remove the Allen bolts (3) to separate the flywheel and starter motor clutch.



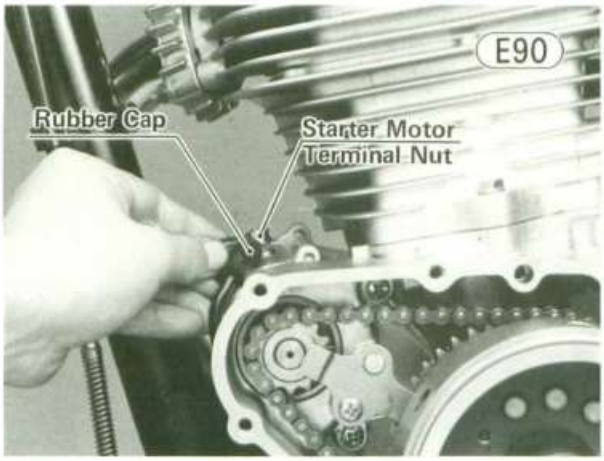
Assembly Note:

•Apply non-permanent locking agent to the starter motor clutch Allen bolts (3), and tighten the bolts with 3.5 kg-m (25 ft-lbs) of torque.

STARTER MOTOR

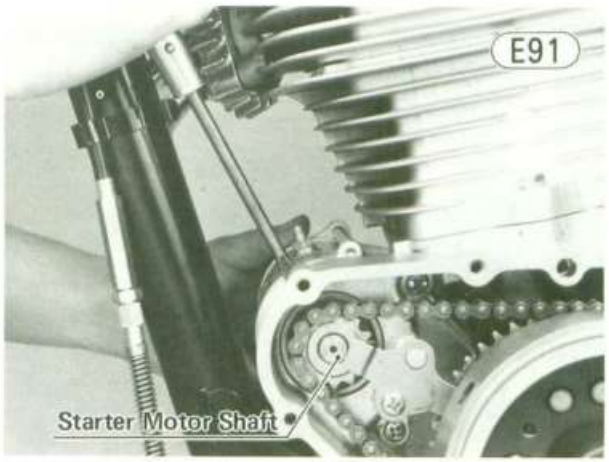
Removal:

•Remove the left engine cover (Pg. 55).
•Slide off the rubber cap, remove the starter motor terminal nut and lockwasher, and free the lead from the motor.

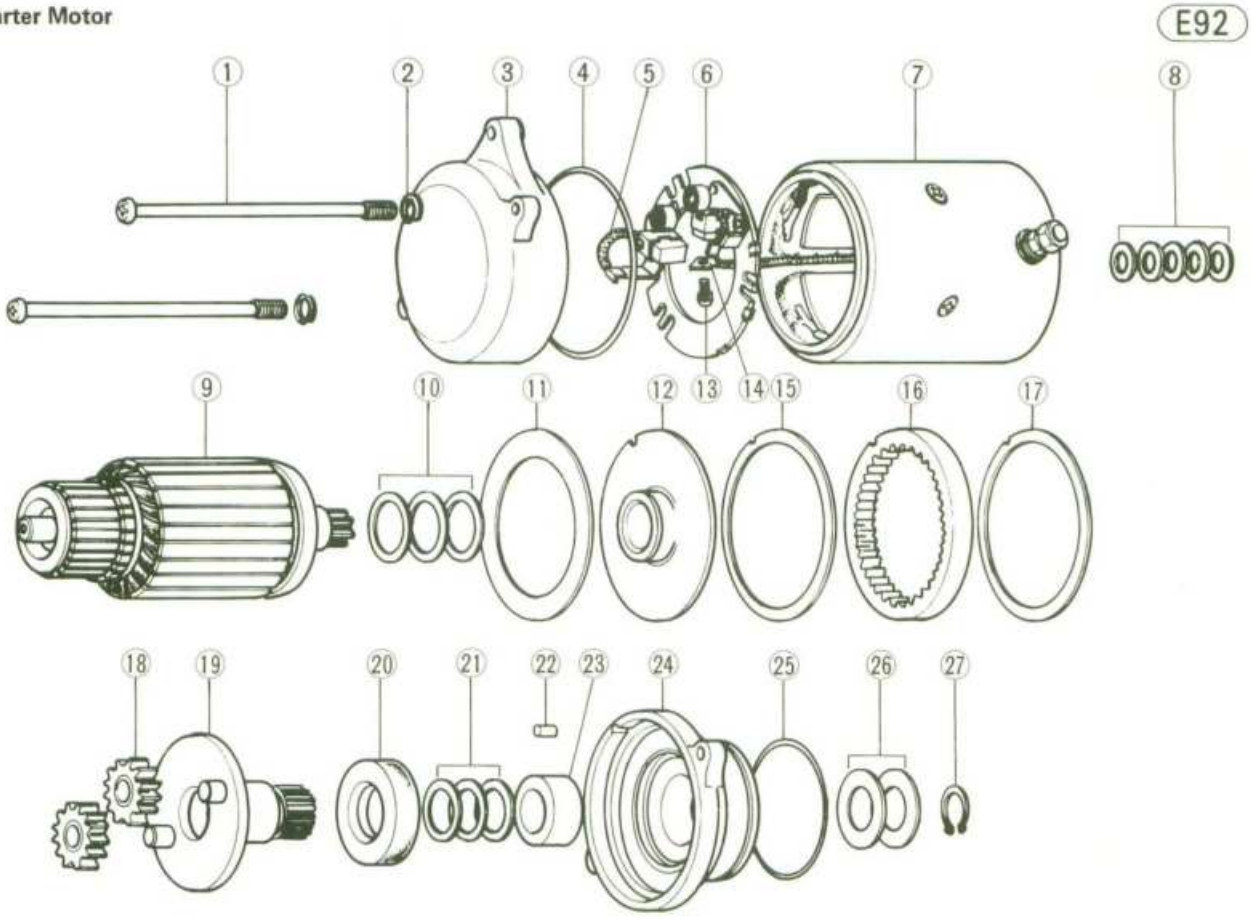


- Remove the starter motor retaining bolts (2).
- Pry the starter motor loose from the crankcase with a screwdriver and pull off the starter motor towards the right side of the engine.

CAUTION **Do not tap on the starter motor shaft. Tapping on the shaft may damage the motor.**



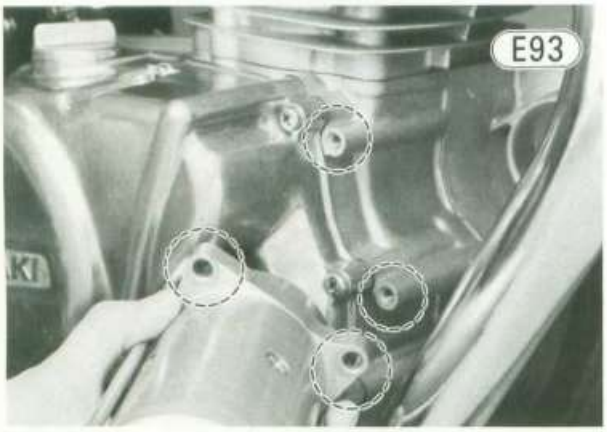
Starter Motor



1. Screw
2. Lockwasher
3. End Cover
4. O Ring
5. Brush Lead
6. Brush Plate
7. Yoke Assembly
8. Thrust Washers
9. Armature
10. Thrust Washers
11. Gasket
12. End Plate
13. Screw
14. Field Coil Lead
15. Gasket
16. Internal Gear
17. Gasket
18. Planet Pinion
19. Output Shaft
20. Grease Seal
21. Thrust Washers
22. Key
23. Bush
24. End Cover
25. O Ring
26. Thrust Washers
27. Circlip

Installation:

- Replace the O ring with a new one, if it is deteriorated or damaged, and apply a little oil to it.
- Clean the starter motor lugs and crankcase where the starter motor is grounded.



- Place the starter motor back into position, fitting the shaft through the sprocket with chain. The protruding side of the sprocket must face in (Fig. E87).
- Tighten the starter motor retaining bolts (2).
- Connect the starter motor lead to the terminal with its lockwasher and nut, and tighten the nut.
- Install the rubber cap.
- Install the left engine cover (Pg. 56).

Disassembly:

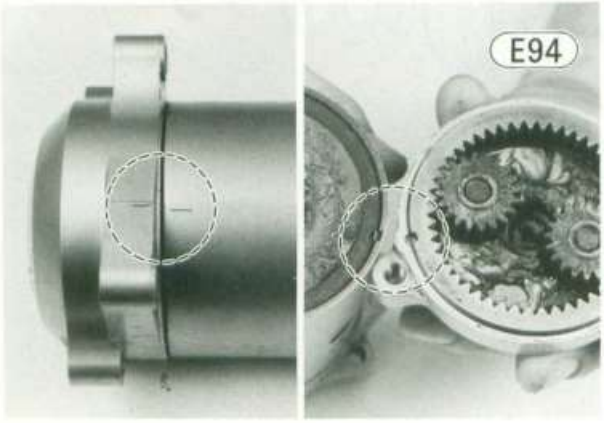
- Remove the screws ① (2), lockwashers ② (2), and remove the end covers ③, ㉔.
- Remove the gasket ⑮, end plate ⑫, gasket ⑪, thrust washers ⑩ and armature ⑨ from the shaft side.
- Remove the screw which connects the brush lead ⑤ to the field coil lead ⑭, and remove the brush plate ⑥. The screw has a lockwasher. There is an O ring ④ at the brush side of the housing.

NOTE: The yoke assembly ⑦ is not meant to be disassembled.

- Remove the planet pinions ⑱, internal gear ⑯, gasket ⑰, and key ㉒.

Assembly Notes:

1. Replace any O rings that are deteriorated or damaged with new ones.
2. Align the notch on the end plate with the tongue on the housing, and align the line on each end cover with its line on the housing.

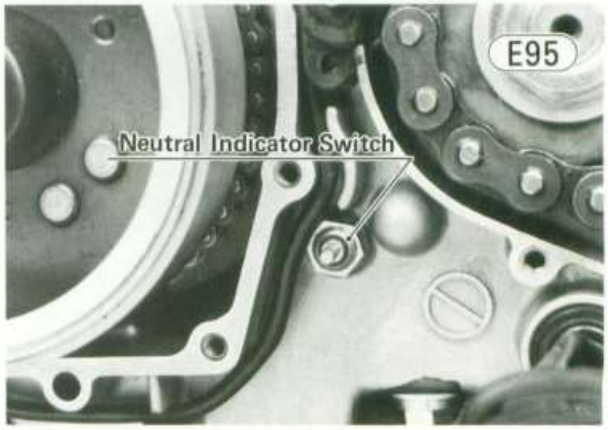


3. Apply a high temperature grease to the planet pinions, internal gear, and planet pinion shafts on the output shaft.

NEUTRAL INDICATOR SWITCH

Removal:

- Remove the left engine cover (Pg. 55).
- Unscrew the neutral indicator switch and gasket.



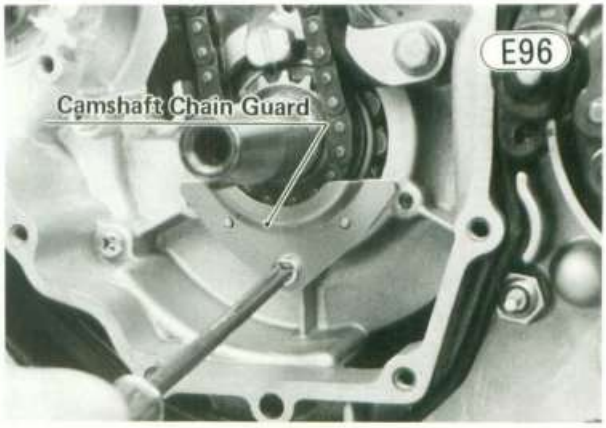
Installation:

- Install the neutral indicator switch and gasket, tightening the switch with 1.5 kg-m (11.0 ft-lbs) of torque.
- Install the left engine cover (Pg. 56).

CAMSHAFT CHAIN

Removal:

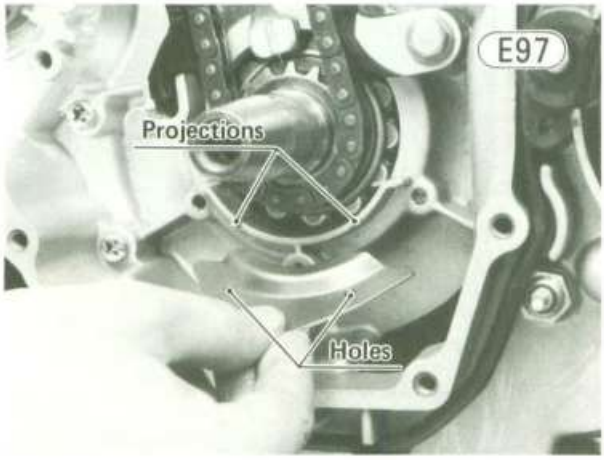
- Remove the timing advancer (Pg. 44).
- Remove the camshaft sprocket (Pg. 45).
- Remove the camshaft (Pg. 47).
- Remove the left engine cover (Pg. 55).
- Remove the dynamo flywheel, starter motor clutch, sprockets, and chain (Pg. 57).
- Remove the camshaft chain guard screw and take off the guard.



- Drop the camshaft chain down onto the crankshaft sprocket and pull the chain off towards the left.

Installation:

- Fit the camshaft chain onto the crankshaft sprocket, pull the chain up through the cylinder block, and then insert a screwdriver through it to keep the chain from falling.
- Install the camshaft chain guard matching its holes with the projections on the crankcase, and tighten its screw.

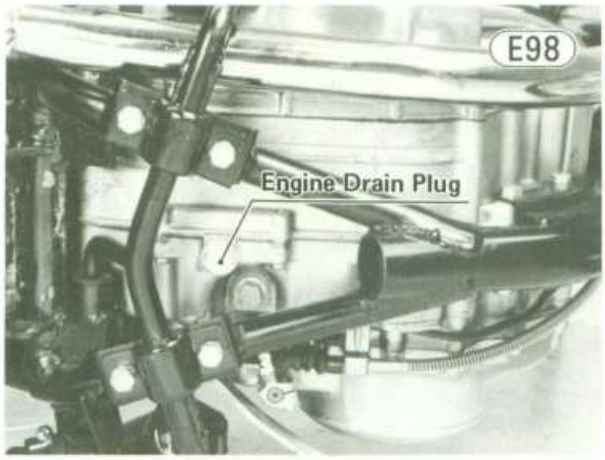


- Install the dynamo flywheel, starter motor clutch, sprockets, and chain (Pg. 58).
- Install the left engine cover (Pg. 56).
- Install the camshaft (Pg. 47).
- Install the camshaft sprocket (Pg. 46).
- Install the timing advancer (Pg. 44).
- Check the oil level and add oil as required (Pg. 18).

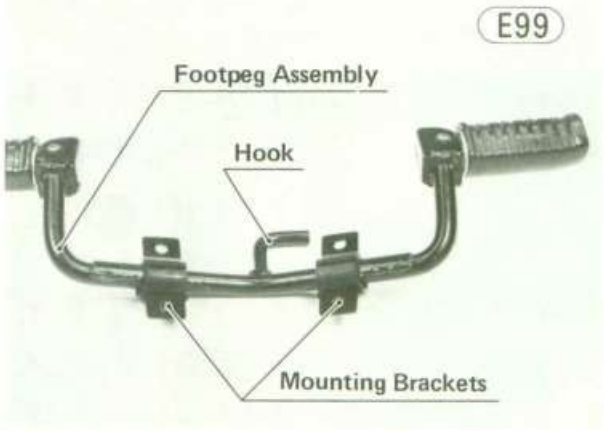
RIGHT ENGINE COVER, OIL FILTER

Removal:

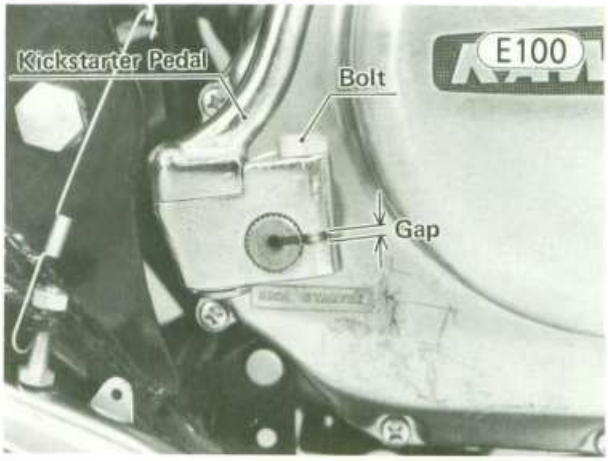
- With the motorcycle on its center stand, place an oil pan beneath the engine, and remove the engine drain plug and washer to drain out the oil.
- After the oil has drained, tighten the drain plug with 1.5 kg-m (11.0 ft-lbs) of torque.



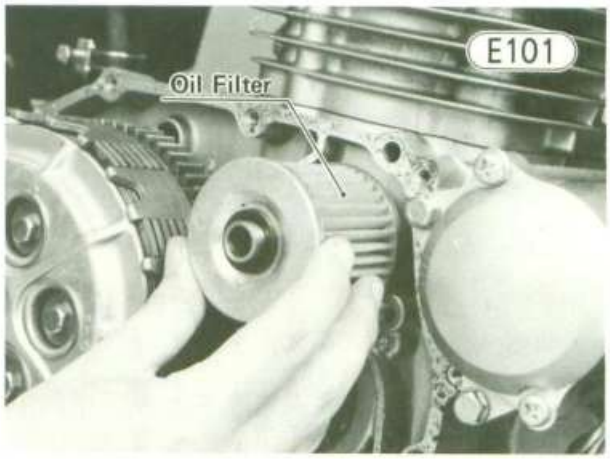
- Being careful not to bend or otherwise damage it, free the rear brake light switch spring from the tab on the brake pedal.
- Back the rear brake adjusting nut off to the end of the brake rod to give the pedal play. Loosen the brake pedal adjusting bolt locknut, and back out the adjusting bolt until the pedal is held down out of the way.
- Remove the foot peg assembly mounting bracket bolts (4), lockwashers (4), and brackets (2). First pull the assembly to the right to free the assembly hook from the frame bracket, and then take off the assembly.



- Mark the position of the kickstarter pedal so that it can later be installed on the kick shaft in the same position.
- Take out the kickstarter pedal bolt. Slightly widen the gap in the kickstarter pedal with a screwdriver, and pull off the kickstarter pedal.

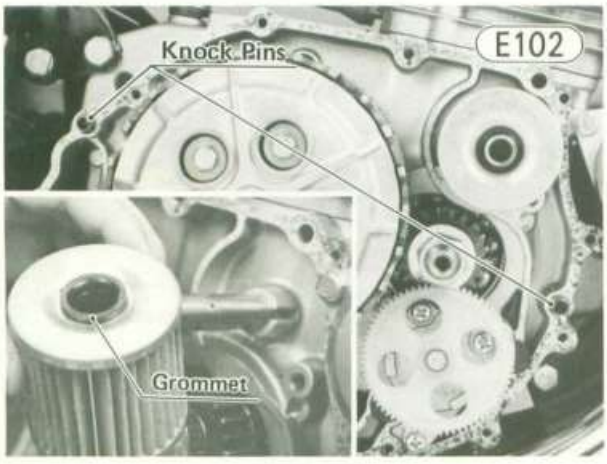


- Remove the right engine cover screws (12), and pull off the cover.
- Remove the right engine cover gasket, and pull off the oil filter.

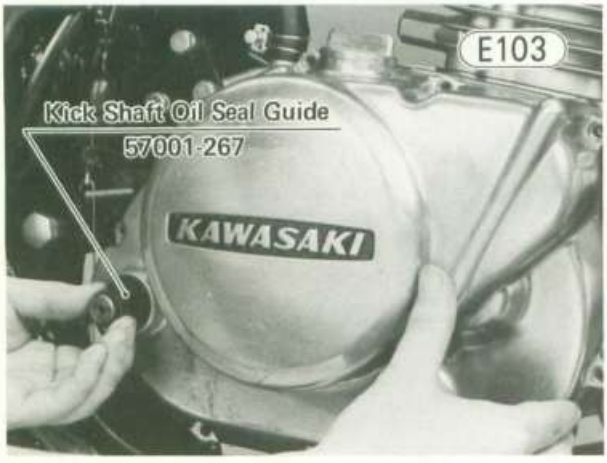


Installation:

- Check that the knock pins (2) are in place, and fit a new right engine cover gasket.
- Apply a little engine oil to the oil filter grommets on both sides of the element, and turn the filter to work the element into place. Be careful that the element grommets do not slip out of place.



- Insert the kick shaft oil seal guide (special tool) in the right engine cover oil seal, and fit the right engine cover onto the crankcase. Tighten its screws (12).

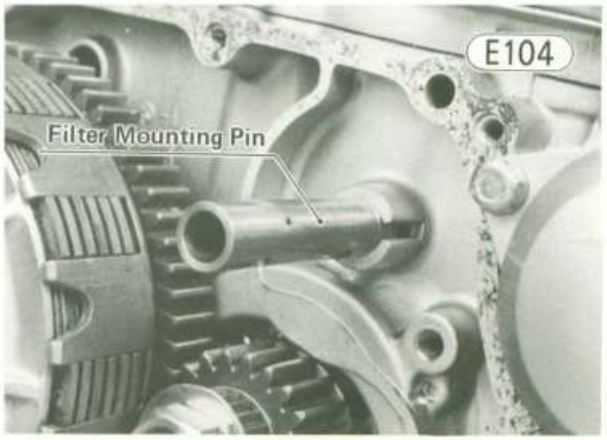


- Install the kickstarter pedal in its original position on the kick shaft, and tighten its bolt.
- Put the footpeg assembly hook into the frame bracket, install the mounting brackets (2), and tighten their bolts (4) (Fig. E99).
- Fill the engine with oil, check the oil level (Pg. 18), and add more if necessary.
- Adjust the rear brake pedal (Pg. 23).
- Install the rear brake light switch spring.
- Adjust the rear brake light switch (Pg. 24).

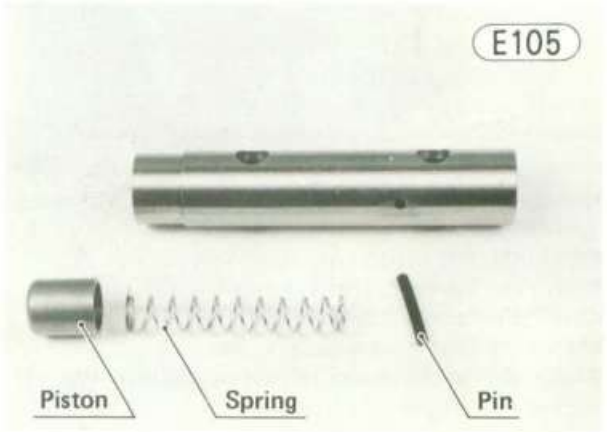
BYPASS VALVE

Removal:

- Remove the right engine cover and oil filter (Pg. 61).
- Pull out the filter mounting pin.



- To remove the bypass valve, drive out the pin and drop out the spring and piston.



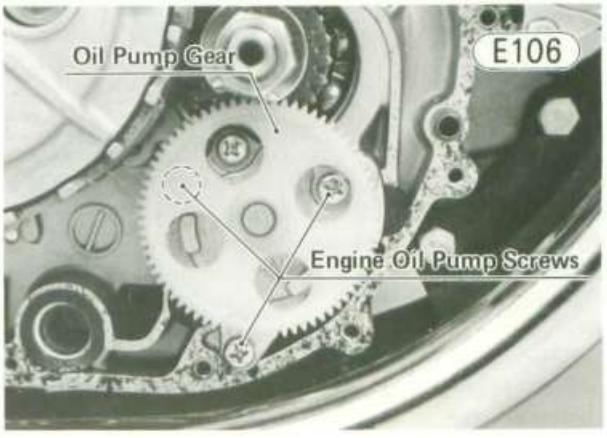
Installation:

- Fit the piston and spring into the mounting pin, and drive in the pin while depressing the spring.
- Install the oil filter mounting pin.
- Install the right engine cover and oil filter.

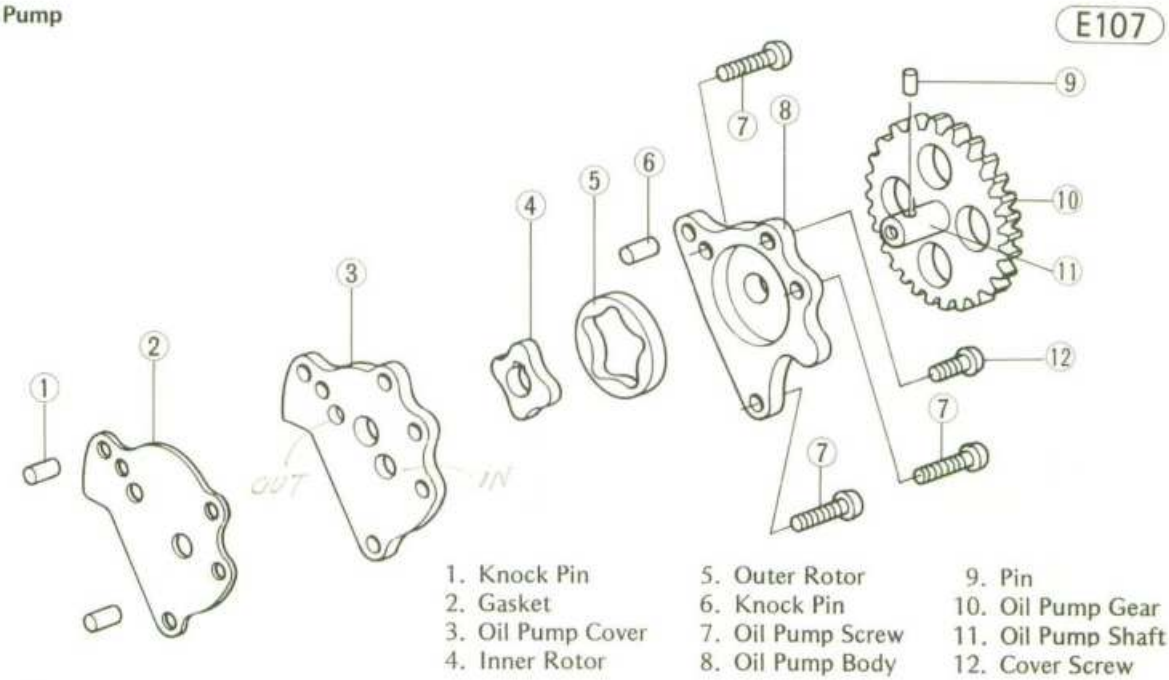
ENGINE OIL PUMP

Removal:

- Remove the right engine cover (Pg. 61).
- Turn the crankshaft so that the engine oil pump screws (3) can be removed through the oil pump gear hole, and remove the screws (3) and oil pump. There are two knock pins.



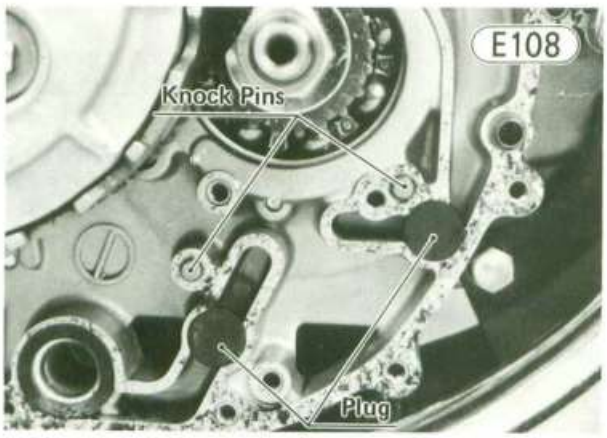
Engine Oil Pump



1. Knock Pin
2. Gasket
3. Oil Pump Cover
4. Inner Rotor
5. Outer Rotor
6. Knock Pin
7. Oil Pump Screw
8. Oil Pump Body
9. Pin
10. Oil Pump Gear
11. Oil Pump Shaft
12. Cover Screw

Installation Notes:

1. Replace the engine oil pump gasket with a new one.
2. Fill the oil pump with engine oil for initial lubrication.
3. Check to see that the knock pins (2) and plugs (2) are in place.



4. Be sure the oil pump gear and pump drive gear at the end of the crankshaft mesh properly.

Disassembly:

- Remove the oil pump cover screw ⑫, and take off the oil pump cover ③.
- Take out the rotors ④, ⑤.
- Take out the pin ⑨, and pull off the oil pump gear ⑩ and shaft ⑪.

Assembly Notes:

1. Check to see that the knock pin ⑥ is in place.
2. After completing the oil pump assembly, check that the rotor shaft and rotors turn smoothly.

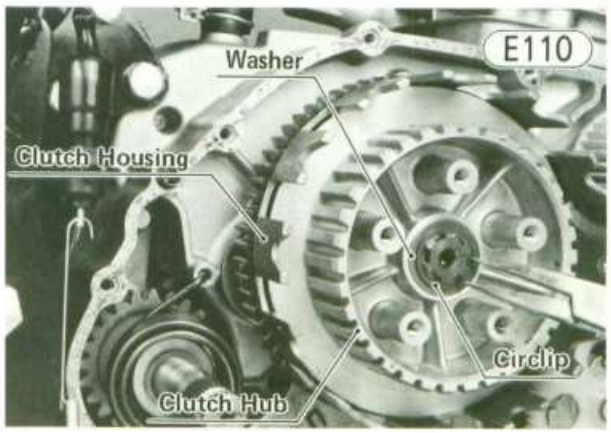
CLUTCH

Removal:

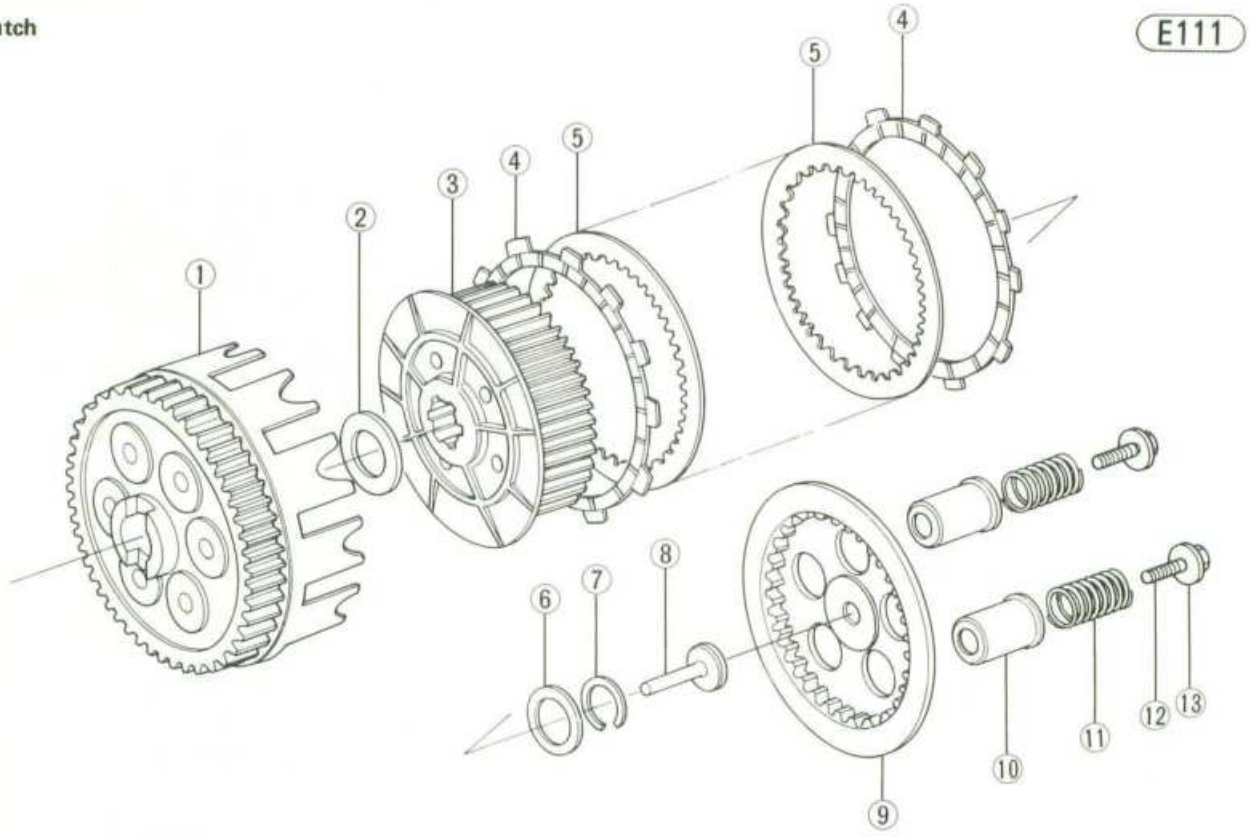
- Remove the right engine cover (Pg. 61).
- Remove the clutch spring bolts ⑫ (5), washers ⑬ (5), springs ⑪ (5), and spring seats ⑩ (5).
- Pull off the spring plate ⑨, and pull out the spring plate pusher ⑧.



- Remove the friction plates ④ (6) and steel plates ⑤ (5).
- Remove the circlip ⑦ and washer ⑥, and pull off the clutch hub ③ and clutch housing ①. There is a thrust washer between the clutch hub and the clutch housing.



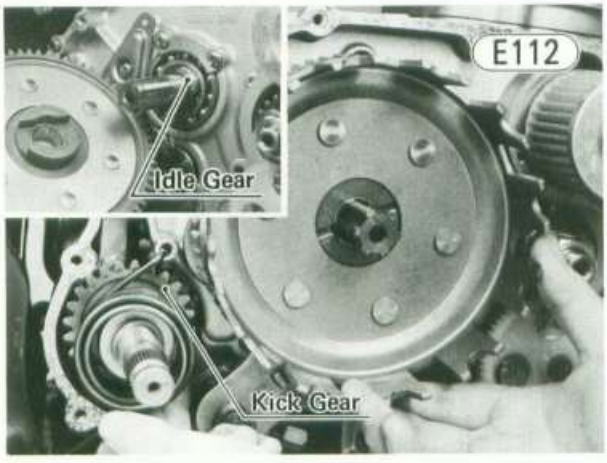
Clutch



1. Clutch Housing
2. Thrust Washer
3. Clutch Hub
4. Friction Plate
5. Steel Plate
6. Washer
7. Circlip
8. Spring Plate Pusher
9. Spring Plate
10. Spring Seat
11. Spring
12. Bolt
13. Washer

Installation:

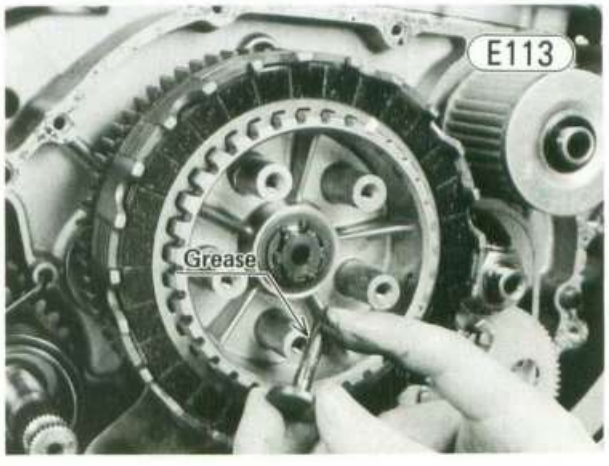
- Fit the clutch housing back onto the drive shaft while turning the kick gear by hand so that the rear of the housing will mesh with the drive shaft idle gear.



- Put on the large thrust washer, clutch hub, flat washer, and circlip.
- Install the friction plates (6) and steel plates (5), starting with a friction plate and alternating them.

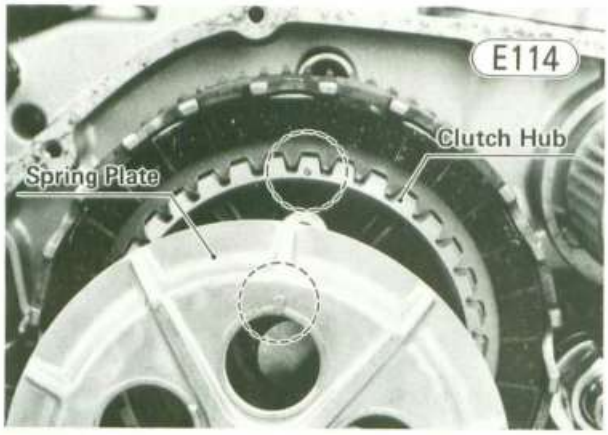
CAUTION **If new, dry steel plates and friction plates are installed, apply engine oil on the surfaces of each plate to avoid clutch plate seizure.**

- Insert the spring plate pusher, applying a thin coat of a high temperature grease to its surface.

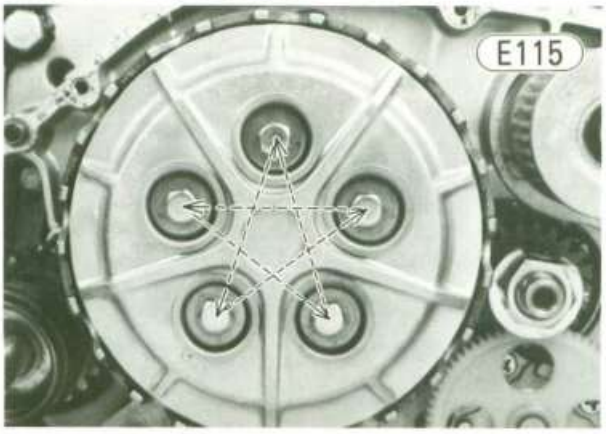


- Fit the spring plate back into place, aligning the mark on the plate with the mark on the clutch hub.

CAUTION **Misalignment of the spring plate can cause clutch drag (when it is disengaged), or clutch slipping.**



•Install the spring seats, springs, washers, and spring bolts (5 ea). Cross tighten the bolts evenly with 1.0 kg-m (87 in-lbs) of torque.

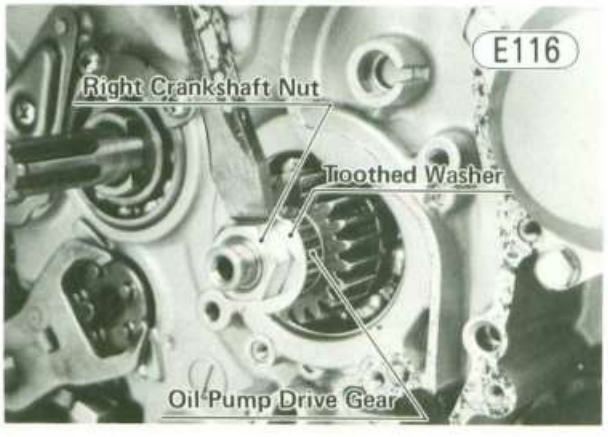


•Install the right engine cover (Pg. 62).
•Fill the engine with oil (Pg. 18).
•Adjust the rear brake pedal (Pg. 23).
•Adjust the rear brake light switch (Pg. 24).

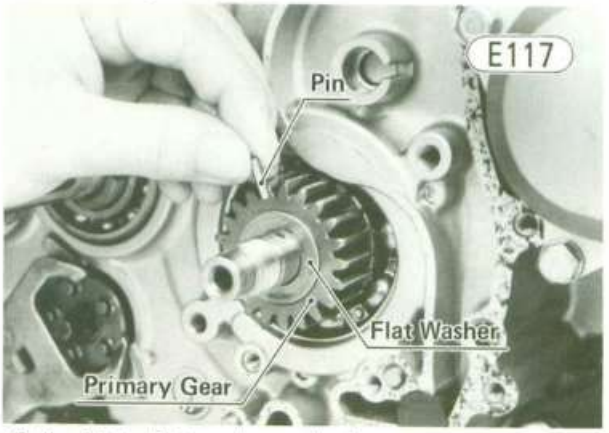
PRIMARY GEAR, OIL PUMP DRIVE GEAR

Removal:

•Remove the left engine cover (Pg. 55).
•Remove the right engine cover and oil filter (Pg. 61).
•Remove the engine oil pump (Pg. 62).
•Pull off the oil filter mounting pin.
•Remove the clutch (Pg. 63).
•Straighten the side of the toothed washer that is bent up against the right crankshaft nut.



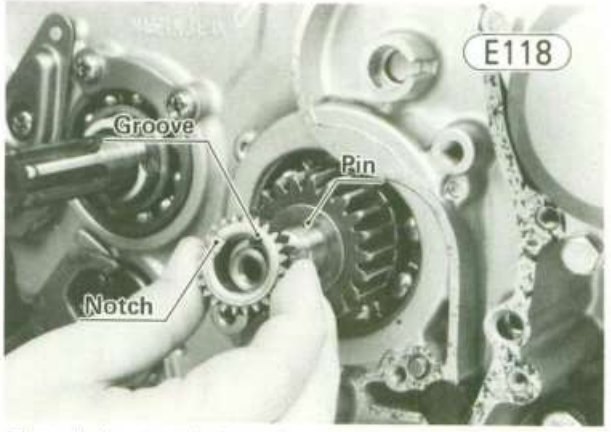
•Hold the dynamo flywheel steady with the flywheel holder (special tool) as shown in Fig. E83, and remove the right crankshaft nut.
•Pull off the toothed washer, oil pump drive gear, and remove the pin.



•Pull off the flat washer and primary gear.

Installation:

•Install the primary gear on the crankshaft with its flat side facing out.
•Fit the flat washer onto the crankshaft.
•Install the pin into the crankshaft.
•Install the oil pump drive gear, fitting the gear groove with the pin. The notched side of the gear must face out.



•Install the toothed washer, fitting the tooth into the notch in the oil pump drive gear.
•Hold the dynamo flywheel steady with the flywheel holder (special tool). Tighten the right crankshaft nut with 6.0 kg-m (43 ft-lbs) of torque.
•Bend one side of the toothed washer over the nut.
•Install the oil filter mounting pin.
•Install the clutch (Pg. 64).
•Install the engine oil pump (Pg. 63).
•Install the right engine cover and oil filter (Pg. 62).
•Install the left engine cover (Pg. 56).

EXTERNAL SHIFT MECHANISM

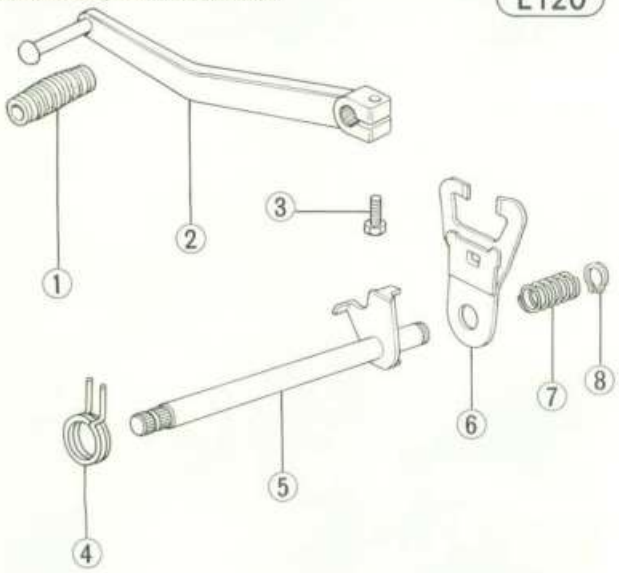
Removal:

•Remove the right engine cover (Pg. 61).
•Remove the clutch (Pg. 63).
•Take out the shift pedal bolt, and remove the shift pedal.

•Pull out the external shift mechanism and return spring.



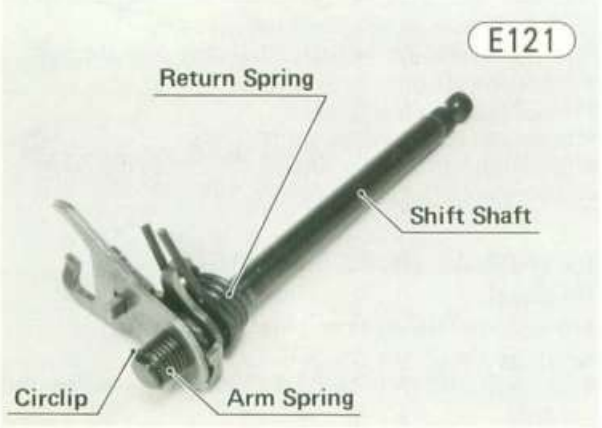
External Shift Mechanism E120



1. Pedal Rubber
2. Shift Pedal
3. Bolt
4. Return Spring
5. Shift Shaft
6. Shift Arm
7. Arm Spring
8. Circlip

Installation:

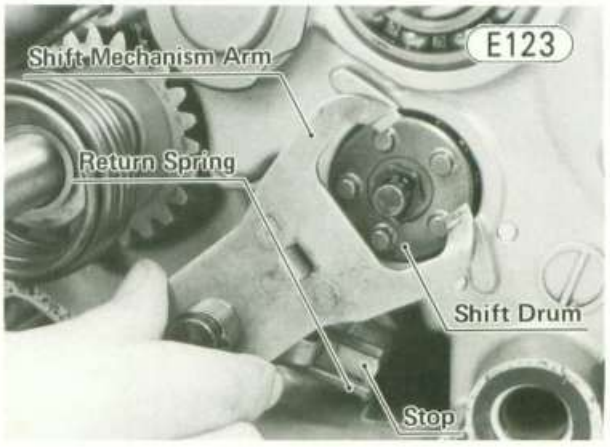
•Fit the return spring on the shift shaft as shown, and check that the arm spring and circlip are in place.



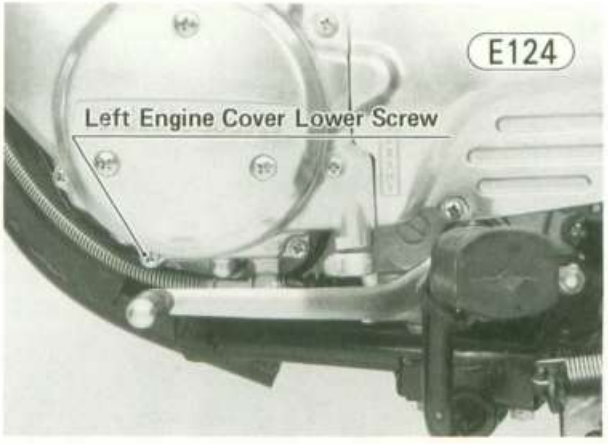
•Insert the shift shaft oil seal guide (special tool) in the left crankcase oil seal. Install the external shift mechanism.



•Fit the return spring onto the return spring stop, and place the shift mechanism arm on the shift drum pins.



•Install the clutch (Pg. 63).
•Install the right engine cover (Pg. 62).
•Install the shift pedal so that its end matches the level of the engine cover lower screw.

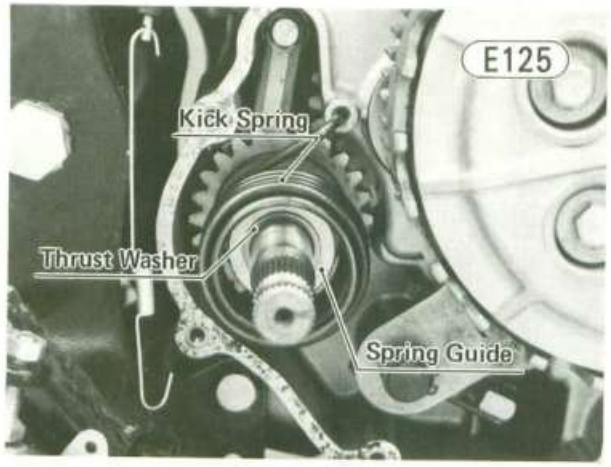


•Fill the engine with oil, and add oil as required (Pg. 18).
•Adjust the rear brake pedal (Pg. 23).
•Adjust the rear brake light switch (Pg. 24).
•Adjust the clutch (Pg. 64).

KICKSTARTER

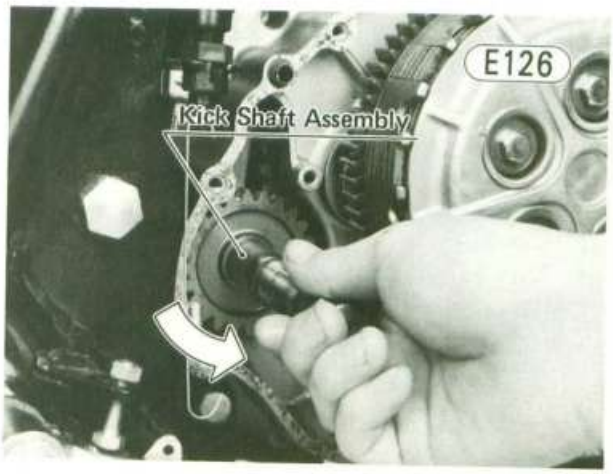
Removal:

- Remove the right engine cover (Pg. 61).
- Pull out the thrust washer ⑰ and spring guide ⑯.



- Remove the kick spring ⑮.
- Remove the kick shaft assembly, twisting it to the left.

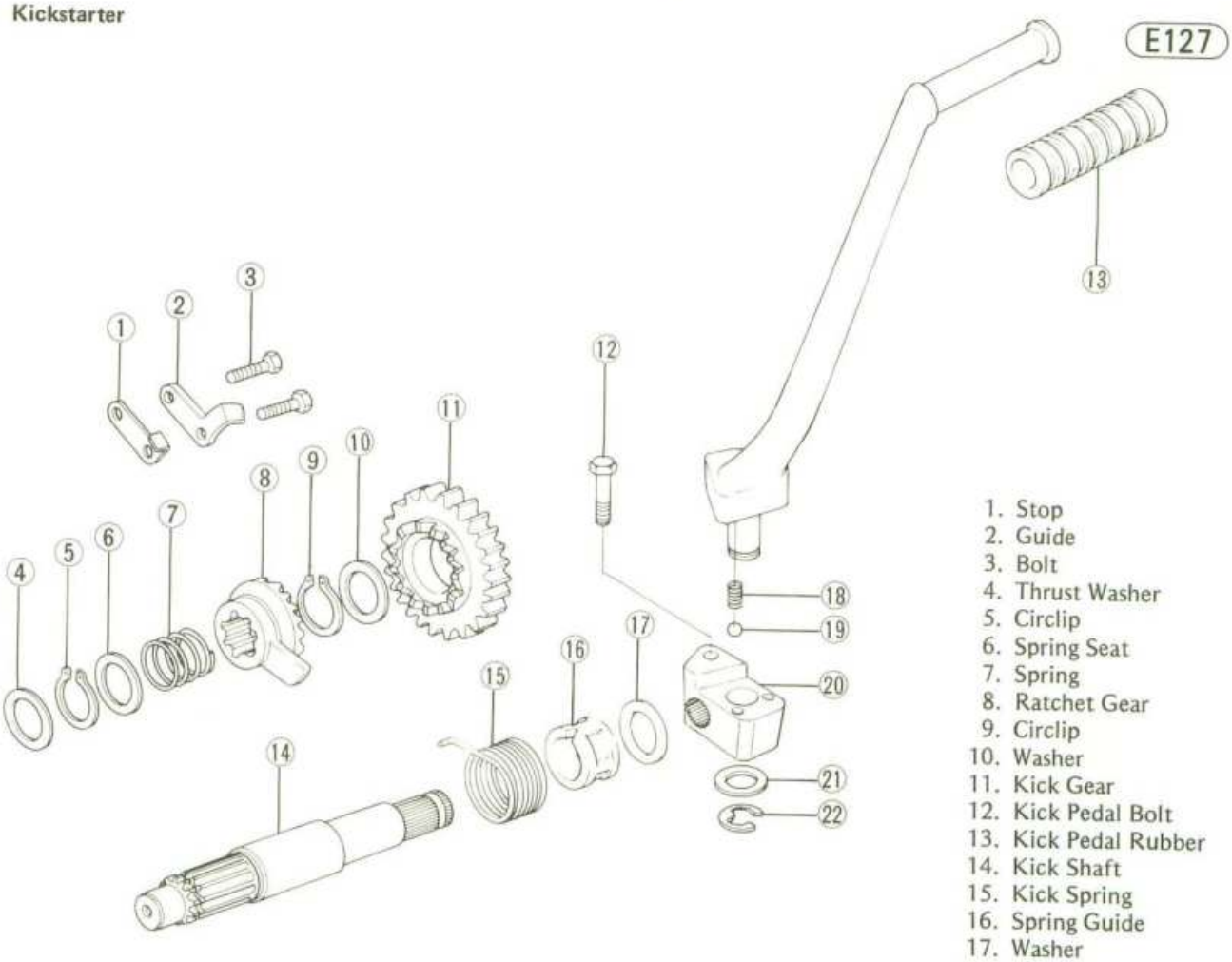
There is a thrust washer ④ between the kick shaft and the crankcase.



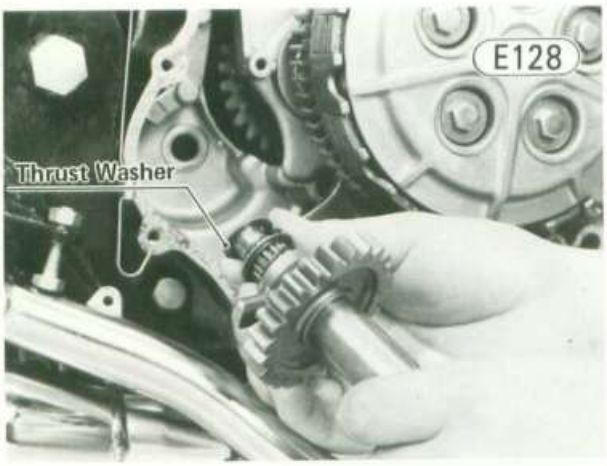
Installation:

- Put the thrust washer on the kick shaft end, and install the kick shaft assembly in the right crankcase (Fig. E128).

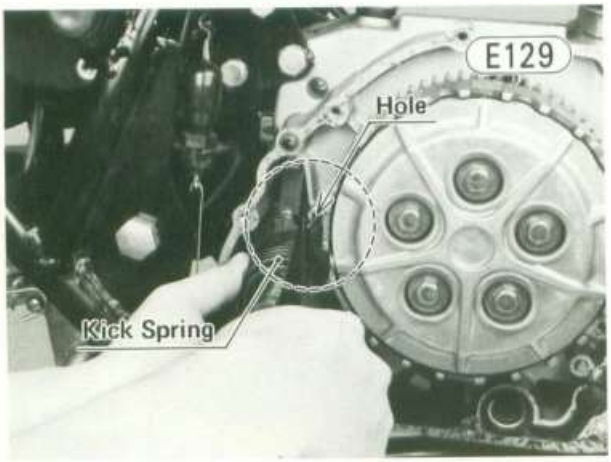
Kickstarter



1. Stop
2. Guide
3. Bolt
4. Thrust Washer
5. Circlip
6. Spring Seat
7. Spring
8. Ratchet Gear
9. Circlip
10. Washer
11. Kick Gear
12. Kick Pedal Bolt
13. Kick Pedal Rubber
14. Kick Shaft
15. Kick Spring
16. Spring Guide
17. Washer
18. Spring
19. Steel Ball
20. Boss
21. Washer
22. **C** Ring



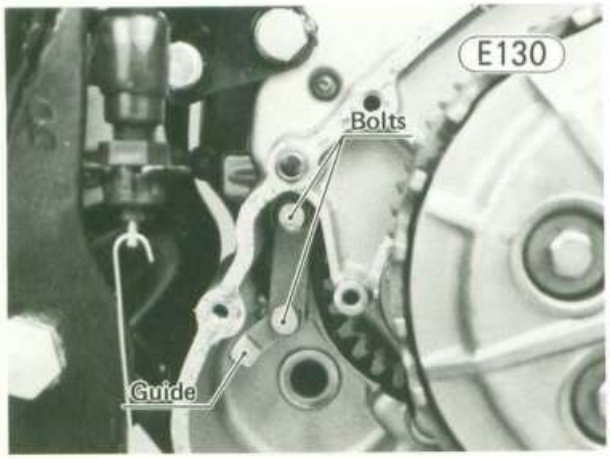
•To install the kick spring, turn the kick shaft assembly all the way clockwise, insert one end of the spring into the kick shaft, and fit the other end of the spring into the crankcase hole, using pliers.



•Install the kick spring guide and washer.
•Install the right engine cover and oil filter (Pg. 62).
•Fill the engine with oil, and add oil as required (Pg. 18).
•Adjust the rear brake pedal (Pg. 23).
•Adjust the rear brake light switch (Pg. 24).

Disassembly:

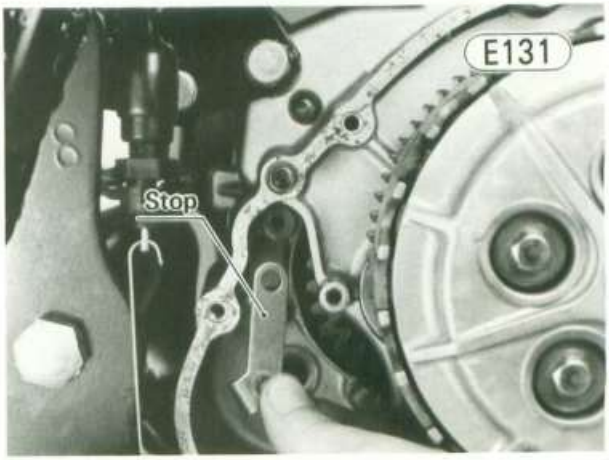
•Remove the ratchet gear arm stop bolts ③, and remove the guide ② and stop ①.



•Remove the circlip ⑤ from the kick shaft end, and take off the washer ⑥, spring ⑦, and ratchet gear ⑧.
•Remove the circlip ⑨, and pull off the washer ⑩ and kick gear ⑪.

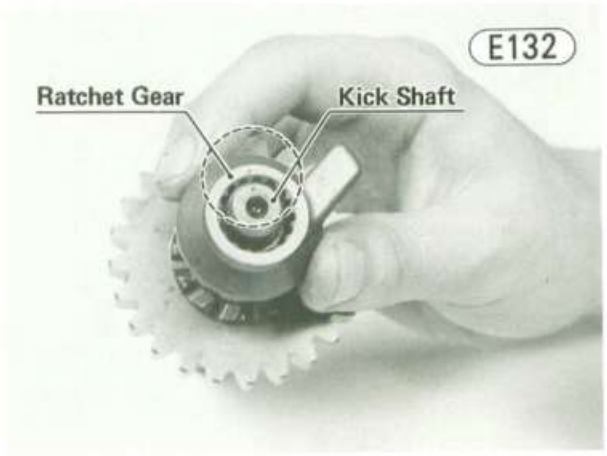
Assembly Notes:

1. Fit the ratchet gear arm stop as shown in Fig. 131, and fit the guide as shown in Fig. 130. Apply a locking agent to the ratchet gear arm stop bolts (2), and tighten them with 0.90 kg-m (78 in-lbs) of torque.



2. Apply a little engine oil to the kick shaft, kick gear, and ratchet gear before installation.
3. When installing the ratchet gear, align the ratchet gear punch mark with the punch mark on the kick shaft.

CAUTION **Misalignment of the ratchet gear changes the kick spring preload. If the kick spring preload is too light, partial mesh of the kick gear and the ratchet gear could cause kick mechanism noise. If the kick spring preload is too heavy, the kick spring could weaken or break.**

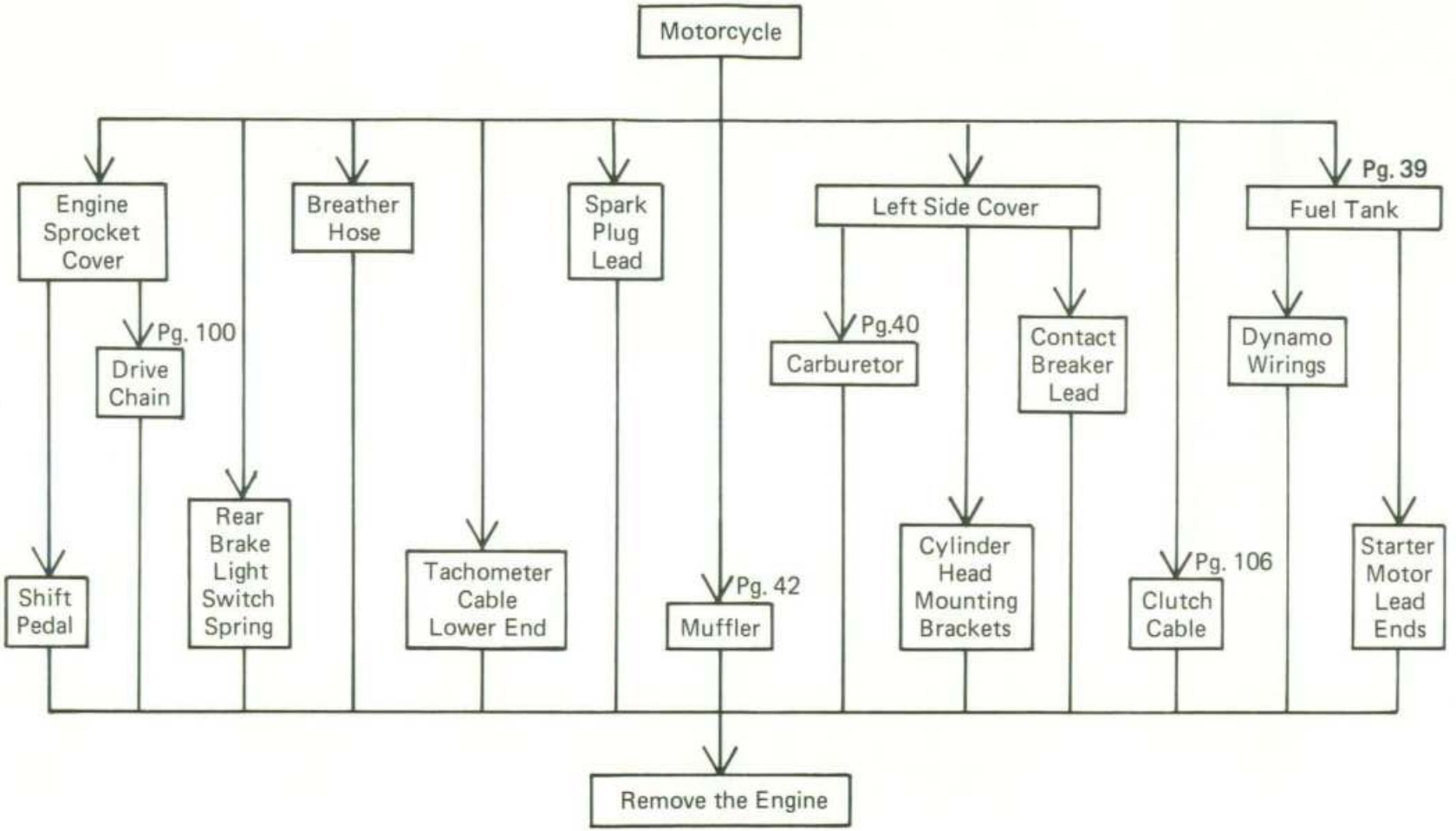


Disassembly–Engine Removed

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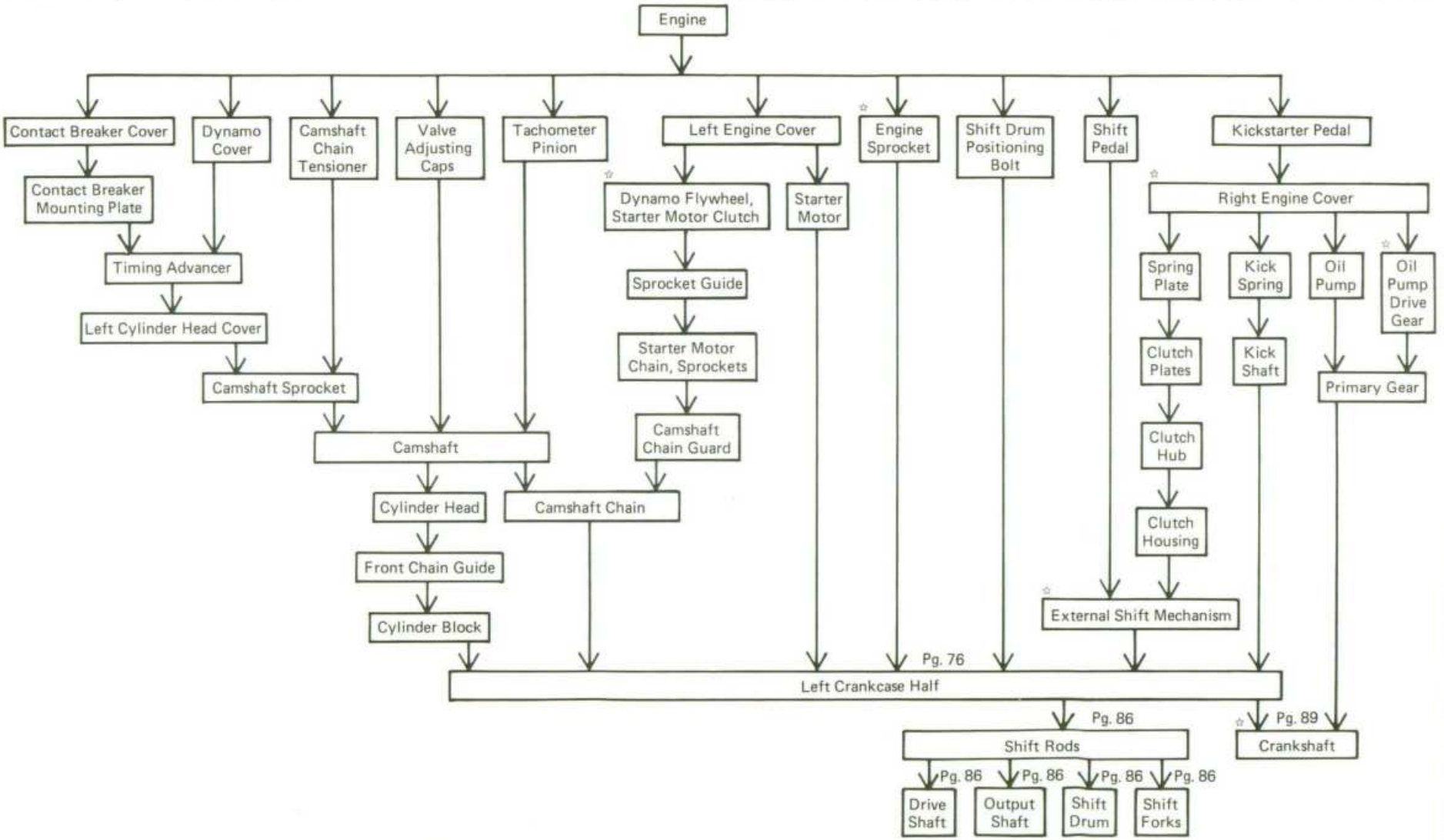
FLOW CHARTS 70
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Shift Drum 88
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Output Shaft 89
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CRANKCASE 91

FLOW CHART
Engine Removal



FLOW CHART
Disassembly – Engine Removed

The following chart is intended to be aids to proper removal. Select the component you wish to remove and follow the arrows to that point on the chart.



NOTES: 1. Action that has been already done in the engine removal procedure is omitted. Action that is not necessarily required for engine disassembly off the motorcycle is also omitted.
2. Action with a mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

ENGINE REMOVAL

Removal:

•With the motorcycle up on its center stand, place an oil pan beneath the engine, and remove the engine drain plug to drain the oil.



•After draining the oil, install the drain plug and a new aluminum washer, and tighten the plug with 1.5 kg-m (11.0 ft-lbs) of torque.
•Remove the fuel tank (Pg. 39).



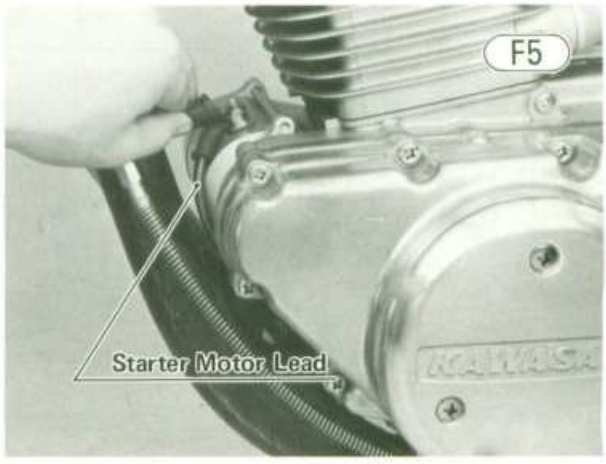
•Disconnect the spark plug lead.
•Disconnect the black contact breaker lead.



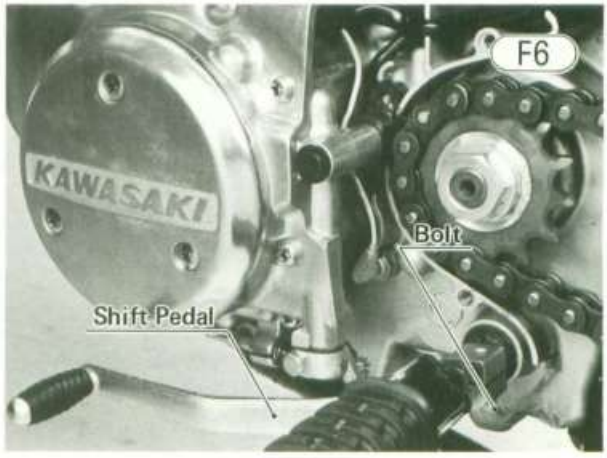
•Take off the left side cover.
•Disconnect the 3-pin dynamo wiring connector.



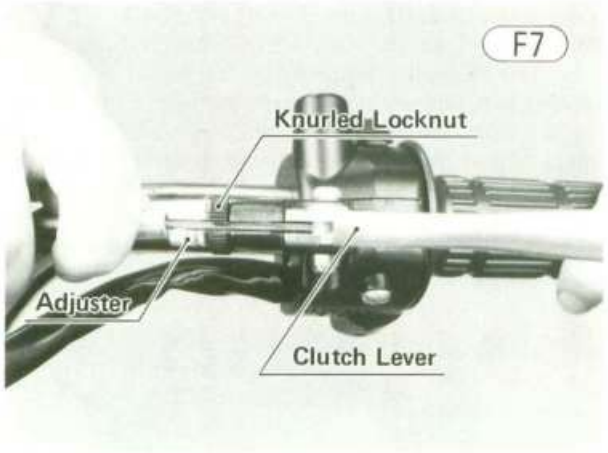
•Remove the nut and lockwasher, and remove the starter motor lead from the starter relay terminal.
•Slide the rubber cap out of place, remove the nut and lockwasher, and free the starter motor lead from the starter motor terminal.



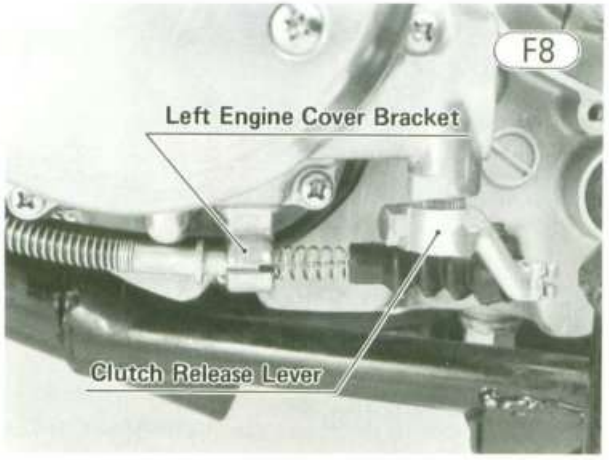
•Remove the engine sprocket cover screws (2), and take off the cover.
•Check to see that the transmission is in neutral, then take out the shift pedal bolt, and remove the shift pedal.



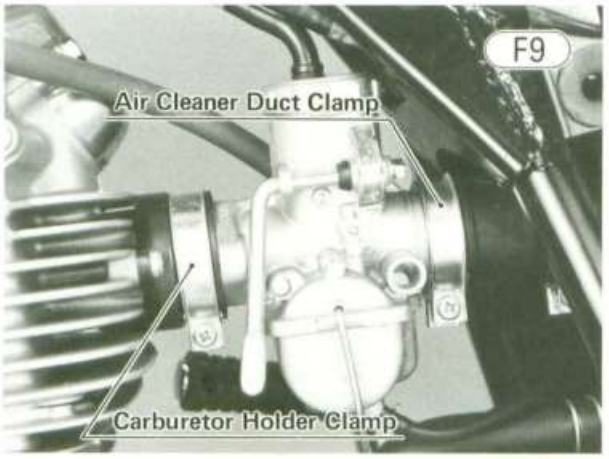
- Remove the drive chain (Pg. 100).
- Loosen the knurled locknut at the clutch lever, and turn in the adjuster.
- Line up the slots in the clutch lever, knurled locknut, and adjuster, and free the cable from the lever.



- Remove the clutch inner cable tip from the clutch release lever and left engine cover bracket.

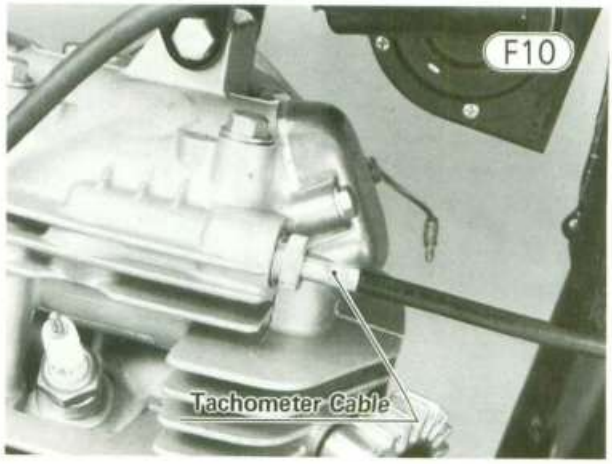


- Loosen the carburetor holder and air cleaner duct clamps and slip the air cleaner duct out of place.



- Slip the carburetor out the right side of the motorcycle, and set it on top of the frame.

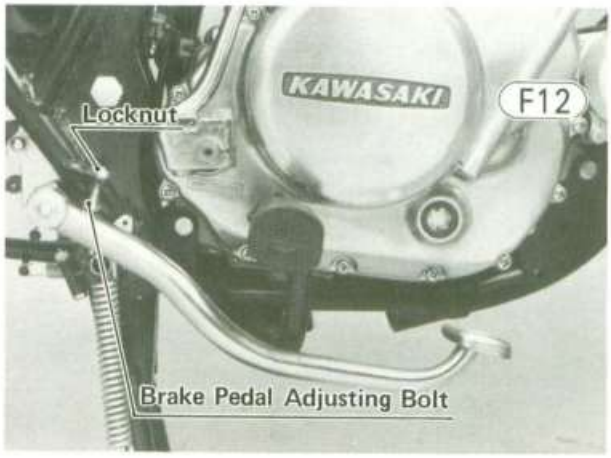
- Disconnect the tachometer cable from the cylinder head.



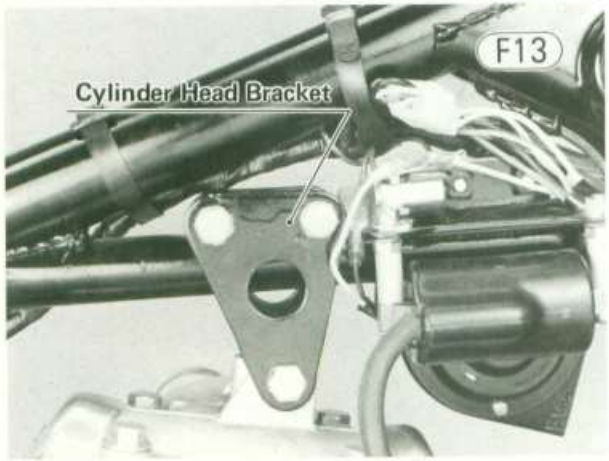
- Remove the muffler (Pg. 42).
- Slide the clip out of place, and remove the breather hose from the breather pipe.



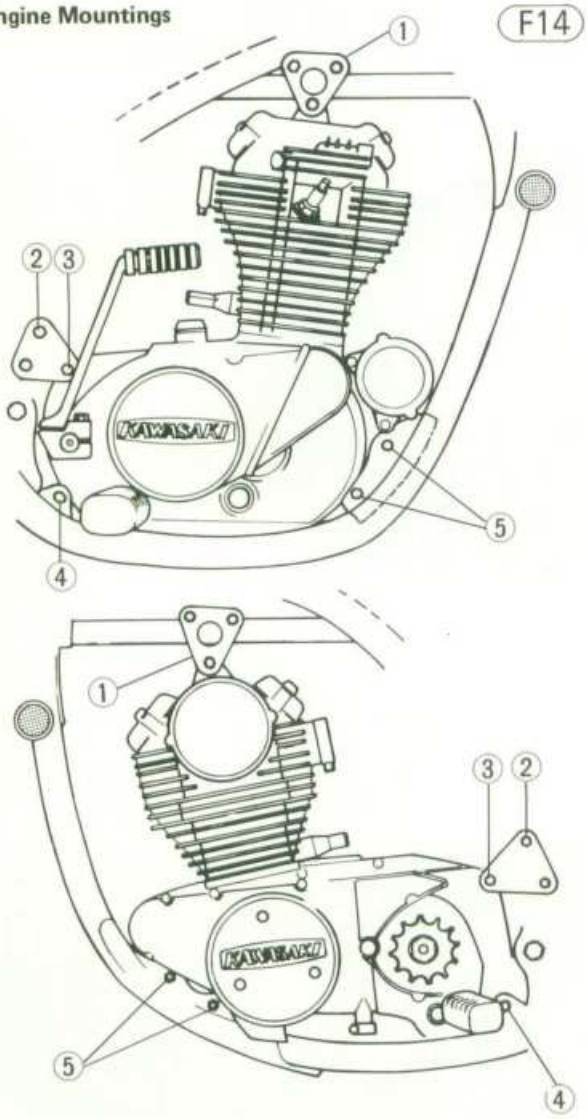
- Being careful not to bend or otherwise damage it, free the rear brake light switch spring from the tab on the brake pedal.
- Back the rear brake adjusting nut off to the end of the brake rod to give the pedal play. Loosen the brake pedal adjusting bolt locknut, and back out the adjusting bolt until the pedal is held down out of the way.



•Remove the cylinder head bracket bolts (3), and take off the brackets.

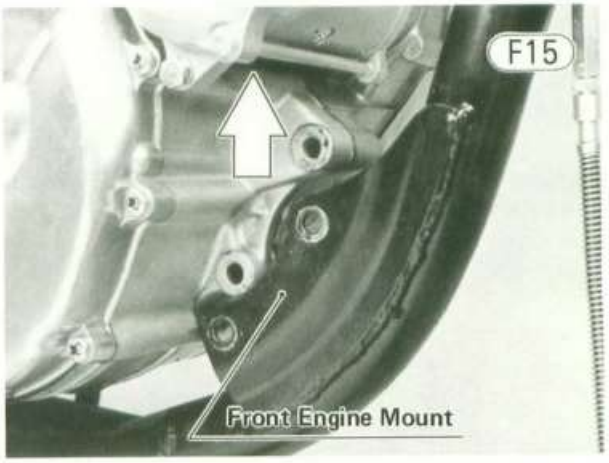


Engine Mountings



1. Cylinder Head Brackets
2. Rear Upper Brackets
3. Rear Upper Engine Mounting Bolt
4. Rear Lower Engine Mounting Bolt
5. Front Engine Mounting Bolts

•Jack or lever the engine up slightly to take the weight off the mounting bolts.
•Remove the engine mounting bolt nuts ③, ④, ⑤.
•Remove the rear upper bracket mounting bolts and lockwashers, and remove the brackets.
•Pull out the engine mounting bolts ③, ④, ⑤. Be careful not to damage the threads in removal.
•Make sure that the following cables and leads are free, and properly positioned on the engine and frame so that they will not get damaged during engine removal: starter lead, clutch cable, tachometer cable, contact breaker lead, dynamo wiring, and throttle cable (with carburetor).
•Lift the engine straight up keeping it level, and then move it to the right slightly so the front and rear ends of the engine slip over the engine mounts.



•Lift up the left side, and pull the engine out diagonally forward and to the right, taking care not to damage the rear brake light switch.

Installation:

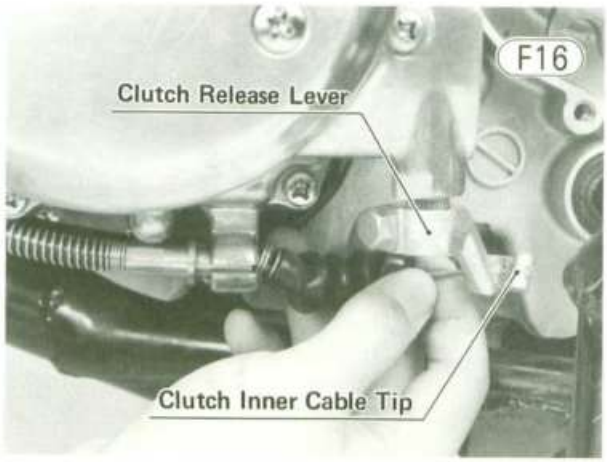
•Place the engine in the frame the reverse of how it was removed.
•Install the rear upper brackets, lockwashers, and the bracket mounting bolts finger tight.
•Lift the engine enough that the mounting bolt threads do not get damaged and insert the four engine mounting bolts ③, ④, ⑤, and install their nuts.
•Tighten the rear upper bracket mounting bolts (4) with 1.8 kg-m (13.0 ft-lbs) of torque, and then tighten the four engine mounting bolts with the torque specified in Table F1.

Table F1 Engine Mounting Bolt

	Length	Tightening Torque
Front (2)	65 mm	1.8 kg-m (13.0 ft-lbs)
Rear Upper	110 mm	3.0 kg-m (22 ft-lbs)
Rear Lower	110 mm	3.0 kg-m (22 ft-lbs)

•Install the cylinder head brackets, and tighten the bracket bolts (3) with 1.8 kg-m (13.0 ft-lbs) of torque.

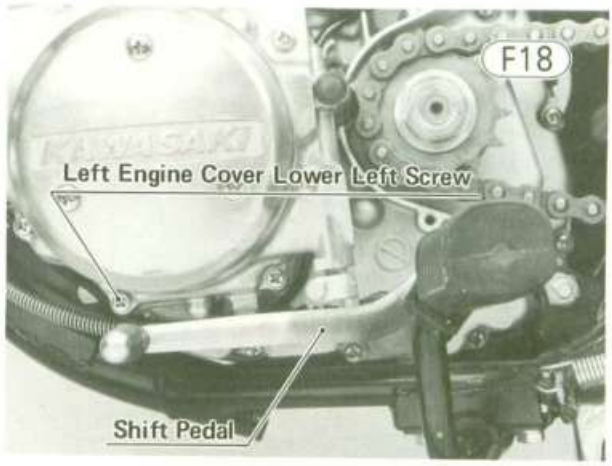
- Turn in the brake pedal adjusting bolt.
- Fit the breather hose onto the breather pipe, and slide the clip back into place.
- Install the muffler (Pg. 43).
- Connect the tachometer cable to the cylinder head.
- Install the carburetor (Pg. 40).
- Run the clutch cable bottom end into the left engine cover, and fit the tip of the inner cable into the clutch release lever.



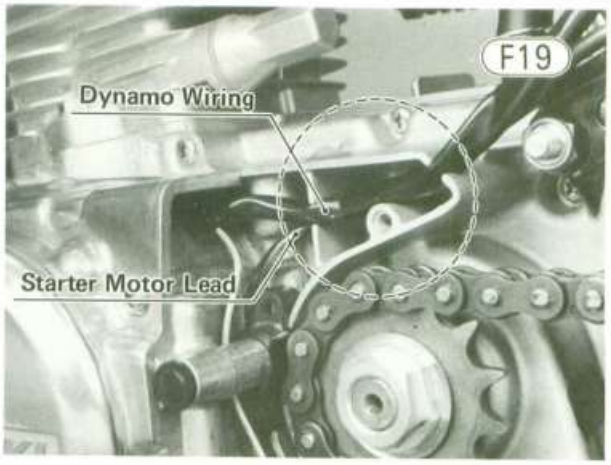
- Fit the tip of the inner cable upper end into the clutch lever.
- Install the drive chain (Pg. 100).
- Fit the starter motor lead to the starter motor terminal. After tightening the nut with the lockwasher, slide the rubber cap back onto the starter motor terminal.
- Run the starter motor lead under the battery housing, fit the lead to the starter relay terminal, and tighten the nut with the lockwasher.



- Connect the 3-pin dynamo wiring connecter.
- Install the shift pedal at the level of the left engine cover lower left screw.



- Fit the dynamo wiring and starter motor lead onto the left crankcase half groove as shown.



- Check to see that the clutch release rubber cap is in place.
- Install the engine sprocket cover, and tighten its screws (2).
- Connect the spark plug lead to the spark plug.
- Connect the black contact breaker lead to the ignition coil lead.

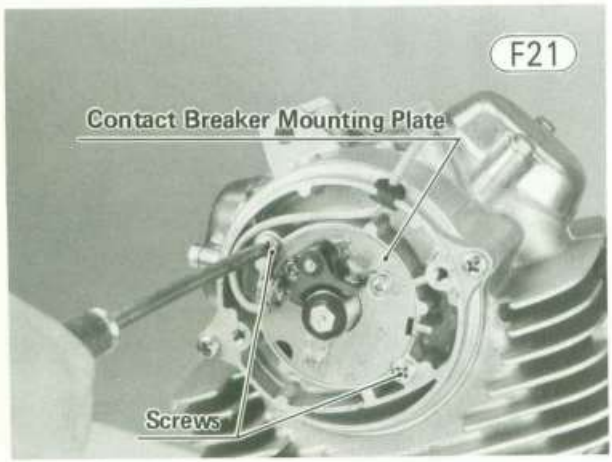


- Fit the left side cover.
- Install the fuel tank (Pg. 39).
- Fill the engine with oil to the proper level (Pg. 18).
- Adjust the drive chain (Pg. 22).
- Adjust the clutch (Pg. 17).
- Adjust the rear brake (Pg. 23).
- Mount the brake light switch spring.
- Adjust the rear brake light switch (Pg. 24).
- Adjust the throttle cable (Pg. 16).
- Adjust the ignition timing (Pg. 12).

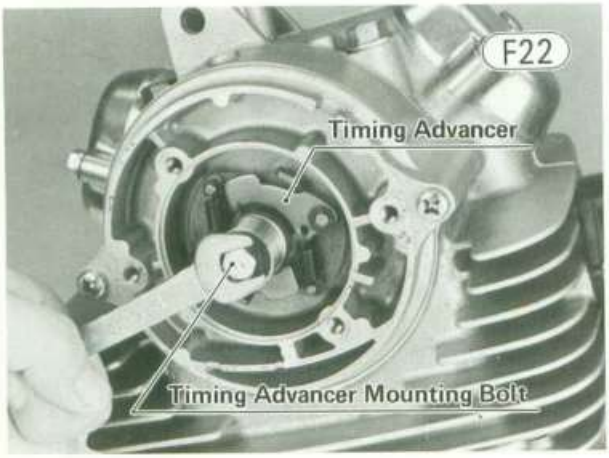
CRANKCASE SPLIT

Disassembly:

- Remove the engine (Pg. 72).
- Set the engine on a clean surface.
- Remove the contact breaker cover and gasket.
- Take out the contact breaker mounting plate screws (2), and remove the plate.



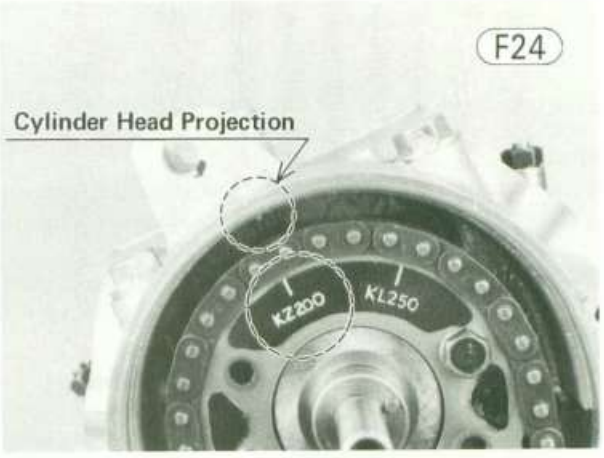
- Remove the dynamo cover screws (3), and dynamo cover.
- Keeping the crankshaft from turning with a wrench on the dynamo flywheel bolt, remove the timing advancer mounting bolt, and take off the washer and timing advancer.



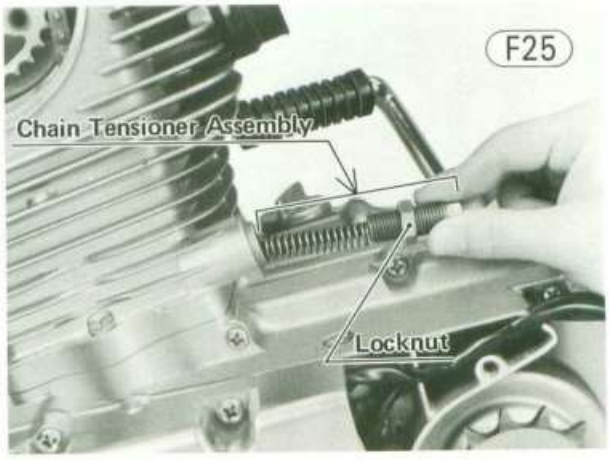
- Remove the left cylinder head cover screws (2), and pull off the left cylinder head cover with the **O** ring. If it is difficult to remove, use a screwdriver to pry at the gap in each side of the cover to free the cover from the cylinder head.



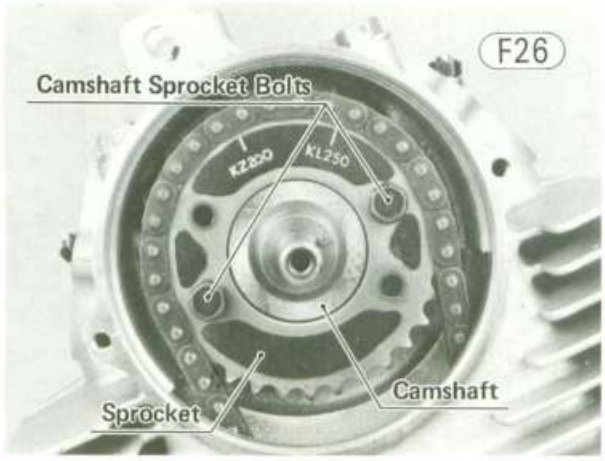
- Remove the valve adjusting caps (2).
- Turn the crankshaft counterclockwise until the line adjoining the KZ200 mark on the camshaft sprocket aligns with the cylinder head projection.



- Remove the chain tensioner cap and **O** ring, loosen the locknut, and then unscrew the chain tensioner assembly from the cylinder block.



•With a wrench on the dynamo flywheel bolt to keep the crankshaft from turning, remove the camshaft sprocket bolts (2).



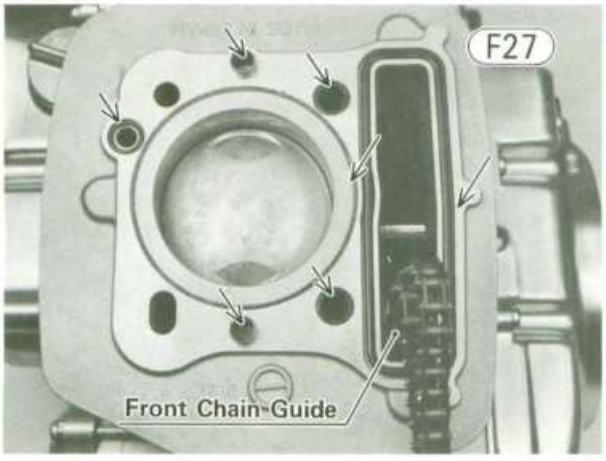
•Slide the sprocket off the camshaft, slip the chain off the sprocket, and then remove the sprocket.
•Pull out the tachometer pinion.
•Remove the camshaft.

CAUTION **Always pull the camshaft chain taut while turning the crankshaft with the camshaft chain loose. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.**

•Remove the cylinder bolt from the left side of the cylinder base.
•Remove the cylinder head bolts (4).
•With a large screwdriver, pry at the gap in the cylinder head base to free the cylinder head from the cylinder block, and remove the cylinder head.

CAUTION **Do not hammer on the screwdriver while it is in the pry point as engine damage could result (Fig. E42).**

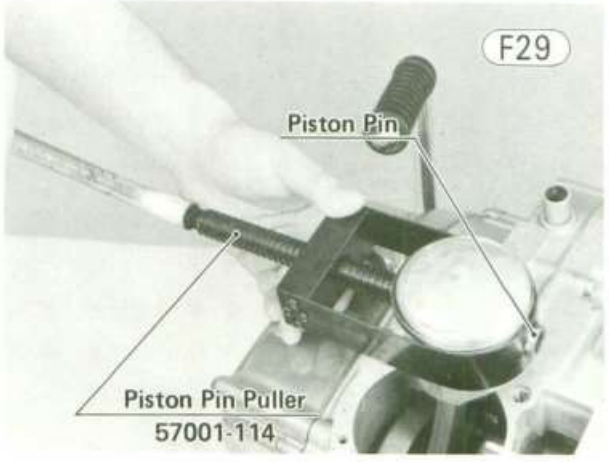
•Remove the cylinder head gasket, small **O** rings (3), large **O** ring, knock pins (2), and front chain guide.



•Remove the cylinder block and gasket.
•Remove the piston pin snap ring from one side of the piston pin.



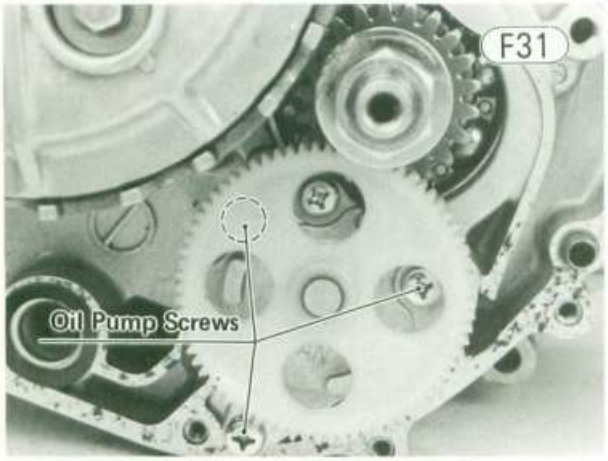
•Remove the piston by pushing its piston pin out the side from which the snap ring was removed. Use the piston pin puller (special tool) if necessary.



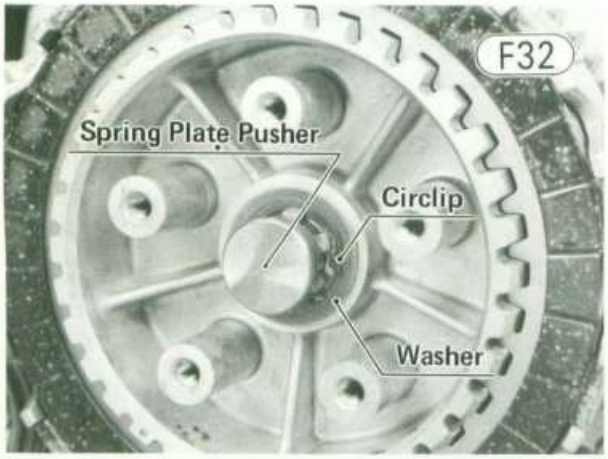
•Straighten the side of the toothed washer that is bent over the side of the engine sprocket nut.
•Hold the engine sprocket steady using the engine sprocket holder (special tool), and remove the engine sprocket nut and toothed washer.



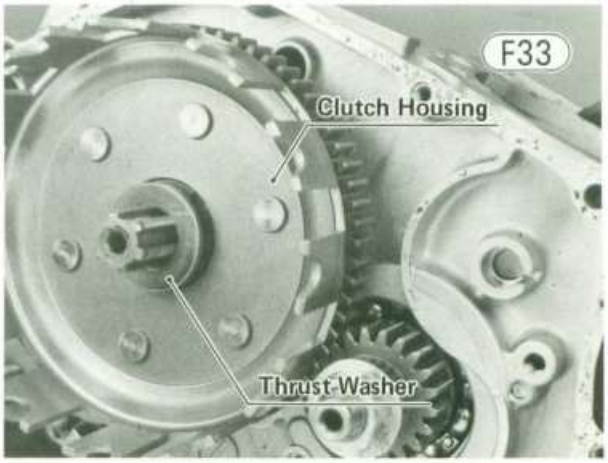
- Pull off the engine sprocket and output shaft collar, and take off the **O** ring.
- Disconnect the neutral indicator switch lead from the switch.
- Remove the left engine cover screws (9), and pull off the cover taking care not to damage the clutch push rod.
- Remove the left engine cover gasket and knock pins (2).
- Pull out the clutch push rod and rubber guard, and remove the starter motor lead.
- Mark the position of the kickstarter pedal so that it can later be installed on the kick shaft in the same position.
- Take out the kickstarter pedal bolt, widen the gap in the kickstarter pedal slightly with a screwdriver, and then pull off the kickstarter pedal.
- Remove the *right engine* cover screws (12), and pull off the cover.
- Remove the oil filter and filter mounting pin, and take off the right engine cover gasket.
- Remove the engine oil pump screws (3), and take off the oil pump and gasket.



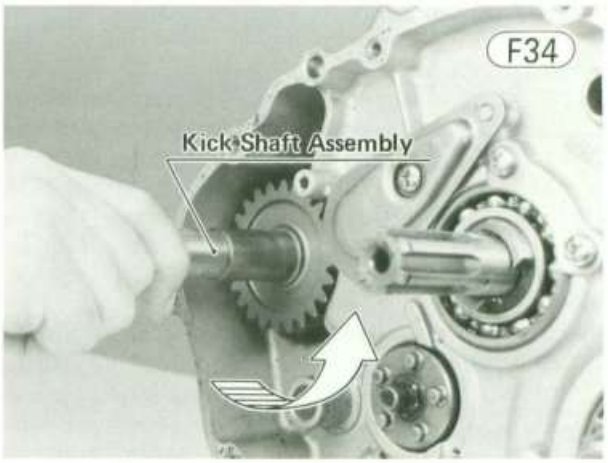
- Remove the clutch spring bolts (5), washers (5), springs (5), and spring seats (5).
- Pull off the spring plate, and pull out the spring plate pusher.



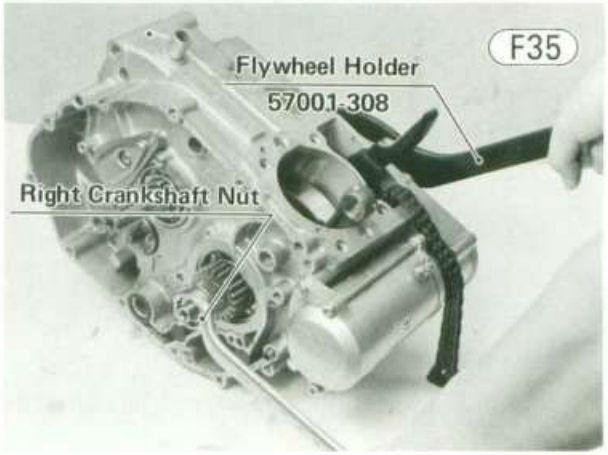
- Remove the friction plates (6) and steel plates (5).
- Remove the circlip and washer, and pull off the clutch hub and clutch housing. There is a thrust washer between the clutch hub and the clutch housing.



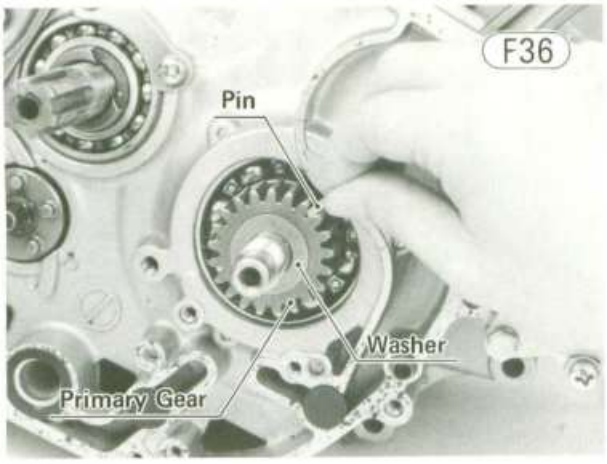
- Pull out the external shift mechanism and return spring.
- Pull out the thrust washer and kick spring guide.
- Remove the kick spring.
- Remove the kick shaft assembly twisting it to the left. There is a thrust washer between the kick shaft and the crankcase.



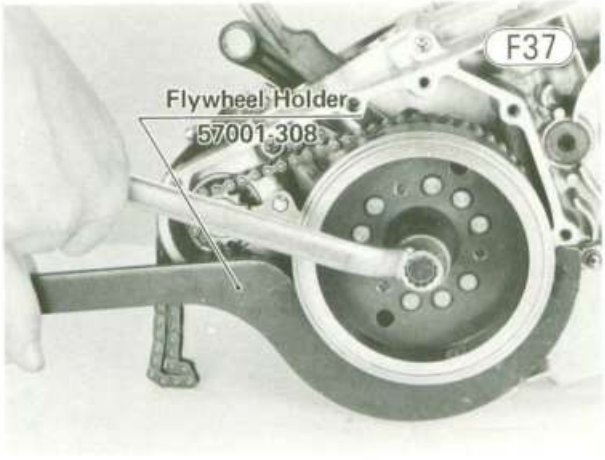
- Remove the primary gear and oil pump gear according to the following four steps only if the crankshaft is to be removed.
- Straighten the side of the toothed washer that is bent over the side of the right crankshaft nut.
- Hold the dynamo flywheel steady with the flywheel holder (special tool), and remove the right crankshaft nut and toothed washer.



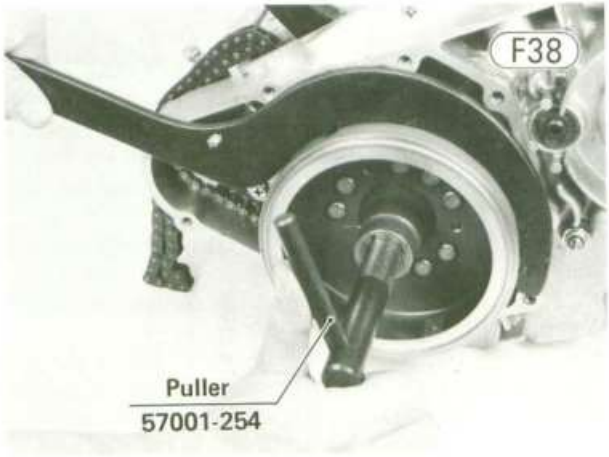
•Pull off the oil pump drive gear, and remove the pin.



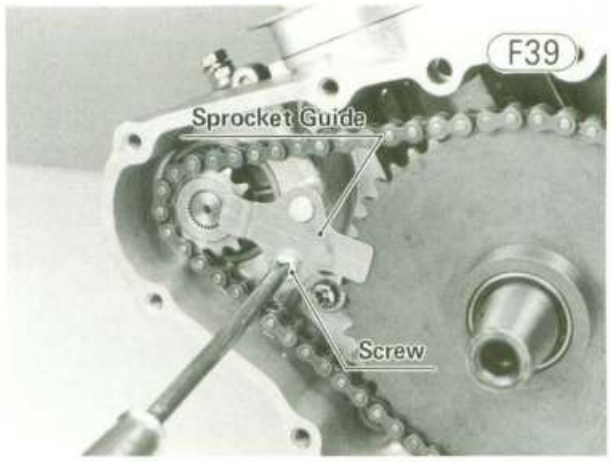
•Pull off the washer and primary gear.
•Hold the dynamo flywheel steady with the flywheel holder (special tool), and remove the flywheel bolt.



•Using a special tool to hold the dynamo flywheel steady, remove the flywheel and starter motor clutch assembly with the puller (special tool).



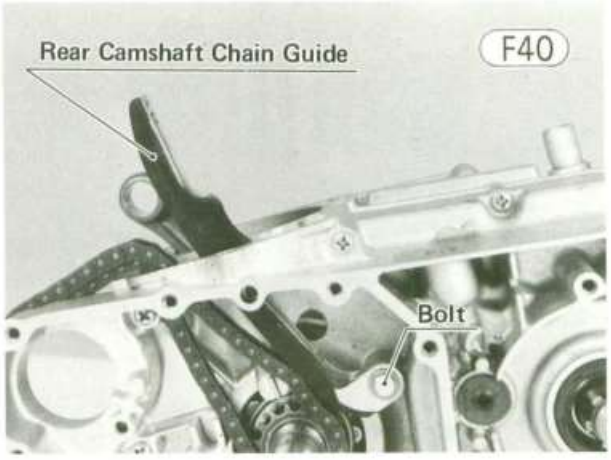
•Remove the screw and take off the sprocket guide.



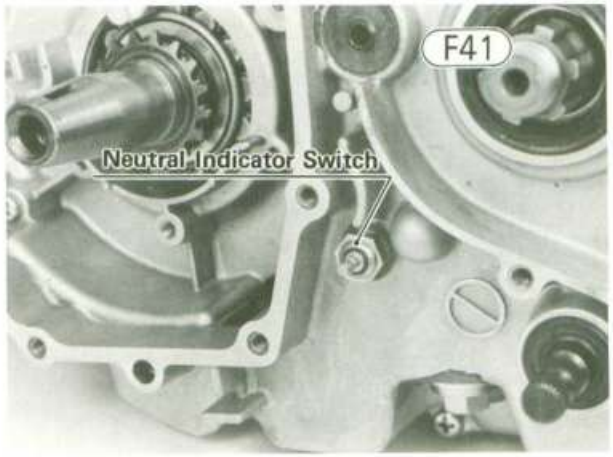
•Pull off the starter motor chain and sprockets.
•Remove the starter motor retaining bolts (2).
•Pry the starter motor loose from the crankcase with a screwdriver and pull the starter motor off towards the right side of the engine.

CAUTION **Do not tap on the starter motor shaft. Tapping on the shaft may damage the motor.**

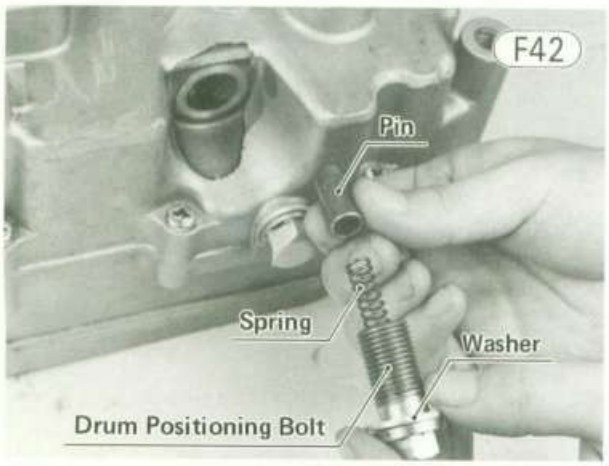
•Remove the rear camshaft chain guide bolt, and take off the chain guide.



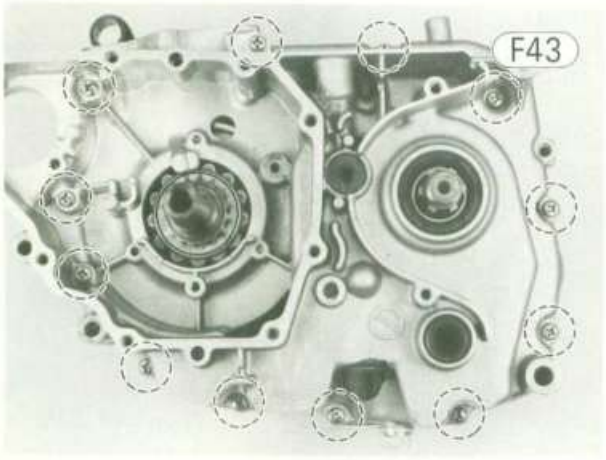
•Remove the camshaft chain guard screw, and take off the guard and camshaft chain.
•Unscrew the neutral indicator switch and gasket.



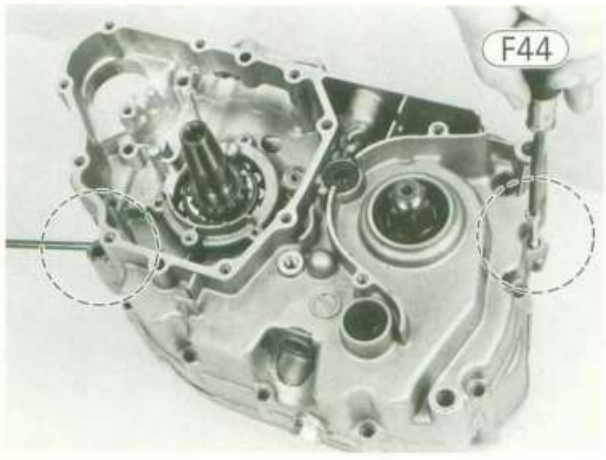
•Remove the shift drum positioning bolt, aluminum washer, spring, and pin.



•Remove the left crankcase half screws (12).

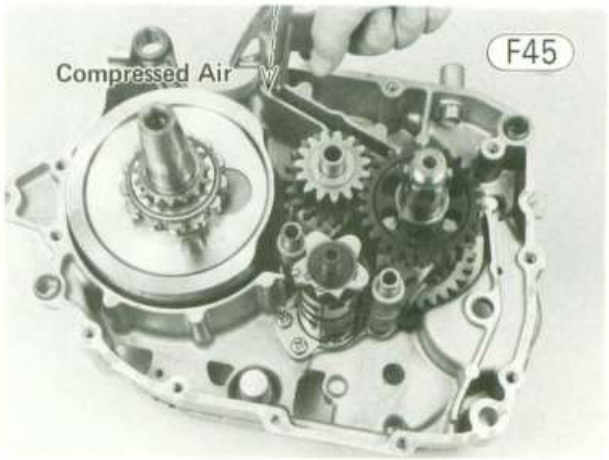


•Turn a 6 mm bolt or screw into the crankcase splitting projection on the rear side of the crankcase, pry at the gap in the front side of the crankcase at the same time to split the two crankcase halves apart, and then pull off the left crankcase half.

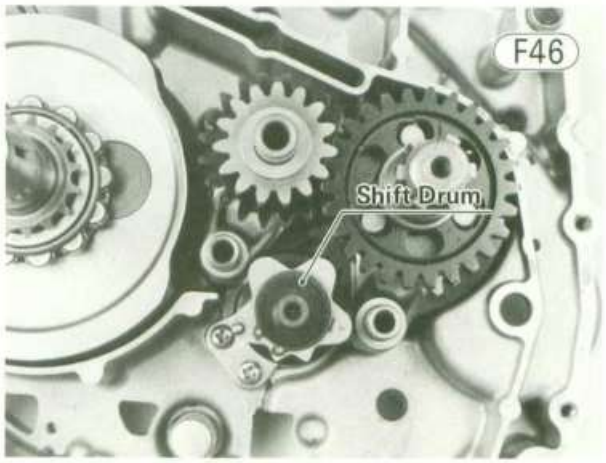


Assembly:

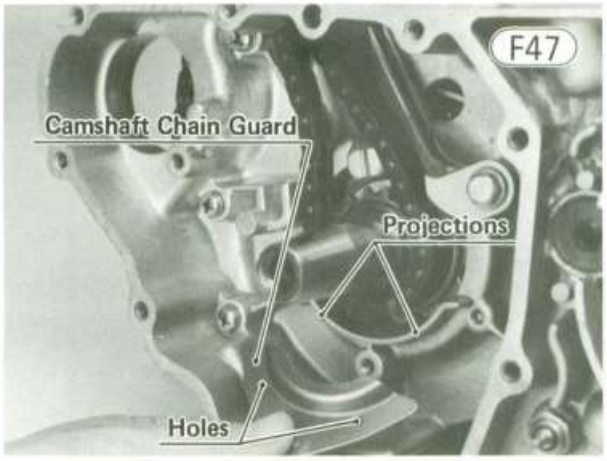
•Check to see that the transmission gears, shift drum, and shift forks are in place on the right crankcase half, and blow the oil passages clean with compressed air.



•Apply a little engine oil to the transmission gears, bearings, and shift drum.
•With a high flash-point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.
•Set the shift drum in neutral position as shown.



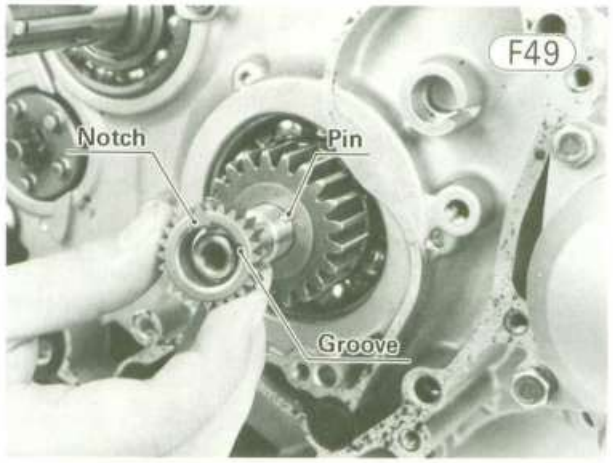
•Apply a liquid gasket to the mating surface of the left crankcase half.
•Fit the left crankcase half on the right crankcase half, and tighten the screws (12).
•Install the shift drum positioning pin, spring, and bolt with a new aluminium washer.
•Check to see that the crankshaft, drive shaft, and output shaft all turn freely (in the neutral position).
•Install the neutral indicator switch and gasket tightening it with 1.5 kg-m (11.0 ft-lbs) of torque.
•Install the rear camshaft chain guide and collar, and tighten the bolt with 0.9 kg-m (78 in-lbs) of torque.
•Install the camshaft chain on the crankshaft sprocket.
•Fit the chain guard onto the crankcase matching its holes with the projections on the crankcase, and tighten its screw.



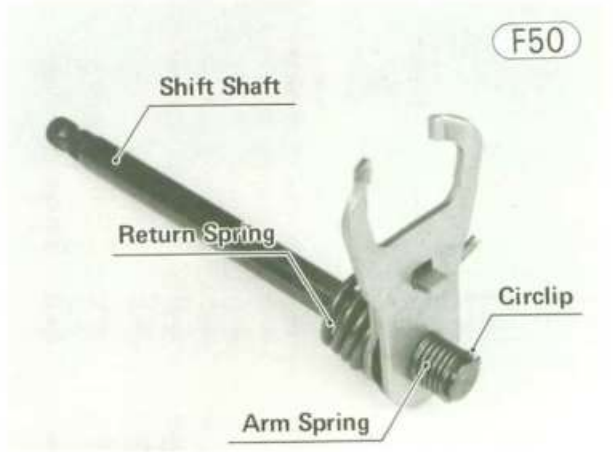
- Clean the starter motor lugs and crankcase where the starter motor is grounded.
- Apply a little engine oil to the O ring, install the starter motor, and tighten the starter motor retaining bolts (2).
- Using a high flash-point solvent, clean off any oil or dirt that may be on the crankshaft taper or flywheel hub.
- Check to see that the key is fitted in its place on the crankshaft properly.
- Turning the large starter motor clutch sprocket, fit the sprocket into the starter motor clutch.
- Assemble the starter motor clutch, sprocket and chain, and install them fitting the crankshaft key into the groove of the flywheel hub. The starter motor sprocket protruding side must face in.



- Tighten the dynamo flywheel bolt with 6.0 kg-m (43 ft-lbs) of torque while holding the flywheel steady with the flywheel holder (special tool).
- Install the sprocket guide with the screw.
- Install the primary gear on the crankshaft with its flat side facing out.
- Install the washer and pin on the crankshaft.
- Install the oil pump drive gear fitting the pin into the groove of the gear hub. The oil pump drive gear must be installed with its notched side facing out.



- Install the toothed washer fitting its tooth into the notch on the oil pump drive gear.
- With the flywheel holder (special tool) on the flywheel to keep the crankshaft from turning, tighten the right crankshaft nut with 6.0 kg-m (43 ft-lbs) of torque, and bend one side of the toothed washer over the side of the nut.
- Fit the external shift mechanism return spring on the shift shaft, and check that the arm spring and the circlip are in place.



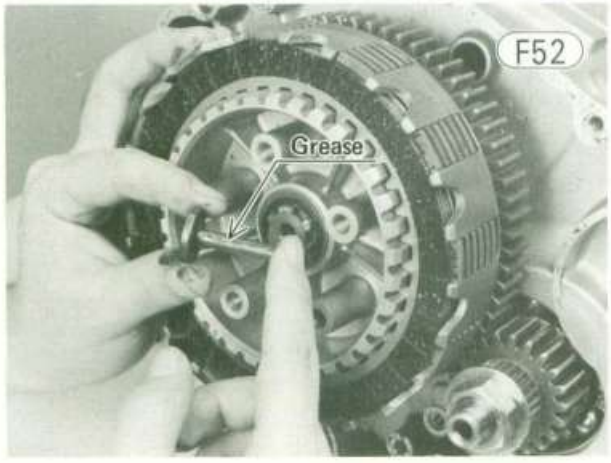
- Insert the shift shaft oil seal guide (special tool) in the left crankcase oil seal, install the external shift mechanism.



- Fit the return spring onto the return spring stop, and place the shift mechanism arm on the shift drum pins.
- Fit the clutch housing on the drive shaft while turning the kick gear by hand so that the rear of the housing will fit into the side of the drive shaft idle gear.
- Put on the thrust washer, clutch hub, washer, and circlip.
- Install the friction plates (6) and steel plates (5), starting with a friction plate and alternating them.

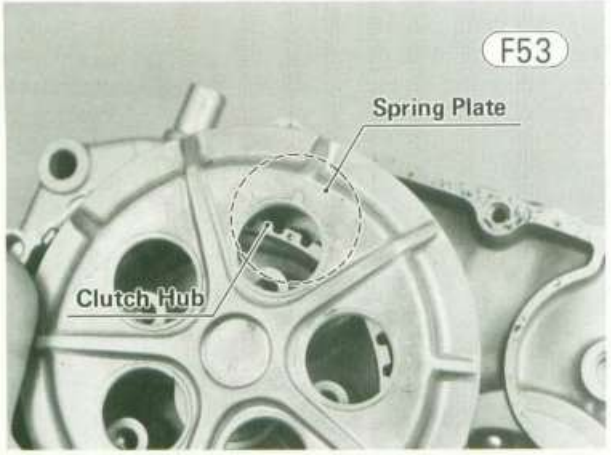
CAUTION **If new dry steel plates and friction plates are installed, apply engine oil to the surfaces of each plate to avoid clutch plate seizure.**

- Insert the spring plate pusher, applying a thin coat of a high temperature grease to its surface.

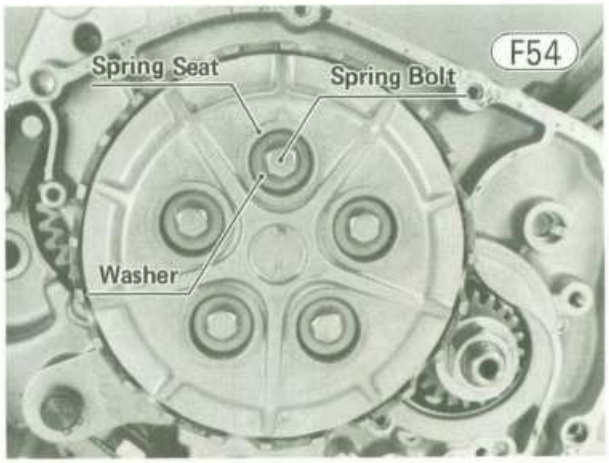


- Fit the spring plate into place, aligning the mark on the plate with the mark on the clutch hub.

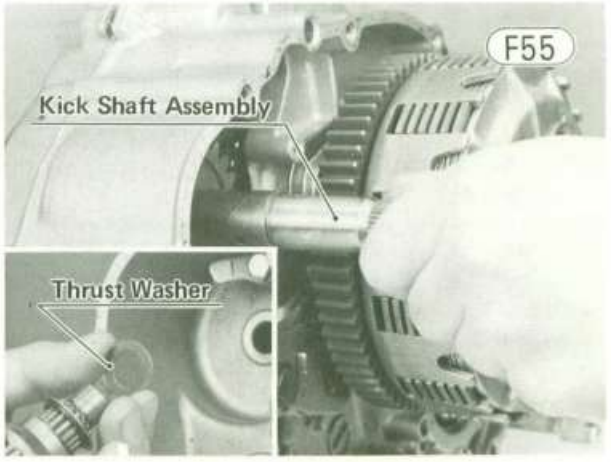
CAUTION **Misalignment of the spring plate can cause clutch drag (when it is disengaged), or clutch slipping.**



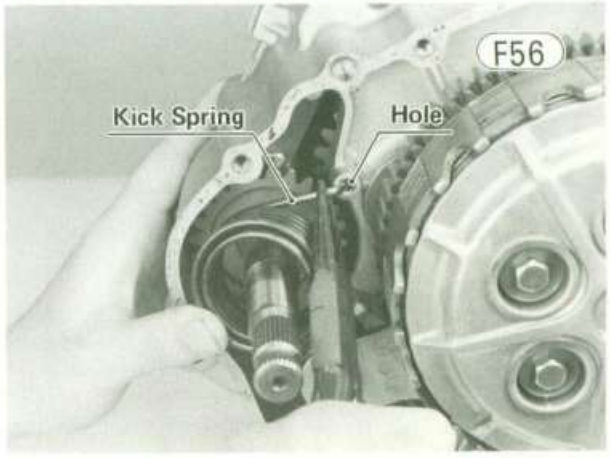
- Install the spring seats, springs, washers, and spring bolts (5 ea). Cross tighten the bolts evenly with 1.0 kg-m (87 in-lbs) of torque.



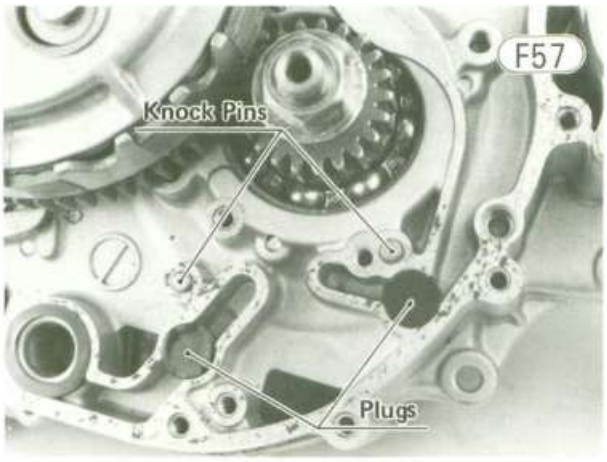
- Put the thrust washer on the kick shaft end, and fit the kick shaft assembly to the right crankcase.



- To install the kick spring, turn the kick shaft assembly all the way clockwise, insert one end of the spring into the kick shaft, and fit the other end of the spring into the crankcase hole using pliers.



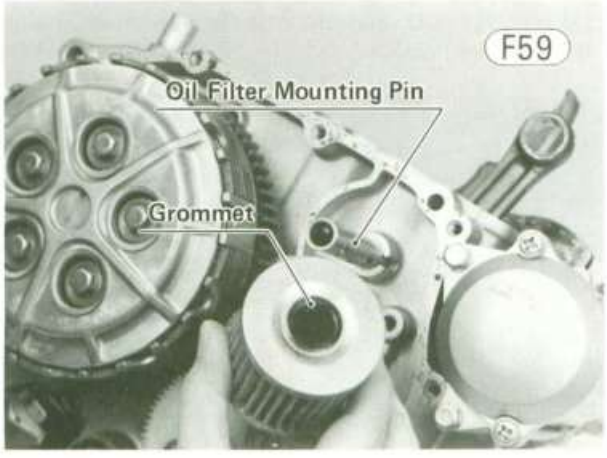
- Install the kick spring guide and washer.
- Check to see that the oil pump knock pins (2) and plugs (2) are in place.



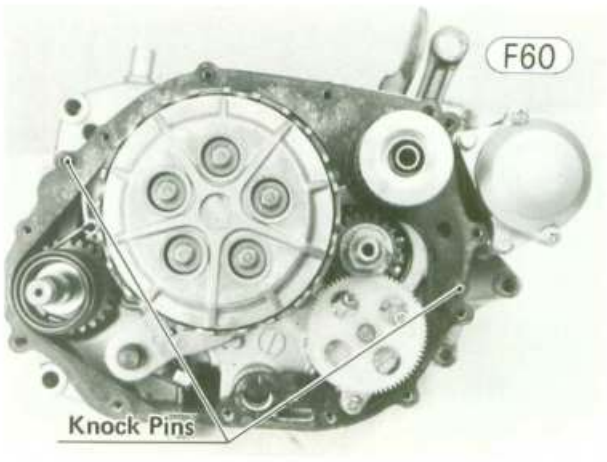
•Install the oil pump with a new gasket making sure the oil pump gear and oil pump drive gear at the end of the crankshaft mesh properly. Tighten the oil pump screws (3)



•Install the oil filter mounting pin in the right crankcase half.
•Apply a little engine oil to the oil filter grommets on the both sides of the element, and turn the element to work it into place. Be careful that the element grommets do not slip out of position.



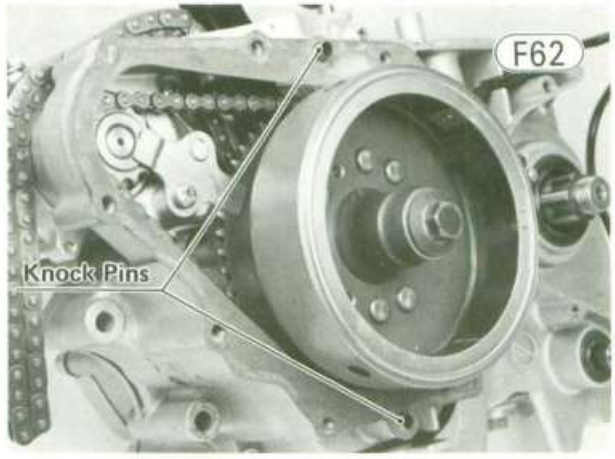
•Check to see that the two knock pins are in place, and fit a new right engine cover gasket.



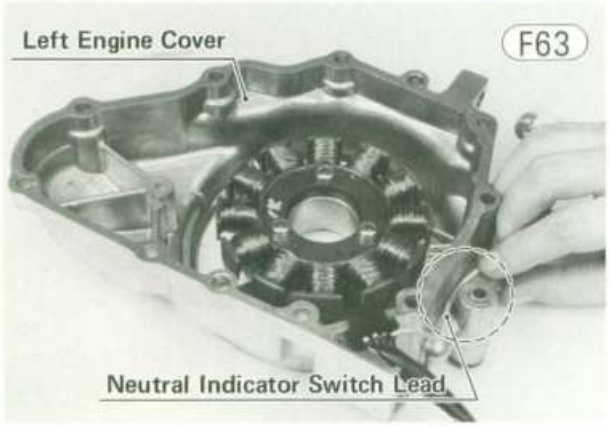
•Insert the kick shaft oil seal guide (special tool) in the right engine cover oil seal, and fit the cover onto the crankcase. Tighten its screws (12).



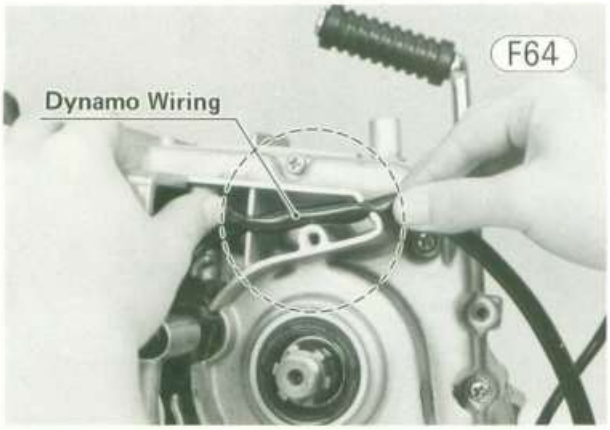
•Install the kickstarter pedal in its original position on the kick shaft, and tighten the bolt.
•Fit the starter motor lead onto the left crankcase, and install the rubber guard and clutch push rod.
•Check to see that two knock pins are in place, and fit a new left engine cover gasket on the crankcase.



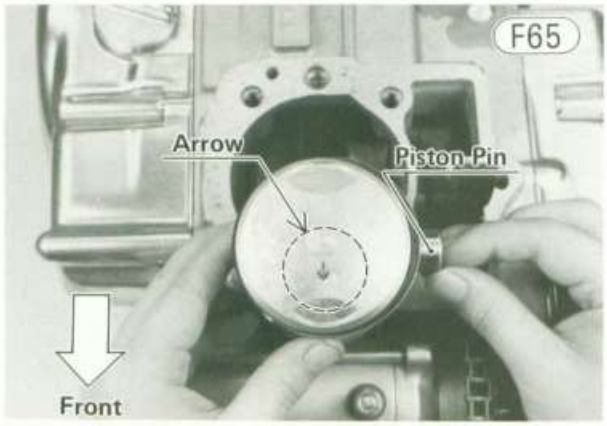
•Install the left engine cover running the neutral indicator switch lead through the groove in the rear end of the cover, and tighten the cover screws (9) (Fig. F63).



- Connect the neutral indicator switch lead to the switch.
- Fit the dynamo wiring into the crankcase groove.



- Replace the output shaft **O** ring with a new one if it is damaged, and install it next to the ball bearing inner race.
- Install the output shaft collar, engine sprocket, and toothed washer.
- Install the engine sprocket nut, and tighten the nut with 8.0 kg-m (58 ft-lbs) of torque while using the engine sprocket holder to keep the sprocket steady.
- Bend one side of the toothed washer over the side of the nut.
- Apply a little engine oil to the piston pin, and install the piston and piston pin. The arrow on the top of the piston must point towards the front.



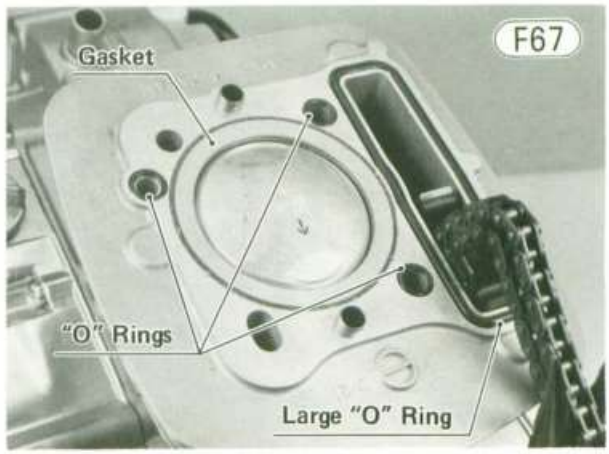
- Fit a new piston pin snap ring into the side of the piston, taking care to compress it only enough to install it and no more. Check the other snap ring is in place. The snap ring opening must be either up or down to prevent its being loosened during engine operation.

CAUTION **Do not reuse snap rings, as removal weakens and deforms the snap ring. It could fall out and score the cylinder wall.**

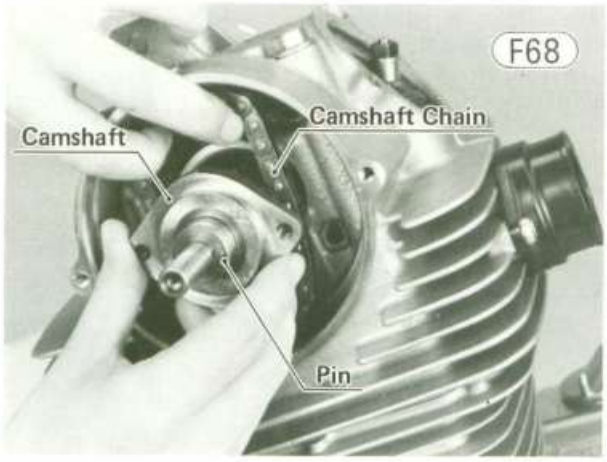
- Position the piston rings so that the openings in the top ring and oil ring are facing forwards, and the second ring opening is facing to the rear. The openings of the oil ring steel rails must be slipped to both directions about 30° from the opening of the expander (Fig. E55).
- Apply engine oil to the piston rings and the cylinder inside surface.
- Put on a new cylinder base gasket, and be sure that knock pins (2) are properly fitted on the crankcase.



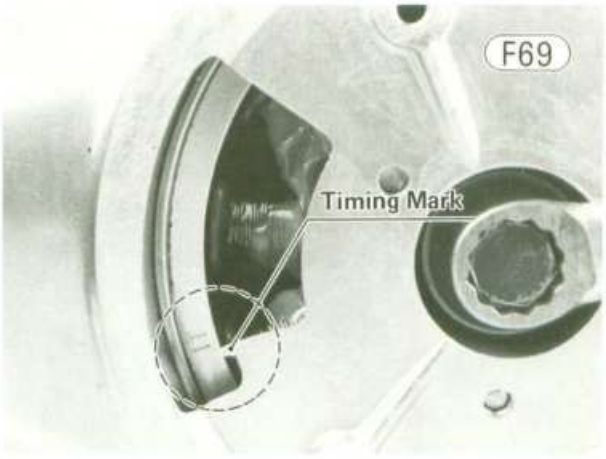
- Pull the camshaft chain up through the cylinder block and insert a screwdriver through it to avoid the chain's falling into the engine. Guide the rear chain guide inside the cylinder block.
- Fit the bottom of the cylinder over the piston rings, pressing in on opposite sides of the rings as necessary. Take care that the rings do not slip out of their proper position. If the cylinder block does not seat on the crankcase, lift it up slightly, pull out the camshaft chain, and press the cylinder block down.
- Install the front chain guide as shown in Fig. E56. There is the "UP" mark on the top the chain guide.
- Install a new cylinder head gasket and new **O** rings (4). The large **O** ring must fitted in with the groove on the cylinder block.



- Check to see that the knock pins (2) are in place, install the cylinder head on the cylinder block, using a screwdriver to keep the chian from falling down into the cylinder block.
- Tighten the cylinder head bolts (4) first with about 2.0 kg-m (14.5 ft-lbs) of torque and finally with 2.6 kg-m (19.0 ft-lbs) of torque, following the tightening sequence numbers on the cylinder head (Fig. E45).
- Tighten the cylinder bolt with 1.2 kg-m (8.5 ft-lbs) of torque.
- Check to be sure that the tachometer pinion is removed from the cylinder head.
- Apply clean oil to all cam parts.
- Insert the camshaft through the chain and remove the screwdriver. The pin on the camshaft must be positioned as shown.



- Apply a small amount of high temperature grease to the tachometer pinion shaft, and insert the pinion.
- Pull the chain taut, using a wrench on the dynamo flywheel bolt, and turn the flywheel counterclockwise so that the "T" mark on the flywheel aligns with the timing mark.



- Set the camshaft sprocket on the camshaft so that the line mark on the sprocket is facing out.
- Fit the camshaft chain onto the camshaft sprocket so that the line adjoining the KZ200 mark on the sprocket is aligned with the cylinder head projection.



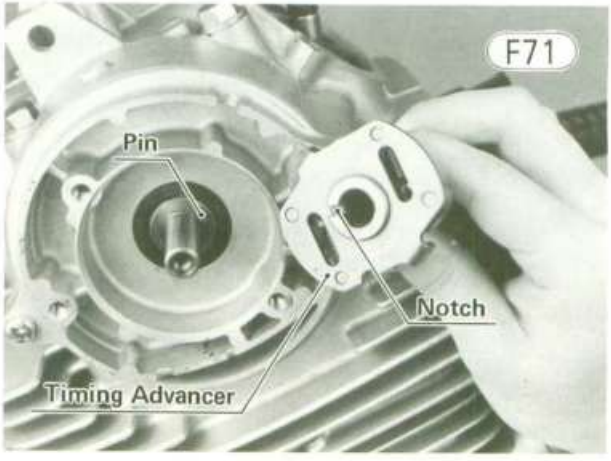
- Fit the sprocket into place, and turn the camshaft while holding the sprocket steady, aligning the bolt holes.
- Keeping the crankshaft from turning with a wrench on the dynamo flywheel bolt, tighten the sprocket bolts with 1.5 kg-m (11.0 ft-lbs) of torque.
- Install the chain tensioner push rod, spring, push rod guide, and locknut, and turn in the guide until the ends of the guide and push rod are flush (Fig. B13).

CAUTION **Rotation of the crankshaft with improper camshaft timing could cause the valves to contact each other or the piston, and bend. If any resistance is felt when turning over the crankshaft, stop immediately, and check the camshaft chain timing.**

- Turn the crankshaft counterclockwise until the line adjoining the KZ200 mark on the sprocket is pointing upwards, and recheck the camshaft timing. If the two timing mark pairs are aligned (Fig. E33), the camshaft timing is correct.

CAUTION **Do not to try to turn the crankshaft and camshaft with a wrench on the camshaft sprocket.**

- Check that the left cylinder head cover large **O** ring is in place, and apply oil to the **O** ring and oil seal.
- Install the left cylinder head cover so that the grommet fitting groove is upward.
- Fit the timing advancer onto the camshaft matching its notch with the pin on the camshaft. Fit the flat washer, and tighten the timing advancer mounting bolt with 0.90 kg-m (78 in-lbs) of torque.



•Mount the contact breaker mounting plate aligning the line on the plate with the mark on the left cylinder head cover, and tighten its mounting screws (2) with 0.45 kg-m (39 in-lbs) of torque.



•Fit the grommet into the groove of the left cylinder head cover.
•Install a new gasket and the contact breaker cover with the "UP" mark on the cover pointing upward, and tighten its screws (2).
•Adjust the camshaft chain (Pg. 15), and install the chain tensioner cap and O ring.
•Install the dynamo cover with new O rings, and tighten its screws (3).

CAUTION **Before installing the screws, place the O rings under the screw heads to prevent O ring damage and oil leaks (Fig. B9).**

•Install the engine (Pg. 74).
•Fill the engine with oil to the proper level (Pg. 18).
•Carry out the adjustment procedures listed in the engine installation section (Pg. 76).

TRANSMISSION

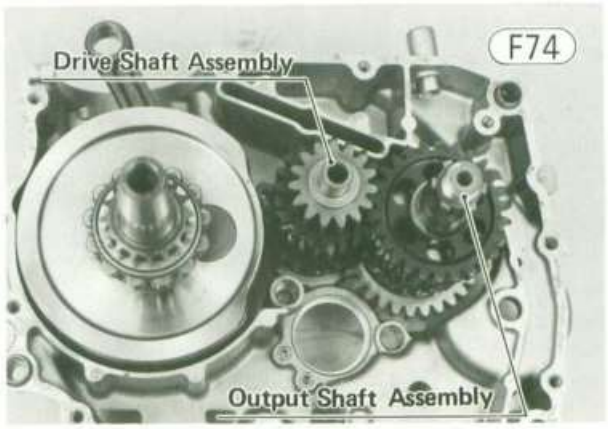
Removal:

•Remove the engine (Pg. 72).
•Split the crankcase (Pg. 76).
•Remove the shift drum bearing stop screws (2), and take out the stop.



•Pull out the shift rods (2) and shift drum, and take out the shift forks (3).

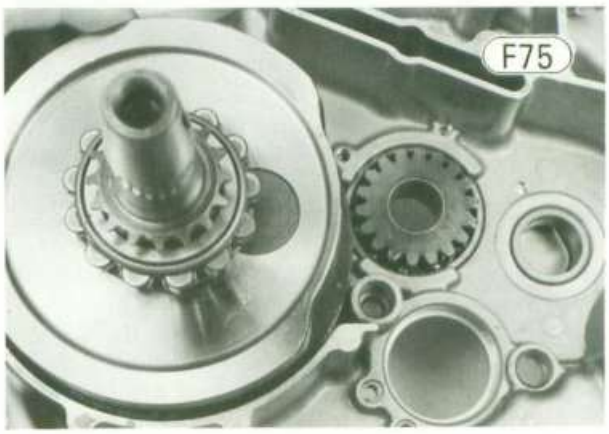
•To remove the output and drive shaft assemblies, the crankshaft must be set in the position as shown.



•There are two thrust washers and one needle bearing at the end of the drive shaft. The thrust needle bearing is between the thrust washers.

Installation:

•Set the crankshaft in the position as shown.

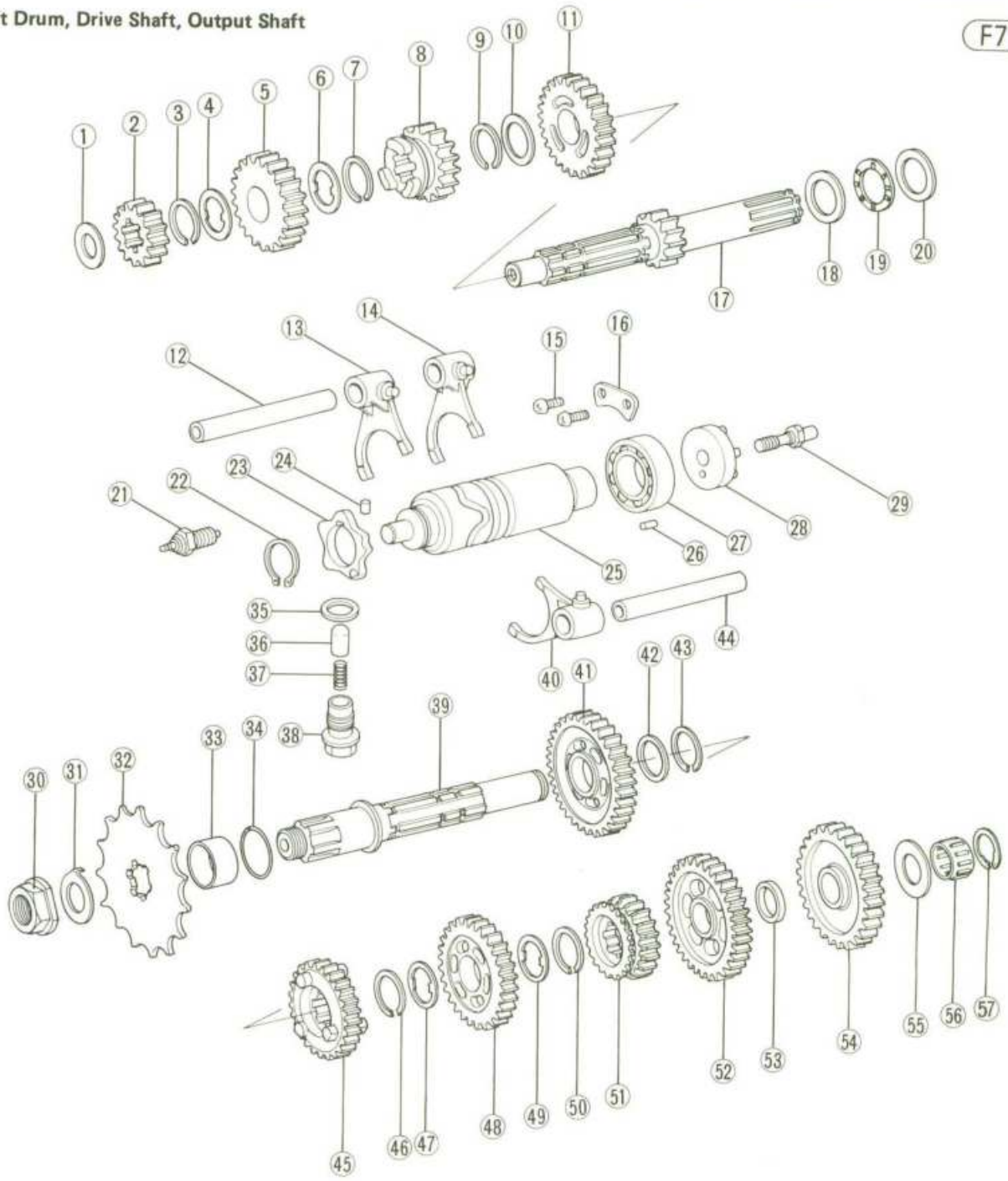


•Apply a little engine oil to the transmission gears, needle bearings, and shaft journals, and fit the output and drive shaft assemblies into the right crankcase half.
•Install the shift drum in the right crankcase half, and install the stop with its screws (2).
•Set the shift drum in neutral position as shown.



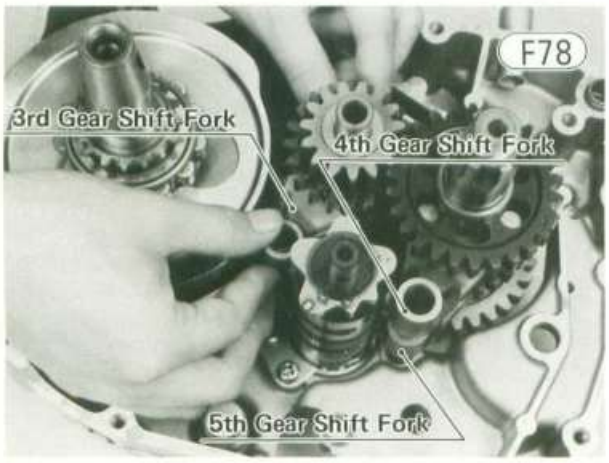
Shift Drum, Drive Shaft, Output Shaft

F77



1. Thrust Washer
2. 2nd Gear (D)
3. Circlip
4. Splined Washer
5. 4th Gear (D)
6. Splined Washer
7. Circlip
8. 3rd Gear (D)
9. Circlip
10. Washer
11. 5th Gear (D)
12. Shift Rod
13. 4th Gear Shift Fork
14. 5th Gear Shift Fork
15. Screw
16. Bearing Stop
17. Drive Shaft
18. Thrust Washer
19. Needle Bearing
20. Thrust Washer
21. Neutral Indicator Switch
22. Circlip
23. Operating Plate
24. Pin
25. Shift Drum
26. Knock Pin
27. Ball Bearing
28. Holder
29. Holder Bolt
30. Nut
31. Toothed Washer
32. Engine Sprocket
33. Collar
34. **O** Ring
35. Gasket
36. Positioning Pin
37. Spring
38. Positioning Bolt
39. Output Shaft
40. 3rd Gear Shift Fork
41. 2nd Gear (O)
42. Washer
43. Circlip
44. Shift Rod
45. 4th Gear (O)
46. Circlip
47. Splined Washer
48. 3rd Gear (O)
49. Splined Washer
50. Circlip
51. 5th Gear (O)
52. 1st Gear (O)
53. Spacer
54. Kickstarter Idle Gear
55. Washer
56. Needle Bearing
57. Circlip

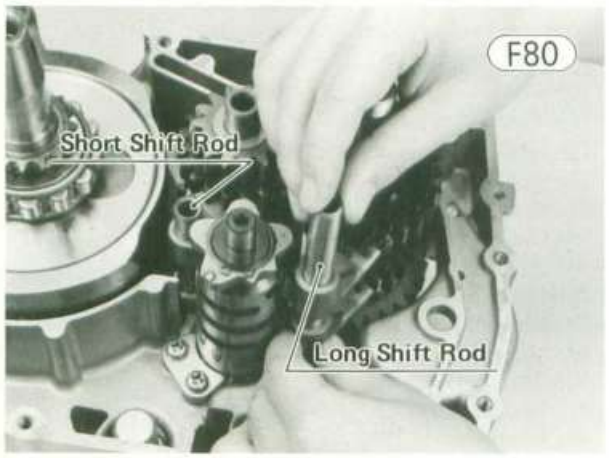
•Apply a little engine oil to the shift fork fingers, and fit each shift fork into its gear-groove so that the shift fork guide pin is in the proper shift drum-groove.



NOTE: Identification of the shift forks.
3rd gear shift fork : fingers are shorter than those of other two shift forks
4th gear shift fork : fingers and guide pin are not in line
5th gear shift fork : shift fork has a notch



•Apply a little engine oil to the shift rods. Insert the short shift rod running it through the dirve shaft 3rd gear shift fork. Insert the long shift rod running it through the output shaft 4th gear shift fork and then through the output shaft 5th gear shift fork.



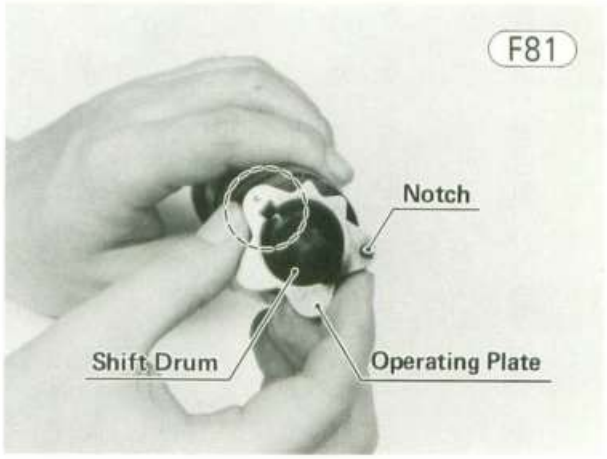
•Assemble the crankcases (Pg. 80).
•Install the engine (Pg. 74).

Shift Drum
Disassembly:

•Remove the operating plate circlip ㉒ and operating plate ㉓.
•Drop out the operating plate pin ㉔.
•Remove the shift drum bearing holder bolt ㉙, and take out the holder ㉘, knock pin ㉖, and ball bearing ㉗.

Assembly Notes:

1. Apply non-permanent locking agent to the shift drum bearing holder bolt, and tighten the bolt with 1.7 kg-m (13.5 ft-lbs) of torque.
2. When assembling the operating plate, the notched side of the operating plate must face toward the end of the shift drum.



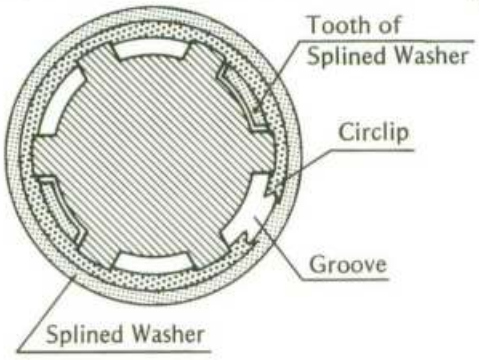
Drive Shaft
Disassembly:

•Pull off the thrust washer ①, and 2nd gear ②.
•Remove the circlip ③, and pull off the splined washer ④, 4th gear ⑤, and splined washer ⑥.
•Remove the circlip ⑦ and 3rd gear ⑧.
•Remove the circlip ⑨, washer ⑩, and 5th gear ⑪.
•Pull off the thrust washer ⑳, needle bearing ⑲, and thrust washer ⑱.

Assembly Notes:

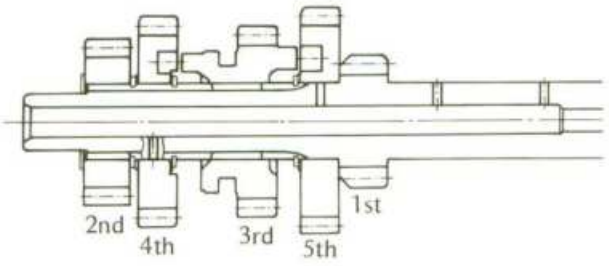
1. Replace any circlips that were removed with new ones. Install the circlip so that the opening coincides with one of the splined grooves in the output shaft (Fig. F82).
2. Install the splined washer so that its teeth do not coincide with the circlip opening.

Circlip, Splined Washer Installation F82



3. Be sure that all parts are put back in the correct sequence and that all circlips and flat washers are properly in place. Proper sequence starting with 1st gear (part of the drive shaft) is 1st gear, 5th gear, washer, circlip, 3rd gear, circlip, splined washer, 4th gear, splined washer, circlip, 2nd gear, and thrust washer. At the other end of the shaft, install the thrust washer, needle bearing, and thrust washer.
4. The drive shaft gears can be revognized by size, the gear with smallest diameter being 1st gear, and the largest one being 5th gear.

Drive Shaft Gears F83



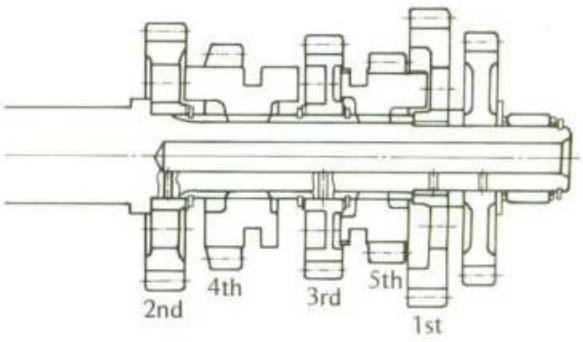
Output Shaft
Disassembly:

- Remove the circlip (57), and pull off the needle bearing (56), washer (55), kickstarter idle gear (54), and spacer (53).
- Pull off 1st gear (52) and 5th gear (51).
- Remove the circlip (50), and pull off the splined washer (49), 3rd gear (48), and another splined washer (47).
- Remove the circlip (46), and pull off 4th gear (45).
- Remove the circlip (43), and pull off the washer (42) and 2nd gear (41).

Assembly Notes:

1. Replace any circlips that were removed with new ones. Install the circlip so that the opening coincides with one of the splined grooves in the output shaft (Fig. F82).
2. Install the splined washer so that its teeth do not coincide with the circlip opening (Fig. F82).
3. Be sure that all parts are put back in the correct sequence and all circlips and splined washers are properly in place. Proper sequence starting with the engine sprocket side is 2nd gear, washer, circlip, 4th gear, circlip, splined washer, 3rd gear, splined washer, circlip, 5th gear, 1st gear, spacer, kickstarter idle gear, washer, needle bearing, and circlip.
4. The output shaft gear sizes are opposite from those of the drive shaft gears, the largest being 1st gear and the smallest, 5th gear.

Output Shaft Gears F84



CRANKSHAFT
Removal:

- Remove the engine (Pg. 72).
- Split the crankcases (Pg. 76).
- Remove the transmission (Pg. 86).
- Remove the crankshaft from the right crankcase half with the crankcase splitting tool (special tool) or a press.

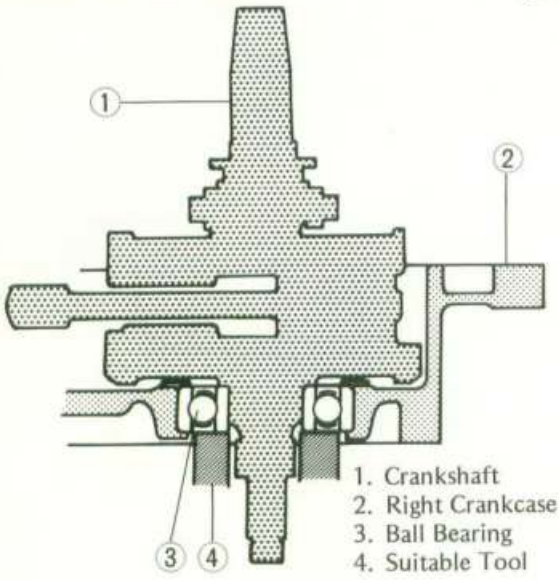


F85

Installation:

- Place the right crankcase half so that the drive shaft ball bearing seats on the suitable tool, and install the crankshaft in the right crankcase half using a press with a chisel or wedge inserted between the flywheels opposite the connecting rod big end (Fig. F86).

Crankshaft Installation F86



1. Crankshaft
2. Right Crankcase Half
3. Ball Bearing
4. Suitable Tool

- Install the transmission (Pg. 86).
- Assembly the crankcases (Pg. 80).
- Install the engine (Pg. 74).
- Fill the engine with oil to the proper level (Pg. 18).
- Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 76).

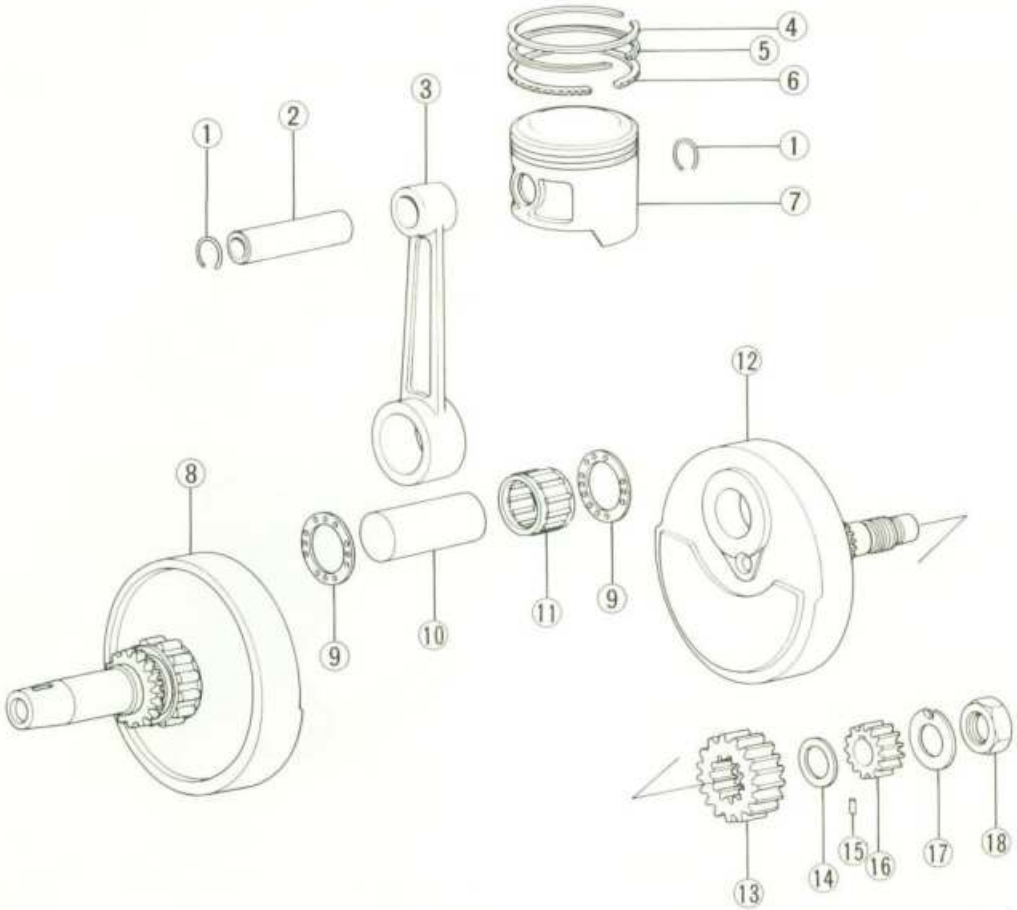
Disassembly:

- If it should be necessary to disassemble the crankshaft, use a press to remove the crankpin ⑩. Removal of the crankpin separates the flywheels ⑧, ⑫, connecting rod ③, big end needle bearing ⑪, crankpin and connecting rod side washers ⑨.

Assembly Notes:

- Since assembly of the crankshaft demands exacting tolerances, the disassembly and reassembly of the crankshaft can only be done by a shop having the necessary tools and equipment. The following information gives the tolerances that are necessary for a properly equipped shop to reassemble the crankshaft.

Crankshaft F87



1. Snap Ring
2. Piston Pin
3. Connecting Rod
4. Top Ring
5. Second Ring
6. Oil Ring
7. Piston
8. Flywheel
9. Washer
10. Crankpin
11. Needle Bearing
12. Flywheel
13. Primary Gear
14. Washer
15. Pin
16. Oil Pump Drive Gear
17. Toothed Washer
18. Crankshaft Nut

1. The flywheels and crankpin are cold-fitted to a tolerance of 0.090~0.111 mm.
2. Select a crankpin, needle bearing and connecting rod such that the radial clearance will be 0.016~0.030 mm.
3. Press the crank together with a thickness gauge inserted between the connecting rod and one of the flywheels so that the side clearance will be 0.3~0.4 mm.
4. Supporting both ends of the crankshaft, check the crankshaft runout using a dial gauge (Pg. 142). The left flywheel runout must be under 0.03 mm total indicated reading, and the right must be under 0.04 mm total indicated reading (Fig. H58).

CRANKCASE

Disassembly (left crankcase half):

- Remove the engine (Pg. 72).
- Split the crankcase (Pg. 76).
- Using a hook, pull out the shift shaft oil seal.
- Using a hook, pull out the output shaft oil seal, and remove the output shaft ball bearing using a suitable tool.
- Using a hook, pull out the clutch push rod oil seal, insert the metal rod from the left side, and remove the needle bearing by tapping evenly around the bearing.

Assembly Notes (left crankcase half):

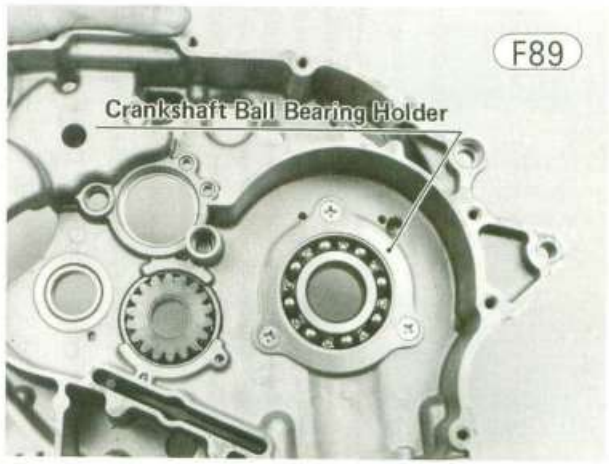
1. Inspect the bearings, and replace if necessary (Pg. 154).
2. Install the output shaft ball bearing using the output shaft bearing driver and bearing driver holder (special tools). Drive in the bearing until it stops at the bottom of the hole.



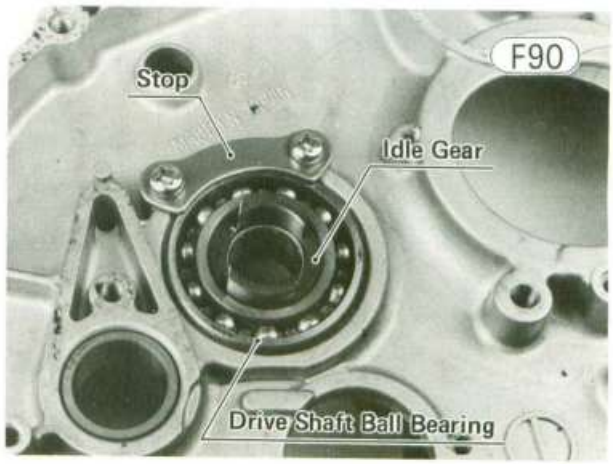
3. Install the drive shaft needle bearing using a suitable tool so that the face of the needle bearing is level with the surface of the left crankcase half. The marked side of the needle bearing faces out.
4. Replace the oil seals with new ones, and using suitable tools, press in the seals so that the face of each seal is level with the surface of the left crankcase half.

Disassembly (right crankcase half):

- Remove the engine (Pg. 72).
- Split the crankcase (Pg. 76).
- Remove the transmission (Pg. 86).
- Remove the screw, and take off the output shaft right end cap and gasket.
- Remove the crankshaft from the right crankcase half (Pg. 89).
- Remove the crankshaft ball bearing holder screws (3), and take off the holder.



- Remove the crankshaft ball bearing using a suitable tool.
- Remove the kickstarter idle gear at the drive shaft ball bearing using a suitable tool.



- Remove the drive shaft ball bearing stop screws (2) and then remove the stop.
- Remove the drive shaft ball bearing using a suitable tool.

Assembly Notes (right crankcase half):

1. Inspect the bearings, and replace if necessary (Pg. 154).
2. Install the crankshaft ball bearing using the crankshaft bearing driver and bearing driver holder (special tools). Drive in the bearing until it stops at the bottom of the hole (Fig. F91).

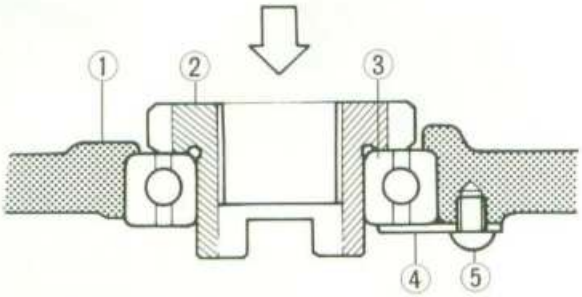


3. Install the drive shaft ball bearing using the drive shaft bearing driver and bearing driver holder (special tools). Drive in the bearing until it stops at the bottom of the hole.



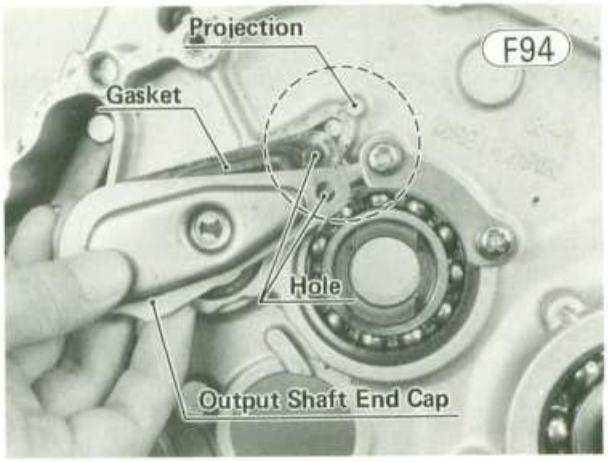
4. When installing the drive shaft idle gear, drive in the gear until it stops at the drive shaft ball bearing inner race.

Kickstarter Idle Gear Installation F93



1. Right Crankcase Half
2. Drive Shaft Idle Gear
3. Ball Bearing
4. Bearing Stop
5. Screw

5. When installing the output shaft end cap and new gasket, align their holes with the projection on the right crankcase half.



Disassembly – Chassis

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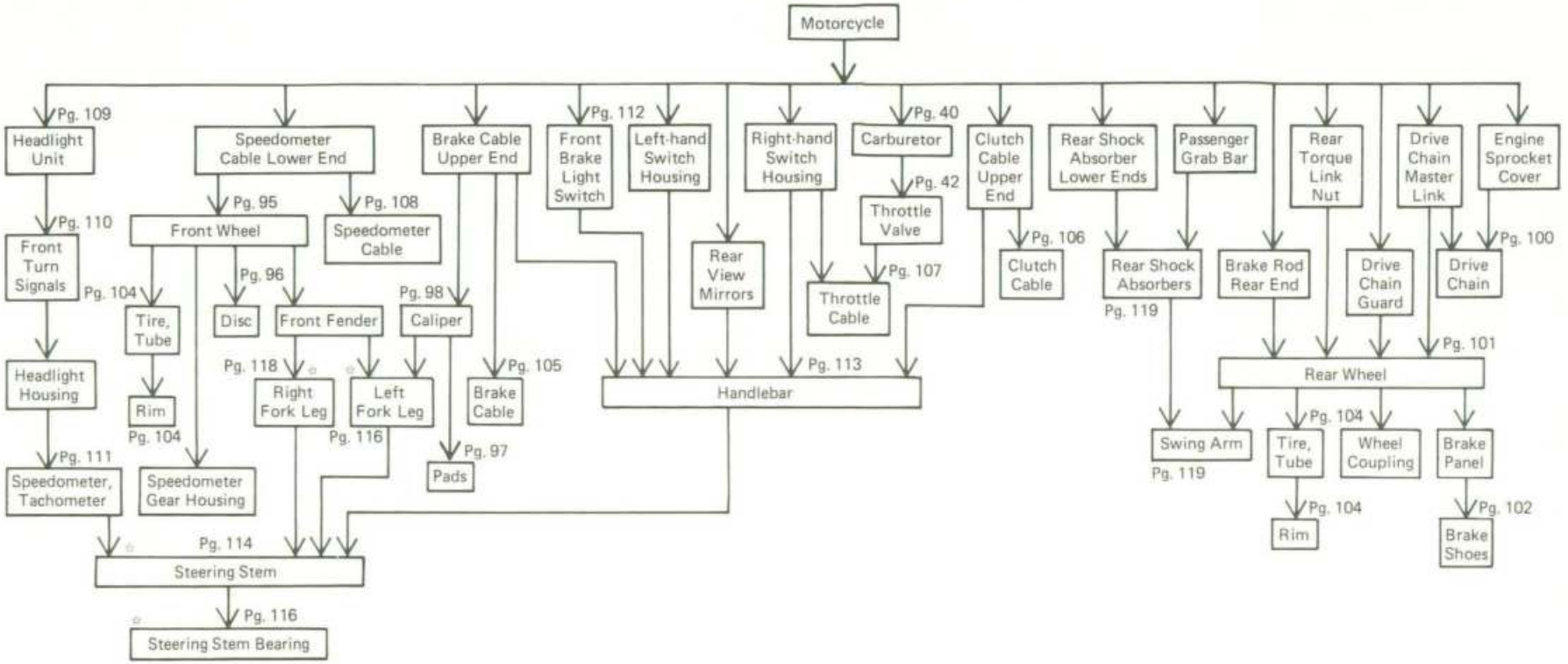
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FLOW CHART
Disassembly — Chassis

The following chart is intended to be aids to proper removal. Select the component you wish to remove and follow the arrows to that point on the chart.

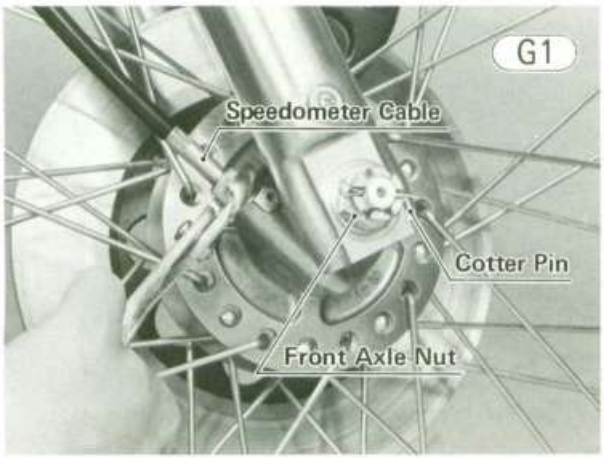


NOTE: Action with mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

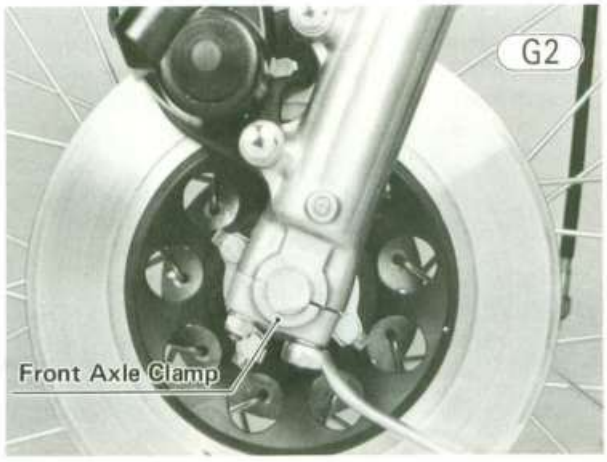
FRONT WHEEL

Removal:

•Disconnect the lower end of the speedometer cable with pliers.



•Remove the front axle cotter pin, nut, and washer.
•Loosen the front axle clamp nuts (2), but do not remove them.

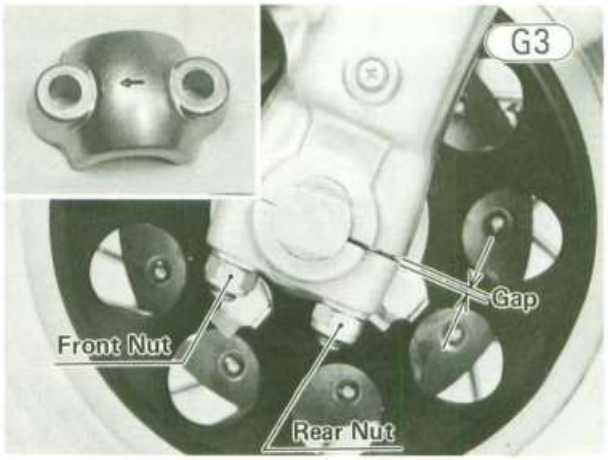


•Use a jack under the engine or other suitable means to lift the front of the motorcycle.
•Remove the axle clamp nuts (2), lockwashers (2), and clamp.
•Holding the wheel to facilitate axle removal, pull out the axle, and then remove the wheel from the motorcycle.
•Insert a wood wedge (5~6 mm thick) between the disc brake pads. This prevents the pads from being moved out of their proper position, should the brake lever be squeezed accidentally.

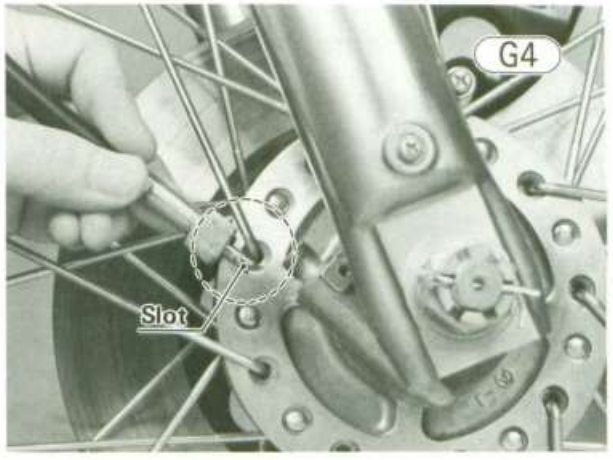
Installation:

•Remove the wedge from between the disc brake pads.
•Check that the speedometer gear drive fits in the hub notches as shown in Fig. G5.
•Hold the front wheel in its place between the front fork tubes, and insert the axle from the left.
•Mount the front axle clamp, and install the lockwashers and nuts with finger tight. The arrow at the bottom of the clamp must point to the front as shown in Fig. G3.
•Install the washer and front axle nut finger tight.
•Turn the speedometer gear housing so that it points to the ten o'clock position. Be sure that the small projection on the gear housing does not catch on the lower part of the left tube.
•Tighten the axle nut with 8.0 kg-m (58 ft-lbs) of torque, and position the speedometer gear housing by turning it clockwise until it stops.
•Insert a new cotter pin through the axle nut and axle, and spread its ends.
•Tighten first the front axle clamp nut and then the rear nut with 1.8 kg-m (13.0 ft-lbs) of torque. There will be a gap at the rear of the clamp after tightening.

WARNING **If the clamp is installed incorrectly or improperly tightened, the clamp or the studs could fail, resulting in loss of control.**



•Insert the speedometer inner cable into the housing while turning the wheel so that the slot in the end of the cable will seat in the tongue of the speedometer pinion. Tighten the cable nut with pliers.



Speedometer Gear Housing Disassembly:

•Pull the speedometer gear housing ⑰ off the front hub ⑨.
•Remove the circlip ⑬ and washer ⑭.
•Pull out the speedometer gear ⑯ and speedometer gear receiver ⑮.

•If the speedometer cable bushing ㉔ or speedometer pinion ㉒ needs to be removed, first drill the housing through the pin ㉕ using a 1 mm drill bit. Drill the housing from the gear side using a 2 mm drill bit. Using a suitable tool, tap out the pin, and then pull out the speedometer cable bushing and pinion.

WARNING **An improperly installed pin could fall out, and this could lead to front wheel lockup from the speedometer gears jamming.**

•If the speedometer gear housing grease seal ⑫ is deteriorated or damaged, remove it with a hook.

Speedometer Gear Housing Assembly Notes:

1. Replace the grease seal with a new one if it was removed. Apply a little grease to the seal. Install it using a press or a suitable driver so that the face of the seal is level with the surface of the housing.
2. After inserting a new pin, punch the housing hole to secure the pin in place.
3. Regrease the speedometer gear.
4. Fit the speedometer gear housing into the hub so that the speedometer gear drive fits in the hub notches.



Front Hub Disassembly (including disc removal):

•Pull off the speedometer gear housing ⑰.

•Remove the collar ② from the left side of the hub.

•Straighten the tabs on the disc double washers ④ bent over the disc bolts ③ (4). Remove the bolts, double washers (2) and disc ⑤.

•Using a hook, pull out the grease seal ⑥ and remove the circlip ⑦.



•Insert a metal rod into the hub from the speedometer gear side, and remove the bearing ⑧ on the right side by tapping evenly around the bearing inner race. The distance collar ⑩ will come out with the bearing.



•Insert the metal rod into the hub from the right side, and remove the other bearing ⑪ by tapping evenly around the bearing inner race.

Front Hub Assembly Notes:

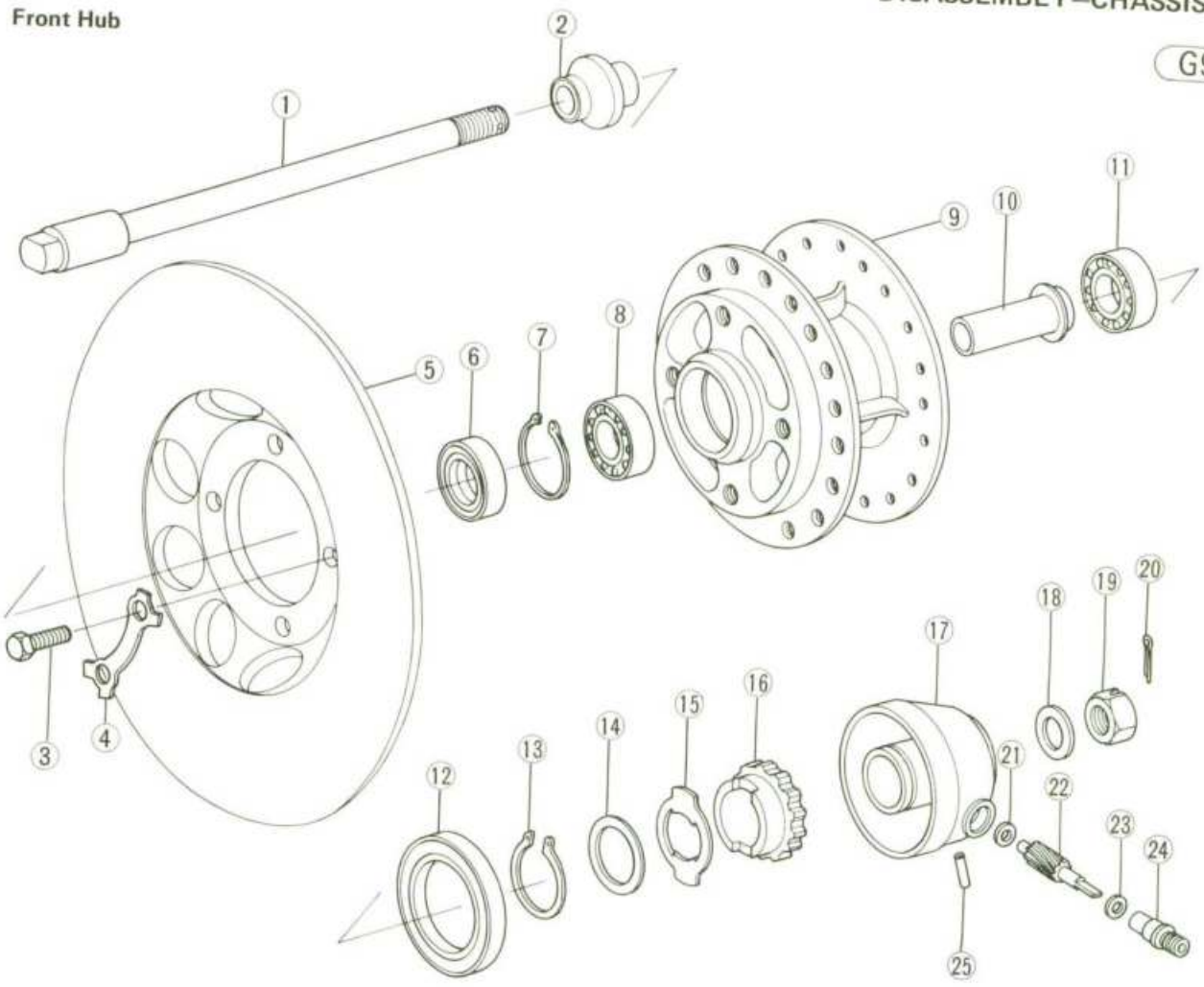
1. Inspect the bearings and replace if necessary (Pg. 160). Install them using the wheel bearing driver and the bearing driver holder (special tools). Drive the bearing in until it stops at the bottom of the hole.



2. Replace the grease seal with a new one using a wheel bearing driver (special tool). Drive the seal until it stops on the bearing.
3. When installing the speedometer gear drive, fit it in the hub notches as shown in Fig. G5.
4. When installing the disc to the front hub, the mating surfaces of the disc and the hub must be clean of any dirt and foreign matters. This could increase the disc runout and cause abnormal disc drag. After installing the disc, check the disc runout (Pg. 164).
5. After tightening the disc mounting bolts (4) with 2.0 kg-m (14.5 ft-lbs) of torque, bend the washer tabs back over the bolts.
6. Clean off any grease that has gotten on either side of the disc with a high flash-point solvent. Do not use one which will leave an oily residue.

Front Hub

G9



1. Front Axle
2. Collar
3. Disc Bolt
4. Double Washer
5. Disc
6. Grease Seal
7. Circlip
8. Bearing
9. Front Hub
10. Distance Collar
11. Bearing
12. Grease Seal
13. Circlip
14. Washer
15. Gear Receiver
16. Speedometer Gear
17. Speedometer Gear Housing
18. Washer
19. Axle Nut
20. Cotter Pin
21. Washer
22. Speedometer Pinion
23. Washer
24. Bushing
25. Pin

FRONT DISC BRAKE

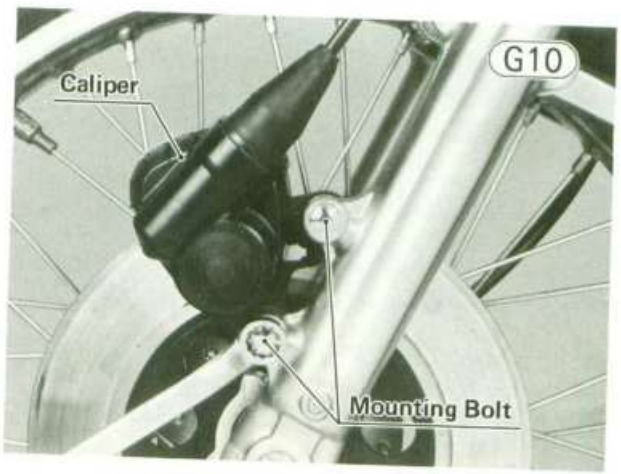
Removal, installation, disassembly, and assembly of the front disc brake is divided as follows:

Pad Removal
Pad Installation
Caliper Removal
Caliper Installation
Caliper Disassembly
Caliper Assembly Notes

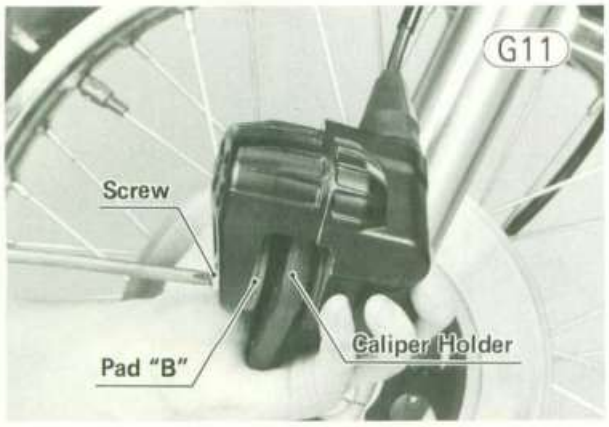
NOTE: Disc removal and disc installation are covered in front hub disassembly and front hub assembly note section (Pg. 96).

Pad Removal:

- Remove the caliper mounting bolts (2), each with a flat washer and lockwasher, and take off the caliper.



•Take out the pad B mounting screw and lockwasher, and remove the pad.



•After pad B is removed, slide out the caliper holder, and remove pad A.

NOTE: If it is difficult to take out pad A, squeeze the brake lever several times until pad A is pushed out.

Pad Installation:

•Remove the rubber cap.

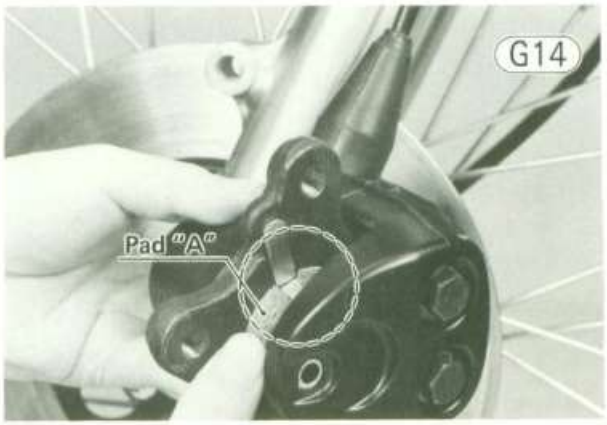


•Loosen the locknut, and turn the caliper adjusting screw counterclockwise until it becomes hard to turn.



•Apply a thin coat of PBC (Poly Butyl Cuprysil) grease to the push rod end where it contacts with pad A. (PBC grease is a special high-temperature, water-resistance grease).

•Install pad A, aligning the notch on the pad with the tongue in the caliper holder.



•Install pad B, lockwasher, and mounting screw; using a non-permanent locking agent on the screw.

•Install the caliper, and tighten its mounting bolts with 4.0 kg-m (29 ft-lbs) of torque. Each bolt has a flat washer and lockwasher.

•Check the brake lever play (Pg. 23).

•Turn the caliper adjusting screw clockwise until it becomes hard to turn.

•Back the adjusting screw ½ turn counterclockwise from that point, and tighten the locknut without changing the adjusting screw position. Tightening torque for the locknut is 0.9 kg-m (78 in-lbs).

•Install the rubber cap.

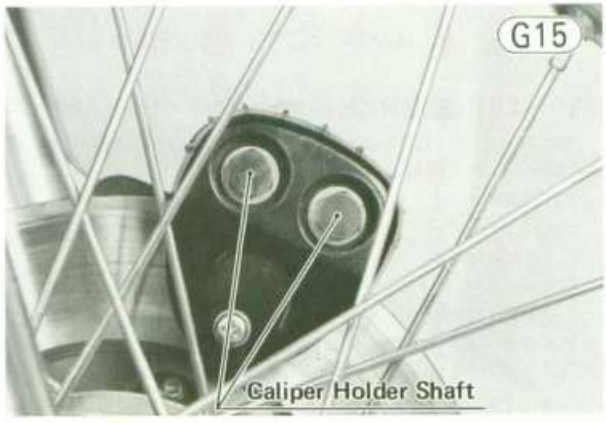
•Squeeze the brake lever about 20 times so that the amount of brake lever travel is adjusted automatically.

WARNING **Do not attempt to drive the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.**

Caliper Removal:

•Remove the front brake cable (Pg.105).

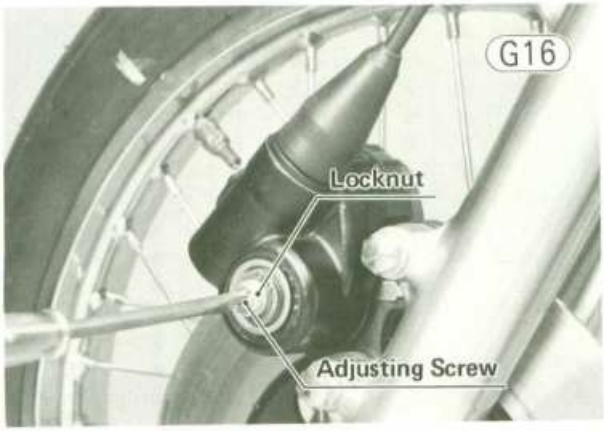
•If the caliper is to be disassembled, loosen the caliper holder shafts (2).



•Remove the caliper mounting bolts (2), each with a flat washer and lockwasher, and then take off the caliper.

Caliper Installation:

- Install the caliper on the left front fork leg. Tighten the mounting bolts with 4.0 kg-m (29 ft-lbs) of torque. Each bolt has a lockwasher and flat washer.
- Check to see that the caliper holder shafts is tightened with 3.1 kg-m (22 ft-lbs) of torque.
- Install the brake cable (Pg. 106).
- Adjust the brake lever (Pg. 23).
- Turn the caliper adjusting screw clockwise until it becomes hard to turn.
- Back the adjusting screw ½ turn counterclockwise from that point, and tighten the locknut without changing the adjusting screw position. Tightening torque for the locknut is 0.9 kg-m (78 in-lbs).

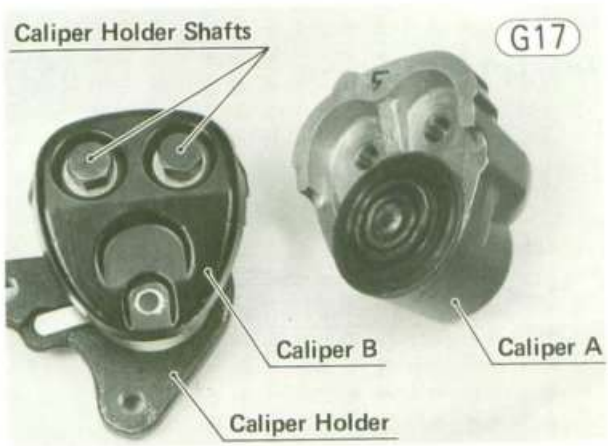


- Install the rubber cap.
- Squeeze the brake lever about 20 times so that the amount of the brake lever travel is adjusted automatically.

WARNING **Do not attempt to drive the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.**

Caliper Disassembly:

- Take out the mounting screw ⑲ and lockwasher ⑱, and remove pad B ⑧.
- After pad B is removed slide out the caliper holder ⑥, and remove pad A ⑦.
- Turn out the caliper holder shafts ⑫ evenly, taking care not to pull up the shafts from caliper B ⑨, and separate caliper B from caliper A ②.



- Pull out the caliper holder and the dust covers ⑤ (4), taking care not to damage the dust covers; and take off the O rings ⑪ (4).



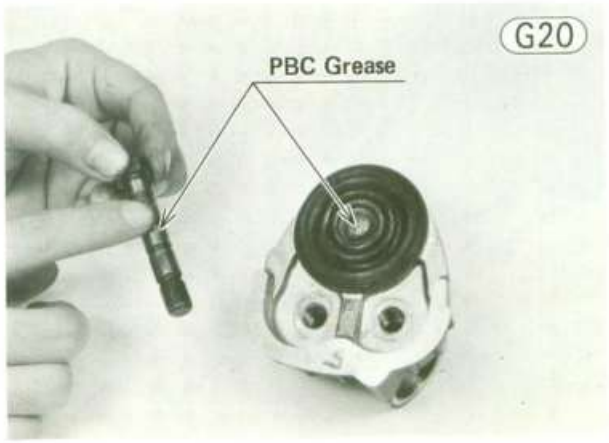
- Push out the caliper holder shafts. Each shaft has a flat washer ⑩.
- Remove the dust seal stop ④, and remove the dust seal ③.



- Remove the rubber cap ①.

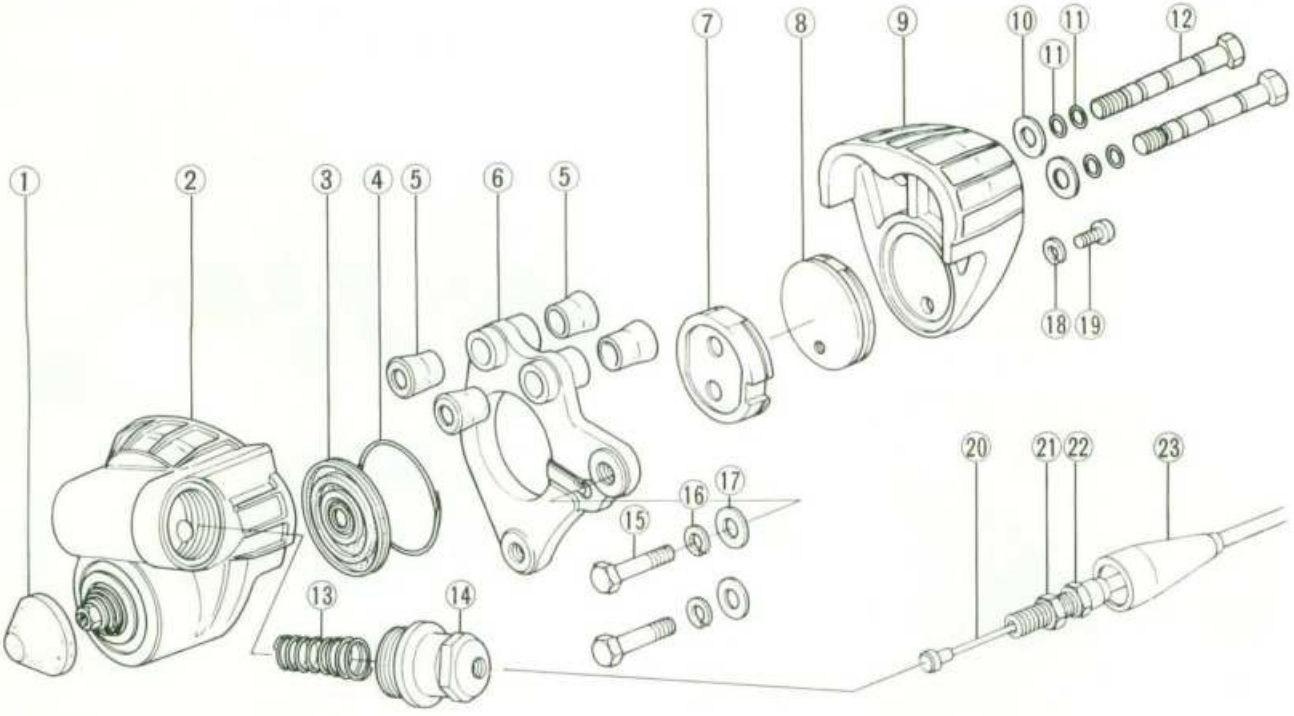
Caliper Assembly Notes:

1. Before assembly, clean the caliper parts (except rubber parts and caliper A assembly) with brake fluid or alcohol.
2. Apply a thin coat of PBC (Poly Butyl Cuprysil) grease to the caliper holder shafts and the push rod end of the caliper A assembly. (PBC grease is a special high-temperature, water-resistance grease).



Caliper

G21



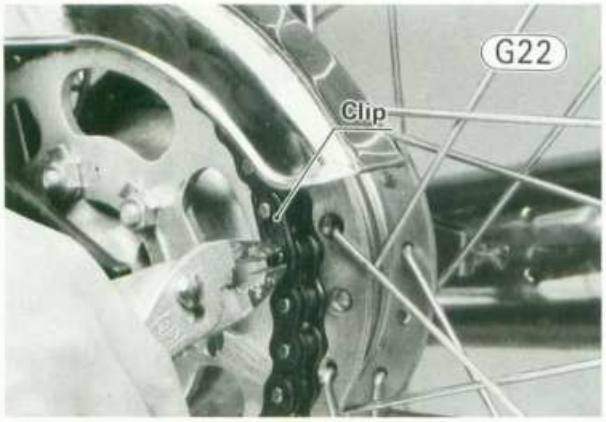
1. Rubber Cap
2. Caliper A
3. Dust Seal
4. Stop
5. Dust Cover
6. Caliper Holder
7. Pad A
8. Pad B
9. Caliper B
10. Washer
11. O Ring
12. Caliper Holder Shaft
13. Return Spring
14. Plug
15. Mounting Bolt
16. Lockwasher
17. Washer
18. Lockwasher
19. Mounting Screw
20. Brake Inner Cable
21. Locknut
22. Adjuster
23. Dust Cover

3. Tighten the caliper holder shafts evenly with 3.1 kg-m (22 ft-lbs) of torque.
4. Install pad A, fitting the notch on the pad over the tongue in the caliper holder (Fig. G14).
5. Use a non-permanent locking agent on the pad B mounting screw.

DRIVE CHAIN

Removal:

- Check to see that the transmission is in neutral.
- Take out the screws (2) and remove the engine sprocket cover.
- Remove the clip from the drive chain master link using pliers, and remove the master link.



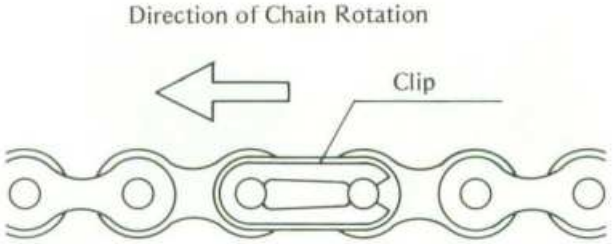
- Free the drive chain from the sprockets, being careful that the chain does not get dirty from contact with the ground.

Installation:

- Fit the drive chain back onto the sprockets with the ends at the rear sprocket.
- Install the master link.
- Install the master link clip with pliers. The direction of the master link clip must be as shown.

WARNING **Incorrect installation of the master link clip can allow it to catch on an adjacent part. If the clip dislodged, the chain could come apart, and this may result in rear wheel lockup and loss of control.**

Master Link Clip Installation G23



- Install the engine sprocket cover.
- Adjust the drive chain (Pg. 22).

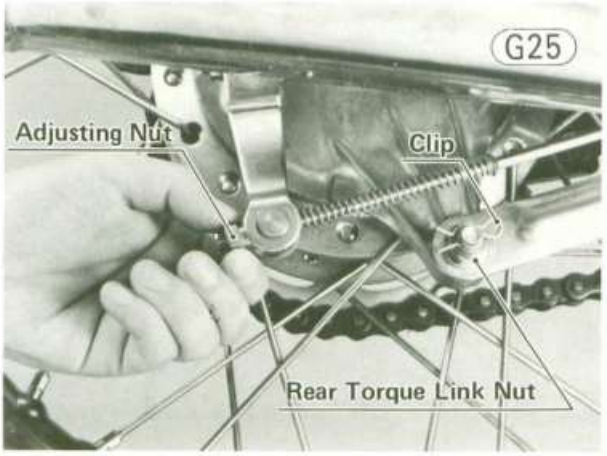
REAR WHEEL, REAR BRAKE

Removal:

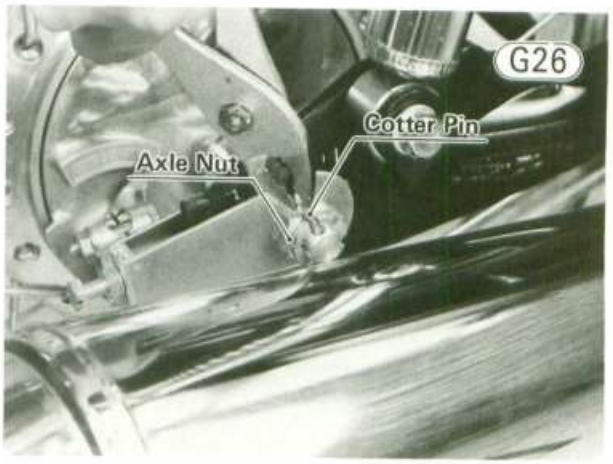
- Put the motorcycle up on its center stand.
- Being careful not to bend or otherwise damage it, free the rear brake light switch spring from the tap on the brake pedal.



- Remove the adjusting nut from the end of the brake rod, and then free the rod from the cam lever by depressing the brake pedal. Remove the brake rod spring and joint.



- Take out the clip from the rear torque link bolt, remove the nut, lockwasher, and bolt.
- Remove the clip from the drive chain master link using pliers, and remove the master link.
- Remove the drive chain from the rear sprocket, being careful that the chain does not get dirty from contact with the ground.
- Take out the cotter pin, remove the rear axle nut.

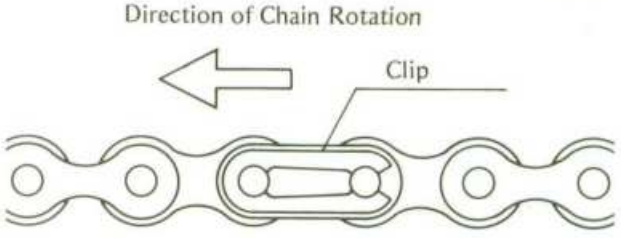


- Pull out the axle, removing the right collar while dropping out the wheel.
- Pull off the rear wheel.

Installation:

- Check to see that the wheel coupling, coupling collar, coupling sleeve, rubber damper, and brake panel are in place.
- Slip the rear wheel into the end of the swing arm, and install the collar.
- Install the chain adjuster on each side of the swing arm. The chain adjusters should be installed with the notch mark side facing out.
- Slide the axle through the left to the right.
- Attach the rear axle nut loosely.
- Fit the drive chain onto the rear sprocket.
- Install the drive chain master link and clip. The direction of the master link clip should be as shown.

Master Link Clip Installation G27



- Insert the torque link bolt into the brake panel, and install the torque link, lockwasher, and nut finger tight.
- Adjust the drive chain (Pg. 22).
- Install the spring on the end of the brake rod, fit the rod through the joint, and screw on the adjusting nut.
- Carefully fit the rear brake light switch spring back into the tab on the brake pedal.
- Adjust the rear brake (Pg. 23), and check the rear brake light switch adjustment (Pg. 24).

Rear Brake Disassembly:

- Remove the brake panel ⑯ from the wheel.
- Using a clean cloth around the linings to prevent grease or oil from getting on them, remove the brake shoes ⑭ by pulling up on the center of the linings.

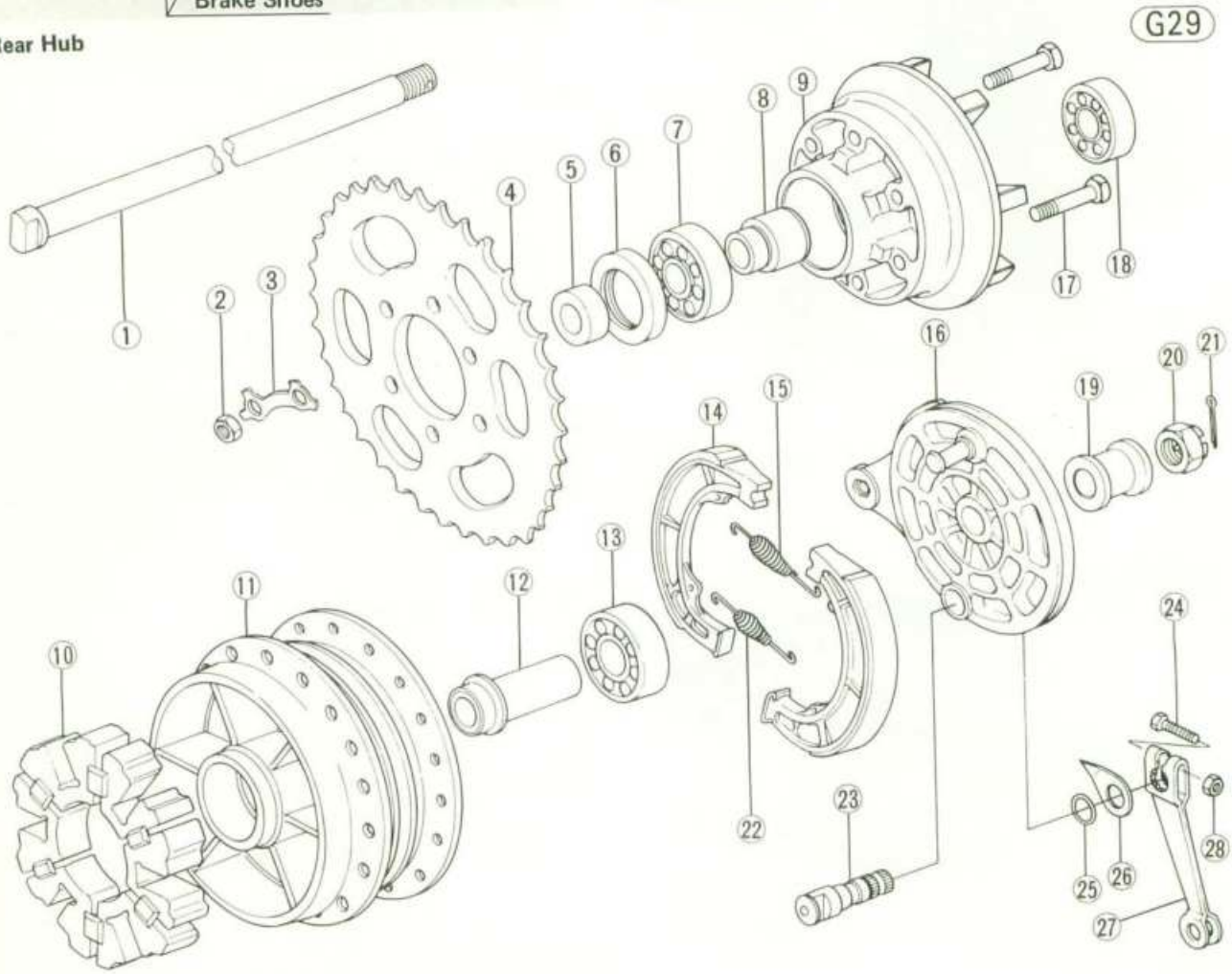


- Remove the long spring ㉒ and short spring ⑮ to separate the two brake shoes.
- Mark the position of the cam lever ㉗ so that it can be installed later in the same position.
- Unbolt and remove the cam lever, brake lining wear indicator ㉖, dust seal ㉕, and camshaft ㉓.

Rear Brake Assembly:

- Clean the old grease from the camshaft, and regrease using regular cup grease. Apply grease to the center of the shaft and to the cam surfaces. Do not overgrease.
- Put the camshaft back into the panel.
- Fit the long spring and short spring onto the brake shoes as shown, and wrapping a clean cloth around the linings to prevent grease or oil from getting on them, install the shoes on the brake panel.

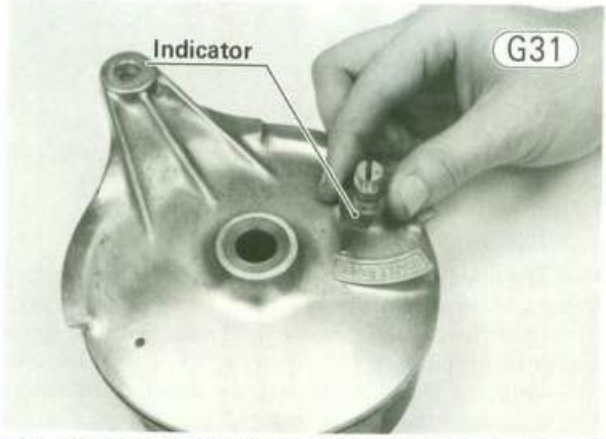
Rear Hub



1. Rear Axle
2. Nut
3. Double Washer
4. Rear Sprocket
5. Coupling Collar
6. Grease Seal
7. Ball Bearing
8. Coupling Sleeve
9. Coupling
10. Rubber Damper
11. Drum Assembly
12. Spacer
13. Ball Bearing
14. Brake Shoe
15. Spring
16. Brake Panel
17. Bolt
18. Ball Bearing
19. Distance Collar
20. Axle Nut
21. Cotter Pin
22. Spring
23. Brake Cam
24. Bolt
25. Dust Seal
26. Wear Indicator
27. Brake Cam Lever
28. Nut



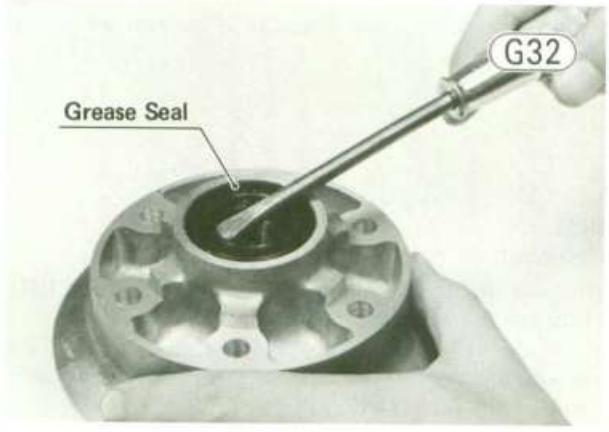
•Fit the dust seal and the indicator on the serration so that it points to the extreme left of the USABLE RANGE.



•Install the cam lever in its original position on the camshaft, and tighten its bolt.

Wheel Coupling Disassembly:

•Remove the wheel coupling ⑨ from the wheel.
•Pull out the coupling collar ⑤ from the left, and the coupling sleeve ⑧ from the right.
•Install the rubber damper ⑩ and wheel coupling assembly temporarily to aid in rear sprocket ④ removal.
•Straighten the bent portions of the double washers (3).
•Remove the rear sprocket nuts ② (6), the double washers, and the sprocket bolts ⑰ (6) to separate the rear sprocket and wheel coupling.
•Remove the coupling from the rear wheel.
•Using a hook, pull out the grease seal ⑥.



•Remove the bearing ⑦ by tapping from the wheel sides evenly around the bearing inner race.

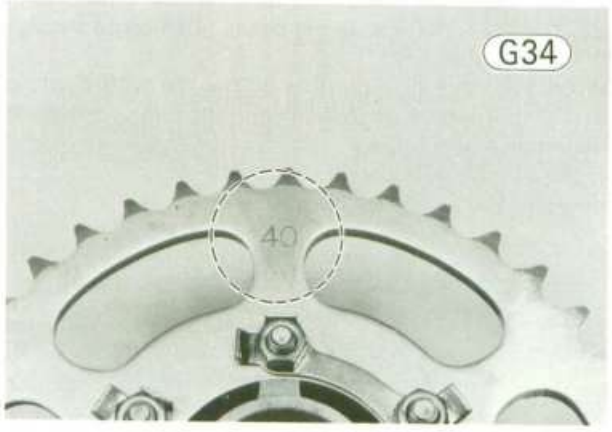
Wheel Coupling Assembly:

•Inspect the bearing, and replace with new one if necessary (Pg. 160). Lubricate the bearing (Pg. 160), and install it using the wheel bearing driver and bearing driver holder (special tools). Drive the bearing until it stops at the bottom of the wheel coupling bearing hole.



•Inspect the grease seal, and replace with a new one if necessary (Pg. 160).
•Install the grease seal using the same special tools used for the bearing installation. Drive the seal in until the face of the seal is level with the end of the grease seal hole.
•Install the rear sprocket, bolts (6), double washers (3), and nuts (6) loosely.

WARNING **The rear sprocket must be installed with the tooth number marked side facing out. If not, the sprocket will not seat on the coupling evenly, causing the drive chain to be thrown off by excessive sprocket runout during operation. This can result in rear wheel lockup and loss of control.**



•Install the rubber damper and wheel coupling on the rear hub, and then tighten the sprocket nuts with 2.2 kg-m (16.0 ft-lbs) of torque.
•Bend the tab portions of the double washers over the nuts.
•Remove the coupling from the rear hub.
•Install the coupling sleeve on the right side and the coupling collar on the left side of the coupling.

Rear Hub Disassembly:

- Remove the wheel coupling, rear brake panel, and rubber damper from the wheel.
- Insert a metal rod into the hub from the brake panel side, and remove the left side bearing ⑱ by tapping evenly around the bearing inner race. The distance collar ⑫ will come out with the bearing.
- Insert the metal rod into the hub from the other side, and tap out the remaining bearing ⑬.

Rear Hub Assembly Note:

Inspect the bearings and replace with new ones if necessary (Pg. 160). Install them using the wheel bearing driver and the bearing driver holder (special tools).



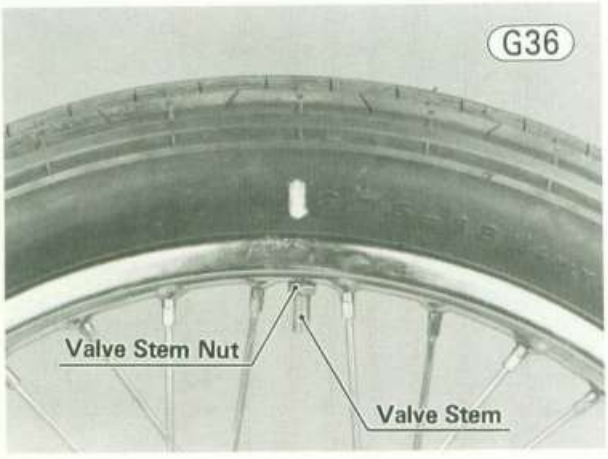
TIRE, TUBE

Removal:

- Remove the wheel from the motorcycle (Pg. 95 or 101).

CAUTION **Do not lay the wheel on the ground with the disc facing down. This could damage or warp the disc.**

- Mark the valve stem position on the tire with chalk so that the tire may be reinstalled in the same position to maintain wheel balance.
- Take out the valve core to let out the air.
- Remove the valve stem nut.



- Use a rubber mallet to break the tire bends away from both sides of the rim.
- Step on the side of the tire opposite the valve stem, and start prying the tire off the rim near the valve stem with tire irons. Take care not to insert the tire irons so deeply that the tube gets damaged.



- Remove the tube when one side of the tire is pried off.
- Pry the tire off the rim.

Installation:

- Put just enough air in the tube to keep it from getting caught between the tire and rim. Too much air makes fitting difficult, and too little will make the tube more liable to be pinched by the irons. Dust the tube and the inside of the tire with talcum powder, and insert the tube into the tire, even if the tire was completely removed from the rim. Insert the valve stem into the rim, and screw the nut on loosely.
- Lubricate the tire beads and rim flanges with a soap and water solution or liquid soap to help seat the tire beads in the rim while inflating the tire.
- If the tire was completely removed, pry one side of the tire back onto the rim.
- Pry the other side of the tire onto the rim, starting at the side opposite the valve. Take care not to insert the tire irons so deeply that the tube gets damaged.
- Check that the tube is not pinched between the tire and rim, and then inflate to the specified pressure (Pg. 156).
- Tighten the valve stem nut, and put on the valve cap.
- Balance the wheel (Pg. 25).
- Mount the wheel on the motorcycle (Pg. 95 or 101).
- Adjust the drive chain (Pg. 22), if the rear wheel was removed.

RIM

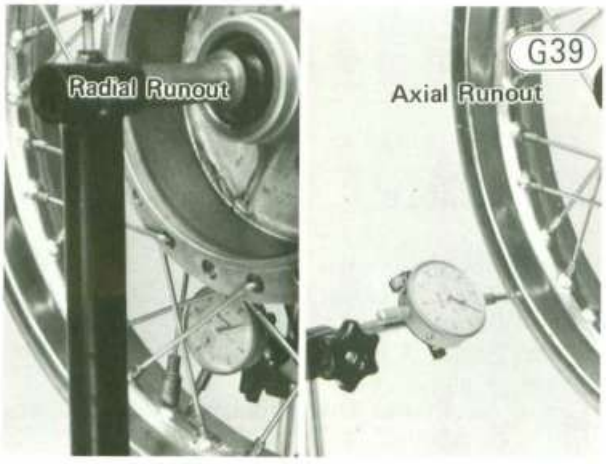
Removal:

- Remove the wheel from the motorcycle (Pg. 95 or 101)
- Take the tire and tube off the rim.
- Tape or wire all the spoke intersections so that the spokes don't get mixed up, and unscrew the nipples from all the spokes with a screwdriver.



Installation:

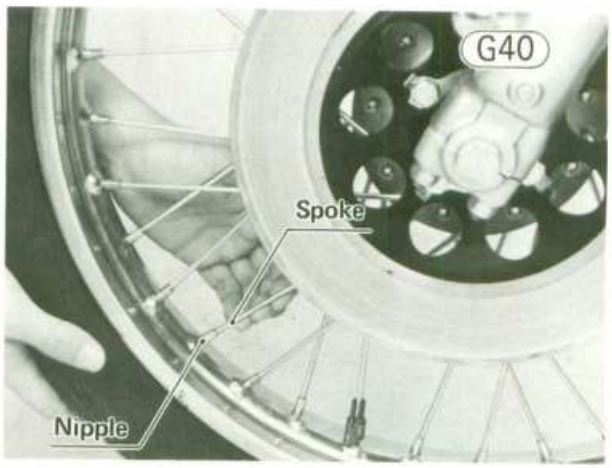
- Fit all the spokes through the holes, and screw all the nipples onto the spokes tightening them partially.
- Suspend the wheel by the axle, and set up a dial gauge to measure rim runout. Fix the axle in place if necessary to prevent horizontal movement.



- Tighten the spokes evenly so that the radial (out from the axle) runout is less than 0.8 mm and the axial (side to side) runout is less than 0.5 mm.
- Make sure that the spokes are tightened evenly. Standard torque is 0.3 kg-m (26 in-lbs).
- Mount the tube and tire (Pg. 104).
- Balance the wheel (Pg. 25).
- Mount the wheel on the motorcycle (Pg. 95 or 101).
- Adjust the drive chain (Pg. 22), if the rear wheel was removed.

SPOKE (breakage replacement)

- Reduce the tire air pressure by a small amount.
- Insert the new spoke through the hub, and bend it to meet the nipple.

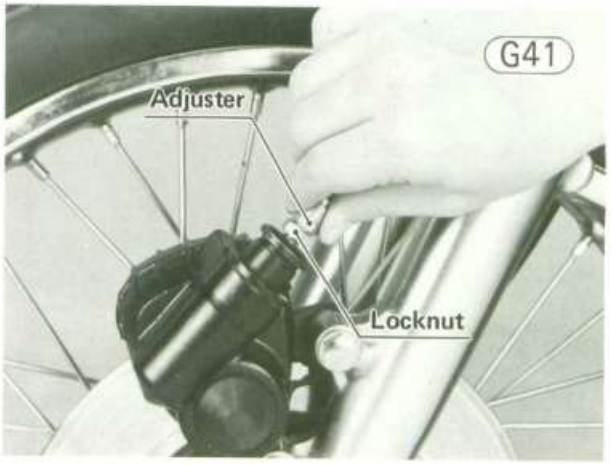


- Tighten with a spoke wrench. Standard torque is 0.3 kg-m (26 in-lbs).
- Inflate the tire to standard pressure (Pg. 156).

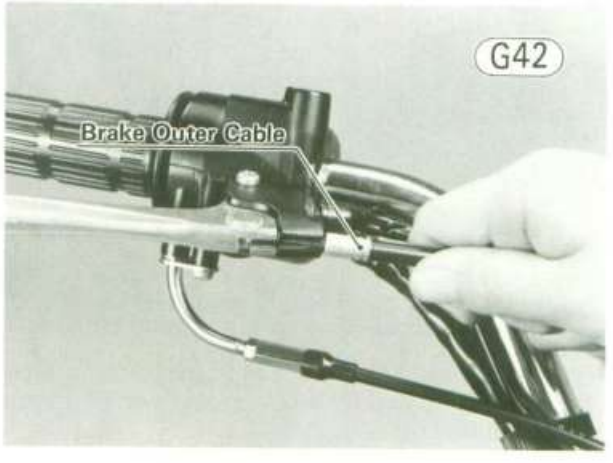
FRONT BRAKE CABLE

Removal:

- Slide back the dust cover, loosen the locknut, and turn in the adjuster fully at the lower end of the brake cable to give the cable plenty of play.



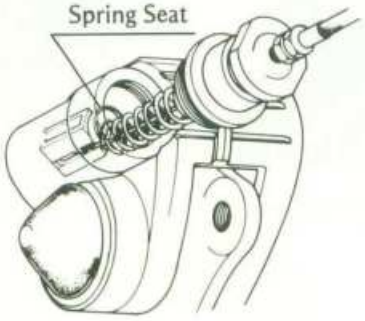
- Pull the brake outer cable out of the brake lever holder, and free the tip of the inner cable from the brake lever.



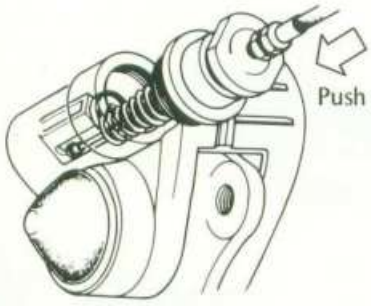
●Turn out the plug in the caliper.
●To remove the cable lower end from the caliper, slip the spring lower end from its seat in the lever, press the spring, and slip the tip of the inner cable out of the lever pushing the inner cable upper end fully into the outer cable.

Brake Cable Removal G43

(1)



(2)



●Take off the spring, and unscrew the cable adjuster.

Installation:
●Turn the adjuster at the lower end of the cable into the caliper plug, and run the cable through the spring. The spring must be installed in the direction as shown.



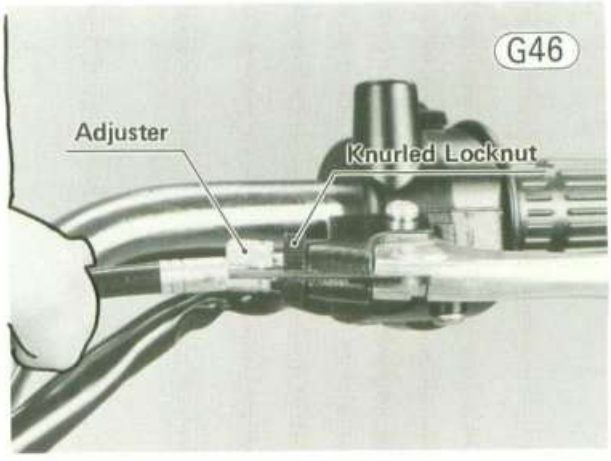
●Press the spring on the lever, and fit the tip of the inner cable lower end into the lever, pushing the inner cable upper end into the outer cable fully.
●Turn in the caliper plug, and tighten it with 2.5 kg-m (18.0 ft-lbs) of torque.
●Run the upper end of the cable through its guides at the front fender left side, steering stem base, and stem head to the brake lever.



●Fit the tip of the cable back into the brake lever.
●Adjust the front brake (Pg. 23).

CLUTCH CABLE

Removal:
●Remove the clutch cable clamp that holds the clutch cable to the frame down tube.
●Loosen the locknut, and turn in the adjusting nut fully at the center of the clutch cable to give the cable plenty of play.
●Loosen the knurled locknut on the clutch lever, and turn in the adjuster.
●Line up the slots in the clutch lever, knurled locknut, and adjuster and free the cable from the lever.



●Pull the lower end of the clutch cable from the left engine cover bracket and free the inner cable from the clutch release lever.



•Pull the clutch cable free from the motorcycle.

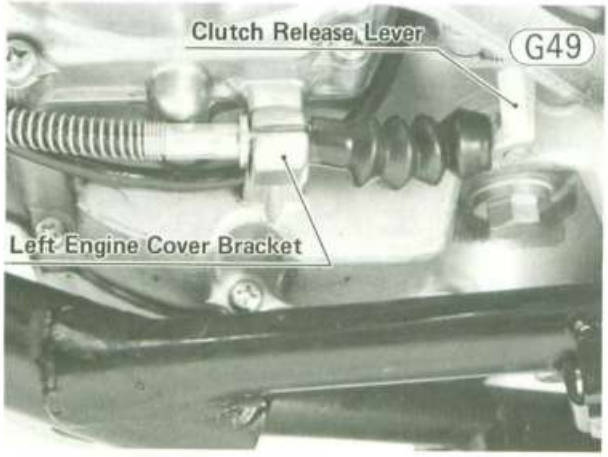
Installation:

NOTE: Before installing the clutch cable, lubricate it (Pg. 28).

•Run the upper end of the cable through its guide at the upper end of the frame down-tube, and between the left fork leg and the head pipe to the clutch lever.



•Run the clutch cable into the left engine cover bracket, spring, and dust cover, and fit the tip of the inner cable into the clutch release lever.



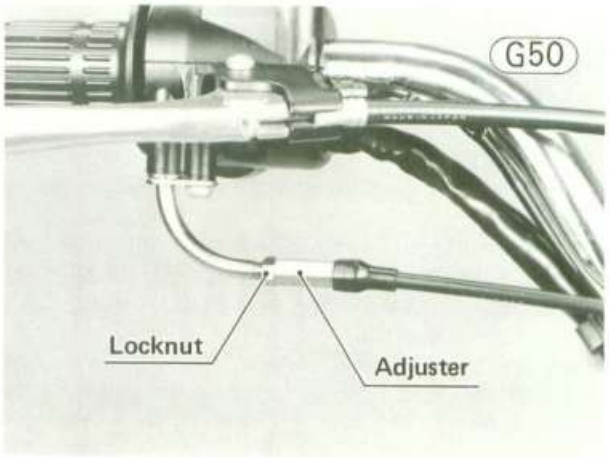
•Fit the tip of the cable back into the clutch lever.
•Fasten the clutch cable to the frame down-tube with the clamp.
•Adjust the clutch (Pg. 17).

THROTTLE CABLE

Removal:

•Remove the fuel tank (Pg. 39).
•Turn in the locknut and adjusting nut fully at the upper end of the throttle cable to give the cable plenty of play.

CAUTION **Removing the throttle cable from the carburetor without enough cable play, may cause throttle cable damage.**

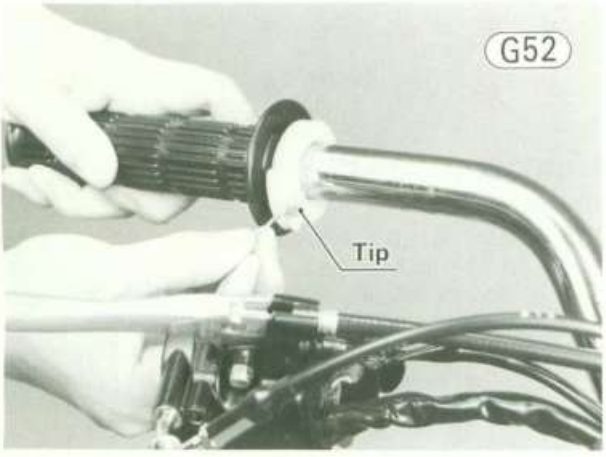


•Remove the carburetor (Pg. 40).
•Remove the throttle valve from the throttle cable (Pg. 42).
•Pull out the cable through the right cable guide on the upper tube.



•Remove the right-hand switch housing screws (2), and open the housing.

•Slip the throttle cable tip from the catch in the throttle grip.



•Pull the cable out of the right-hand switch housing to free the cable from the motorcycle.

Installation:

NOTE: Before installing the throttle cable, lubricate them (Pg. 28).

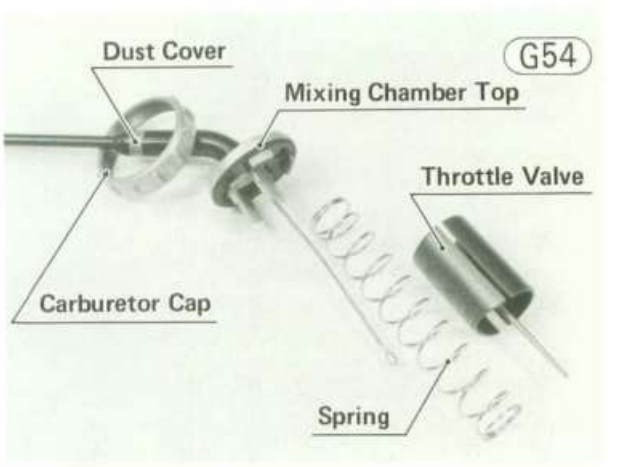
•Insert the throttle cable elbow into the right-hand switch housing. Turn the throttle grip so that the cable catch is facing down, and fit the throttle cable tip in the cable catch.

•Run the throttle cable between the right front fork leg and the head pipe, and through its guide on the upper tube.



•Put together the right-hand switch housing, and tighten its screws (2). The throttle cable elbow holder was installed with the right-hand switch housing front screw. (The front screw is longer than the rear screw.)

•Run the lower end of the throttle cable through the dust cover, carburetor cap, mixing chamber top, and spring, and fit the tip of the inner cable into the throttle valve.



•Install the carburetor (Pg. 40).

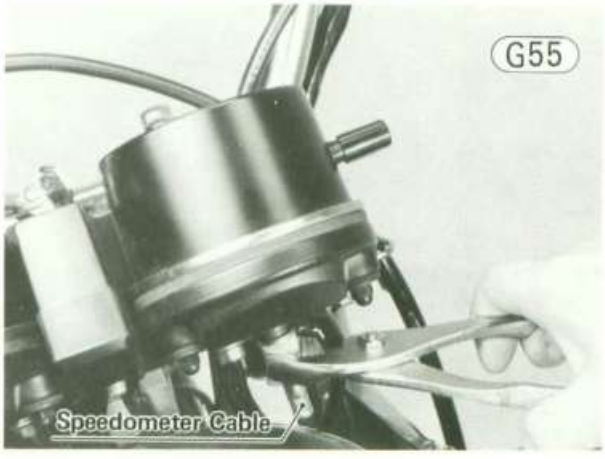
•Install the fuel tank (Pg. 39).

•Adjust the throttle cable (Pg. 16).

SPEEDOMETER CABLE

Removal:

•Disconnect the upper and lower ends of the speedometer cable with pliers.

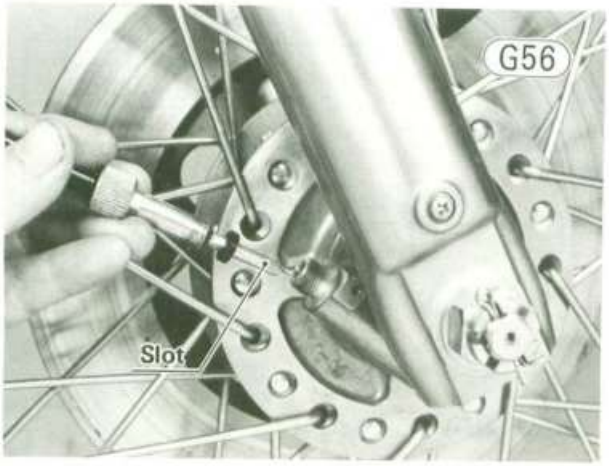


•Pull the cable free.

Installation:

•Run the speedometer cable through its guides at the steering stem base and the right side of the front fender, and secure the upper end of the cable to the speedometer with pliers.

•Insert the speedometer inner cable into the speedometer gear housing while turning the wheel so that the slot in the end of the cable will seat in the tongue of the speedometer pinion. Tighten the cable nut with pliers.



HEADLIGHT UNIT

Removal:

- Take out the retaining screws ㉒ (2), and swing the unit ⑬ from the housing ⑰.
- Disconnect the headlight leads. For semi-sealed beam units, the bulb can now be removed.
- Remove the pivot screws ⑤, nuts ⑧, and rubber dampers (2 ea), and the beam horizontal adjusting screw ④. A nut ③, spring seat ②, and spring ① will come off with the adjusting screw.
- Separate the rim ⑥ from the sealed beam unit ⑬.

Installation Notes:

1. Place the sealed beam unit into the rim, aligning the unit screw hole with the rim screw hole. This ensures that the part of the sealed beam unit marked "TOP" will be on top after the headlight unit is mounted the headlight housing.

TACHOMETER CABLE

Removal:

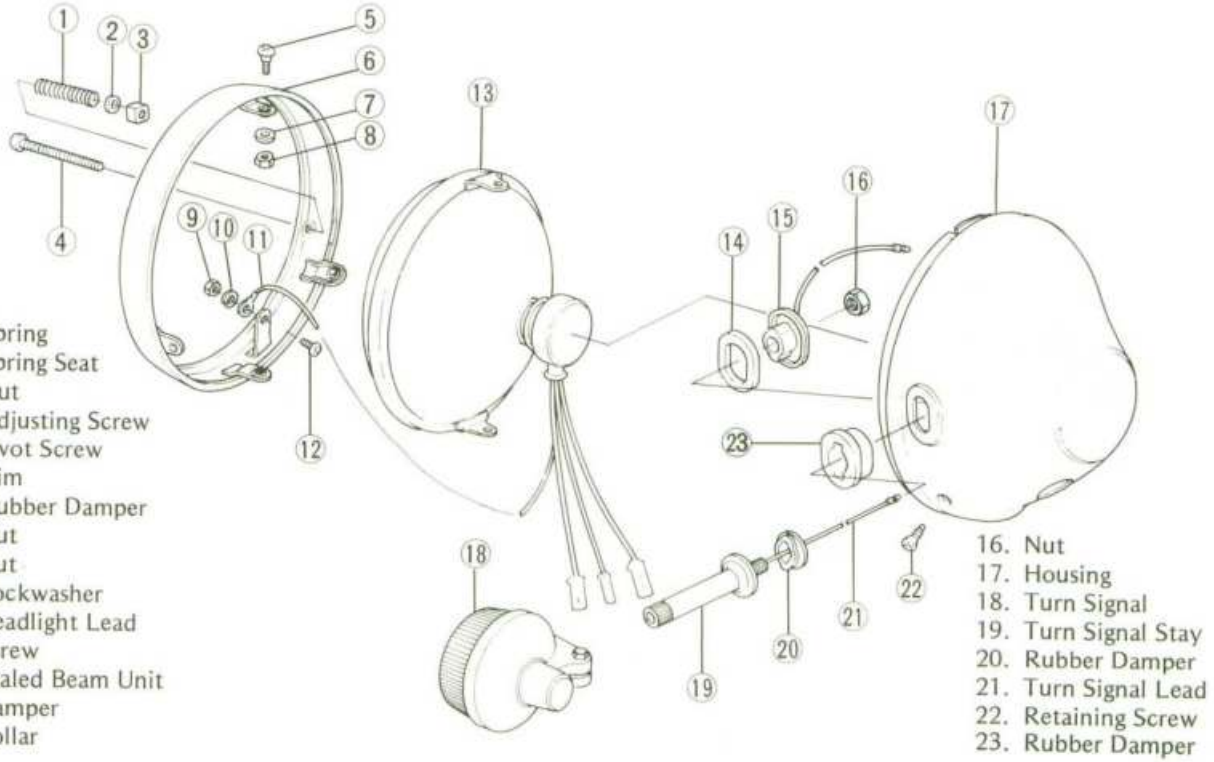
- Disconnect the upper and lower ends of the tachometer cable with pliers.
- Free the cable from the motorcycle.

Installation:

- Run the tachometer cable through its guide at the steering stem base, fit the inner cable into the tachometer, and tighten the cable nut with pliers.
- Fit the bottom end of the cable into its place in the cylinder head. If necessary, turn it so that it fits all the way into place, and tighten its nut with pliers.



Headlight Unit



1. Spring
2. Spring Seat
3. Nut
4. Adjusting Screw
5. Pivot Screw
6. Rim
7. Rubber Damper
8. Nut
9. Nut
10. Lockwasher
11. Headlight Lead
12. Screw
13. Sealed Beam Unit
14. Damper
15. Collar
16. Nut
17. Housing
18. Turn Signal
19. Turn Signal Stay
20. Rubber Damper
21. Turn Signal Lead
22. Retaining Screw
23. Rubber Damper

2. The washer on the adjusting screw goes between the spring and the bracket.
3. Carry out horizontal beam adjustment after installation (Pg. 26).

Table G1 Indicator Lights

Indicator Lights	Lead Color	Bulb Wattage
Turn Signal	Slate, Green	12V 3.4W
Neutral	Brown, Light Green	
High Beam	Black/Yellow, Red/Black	

INDICATOR LIGHTS
(Neutral, High Beam, Turn)

Removal:

•Remove the screws (2) and take off the upper cover.



•To remove the indicator lights (3), first press the bulb inwards, then holding the bulb in this position, twist it to the left and pull it out.

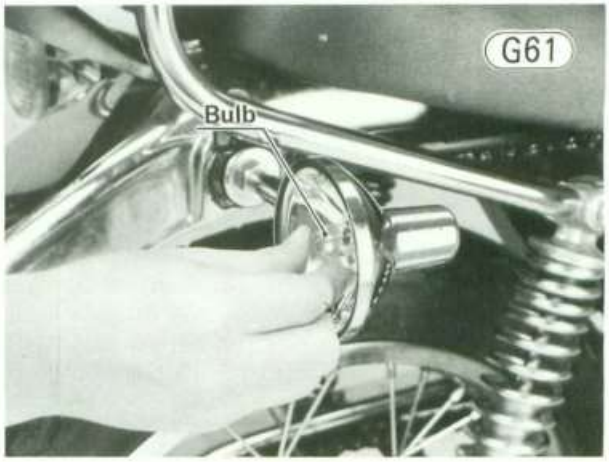


Installation Note:

•Use the bulbs shown in Table G1 for indicator light replacement. Also, refer to the table for light location by lead color. Example: The right turn signal socket takes the bulb with black/yellow and gray leads.

TURN SIGNAL LIGHT
(Burn out Replacement)

•Remove the lens mounting screws, and take off the lens.
•Press the bulb inwards, and holding the bulb in this position, twist it to the left and pull it out.



•Install a new 12 volt bulb of the correct wattage (see the wiring diagram).
•Fit the rubber gasket in place, and install the lens. Be careful not to overtighten the mounting screws.

TURN SIGNAL ASSEMBLY

Removal (front, either side):

•Take out the retaining screws (2), pull the bottom of the headlight unit out of its housing, and swing the unit out of the housing.
•Disconnect the headlight leads.
•Disconnect the turn signal slate lead in the headlight housing.
•Remove the mounting nut and pull the front turn signal from the front fork cover stay.

Installation Notes (front, either side):

1. If the front turn signal dampers have been removed, install them as shown in Fig. G58.
2. Connect the turn signal leads referring to Table G2.

Table G2 Turn Signal Lead Color

	Turn Signal Lead ↔ Main Wiring Harness Lead	
Right	Slate	↔ Slate
	Black/Yellow	↔ Black/Yellow
Left	Slate	↔ Green
	Black/Yellow	↔ Black/Yellow

3. Adjust the headlight vertically (Pg. 26).

Removal (rear, either side):

- Unlock the seat and swing it open.
- Disconnect the turn signal slate lead.



- Remove the nut and washer, and pull the rear turn signal from the frame.

Installation Notes (rear, either side):

1. If the rear turn signal dampers have been removed, install them as illustrated.

Rear Turn Signal Installation

2. Connect the turn signal leads according to Table G2.

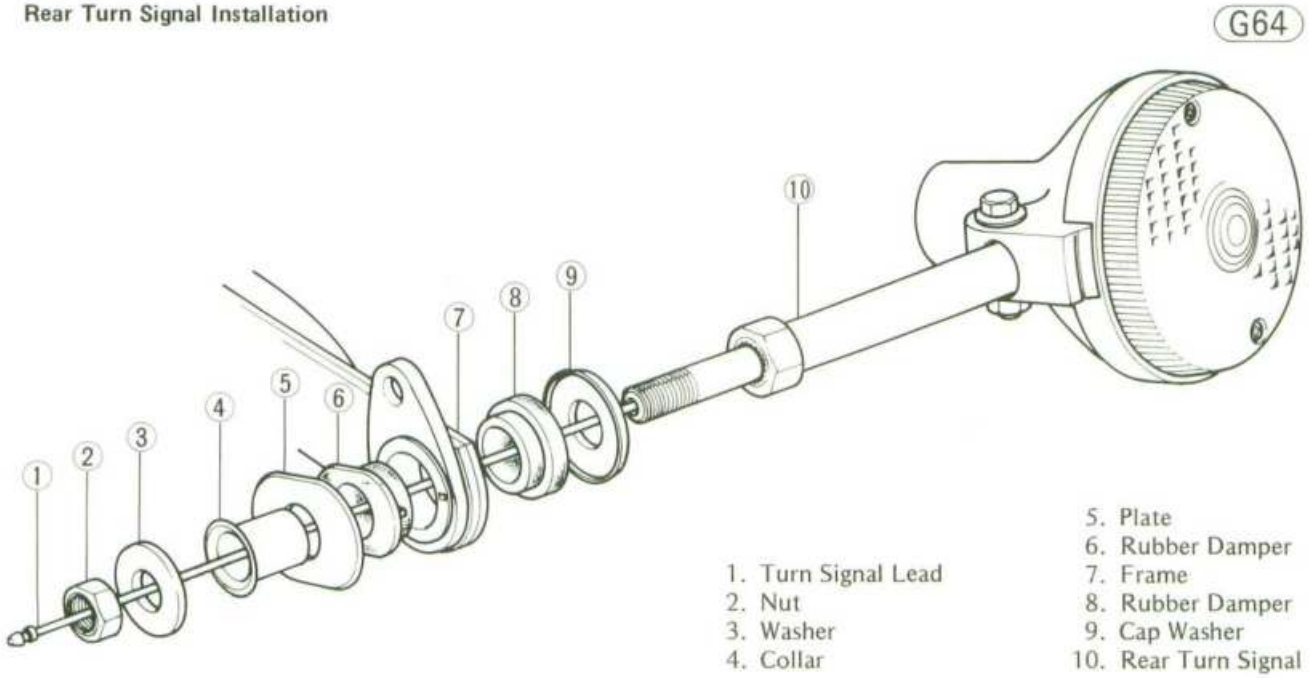
SPEEDOMETER, TACHOMETER, ILLUMINATOR LIGHTS

Removal:

- Disconnect the upper end of the speedometer cable and tachometer cable with pliers.
- Remove the cap nuts, flat washers, dampers (2 ea) from the bottom of the meter holder.

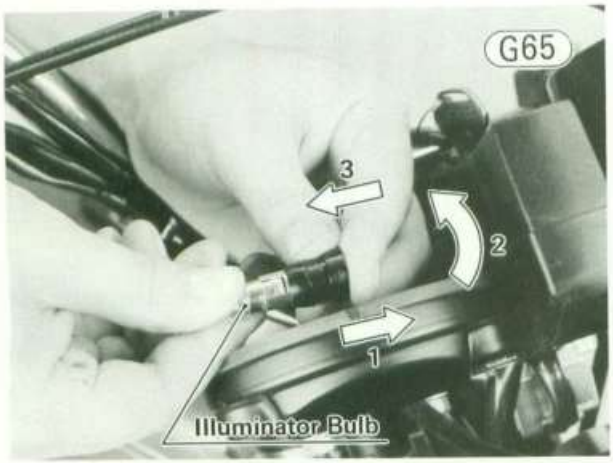


- Pull up on the front of the meter, and pull out the illuminator lights from their base to complete meter removal.



1. Turn Signal Lead
2. Nut
3. Washer
4. Collar
5. Plate
6. Rubber Damper
7. Frame
8. Rubber Damper
9. Cap Washer
10. Rear Turn Signal

•To remove the illuminator bulb, first press the bulb inwards, then holding the bulb in this position, twist it to the left and pull it out.

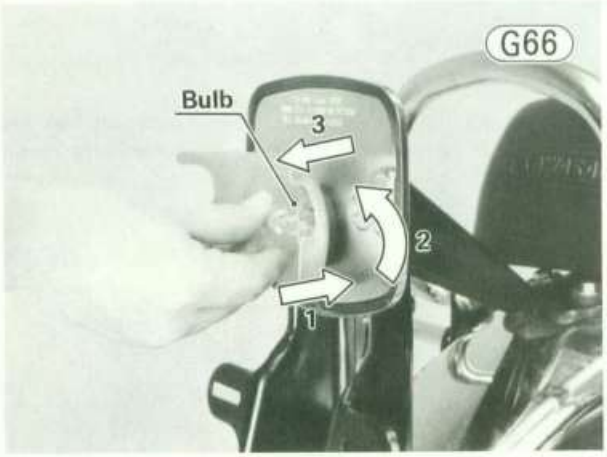


Installation Note:

Use 12V 3.4W bulbs for illuminator light replacement.

TAIL/BRAKE LIGHT (Burn out Replacement)

•Remove the lens mounting screws, and take off the lens.
•Press the bulb inwards, and holding the bulb in this position, twist it to the left and pull it out.

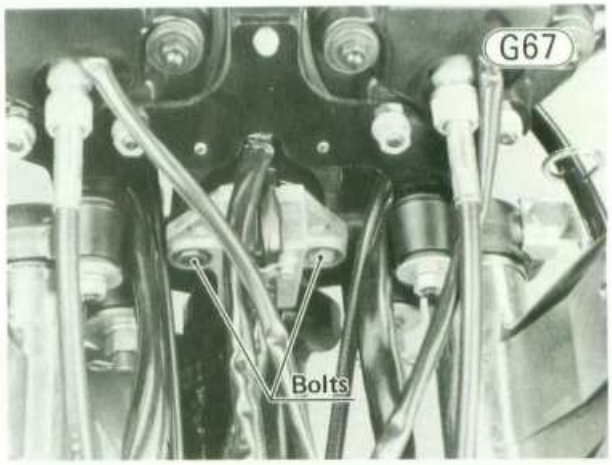


•Replace a burned-out bulb with a new 12 volt bulb of the correct wattage (see the wiring diagram).
•Fit the rubber gasket in place, if removed, and install the lens. Be careful not to overtighten the mounting screws.

IGNITION SWITCH

Removal:

•Remove the left and right front turn signal assemblies (Pg. 110).
•Disconnect the ignition switch wiring harness 4-pin connector in the headlight housing, and push the socket out of the housing.
•Move the headlight housing down slightly.
•Take out the bolts and lockwashers (2 ea) from the bottom of the steering lock assembly, and remove the steering lock assembly and ignition switch.



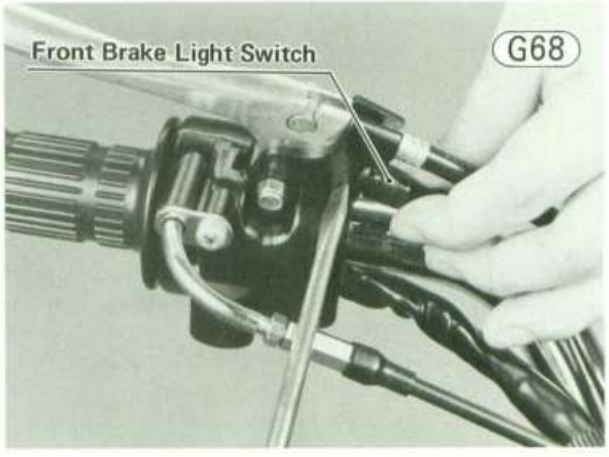
Installation:

•Fit the ignition switch and steering lock assembly in place, and tighten the bolts (2). Each bolt has a lockwasher.
•Connect the ignition switch wiring harness socket to its plug in the headlight housing.
•Install the turn signal assemblies (Pg. 110).
•Adjust the headlight vertically (Pg. 26).

FRONT BRAKE LIGHT SWITCH

Removal:

•Take out the retaining screw, and pull the headlight unit out of its housing.
•Disconnect the brown and the blue/red front brake switch lead connections in the headlight housing, and pull these plugs out of the housing.
•Remove the straps (2) on the right side of the handlebar, and free the front brake switch leads.
•Using a thin-bladed screwdriver or some other suitable tool, press in the front brake switch tab which catches in the hole in the underside of the brake lever holder, and then remove the switch.



REAR BRAKE LIGHT SWITCH

Removal:

- Remove the rear brake light switch spring.
- Remove the right side cover, and disconnect the blue and brown leads from the rear brake light switch.
- Press in the rear brake light switch tabs which catch in the bracket hole, and remove the rear brake light switch.



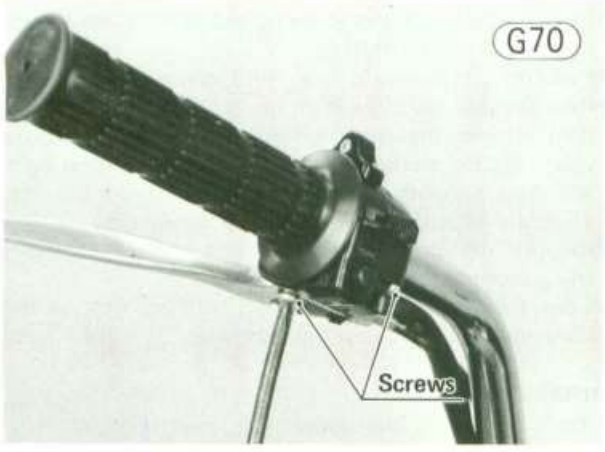
Installation Note:

- Adjust the switch after installation (Pg. 24).

HANDLEBAR

Removal:

- Take off the rear view mirrors.
- Remove the fuel tank (Pg. 39) or cover the tank with a thick cloth to avoid damaging the painted surface.
- Remove the straps which hold the left and right-hand switch housing leads to the handlebar.
- Take out the left-hand switch housing screws (2), and remove the left-hand switch housing from the handlebar.



- Loosen the right-hand switch housing screws (2).
- Remove the handlebar clamp bolts and lockwashers (4 ea), remove the clamps (2), and slide the handlebar from the right-hand switch housing and throttle grip assembly.



Installation:

- Slide the right side of the handlebar into the right-hand switch housing and throttle grip assembly, and put the handlebar onto the handlebar holder stems.
- Install the handlebar clamps, lockwashers, and clamp bolts so that the angle of the handlebar matches the angle of the front fork as shown, and tighten the clamp bolts with 1.8 kg-m (13.0 ft-lbs) of torque.



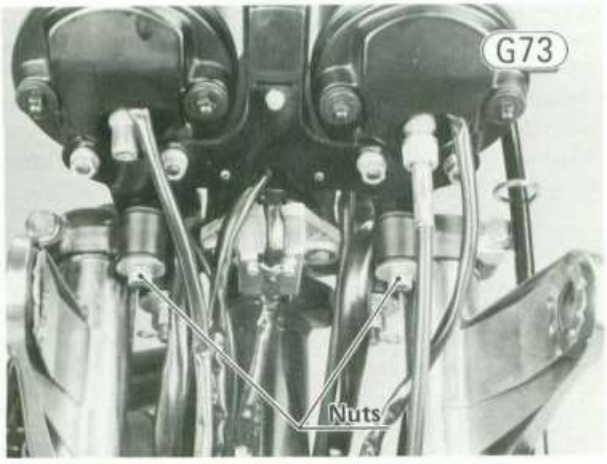
- Position the right-hand switch housing and throttle grip assembly in place, and tighten the switch housing screws.
- Position the left-hand switch housing in place, and tighten its screws. The front screw is longer than the rear screw.
- Strap both the right-hand switch housing wiring harness and the left-hand switch housing wiring harness back onto the handlebar.
- Install the fuel tank (Pg. 39).
- Adjust the front brake (Pg. 23).

- Adjust the throttle cable (Pg. 16).
- Adjust the clutch (Pg. 17).
- Install the rear view mirrors.
- Adjust the rear view mirrors.

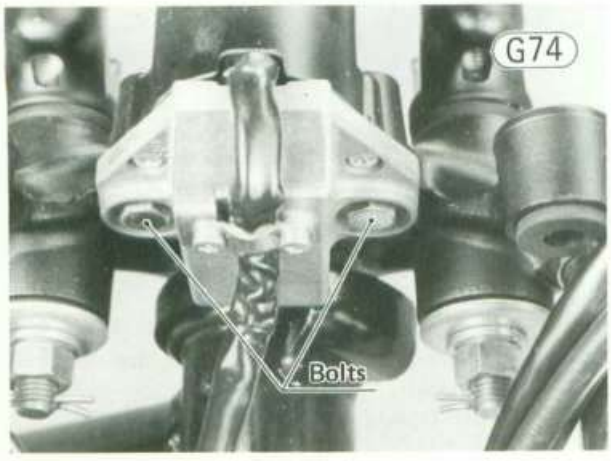
STEERING STEM

Removal:

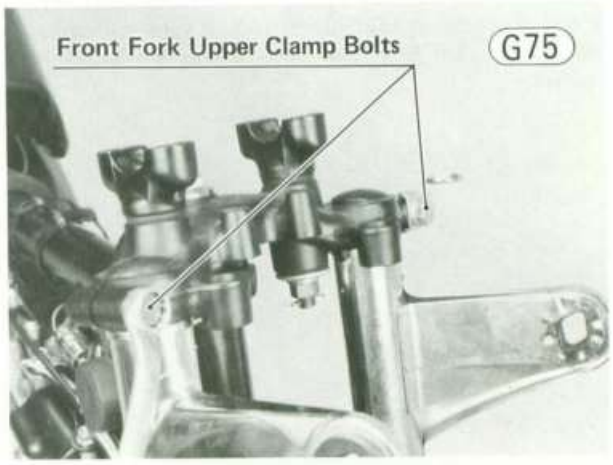
- Remove the fuel tank (Pg. 39).
- Remove the front wheel (Pg. 95).
- Remove the handlebar (Pg. 113).
- Remove the headlight unit (Pg. 109).
- Remove the left and right front turn signal assemblies (Pg. 110).
- Remove the headlight housing and front brake switch.
- Disconnect the tachometer cable at the tachometer.
- Remove the nuts, lockwashers, and flat washers that secure the instrument unit to the stem head, and then remove the instrument unit while pulling the speedometer cable out through its guides. There are four rubber dampers.



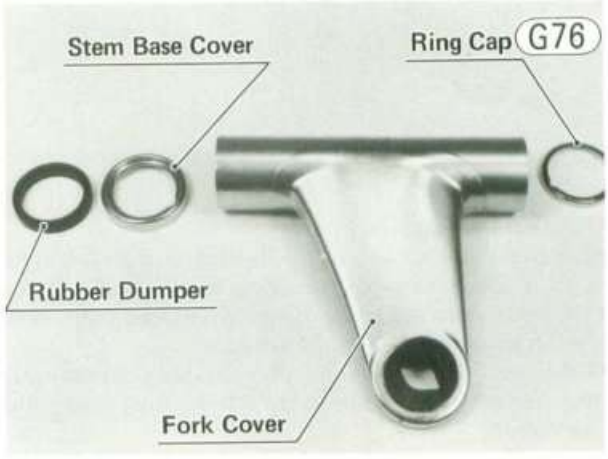
- Remove the bolts and lockwashers (2 ea), and remove the ignition switch assembly.



- Remove the caliper (Pg. 98).
- Remove the fender bolts (4), and take off the fender.
- Loosen the front fork upper clamp bolts (2).



- Remove the stem head bolt and flat washer.
- Tap lightly on the bottom of the stem head with a mallet, and remove the steering stem head.
- Remove the fork covers. Each fork cover has a ring cap at the top; and a stem base cover, and rubber damper at the bottom.



- Loosen the lower clamp bolts, and pull out each fork leg with a twisting motion.
- Push up on the stem base, and remove the steering stem locknut with the stem nut wrench (special tool); then remove the steering stem and stem base (single unit). As the stem is removed, some of the steel balls will drop out of the lower outer race. Remove the rest. There are 19 steel balls in the lower outer race.
- Remove the steering stem cap and upper inner race, and remove the upper steel balls (23).
- Keep the upper and lower steel balls separate as the lower steel balls are larger in diameter.

Installation:

- Apply grease to the upper and lower outer races in

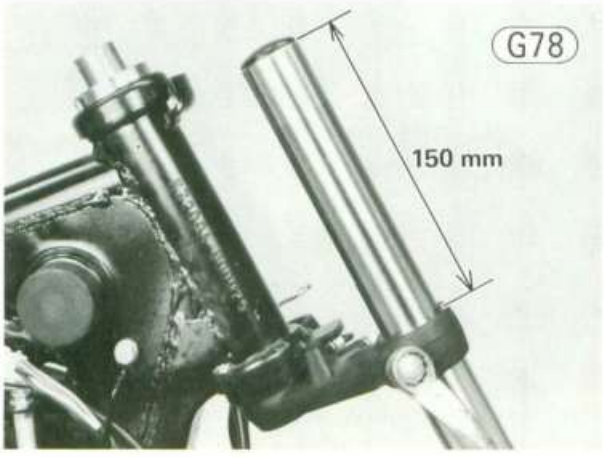
the head pipe so that the steel balls will stick in place during stem insertion, and install the upper steel balls (23) and lower steel balls (19).



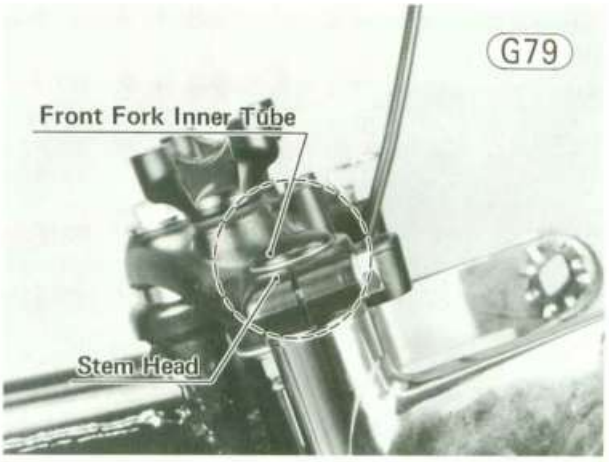
- Put on the upper inner race and steering stem cap. Insert the steering stem into the head pipe, and tighten the steering stem locknut.

NOTE: The steering stem locknut tightness is only temporary. The tightness changes with steering stem adjustment (Pg. 24).

- Run the inner tube of each front fork leg up through its clamp in the stem base. Temporarily tighten the lower clamp bolt on each side to hold each fork leg in place with its inner tube protruding about 150 mm above the steering stem base.



- Install the rubber damper, base cover, fork cover, and ring cap on each tube in this order.
- Install the stem head, and the stem head flat washer (flat side facing down). Turn in the stem head bolt loosely. Be sure the wiring harness and all cables go in front of the stem head.
- For each fork leg, loosen the lower clamp, and align the upper surface of the front fork inner tube with the upper surface of the stem head. Tighten the upper clamp bolt with 1.8 kg-m (13.0 ft-lbs) of torque.

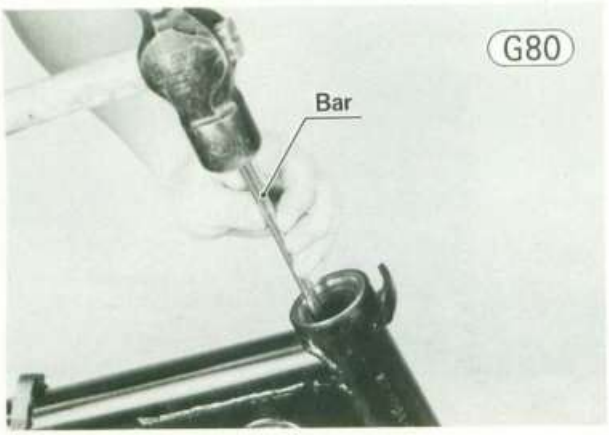


- Tighten the stem head bolt with 2.5 kg-m (18.0 ft-lbs) of torque.
- Tighten the fork leg lower clamp bolts with 3.0 kg-m (22 ft-lbs) of torque.
- Secure the instrument unit to the stem head. Be sure the right switch wiring harness and the left switch wiring harness run between the stem head and the instrument unit. The installation sequence is rubber damper, stem head, rubber damper, flat washer, lockwasher, and nut.
- Run the speedometer cable through its guide at the steering stem base. Run the tachometer cable through its guide, fit the inner cable into the tachometer, and tighten the cable nut with pliers.
- Run the plugs, sockets, and wiring into the headlight housing, and connect the plugs and sockets.
- Put the turn signal assemblies through the fork cover, into the headlight housing, and tighten the mounting nuts. The sequence is the turn signal, rubber damper, fork cover, rubber damper, headlight housing, rubber damper, collar, and nut (Fig. G58).
- Connect the turn signal leads. The left turn signal lead goes to the green lead, and the right is plugged into the gray lead. Both turn signal black/yellow leads go to the same black/yellow plug.
- Run the front brake light switch leads into the headlight housing, and connect the leads.
- Install the handlebar (Pg. 113).
- Install the front fender between the front fork legs. First screw in the left side front mounting bolt with the front brake cable guide then install the right side 2 mounting bolts. Tighten the bolts securely. Each bolt has a lockwasher and flat washer.
- Run the speedometer cable lower end through its guide at the front fender right side.
- Install the front wheel (Pg. 95).
- Install the caliper (Pg. 99).
- Install the fuel tank (Pg. 39).
- Adjust the front brake (Pg. 23).
- Check the steering (Pg. 24), and adjust if necessary.
- Adjust the headlight (Pg. 26).

STEERING STEM BEARING

Removal:

- Remove the steering stem (Pg. 114).
- To remove the outer races pressed into the head pipe, insert a bar into the head pipe, and hammer evenly around the circumference of the opposite race to drive it out.



- Remove the lower inner race, which is pressed onto the steering stem, with a stem bearing puller and adapter (special tools). Be careful not to damage the grease seal under the race during race removal.



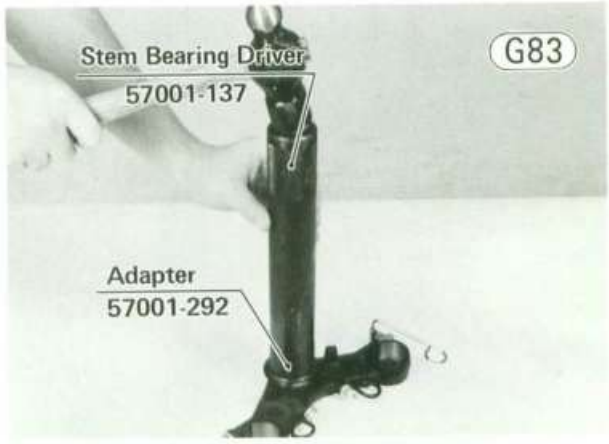
Installation:

- Apply oil to the outer races, and drive them onto the head pipe using the stem cup driver and the bearing driver holder (special tools).



- Apply oil to the lower inner race, and drive it onto the steering stem using the stem bearing driver (special tool).

NOTE: Replace the grease seal with a new one, if it is damaged.

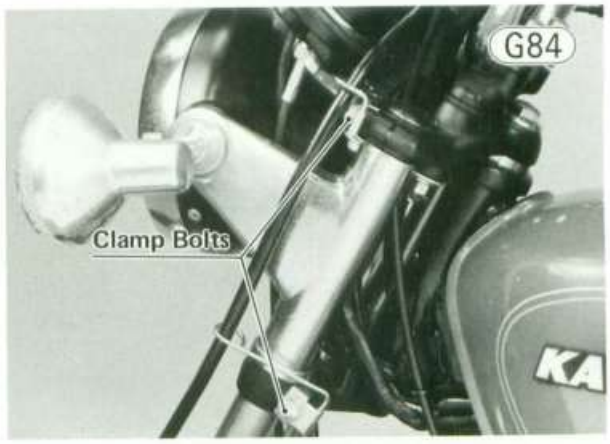


- Install the steering stem (Pg. 114).

FRONT FORK

Removal (left fork leg):

- Remove the front wheel (Pg. 95).
- Remove the bolts (2) that hold the front fender to the left fork leg.
- Remove the caliper mounting bolts (2), and free the caliper from the left fork leg.
- Loosen the upper and lower clamp bolts.



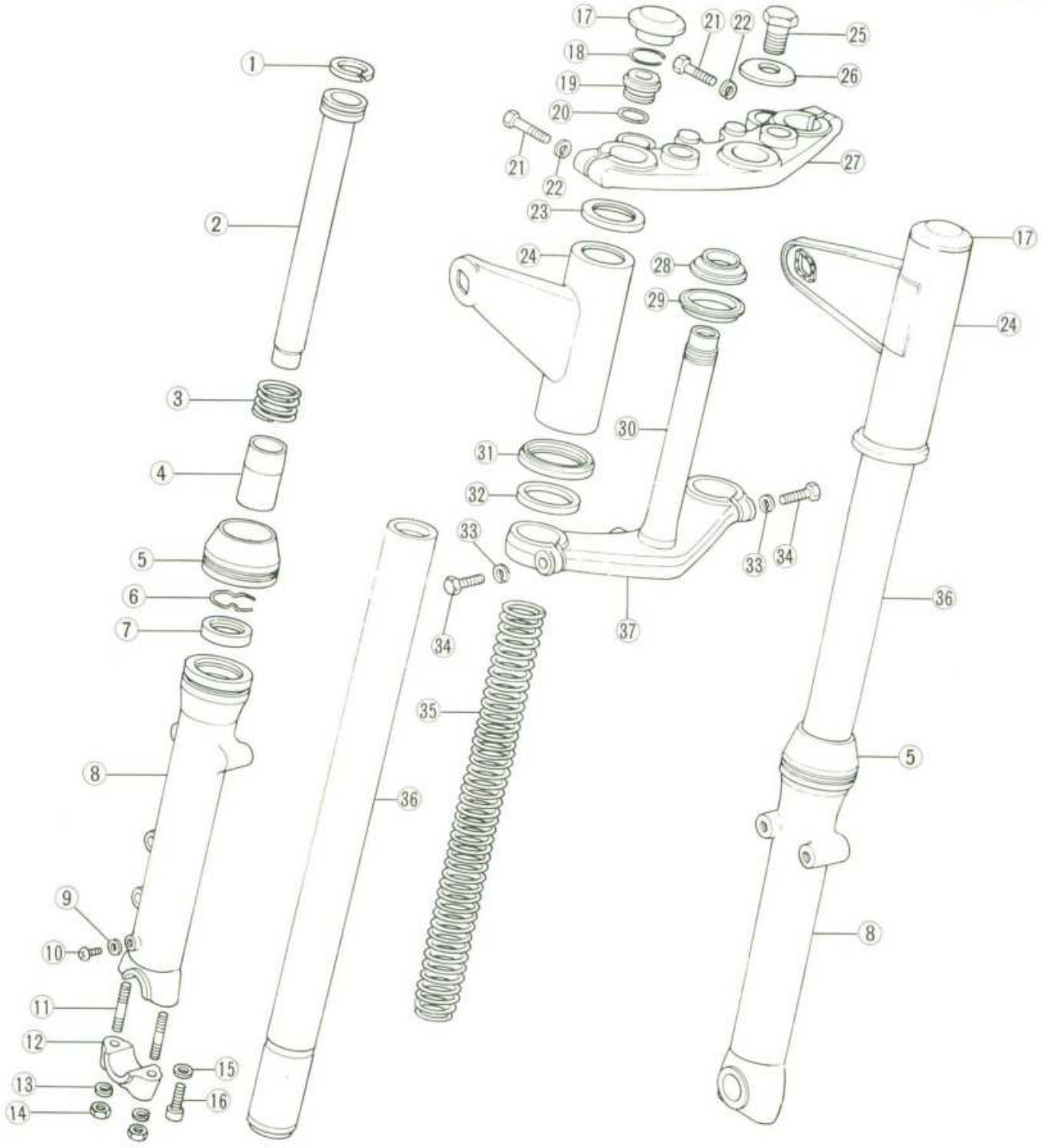
- With a twisting motion, work the fork leg down and out.

Installation (left fork leg):

- Slide the fork leg up through the lower and upper clamps until the upper surface of the front fork inner tube is even with the upper surface of the stem head. Tighten the upper clamp bolt with 1.8 kg-m (13.0 ft-lbs) of torque and the lower clamp bolt with 3.0 kg-m (22 ft-lbs).
- Install the caliper, tightening the caliper mounting bolts with 4.0 kg-m (29 ft-lbs) of torque. Each mounting bolt has a flat washer and lockwasher.

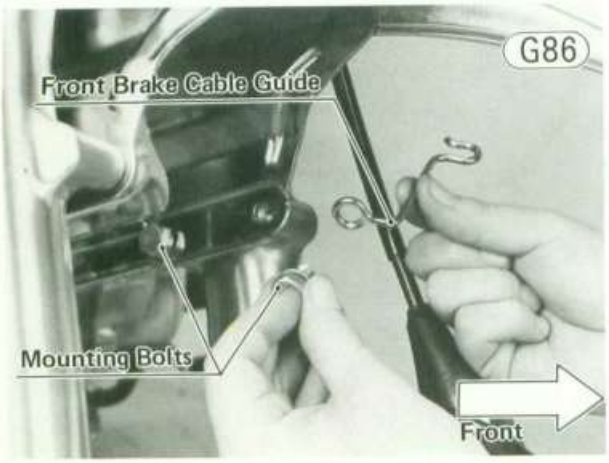
Front Fork

G85



1. Piston Ring
2. Cylinder and Piston Unit
3. Spring
4. Cylinder Base
5. Dust Seal
6. Clip
7. Oil Seal
8. Outer Tube
9. Gasket
10. Drain Screw
11. Stud
12. Axle Clamp
13. Lockwasher
14. Clamp Nut
15. Gasket
16. Allen Bolt
17. Rubber Cap
18. Stop
19. Top Plug
20. **O** Ring
21. Clamp Bolt
22. Lockwasher
23. Ring Cap
24. Fork Cover
25. Stem Head Bolt
26. Washer
27. Stem Head
28. Lower Inner Race
29. Grease Seal
30. Steering Stem
31. Stem Base Cover
32. Rubber Damper
33. Lockwasher
34. Clamp Bolt
35. Fork Spring
36. Inner Tube
37. Stem Base

•Install the front fender left side 2 mounting bolts. The front bolt is installed with the front brake cable guide.



•Install the front wheel (Pg. 95).

Removal (right fork leg):

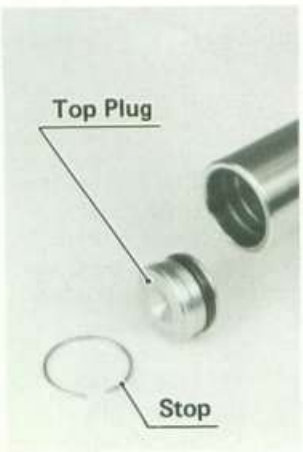
•Remove the front wheel (Pg. 95).
•Remove the bolts (2) that hold the front fender to the right fork leg.
•Loosen the upper and lower clamp bolts.
•With a twisting motion, work the fork leg down and out.

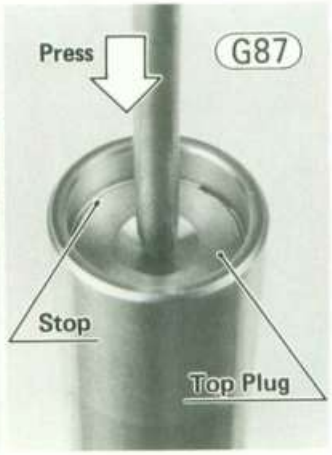
Installation (right fork leg):

•Slide the fork leg up through the lower and upper clamps until the upper surface of the front fork inner tube is even with the upper surface of the stem head. Tighten the upper clamp bolt with 1.8 kg-m (13.0 ft-lbs) of torque and the lower clamp bolt with 3.0 kg-m (22 ft-lbs).
•Install the fender bolts. There are a lockwasher and flat washer for each bolt.
•Install the front wheel (Pg. 95).

Disassembly:

•Remove the rubber cap ⑰.
•Press the top plug ⑲ to remove the top plug stop ⑱, and then remove the top plug and spring ㉟.

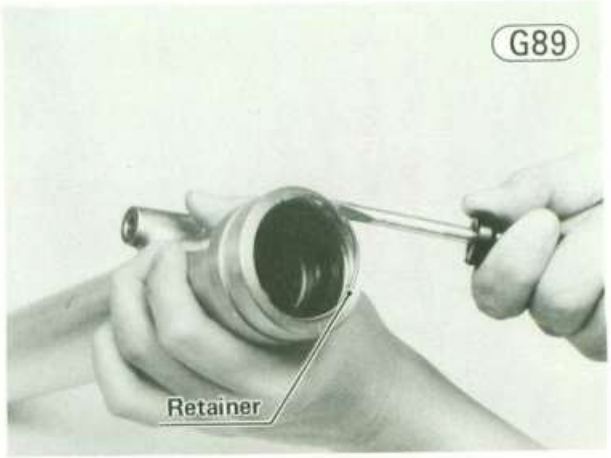




•Pour the oil into a suitable container, pumping as necessary to empty out all the oil.
•Slide the dust seal ⑤ off the inner tube ㊱.
•Stop the cylinder ② from turning by using the front fork cylinder holder and adapter (special tools). Unscrew the Allen bolt ⑯ from the bottom of the outer tube ⑧, and then separate the inner tube from the outer tube by pulling it out.



•Slide or push the cylinder ② and its spring ③ out the top of the inner tube.
•Remove the cylinder base ④ out the top of outer tube.
•Remove the retainer ⑥ from the outer tube with a sharp hook, and pull out the oil seal ⑦. It may be necessary to heat the outer tube around the oil seal before pulling it out.



Assembly Notes:

1. Apply a non-permanent locking agent to the Allen bolt, and tighten it using the front fork cylinder holder and holder adapter (special tools) to stop the cylinder from turning. The torque for the Allen bolt is 1.8 kg-m (13.0 ft-lbs).
2. Replace the oil seal with a new one, apply oil to the outside, and install it with the front fork oil seal driver (special tool).



3. Refill with 145~155 cc of fresh SAE 10W20 oil.

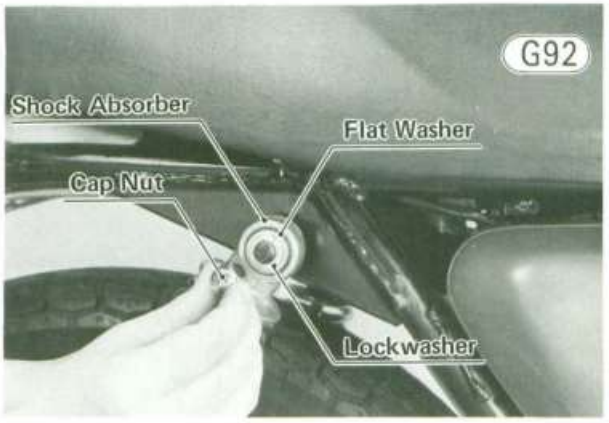
REAR SHOCK ABSORBER

Removal (each side):

- Set the motorcycle up on its center stand.
- Remove the passenger grab bar mounting bolts (2), loosen the shock absorber cap nuts (2), and take off the bar.



- Lift up on the rear wheel as necessary to avoid damaging the shock absorber bolt threads, and remove the shock absorber bolt.
- Remove the cap nut, lockwasher, and flat washer, and pull off the shock absorber.



Installation (each side):

- Fit the shock absorber on its stud.
- Lift up on the rear wheel, insert the shock absorber bolt with its locknut, and tighten with 3.0 kg-m (22 ft-lbs) of torque.
- Install the flat washer and cap nut, and then fit the passenger grab bar into place between the flat washer and rear shock absorber on each side.
- Install and tighten the bar mounting bolts (2). Each bolt has a lockwasher and flat washer.
- Tighten each cap nut with 3.0 kg-m (22 ft-lbs) of torque.

SWING ARM

Removal:

- Set the motorcycle up on its center stand.
- Remove the rear wheel (Pg. 101).
- Remove the mounting bolt from each shock absorber bottom. A lockwasher comes off with the bolt.
- Move the swing arm up and down to check for abnormal friction.
- Remove the pivot shaft nut and flat washer, and pull out the pivot shaft.



- Pull back the swing arm. A cap on each side of the pivot will also drop off.

Installation:

- Install the cap on each end of the pivot of the swing arm.
- Position the pivot of the swing arm into its place in the frame, and slide in the pivot shaft from right to left. A screwdriver inserted into the left side of the pivot will keep the left cap in place.

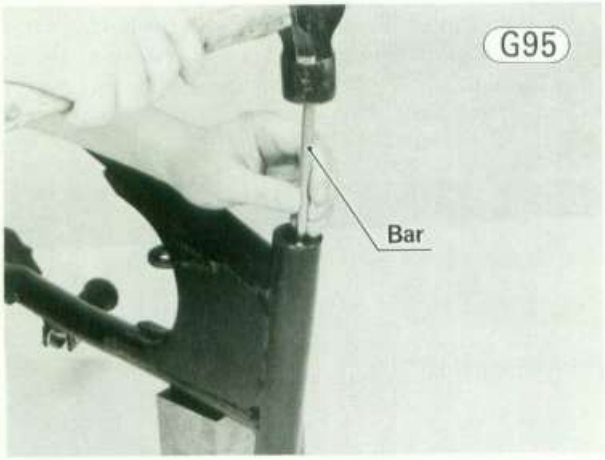


- Install the pivot shaft nut and flat washer, and tighten the nut with 8.0 kg-m (58 ft-lbs) of torque.
- Install the rear shock absorber bolts and lockwashers, tightening each bolt with 3.0 kg-m (22 ft-lbs) of torque.
- Install the rear wheel (Pg. 101).
- Adjust the drive chain (Pg. 22).

Disassembly

NOTE: As the swing arm bushes will be damaged upon removal, be sure to have new ones on hand prior to disassembly.

- Pull the safety clip ⑩ off the torque link bolt ⑯. Take out the nut ⑨, lockwasher ⑧, and bolt, and remove the torque link ⑰ from the swing arm ⑤.
- Pull out the swing arm bushing ⑥.
- Insert a bar into one side, and hammer on it lightly to knock out the bushing ④ on the opposite side.

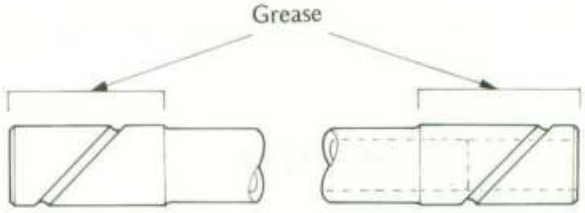


- Use the bar again to knock out the other bushing.

Assembly Notes:

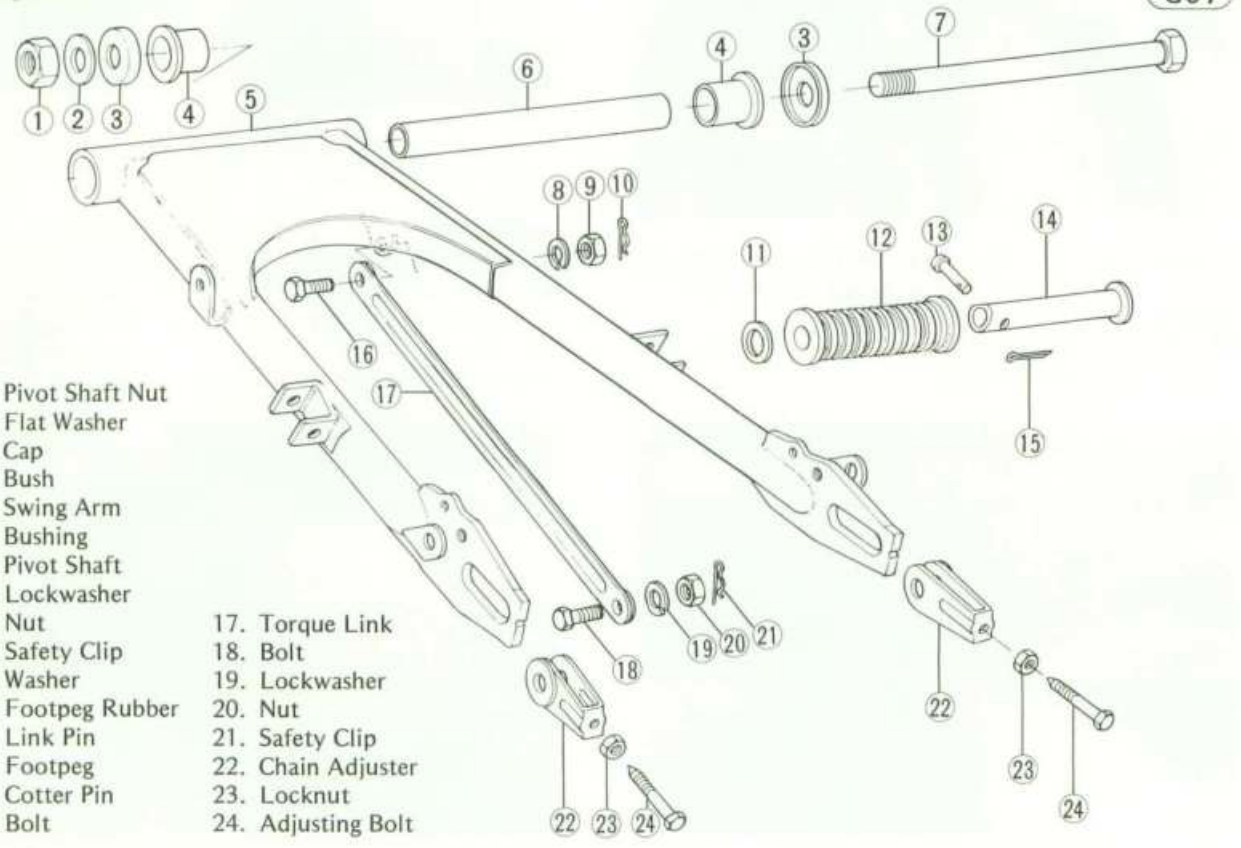
1. Replace the bushes with new ones if either one has worn past the service limit (Pg. 172) or has been removed. Apply oil to the bushes before installing them with a press.
2. Wipe the old grease off the swing arm bushing, and inspect it (Pg. 172). Apply fresh grease, especially in each bushing groove.

Swing Arm Bushing Lubrication G96



3. Install the torque link and tighten the torque link nut with 3.0 kg-m (22 ft-lbs) of torque, and insert a safety clip.
4. Adjust the drive chain (Pg. 22) after installing the swing arm.

Swing Arm G97



1. Pivot Shaft Nut
2. Flat Washer
3. Cap
4. Bush
5. Swing Arm
6. Bushing
7. Pivot Shaft
8. Lockwasher
9. Nut
10. Safety Clip
11. Washer
12. Footpeg Rubber
13. Link Pin
14. Footpeg
15. Cotter Pin
16. Bolt
17. Torque Link
18. Bolt
19. Lockwasher
20. Nut
21. Safety Clip
22. Chain Adjuster
23. Locknut
24. Adjusting Bolt

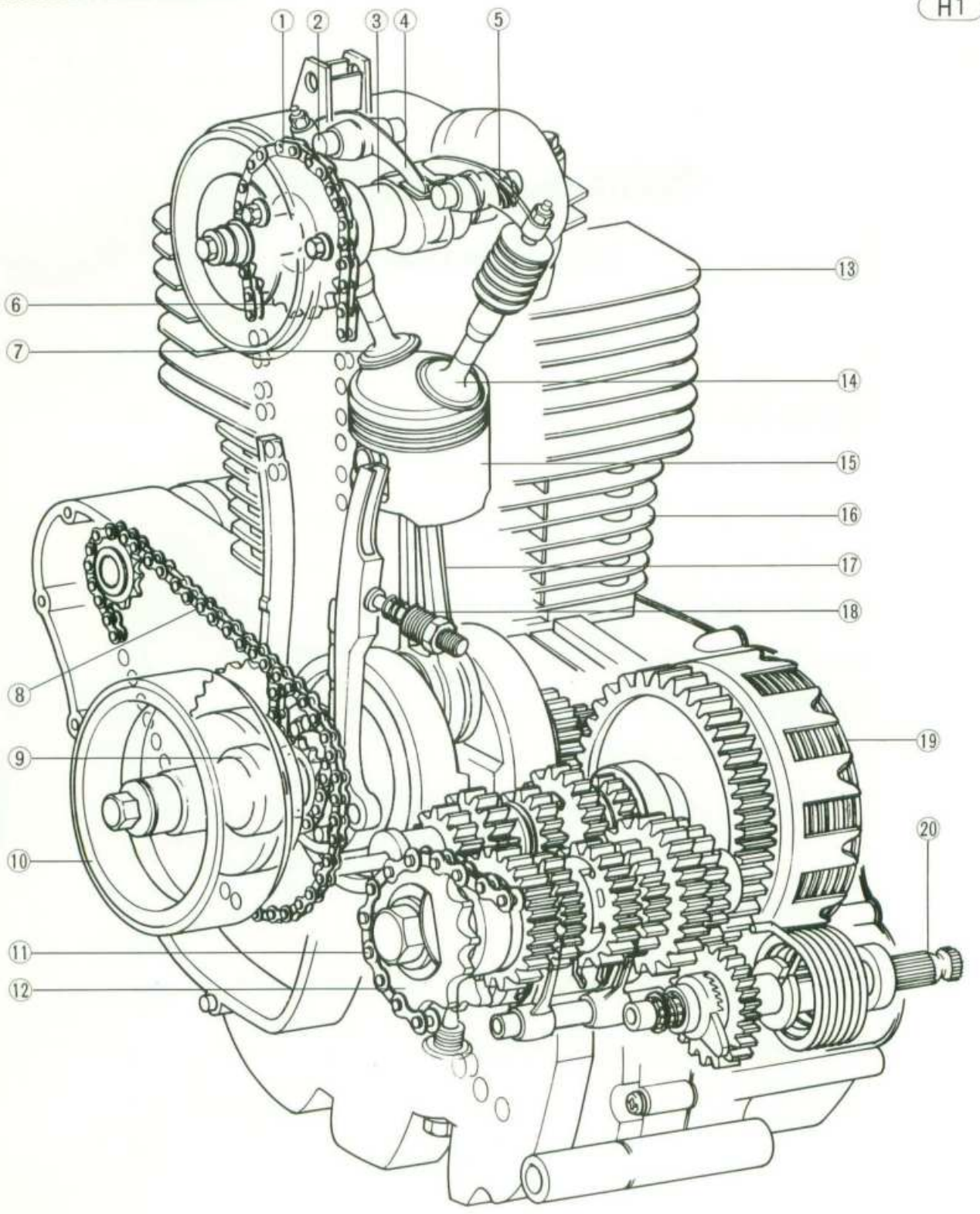
Maintenance – Engine

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ENGINE PERSPECTIVE

H1



1. Camshaft Chain
2. Rocker Arm Shaft
3. Camshaft
4. Rocker Arm (Exhaust)
5. Rocker Arm (Inlet)
6. Camshaft Sprocket
7. Exhaust Valve
8. Starter Motor Chain
9. Crankshaft
10. Dynamo Flywheel
11. Drive Chain
12. Engine Sprocket
13. Cylinder Head
14. Inlet Valve
15. Piston
16. Cylinder Block
17. Connecting Rod
18. Camshaft Chain Tensioner
19. Clutch
20. Kickstarter

AIR CLEANER

A properly maintained air cleaner ensures that only clean, filtered air is supplied through the carburetor to the engine. If the air is supplied directly without filtering, dirt and dust from the air will clog carburetor passages causing the engine to run poorly. The dust that enters the engine will also act like grinding compound, wearing down the cylinders, pistons, and rings. If the air cleaner element is damaged, the result will be the same as if no element were used.

An air cleaner element clogged with dirt chokes the air supply to the engine, resulting in an overly rich fuel/air mixture and inefficient combustion. This in turn causes overheating from carbon build-up, and reduced engine power.

Cleaning and replacement

The air cleaner element must be cleaned periodically (Pg. 10). In extremely dry, dusty areas, the element will need to be cleaned more often. After riding through rain or on muddy roads, the element should be cleaned immediately.

Remove the air cleaner element (Pg. 39). Clean it in a bath of a high flash-point solvent, and then dry it from the inside using compressed air. Since this is a dry-type element, do not use kerosene or any fluid which would leave the element oily.

WARNING **Clean the element in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low flash-point solvents to clean the element.**

If the sponge gaskets on the sides of the element come loose, stick them back on with an adhesive sealant. If the sponge or the element is damaged or holed, replace the element.

Since repeated cleaning opens the pores of the element, replace it with a new one in accordance with the Periodic Maintenance Chart (Pg. 10). Also, if there is a break in the element material or any other damage to the element, replace the element with a new one.

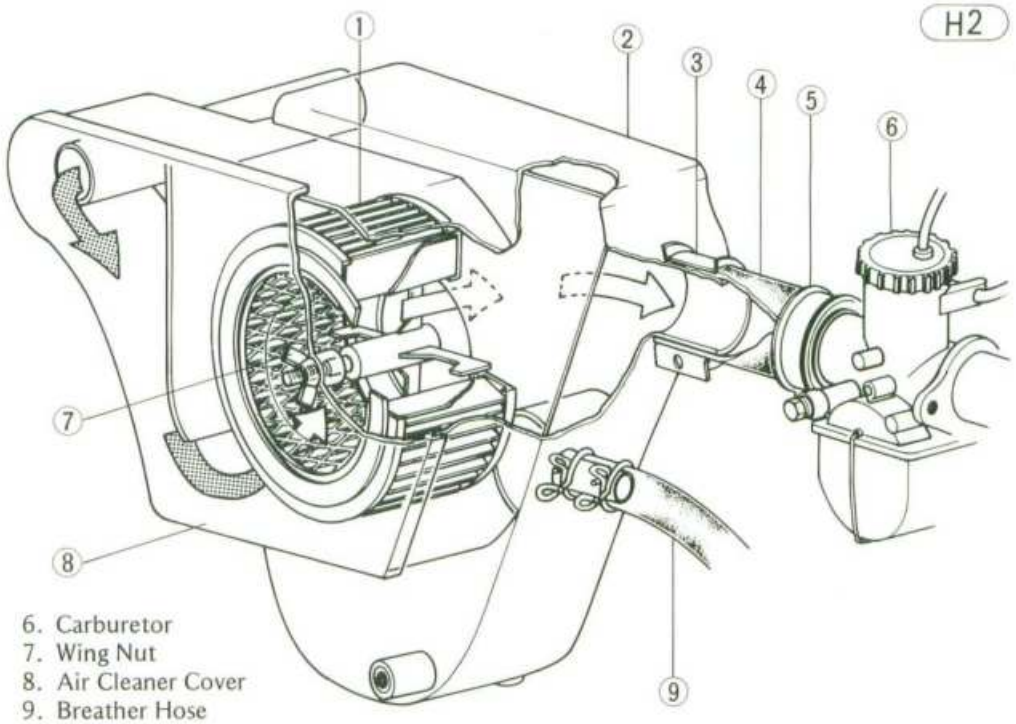
CARBURETOR

The carburetor performs the function of mixing the fuel and air in the proportions necessary for good engine performance at varying speeds and loads. In order for it to function satisfactorily, it must be properly adjusted and maintained. The throttle cable adjustment (Pg. 16) and the air screw and idle adjustment (Pg. 16) are covered in the Adjustment Section. The discussion here concerns the fundamentals of carburetor operation, special adjustments, and the checking and replacement of carburetor parts.

As the throttle grip is turned counterclockwise, the throttle cable pulls up the throttle valve. As the throttle grip is turned clockwise or is released, the return spring pushes down the throttle valve.

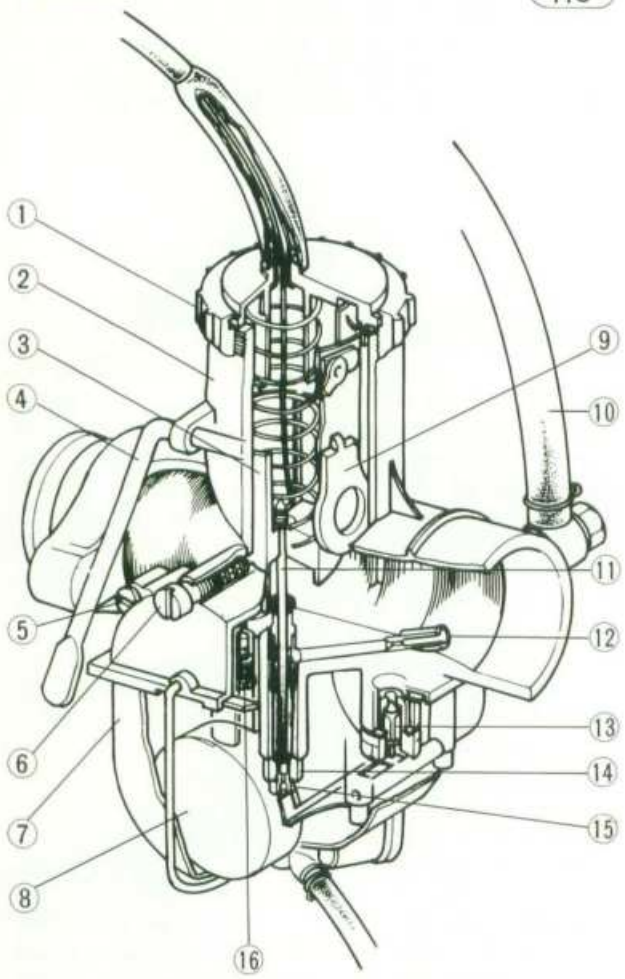
One of the basic principles in carburetor operation is that the pressure exerted by a moving body of air is less than atmospheric pressure. As the engine draws air in through the carburetor bore, the air pressure in the carburetor bore is less than the air pressure in the float chamber, which is vented to the atmosphere. This difference in air pressure forces fuel up through passages into the carburetor bore, where it is atomized by the high-speed air flowing into the engine.

Air Cleaner



1. Air Cleaner Element
2. Air Cleaner Housing
3. Clamp
4. Intake Duct
5. Clamp
6. Carburetor
7. Wing Nut
8. Air Cleaner Cover
9. Breather Hose

Carburetor H3



1. Cap
2. Carburetor Body
3. Throttle Valve
4. Choke Lever
5. Air Screw
6. Idle Adjusting Screw
7. Float Bowl
8. Float
9. Choke Valve
10. Fuel Hose
11. Jet Needle
12. Main Air Jet
13. Valve Needle
14. Air Bleed Pipe
15. Main Jet
16. Pilot Jet

Another important principle is the Venturi Principle, which states that when an air passage narrows, moving air flows faster, exerting even less pressure. For example, especially at lower speeds the amount of the cutaway on the throttle valve makes use of this principle in determining the speed, and thus the pressure, of the air passing below it.

The amount of fuel passing through a jet depends both on the size of the jet (variable in the case of the needle jet) and on the speed of the air flow over the jet. The speed of this air flow is in turn determined both by the engine rpm and by the dimensions of the passage (varied with the throttle valve) just above the jet. The size of the jet openings, the various dimensions of the air passages, and the enigne rpm are correlated through carburetor design so that, when properly adjusted, the carburetor meters (measures) the fuel and air in the correct proportions at different throttle openings.

The ratio of fuel to air at different throttle openings is set through carburetor design by a number of interrelating factors, but alteration of the ratio is primarily controlled by the following:

0~1/8 throttle	pilot air screw
1/8~1/4 throttle	throttle valve cutaway, pilot air screw
1/4~3/4 throttle	jet needle position
3/4~1 throttle	main jet size

The carburetor specifications (Table H1) have been chosen for best all around performance, and ordinarily will not require any change. However, sometimes an alteration may be desirable for improved performance under special conditions when proper mixture is not obtained after the carburetor has been properly adjusted, and all parts cleaned and found to be functioning properly. For example, the quantity of air entering the carburetor bore is less at high altitude due to the lower atmospheric pressure. To obtain the proper carburetor fuel/air mixture, it may be necessary to raise the clip on the jet needle and to exchange the main jet for one a size smaller. In particularly cold weather, the increased density of the air may necessitate a lower clip position on the jet needle and a size larger main jet.

Since the carburetor regulates and mixes fuel and air going to the engine, there are two general types of carburetor trouble: too rich a mixture (too much fuel); or too lean a mixture (too little fuel). Such trouble can be caused by dirt, wear, maladjustement, or improper fuel level in the float chamber. A dirty or damaged air cleaner can also alter the fuel-to-air ratio.

Table H2 Mixture Trouble Symptoms

Mixture too rich	Mixture too lean
Engine is sluggish	Engine overheats
Smoky exhaust	Runs better with choke lever pulled up
Runs worse when warm	Spark plug burned white
Spark plug fouled black	Running is unstable
Runs better without air cleaner	Loss of power

The following explanation of the functioning and maintenance of the carburetor covers the four main systems for fuel regulation and supply.

Table H1 Carburetor Specifications

Type	Main Jet	Jet Needle	Pilot Jet	Air Screw	Throttle Valve Cutaway	Design Fuel Level	Service Fuel Level
PW26	110	013001-3†	38	$1\frac{1}{4} \pm \frac{3}{8}$ turn out	3.0	22.5 ± 1 mm	5 ± 1 mm

† The last two numbers (01) of "013001" shows lot number, and may vary.

Table H3 Carburetor Systems

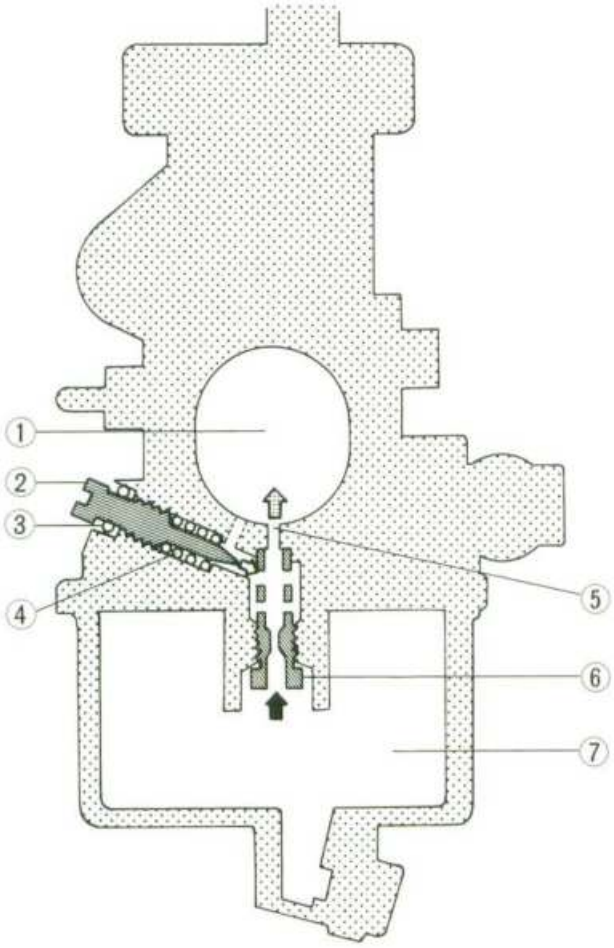
System	Function
Pilot System	Supplies fuel at idling and low speeds
Main System	Supplies fuel at medium and high speeds.
Starter System	Supplies the necessary rich mixture for starting a cold engine.
Float System	Maintains the fuel at a constant level in the float chamber.

CAUTION **1. Do not use wire for cleaning as this could damage the jets.**
2. Never use carburetor cleaner on any rubber parts.

Pilot System

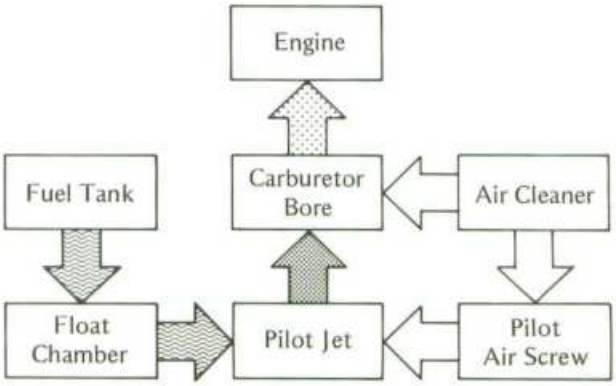
Fig. H4 shows the pilot system, which includes the pilot air screw ②, pilot jet ⑥, and pilot outlet ⑤.

Pilot System H4



1. Carburetor Bore
2. Air Screw
3. O Ring
4. Spring
5. Pilot Outlet
6. Pilot Jet
7. Float Chamber

Pilot System Fuel and Air Supply H5



The pilot system determines the operation of the carburetor from 0 to ¼ throttle opening. At these small throttle openings, almost no fuel is drawn through the main system due to insufficient air flow. Instead, the fuel is drawn through the pilot jet as a result of the low pressure (suction) brought about by the demand for air by the engine and the limited but relatively fast flow of air past the pilot outlet.

The supply of the fuel and air in the pilot system is shown in Fig. H5. Fuel is metered by the pilot jet. The pilot jet has holes to admit the air metered by the pilot air jet and air screw. This air mixes with the fuel to prepare the fuel for better atomization in the carburetor bore.

At the idle position the throttle valve restricts the carburetor bore air flow, preventing it from relieving the low pressure around the pilot outlet created by the engine's suction, while the venturi effect (i.e., the narrower the air passage, the faster the flow of air) at the engine side of the throttle valve further reduces the low pressure.

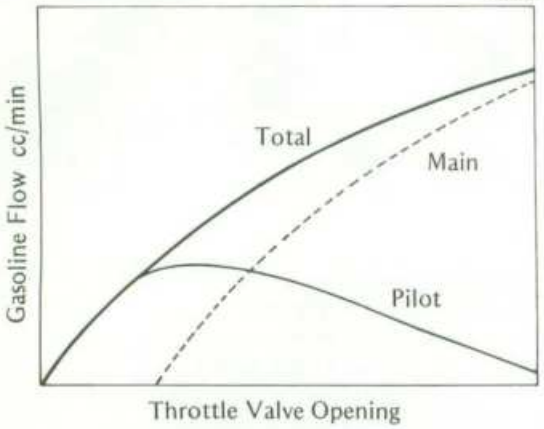
Up to roughly 1/8 throttle valve opening, as fuel is drawn out of the pilot jet, and through the pilot jet passage, it mixes with air drawn in through the air screw controlled air passage, and through the pilot outlet. However, as the throttle valve rises further, air to the pilot jet passage is drawn in only through the air screw controlled air passage. This change of role for the pilot outlet is caused by the increased carburetor bore air flow, the speed of which at lower speeds is set by the throttle valve cutaway. Once the throttle valve rises, it no longer concentrates the low pressure area around just the pilot outlet.

The purpose of the pilot system is to provide the rich fuel/air mixture necessary at low engine speed. The pilot system mixture consists primarily of the fuel measured out by the pilot jet and the air let in past the air screw. Since the size of the pilot jet opening is fixed, the fuel to air ratio is controlled by the position of the air screw. As the air screw is backed out, more air is permitted to enter, making the mixture leaner. Conversely, turning the screw in restricts the air flow, making the mixture richer.

Fig. H6 shows throttle valve opening versus fuel flow for the main and pilot systems. If trouble occurs in the

pilot system not only are starting and low speed running affected, but the transition from pilot to main system is not smooth as the throttle is opened, causing a drop in acceleration efficiency. Pilot system trouble might be due to maladjustment; a dirty or loose pilot jet; or clogging of the pilot outlet passage, pilot jet passage, or air screw air passage.

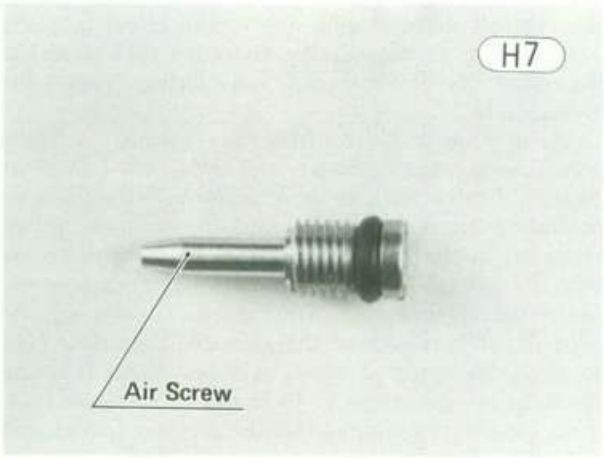
Flow Charasteristic H6



Cleaning and replacement (See cautions Pg. 125)

Wash the pilot jet with a high flash-point solvent, and blow it clean with compressed air. Also use compressed air to clean the pilot outlet passage and air passage.

Remove the air screw, and check that the tapered portion is not worn or otherwise deformed. If it is, replace the screw.

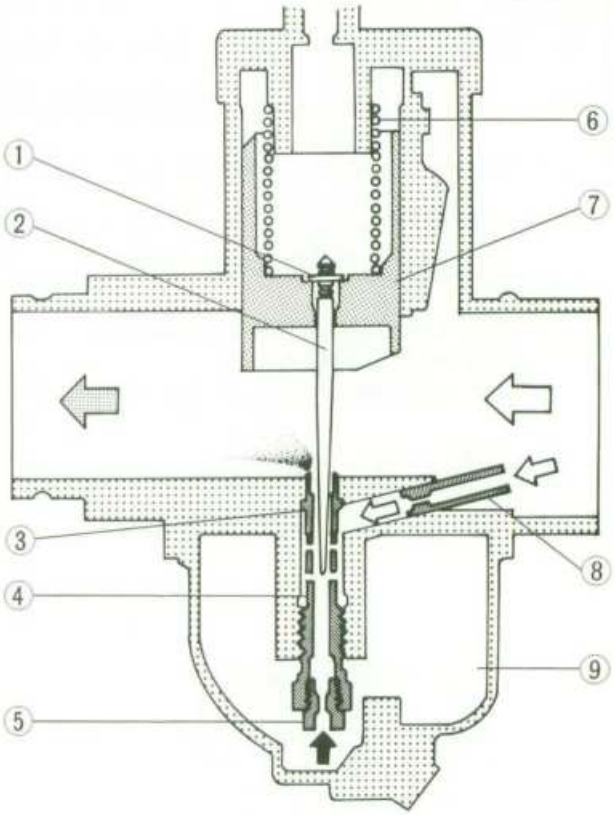


Main System

Fig. H8 shows the main system, which consists of the main jet ⑤, bleed pipe ④, needle jet ③, jet needle ②, throttle valve ⑦, and air jet ⑧.

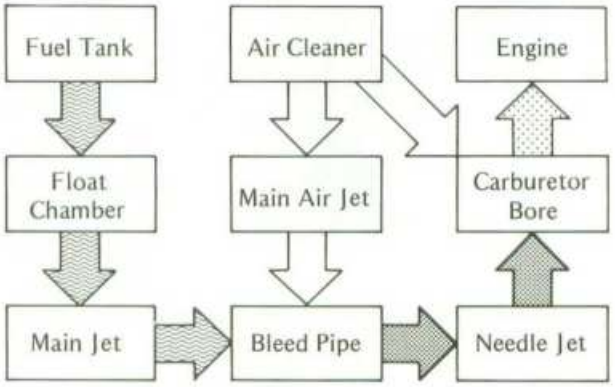
From about 1/4 throttle opening, the air flow past the needle jet outlet is sufficient to cause most of the engine's fuel supply to be drawn through the main system. Fuel passes through the main jet and the bleed pipe, through the space in the needle jet around the jet needle, and into the carburetor bore, where it is atomized by the air flow to the engine.

Main System H8



1. Clip
2. Jet Needle
3. Needle Jet
4. Bleed Pipe
5. Main Jet
6. Spring
7. Throttle Valve
8. Air Jet
9. Float Chamber

Main System Fuel and Air Supply H9



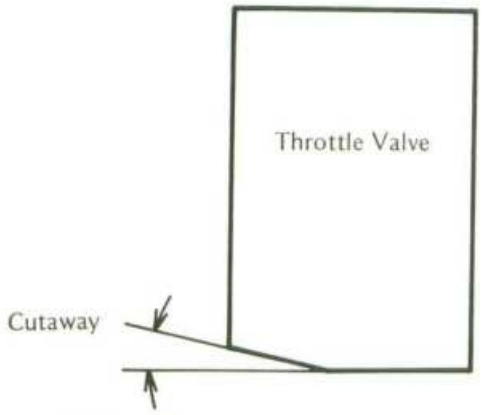
The bleed pipe has holes to admit the air metered by the main air jet. This air mixes with the fuel in the needle jet to prepare the fuel for better atomization in the carburetor bore.

The lower part of the jet needle is tapered and extends down into the needle jet. It is fixed to the throttle valve, and thus rises up in the needle jet as the

throttle valve rises. At ¼ throttle opening, the tapered portion of the needle starts coming up out of the jet, which increases the needle-to-jet clearance and thereby increases the amount of fuel that can pass up through the jet.

The amount of fuel drawn out of the needle jet is also influenced, particularly at lower speeds, by the amount of cutaway on the throttle valve. The amount of this cutaway, which is on the intake side of the throttle valve, helps define the size of the air passage directly above both the pilot outlets and needle jet outlet.

Cutaway (H10)



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

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

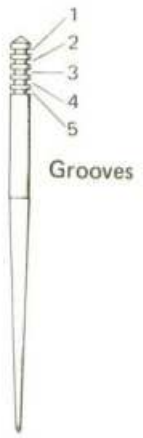
Cleaning and adjustment (See caution Pg. 125)

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

A worn needle jet or jet needle should be replaced, although a certain amount of adjustment can be made by lowering the position of the needle. There are five grooves at the top of the needle. Changing the position of the clip to a groove closer to the top lowers the needle, which makes the mixture leaner at a given position of the throttle valve.

NOTE: The last number of the jet needle number ("3" of 013001-3) is not stamped on the needle, but is the number of the standard groove in which the clip is set. The groove numbers are counted from the top of the needle, 1 being the topmost groove, and 5 being the lowest groove.

Jet Needle (H11)



If the engine still exhibits symptoms of overly rich or lean carburetion after all maintenance and adjustments are correctly performed, the main jet can be replaced with a smaller or larger one. A smaller numbered jet gives a leaner mixture and a larger numbered jet a richer mixture. Many jets are available, but it is recommended that any change be limited to one jet size (5) difference from the standard jet.

Starter System

Fig. H12 shows the starter system, which includes the choke lever, choke valve ①, and relief valve ②.

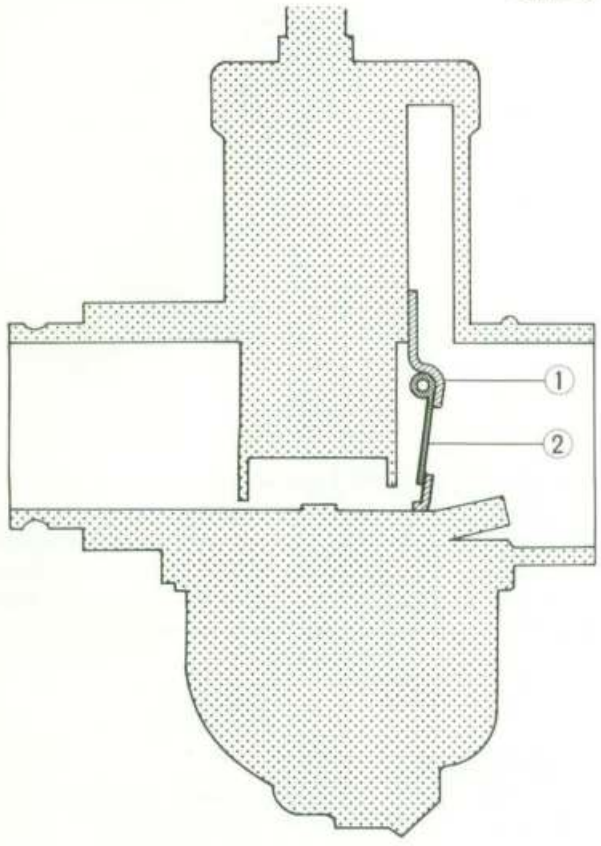
The starter system provides the exceptionally rich 1:1 fuel/air ratio that is necessary to enable easy starting when the engine is cold. When starting the engine, the choke valve closed down the carburetor bore by pulling up the choke lever. Since the choke valve closes down the carburetor bore, a high intake vacuum (suction or low pressure) is developed at the engine side of the carburetor bore. The relief valve on the choke valve is opened by a high intake vacuum, and air is drawn into the carburetor bore. As the engine is cranked over, fuel is drawn in from the float chamber through the pilot outlet. Fuel metered by the pilot jet mixes with a small amount of air drawn in through the air bleed holes of the pilot jet to prepare for better atomization. This mixture is then drawn into the carburetor, mixed with the air drawn in through the relief valve, and drawn into the engine.

In order for the starter system to work properly when the engine is cranked, the throttle must be kept closed so that sufficient vacuum can be built up at the pilot outlet. Also, the choke lever must be pulled up fully so that the choke valve closes down the carburetor bore perfectly. A damaged relief valve will cause insufficient vacuum, thus impairing starter system efficiency. Fuel mixture trouble results if the choke valve does not open fully after the choke lever is returned.

Starter system inspection

Pull up and push down the choke lever to check that the choke valve moves smoothly. The choke valve must close the carburetor bore perfectly when the lever is pulled up, and must open fully when the lever is pushed down. To check that the relief valve spring is working

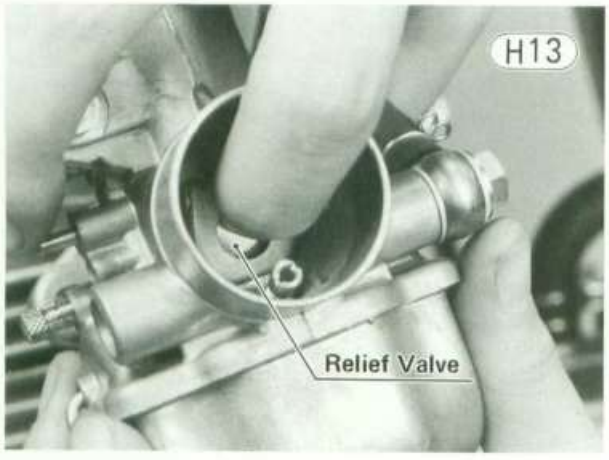
Starter System



1. Choke Valve
2. Relief Valve

properly, push on the relief valve itself. The relief valve must move smoothly, and must close by spring tension.

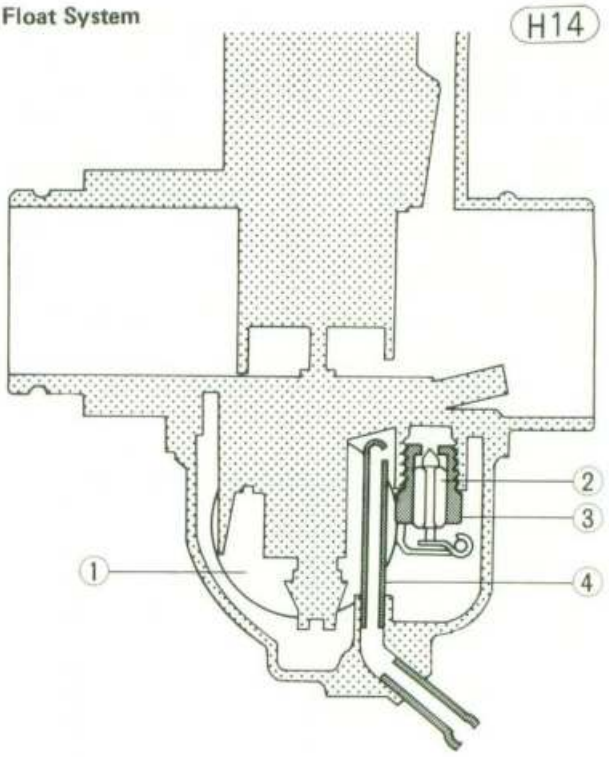
If the choke valve or the relief valve does not work properly, replace the carburetor body.



Float System

Fig. H14 shows the float system which consists of the float ①, float valve needle ②, float valve seat ③, and overflow pipe ④.

Float System



1. Float
2. Valve Needle
3. Valve Seat
4. Over Flow Pipe

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

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

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

Service fuel level/measurement and adjustment

Secure the motorcycle in a true vertical position.

Turn the fuel tap off, and remove the drain from the bottom of the float bowl. Install the fuel level gauge (special tool). Hold the plastic tube against the side of the carburetor so that the "0" line is even with the bottom edge of the carburetor body. Turn on the fuel tap. Read the service fuel level in the plastic tube.
NOTE: Measure the service fuel level at the center of the carburetor.



Fuel Level Measurement H16

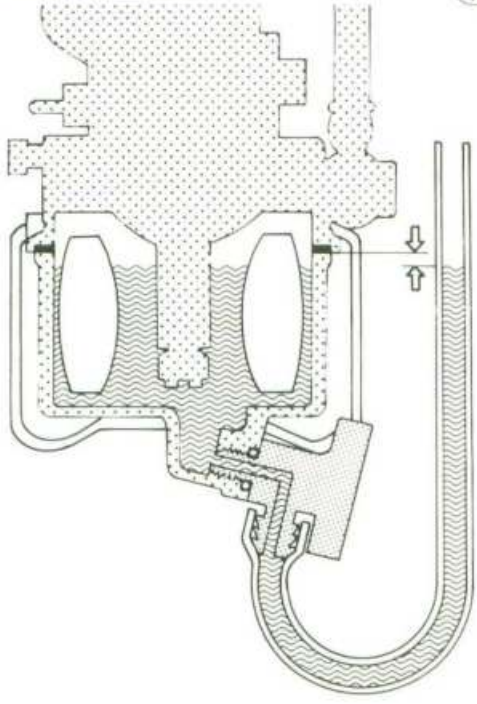


Table H4 Service Fuel Level

Standard
4 ~ 6 mm from the edge of the carburetor body to the fuel level

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

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

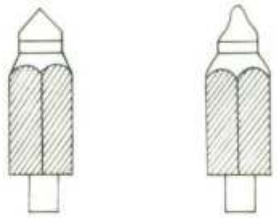
Cleaning and replacement (See caution Pg. 125)

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

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

Examine the float, and replace it if it is damaged. If the needle is worn as shown in the diagram, replace the needle and seat as a set.

Valve Needle H17



Good Bad

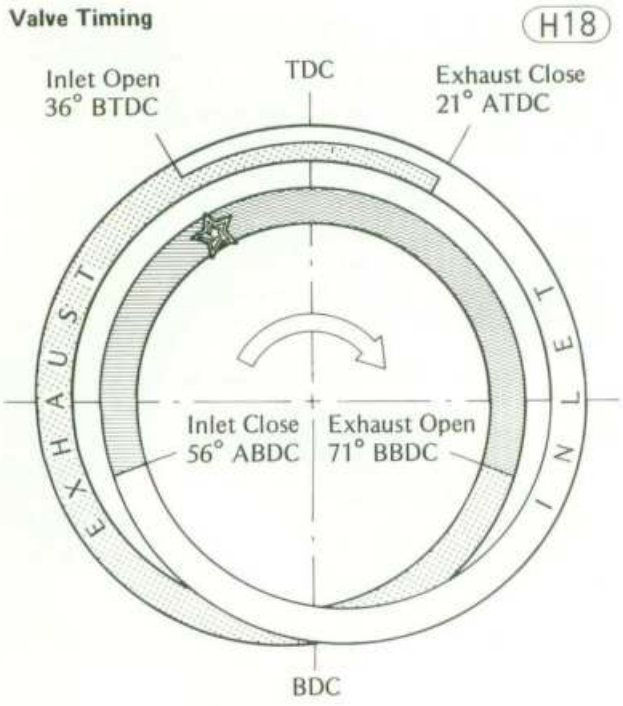
CAMSHAFT

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

The sprocket has marks so that valve timing (the time that each valve is opened) can be reset correctly any time the camshafts are removed for inspection or repairs (See Pg. 47).

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

Valve Timing



Cam wear

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

Cam Height Measurement

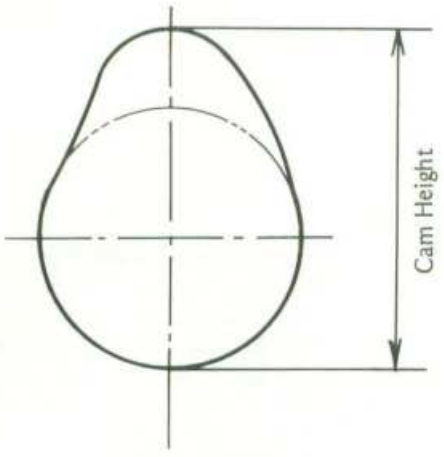


Table H5 Cam Height

	Standard	Service Limit
Inlet	40.673~40.753 mm	40.60 mm
Exhaust	40.084~40.164 mm	40.05 mm

Journal, bearing wear

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

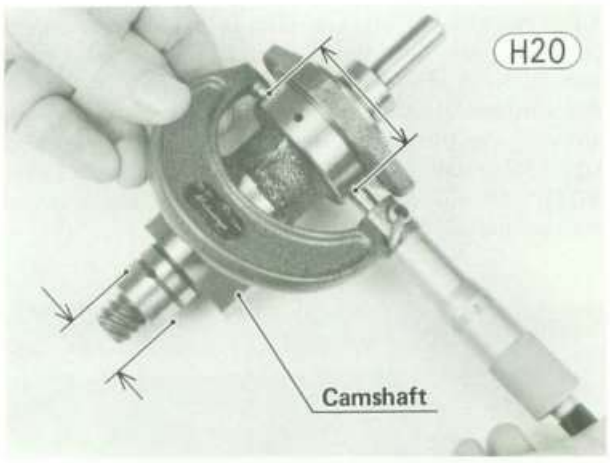


Table H6 Camshaft Journal Diameter

	Standard	Service Limit
Big	43.950~43.975 mm	43.91 mm
Small	21.959~21.980 mm	21.92 mm

Remove the camshaft, and measure the camshaft bearing in the cylinder head with a cylinder gauge. If it exceeds the service limit, replace the cylinder head.



Table H7 Camshaft Bearing Inside Diameter

	Standard	Service Limit
Big	44.025~44.050 mm	44.09 mm
Small	22.000~22.021 mm	22.06 mm

CAMSHAFT CHAIN, GUIDES, TENSIONER

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

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

Camshaft chain wear

Remove the camshaft chain, hold the chain taut with a force of about 5 kg in some manner such as the one shown in Fig. H22, and measure a 20-link length. If the chain has lengthened beyond the service limit, replace it with a new one.

Camshaft Chain Length Measurement (H22)



Table H8 Camshaft Chain Length (20-link Length)

Standard	Service Limit
160.0 mm	162.4 mm

Chain guide wear

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

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

Chain Guide Rubber Wear (H23)

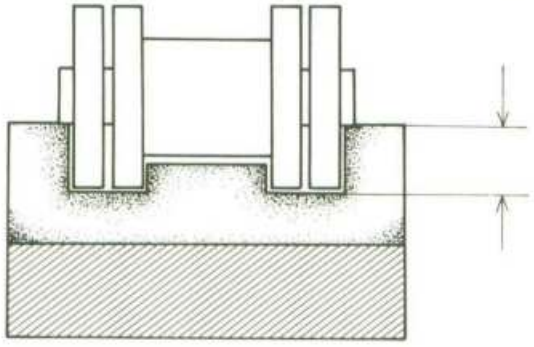


Table H9 Camshaft Chain Guide Wear

	Service Limit
Front	2.0 mm
Rear	1.5 mm

Chain tensioner wear

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

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

(H24)

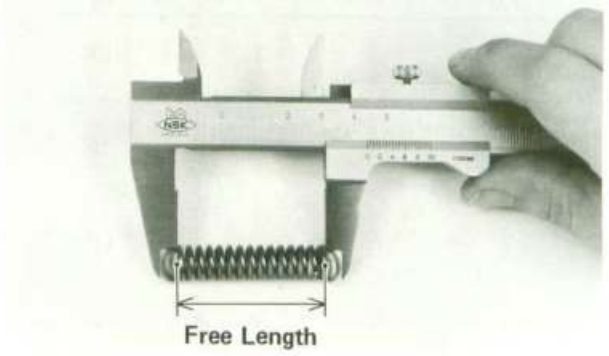


Table H10 Chain Tensioner Spring Free Length

Standard	Service Limit
42.2~46.2 mm	40.0 mm

ROCKER ARMS, SHAFTS

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

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

Rocker arm wear

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

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

(H25)

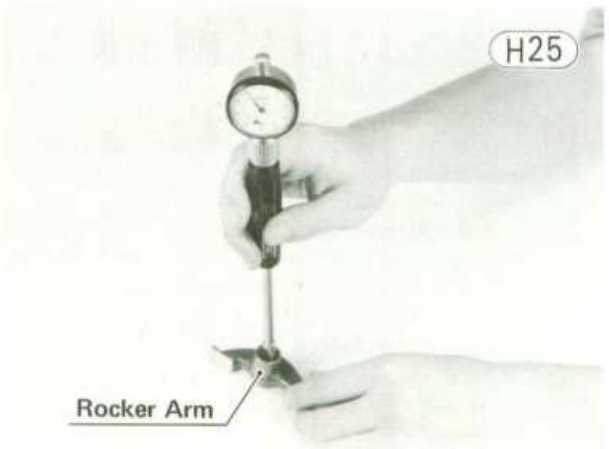


Table H11 Rocker Arm Inside Diameter

Standard	Service Limit
13.000~13.018 mm	13.05 mm

Rocker shaft wear

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

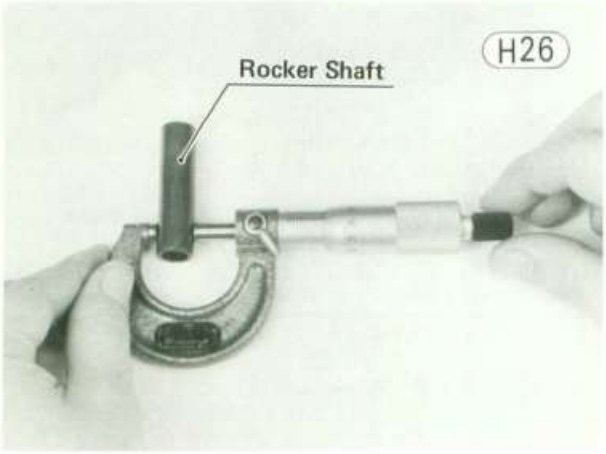


Table H12 Rocker Shaft Diameter

Standard	Service Limit
12.976~12.994 mm	12.95 mm

CYLINDER HEAD, VALVES

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

Valve guides are pressed into the cylinder head, and the valve seats are cast in. The valve seat prevents compression leakage by fitting snugly against the valve. If also prevents the valve from overheating by allowing efficient heat transfer.

Cylinder Head

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

Cleaning and inspection

Remove the cylinder head (Pg. 48) and valves (Pg. 49). Scrape out any carbon, and wash the head with a high flash-point solvent.



Cylinder head warp

Lay a straight edge across the lower surface of the head at several different points, and measure warp by inserting a thickness gauge between the straight edge and the head. Repair the light damage of the lower surface. If warp exceeds the service limit, replace the cylinder head.

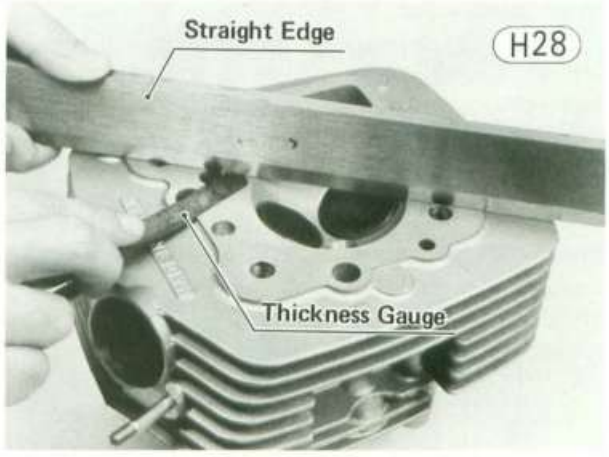


Table H13 Cylinder Head Warp

Standard	Service Limit
under 0.05 mm	0.15 mm

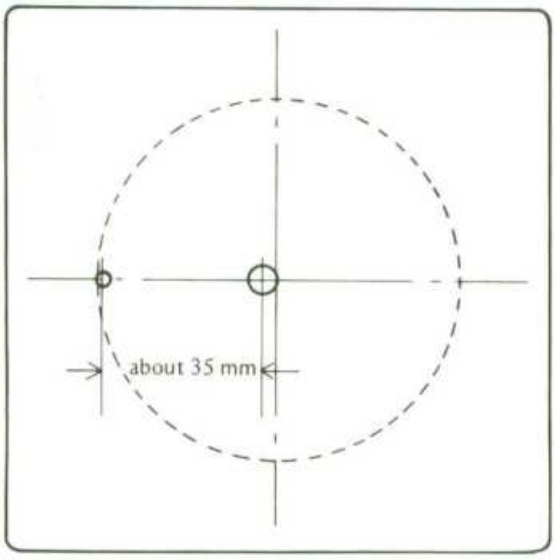
Combustion chamber volume measurement

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

NOTES:

1. One more person will be needed to help expel air bubbles out of the combustion chamber.
2. Prepare a piece of transparent plastic plate which has a flat surface and two holes about 35 mm apart in its center portion. One hole should be about 6 mm in diameter, the other about 3 mm in diameter. The plate must be oil resistant, about 120 mm square, and at least 3 mm thick (Fig. H29).
3. Obtain a burette or syringe which is calibrated at one-cc or smaller graduations. Fill it with thin oil.

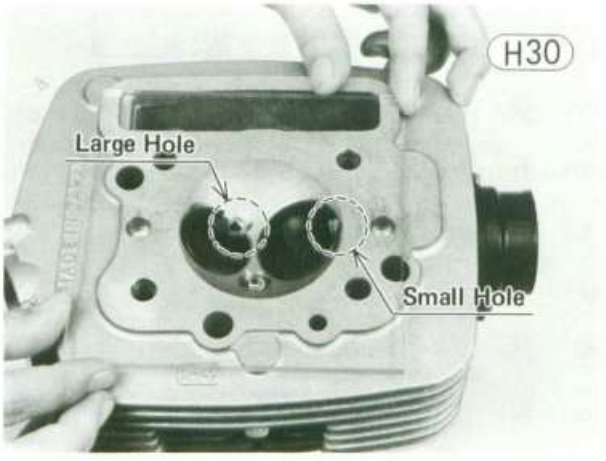
Measuring Plastic Plate H29



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

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

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



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

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

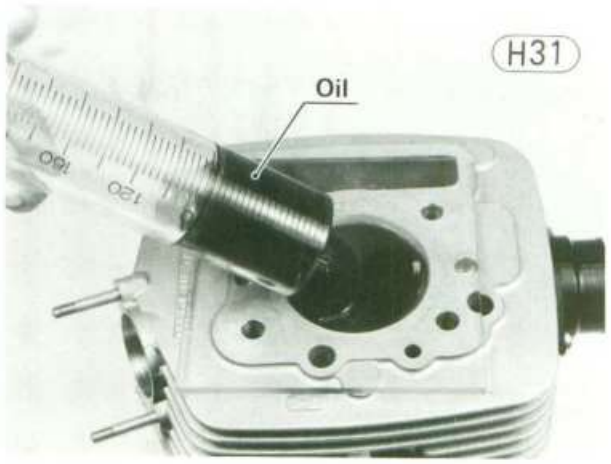


Table H14 Combustion Chamber Volume

Standard
28.8 ~ 29.6 cc

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

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

Valve, Valve Guide, Valve Seat

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

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

Valve inspection

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

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

If the seating surface of the valve or the end of the valve stem is damaged or badly worn, repair the valve with a valve refacer. The angle of the seating surface is 45° (Fig. H32).

CAUTION **If the valve stem is ground down, be sure to leave at least 4.9 mm of stem end above the wide groove portion.**

Valve Shape (H32)

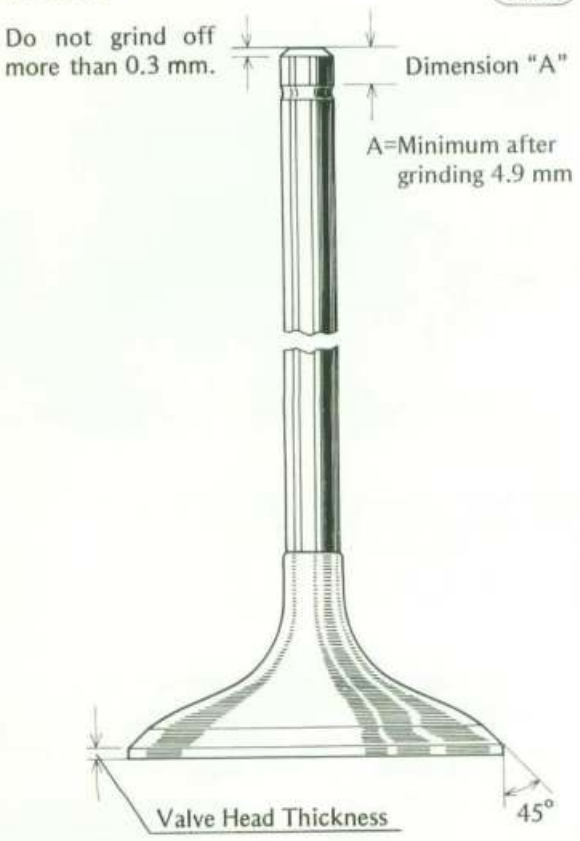
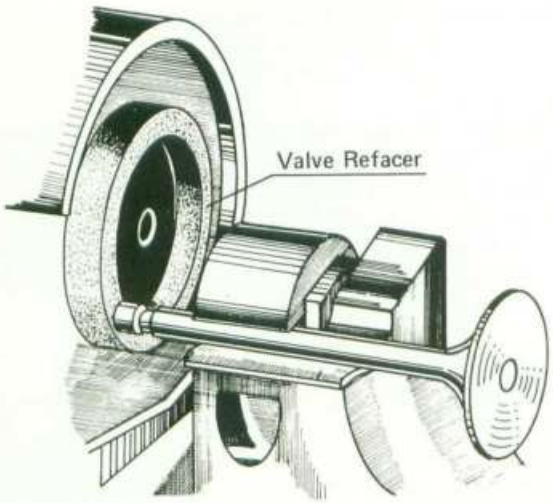


Table H15 Valve Head Thickness

Standard	Service Limit
0.80~1.20 mm	0.5 mm

Valve Stem Grinding (H33)



Position the valve in **V** blocks at each end of the straight portion of the stem, and set a dial gauge against the center of the stem. See the example shown in Fig. H34.

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

Valve Stem Bend (H34)

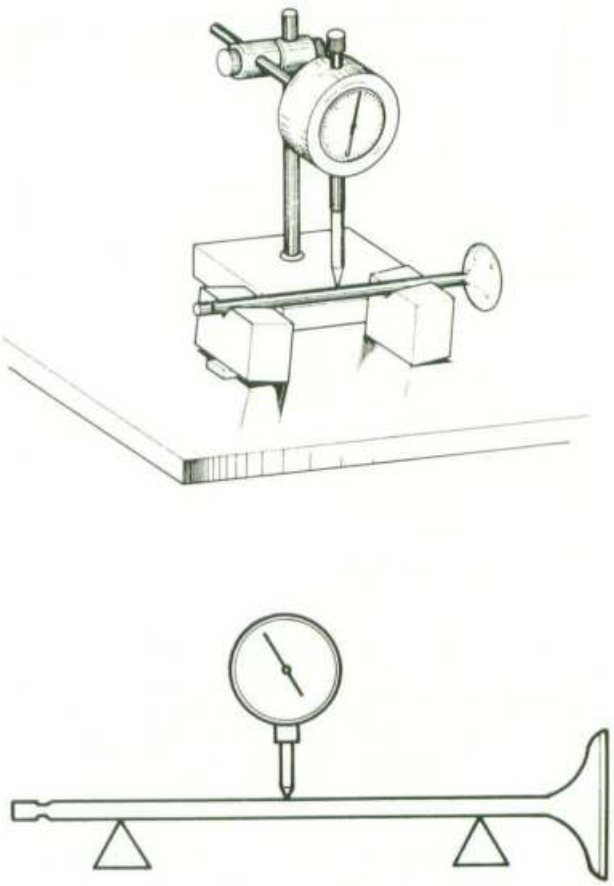


Table H16 Valve Stem Bend

Standard	Service Limit
under 0.01 mm	0.05 mm

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

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

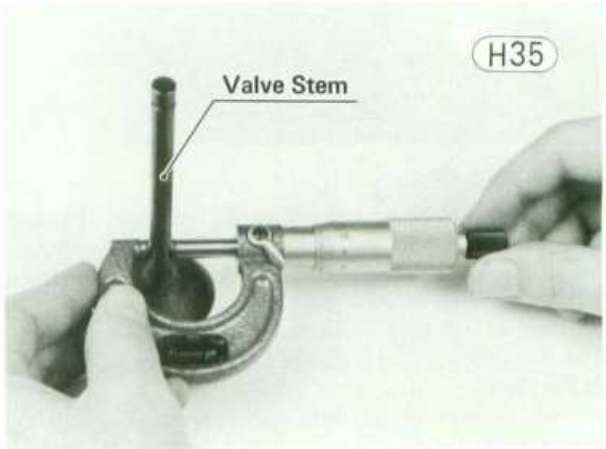


Table H17 Valve Stem Diameter

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

Valve guide inspection

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

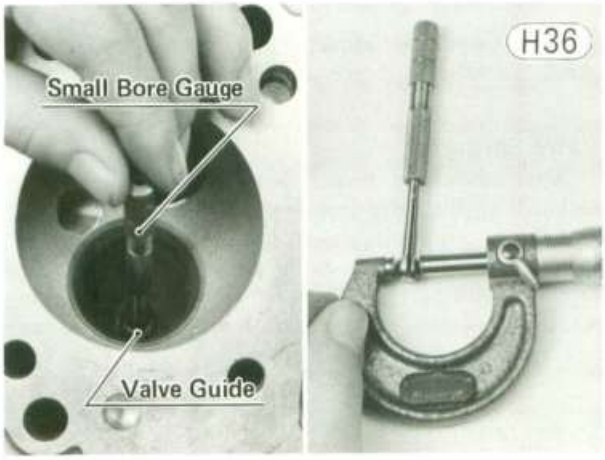


Table H18 Valve Guide Inside Diameter

Standard	Service Limit
7.000~7.015 mm	7.08 mm

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

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

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

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



Table H19 Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Inlet	0.049~0.123 mm	0.25 mm
Exhaust	0.076~0.166 mm	0.26 mm

Valve seat repair

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

Valve Seating Width

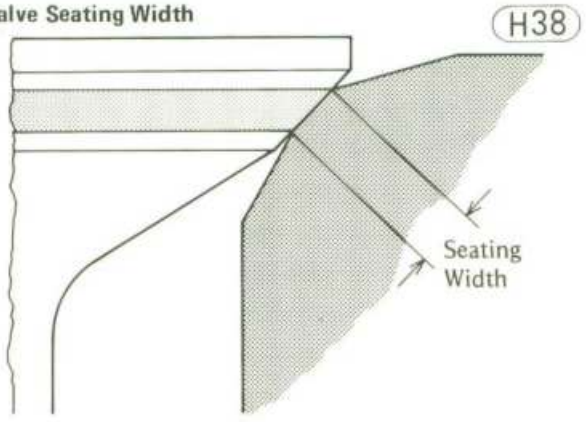


Table H20 Valve Seating Width

Standard
0.5~1.0 mm

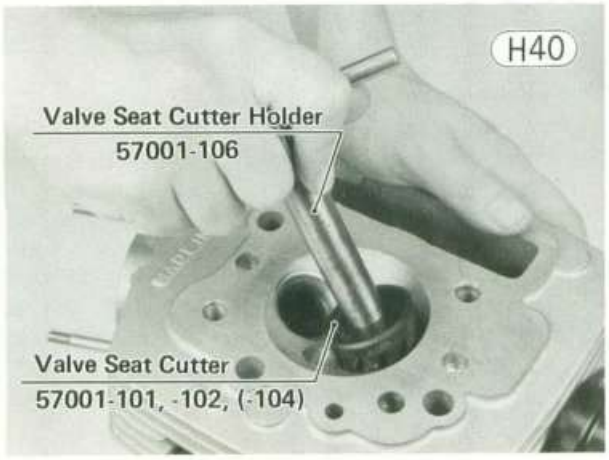
Valve/Valve Seat Contact Area



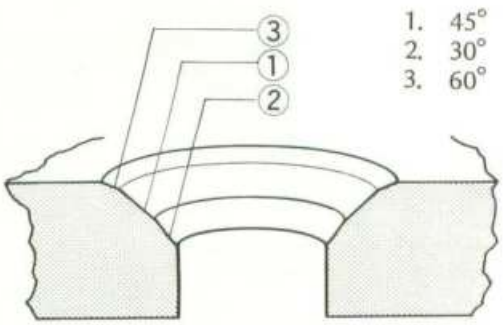
To determine whether or not the valve seat requires repair, first remove the valve, apply machinist's dye to the valve seat, and then use a lapper to tap the valve lightly into place. Remove the valve, and note where the dye adheres to the valve seating surface. The valve seating surface should be in the middle of the valve face (Fig. H38). The distribution of the dye on the seating surface gives an indication of seat condition (Fig. H39).
NOTE: The valve and valve guide must be in good condition before this check will give an accurate indication of valve seat condition.

A valve seat which requires repair is cut with a set of valve seat cutters (special tools). Three cutters are required for complete repair: one 30°, one 45°, and one 60° cutter (exhaust valve seat only).

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



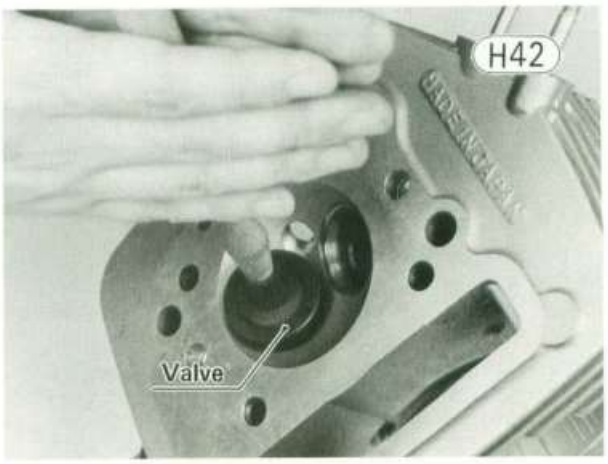
Cutting Angle of Valve Seat H41



Next, use the 30° cutter to cut the surface inside the seating surface, and then use the 60° cutter to cut the outermost surface. Cut these two surfaces so that the seating surface will have the specified width.

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

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



When lapping is completed and the valves are installed, check the valve clearance and adjust if necessary (Pg. 16).

Valve Springs

When the valve is not being pushed open by the rocker arm, the valve springs press the valve against the seat to prevent compression leakage. An inner spring is used with each outer spring to prevent spring surge, which may cause valve float at high rpm. If the springs weaken or break, compression leakage and valve noise will result, dropping engine power.

Spring tension

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

Valve Spring Tension Measurement H43

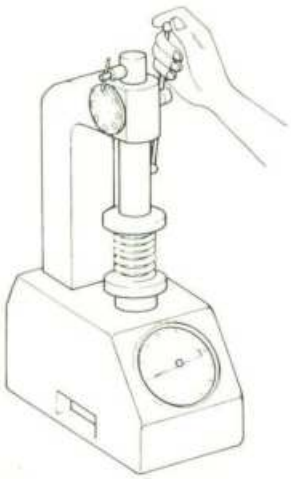


Table H21 Valve Spring Tension

	Length	Standard	Service Limit
Inner	22.2 mm	28.5~31.5 kg	27.3 kg
Outer	25.7 mm	52.2~58.8 kg	50.0 kg

Squareness

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

Valve Spring Squareness (H44)

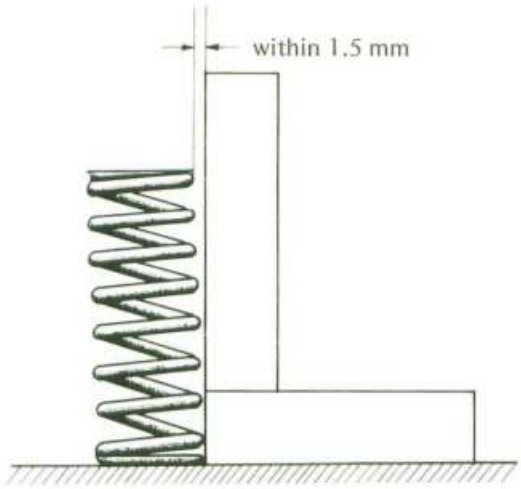


Table H22 Valve Spring Squareness

	Standard	Service Limit
Inner	under 0.85 mm	1.5 mm
Outer	under 0.98 mm	1.5 mm

Oil Seals

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

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

CYLINDER BLOCK, PISTON

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

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

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

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

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

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

Compression measurement

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

Before measuring compression, check that the cylinder head is tightened down with the specified torque (Pg. 34) and that the battery is fully charged (Pg. 177). Thoroughly warm up the engine so that engine oil between the piston and cylinder wall will help seal compression as it does during normal running. While the engine is running, check that there is no gas leakage from around the cylinder head gasket and from the spark plug.

Stop the engine, remove the spark plug, and screw the compression gauge (special tool) firmly into the spark plug hole. Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.



Table H23 Cylinder Compression

Standard	Service Limit
13.7 kg/cm² (195 psi)	9.6 kg/cm² (136 psi)

† Engine hot, spark plug removed, throttle fully opened, cranking the engine with the starter motor.

If cylinder compression is higher than the standard value, check the following:
1. Carbon build-up on the piston head and cylinder head – clean off any carbon on the piston head and cylinder head.
2. Cylinder head gasket, cylinder base gasket – use only the proper gasket for the cylinder head. The use of a gasket of incorrect thickness will change the compression.
3. Valve stem oil seals and piston rings – rapid carbon accumulation in the combustion chamber may be caused by damaged valve stem oil seals and/or damaged piston oil ring. This may be indicated by white exhaust smoke.
4. Combustion chamber volume (Pg. 132).

If cylinder compression is lower than the service limit, check the following:
1. Gas leakage around the cylinder head – replaced the damaged gasket and check the cylinder head warp (Pg. 132)
2. Condition of the valve seating (Pg. 135)
3. Valve clearance (Pg. 16)
4. Piston/cylinder clearance, piston seizure
5. Piston ring, piston ring groove

Cylinder, piston wear

Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the 3 locations (total of 6 measurements) shown in Fig. H46. If any of the cylinder inside diameter measurements exceeds the service limit, the cylinder will have to be bored to oversize and then honed. However, if the amount of boring necessary would make the inside diameter greater than 66.1 mm, the cylinder block must be replaced.

Cylinder Inside Diameter Measurement H46

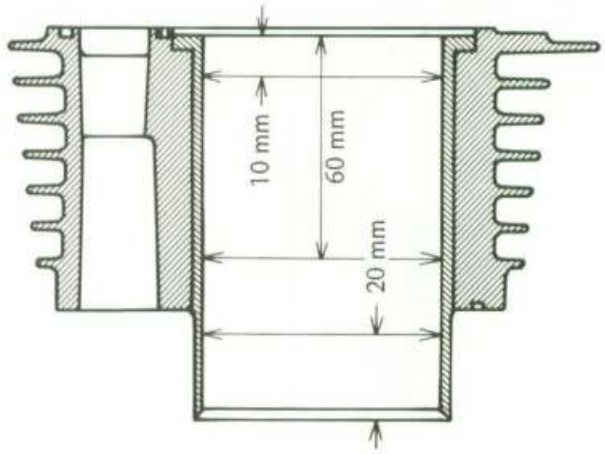


Table H24 Cylinder Inside Diameter

Standard	Service Limit
66.000 ~ 66.008 mm, and less than 0.01 mm difference between any two measurements	66.10 mm, or more than 0.05 mm difference between any two measurements

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

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



Table H25 Piston Diameter

Standard	Service Limit
65.950~65.965 mm	65.80 mm

Table H24 applies only to a cylinder that has not been bored to oversize, and Table H25 applies only to the standard size piston. In the case of a rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus 0.1 mm and the service limit for the piston is the oversize piston original diameter minus 0.15 mm. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.

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

Piston/cylinder clearance

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

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

Table H26 Piston/Cylinder Clearance

Standard
0.035~0.058 mm

Boring, honing

When boring and honing a cylinder, note the following:

1. Before boring a cylinder, first measure the exact diameter of the oversize piston, and then, in accordance with the standard clearance given in Table H26, determine the diameter of the rebore.
2. Cylinder inside diameter must not vary more than 0.01 mm at any point.
3. There are two sizes of oversize pistons available: 0.5 mm and 1.0 mm. Oversize pistons require oversize rings.
4. Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.

Piston/cylinder seizure

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

Piston cleaning

Built-up carbon on the piston head reduces the cooling capability of the piston and raises compression, leading to overheating which could possibly even melt the top of the piston. To decarbonize the piston head, remove the piston (Pg. 52), scrape off the carbon, and then lightly polish the piston with fine emery cloth.



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



CAUTION

1. When removing carbon, take care not to scratch the side of the piston, or the piston ring grooves.

2. Never clean the piston heads with the engine assembled. If the carbon is scraped from the piston heads with the cylinder left in place, carbon particles will unavoidably drop between the pistons and cylinder walls onto the rings and eventually find their way into the crank chamber. Carbon particles, which are very abrasive, drastically shorten the life of the rings, pistons, cylinders, crankshaft bearings, and oil seals.

Piston ring, piston ring groove wear

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

worn unevenly or damaged, the piston must be replaced and fitted with new rings.

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



Table H27 Piston Ring/Groove Clearance

	Standard	Service Limit
Top	0.045~0.080 mm	0.18 mm
2nd	0.010~0.050 mm	0.15 mm

Table H28 Piston Ring Thickness

	Standard	Service Limit
Top	1.440~1.455 mm	1.37 mm
2nd	1.470~1.490 mm	1.40 mm

Table H29 Piston Ring Groove Width

	Standard	Service Limit
Top, 2nd	1.50~1.52 mm	1.60 mm
Oil	2.50~2.52 mm	2.60 mm

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

Piston ring end gap (top, second)

Place the piston ring inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low. Measure the gap between the ends of the ring with a thickness gauge. If the gap is wider than the service limit, the ring is overworn and must be replaced.

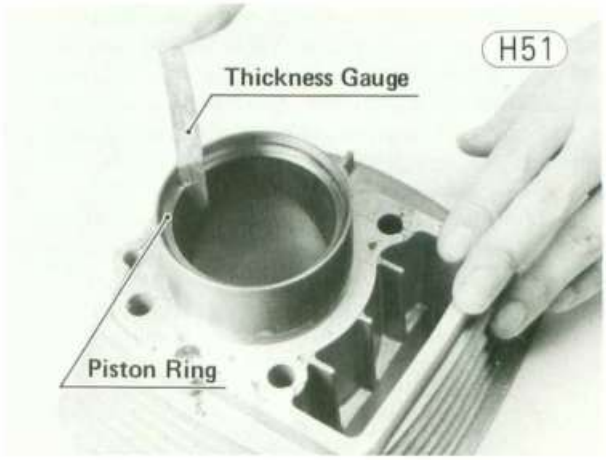


Table H30 Ring End Gap

Standard	Service Limit
0.2~0.4 mm	0.7 mm

Piston ring tension (top, second)

Piston ring tension can be evaluated by measuring the gap between the ends of the ring with the ring free of any restraint. If the measured gap is less than the service limit, the ring is weak and must be replaced.

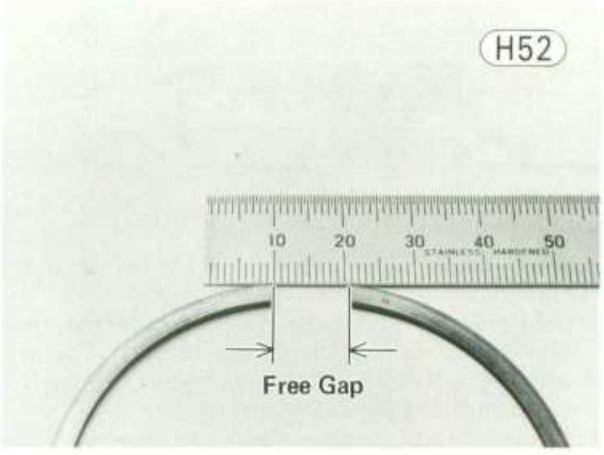


Table H31 Ring Free Gap

	Standard	Service Limit
Top	about 11.5 mm	8.5 mm
2nd	about 11.0 mm	8.0 mm

Piston, piston pin, connecting rod wear

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

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



Table H32 Piston Pin, Piston Pin Hole, Small End Diameter

	Standard	Service Limit
Piston Pin	16.994~17.000 mm	16.96 mm
Piston Pin Hole	17.006~17.011 mm	17.08 mm
Small End	17.003~17.014 mm	17.05 mm

NOTE: When a new piston or pin is used, also check that piston-to-pin clearance is 0.006 ~ 0.017 mm, and that pin to small end clearance is within 0.003 ~ 0.020 mm.

CRANKSHAFT, CONNECTING ROD

The crankshaft changes the reciprocating motion of the piston into rotating motion, which is transmitted to the rear wheel when the clutch is engaged. The connecting rod connects the piston to the crankshaft. Crankshaft trouble, such as excessive play or runout, will multiply the stress caused by the intermittent force on the piston, and will result in not only rapid crankshaft bearing wear, but also noise, power loss, vibration, and shortened engine life. A defective crankshaft should always be detected at an early stage and then repaired immediately.

The following explanation concerns the most common crankshaft problems, the method for measuring warp, play, and runout, and the method for correcting flywheel misalignment. Since the crankshaft assembly requires a manual or hydraulic press and special tools to attain the precise tolerances that are required, a defective crankshaft should be either rebuilt by a properly equipped shop or replaced as an assembly.

Connecting rod bend, twist

Set the crankshaft in a flywheel alignment jig or on **V** blocks on a surface plate. Select an arbor of the same diameter as the piston pin and of optional length, and insert it through the small end of the connecting rod.

Using a height gauge or dial gauge, measure the difference in the height of the rod above the surface plate over a 100 mm length to determine the amount the connecting rod is bent. If the measurement exceeds the service limit, the connecting rod or the crankshaft assembly must be replaced.

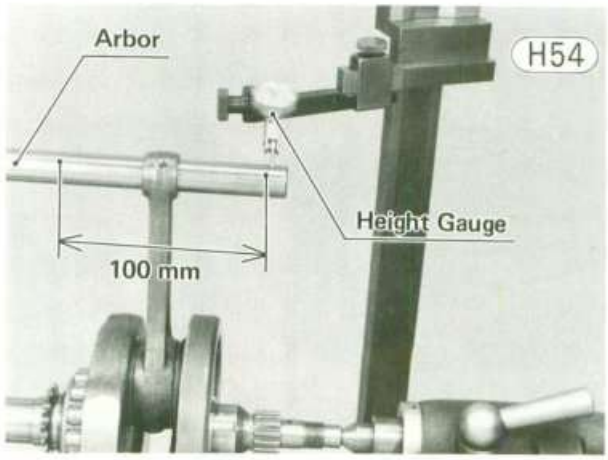


Table H33 Connecting Rod Bend/100 mm

Standard	Service Limit
under 0.05 mm	0.20 mm

Using the arrangement and arbor shown below, measure the amount that the arbor varies from being parallel with the crankshaft over a 100 mm length of the arbor to determine the amount the connecting rod is twisted. If the measurement exceeds the service limit, the connecting rod or the crankshaft assembly must be replaced.

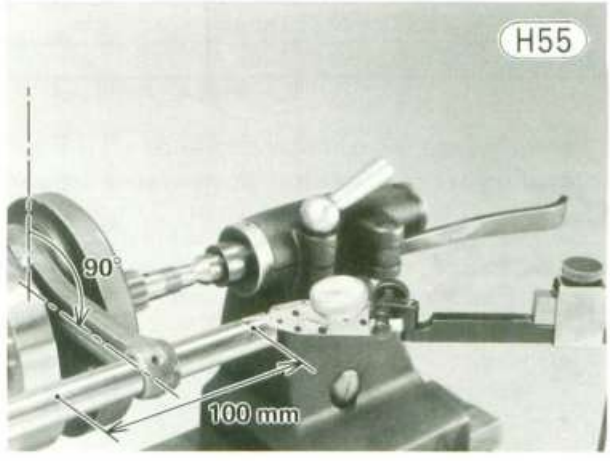


Table H34 Connecting Rod Twist/100 mm

Standard	Service Limit
under 0.05 mm	0.20 mm

Connecting rod big end radial clearance

Set the crankshaft in a flywheel alignment jig or on **V** blocks, and place a dial gauge against the big end of the connecting rod. Push the connecting rod first towards the gauge and then in the opposite direction.

The difference between the two gauge readings is the radial clearance.

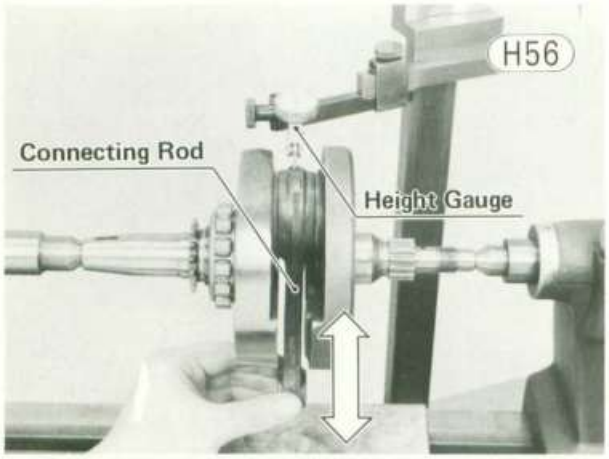


Table H35 Connecting Rod Big End Radial Clearance

Standard	Service Limit
0.016~0.030 mm	0.07 mm

If the radial clearance exceeds the service limit, the crankshaft assembly must be replaced or disassembled and the crankpin, needle bearing, and connecting rod big end examined for wear.

Table H36 Crankpin, Connecting Rod Big End Diameter

	Standard	Service Limit
Crankpin	28.991~29.000 mm	28.97 mm
Big End	39.002~39.019 mm	39.04 mm

Connecting rod big end side clearance

Measure the side clearance of the connecting rod with a thickness gauge as shown in the figure. If the measured value exceeds the service limit, the crankshaft assembly must be replaced or disassembled and the connecting rod and the thrust washers examined for wear.

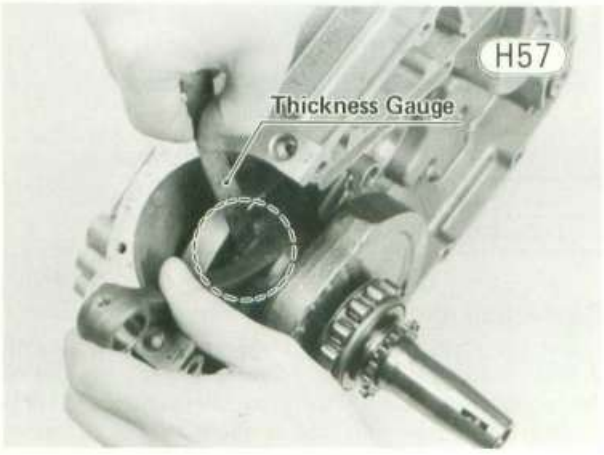


Table H37 Connecting Rod Big End Side Clearance

Standard	Service Limit
0.3~0.4 mm	0.6 mm

Table H38 Connecting Rod Big End Width

Standard	Service Limit
21.55~21.60 mm	21.50 mm

Table H39 Thrust Washer Thickness

Standard	Service Limit
1.15~1.25 mm	1.10 mm

Crankshaft runout

Set the crankshaft in a flywheel alignment jig, and place a dial gauge at the ball bearing (A) and at the starter motor clutch sprocket (B). Turn the crankshaft slowly. The maximum difference in gauge readings is the crankshaft runout.

Crankshaft Runout H58

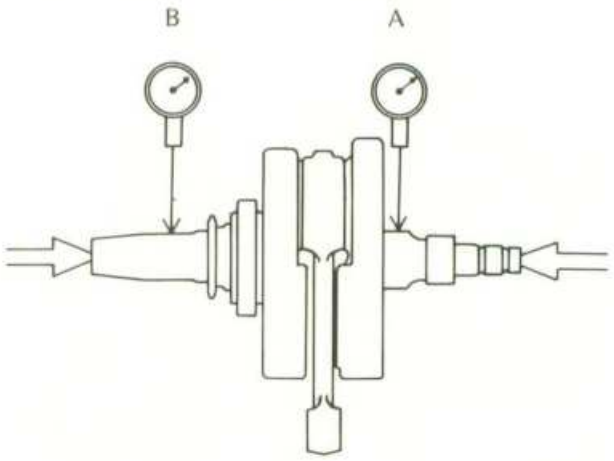


Table H40 Crankshaft Runout

	Standard	Service Limit
(A)	under 0.03 mm	0.08 mm
(B)	under 0.04 mm	0.10 mm

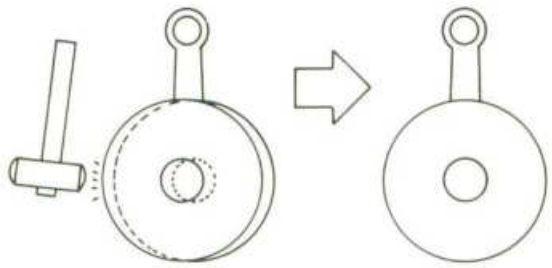
If the runout at either point exceeds the service limit, align the flywheels so that the runout falls within the service limit. As shown in Figs. H59, H60, there are three types of flywheel misalignment. In the case of horizontal misalignment, which is the most common, strike the projecting rim of the flywheel with a plastic, soft lead, or brass hammer as indicated in the figure. Recheck the runout with a dial gauge, repeating the process until the runout falls within the service limit.

Vertical misalignment is corrected either by driving a wedge in between the flywheels or by squeezing the flywheel rims in a vise, depending on the nature of the misalignment. In case of both horizontal and vertical misalignment, correct the horizontal misalignment first.

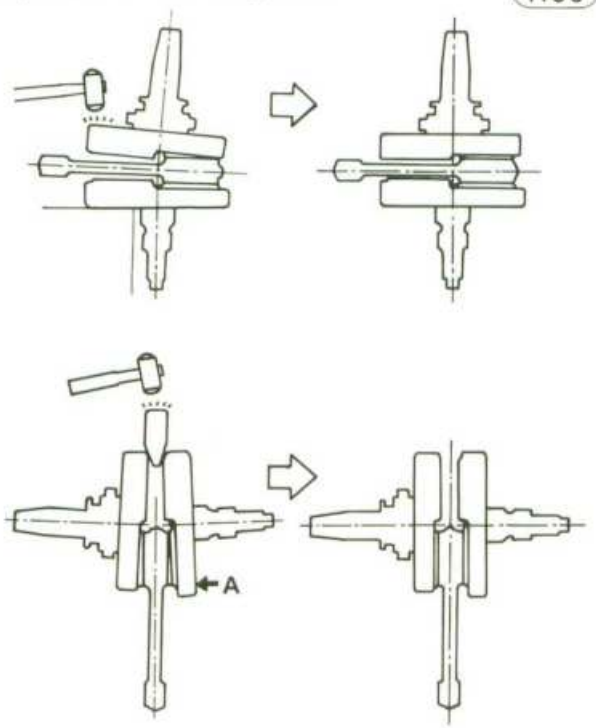
If flywheel misalignment cannot be corrected by the above method, replace the crankpin or the crankshaft itself.

NOTE: Don't hammer the flywheel at part "A".

Flywheel Horizontal Misalignment H59



Flywheel Vertical Misalignment H60



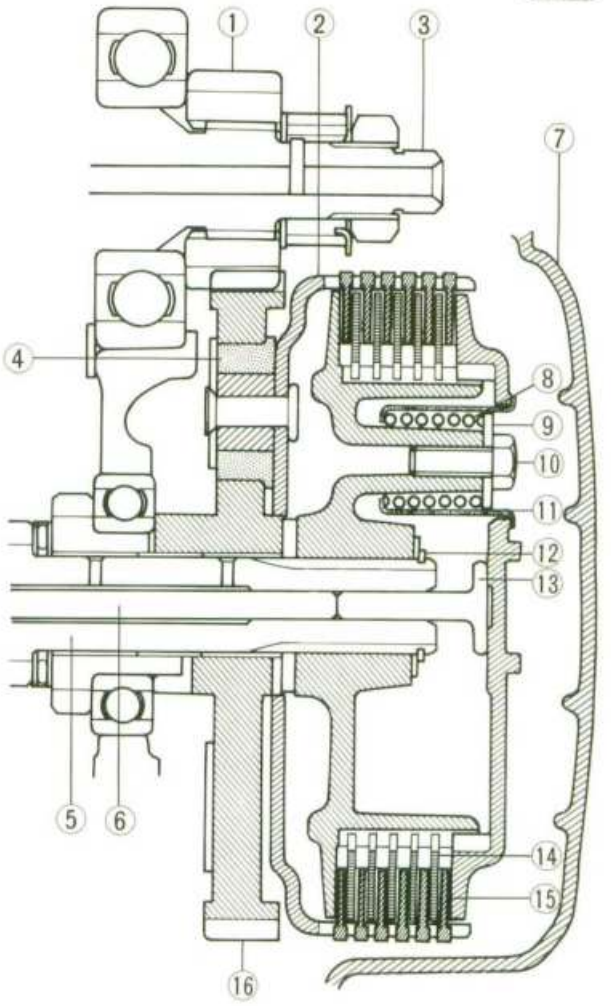
Big end seizure

In case of serious seizure with damaged flywheels, the crankshaft must be replaced. In case of less serious damage, disassemble the crankshaft and replace the crankpin, needle bearing, side washers, and connecting rod.

CLUTCH

Fig. H61 shows the construction of the clutch, which is a wet, multi-plate type with 6 friction plates ⑮ and 5 steel plates ⑭. The friction plates are made of cork, used for its high coefficient of friction, bonded on a steel core, which provides durability and warp resistance. The clutch housing ② has a reduction gear ⑯ on one side and contains 6 rubber dampers ④ to absorb shock from the drive train.

Clutch H61

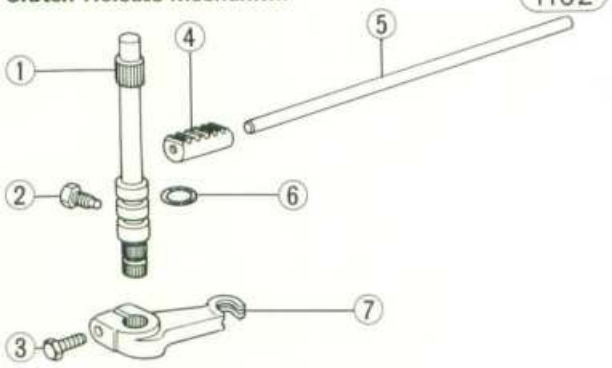


1. Primary Gear
2. Clutch Housing
3. Crankshaft
4. Rubber Damper
5. Drive Shaft
6. Push Rod
7. Right Engine Cover
8. Spring
9. Washer
10. Bolt
11. Spring Seat
12. Circlip
13. Spring Plate Pusher
14. Steel Plate
15. Friction Plate
16. Clutch Housing Gear

The clutch release mechanism is shown in Fig. H62. The clutch release rack ④ and pinion ① are both made of steel.

The friction plates are keyed to the clutch housing by tangs on the outer circumference of each plate. Since the clutch housing is gear-driven from the crankshaft, these plates are always turning any time the engine is running. The steel plates have a toothed inner circumference and mesh with the splines in the clutch hub. The hub is mounted on the drive shaft, so that the drive shaft and steel plates always turn together.

Clutch Release Mechanism (H62)



1. Pinion
2. Bolt
3. Bolt
4. Rack
5. Push Rod
6. **O** Ring
7. Release Lever

One end of each clutch spring pushes against its washer and bolt, which is threaded into the clutch hub. The other end pushes against the spring plate. When the clutch is left engaged, the springs force the spring plate, friction plates, steel plates, and clutch hub tightly together so that the friction plates will drive the steel plates and transmit power to the transmission drive shaft.

When the clutch lever is pulled to release (disengage) the clutch, the clutch cable pulls the clutch release lever turning the release shaft. The release pinion, which is part of the release shaft, moves the rack in the direction of the clutch. Then the rack pushes the push rod, which through the spring plate pusher pushes the spring plate. Since the spring plate moves the same distance that the release rack moves and the clutch hub remains stationary, the spring pressure is taken off the clutch plates. Because the plates are no longer pressed together, the power transmission from the crankshaft to the transmission drive shaft is interrupted. However, as the clutch lever is released, the clutch springs return the spring plate and once again force the spring plate, plate assembly, and clutch hub tightly together.

A clutch that does not properly disengage will cause shifting difficulty and possible transmission damage. On the other hand, a slipping clutch will reduce power transmission efficiency and may overheat and burn out. A clutch that does not properly disengage may be caused by:

1. Excessive clutch lever play.
2. Clutch plates that are warped or too rough.
3. Uneven clutch spring tension.
4. Deteriorated engine oil.
5. Engine oil viscosity too high.
6. Engine oil level too high.
7. The clutch housing frozen on the drive shaft.
8. A defective clutch release mechanism.
9. An unevenly worn clutch hub or housing.
10. Missing parts.

A slipping clutch may be caused by:

1. No clutch lever play.
2. Worn friction plates.
3. Weak clutch springs.
4. The clutch cable not sliding smoothly.
5. A defective clutch release mechanism.
6. An unevenly worn clutch hub or housing.

Clutch noise may be caused by:

1. Too much backlash between the primary gear and the clutch gear.
2. Damaged gear teeth.
3. Too much clearance between the friction plate tangs and the clutch housing.
4. Deteriorated damper rubber.
5. Metal chips jammed into the clutch housing gear teeth.

Spring tension

Remove the clutch springs, and set them, one at a time, on a spring tension testing device (Fig. H43). Compress the spring, and read the tension at the test length. If the spring tension at the specified length is weaker than the service limit, replace the spring.

Table H41 Clutch Spring Tension

Length	Standard	Service Limit
21.0 mm	13.0~15.0 kg	12.0 kg

Friction plate wear, damage

Visually inspect the friction plates to see whether or not they show any signs of seizure, overheating, or uneven wear. Measure the thickness of the plates with vernier calipers.

If any plates show signs of damage, or if they have worn past the service limit, replace them with new ones.

Friction Plate Measurement (H63)



Table H42 Friction Plate Thickness

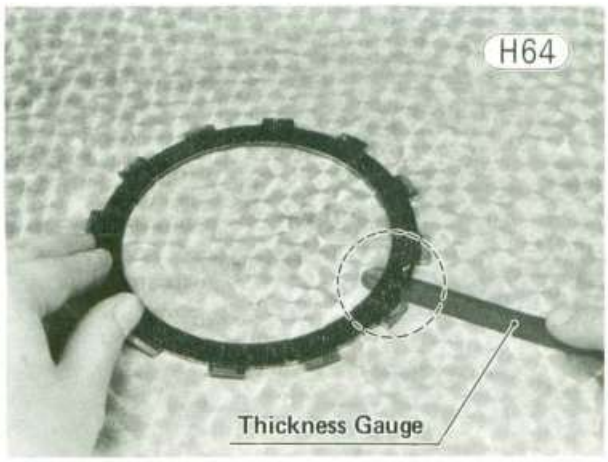
Standard	Service Limit
2.7~2.9 mm	2.5 mm

Clutch plate warp

Place each clutch plate on a surface plate, and measure the gap between each clutch plate and the surface plate. This gap is the amount of clutch plate warp. Replace any plates warped over the service limit.

Table H43 Clutch Plate Warp

	Standard	Service Limit
Friction Plate	under 0.15 mm	0.30 mm
Steel Plate	under 0.20 mm	0.35 mm



Friction plate/clutch housing clearance

Measure the clearance between the tangs on the friction plates and the fingers of the clutch housing. If this clearance is excessive, the clutch will be noisy.

If the clearance exceeds the service limit, replace the friction plates. Also, replace the clutch housing if it is unevenly or badly worn where the friction plates wear against it.

Friction Plate/Clutch Housing Clearance (H65)

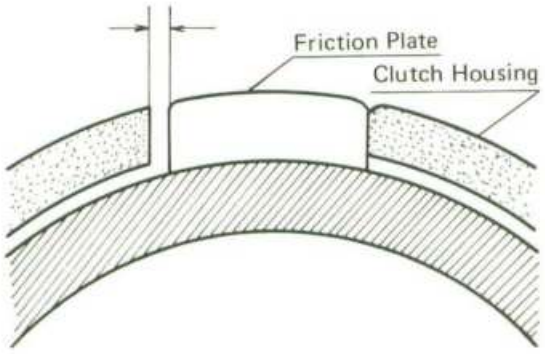


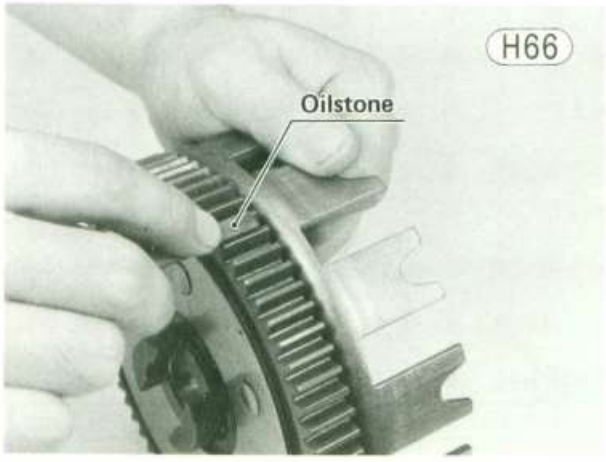
Table H44 Friction Plate/Clutch Housing Clearance

Standard	Service Limit
0.09 ~ 0.40 mm	0.60 mm

Inspect the fingers of the housing where the tangs of the friction plates hit them. If they are badly worn or if there are grooves out where the tangs hit, replace the clutch housing.

Clutch housing gear damage

Inspect the teeth on the clutch housing gear. Any light damage can be corrected with an oilstone, but the clutch housing must be replaced if the teeth are badly damaged. Damaged teeth on the clutch housing gear indicate that the primary gear, by which it is driven, may also be damaged. Whenever the clutch housing gear is repaired or replaced, the primary gear should be inspected, and then replaced if necessary.



Clutch housing gear/primary gear backlash

Measure the backlash between the clutch housing gear and primary gear. To measure the backlash, set a dial gauge against the teeth of one gear. Then move the gear back and forth while holding the other gear steady. The difference between the highest and the lowest gauge reading is the amount of backlash. Replace both the clutch housing and the primary gear wherever the amount of backlash exceeds the service limit.

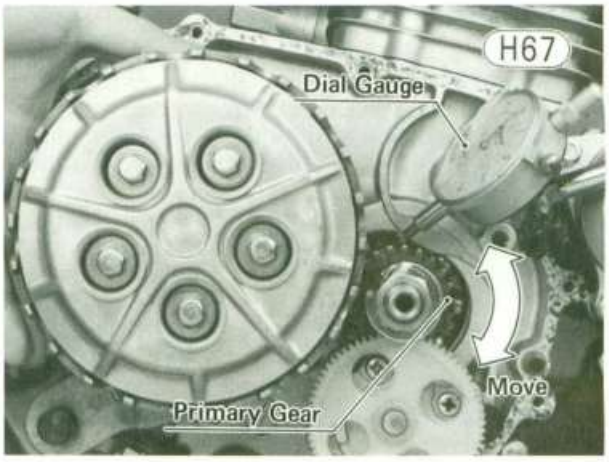


Table H45 Clutch Housing/Primary Gear Backlash

Standard	Service Limit
0.02 ~ 0.11 mm	0.15 mm

Clutch housing wear

Measure the inside diameter of the clutch housing with a cylinder gauge. Replace the clutch housing if the diameter exceeds the service limit (Table H46). Check the diameter of the drive shaft at the clutch housing.

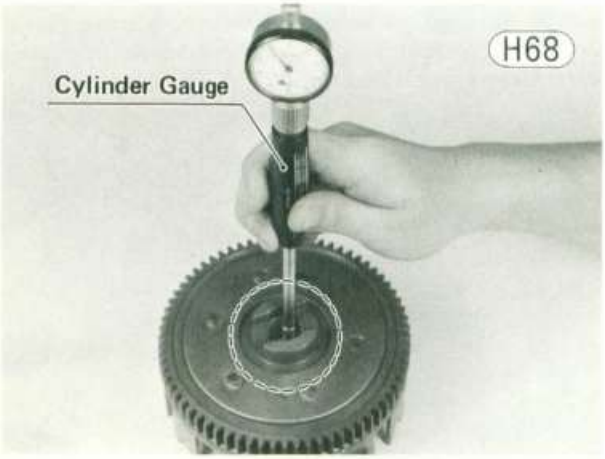


Table H46 Clutch Housing, Drive Shaft Diameter

	Standard	Service Limit
Clutch Housing	20.000 ~ 20.021 mm	20.03 mm
Drive Shaft	19.059 ~ 19.080 mm	19.04 mm

Clutch hub damage

Inspect where the teeth on the steel plates wear against the splines of the clutch hub. If there are notches worn into the splines, replace the clutch hub.

Clutch release rack, pinion wear

Visually inspect the clutch release rack and pinion for damage or excessive wear. If there is any damage or excessive wear, replace the rack and shaft as a set.

Fit the rack and shaft into the left engine cover, and turn the shaft back and forth to check the rack and pinion movement. If there is excessive play, replace the rack and shaft as a set.

Lubrication

Apply grease liberally to the clutch release rack, shaft, and inside the holes (2) in the left engine cover.

TRANSMISSION

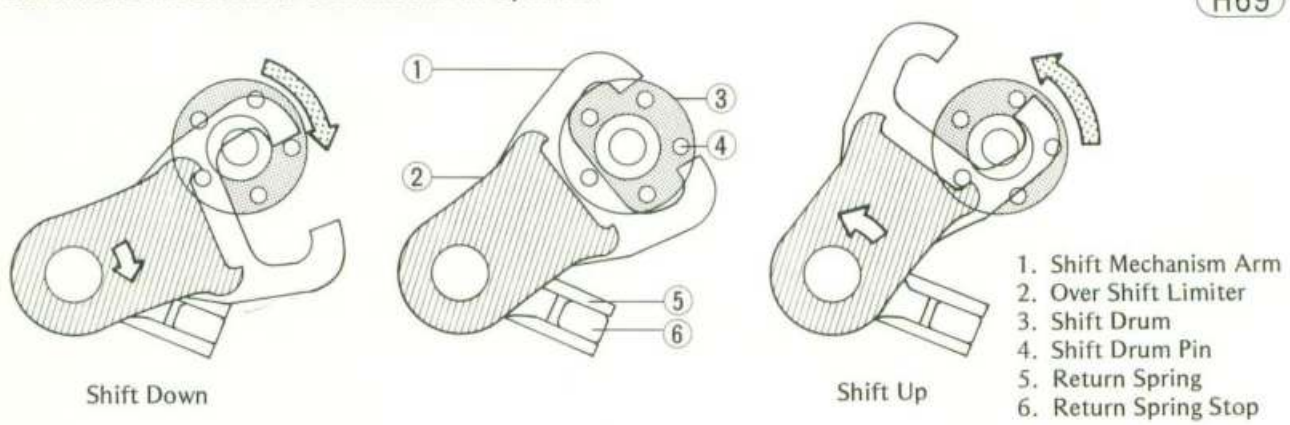
The transmission is a 5-speed, constant mesh, return shift type. Its cross section is shown in Fig. H71, and the external shift mechanism is shown in Fig. H70. For simplicity, the drive shaft gears in the following explanation are referred to as "D" (e.g., D1=drive shaft 1st gear) and the output shaft gear as "O".

Gears D3, O4, and O5 are all splined to, and thus rotate with their shafts. During gear changes, these gears are moved sideways on their shafts by the three shift forks, one for each of them. Gears D4, D5, O1, O2, and O3 rotate free of shaft rotation, but cannot move sideways. Gears D1 and D2 rotate with the shaft and are unable to move sideways.

Shift Mechanism

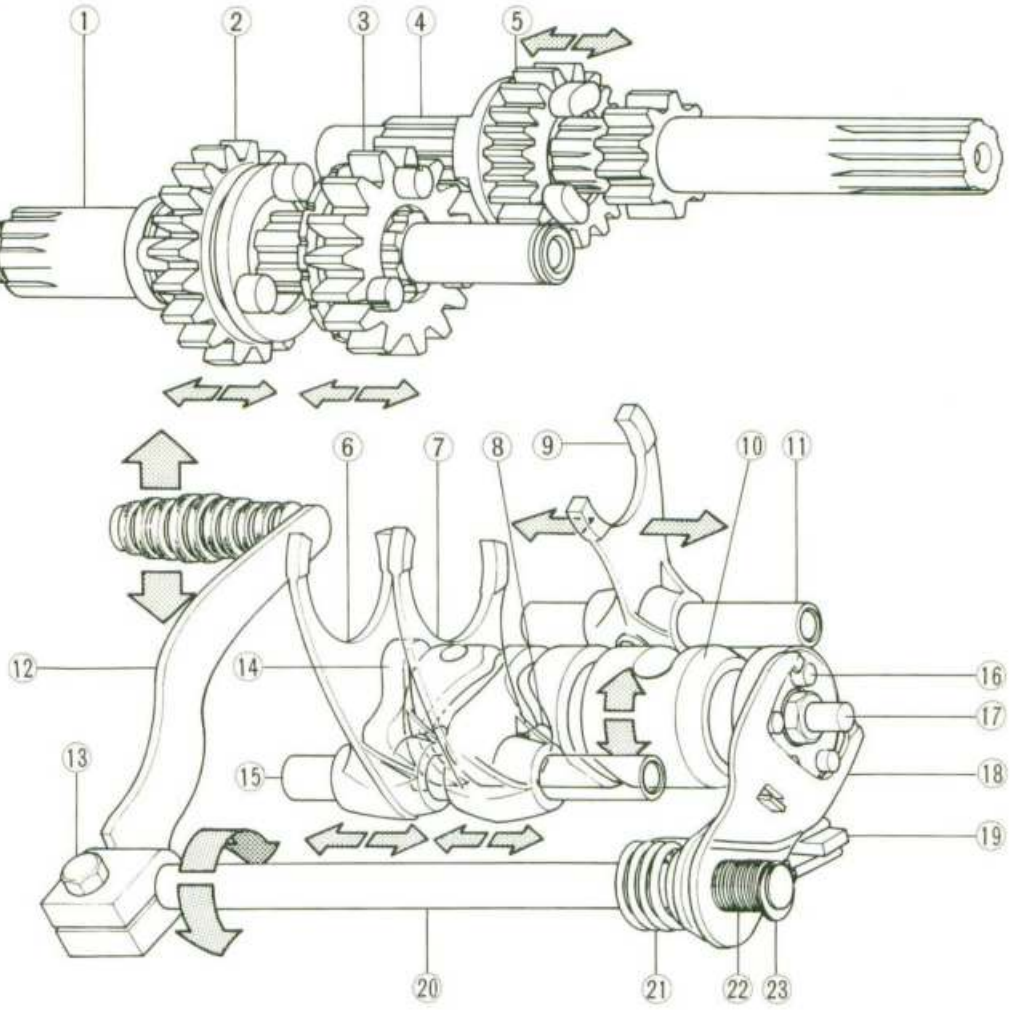
When the shift pedal ⑫ is raised or lowered, the shift shaft ⑳ turns, a pawl on the external shift mechanism arm ⑱ catches on one of the shift drum pins ⑯, and the shift drum ⑩ turns. At the same time, the overshift limiter ② on the shift arm catches another pin as shown in Fig. H69. As the shift drum turns, the shift fork guide pins ⑧ (3), each riding in a groove in the shift drum, change the position of one or another of the shift forks ⑥, ⑦, ⑨, in accordance with the winding of the grooves. The shift fork ears then determine the position of gears D3 ⑤, O4 ②, and O5 ③. Refer to Fig. H72 for the gear position and drive path for neutral and each of the 5 gears. A shift arm spring ㉒ is fitted on the external shift mechanism to keep the shift arm pressed against the shift drum pin plate to ensure proper pawl and pin contact. When the shift pedal is released after shifting, the return spring ㉑ returns the shift lever and shift pedal to their original positions. The return spring stop ⑲ on the side of the crankcase engages between the two ends of the shift mechanism return spring. So that the transmission will remain where it was shifted, the shift drum positioning pin spring pushes the shift drum positioning pin into one of six notches on the shift drum operating plate ⑭. Five of these notches are equally spaced and correspond to the 5 gears. The other notch is halfway between the notches for 1st and 2nd gears, and corresponds to the half-stroke shift pedal movement from 1st or 2nd gear required to shift into neutral.

Shift Mechanism Lever and Overshift Limiter Operation



Shift Mechanism

H70



1. Output Shaft
2. Output 4th Gear
3. Output 5th Gear
4. Drive Shaft
5. Drive 3rd Gear
6. Shift Fork (O4)
7. Shift Fork (O5)
8. Shift Fork Guide Pin
9. Shift Fork (D3)
10. Shift Drum
11. Shift Rod
12. Shift Pedal
13. Bolt
14. Operating Plate
15. Shift Rod
16. Shift Drum Pin
17. Holder Bolt
18. Shift Mechanism Arm
19. Return Spring Stop
20. Shift Shaft
21. Return Spring
22. Shift Arm Spring
23. Circlip

Overshift Limiter

Each time that the shift pedal is operated, the overshift limiter interlocks with the shift drum pins to prevent overshifting. On a full upshift or downshift stroke, the limiter "hooks" catch the shift drum pins to keep the inertia of the heavy shift drum from allowing it to rotate beyond the intended gear position, particularly on a fast shift. At the same time, the overshift limiter arrests the shift lever's motion at the end of the stroke to aid in preventing overshifting.

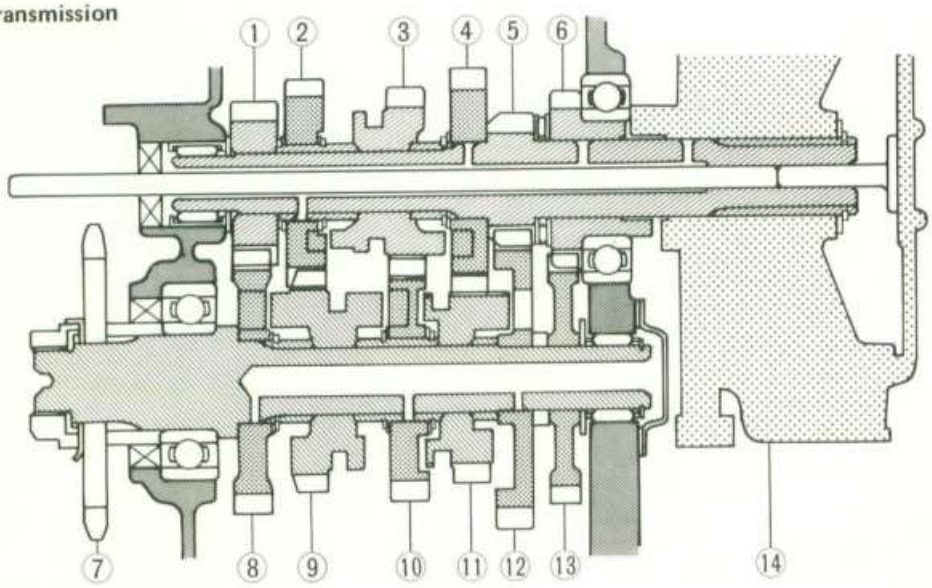
Transmission or external shift mechanism damage, causing the transmission to misshift, overshift, and/or jump out of gear, can cause further damage to the transmission and overrev damage to the engine itself. An improperly functioning transmission or external shift mechanism may be caused by the following:

1. Broken or weakened return spring or shift drum positioning pin spring
2. Broken or weakened shift arm spring
3. Damaged shift lever and/or over shift limiter
4. Damaged shift drum bearing
5. Loose shift drum bearing stop
6. Bent or worn shift fork(s)
7. Worn shift fork grooves on gears D3, O4, and/or O5
8. Worn shift fork guide pin(s)
9. Worn shift drum groove(s)
10. Binding of shift drum positioning pin in the positioning bolt
11. Worn or damaged gear dogs, gear dog holes, and/or gear dog recesses
12. Improperly functioning clutch or clutch release
13. Improper assembly or missing parts

Transmission noise results from worn or damaged shafts, bearings, gear hubs or teeth, etc.

Transmission

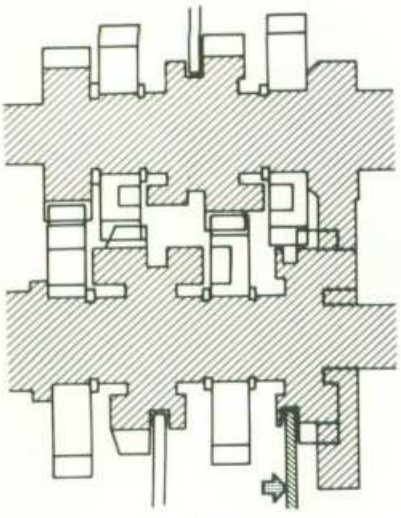
H71



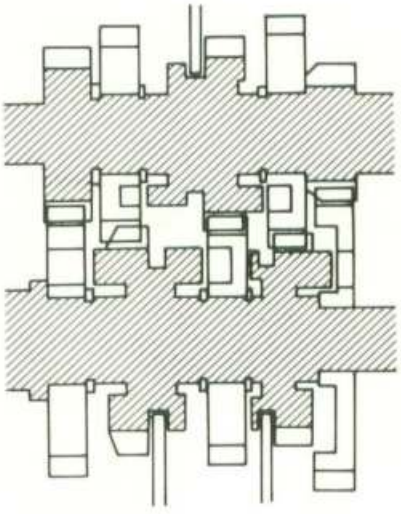
1. Drive 2nd Gear
2. Drive 4th Gear
3. Drive 3rd Gear
4. Drive 5th Gear
5. Drive 1st Gear
6. Drive Idle Gear
7. Engine Sprocket
8. Output 2nd Gear
9. Output 4th Gear
10. Output 3rd Gear
11. Output 5th Gear
12. Output 1st Gear
13. Output Idle Gear
14. Clutch

Gear Position

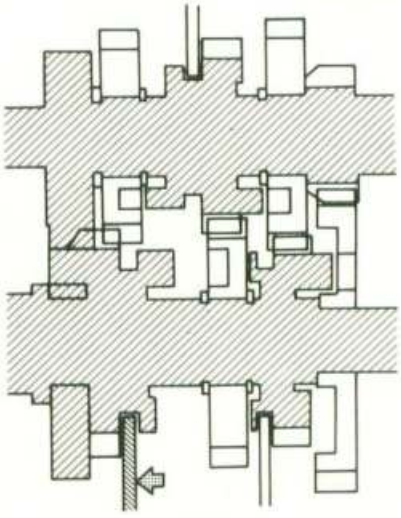
H72



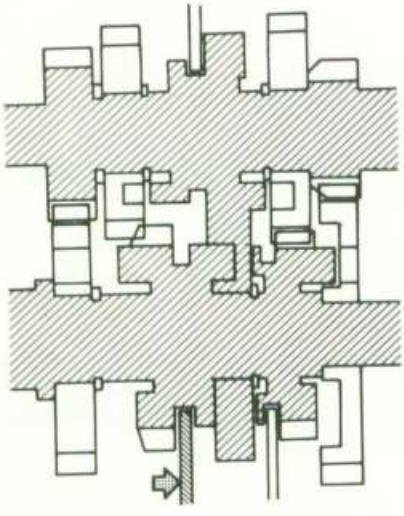
1st



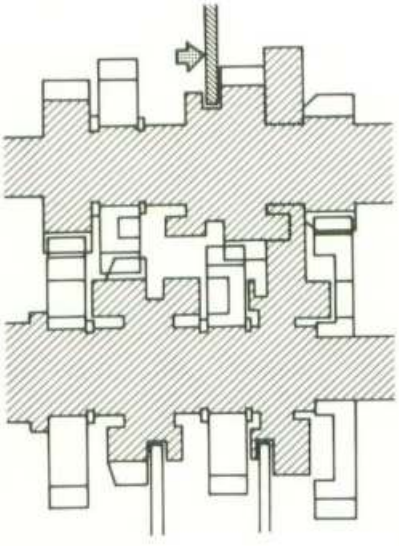
Neutral



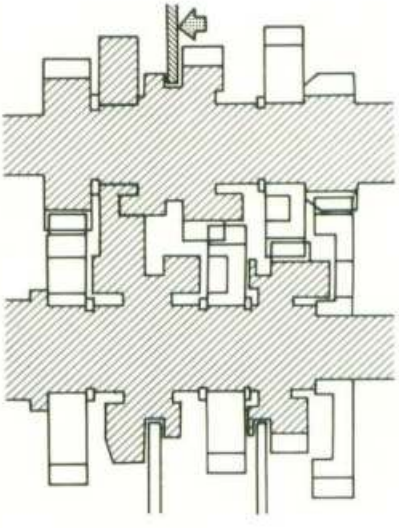
2nd



3rd



4th



5th

External shift mechanism inspection

Inspect the shift lever spring, shift pawls, and return spring. Replace any broken or other wise damaged parts.

Measure the free length of the shift drum positioning pin spring. If it is shorter than the service limit, replace it with a new one.

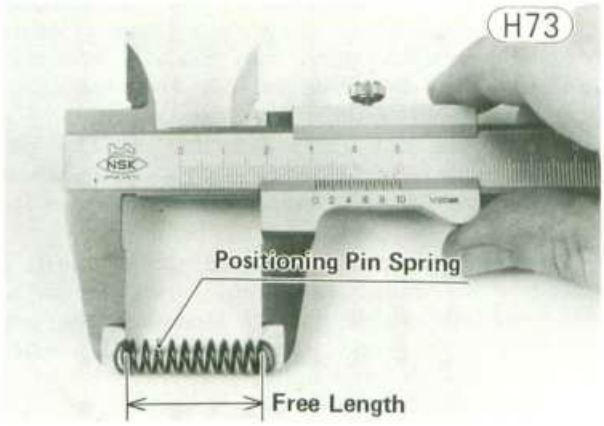


Table H47 Positioning Pin Spring Free Length

Standard	Service Limit
32.3 mm	30.7 mm

Shift fork bending

Visually inspect the shift forks, and replace any fork that is bent. A bent fork could cause difficulty in shifting or allow the transmission to jump out of gear when under power.

Shift fork/gear groove wear

Measure the thickness of the ears of each shift fork, and measure the width of the shift fork grooves on gears D3, O4, and O5. If the thickness of a shift fork ear is under the service limit, the shift fork must be replaced. If a gear shift fork groove is worn over the service limit, the gear must be replaced.

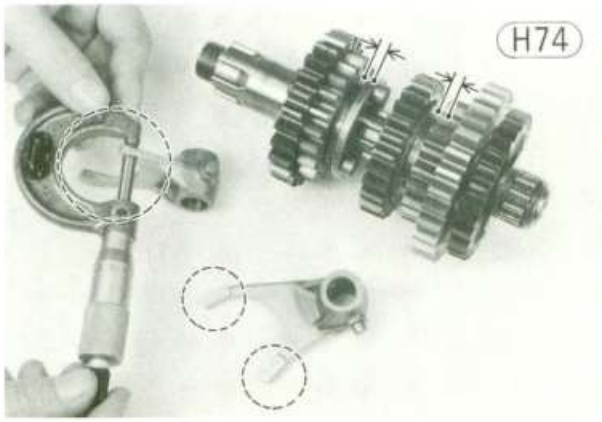


Table H48 Shift Fork Thickness

Standard	Service Limit
4.4~4.5 mm	4.2 mm

Table H49 Gear Shift Fork Groove Width

Standard	Service Limit
4.55~4.65 mm	4.75 mm

Shift fork guide pin/shift drum groove wear

Measure the diameter of each shift fork guide pin, and measure the width of each shift drum groove. Replace any shift fork on which the guide pin has worn past the service limit. If a shift drum groove is worn past the service limit, replace the shift drum.

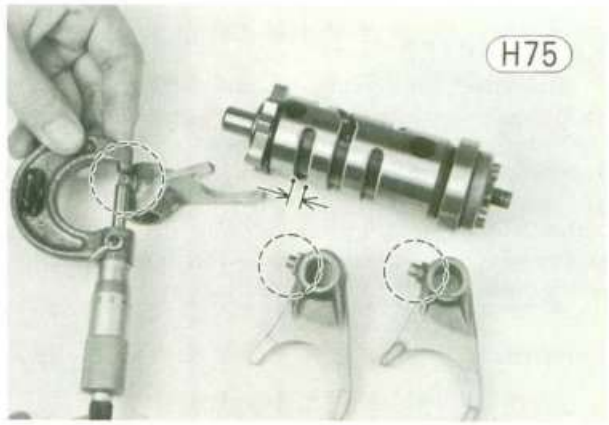


Table H50 Shift Fork Guide Pin Diameter

Standard	Service Limit
5.9~6.0 mm	5.85 mm

Table H51 Shift Drum Groove Width

Standard	Service Limit
6.05~6.20 mm	6.25 mm

Gear dog, gear dog hole, gear dog recess damage

Visually inspect the gear dogs, gear dog holes, and gear dog recesses. Replace any gears that have damaged, or unevenly or excessively worn dogs, dog holes, or dog recesses.

Gear/shaft wear

Measure the diameter of each shaft and bush with a micrometer, and measure the inside diameter of each gear listed below. Find the difference between the two readings to figure clearance, and replace any gear with clearance exceeding the service limit.



Table H52 Gear/Shaft, Bush/Shaft Clearance

Gear	Standard	Service Limit
D4, D5, O2, O3	0.027 ~ 0.069 mm	0.17 mm
O1	0.016 ~ 0.046 mm	0.15 mm

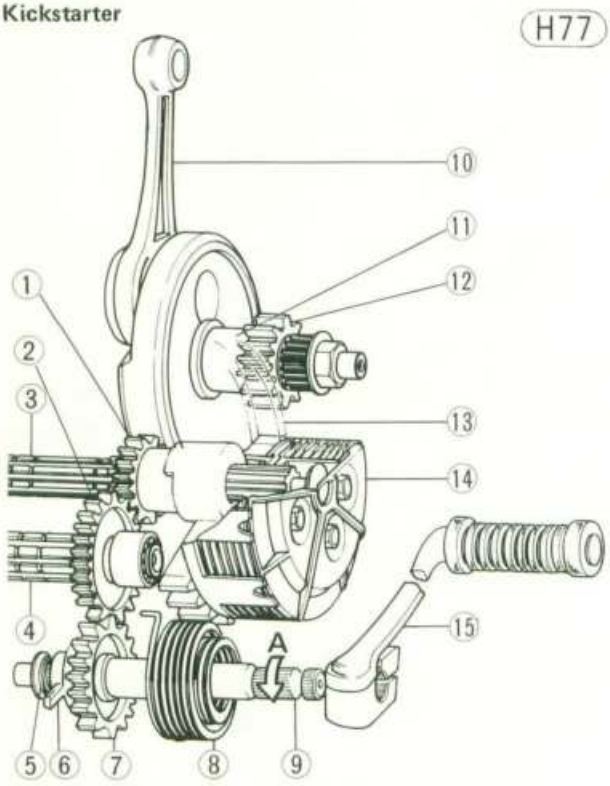
Ball bearing, needle bearing wear, damage

Check the ball bearing and needle bearing (Pg. 154).

KICKSTARTER

Kickstarter construction is shown in Fig. H77. The kick gear is connected to the primary gear on the crankshaft through the idle gear on the output shaft, the idle gear on the drive shaft, and the clutch housing gear. This gear train is free from the drive shaft whenever the clutch is disengaged, thereby allowing the engine to be kicked over even when in gear. This type of starting arrangement is called the primary kick system.

Kickstarter



1. Drive Shaft Idle Gear
2. Output Shaft Idle Gear
3. Drive Shaft
4. Output Shaft
5. Spring
6. Ratchet Gear
7. Kick Gear
8. Kick Spring
9. Kick Shaft
10. Connecting Rod
11. Crankshaft
12. Primary Gear
13. Clutch Housing Gear
14. Clutch
15. Kick Pedal

The kick gear ⑦, constructed with a ratchet on one side, is always meshed with the output shaft idle gear ②. The ratchet gear ⑥, mounted on the splined portion of the kick shaft ⑨, turns with the kick shaft and can be moved sideways on the shaft. A spring ⑤ presses the ratchet gear toward the kick gear. But when the kick pedal ⑮ is not being operated, an arm on the ratchet gear is caught on the stop, which prevents the ratchet gear from meshing with the ratchet on the kick gear.

When the kick pedal is operated, the ratchet gear arm is free from the stop and the ratchet gear then meshes with the kick gear ratchet, rotating the kick gear. The gear train of the kickstarter system then cranks the engine through the output shaft idle gear, drive shaft idle gear ①, clutch housing gear ⑬, and primary gear ⑫. As the engine starts, the primary gear through the gear train turns the kick gear. But, since the kick gear rotates in the direction of arrow "A" as shown in Fig. H77, the kick gear ratchet doesn't catch on the ratchet gear.

When the kick pedal is released, the kick shaft is turned by the return spring, bringing the kick pedal to its original position. At the same time, the ratchet gear arm rides up the stopper, breaking away from the kick gear. The kick gear now turns freely.

If the kick pedal return spring weakens or breaks, the kick pedal will not return completely or at all, and the kick gear and ratchet gear will stay partially meshed, making noise while the engine is running. Kick mechanism noise may also result when the kick gear, or kick shaft becomes worn.

If the ratchet gear or ratchet on the kick gear is worn or damaged, the kick gear will slip, and it will not be possible to kickstart the engine.

Kick gear, shaft wear

Measure the inside diameter of the kick gear, and replace the gear if the diameter is over the service limit. Visually inspect the ratchet portion of the kick gear. If there is any kind of damage, replace the kick gear.

Measure the kick shaft diameter at the kick gear, and replace it if it is under the service limit.

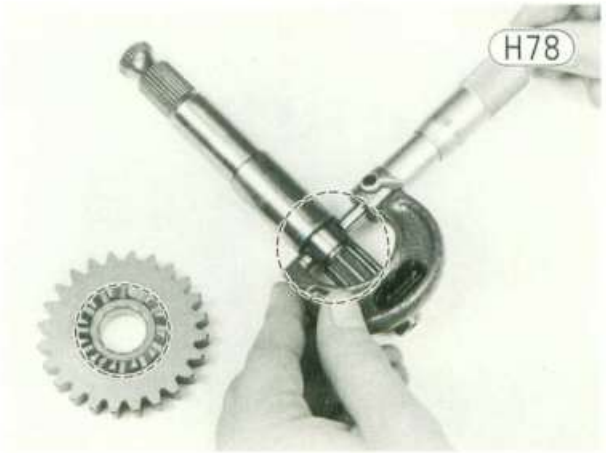


Table H53 Kick Gear Inside Diameter

Standard	Service Limit
16.500 ~ 16.518 mm	16.56 mm

Table H54 Kick Shaft Diameter at Kick Gear

Standard	Service Limit
16.466 ~ 16.484 mm	16.44 mm

Drive shaft idle gear wear

Measure the inside diameter of the drive shaft idle gear, and the outside diameter of the drive shaft at the idle gear with a micrometer. Find the difference between the two readings to figure the clearance. Replace the gear if the clearance exceeds the service limit.

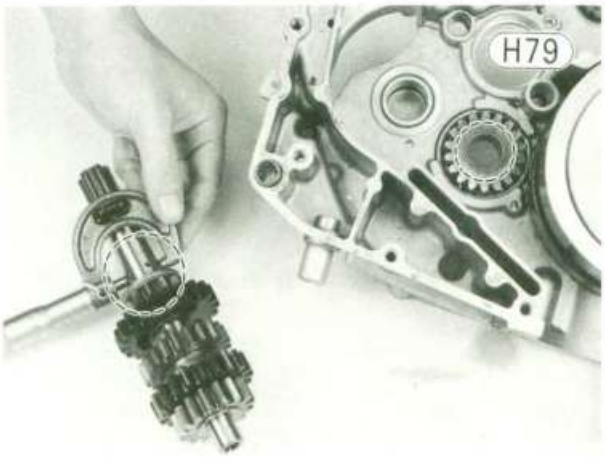


Table H55 Drive Shaft/Idle Gear Clearance

Standard	Service Limit
0.020~0.062 mm	0.16 mm

Output shaft idle gear, shaft wear

Measure the inside diameter of the output shaft idle gear, and the diameter of the output shaft at the idle gear with a micrometer. Find the difference between the two readings to figure the clearance. Replace the gear if the clearance exceeds the service limit.



Table H56 Output Shaft/Idle Gear Clearance

Standard	Service Limit
0.032~0.061 mm	0.16 mm

ENGINE LUBRICATION

The engine lubrication system includes the oil screen, engine oil pump, oil filter, oil bypass valve, and oil passages. An oil breather keeps crankcase pressure variations to a minimum and reduces emissions by recirculating blowby gases. The discussion here concerns how these parts work together, and how the oil reaches the various parts of the engine. Details on the engine oil pump, oil filter, and oil breather are given in the sections (Pgs. 151 ~ 154) following engine lubrication.

Since the engine lubrication system is a wet sump type, there is always supply of oil in the crankcase at the bottom of the engine. The oil is drawn through the wire screen into the oil pump as the pump rotors turn. The pump is driven by a gear on the crankshaft. The screen removes any metal particles and other foreign matter which could damage the oil pump. From the pump the oil passes through the oil filter element for filtration. If the element is badly clogged, slowing the flow of oil through it, oil bypasses the element through a bypass valve in the oil filter mounting pin. After passing through the filter, the oil branches into two lubrication routes.

One of these routes is through the oil passage in the right engine cover into the crankshaft. Through the hole of the right crankshaft, oil flows to the crankpin and needle bearing. The cylinder walls, pistons, and piston pins are lubricated by splash from the spinning crankshaft. The oil then drops and collects at the bottom of the crankcase to be used again.

The other route for filtered oil is to the passage between the crankcase and cylinder base. The oil flows through the crankcase passage to the drive shaft needle bearing and output shaft needle bearing. Finally the oil drops down into the crankcase after lubricating the bearings and transmission gears. An oil passage of the cylinder block takes oil up to the cylinder head from the passage between the crankcase and cylinder base. The oil lubricates the camshaft small journal, flows into the camshaft, and lubricates the camshaft large journal and each cam surface. After lubricating each camshaft journal and cam surface, the oil flows out, and returns via the cam chain opening in the left side of the cylinder.

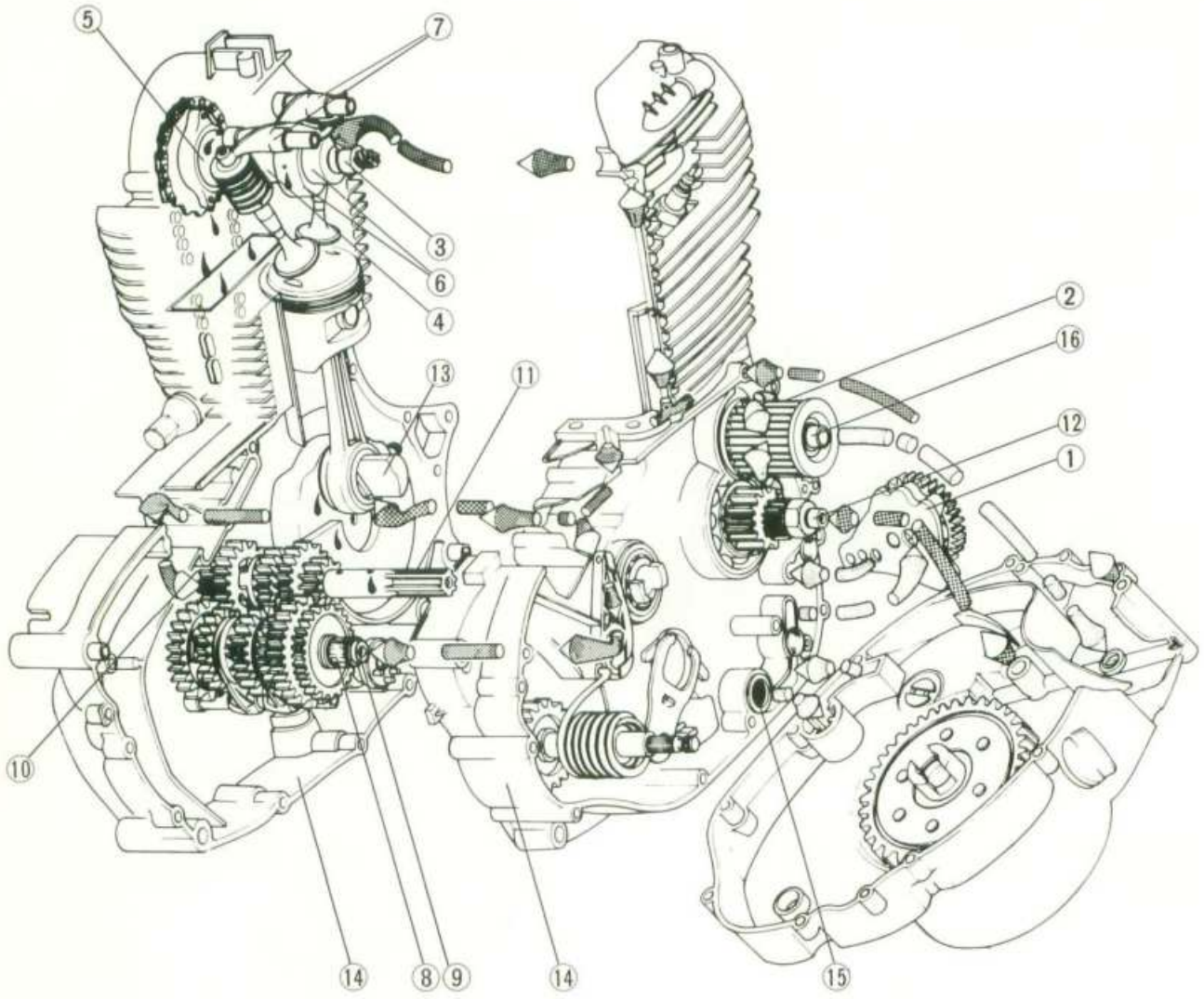
Engine Oil Pump

The oil pump, installed in the right side of the crankcase, is a simple trochoid type with an outer and an inner rotor. The gear on the pump is driven in direct proportion to engine rpm by a gear attached to the crankshaft.

If the oil pump becomes worn, it may no longer be able to supply oil to lubricate the engine adequately.

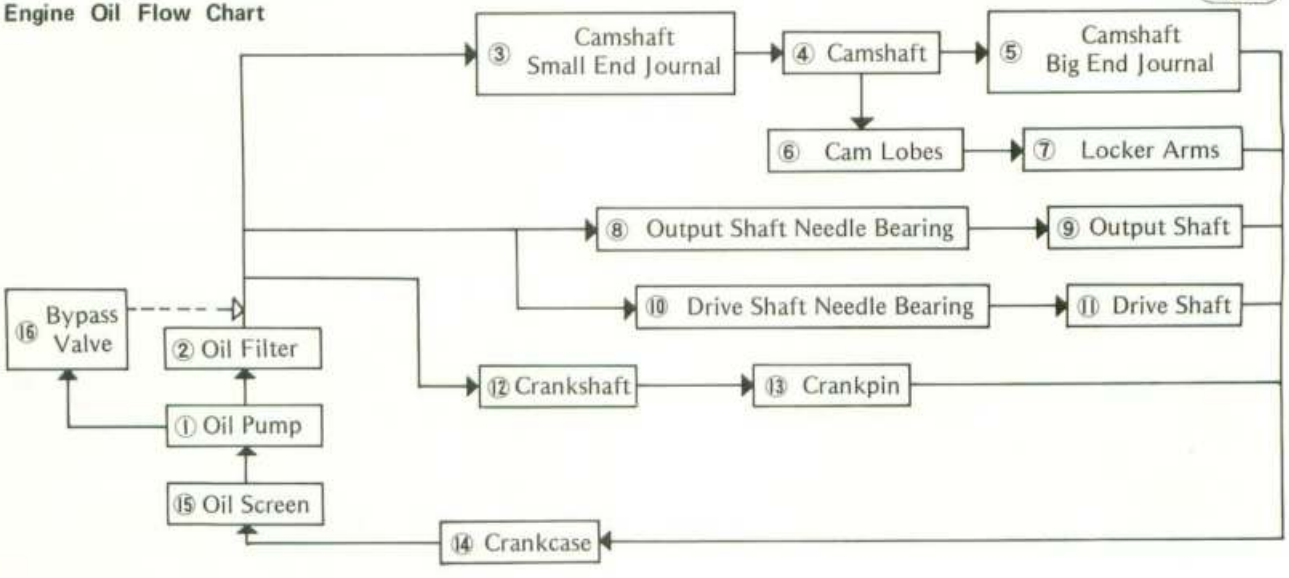
Engine Lubrication System

H81



H82

Engine Oil Flow Chart



Outer rotor/inner rotor clearance

Measure the clearance between the outer rotor and inner rotor with a thickness gauge. If the clearance exceeds the service limit, replace the rotors.

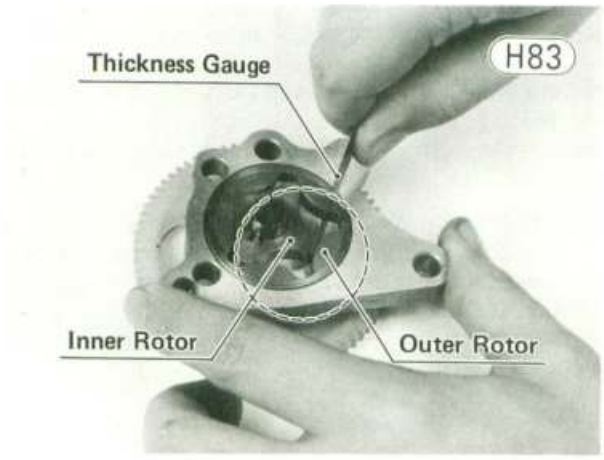


Table H57 Outer Rotor/Inner Rotor Clearance

Standard	Service Limit
under 0.15 mm	0.20 mm

Outer rotor/pump body clearance

Measure the clearance between the outer rotor and the pump body with a thickness gauge. If the clearance exceeds the service limit, measure the outer rotor outside diameter and pump body inside diameter. If the outer rotor outside diameter is less than the service limit, replace the rotors. If the pump body inside diameter exceeds the service limit, replace the oil pump assembly.

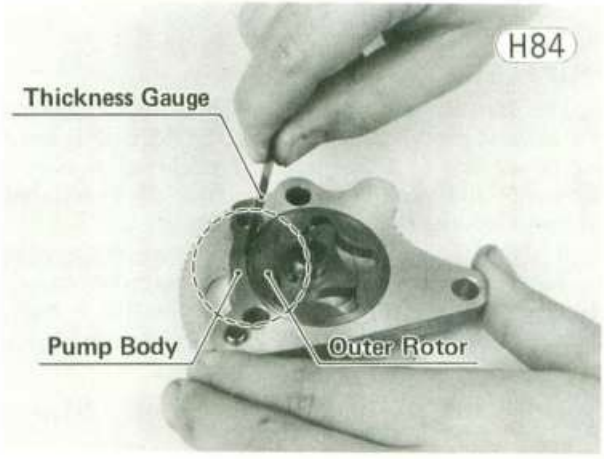


Table H58 Outer Rotor/Pump Body Clearance

Standard	Service Limit
0.15~0.23 mm	0.30 mm

Table H59 Outer Rotor, Pump Body Diameter

	Standard	Service Limit
Outer Rotor	40.51~40.56 mm	40.45 mm
Pump Body	40.71~40.74 mm	40.80 mm

Rotor side clearance

Lay a straight edge on the oil pump body, and measure the clearance between the straight edge and the rotors with a thickness gauge. If the clearance exceeds the service limit, replace the rotors or the oil pump assembly.

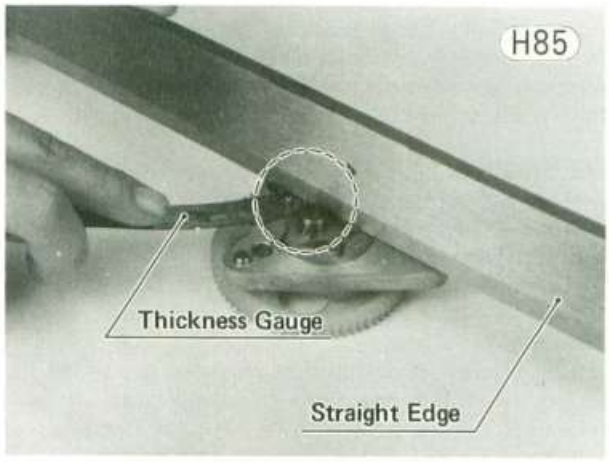


Table H60 Rotor Side Clearance

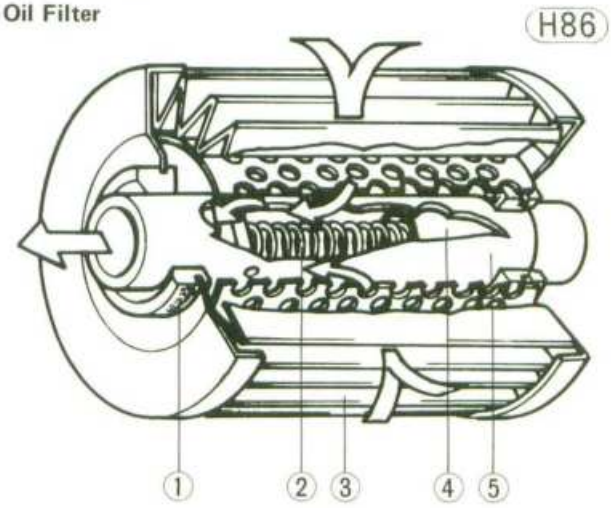
Standard	Service Limit
0.02~0.08 mm	0.12 mm

Oil Filter

The oil filter, located in the right side of the crankcase, removes impurities from the oil.

As the filter element becomes dirty and clogged, its filtering efficiency is impaired. If it becomes so clogged that it seriously impedes oil flow, a pressure-activated bypass valve in the oil filter mounting pin opens so that sufficient oil will still reach the parts of the engine needing lubrication. When the filter becomes clogged such that the oil pressure difference between the inelt and outlet for the filter reaches a certain pressure, the oil on the inlet side pushing on the valve spring opens the valve, allowing oil to flow to the oil passage, bypassing the filter.

Oil Filter



1. Grommet
2. Bypass Valve Spring
3. Filter Element
4. Bypass Valve Piston
5. Filter Mounting Pin

Never neglect the oil filter, or else metal particles or other foreign matter in the oil could reach the crankshaft and transmission, accelerating wear and shortening engine life.

Replace the filter element in accordance with the Periodic Maintenance Chart (Pg. 10) since it becomes clogged with metal filings from the engine and transmission especially during break-in. After break-in, replace the element at every other oil change. When the filter is removed for element replacement, wash it in a high flash-point solvent.

Oil Breather

The rear upper part of the crankcase works as an oil breather. The pipe on the rear upper of the crankcase connects through the breather hose to the air cleaner. Its function is to minimize crankcase pressure variations caused by crankshaft and piston movement and to recycle blowby gas.

Gas blowby is combustion chamber gas which has escaped past the rings into the crankcase. A small amount is unavoidable, but gas blowby increases as cylinder wall and piston ring wear progresses. If not efficiently removed, blowby gas will seriously contaminate the engine oil.

Recycling blowby gas means more efficient combustion, but the oil mist resulting from transmission gear movement must first be removed. The mixture of blowby gas and oil mist passes into the breather, which separates most of the oil from the gas. The oil which is separated from the gas returns to the bottom of the crankcase. The gas is drawn through the breather hose into the air cleaner housing, and from there, through the carburetor into the engine.

If the breather hose or the parts inside the breather become clogged, pressure may build up in the crankcase and cause oil leaks.

NOTE: If the engine is overfilled with engine oil, mist from the excess oil will go through the oil breather to clog the air cleaner and cause carburetion trouble. This is not the fault of the oil breather.

BALL, ROLLER, NEEDLE BEARINGS

Ball bearing wear, damage

Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than by measurement.

Clean each bearing in a high flash-point solvent, dry it (do not spin it while it is dry), and oil it. Spin it by hand to check its condition. If it is noisy, does not spin smoothly, or has any rough spots, replace it.

Roller bearing wear, damage

The rollers of the bearing wear so little that the wear is difficult to measure. Instead, inspect the bearing for abrasion, color change, or other damage. If there is any doubt as to the condition of the rollers, replace the left crankshaft or the crankshaft assembly. Inspect the bearing outer race in the left crankcase half. If there is any damage on the outer race, replace the crankcase.

Needle bearing wear, damage

The rollers in the needle bearings wear so little that the wear is difficult to measure. Instead, inspect the bearings for abrasion, color change, or other damage. If there is any doubt as to the condition of either bearing, replace it.

OIL SEALS

The camshaft oil seal in the cylinder head forms a seal between the rocker arm chamber and the contact breaker point cavity. If this seal is damaged, oil will leak into the contact breaker point cavity, and foul the contact breaker points. Any damaged, hardened, or otherwise defective oil seal will allow oil to leak.

Oil seal damage

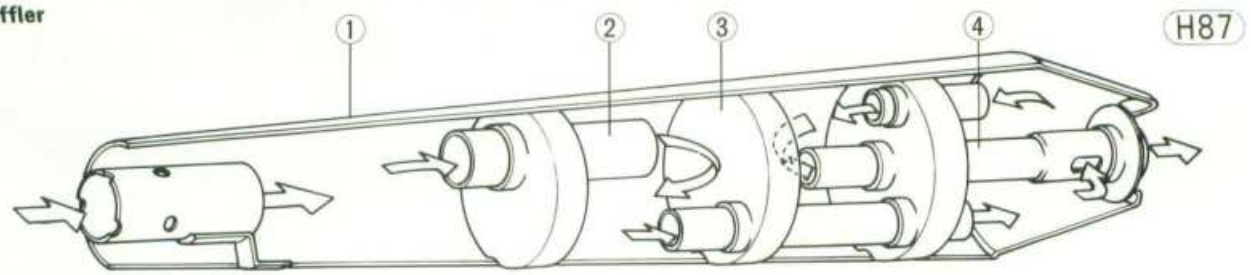
Inspect the oil seals, and replace any if the lips are misshapen, discolored (indicating the rubber has deteriorated), hardened, or otherwise damaged. Since an oil seal is nearly always damaged on removal, any removed oil seals must be replaced. When pressing in an oil seal which is marked, press it in with the mark facing outward. Press the seal in so that the face of the seal is level with the surface of the hole.

MUFFLER

The muffler reduces exhaust noise and conducts the exhaust gases back away from the rider while keeping power loss to a minimum. If much carbon is built up inside the muffler, exhaust efficiency is reduced, which lowers the engine power output.

If there is any exhaust leakage where the muffler connects to the cylinder head, or if the gasket appears damaged, replace the gasket. If the muffler is badly damaged, dented, cracked or rusted, replace it with a new one.

Muffler



1. Muffler
2. Connecting Pipe
3. Partition Wall
4. Buffle Tube

Maintenance–Chassis

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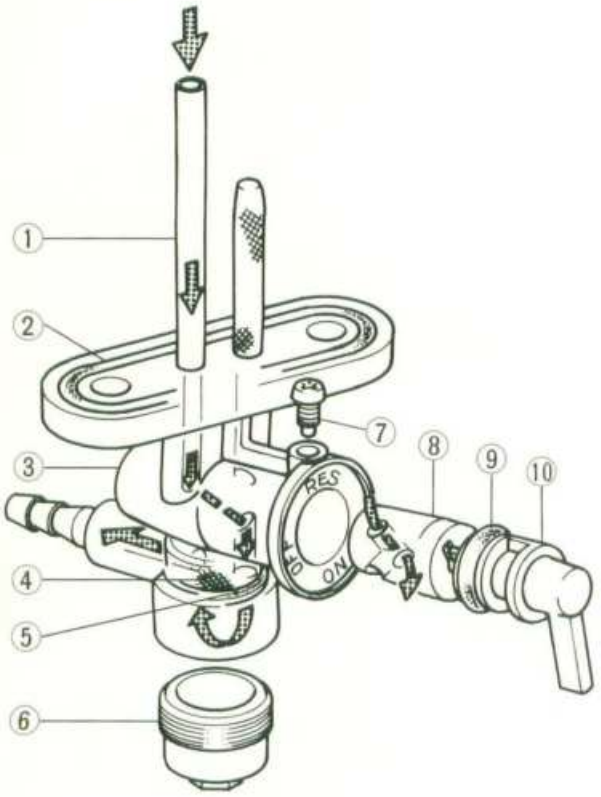
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FUEL TANK

The fuel tank capacity is 9.3 liters, 1.0 liter of which forms the reserve supply. A cap is attached to the top of the tank, and a fuel tap to the bottom. An air vent is provided in the cap to prevent an air lock, which would hinder fuel flow to the carburetor.

Fuel tap construction is shown in Fig. J1. The fuel tap has three positions: Off, On, and Reserve. With the tap in the "Off" position, no fuel will flow through the tap; with the tap in the "On" position, fuel flows through the tap by way of the main pipe until only the reserve supply is left in the tank; with the tap in the "Reserve" position, fuel flows through the tap from the bottom of the tank. The fuel tap contains a filter and a sediment cup to filter out dirt and collect water.

Fuel Tap J1



1. Main Pipe
2. Gasket
3. Fuel Tap Body
4. Filter
5. Gasket
6. Sediment Cup
7. Screw
8. Valve
9. Gasket
10. Lever

Inspection and cleaning

If fuel leaks from the tank cap or from around the fuel tap, the cap gasket or tap gasket may be damaged. Visually inspect these parts, and replace them if necessary.

Examine the air vent in the tank cap to see if it is obstructed. Use compressed air to clear an obstructed vent.

Periodically inspect and clean the fuel tap filter and the sediment cup, using a high flash-point solvent and a fine brush. If the filter is damaged, it must be replaced. If the sediment cup contains much water or dirt, the fuel tank and the carburetor may also need to be cleaned.

To clean out the fuel tank, disconnect the fuel hose, remove the fuel tap, and flush out the tank with a high flash-point solvent.

To drain the carburetor float bowl, remove the plug at the bottom of the carburetor. For thorough cleaning, remove and disassemble the carburetor (Pg. 40).

WHEELS

Wheel construction is shown in Fig. J2 and J3. The following sections, Pgs 156 ~ 161, cover the tires, rims, spokes, axles, wheel bearings, and grease seals. For the brakes, see Pgs. 163 ~ 166.

Tires

The tires are designed to provide good traction and power transmission during acceleration and braking even on bad surfaces. To do this, they must be inflated to the correct pressure and not overloaded. The maximum recommended load, in addition to vehicle weight, is 150 kg.

If the tires are inflated to too high a pressure, the ride is rough, the center portion of the tread wears quickly, and the tires are easily damaged.

If inflation pressure is too low, the shoulder portions wear quickly, the cord suffers damage, fuel consumption is high and handling is poor. In addition, heat builds up at high speeds, and tire life is greatly shortened.

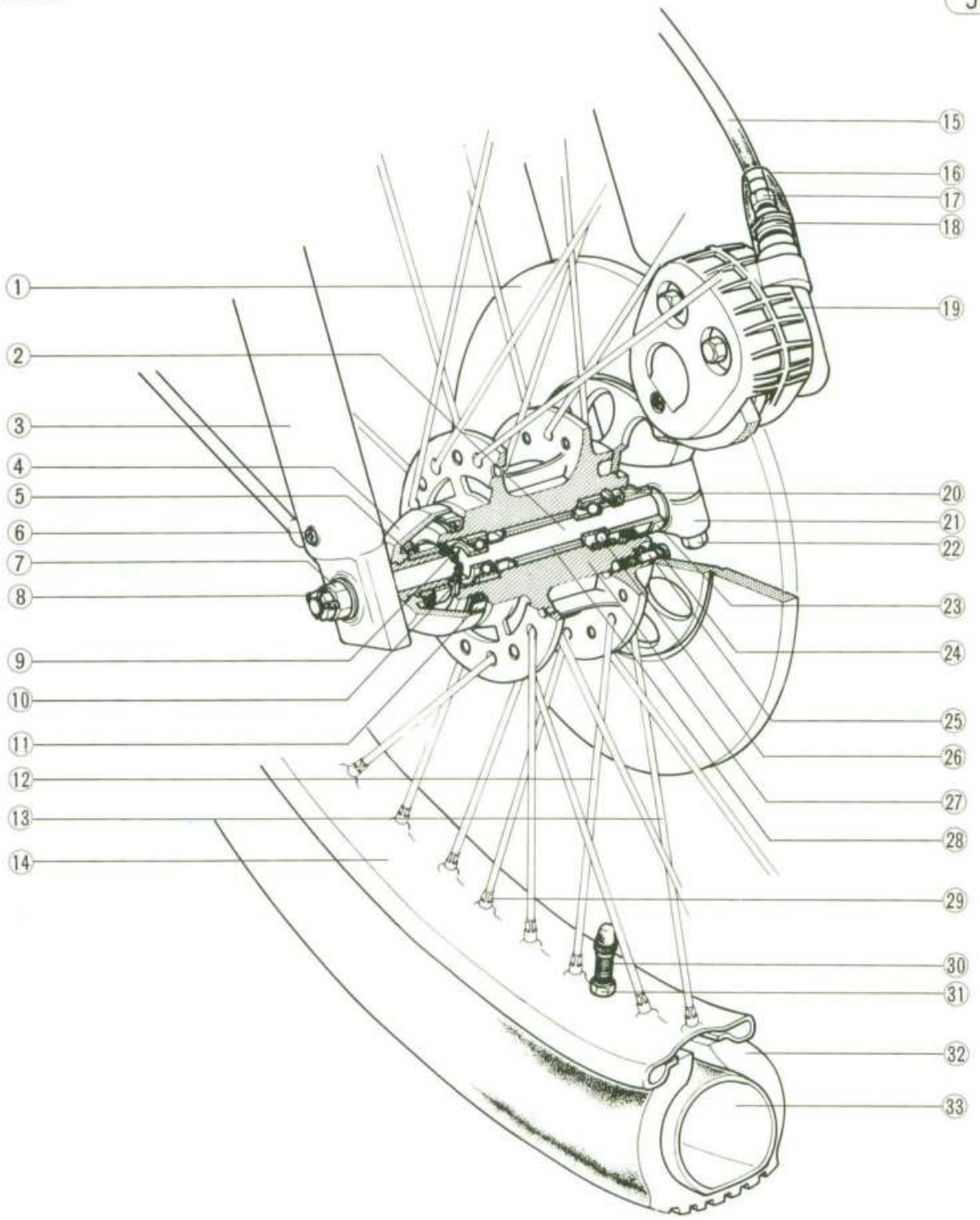
To ensure safe handling and stability, use only the recommended standard tires for replacement, inflating them to the standard pressure. A certain variation from the standard pressure may be desired depending on road surface conditions (rain, ice, rough surface, etc.).

Table J1 Tires, Air Pressure (measured when cold)

	Air Pressure		Size	Make, Type
Front	1.75 kg/cm² (25 psi)		2.75-18 4PR	Yokohama Y954
Rear	Up to 97.5 kg	2.0 kg/cm² (2.8 psi)	3.25-17 6PR	Yokohama Y955
	Over 97.5 kg	2.5 kg/cm² (36 psi)		

Front Wheel

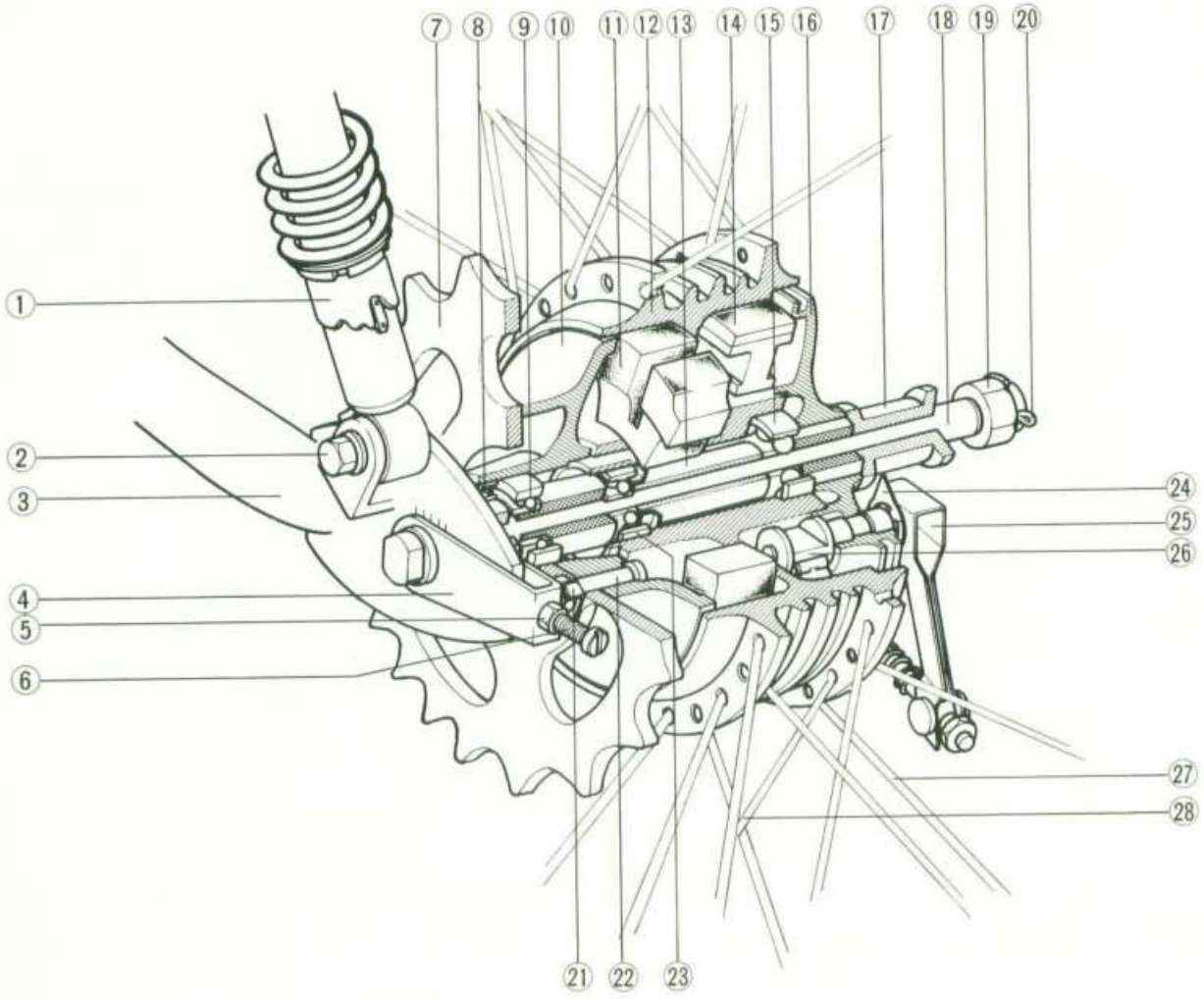
J2



1. Disc
2. Front Axle
3. Front Fork Leg
4. Speedometer Gear Housing
5. Speedometer Gear
6. Drain Screw
7. Front Axle Nut
8. Cotter Pin
9. Circlip
10. Washer
11. Grease Seal
12. Inner Spoke
13. Outer Spoke
14. Rim
15. Front Brake Cable
16. Dust Cover
17. Adjuster
18. Plug
19. Caliper
20. Grease Seal
21. Front Axle Clamp
22. Front Axle Clamp Nut
23. Collar
24. Double Washer
25. Disc Mounting Bolt
26. Ball Bearing
27. Front Hub
28. Distance Collar
29. Spoke Nipple
30. Valve Stem
31. Locknut
32. Tire
33. Tube

Rear Wheel

J3



1. Rear Shock Absorber
2. Mounting Bolt
3. Swing Arm
4. Chain Adjuster
5. Locknut
6. Adjusting Bolt
7. Rear Sprocket
8. Grease Seal
9. Ball Bearing
10. Wheel Coupling
11. Rubber Damper
12. Rear Hub
13. Distance Collar
14. Brake Shoe
15. Ball Bearing
16. Brake Panel
17. Spacer
18. Rear Axle
19. Rear Axle Nut
20. Cotter Pin
21. Double Washer
22. Rear Sprocket Bolt
23. Ball Bearing
24. Wear Indicator
25. Rear Brake Cam Lever
26. Rear Brake Camshaft
27. Outer Spoke
28. Inner Spoke

Tire wear, damage

Tires must not be used if they are getting bald, or if they are cut or otherwise damaged. As the tire tread wears down, the tire becomes more susceptible to puncture and failure. 90% of tire failures occur during the last 10% of tire life.

Visually inspect the tire for cracks and cuts, replacing the tire in case of bad damage. Remove any imbedded stones or other foreign particles from the tread. Swelling or high spots indicate internal damage, requiring tire replacement unless the damage to the fabric is very minor.

Measure the depth of the tread with a depth gauge, and replace the tire if the tread depth is less than the service limit.

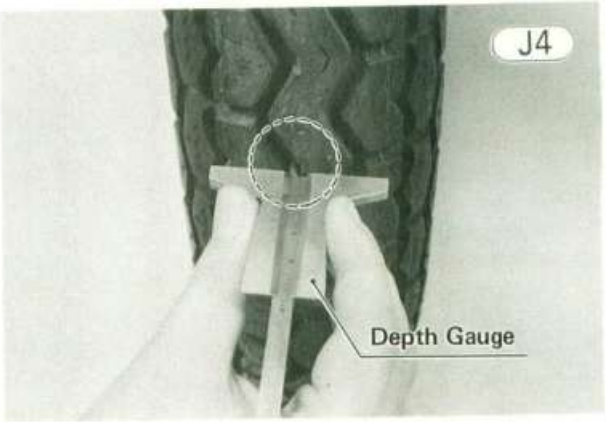


Table J2 Tire Tread Depth

	Standard	Service Limit
Front	4.9 mm	1 mm
Rear	6.8 mm	2 mm

Rim, Spokes

The rim of each wheel is made of steel and is connected to the hub by the spokes. A rim band around the outside center of the rim keeps the tube from coming into direct contact with the spoke nipples.

The spokes are connected to the hub at tangents and in different directions so that different spokes bear the brunt of the load under different conditions. With the spokes doing specialized work, the strength of the spokes can be used more effectively.

When the motorcycle is at rest (Fig. J6A), the spokes above the axle are stretched and tense, while the spokes below the axle are slightly loose and do not provide support. During acceleration (B), the spokes running to the hub in the direction of rotation are stretched, while during deceleration or braking (C), the spokes running to the hub opposite to the direction of rotation are the ones that are stretched. In both cases (B) and (C), the spokes that are not stretched (omitted from the diagram) are slightly loose and do not provide support. A damping of road shock is achieved by flexing of the spokes since they are arranged in this cross pattern instead of running straight from the hub to the rim.

Since the spokes must withstand this repeated stress, it is important to take sufficient care that the spokes are not allowed to loosen and that they are tightened evenly. Loose or unevenly tightened spokes cause the rim to warp, increase the possibility of spoke breakage, and hasten nipple and spoke metal fatigue.

NOTE: The rim size shown in Table J3 is the outer width and diameter, both in inches. The spoke size is diameter by length in millimeters. The two numbers for diameter size mean that each spoke has two diameters. To make the spoke more resistant to breakage the diameter is greater near the hub.

Spoke breakage

If any spoke breaks, it should be replaced immediately. A missing spoke places an additional load on the other spokes, which will eventually cause other spokes to break.

Periodically check that all the spokes are tightened evenly since they stretch a certain amount during use. Standard spoke tightened torque is 0.3 kg-m (26 in-lbs). Over or undertightening may cause breakage.

Rim runout

Set a dial gauge against the side of the rim, and rotate the wheel to measure axial runout. The difference between the highest and lowest dial readings is the amount of runout.

Set the dial gauge against the inner circumference of the rim, and rotate the wheel to measure radial runout. The difference between the highest and lowest dial readings is the amount of runout.

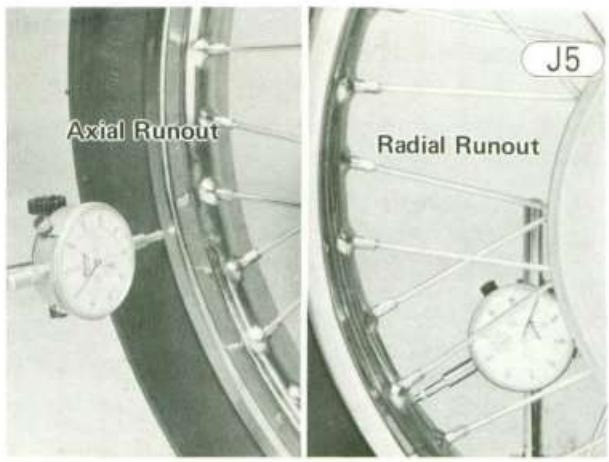


Table J3 Rim, Spoke Size

	Front		Rear	
	Inner	Outer	Inner	Outer
Spokes	#9 x #10 x 179.5 x 100°	#9 x #10 x 179 x 84°	#8 x #9 x 147.5 x 103°	#8 x #9 x 146.5 x 82°
Rim	1.60 x 18		1.85 x 17	

Spoke Force

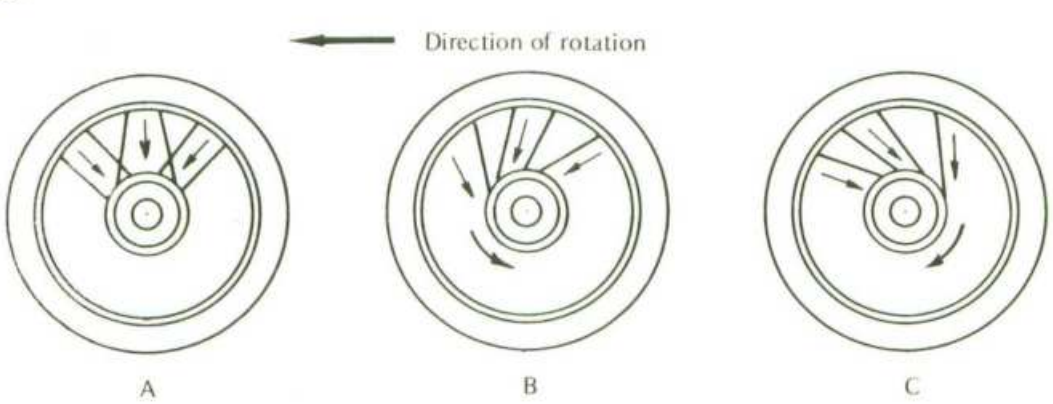


Table J4 Rim Runout

	Standard	Service Limit
Axial	under 0.5 mm	3 mm
Radial	under 0.8 mm	2 mm

A certain amount of rim warp (runout) can be corrected by recentering the rim. Loosen some spokes and tighten others to chagne the position of different parts of the rim. If the rim is badly bent, however, it should be replaced.

Axle

A bent axle causes vibration, poor handling, and instability.

To measure axle runout, remove the axle, place it in V blocks that are 100 mm apart, and set a dial gauge the axle at a point halfway between the blocks. Turn the axle to measure the runout. The amount of runout is the amount of dial variation.

If runout exceeds the service limit, straighten the axle or replace it. If the axle cannot be straightened to within tolerance, or if runout exceeds the repair limit, replace the axle.

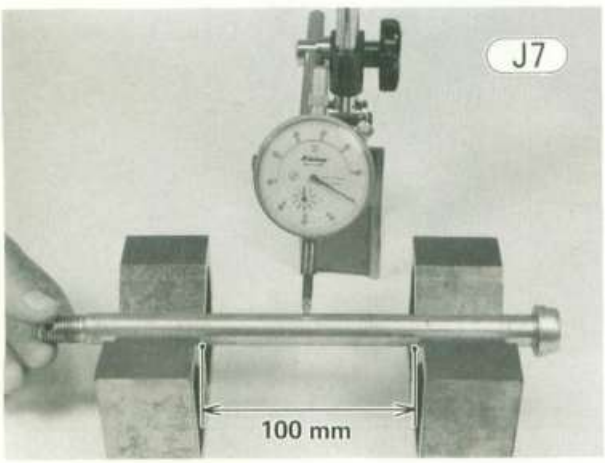


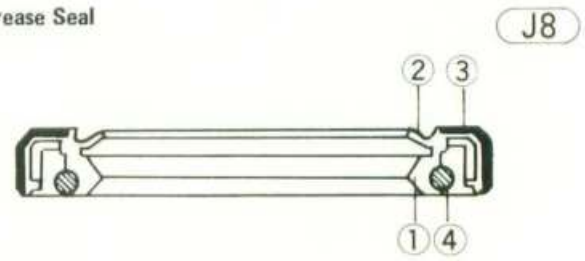
Table J5 Axle Runout/100 mm

Standard	Service Limit	Repair Limit
under 0.05 mm	0.2 mm	0.7 mm

Wheel Bearings, Grease Seals

A grease seal is fitted in the speedometer gear housing, in the left side of the front hub, and in the rear wheel coupling. Each grease seal is a rubber ring equipped with a steel band on its outer circumference. The grease seal inner lip is held against the axle collar by a wire spring band. Since the grease seal not only seals in the wheel bearing grease but also keeps dirt and moisture from entering the hub, the use of a damaged grease seal will cause the wheel bearing to wear quickly.

Grease Seal



1. Primary Lip
2. Secondary Lip
3. Metal Band
4. Wire Spring Band

A wheel bearing is fitted in both sides of each hub. Since worn wheel bearings will cause play in the wheel (resulting in vibration and instability), they should be cleaned, inspected, and greased periodically.

Inspection and lubrication

If the grease seals are examined without removing the seals themselves, look for discoloration (indicating the rubber has deteriorated), hardening, damage to the internal ribbing, or other damage. If the seal or internal ribbing has hardened, the clearance between the seal and the axle sleeve will not be taken up, which will allow dirt and moisture to enter and reach the bearing. If in doubt as to its condition and whenever the seal is removed for greasing the bearing, the seal should be replaced. The seals are generally damaged upon removal.

Since the wheel bearings are made to extremely close tolerances, the clearance cannot normally be measured. Wash the bearing with a high flash-point solvent, dry it (do not spin it while it is dry), and oil it. Spin it by hand to check its condition. If it is noisy, does not spin smoothly, or has any rough spots, it must be replaced. If the same bearing is to be used again, re-wash it with a high flash-point solvent, dry it, and pack it with good quality bearing grease before installation. Turn the bearing by hand a few times to make sure the grease is distributed uniformly inside the bearing, and wipe the old grease out of the hub before bearing installation. Clean and grease the wheel bearings and the front hub gear housing (speedometer gear) in accordance with the Periodic Maintenance Chart (Pg. 10).

Table J6 Grease Seals, Wheel Bearings

	Front Wheel			Rear Wheel		
	Hub Left	Hub Right	Speedometer Gear Housing	Coupling	Hub Left	Hub Right
Grease Seal	PJA223508	———	PJA425509	AJ264208	———	———
Bearing	#6202	#6202	———	#6004	#6202	#6302Z

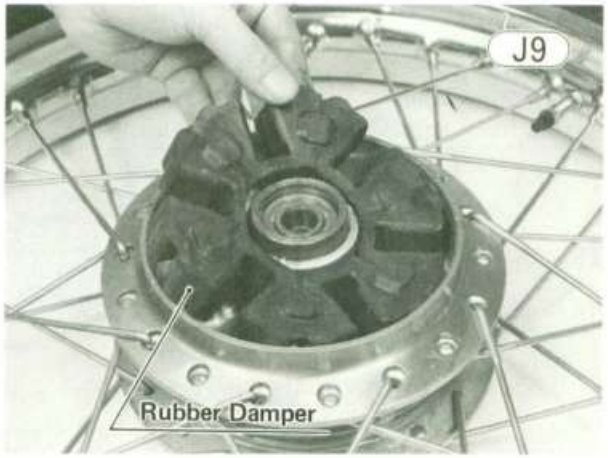
Rear wheel coupling

The rear wheel coupling connects the rear sprocket to the wheel. A rubber shock damper in the coupling absorbs some of the shock resulting from sudden changes in torque due to acceleration or braking.

Damper inspection

Remove the rear wheel coupling (Pg. 101), and inspect the rubber damper.

Replace the damper if it appears damaged or deteriorated.



DRIVE CHAIN

The drive chain is provided with a master link to facilitate removal and replacement. To minimize any chance of the master link dislodging, the master link clip is fitted with the closed end of the "U" pointed in the direction of the chain rotation; follow the replacement procedure given in the "Disassembly" section of this manual. When chain replacement is necessary, use only the standard chain (Table J7) for replacement.

Table J7 Drive Chain Specifications

Make	Standard	Service Limit
ENUMA	EK520SH-G	98-link

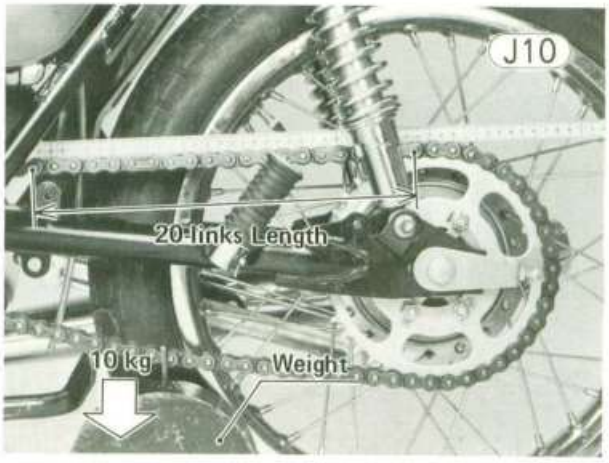
Chain construction is shown in Fig. J11. Most chain wear occurs between the pin and bushing and between the bushing and roller, rather than on the outside of the roller. This wear causes the chain to lengthen and invites noise, excessive wear, breakage and disengagement from the sprocket if the chain is left unadjusted. If the chain is allowed to wear too much, the chain pitch (i.e., the distance from one roller to the next) becomes much greater than the sprocket pitch, causing the chain to slide up and down the sprocket teeth and wear even faster.

The wear between the bushing and the roller, and between the pin and the bushing can be minimized by frequent and sufficient lubrication.

Wear

When the chain has worn so much that it is more than 2% longer than when new, it is no longer safe for use and should be replaced. Whenever the chain is replaced, inspect both the engine and rear sprockets and replace them if necessary. Overworn sprockets will cause a new chain to wear quickly. See page 162 ("Sprockets" section).

Since it is impractical to measure the entire length of the chain, determine the degree of wear by measuring a 20-link length of the chain. Stretch the chain taut either by using the chain adjuster, or by hanging a 10 kg weight on the chain. Measure the length of 20 links on a straight part of the chain from the center of the 1st pin to the center of the 21st pin. If the length is greater than the service limit, the chain should be replaced.



Drive Chain

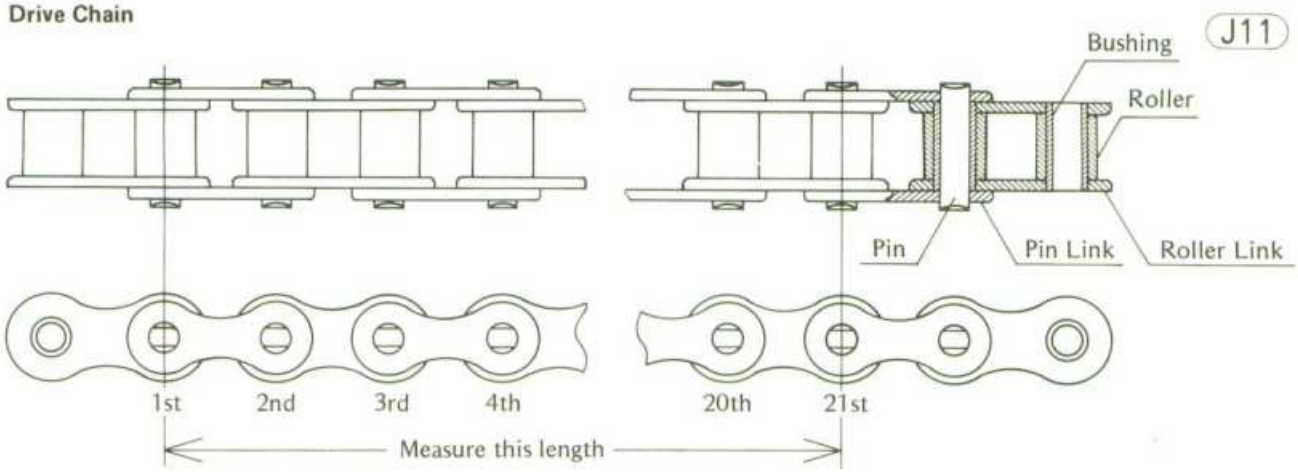


Table J8 Drive Chain Length

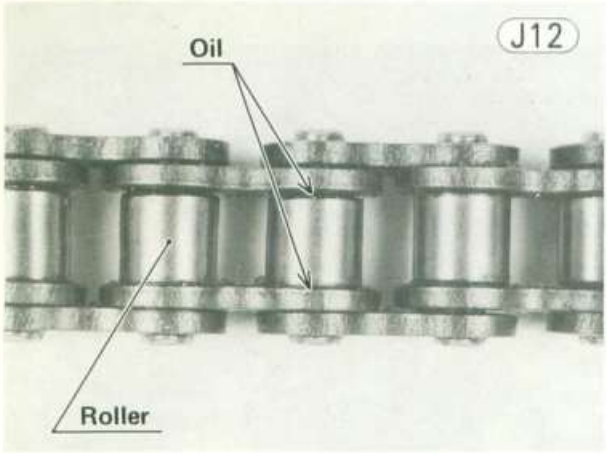
	Standard	Service Limit
20-link Length	317.5 mm	323 mm

NOTE: The drive system was designed for use with the standard chain. For maximum strength and safety, the standard chain must be used for replacement.

Lubrication

In order for the chain to function safely and wear slowly, it should be properly lubricated in accordance with the Periodic Maintenance Chart (Pg. 10). Lubrication is also necessary after riding through rain or on wet roads, or any time that the chain appears dry. Anytime that the motorcycle has been washed, the chain should be immediately lubricated in order to avoid rust.

The chain lubricant used should both prevent the exterior from rusting and also absorb and reduce friction in the interior of the chain. An effective, good quality lubricant specially formulated for chains is best for regular chain lubrication. If a special lubricant is not available, a heavy oil such as SAE 90 is preferred to a lighter oil because it will stay on the chain longer and provide better lubrication. Apply the oil to the sides of the rollers so that it will penetrate to the rollers and bushings. Wipe off any excess oil.



If the chain is especially dirty, it should be washed in Diesel oil or kerosene, and afterward soaked in a heavy oil. Shake the chain while it is in the oil so that oil will penetrate to the inside of each roller.

SPROCKETS

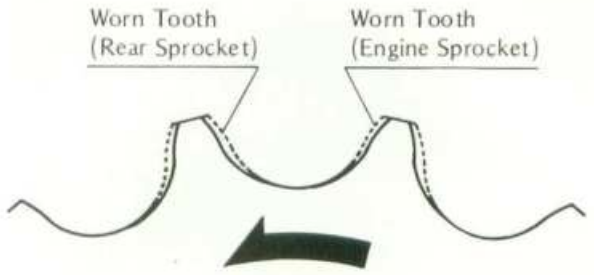
There are two sprockets for the drive chain. A forward sprocket, or engine sprocket, is mounted on the end of the output shaft and is used to drive the chain. A rear sprocket is connected to the rear wheel hub through the rear wheel coupling and is driven by the chain to turn the rear wheel.

Sprockets that have become excessively worn cause chain noise and greatly accelerate chain and sprocket wear. The sprockets should be checked for wear any time that the chain is replaced. A warped rear sprocket destroys chain alignment and may cause the chain to break or jump off the sprockets when traveling at high speed. The sprockets should be checked for wear and the rear sprocket for warp any time the chain is replaced.

Sprocket wear

Visually inspect the sprocket teeth. If they are worn as illustrated, replace the sprocket.

Sprocket Teeth J13



Measure the diameter of the sprocket at the base of the teeth. If the sprocket is worn down to less than the service limit, replace the sprocket.



Table J9 Sprocket Diameter

	Standard	Service Limit
Engine	65.58~65.78 mm	64.9 mm
Rear	186.47~186.97 mm	186.1 mm

NOTE: If a sprocket requires replacement, the chain is probably worn also. Upon replacing a sprocket, inspect the chain.

Rear sprocket warp

Elevate the rear wheel so that it will turn freely, and set a dial gauge against the rear sprocket near the teeth as shown in Fig. J15. Rotate the rear wheel.

The difference between the highest and lowest dial gauge readings is the amount of runout (warp).

If the runout exceeds the service limit, replace the rear sprocket.

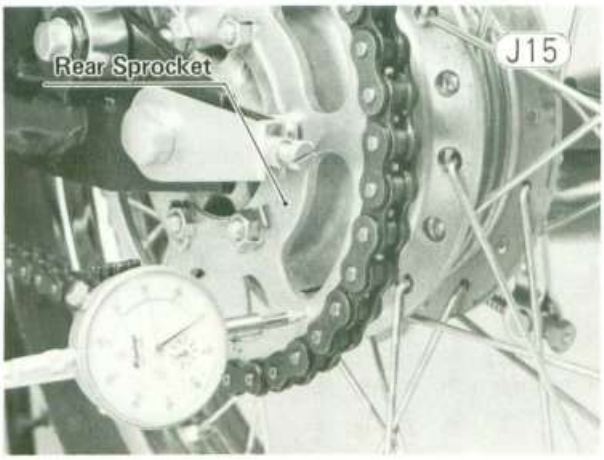


Table J10 Rear Sprocket Warp

Standard	Service Limit
under 0.5 mm	0.6 mm

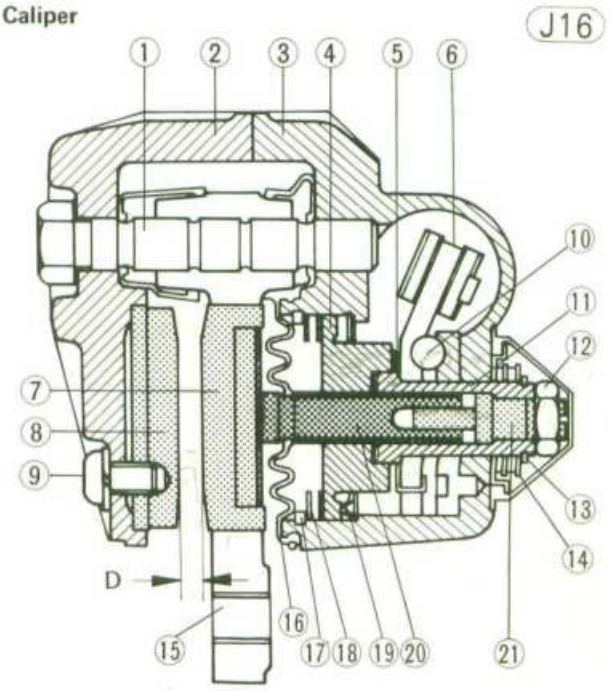
FRONT BRAKE

A mechanical disc brake is used on the front wheel. The major components of the disc brake are the brake lever, brake cable, caliper assembly, and disc. The force applied at the brake lever is transmitted through the brake cable to operate the caliper. The caliper grips the disc attached to the wheel, slowing wheel rotation. The brake lever operates the brake light switch mounted on the brake lever holder. The switch turns on the brake light.

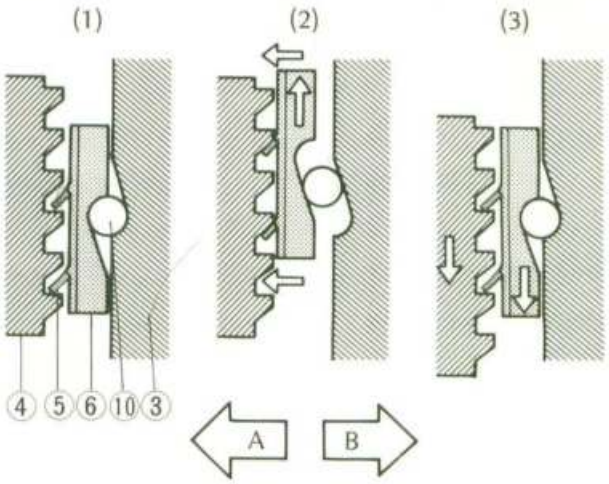
Unlike a drum-type brake, the components of the disc brake which perform the actual braking action, i.e., the disc and pads, are open to direct contact with the air flow past the motorcycle. This provides for excellent dissipation of the heat from the brake friction, and minimizes the possibility of brake fade common to drum brakes.

The caliper assembly includes pad A ⑦, pad B ⑧, and a push rod ⑳, which is inside the caliper body ③. Through the caliper run two shafts ①, which also pass through the caliper holder ⑮ to mount the caliper assembly to the left fork leg. When the brake is applied, the lever ⑥ turns and rides on the steel balls ⑩, moving in the direction "A" as shown. The lever pushes the sleeve ⑪, adjuster ④, and push rod to press pad A against the disc. When the push rod forces pad A against the disc, the shaft portion of the caliper assembly slides through the holder such that pad B is also forced against the disc, both brake pads being kept parallel to the disc.

Caliper



1. Caliper Holder Shaft
2. Caliper B
3. Caliper A
4. Adjuster
5. Ratchet
6. Lever
7. Pad A
8. Pad B
9. Mounting Screw
10. Steel Ball
11. Sleeve
12. Locknut
13. Circlip
14. Wave Washers
15. Caliper Holder
16. Dust Seal
17. Circlip
18. Wave Washers
19. Stop
20. Push Rod
21. Adjusting Screw



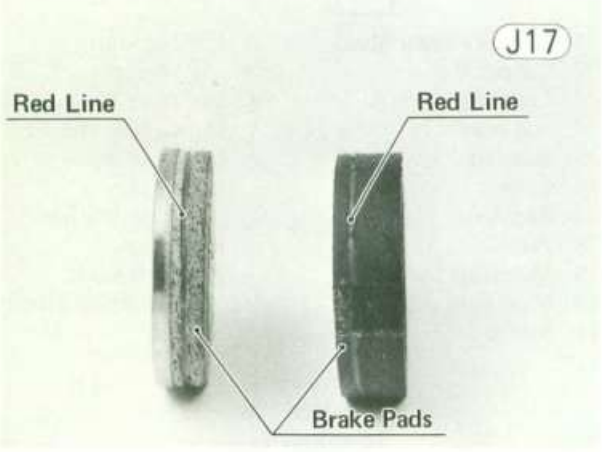
Automatic Wear Adjustment

The lever and push rod always turn together because the push rod is engaged with the adjusting screw mounted on the sleeve, and the sleeve is fitted in the lever. The adjuster is pressed against the stop ⑲ by the wave washers ⑱. The ratchet ⑤ mounted on the lever meshes the toothed side of the adjuster (insert #1), Fig. J16. When the brake pads wear off, the distance "D" in the Fig. J16 becomes greater and the lever must turn further to press the pads against the disc. As the adjuster does

not turn when the lever turns to move in the direction "A" (the brake is applied), the ratchet goes over the teeth of the adjuster (insert #2). When the lever turns to move in the direction "B" (the brake is released), the adjuster is turned together with the lever by the ratchet (insert #3). When the lever turns to move in the direction "A", the push rod turns but the adjuster does not. So the push rod turns in the adjuster, moving in the direction "A" slightly. When the lever turns to move in the direction "B", the adjuster and push rod turn together with the lever. Thus the push rod keeps its new position in the adjuster. This action takes up the excessive play which is caused by pad wear, and adjusts the brake pad wear automatically.

Brake pad wear

Inspect the pads for wear. If either pad is worn down through the red line, replace both pads as a set. If any grease or oil spills on the pads, wash it off with trichloroethylene or a high flash-point solvent. Do not use one which will leave an oily residue. If the oil cannot be thoroughly cleaned off, replace the pads.



Dust seal, O ring wear, damage

Check both seals and **O** rings, and replace any that are cracked, worn, swollen or otherwise damaged.

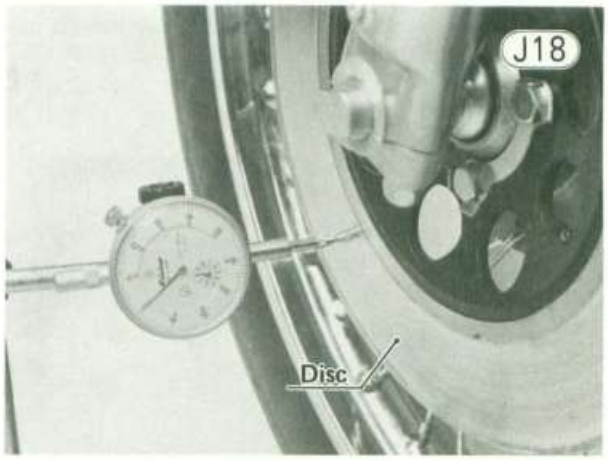
Disc wear, warp

Besides wearing down, the disc may warp. A warped disc will cause the brake pads to drag intermittently on the disc and wear down both the pads and disc quickly. Dragging will also cause overheating and poor braking efficiency. Poor braking can also be caused by oil on the disc. Oil on the disc must be cleaned off with trichloroethylene or a high flash-point solvent. Do not use one which will leave an oily residue.

Jack up the motorcycle so that the front wheel is off the ground, and turn the handlebar fully to one side. Set up a dial gauge against the front disc as illustrated and measure disc runout. If runout exceeds the service limit, replace the disc.

Table J11 Disc Runout

Standard	Service Limit
under 0.20 mm	0.3 mm



Measure the thickness of the disc at the point where it has worn the most. Replace the disc if it has worn past the service limit.

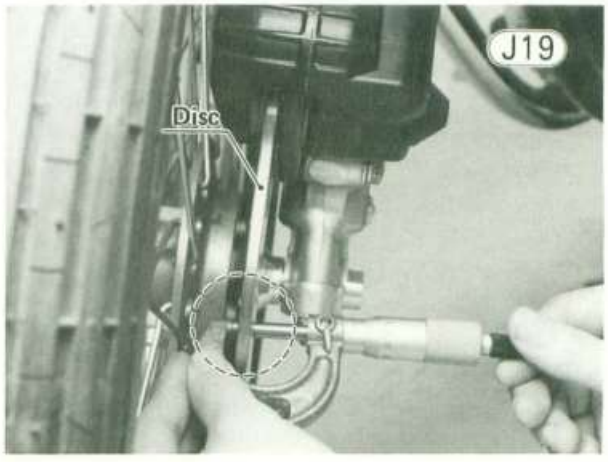


Table J12 Disc Thickness

Standard	Service Limit
4.9 ~ 5.1 mm	4 mm

Lubrication

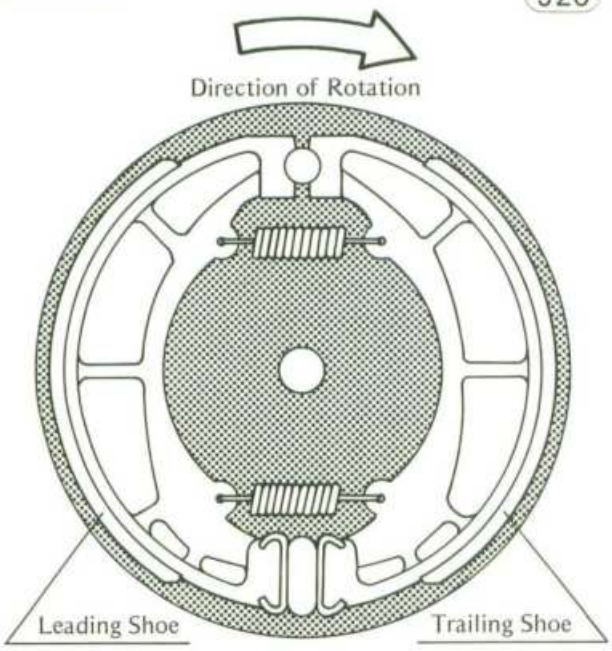
Every time that the front brake caliper is disassembled, and in accordance with the Periodic Maintenance Chart (Pg. 10), the caliper holder shafts and the end of the push rod must be relubricated.

Wipe out the old grease, and apply a thin coat of PBC (Poly Butyl Cuprysil) grease to the caliper holder shafts and the end of the push rod. (PBC grease is a special high-temperature, water-resistant grease.)

REAR BRAKE

The rear wheel is equipped with a leading-trailing type of drum brake. "Leading-trailing" means that one of the two brake shoes leads, expanding against the drum in the direction of drum rotation, and the other shoe trails, expanding in the direction opposite drum rotation.

Rear Brake J20



The force applied by the rider when braking is transmitted to the interior of the brake by a camshaft. The force applied at the brake pedal is transmitted by a rod to the cam lever which then turns the camshaft. When the camshaft rotates, the large portion of the cam is forced between the two brake shoes. Since the shoes are only held away from the drum by a spring, the cam overcomes spring tension and pushes the shoes outward against the drum. The leading shoe rotates in the direction "A" and the trailing shoe in the direction "B" as shown in the diagram.

The friction between the linings and the drum, which decelerates the motorcycle, gradually wears down the brake shoe linings. On the outside of the brake panel is a brake lining wear indicator, which, as the brake is applied, moves in direct proportion to the distance that the brake shoe linings move to reach the brake drum. As the linings wear down, the lining surface has farther to travel before reaching the drum. The indicator accordingly travels farther until it finally points just to the left of the "U" in USABLE when the lining wear has reached the service limit.

Due to wear of the brake drum, shoe linings, and cam, periodic brake adjustment is required. However, if the brake parts become overworn, adjustment will not be sufficient to ensure safe brake operation. Not only can overworn parts crack (drum) and otherwise suffer damage as they lose their braking effectiveness, but, if the cam wears to the point where it turns nearly horizontal when the brake is fully applied, the brake may lock in the applied position, or brake pedal return may be very sluggish. All brake parts should be checked for wear in accordance with the Periodic Maintenance Chart (Pg. 10).

Brake drum wear

Measure the inside diameter of the brake drum with calipers to determine wear. Since uneven drum wear will decrease braking effectiveness, take measurement at a minimum of two places. If the drum is worn unevenly or if it is scored, turn the drum down on a brake drum lathe or replace the hub with a new one. (Do not turn it down to the service limit, and do not turn it down if any diameter measurement exceeds the service limit). If any diameter measurement exceeds the service limit, replace the hub with a new one.



Table J13 Brake Drum Inside Diameter

Standard	Service Limit
130.000~130.160 mm	130.75 mm

Brake shoe lining wear

Check the thickness of the brake linings, and replace both shoes as a set if the thickness at any point is less than the service limit. If the thickness of the brake linings is sufficient, check the linings for uneven wear, and file or sand down any high spots. With a wire brush, remove any foreign particles imbedded in the lining surface. Wash off any oil or grease with a high flash-point solvent. Do not use one which will leave an oily residue. In case the linings are damaged or the surface cannot be restored by sanding and cleaning, the shoes must be repalced.

Brake Shoe Linings J22



Table J14 Brake Lining Thickness

Standard	Service Limit
3.95~4.15 mm	2 mm

Brake shoe spring tension

If the brake springs have stretched, they will not pull the shoes back away from the drum after the brake pedal is released, and the shoes will drag on the drum. Remove the springs, and check their free length with vernier calipers. If either is stretched beyond the service limit, replace both springs.

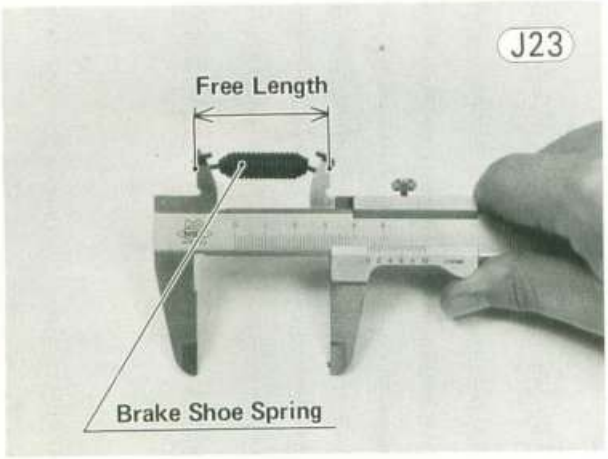


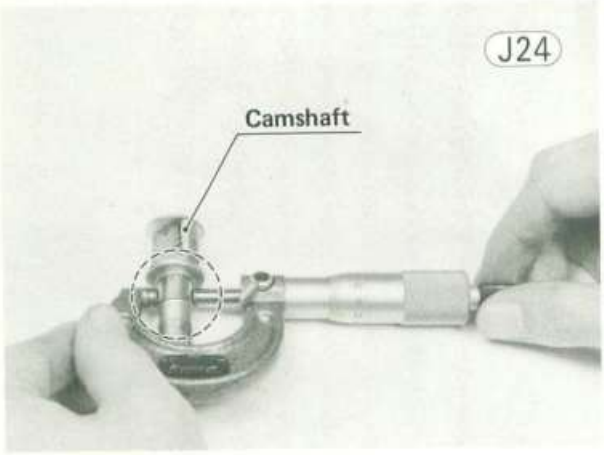
Table J15 Brake Spring Free Length

	Standard	Service Limit
Short	30.8 ~ 31.2 mm	32.5 mm
Long	44.5 ~ 45.5 mm	47.0 mm

Camshaft, shaft hole wear

Excessive shaft to hole clearance will increase camshaft play and reduce braking efficiency.

Measure the shaft diameter with a micrometer, and replace it if it is worn down to less than the service limit.



Measure the inside diameter of the camshaft hole, and replace the brake panel if the hole is worn past the service limit.

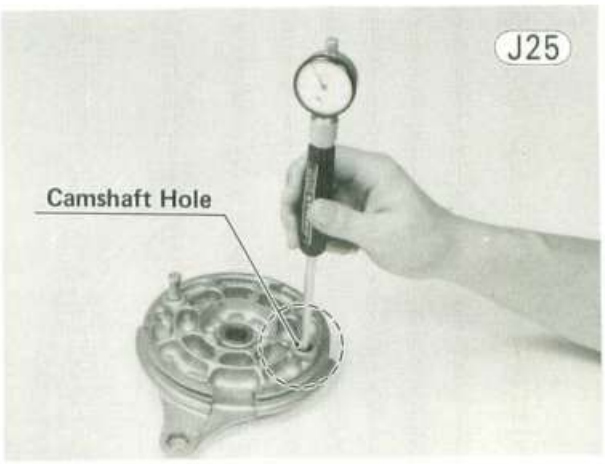


Table J16 Brake Camshaft, Hole Diameter

	Standard	Service Limit
Camshaft	11.957 ~ 11.984 mm	11.83 mm
Shaft Hole	12.000 ~ 12.027 mm	12.18 mm

Lubrication

Every time that the brake is disassembled, and in accordance with the Periodic Maintenance Chart (Pg. 10), wipe out the old grease, and re-grease the brake pivot points. Apply grease to the brake shoe anchor pin, spring ends, and cam surface of the camshaft, and fill the camshaft groove with grease. Do not get any grease on the brake shoe linings, and wipe off any excess grease so that it will not get on the linings or drum after brake assembly.



STEERING STEM

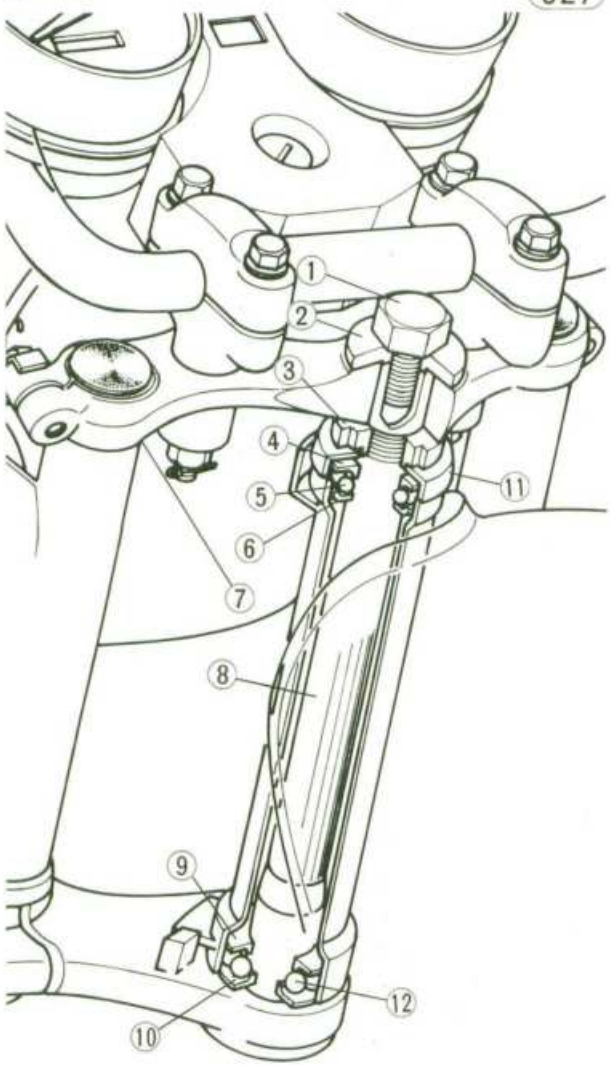
The steering stem supports the handlebar and front fork legs, and turns inside the frame head pipe. Ball bearings in the upper and lower ends of the head pipe enable the steering stem to turn smoothly and easily.

The steering stem itself does not wear, but it may become bent. If it becomes bent, the steering will be stiff, and the bearings may become damaged.

The steering stem will require periodic adjustment as it loosens due to bearing wear. Overtightening during adjustment, however, will make the steering stiff and cause accelerated bearing wear. Lack of proper lubrication will do the same.

Overtightening or a heavy shock to the steering stem may dent the bearing race surfaces. Damaged bearing races will cause the handlebar to jerk or catch when turned.

Steering J27



1. Stem Head Bolt
2. Flat Washer
3. Stem Locknut
4. Upper Inner Race
5. Steel Ball
6. Upper Outer Race
7. Stem Head
8. Steering Stem
9. Lower Outer Race
10. Lower Inner Race
11. Stem Cap
12. Steel Ball

Steering stem warp

Examine the steering stem, and replace it if it is bent.

Bearing wear, damage

Wipe the bearings clean of grease and dirt, and examine the races and balls. If the balls or races are worn, or if either race is dented, replace both races and all the balls for that bearing as a set.

Table J17 Bearing Ball Specifications

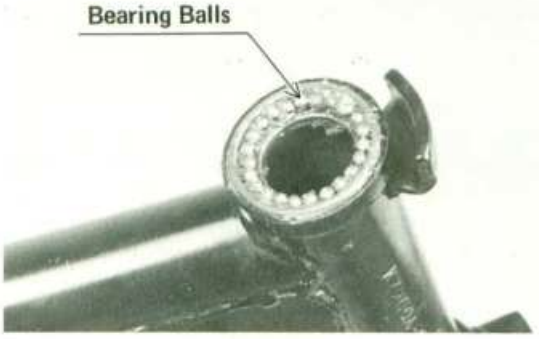
	Size	Quantity
Upper	3/16"	23
Lower	1/4"	19

Bearing lubrication

In accordance with the Periodic Maintenance Chart (Pg. 10), and whenever the steering stem is disassembled, the steering stem bearings should be relubricated.

Wipe all the old grease off the races and balls, washing them in a high flash-point solvent if necessary. Replace the bearing parts if they show wear or damage. Apply grease liberally to the upper and lower races, and stick the bearing balls in place with grease.

J28



Grease seal deterioration, damage

Inspect the grease seal for any signs of deterioration or damage, and replace it if necessary.

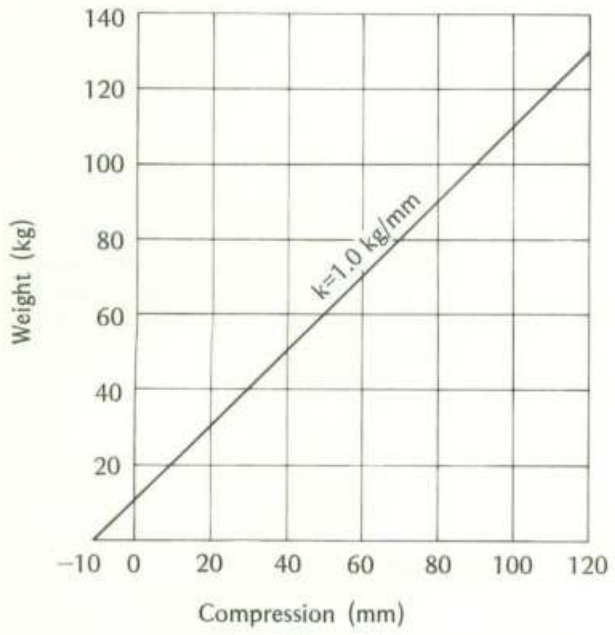
Replace the grease seal with a new one whenever it has been removed. The grease seal comes off whenever the lower bearing inner race is removed.

FRONT FORK

Front fork construction is shown in Fig. J30 and Fig. J31. It consists of two fork legs connected to the frame head pipe by the stem base and stem head bracket. It accomplishes shock absorption through spring action, air compression in the inner tube, and resistance to the flow of the oil forced into the cylinder by tube movement.

Each fork leg is a telescopic tube including an inner tube ⑤, outer tube ⑫, piston and cylinder unit ⑥, collar ⑪, and cylinder base ⑬. The inner tube fits into the outer tube, altering its position in the outer tube as the tube arrangement absorbs shocks. The cylinder is fixed to the bottom of the outer tube and the piston (equipped with a piston ring ④) is secured to the top of the cylinder.

Front Fork Spring Force J29



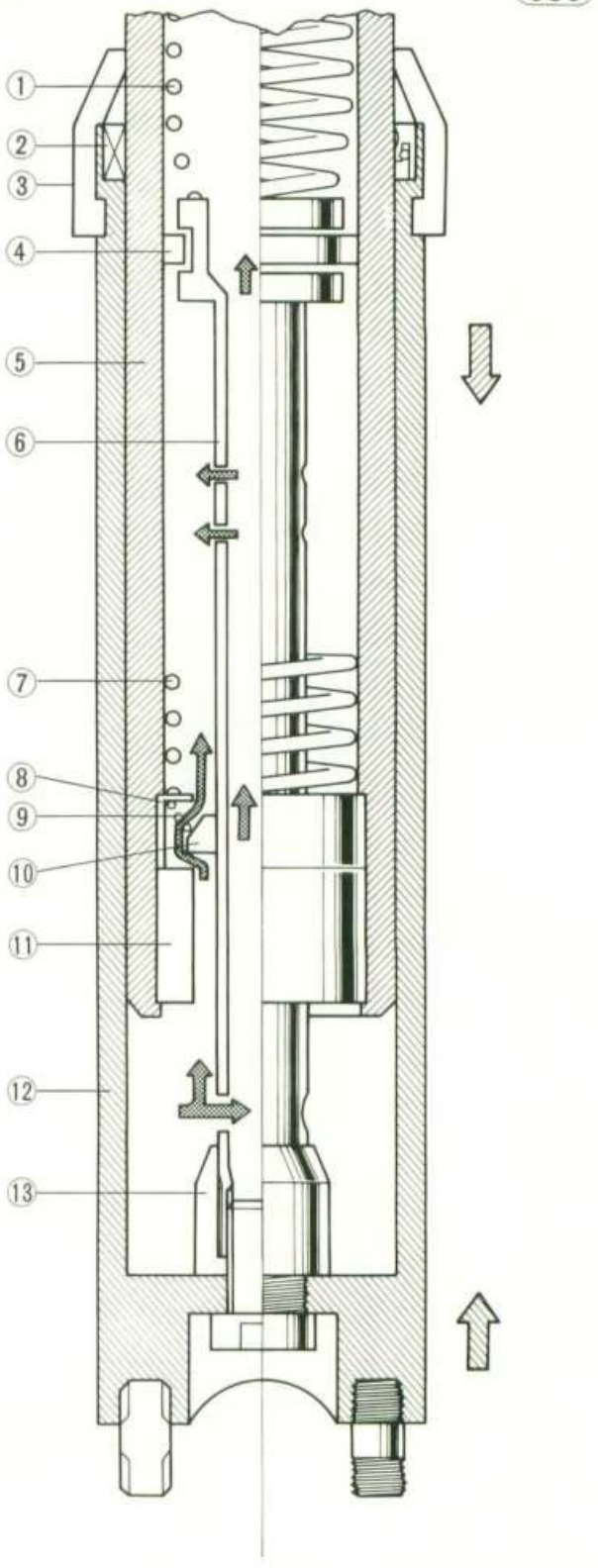
The collar (coupled with a non-return valve ⑩), fixed in the lower end of the inner tube, forms the upper part of the lower chamber and, together with the piston, helps seal the upper chamber. The collar and cylinder base configuration function to form an oil lock at the end of the compression stroke to prevent the inner tube from striking the bottom. Small orifices in the upper part of the cylinder cause an oil lock at the end of the extension stroke to prevent the inner tube from striking the top.

Oil is prevented from leaking out by the oil seal ②, which is fitted at the upper end of the outer tube. A dust seal ③ on the outside of the tube keeps dirt and water from entering and damaging the oil seal and tube surface.

Compression Stroke

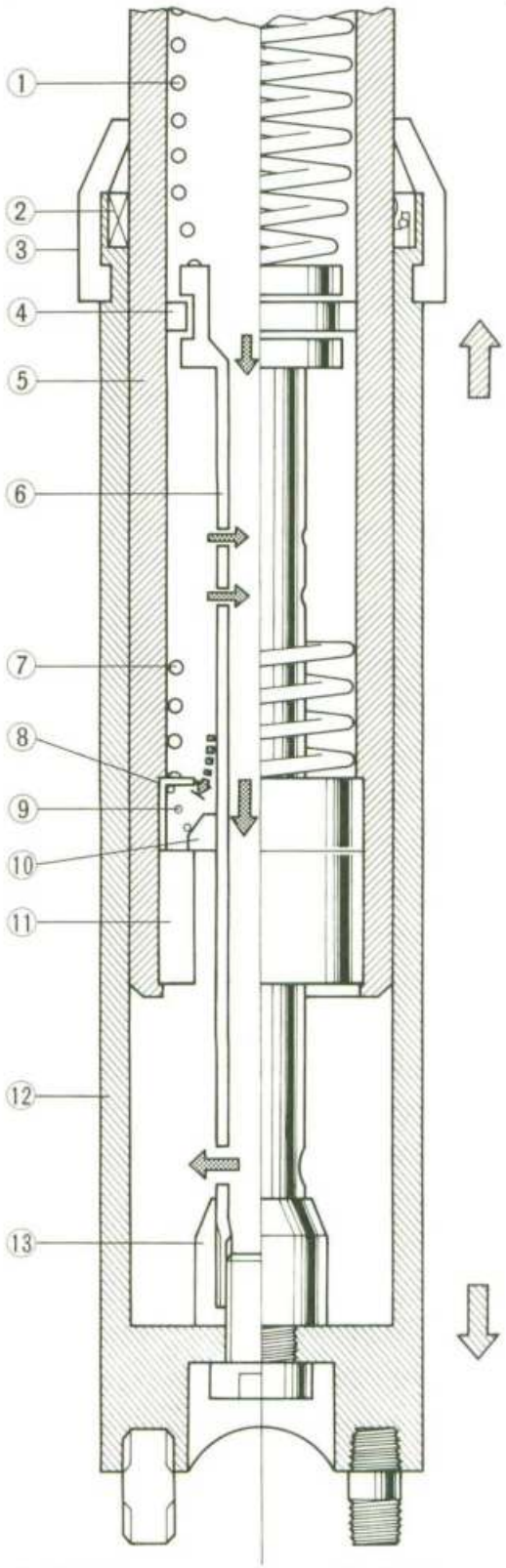
Whenever a load is placed on the front fork and whenever the front wheel receives a shock, the inner tube ⑤ moves down inside the outer tube ⑫, or the outer tube moves up, compressing both the spring ① and the air in the inner tube. At the same time, low pressure (suction) is created in an enlarging chamber (upper chamber) formed between the inner tube and the cylinder ⑥, and oil is drawn in from a diminishing chamber (lower chamber) formed between the outer tube and the cylinder. As the lower chamber shrinks in size with oil passing freely through the non-return valve ⑩ into the upper chamber, oil also passes freely through the cylinder lower orifices into the cylinder as the inner tube approaches the cylinder base ⑬. Near the end of the compression stroke, the clearance between the tapered-out cylinder base and the collar at the lower end of the inner tube approaches zero. The resulting resistance to the flow of oil through this small space slows the movement, finally forming an oil lock to finish the compression stroke.

Compression Stroke J30



1. Spring
2. Oil Seal
3. Dust Seal
4. Piston Ring
5. Inner Tube
6. Cylinder and Piston Unit
7. Spring
8. Spring Seat
9. Spring
10. Non-return Valve
11. Collar
12. Outer Tube
13. Cylinder Base

Extension Stroke (J31)



1. Spring
2. Oil Seal
3. Dust Seal
4. Piston Ring
5. Inner Tube
6. Cylinder and Piston Unit
7. Spring
8. Spring Seat
9. Spring
10. Non-return Valve
11. Collar
12. Outer Tube
13. Cylinder Base

Extension Stroke

Following the compression stroke is the extension stroke, in which the compressed spring extends to push the inner tube back out of the outer tube. As the tubes move apart, the upper chamber grows smaller, forcing the oil through the cylinder upper orifices since the oil cannot return the way it came through the non-return valve. These small holes restrict the oil flow into the inner tube, damping fork extension. Near the end of the extension stroke both the cylinder spring and the arrangement of the cylinder upper orifices provide further resistance to extension. As the collar rises, reducing the size of the upper chamber the cylinder upper orifices are eliminated and an oil lock forms, finishing the extension stroke.

Either too much or too little oil in the fork legs will adversely affect shock damping. Too much oil or too heavy an oil makes the action too stiff; too little oil or too light an oil makes the action soft, decreases damping potential, and may cause noise during fork movement.

Contaminated or deteriorated oil will also affect shock damping and, in addition, will accelerate internal wear. The fork oil should be changed periodically (Pg. 10) or sooner if the oil appears dirty.

A bent, dented, scored, or otherwise damaged inner tube will damage the oil seal, causing oil leakage. A badly bent inner tube may cause poor handling.

Fork oil

To check the fork oil level, first place a jack or stand under the engine so that the front wheel is raised off the ground. Remove the top plug from the inner tube. Insert a rod down into the tube, and measure the distance from the top of the inner tube to the oil level. If the oil is below the correct level, add enough oil to bring it up to the proper level, taking care not to overfill.



To drain the old oil, remove the drain screw from the lower end of the outer tube. With the front wheel on the ground and the front brake fully applied push down on the handlebar a few times to pump out the oil.

Install the drain screw, remove the top plug from the inner tube, and pour in the type and amount of oil specified in Table J18. Check the oil level, and install the top plug. If the oil is below the specified level, add oil and recheck the oil level.

NOTE: After the front fork oil is changed, but before checking the oil level, pump the forks several times to expel the air from the upper and lower chambers.

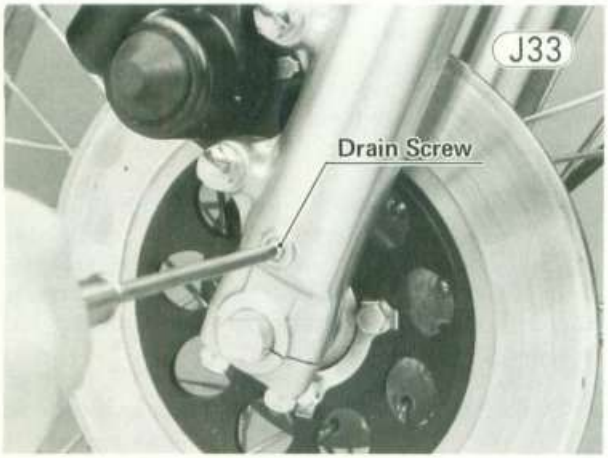


Table J18 Fork Oil

Type	Filling fork oil capacity		Oil level
	When changing oil	After disassembly and completely dry	
SAE 5W 20	about 135 cc	145~155 cc	345 mm from top of inner tube

Spring tension

Since the spring becomes shorter as it weakens, check its free length to determine its condition. If the spring of either fork leg is shorter than the service limit, it must be replaced. If the length of a replacement spring and that of the remaining spring vary greatly, the remaining spring should also be replaced in order to keep the fork legs balanced for motorcycle stability.

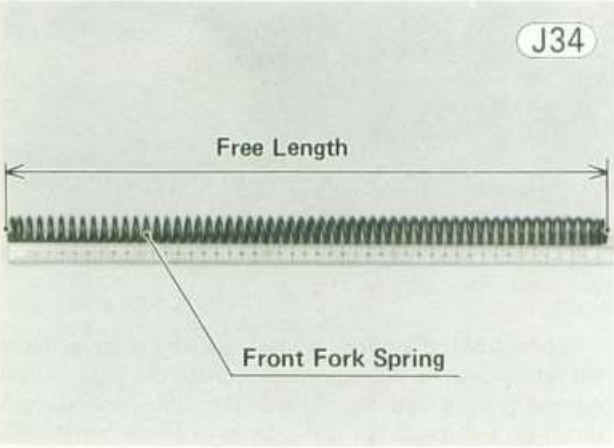


Table J19 Fork Spring Free Length

Standard	Service Limit
470 mm	460 mm

Inner tube damage

Visually inspect the inner tube, and repair any damage. If the damage is not repairable, replace the inner tube. Since damage to the inner tube damages the oil seal, replace the oil seal whenever the inner tube is repaired or replaced. Temporarily assemble the inner and outertubes, and pump them back and forth manually to check for smooth operation.

CAUTION **If the inner tube is bent or badly creased, replace it. Excessive bending, followed by subsequent straightening, can weaken the inner tube.**

REAR SHOCK ABSORBERS

The rear shock absorbers serve to damp shocks transmitted to the frame and rider from the rear wheel. For this purpose, they are connected between the frame and the rear end of the swing arm. Shock absorption is performed by the spring and by the resistance to the flow of oil inside each unit. Shock absorption is further aided by the use of rubber bushings in both the upper and lower shock absorber mountings.

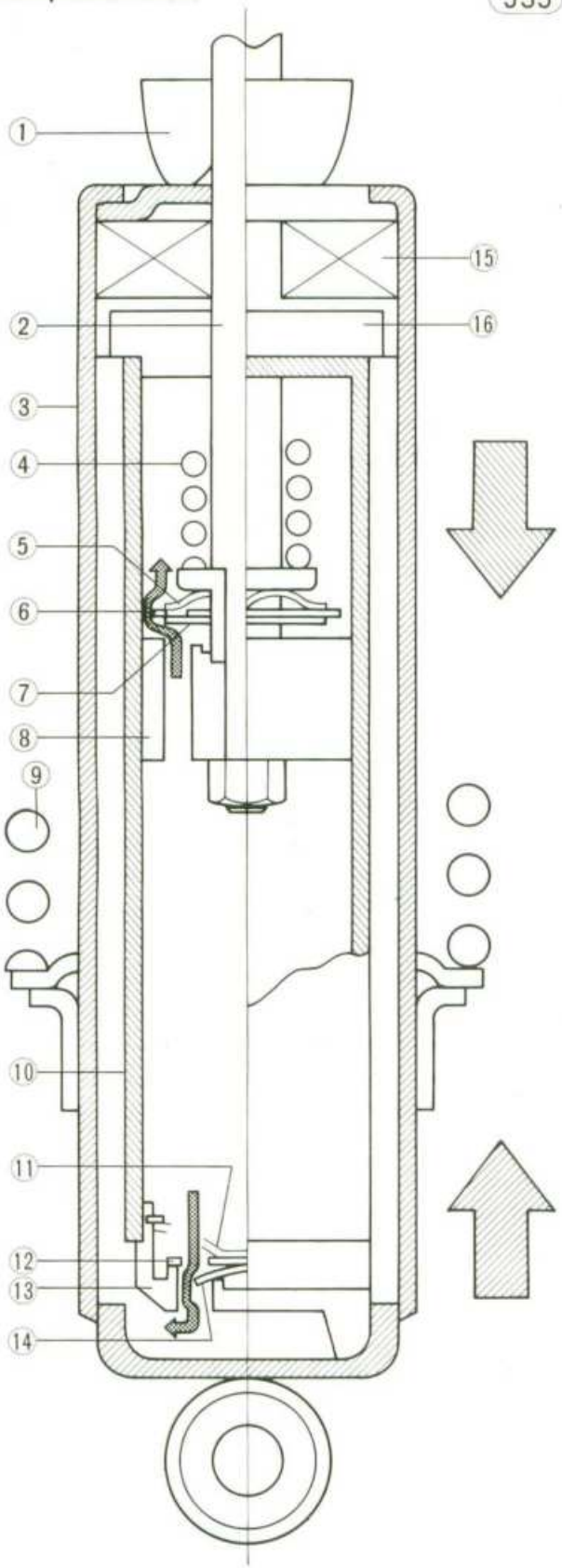
Each shock absorber is a telescopic tube including an outer shell ③, cylinder ⑩, piston ⑧, piston rod ②, and cylinder base ⑬. The piston rod and piston fit into the cylinder, altering their position in the cylinder as the shock absorber arrangement absorbs shocks. The cylinder is fixed in the outer shell and the cylinder base (equipped with a base valve ⑫) is secured to the lower end of the cylinder. The piston (equipped with a piston valve ⑥) fixed to the lower end of the piston rod, forms the lower part of the upper chamber, and together with the cylinder base, forms the lower chamber.

Oil is prevented from leaking out by the oil seal ⑮, which is fitted at the upper end of the outer shell.

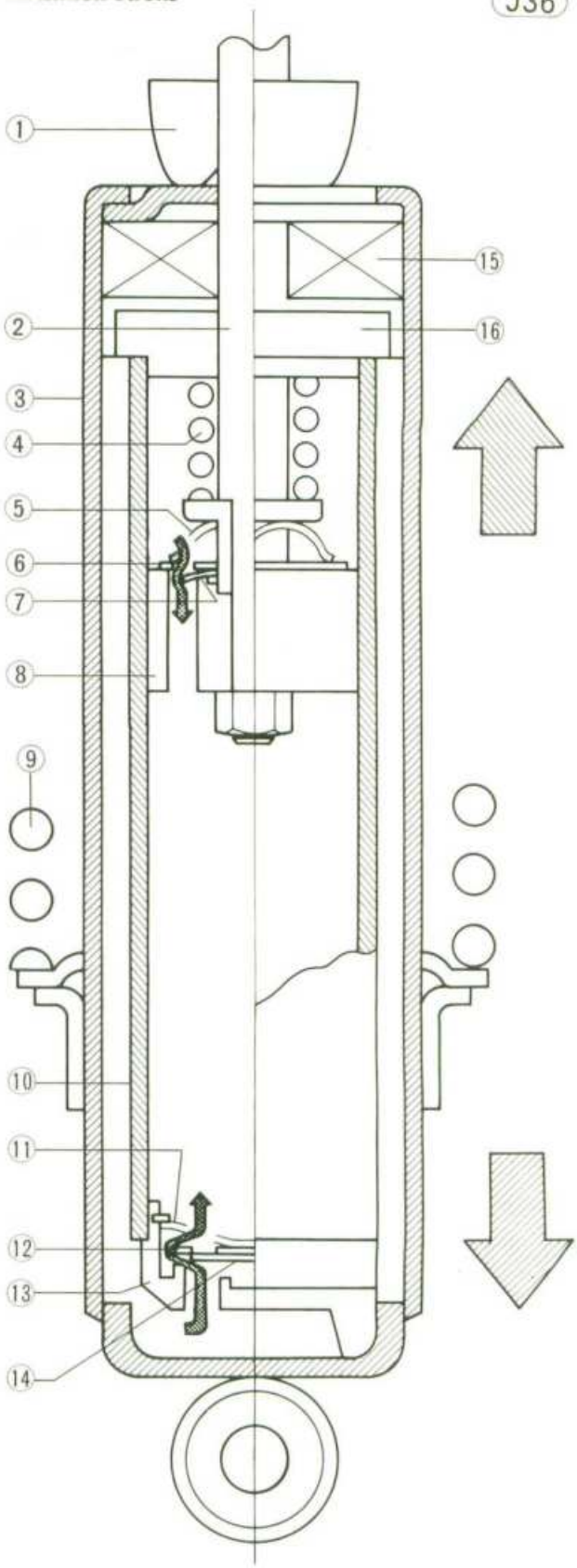
Compression Stroke

Whenever a load is placed on the rear shock absorber and whenever the rear wheel receives a shock, the piston rod ② moves down inside the cylinder ⑩ with the piston ⑧, compressing both the spring ⑨ and the air between the outer shell ③ and cylinder. At the same time, low pressure (suction) is created in an upper chamber and high pressure (compression) is created in lower chamber. The oil flows through the piston orifices, pushes up the piston valve ⑥ held down by the spring ⑤, and enters the upper chamber. A small amount of oil also flows through the openings of the base valve ⑫, pushes down the spring valve ⑭, and enters the space between the cylinder and the outer shell ③. The resulting resistance to the flow of oil through the small spaces slows the downward movement. The compression stroke is terminated when the top end of the outer shell strikes the rubber stop ① at the top end of the piston rod.

Compression Stroke J35



Extension Stroke J36



1. Rubber Stop
2. Piston Rod
3. Outer Shell
4. Spring
5. Spring
6. Piston Valve
7. Spring Valve
8. Piston
9. Spring
10. Cylinder
11. Spring
12. Base Valve
13. Cylinder Base
14. Spring Valve
15. Oil Seal
16. Stop

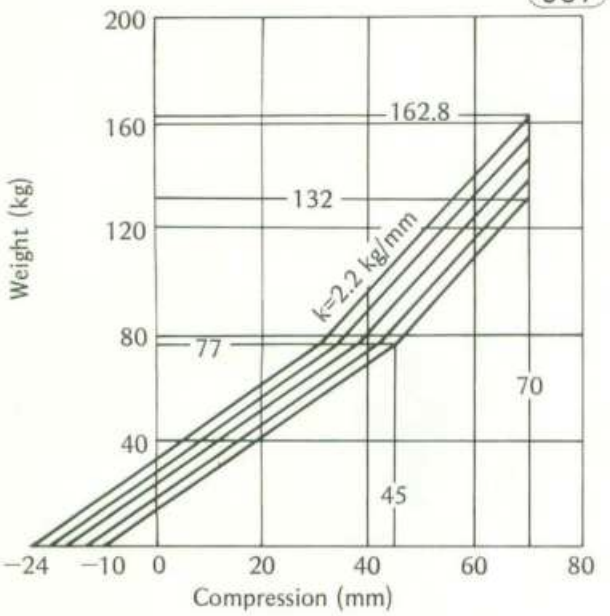
Extension Stroke

Following the compression stroke is the extension stroke, in which the piston rod is pushed back out by the compressed spring. As the piston rod moves upward, the upper chamber grows smaller, the oil pushes down the spring valve, and enters the lower chamber. At the same time, the oil in the space between the outer shell and the cylinder also flows through the cylinder base orifices, pushes up the base valve held down by the spring, and enters the lower chamber. These small spaces restrict the oil flow into the lower chamber, damping the spring extension. The extension stroke is completed when the spring ④ hits the stop ⑯ at the top of the cylinder.

Since the rear shock absorbers are sealed units which cannot be disassembled, only external checks of operation are necessary. With the shocks removed, compress each one and see that the compression stroke is smooth and that there is damping in addition to spring resistance on compression. When the unit is released, the spring should not suddenly snap it to full length. It should extend smoothly with notable damping. When the shock absorber is operated, there should be no oil leakage. If either shock absorber does not perform all of these operations satisfactorily, or if one unit feels weaker than the other, replace both shock absorbers as a set. If only one unit is replaced and the two are not balanced, motorcycle instability at high speeds may result.

Shock absorber spring force for the 5 different settings is shown in Fig. J37.

J37



Bushings

Check the rubber bushings, and replace any that are worn, cracked, hardened, or otherwise damaged.

SWING ARM

The swing arm is designed to work with the shock absorbers to damp the shocks to the frame from the rear wheel. The rear of the swing arm is connected to the frame by the rear shock absorbers, while the front end pivots on a shaft connected to the frame. When the rear wheel receives a shock, the swing arm, pivoting on its shaft, allows the wheel to move up and down in relation to the frame within the limits of the shock absorbers.

Wear takes place where the swing arm bushing and bushes rub together. If wear has progressed such that the swing arm has become loose, the motorcycle will be unstable. To minimize wear, the swing arm should be kept properly lubricated.

A bent pivot shaft or twisted swing arm will also cause instability by throwing the rear wheel out of alignment. A bent pivot shaft may also cause bushing and bush seizure.

Swing arm bushing, bush wear

Measure the outside diameter of the swing arm bushing at both ends with a micrometer. Replace a swing arm bushing if the diameter is less than the service limit or if it shows visible damage.

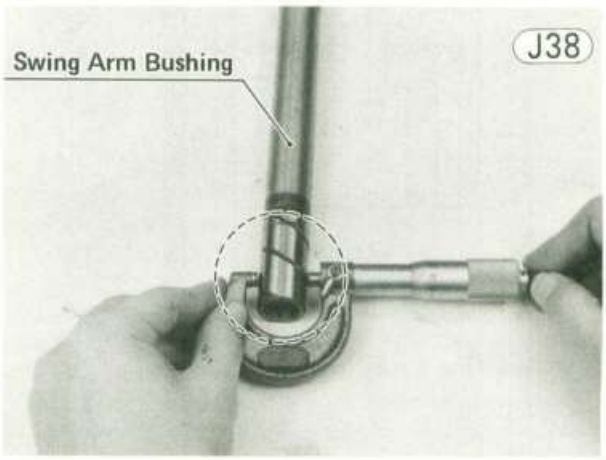
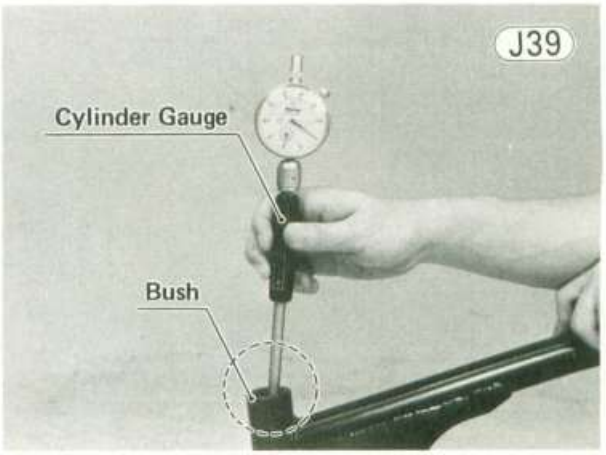


Table J20 Bushing Outside Diameter

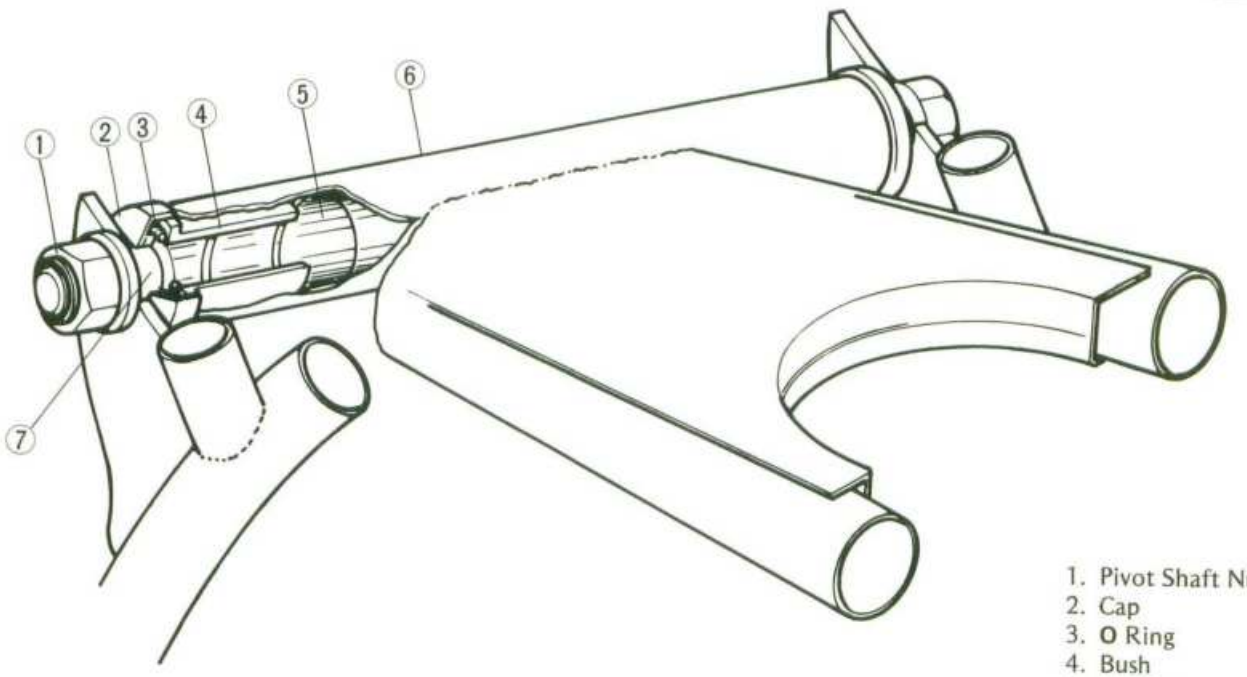
Standard	Service Limit
21.979~22.000 mm	21.95 mm

Measure the inside diameter of each bush with a cylinder gauge. Replace both bushes if the diameter of either exceeds the service limit. Also, replace both bushes if either shows visible damage.



Swing Arm

J40



1. Pivot Shaft Nut
2. Cap
3. O Ring
4. Bush
5. Bushing
6. Swing Arm
7. Pivot Shaft

Table J21 Bush Inside Diameter

Standard	Service Limit
22.030~22.063 mm	22.26 mm

Pivot shaft

Check whether or not the pivot shaft is bent by placing it in two V blocks set 100 mm apart, setting a dial gauge on the shaft halfway between the blocks and turning the shaft to get a variation in the dial gauge reading. If the shaft runout exceeds the service limit, straighten it. If it cannot be straightened, or if the runout exceeds the repair limit, replace the shaft.

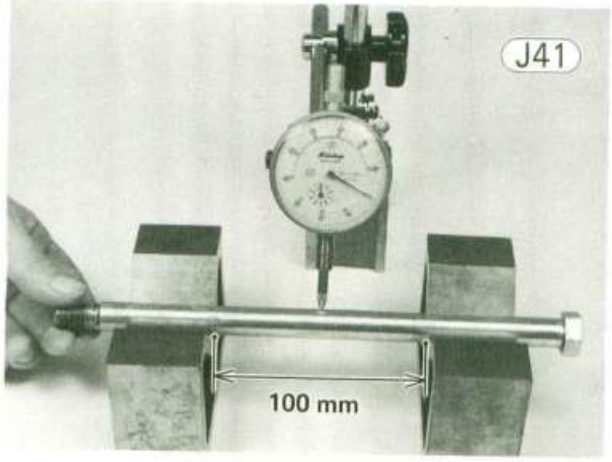


Table J22 Pivot Shaft Runout/100 mm

Standard	Service Limit	Repair Limit
under 0.1 mm	0.2 mm	0.7 mm

Swing arm lubrication

In order for the swing arm to function safely and wear slowly, it should be properly lubricated in accordance with the Periodic Maintenance Chart (Pg. 10). Lubrication is also necessary after disassembly.

Wipe the old grease off the swing arm bushing, and apply fresh grease, especially in each bushing groove as shown in Fig. G96.

Maintenance – Electrical

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BATTERY

The battery supplies the current to the starter motor and serves as a back-up source of power to operate the electrical equipment whenever the engine is turning over too slowly for the dynamo to supply sufficient power.

With proper care, the battery can be expected to last several years, but it may be completely ruined long before that if it is mistreated. Following a few simple rules will greatly extend the life of the battery.

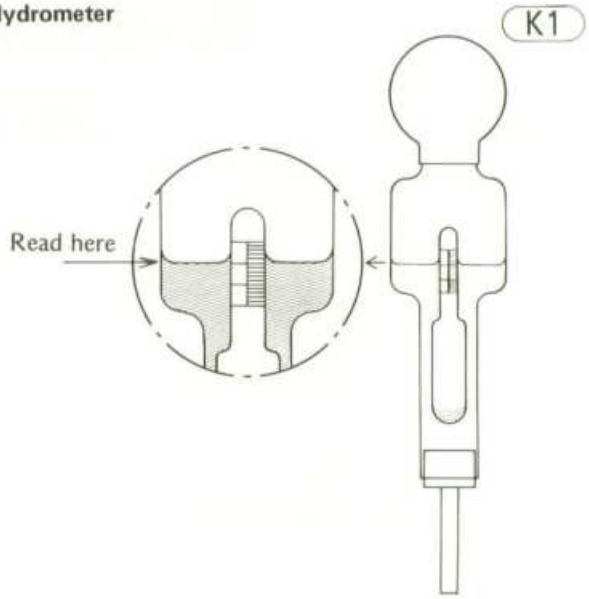
1. When the level of the electrolyte in the battery is low, add only distilled water to each cell, until the level is at the upper level line marked on the outside of the battery. Ordinary tap water is not a substitute for distilled water and will shoten the life of the battery.
2. Never add sulphuric acid solution to the battery. This will make the electrolyte solution too strong and will ruin the battery within a very short time.
3. Avoid quick-charging the battery. A quick-charge will damage the battery plates.
4. Never let a good battery stand for more than 30 days without giving it a supplemental charge, and never let a discharged battery stand without charging it. If a battery stands for any length of time, it slowly self-discharges. Once it is discharged, the plates sulphate (turn white), and the battery will no longer take a charge.
5. Keep the battery well-charged during cold weather so that the electrolyte does not freeze and crack open the battery. The more discharged the battery becomes, the more easily it freezes.
6. Always keep the battery vent hose free of obstruction, and make sure it does not get pinched, crimped, or melted shut by contact with the hot muffler. If battery gases cannot escape through this hose, they will explode the battery.
7. DON'T INSTALL THE BATTERY BACKWARDS. The negative side is grounded.

Electrolyte

The electrolyte is dilute sulphuric acid. The standard specific gravity of the electrolyte used in warm climates in a fully charged battery is 1.260 at 20°C (68°F). (In particularly cold regions a solution with a standard specific gravity of 1.280 is used). The water in this solution changes to a gaseous mixture due to chemical action in the battery and escapes, which concentrates the acid in a charged battery. Consequently, when the level of the electrolyte becomes low, only distilled water should be added. If sulphuric acid is added, the solution will become too strong for proper chemical action and will damage the plates. Metal from the damaged plates collects in the bottom of the battery. This sediment will eventually cause an internal short circuit.

The specific gravity of the electrolyte is measured with a hydrometer and is the most accurate indication of the condition of the battery. When using the hydrometer, read the electrolyte level at the bottom of the menicus (curved surface of the fluid). Fig. K1 shows the relationship between the specific gravity of the solution at 20°C (68°F) and the percentage of battery charge. Since specific gravity varies with temperature, and since the temperature of the solution being checked is likely to be other than 20°C (68°F); the formula given below should be used to compute the equivalent specific gravity for any temperature. When the temperature goes up, the specific gravity goes down, and vice versa.

Hydrometer K1



○Celsius

$S_{20}=S_t + [0.007\ (t-20)]$

○Fahrenheit

$S_{68}=S_t + [0.004\ (t-68)]$

S_t=specific gravity at the present temperature

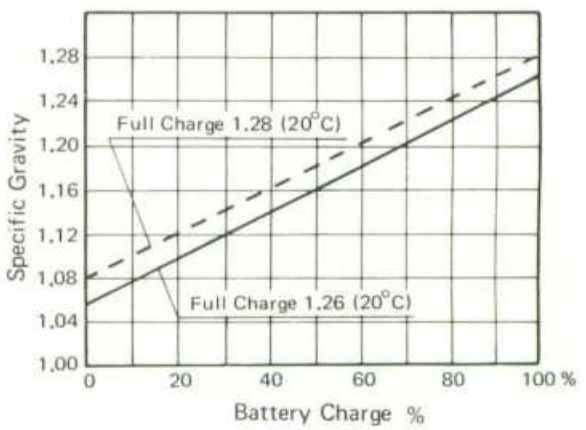
S_{20}=specific gravity at 20°C

S_{68}=specific gravity at 68°F

t=present temperature of solution

Generally speaking, a battery should be charged if a specific gravity reading shows it to be discharged to 50% or less of fuel charge.

Specific Gravity/Battery Charge Relationship K2



Initial charge

New batteries for Kawasaki motorcycles are dry charged and can be used directly after adding the electrolyte. However, the effect of the dry charge deteriorates somewhat during storage, especially if any air has entered the battery from imperfect sealing. Therefore, it is best to give the battery an initial charge before using it in order to ensure long battery life.

WARNING **Because the battery gives off an explosive gas mixture of hydrogen and oxygen, keep any sparks or open flame away from the battery during charging.**

- Pour a 1.260 (specific gravity at 20°C or 68°F) sulphuric acid solution into each cell of the battery up to the upper level line.
- Let the battery stand for 30 minutes, adding more acid if the level drops during this time.

NOTES: 1. If the temperature of the solution is over 30°C (85°F) cool the solution before pouring it into the battery.

2. After pouring the acid into the battery, start charging the battery within 12 hours.

- Leaving the caps off the cells, connect the battery to a charger, set the charging rate at 1/10 the battery capacity, and charge it for 10 hours. For example, if the battery is rated at 10AH, the charging rate would be 1 ampere. If a constant voltage charger is used, the voltage must be adjusted periodically to keep the current at a constant value.

CAUTION **If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to bring down the temperature, and increase the charging time proportionately.**

- After charging, check the electrolyte level in each cell. If the level has dropped, add distilled water to bring it back up to the upper level line.
- Check the results of charging by measuring the specific gravity of each cell and by measuring battery voltage. Battery voltage of a 12 volt battery directly after the completion of charging should be 15 to 16 volts.

Ordinary charge

WARNING **Because the battery gives off an explosive gas mixture of hydrogen and oxygen, keep any sparks or open flame away from the battery during charging.**

- Clean off the battery using a solution of baking soda and water. Make especially sure that the terminals are clean.
- If the electrolyte level is low in any cell, fill to over the lower level line but not up to the upper level line since the level rises during charging. Figure the charging rate to be between 1/10 and 3/10 of battery capacity. For example, the maximum charging rate for a 10AH battery would be 3/10 x 10 which equals 3 amperes.
- Measure the specific gravity of the electrolyte, and use the graph, Fig. K2, to determine the percentage of discharge. Multiply the capacity of the battery by the percentage of discharge to find the amount of discharge in ampere-hours. Use this figure in the formula below to compute charging time.

$$\text{Charging (hours)} = \frac{\text{Amount of discharge (AH)}}{\text{charging current (A)}} \times 1.2 \sim 1.5$$

- Remove the caps from all the cells, and begin charging the battery at the rate just calculated. If a constant voltage charger is used, the voltage will have to be adjusted periodically to maintain charging current at a constant value.

CAUTION **If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to bring down the temperature, and increase charging time proportionately.**

- After charging, check the electrolyte level in each cell. If the level has dropped, add distilled water to bring it back up to the upper level line.
- Check charging results by measuring the specific gravity of each cell and by measuring battery voltage. Battery voltage of a 12 volt battery directly after the completion of charging should be 15 to 16 volts. If the voltage is lower than this, the battery is not completely charged or can no longer take a full charge.

Test charging

When the battery is suspected of being defective, first inspect the points noted in the Table below. The battery can be restored by charging it with the ordinary charge. If it will take a charge so that the voltage and specific gravity come up to normal, it may be considered good except in the following case:

★ If the voltage suddenly jumps to over 13 volts just after the start of charging, the plates are probably sulphated. A good battery will rise to 12 volts immediately and then gradually go up to 12.5 ~ 13 volts in about 30 to 60 minutes after charging is started.

★ If one cell produces no gas bubbles, or has a very low specific gravity, it is probably shorted.

Table K1 Battery Troubleshooting Guide

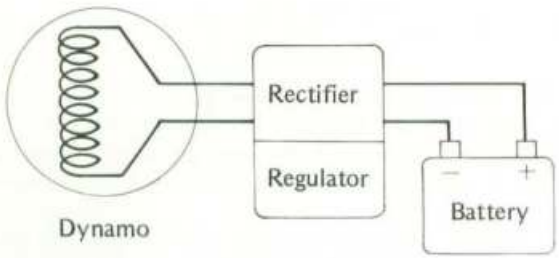
	Good Battery	Suspect Battery	Action
Plates	(+) chocolate color (–) gray	white (sulphated); + plates broken or corroded	Replace
Sediment	none, or small amount	sediment up to plates, causing short	Replace
Voltage	above 12 volts	below 12 volts	Test charge
Electrolyte Level	above plates	below top of plates	Fill and test charge
Specific Gravity	above 1.200 in all cells; no two cells more than 0.020 different	below 1.100, or difference of more than 0.020 between two cells	Test charge

CHARGING SYSTEM

The charging system consists of a dynamo (an alternator) and regulator/rectifier.

The dynamo generates the current required by the electrical circuits. The generated current is a single phase alternating current (AC), which is changed to direct current (DC) and by a controlled regulator/rectifier unit to supply an even voltage to the circuit components.

Charging System K3



There are a number of important precautions that are musts when servicing the charging system. Cautions that are applied to the individual sections are mentioned each section. Failure to observe these rules can result in serious system damage. Learn and observe all the rules in each section.

When there are any problem indications in the charging system, give the system a quick initial inspection or check before starting a series of time consuming tests, or worse yet, removing parts for repair or replacement. Such a check will often turn up the source of the trouble.

Make sure all connectors in the circuit are clean and tight. Examine wires for signs of burning, fraying, etc. Poor wires and bad connections will affect electrical system operation. Check the dynamo and regulator/rectifier for evidence of physical damage.

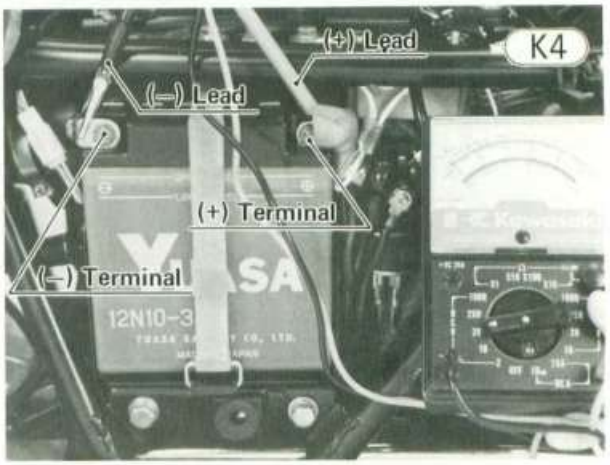
A worn out or badly sulphated battery will produce numerous problems that cannot be corrected until the battery is replaced. ALWAYS CHECK BATTERY CONDITION BEFORE CONDEMNING OTHER PARTS OF THE SYSTEM. A FULLY CHARGED BATTERY IS A MUST FOR CONDUCTING ACCURATE SYSTEMS TESTS.

Charging system malfunctions can be traced to either the battery, dynamo, regulator/rectifier, or the wiring. Troubles may involve one unit or in some cases, all units. Never replace a defective unit without determining what CAUSED the failure. If the failure was brought on by some other unit or units, they too must be repaired or replaced, or the new replacement will soon fail.

Charging voltage test

Before making this test, check the condition of the battery (Pg. 176). If the battery voltage is less than 12 volts, charge the battery. Before starting the charging voltage test warm up the engine to obtain actual dynamo operating conditions.

- Remove the left side cover.
- Set the multimeter to the 20V DC range, and connect the meter + lead to the battery + terminal and the meter – lead to the battery – terminal.



- Start the engine, and run the engine at the rpm in Table K2. Note the voltage reading.

Table K2 Charging Voltage

Meter	Reading @4,000 rpm
20V DC	about 14.5 V

- If the reading is more than 16V, the regulator/rectifier is defective, and should be replaced with a new one. If the reading is less than 14V, check the dynamo output and regulator/rectifier (Pg. 179) to determine which part is defective.

Dynamo

The dynamo, fundamentally a singe phase A.C. generator, can be divided up into a moving part called the flywheel ④, which is taper fitted to one end of the crankshaft ⑤, and a stationary part called the armature ③, which is located inside the flywheel and fixed to the inside of the left engine cover ①. The flywheel is die cast with 6 permanent magnets evenly spaced in its circumference and arranged as 3 north-south sets to generate in the armature a current with 3 cycles per flywheel revolution.

Dynamo output test

If the battery, and regulator/rectifier are good but there is low voltage or insufficient charging current, the dynamo may be defective. A defective dynamo is due to either an electrical short or open in the armature. Either an electrical short or open will result in a low output or no output at all. Before starting dynamo output test warm up the engine to obtain actual dynamo operating conditions.

- Start the engine, and disconnect the 3-pin connector from the dynamo. Set the multimeter to the 250 VAC, and connect the meter leads to the yellow leads.



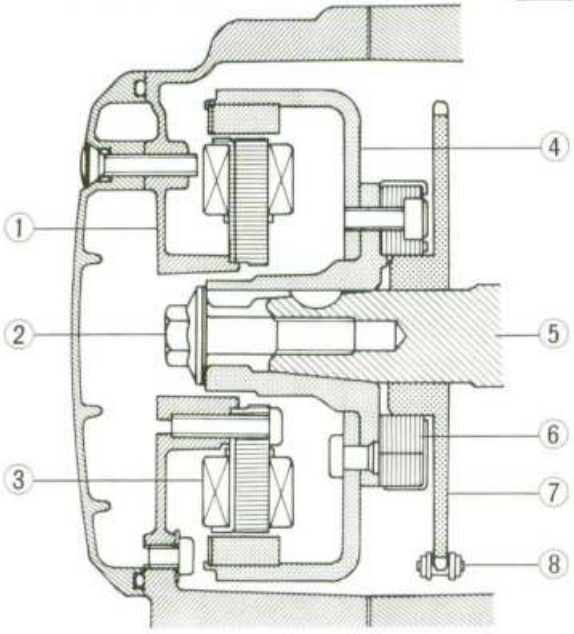


•Run the engine at the rpm in Table K3, and note the reading of voltage. A much lower reading indicates that the dynamo is defective.

Table K3 Dynamo Output

Meter	Reading @4,000 rpm
250V AC	about 60V

Dynamo Construction K6



1. Left Engine Cover
2. Flywheel Bolt
3. Dynamo Armature
4. Dynamo Flywheel
5. Crankshaft
6. Starter Clutch
7. Starter Clutch Sprocket
8. Starter Chain

Armature resistance check

•Disconnect the 3-pin connector from the dynamo.

•Set the multimeter to the R x 1Ω range, and measure for continuity between the yellow leads. If there is more resistance than shown in Table K4, or no meter reading, the armature has an open and must be replaced.

Table K4 Armature Resistance

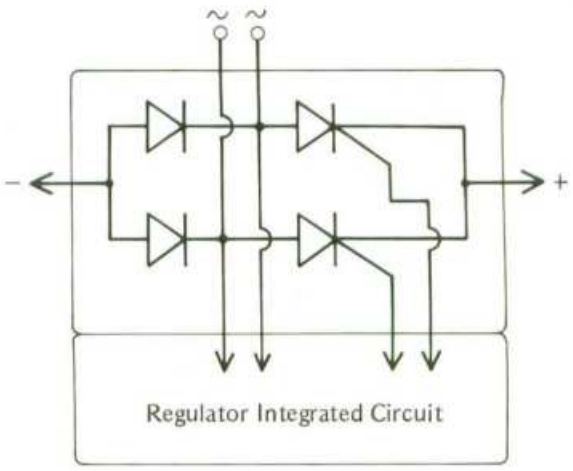
Meter	Reading
R x 1	0.4 ~ 0.5 Ω

•Using the highest resistance range of the multimeter, measure the resistance between each of the yellow leads and chassis ground. Any meter reading indicates a short, necessitating armature replacement.

Regulator/Rectifier

This motorcycle has a regulator and rectifier as a unit. The regulator/rectifier functions cannot be checked separately because it is a solid-state type, and must be replaced as a unit should it become defective.

Regulator/Rectifier K8



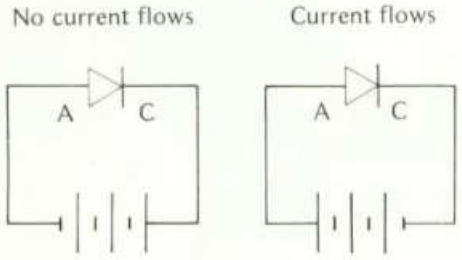
The rectifier is used to change the alternating current (AC) from the dynamo to direct current (DC) for the battery charging, ignition, lighting, and other circuits. It contains two silicon diodes and thyristors. The diodes and thyristors are connected in a bridge circuit arrangement for efficient, full-wave rectification.

1. Diode

The current of electrons flows only from the – to the + side of the diode. However, a defective diode will conduct in both directions (a short) or not conduct at all (an open). If any of the diodes is shorted or

open, the voltage from the rectifier will be below normal, and the battery may not be charged adequately.

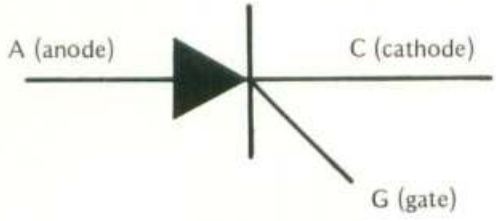
Diode Current Flow (K9)



2. Thyristor

The current of electrons will flow from the cathode to the anode but will not flow in the reverse direction. The thyristor differs from a diode in two respects: (a) even through a voltage of the correct polarity (negative to cathode) may be applied, the thyristor will not conduct until a signal is received at the gate input lead; (b) once started, it will not stop conducting (even if the gate lead signal voltage stops) until the anode to cathode voltage is removed or reversed.

Thyristor (K10)



The solid-state regulator limits dynamo output voltage to a maximum of 14.0 ~ 15.0 volts. Since it contains no contacts or other moving parts, it does not wear out and never needs to be adjusted. According to the dynamo output, the regulator circuit sends signals to the rectifier thyristors to keep the output voltage at specified value.

Inspection

Before testing the regulator/rectifier out of circuit, check the charging voltage and the dynamo output (Pg. 178).

- Remove the left side cover.
- Unlock the seat, and swing it open.
- With the ignition switch turned off, disconnect the regulator/rectifier 3-pin connector.
- Using the R x 1Ω or R x 1 kΩ ohmmeter range, check the resistance in both directions between the black lead and each yellow lead. There is a total of 4 measurements. The resistance should be as shown in Table K5. If any two leads are low or high in both directions, the regulator/rectifier is defective and must be replaced.



Table K5 Regulator/Rectifier Resistance

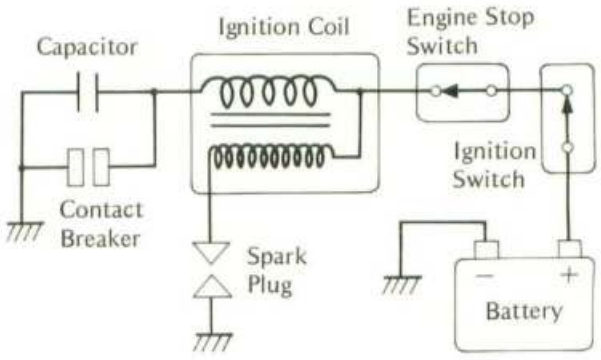
Connections	Reading
Meter (+) ↔ Yellow Lead Meter (–) ↔ Black Lead	less than 20Ω
Meter (+) ↔ Black Lead Meter (–) ↔ Yellow Lead	more than 100 kΩ

NOTE: If the regulator/rectifier check is good with the above procedure but still does not appear to be operating correctly in the circuit, check it by trial replacement with a good unit.

IGNITION SYSTEM

The working electrical part of the ignition system consists of the battery, contact breaker points, capacitor, ignition coil, and spark plug. A timing advancer is attached to advance the igniton timing as engine rpm rises.

Ignition Circuit (K12)



A wiring diagram of the ignition system is shown in Fig. K12, and works as follows. The battery supplies the current for the primary circuit, which includes the contact breaker points, capacitor, and the primary winding of the ignition coil. When the points suddenly open

with the ignition switch turned on, a surge of electrons is produced in the secondary circuit, which includes the ignition coil secondary winding and the spark plug. For this system to function properly,all ignition parts must be in good order, the ignition timing correctly set, the ignition and engine stop switches not shorted, and all wiring in good condition (no shorts or breaks, and no loose or corroded connections).

In a 4-stroke engine, a spark jumps across the spark plug electrodes only every other time that the piston rises (once every 720° of crankshaft rotation). This is because between each compression stroke, in which a fuel/air mixture ready for combustion is in the cylinder, there is an exhaust stroke, in which the piston rises only to push out the burned gases.

Ignition Coil

With the ignition switch on and the points closed, current flows in the primary circuit, including the ignition coil primary winding where the magnetic field (which accompanies electron flow) is concentrated (due to the winding). When the points open, this circuit is broken stopping the electron flow and collapsing the magnetic field. As this field collapses, magnetic flux cuts through the secondary winding including a current in the wiring. The voltage of this current, depending on the number of turns in the secondary winding and the speed of the drop in the primary winding voltage, is much greater than the voltage in the primary winding. It is this high voltage that causes a spark to jump across the spark plug electrodes. A greater ratio of secondary winding turns over primary winding turns and a sharper drop of primary winding voltage increase the secondary winding voltage that is produced. For this reason, a certain ratio of turns in the ignition coil has been chosen and a certain voltage drop sharpness (determined by capacitor and breaker point performance) has been designed into the ignition system so that a spark of sufficient but not excessive strength will be produced.

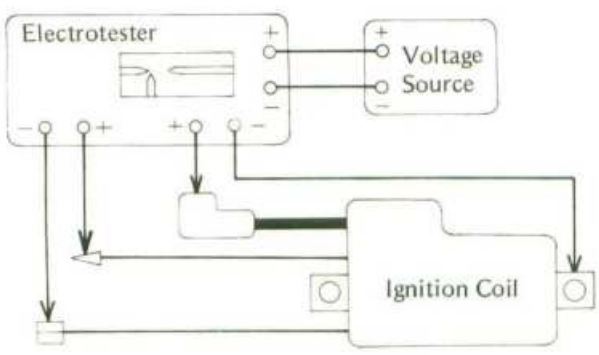
Ignition coil inspection

The most accurate test for determining the condition of the ignition coil is made with the Kawasaki Electro-tester. The ignition coil must be connected to the tester in accordance with the tester directions and should produce at least a 6 mm spark. Since a tester other than the Kawasaki Electro-tester may produce a different arcing distance, the Kawasaki Electro-tester is recommended for reliable results.

If an **Electrotester** is not available, the coil can be checked for a broken or badly shorted winding with an ohmmeter. However, an ohmmeter cannot detect layer shorts and shorts resulting from insulation breakdown under high voltage.

To measure the primary winding resistance, set the ohmmeter to the R x 1 Ω range, and connect one ohmmeter lead to the yellow/red lead and the other to the black lead from the ignition coil. To measure the secondary winding resistance, set the ohmmeter to the R x 100 Ω range, and connect one ohmmeter lead to the yellow/red lead and the other ohmmeter lead to the spark plug lead.

Ignition Coil Test (K13)





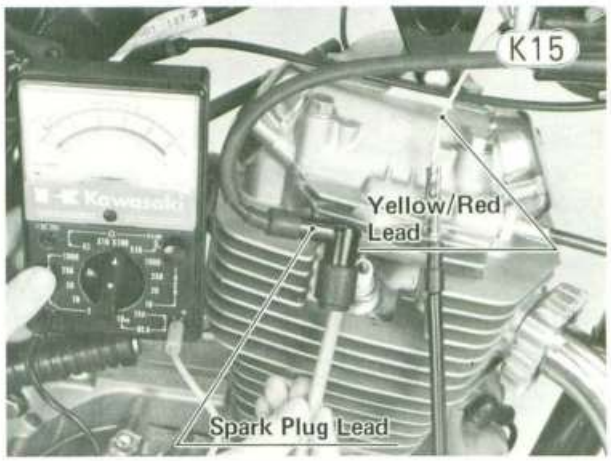


Table K6 Ignition Coil Resistance

	Meter	Reading
Primary Winding	R x 1	about 4.2 Ω
Secondary Winding	R x 100	about 11.4 kΩ

If the coil does not produce an adequate spark, or if either the primary or secondary winding does not have the correct resistance, replace the ignition coil.

With the highest ohmmeter range, check for continuity between the yellow/red lead and the coil core and between the plug lead and the coil core. If there is any reading, the coil is shorted and must be replaced. Also, replace the ignition coil if the spark plug lead shows visible damage.

Contact Breaker

The contact breaker consists of one fixed and one movable contact point. The movable point is pivoted, and the heel on one end is held against the cam surface on the timing advancer by a single leaf spring. As the camshaft rotates, the heel rides on the cam surface, and, as the camshaft reaches the position where ignition takes place, the high spot on the cam surface pushes out on the heel, which opens the points. As the heel wears down, the point gap narrows, affecting ignition timing. Consequently, the ignition timing and point gap must be periodically adjusted to compensate for heel wear.

Contact breaker inspection

When the points become dirty, pitted, or burned, or if the spring weakens, the points will not make the contact necessary to produce a good spark, resulting in unstable idling, misfiring, or the engine not running at all. Inspect the contact breaker in accordance with the Periodic Maintenance Chart (Pg. 10), and repair or replace if necessary.

Clean the points with clean paper or cloth using an oil-free solvent. A business card soaked in trichloroethylene can be used to remove traces of oil. To repair light damage, use emery cloth or an oilstone. If the points are badly worn down or damaged, or if the spring is weak, replace the contact breaker.

Whenever the contact breaker is inspected or replaced, apply a small amount of point cam grease to the felt to lubricate the cam. This will minimize wear of the contact breaker heel. Be careful not to apply so much grease that it can drop off or be thrown onto the points, which will cause the points to foul and burn.

Capacitor

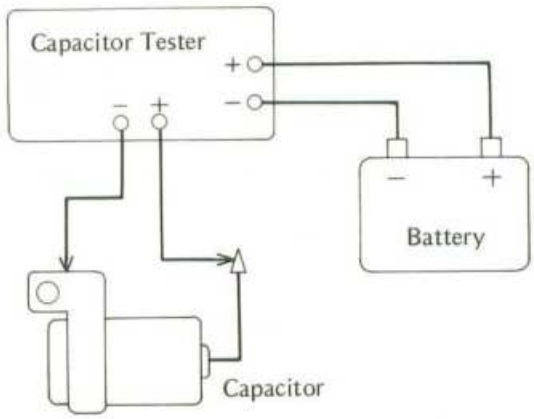
A capacitor is connected in parallel across the contact breaker points and serves to prevent current from arcing across the points as they open. Arcing across the points would reduce the sharpness of the voltage drop in the primary winding, thus weakening the spark plug spark, and also damaging the surface of the points. When the points are first opening, the capacitor absorbs a certain amount of current, giving the points time to open far enough apart to where current will not arc across. However, if the capacitor shorts, the current will simply flow through the capacitor whenever the points open. When the capacitor is otherwise defective, the current will not be prevented from arcing across the points at the time of ignition, resulting in poor spark plug performance and burned and pitted points.

Capacitor inspection

The capacitor can usually be considered to be defective if a long spark is seen arcing across the points as they open or if the points are burned or pitted for no apparent reason. Replace the capacitor any time it appears defective and whenever the contact breaker is replaced.

NOTE: For checking with a capacitor tester, capacitor specifications are: 0.25 ± 0.03 μF, 1,000 WVDC.

Capacitor Test (K16)

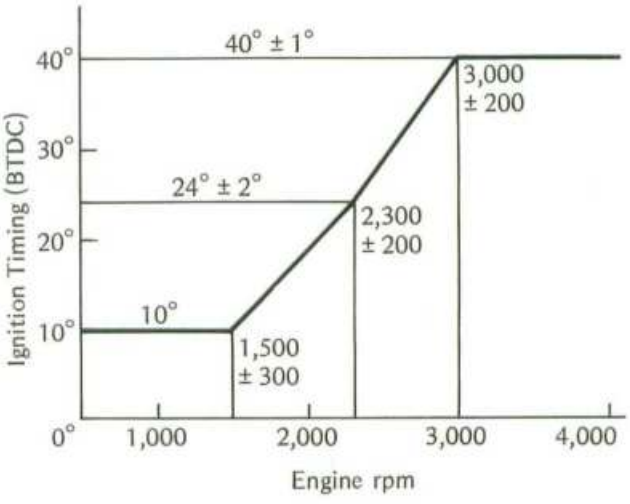


Timing Advancer

The timing advancer is a device that advances the ignition timing (makes the spark plug fire sooner) as engine rpm rises. It consists of two weights and two springs connected to the timing cam that opens the contact breaker points. The more the engine speed rises, the further the weights are thrown out against spring tension, turning the cam in the direction of camshaft rotation and causing the points to open sooner.

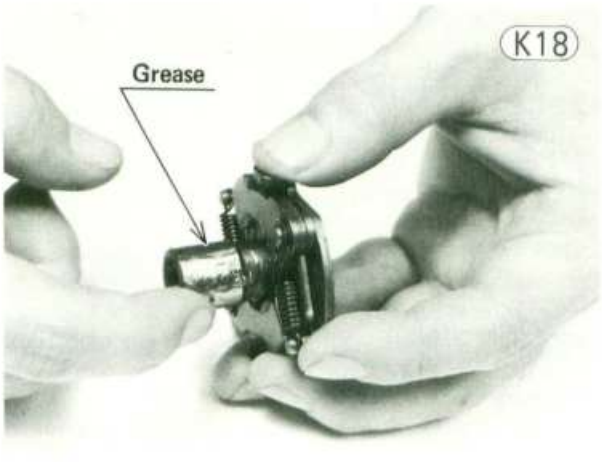
If the mechanism is damaged, has a weak or broken spring(s), or does not move smoothly, the ignition timing will not advance smoothly or it may stick in one position. This will result in incorrect timing at certain engine speeds, causing poor engine performance. Failure to advance at all will cause poor high speed performance, and excessive advance will cause knocking and poor low speed performance.

Ignition Timing/Engine rpm Relationship (K17)



Inspection and lubrication

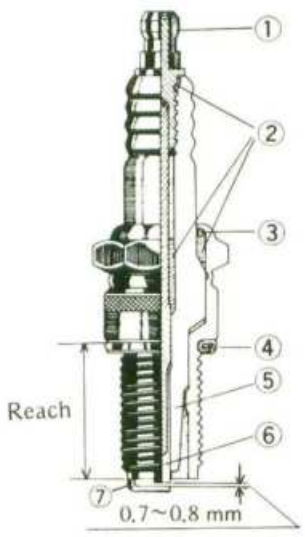
Remove the timing advancer (Pg. 44), and check that the mechanism moves smoothly by hand and that no parts are visually worn or damaged. Periodically wipe the advancer clean, apply oil to it, and fill the groove in the advancer body with grease.



Spark Plug

The spark plug ignites the fuel/air mixture in the combustion chamber. To do this effectively and at the proper time, the correct spark plug must be used, and the spark plug must be kept clean and adjusted.

Spark Plug



Tests have shown the NGK B8ES, ND W24ES, set to a 0.7 ~ 0.8 mm gap to be the best plug for general use. But since spark plug requirements change with ignition and carburetion adjustments and with riding conditions, this plug may have to be replaced with one of the next higher or lower heat range. Whether or not a spark plug of a different heat range should be used is generally determined by removing and inspecting the plug.

When a plug of the correct heat range is being used, the electrodes will stay hot enough to keep all the carbon burned off, but cool enough to keep from damaging the engine and the plug itself. This temperature is about 400~800°C (750~1,450°F) and can be judged by noting the condition and color of the ceramic insulator around the center electrode. If the ceramic is clean and of a light brown color, the plug is operating at the right temperature.

A spark plug for higher operating temperatures is used for racing and other high speed applications. Such a plug is designed for better cooling efficiency so that it will not overheat and thus is often called a "colder" plug. If a spark plug with too high a heat range is used – that is, a "cold" plug that cools itself too well – the plug will stay too cool to burn off the carbon, and the carbon will collect on the electrodes and the ceramic insulator. This carbon conducts electricity, and can short the center electrode to ground by either coating the ceramic insulator or bridging across the gap. Such a short will prevent an effective spark. Carbon build-up on the plug can also cause other troubles. It can heat up red-hot and cause preignition and knocking, which may eventually burn a hole in the top of the piston.

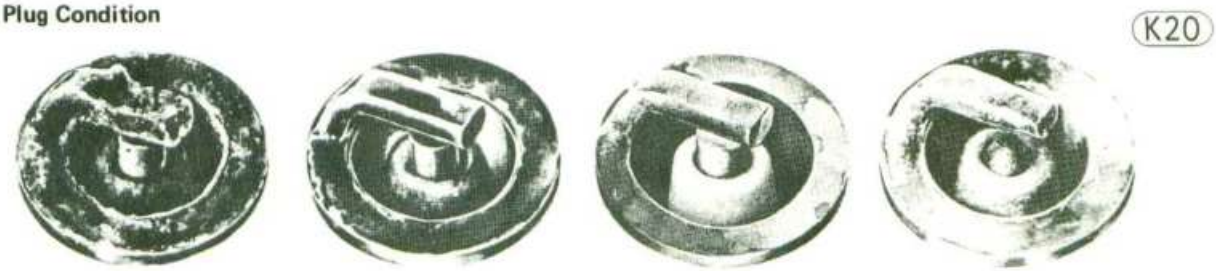
A spark plug in the lower heat range is used when engine temperature is comparatively low such as for contact city use or during the break-in period. Such a plug is designed to hold the heat and thus is often referred to as a "hotter" plug. If a "hot" plug is used for racing or other high speed use, the plug will run too hot, causing engine overheating, preignition and knocking, which may burn a hole in the piston.

Inspection and replacement

Remove each plug and inspect the ceramic insulator. Whether or not the right temperature plug is being used can be ascertained by noting the condition of the ceramic insulator around the electrode. A light brown color indicates the correct plug is being used. If the ceramic is black, it indicates that the plug is firing at too low a temperature, so the next hotter type (NGK B7ES) should be used instead. If the ceramic is white, the plug is operating at too high a temperature and it should be replaced with the next colder type (NGK B9ES).

The heat range of the spark plug functions like a thermostat for the engine. Using the wrong type of

Spark Plug Condition



spark plug can make the engine run too hot (resulting in engine damage) or too cold (with poor performance, misfiring, and stalling). The standard plug has been selected to match the normal usage of this motorcycle in combined street and highway riding. Unusual riding conditions may require a different spark plug heat range. For extended high speed riding, install the NGK B9ES plug (colder). For constant low speed riding, it may be necessary to use NGK B7ES plug (hotter) to avoid fouling. This is especially true during the break-in period, where engine speed must be limited to insure long engine life.

CAUTION **If the spark plugs are replaced with a type other than those mentioned below, make certain the replacement plugs have the same thread pitch and reach (length of threaded portion) as the standard plugs.**

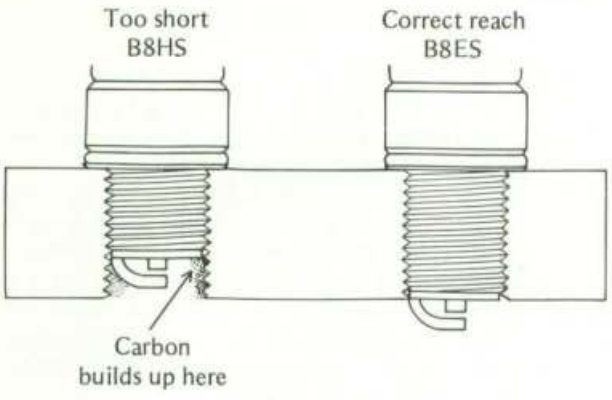
Table K7 Spark Plug Specifications

Diameter	Reach	NGK (ND) Number
14 mm	19.0 mm	B8ES (W24ES)

If the plug reach is too short, carbon will build up on the plug hole threads in the cylinder head, causing overheating and making it very difficult to insert the correct spark plug later.

If the reach is too long, carbon will build up on the exposed spark plug threads causing overheating, preignition, and possibly burning a hole in the piston top. In addition, it may be impossible to remove the plug without damaging the cylinder head.

Spark Plug Reach (K21)



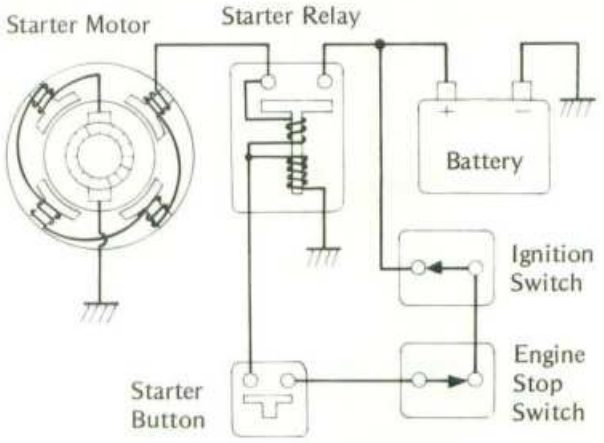
ELECTRIC STARTER SYSTEM

Starter Motor Circuit

The starter motor circuit includes the starter button (switch), starter relay, battery, and starter motor. When the ignition switch is on and the starter button is pushed, a small amount of current flows through the switch and the relay coil. This current magnetizes the relay core, which then pulls the armature to it, closing the relay contacts. The closed contacts complete a circuit for the starter motor, and the motor turns. The reason for using a relay instead of using the switch to turn on the starter motor directly is that the starter motor requires much current – enough that relatively thick wire is necessary to carry the current to the starter motor. Because it is not practical to put a heavy switch on the handlebar and have large wires running to it, the starter switch is made to carry just the light relay coil current, and heavy contacts inside the relay carry the starter motor current.

CAUTION **Because of the large amount of current, never keep the starter button pushed any time that the starter motor will not turn over, or the current may burn out the starter motor windings.**

Starter Motor Circuit (K22)



Starter relay test

- Disconnect the starter motor lead from the starter relay, and connect an ohmmeter set to the R x 1Ω range across the relay terminals.
- Turn on the ignition switch, push the starter button, and see if the meter reads zero ohms. If the relay makes a single clicking sound and the meter reads zero, the relay is good. If the relay clicks but the meter does not read zero, the relay is defective, and must be replaced.



- If the relay does not click at all, disconnect the other two leads (black and yellow/red), and measure the resistance across them. If the resistance is not close to zero ohms, the relay is defective.



However, if there is zero ohms resistance, the relay may be good; check that there is actually voltage to the relay before deciding that the relay is defective.

- To check for the voltage, first turn the meter to 20V DC, connect the – meter lead to the yellow/red lead which was disconnected from the relay, and connect the + meter lead to the black lead. Push the starter button, and see if the meter reads battery voltage. If it does not, there is wiring trouble. If the meter reads battery voltage but the relay does not click, the relay is defective.

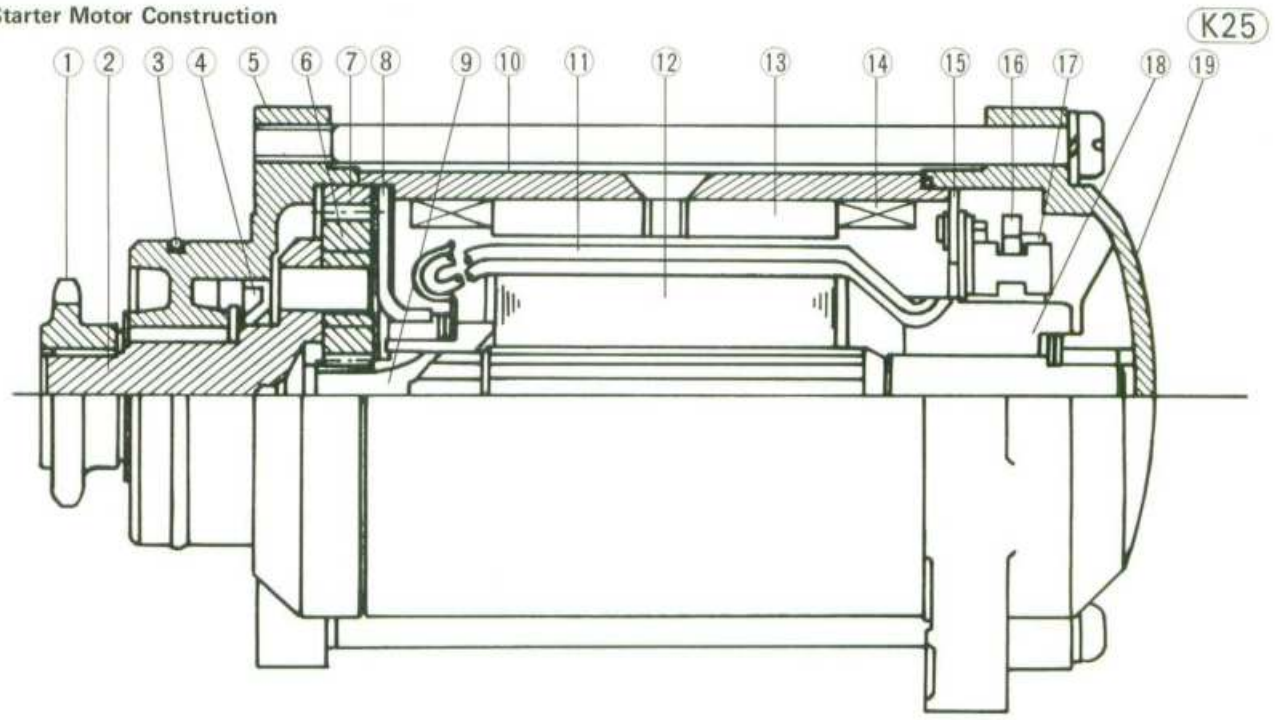
Starter Motor

The starter motor is installed with a sprocket and chain arrangement to transmit starter motor rotation to the crankshaft. A starter motor clutch (Pg. 187) disengages the starter motor once the engine starts.

Fig. K25 shows starter motor construction. The field coils ⑬ are wound around four cores ⑭, forming the yoke ⑩, and the armature windings ⑪ are connected to the commutator ⑱ and receive their current through the brushes ⑰. If the brushes are not making good contact, no starter motor current will flow at all since the field coils and armature windings are connected in series, and the motor will not turn over. A short or open in a coil or winding may also cause the motor to be inoperative. Particles from brush wear may be another cause of starter motor failure; these particles may get onto the bearing at the rear of the motor, causing heat seizure.

A planetary gear train is provided at the output side of the starter motor. The planetary gear train consists of an internal gear ⑦, two planet pinions ⑥, and a sun gear ⑨. These gears reduce the rotational speed of the armature to give more power to the output shaft. The internal gear is fixed to the end cover.

Starter Motor Construction



1. Starter Motor Sprocket
2. Output Shaft
3. O Ring
4. Grease Seal
5. End Cover
6. Planet Pinion
7. Internal Gear
8. End Plate
9. Sun Gear
10. Yoke Assembly
11. Armature Winding
12. Armature
13. Field Coil
14. Core
15. Brush Plate
16. Spring
17. Carbon Brush
18. Commutator
19. End Cover

Carbon brushes

Worn brushes or weak springs will cause poor brush contact.

Measure the length of the brushes, and replace both if either one is worn down to less than the service limit.

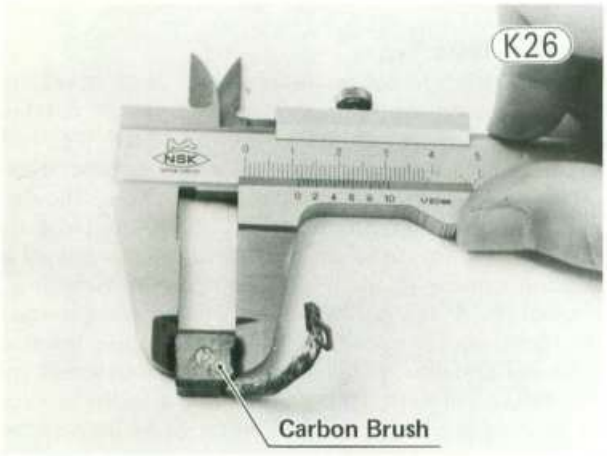


Table K8 Carbon Brush Length

Standard	Service Limit
11.0~11.5 mm	5.5 mm

Brush spring

Spring tension should 495 ~ 605 grams but a spring can be considered serviceable if it will snap the brush firmly into place.

Commutator

A dirty or damaged commutator will result in poor brush contact and cause the brushes to wear down quickly. In addition, particles from brush wear accumulating between commutator segments may cause *partial shorts*.

- Correct the commutator surface if necessary with fine emery cloth, and clean out the grooves as illustrated. Determine as accurately as possible the depth of the grooves between commutator segments. Replace the armature with a new one if the groove depth is less than the service limit.

Commutator

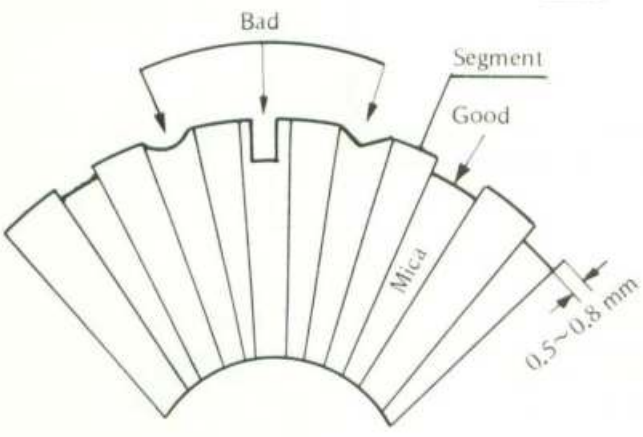
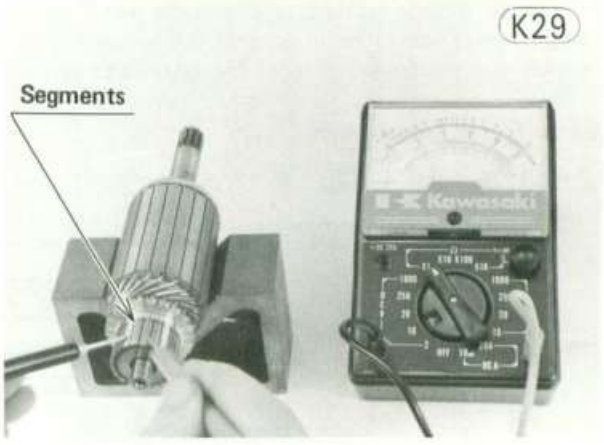




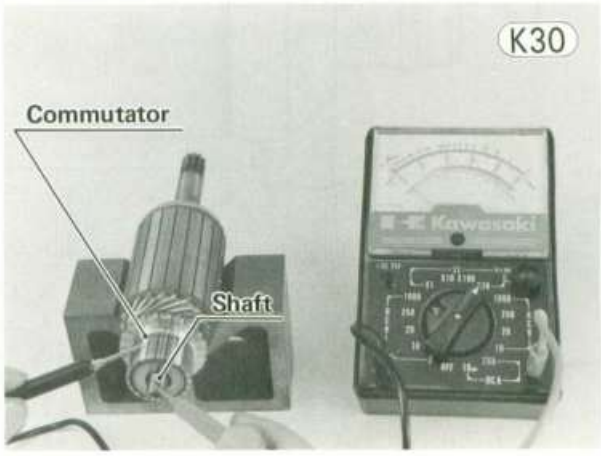
Table K9 Commutator Groove Depth

Standard	Service Limit
0.5~0.8 mm	0.2 mm

- Using the R x 1Ω ohmmeter range, measure the resistance between any two commutator segments. If there is a high resistance or no reading between any two segments, a winding is open and the armature must be replaced.



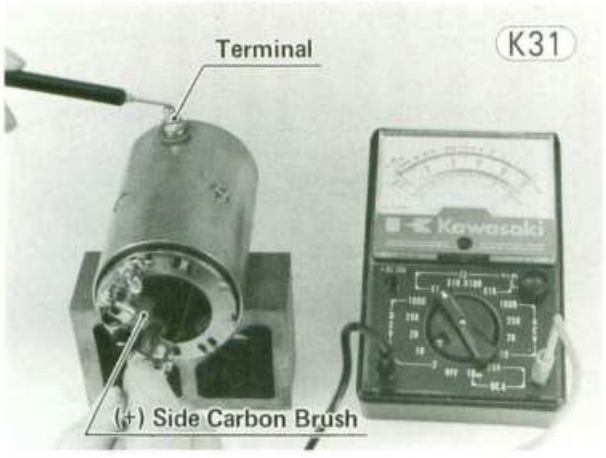
- Using the highest ohmmeter range, measure the resistance between the commutator and the shaft. If there is any reading at all, the armature has a short and must be replaced.



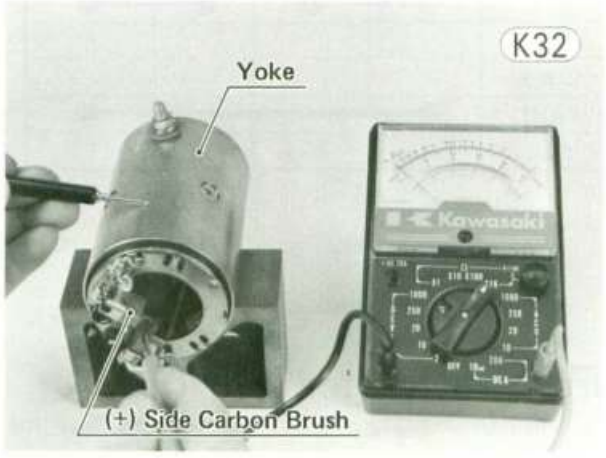
NOTE: Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with an ohmmeter. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the armature with a new one.

Field coils

- Using the R x 1Ω ohmmeter range, measure the resistance between the + side carbon brush and the starter motor terminal. If there is not close to zero ohms, the field coils have an open and the yoke assembly must be replaced.



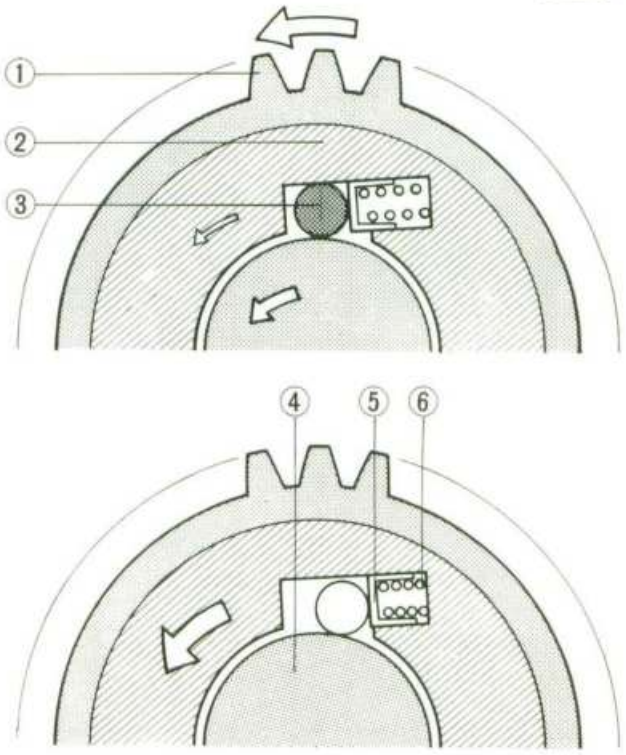
- Using the highest ohmmeter range, measure the resistance between the + side carbon brush and the yoke (housing). If there is any meter reading, the coils are shorted to ground and the yoke assembly must be replaced.



Starter Motor Clutch, Chain

Fig. K33 shows starter motor clutch operation. The clutch body ② is fixed to the crankshaft ④ through the dynamo flywheel. When the starter clutch sprocket ① rotates in the direction of the arrow, each of the three rollers ③, pushed by its spring ⑥, is wedged into the narrower space between the clutch body and the starter clutch sprocket hub (the portion jutting out from the sprocket), thereby locking the clutch body and starter clutch sprocket together. With these two locked, starter motor rotation is transmitted to the crankshaft through the starter chain, starter clutch sprocket, rollers, clutch body, and flywheel.

Starter Motor Clutch Operation K33



1. Clutch Sprocket
2. Clutch Body
3. Roller
4. Crankshaft
5. Spring Cap
6. Spring

When the engine starts, friction with the starter clutch sprocket (and at higher speeds, inertia) moves the rollers back against the tension of their springs so that they no longer serve as wedges locking the clutch body and starter clutch sprocket together. In this manner, the engine rotates freely without forcing the starter motor to turn with it.

If the rollers or the starter clutch sprocket hub become damaged or worn, the rollers may lock in place so that the starter motor will not disengage when the engine starts. On the other hand, roller or sprocket hub damage could prevent the clutch from engaging properly, causing the starter motor to run freely without transmitting rotation.

Clutch inspection

- Turn off the ignition switch and disconnect the battery negative lead from the battery.
- Remove the left engine cover (Pg. 55).

NOTE: Some engine oil will be spilled by left engine cover removal. After installing the cover, check the engine oil level and add engine oil as necessary (Pg. 18).

- Turn the dynamo flywheel using the flywheel holder (special tool), and check the starter motor clutch

operation. When turning the flywheel counterclockwise, the starter clutch sprocket should not turn with the flywheel, but, when turning the flywheel clockwise, the sprocket should turn. If the clutch does not operate as it should or if it makes noise, disassemble the starter motor clutch (Pg. 57), examine each part visually, and replace any worn or damaged parts.



Starter chain inspection

- Remove the starter chain (Pg. 57), hold the chain taut with a force of about 5 kg in some manner such as the one shown in Fig. K35, and measure a 20-link length. If the chain has lengthened beyond the service limit, replace it with a new one.

Starter Chain Measurement K35

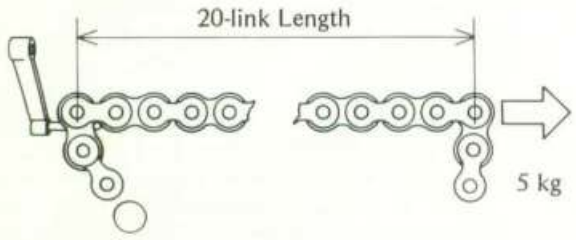


Table K10 Starter Chain Length

	Standard	Service Limit
20-link Length	155.5 mm	157.8 mm

IGNITION SWITCH

The ignition switch has four positions: Off, On, Lock, and Park. In the "Off" position all circuits are turned off and the key can be removed from the switch. In the "On" position the motorcycle can be started and all electrical equipment can be used. The key cannot be removed from the switch when it is in the "On" position. In the "Lock" position all circuits are cut off and the steering is locked. The key can be removed from the switch when it is in the "Lock" position. In the "Park" position the tail light is on, but all other circuits are off and the key can be removed from the switch. This provides added visibility when the motorcycle is parked.

Testing the switch

Table K11 shows the internal connections of the ignition switch for each switch position. To check the switch, disconnect the plug (4-pin) from the switch, and use an ohmmeter to verify that all the connecting listed in the table are making contact (zero ohms between those wires), and that no other wires are connected. If there are any opens or shorts in the switch, replace it with a new one.

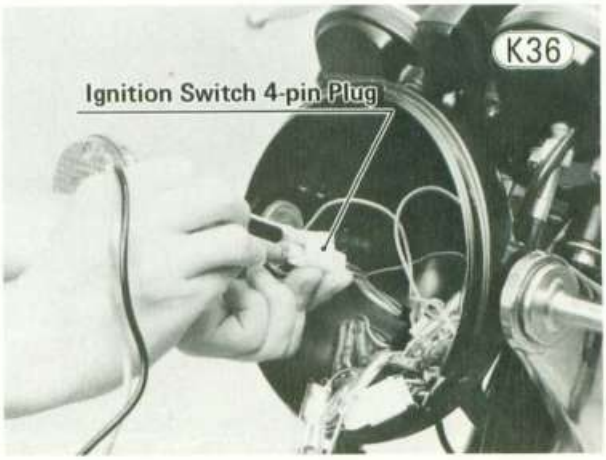


Table K11 Ignition Switch Connection

Color	White	Brown	Blue	Red
ON	●	●	●	●
OFF				
LOCK				
PARK	●			●
Lead	BAT	IG	TL1	TL2

NEUTRAL INDICATOR SWITCH

A neutral indicator light is provided so that the rider can readily determine whether or not the transmission is in neutral. The neutral switch, installed in the left crankcase half, consists of a spring loaded pin which contacts a nub on the shift drum operating plate when the transmission is in neutral. This completes the neutral indicator light circuit, which turns on the neutral indicator light.

Switch inspection

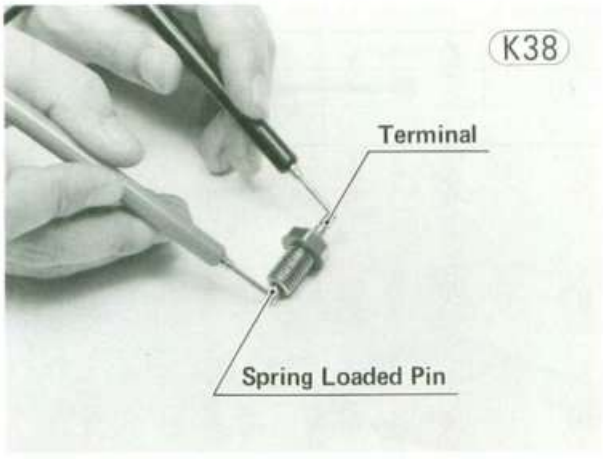
- Turn on the ignition switch. Watching the indicator light, shift the transmission into neutral and then

shift the transmission into other positions. If the neutral indicator light goes on in neutral position and the light does not go on in other positions, the neutral indicator switch is good.

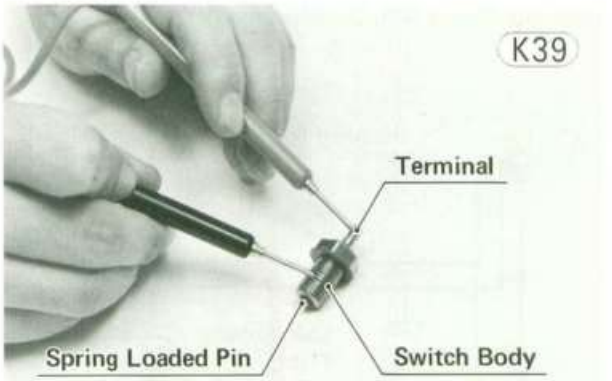
- If the neutral indicator light does not go on in the neutral position or it goes on in other positions, disconnect the neutral indicator switch lead.
- To check for the voltage, first turn the meter to 20V DC, connect the + meter lead to the switch lead, and connect the – meter lead to chassis ground.



- Turn the ignition switch on, and see if the meter reads battery voltage. If the meter does not indicate battery voltage, the trouble is either defective wiring or a burned-out indicator bulb. If the voltmeter reads battery voltage, then the neutral indicator switch may be defective.
- To check the neutral switch, first remove the switch (Pg. 60), turn the meter to the R x 1Ω range, and measure the resistance between the switch terminal and the spring loaded pin. If the resistance is not close to zero ohms, the switch is defective, and must be replaced.



- If the resistance is close to zero ohms, measure the resistance between the switch terminal or spring loaded pin and the switch body. If there is any meter reading, the neutral indicator switch is defective and must be replaced.



LIGHTING SYSTEM

Headlight Circuit

Fig. K40 and Fig. K41 are US, Canadian and European model wiring diagrams of the headlight circuit.

In the US model, when both the ignition switch and headlight switch are turned to the "On" position the headlight circuit is completed, turning on the headlight, tail light, and meter lights.

In the Canadian model, there is no headlight switch, and when the ignition switch is turned on, the headlight circuit is completed.

In the European model, the center CL (po) position of the headlight switch turns on the small city light, tail light, and meter lights for driving in the city after dark. When the switch is turned to the "On" position, the headlight illuminates and the city light stays on. With the dimmer switch, high and low beam can be selected only when the headlight switch is in the "On" position.

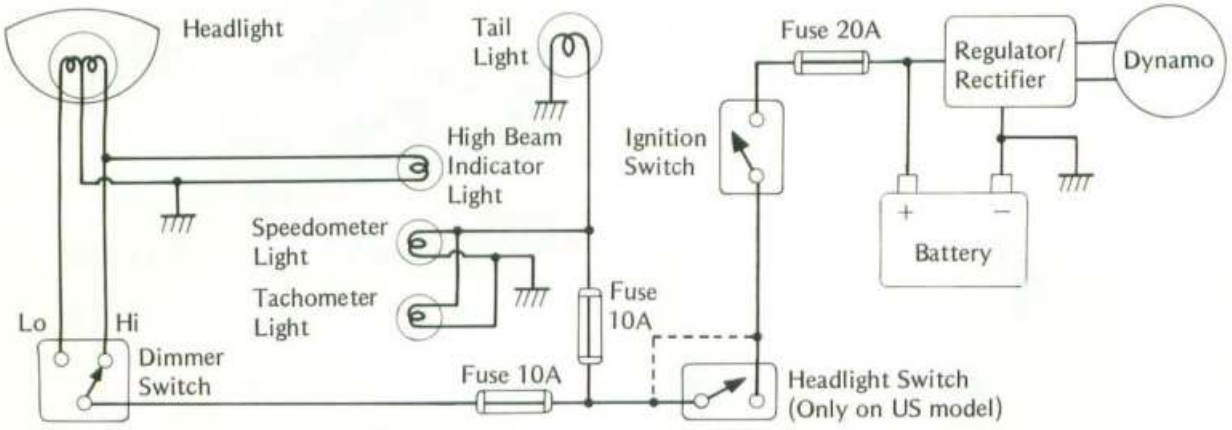
In the European model, there is also a passing and horn button. This button is spring loaded and when the button is pushed to pass, the high beam light (but not the tail light) comes on as a passing signal to the driver of the vehicle ahead. The passing button will light the high beam light regardless of the headlight switch position, and the button will spring back and turn the light off as soon as it is released.

Headlight trouble

If the headlight does not light, check to see if the bulb has burned out or fuses have blown. If the bulb on the US or Canadian model has burned out, the sealed beam unit must be replaced. A blown fuse should be replaced. On the European model the headlight or the city light can be replaced separately, as the headlight is of semi-sealed construction. If the bulb and fuses are good, check the dimmer switch and the headlight switch. Tables K12, K13, and K14 show the connections in the dimmer switch for both high and low beam, and the connections in the headlight switch. Remove the fuel tank, and disconnect the plug (6-pin) and lead (Blue) to the left-hand switch housing or the plug (6-pin) to the right-hand switch housing (not on Canadian model). Use an ohmmeter to see that only the connections shown in the table have continuity (zero ohms). If the switch has an open or a short, it can be disassembled for repair.

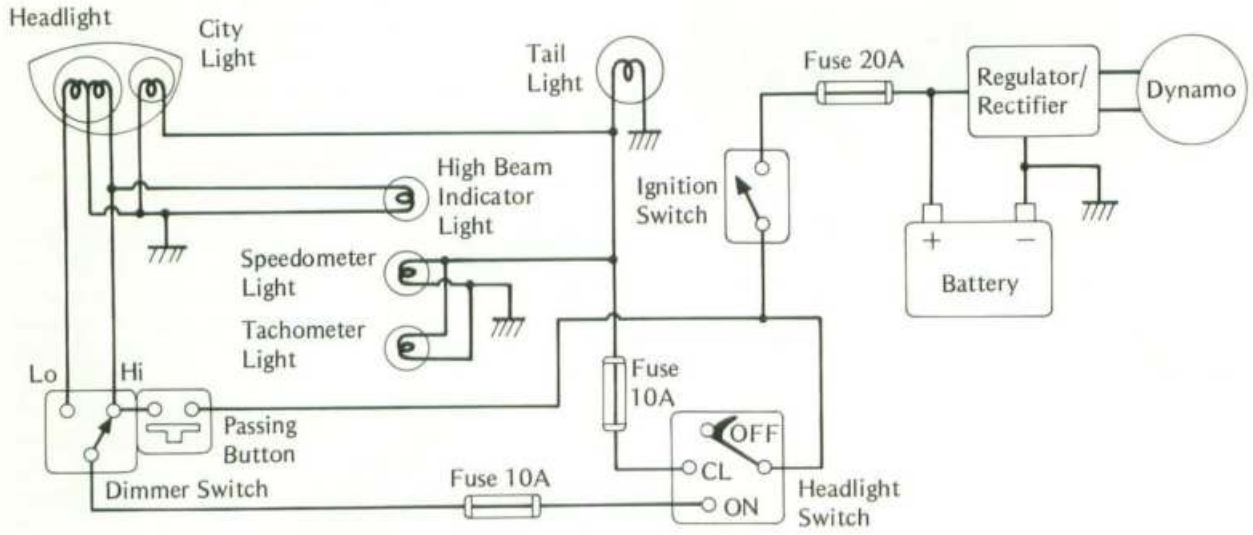
Headlight Circuit (US, Canadian model)

K40



Headlight Circuit (European model)

K41



The contact surfaces may be cleaned, but no internal parts are available for replacement. If any parts are not repairable, the switch must be replaced as a unit. If the procedure above does not remedy the problem, check the ignition switch, the wiring, and the dynamo.

Table K12 Dimmer Switch Connection

Color	Red/Black	Blue	Red/Yellow
HI	●	●	
LO		●	●



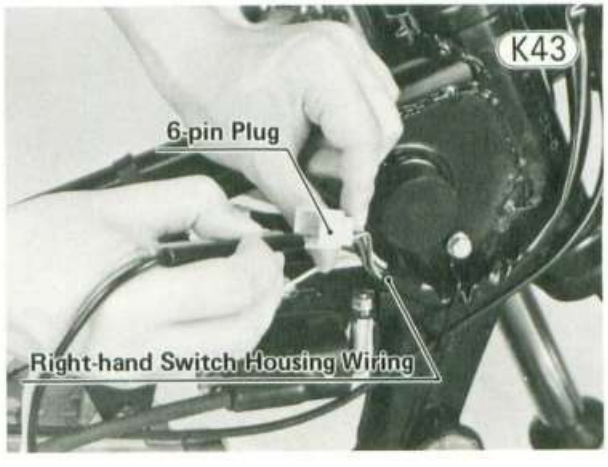


Table K13 Headlight Switch Connection

Color	Brown	Blue/White	Brown/White
OFF			
ON	●	●	●

Table K14 Headlight Switch Connection (European Model)

Color	Brown	Blue/White	Brown/White
OFF			
PO	●		●
ON	●	●	●

If the headlight lights but does not light brightly, the trouble may be that the headlight is of improper wattage or the dynamo is not supplying sufficient current. However, the trouble may also be caused by a short or a component drawing too much current in some other part of the electrical system.

Tail light trouble

If the tail light does not go on when the circuit is closed, the filament is probably burned out. However, if the bulb is good, check the fuses, wiring, ignition switch, headlight switch, and battery.

Brake Light Circuit

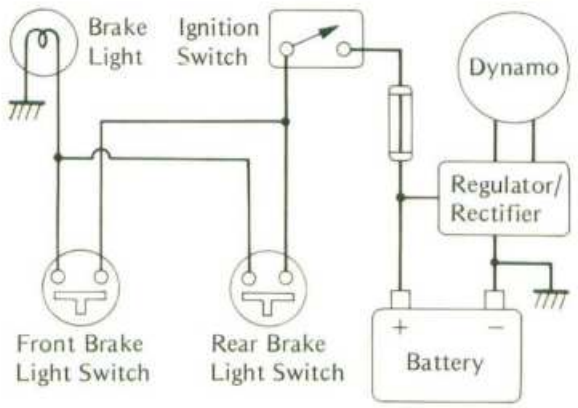
The brake light circuit is shown in Fig. K44. When the ignition switch is turned on, the brake light goes on whenever the circuit is closed by either the front or rear brake light switch. The same bulb is used for both the brake and tail lights as explained in the preceding section.

The front brake light switch, mounted on the front brake lever holder, is actuated when pressed by the front brake lever. The front brake light switch never requires adjustment, and so is not designed to be adjusted. It cannot be disassembled for repair and must be replaced when defective.

The rear brake light switch is a plunger type switch actuated by a spring attached to the rear brake pedal. It can be adjusted by changing its position higher or lower in the mounting bracket (See Pg. 24).

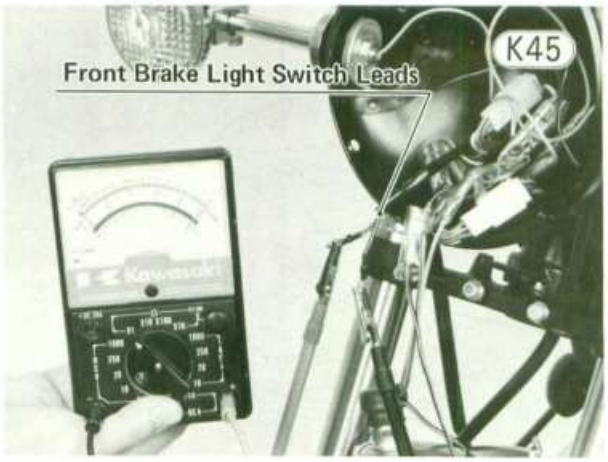
Brake light circuit inspection involves the front brake light switch, rear brake light switch, brake light, and wiring.

Brake Light Circuit K44



Front brake light switch inspection

- Remove the headlight unit (Pg. 109).
- Disconnect the front brake light switch leads (Brown, Blue/Red).
- Set an ohmmeter to the R x 1Ω range, connect the meter to the switch leads, and determine whether or not there is continuity whenever the front brake lever is squeezed.



- If there is no continuity, replace the switch with a new one.

Rear brake light switch inspection

- Disconnect the rear brake light switch leads in the right side cover.
- Inspect in the same way that the front brake light switch was inspected. If there is no continuity whenever the rear brake pedal is depressed, replace the switch.



Brake light inspection

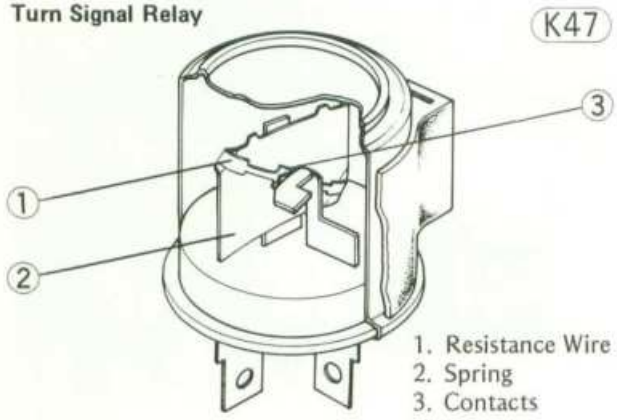
If the brake light does not go on when the circuit is closed, the filament is probably burned out. However, if the bulb is good, check the fuses, wiring, ignition switch, front brake light switch, rear brake light switch, and battery.

Turn Signal Circuit

A wiring diagram of the turn signal circuit is shown in Fig. K48. When the ignition switch is on and the turn signal switch is turned to "R" or "L", a ground is

provided for the circuit so current can flow. Current to the right or left turn signals flows thorugh the closed contacts and the resistance wire inside the turn signal relay, and the turn signals go on. The resistance wire quickly heats up, expands, and allows a spring to pull the contacts open. When the contacts have opened, the circuit is broken, the turn signals go off, and the resistance wire cools and contacts, closing the contacts so that the cycle can begin again. The indicator light for the turn signals indicates that they are working properly.

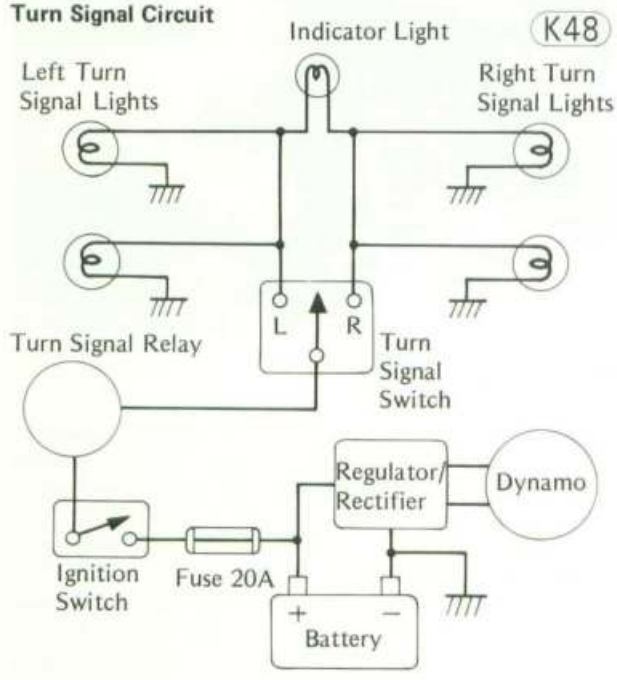
Turn Signal Relay



1. Resistance Wire
2. Spring
3. Contacts

Since the turn signal relay is designed to operate correctly only when two turn signals (one front and one rear) and the turn signal indicator light are properly connected in the circuit, trouble may result from a burned out bulb, a bulb of incorrect wattage, loose wiring, as well as from a defect in the relay itself. In general, if the trouble with the circuit is common to both right and left turn signals, it is probably caused by a defective turn signal relay, although it may be due to a bad switch, wiring, or battery. If the trouble is with only one side – either right or left – then the relay is not at fault since the same relay is used for both sides.

Turn Signal Circuit



Turn signal trouble

(1)Neither right nor left turn signals come on at all:

- Check that battery voltage is normal.
- Disconnect the relay leads and use an ohmmeter to check that there is continuity (close to zero ohms) between the relay terminals. If there is no ohmmeter reading, or if there is several ohms resistance, replace the relay with a new one.



- If the relay checks good, turn the meter to the 20V DC range, connect the + meter lead to the brown lead that was disconnected from the relay, and connect the – meter lead to the orange lead.
- With the ignition switch on, first switch the turn signal switch to the "R" and then to the "L" position. The meter should register battery voltage at either position. If it does not, the fuse, ignition switch, or wiring is at fault. If battery voltage is read on the meter but the turn signals still will not work when the relay is reconnected, then recheck all wiring connections.



(2)Both right or both left turn signals come on and stay on or flash too slowly:

- Check that battery voltage is not low.
- Check that all wiring connections are good.
- Check that the turn signal bulbs and indicator bulb are of the correct wattage.
- If all of the above check good, replace the relay.

(3)A single light on one side comes on and stays on:
- Either the light that does not come on is burned out, of the incorrect wattage, or the wiring is broken or improperly connected.

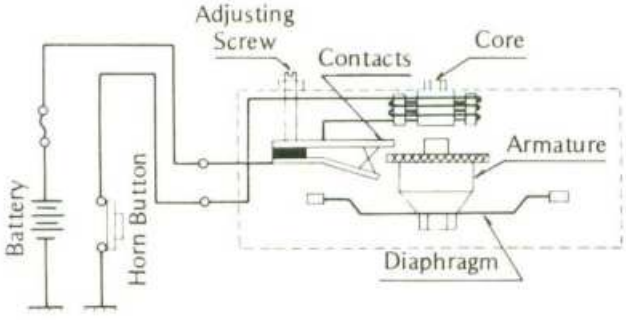
(4)Neither light on one side comes on:
- Unless both lights for that side are burned out, the trouble is with the turn signal switch.

(5)Flashing rate is too fast:
- If this occurs on both the right and left sides, check that the battery is not being overcharged (indicating a defective regulator/rectifier). If the dynamo and the battery voltage are normal, replace the turn signal relay.
- If this occurs on only one side, one or both of the turn signal bulbs are of too high a wattage.

HORN

The horn circuit and construction are shown in Fig. K51. When the horn button is pressed with the ignition switch on, the horn is grounded to complete the horn circuit. Current then flows through the horn contacts and horn coil, magnetizing the iron core. The magnetized iron core pulls on the armature and diaphragm assembly, the movement of which pushes open the contacts, interrupting the current flow. Since the core now loses its magnetism, the armature and diaphragm assembly springs back to its original position, closing the contacts. This cycle repeats until the horn button is released. Since each cycle takes only a fraction of a second, the diaphragm moves fast enough to produce sound.

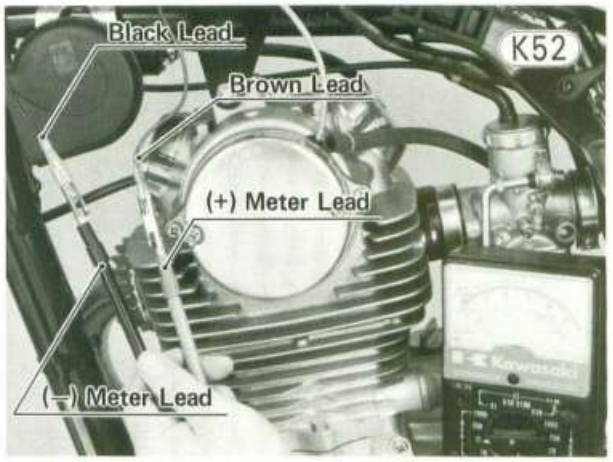
Horn Construction (K51)



The contacts wear down after long use, requiring adjustment from time to time (Pg. 27). If the horn itself is determined to be at fault and adjustment fails to correct the trouble, the contacts or some other component in the horn is defective. The horn cannot be disassembled and must be replaced if defective.

Horn trouble

- Check that battery voltage is normal.
- Disconnect the leads to the horn, and connect a multimeter set to the R x 1Ω range to the horn terminals to check for continuity (close to zero ohms). If the reading is several ohms or if there is no reading at all, replace the horn.
- If the reading is very close to zero, set the multimeter to the 20V DC range, and connect the meter to the leads that were disconnected from the horn. The + meter lead goes to the brown lead, and the – meter lead goes to the black lead.
- With the ignition switch on, press the horn button. The meter should register battery voltage. If it does not, the fuse, ignition switch, or wiring is at fault.



- If the meter does show battery voltage, indicating that the horn trouble lies within the horn itself, and adjustment fails to correct the trouble, replace the horn.

NOTE: Do not loosen the armature mounting since doing so would alter the armature position such that the horn would probably have to be replaced.

SPEEDOMETER, TACHOMETER

The speedometer and tachometer are sealed units which cannot be disassembled. If either fails to work satisfactorily, it must be replaced as a complete unit.

The speedometer and tachometer lights and the indicator lights are independent and can be removed for replacement if necessary.

Troubleshooting—Guide

Engine Doesn't Start, Starting Difficulty

Starter motor not rotating
- Starter motor defective
- Battery voltage low
- Relay not contacting or operating
- Starter button not contacting
- Wiring open or shorted
- Ignition switch defective
- Engine stop switch defective
- Engine stop switch off
- Fuse blown

Starter motor rotating but engine doesn't turn over
- Starter motor clutch defective

Engine won't turn over
- Valve seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure
- Kickstarter return spring broken
- Kick ratchet gear not engaging

No fuel flow
- No fuel in tank
- Fuel tap turned off
- Tank cap air vent obstructed
- Fuel tap clogged
- Fuel line clogged
- Float valve clogged

Engine flooded
- Fuel level too high
- Float valve worn or stuck open
- Starting technique faulty
- (When flooded, kick with the throttle fully open to allow more air to reach the engine.)

No spark; spark weak
- Ignition switch not on
- Engine stop switch turned off
- Battery voltage low
- Spark plug dirty, defective, or maladjusted
- Spark plug cap or high tension wiring defective
- Spark plug cap not in good contact
- Contact breaker points dirty or damaged
- Contact breaker point gap maladjusted
- Capacitor defective
- Ignition coil defective
- Ignition or engine stop switch shorted
- Wiring shorted or open

Compression low
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston rings bad (worn, weak, broken, or sticking)
- Piston ring/land clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Poor Running at Low Speed

Spark weak
- Battery voltage low
- Spark plug dirty, defective, or maladjusted
- Spark plug cap or high tension wiring defective
- Spark plug cap shorted or not in good contact
- Incorrect spark plug heat range
- Contact breaker points dirty or damaged
- Contact breaker point gap maladjusted
- Capacitor defective
- Ignition coil defective

Fuel/air mixture incorrect
- Pilot air screw and/or idle adjusting screw maladjusted
- Pilot jet, or air passage clogged
- Pilot jet bleed holes clogged
- Air cleaner clogged, poorly sealed, or missing
- Choke valve closed
- Fuel level too high or too low
- Fuel tank air vent obstructed
- Carburetor holder loose
- Air cleaner duct loose

Compression low
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston rings bad (worn, weak, broken or sticking)
- Piston ring/land clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Other
- Ignition timing maladjusted
- Timing not advancing (spring broken or stretched)
- Throttle valve doesn't slide smoothly
- Engine oil viscosity too high
- Brakes dragging

Poor Running or No Power at High Speed

Firing incorrect
- Spark plug dirty, defective, or maladjusted
- Spark plug cap or high tension wiring defective
- Spark plug cap shorted or not in good contact
- Incorrect spark plug heat range
- Contact breaker points dirty or damaged
- Contact breaker point gap maladjusted
- Capacitor defective
- Ignition coil defective
- Ignition timing maladjusted and/or timing not advancing
- Contact breaker spring weak

Fuel/air mixture incorrect
- Main jet clogged or wrong size
- Jet needle or needle jet worn
- Jet needle clip in wrong position
- Fuel level too high or too low
- Air bleed pipe bleed holes clogged
- Air cleaner clogged, poorly sealed, or missing
- Air cleaner duct poorly sealed
- Choke valve closed
- Water or foreign matter in fuel
- Carburetor holder loose
- Air cleaner duct loose
- Fuel tank air vent obstructed
- Fuel tap clogged
- Fuel line clogged

Compression low
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston rings bad (worn, weak, broken, or sticking)
- Piston ring/land clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn or carbon accumulation on the seating surface.)

Knocking
- Ignition timing maladjusted
- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Incorrect spark plug heat range

Miscellaneous
- Throttle valve won't fully open
- Throttle valve doesn't slide smoothly
- Ignition timing maladjusted
- Timing not advancing
- Brakes dragging
- Clutch slipping
- Overheating
- Engine oil level too high
- Engine oil viscosity too high

Overheating

Firing incorrect
- Spark plug dirty, damaged, or maladjusted
- Incorrect spark plug heat range
- Ignition timing maladjusted

Fuel/air mixture incorrect
- Main jet clogged
- Fuel level too low
- Carburetor holder loose
- Air cleaner poorly sealed, or missing
- Air cleaner duct poorly sealed
- Air cleaner clogged

Compression high
- Carbon built up in combustion chamber

Engine load faulty
- Clutch slipping
- Engine oil level too high
- Engine oil viscosity too high
- Brakes dragging

Lubrication inadequate
- Engine oil level too low
- Engine oil poor quality or incorrect

Clutch Operation Faulty

Clutch slipping
- No clutch lever play
- Friction plates worn or warped
- Steel plates worn or warped
- Clutch springs broken or weak
- Clutch release maladjusted
- Clutch cable maladjusted
- Clutch inner cable catching
- Clutch release mechanism defective
- Clutch hub or housing unevenly worn

Clutch not disengaging properly
- Clutch lever play excessive
- Clutch plates warped or too rough
- Clutch spring tension uneven
- Engine oil deteriorated
- Engine oil viscosity too high
- Engine oil level too high
- Clutch housing frozen on drive shaft
- Clutch release mechanism defective

Gear Shifting Faulty

Doesn't go into gear; shift pedal doesn't return
- Clutch not disengaging
- Shift fork(s) bent or seized
- Gear(s) stuck on the shaft
- Shift return spring weak or broken
- Shift mechanism arm spring broken

Jumps out of gear
- Shift fork(s) worn
- Gear groove(s) worn
- Gear dogs, dog holes, and/or dog recesses worn
- Shift drum groove(s) worn
- Shift drum positioning pin spring weak or broken
- Shift fork pin(s) worn
- External shift mechanism arm spring weak
- Drive shaft, output shaft, and/or gear splines worn

Overshifts
- Shift drum positioning pin spring weak or broken

Abnormal Engine Noise

Knocking
- Ignition timing maladjusted
- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Incorrect spark plug heat range
- Overheating

Piston slap
- Cylinder/piston clearance excessive
- Cylinder, piston worn
- Connecting rod bent
- Piston pin, piston holes worn

Valve noise
- Valve clearance incorrect

Valve spring broken or weak

Other noise

Connecting rod small end clearance excessive
Connecting rod big end clearance excessive
Piston ring(s) worn, broken, or stuck
Piston seizure damage
Cylinder head gasket leaking
Exhaust pipe leaking at cylinder head connection
Crankshaft runout excessive
Engine mounts loose
Crankshaft bearings worn
Camshaft chain tensioner defective
Camshaft chain, sprocket, guides worn
Camshaft chain requires adjustment
Starter motor chain worn
Loose dynamo flywheel

Abnormal Drive Train Noise

Clutch noise

Clutch damping rubber deteriorated
Clutch housing/friction plate clearance excessive

Transmission noise

Bearings worn
Transmission gears worn or chipped
Metal chips jammed in gear teeth
Engine oil insufficient or too thin
Kick ratchet gear not properly disengaging from kick gear

Drive chain noise

Drive chain adjusted improperly
Chain worn
Rear and/or engine sprocket(s) worn
Chain lubrication insufficient
Rear wheel misaligned

Abnormal Frame Noise

Front fork noise

Oil insufficient or too thin
Spring weak or broken

Rear shock absorber noise

Shock absorber defective

Front brake noise

Pad B loose
Pad surface glazed
Disc warped

Rear brake noise

Brake linings overworn or worn unevenly
Drum worn unevenly or scored
Brake spring weak or broken
Foreign matter in hub
Brake not properly adjusted

Other noise

Brackets, nuts, bolts, etc. not properly mounted or tightened

Exhaust Smokes Excessively

White smoke

Piston oil ring worn
Cylinder worn
Valve oil seal damaged
Valve guide worn
Engine oil level too high

Black smoke

Air cleaner clogged
Main jet too large or fallen off
Starter plunger stuck open
Fuel level too high

Brown smoke

Main jet too small
Fuel level too low
Air cleaner duct loose
Air cleaner poorly sealed or missing

Handling and/or Stability Unsatisfactory

Handlebar hard to turn

Steering stem locknut too tight
Bearing balls damaged
Race(s) dented or worn
Steering stem lubrication inadequate
Steering stem bent
Tire air pressure too low

Handlebar shakes or excessively vibrates

Tire(s) worn
Swing arm bush and bushing worn
Rim(s) warped, or not balanced
Front, rear axle runout excessive
Spokes loose
Wheel bearing(s) worn
Handlebar clamps loose
Steering stem head bolt and/or clamp bolt loose

Handlebar pulls to one side

Frame bent
Wheel misalignment
Swing arm bent or twisted
Swing arm pivot shaft runout excessive
Steering stem bent
Front fork bent
Right/left front fork oil level uneven
Right/left rear shock absorbers unbalanced

Shock absorption unsatisfactory

Too hard:
Front fork oil excessive
Front fork oil viscosity too high
Tire air pressure too high
Shock absorber maladjusted
Front fork bent
Too soft:
Front fork oil insufficient and/or leaking
Front fork oil viscosity too low
Front fork, rear shock absorber spring(s) weak
Rear shock absorber oil leaking

Brakes Don't Hold

Disc (front) brake

Pad or disc worn
Disc warped
Contaminated pads

Drum (rear) brake

Brake maladjusted
Brake lining or drum worn
Overheated

Water in brake drum
Brake cam, camshaft worn
Oil on brake linings

Battery Discharged

Battery faulty (e.g., plates sulphated, shorted through sedimentation, electrolyte level too low)
Battery leads making poor contact
Load excessive (e.g., bulb of excessive wattage)
Regulator/rectifier defective
Ignition switch defective
Dynamo defective
Armature coil open or short
Wiring faulty

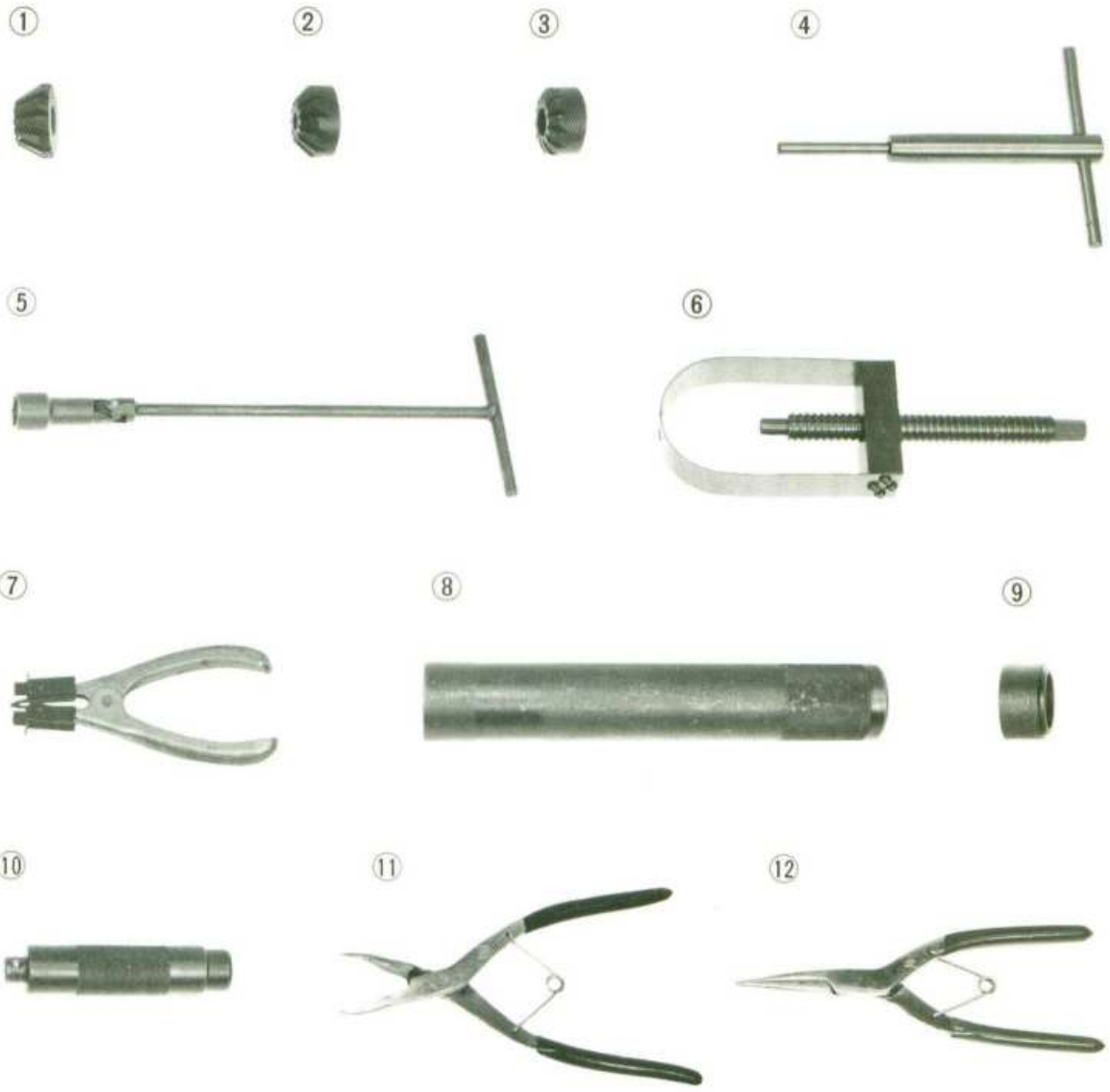
Battery Overcharged

Regulator/rectifier defective
Battery defective

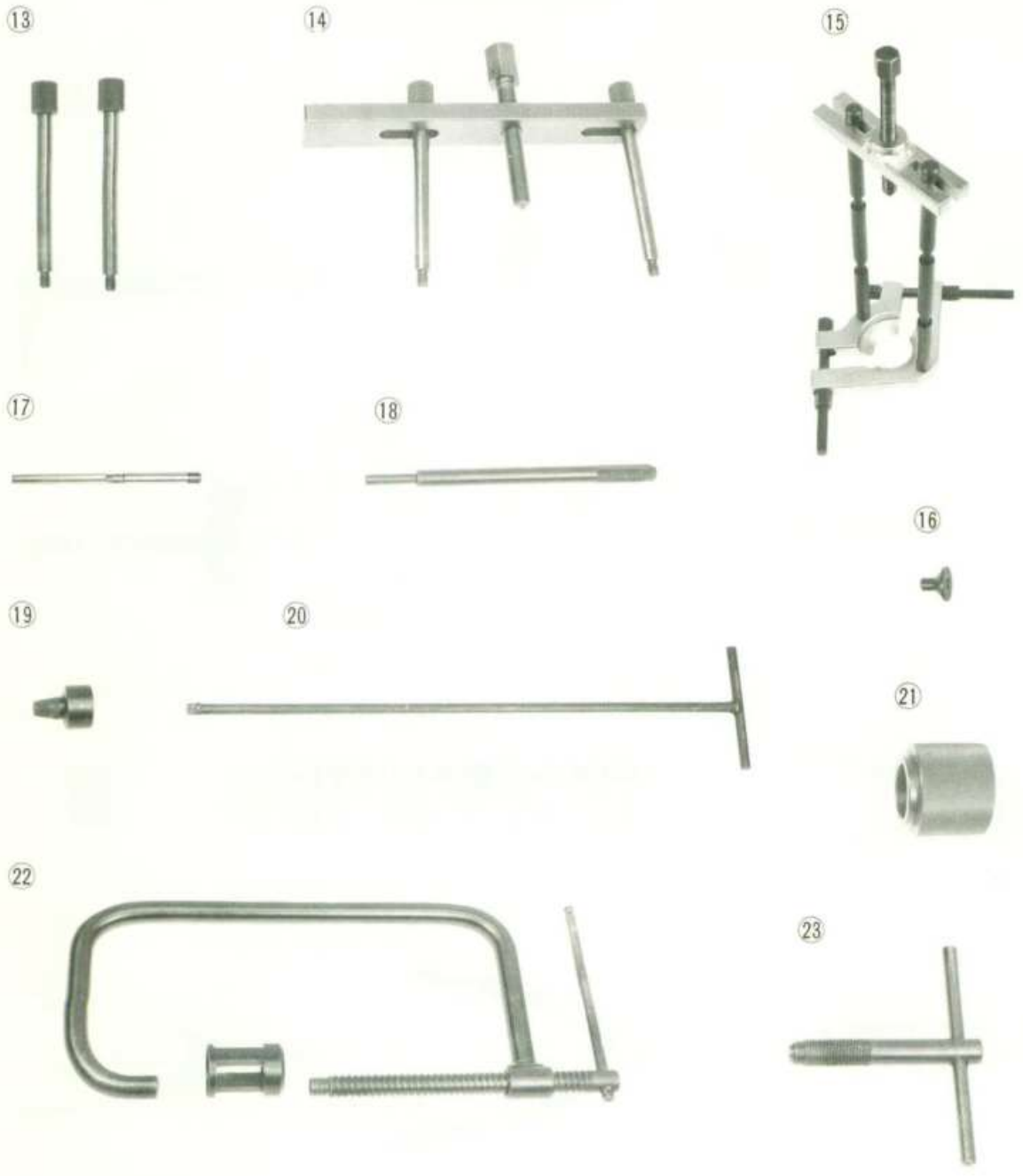
NOTE: This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties. Electrical troubleshooting is not covered here due to its complexity. For electrical problems, refer to the appropriate heading in the Maintenance Section.

Appendix

SPECIAL TOOLS



REF. NO.	PART NO.	DESCRIPTION
1	57001-101	VALVE SEAT CUTTER 30°
2	57001-102	VALVE SEAT CUTTER 45°
3	57001-104	VALVE SEAT CUTTER 60° (EXHAUST)
4	57001-106	VALVE SEAT CUTTER HOLDER
5	57001-110	SPARK PLUG WRENCH
6	57001-114 (or P/No. 57001-910)	PISTON PIN PULLER
7	57001-115	PISTON RING PLIERS
8	57001-137	STEM BEARING DRIVER
9	57001-292	STEM BEARING DRIVER ADAPTER
10	57001-139	BEARING DRIVER HOLDER
11	57001-143	INSIDE CIRCLIP PLIERS
12	57001-144	OUTSIDE CIRCLIP PLIERS



REF. NO.	PART NO.	DESCRIPTION
13	57001-151	CRANKCASE SPLITTING TOOL ADAPTER
14	57001-153	CRANKCASE SPLITTING TOOL
15	57001-158	BEARING PULLER
16	57001-166 (or P/No. 57001-317)	BEARING PULLER ADAPTER
17	57001-162	VALVE GUIDE REAMER
18	57001-163	VALVE GUIDE ARBOR
19	57001-181	FRONT FORK CYLINDER HOLDER ADAPTER
20	57001-183	FRONT FORK CYLINDER HOLDER HANDLE
21	57001-196	FRONT FORK OIL SEAL DRIVER
22	57001-241	VALVE SPRING COMPRESSOR ASSEMBLY
23	57001-254	ROTOR PULLER























REF. NO.	PART NO.	DESCRIPTION
24	57001-264	SHIFT SHAFT OIL SEAL GUIDE
25	57001-267	KICK SHAFT OIL SEAL GUIDE
26	57001-283	BEARING DRIVER
27	57001-288	BEARING DRIVER "A"
28	57001-289	BEARING DRIVER "B"
29	57001-293	STEM CUP DRIVER
30	57001-298	BEARING DRIVER
31	57001-307	ENGINE SPROCKET HOLDER
32	57001-308	FLYWHEEL HOLDER
33	57001-320	STEM NUT WRENCH
34	57001-405	TIMING INSPECTION COVER

35



36



37

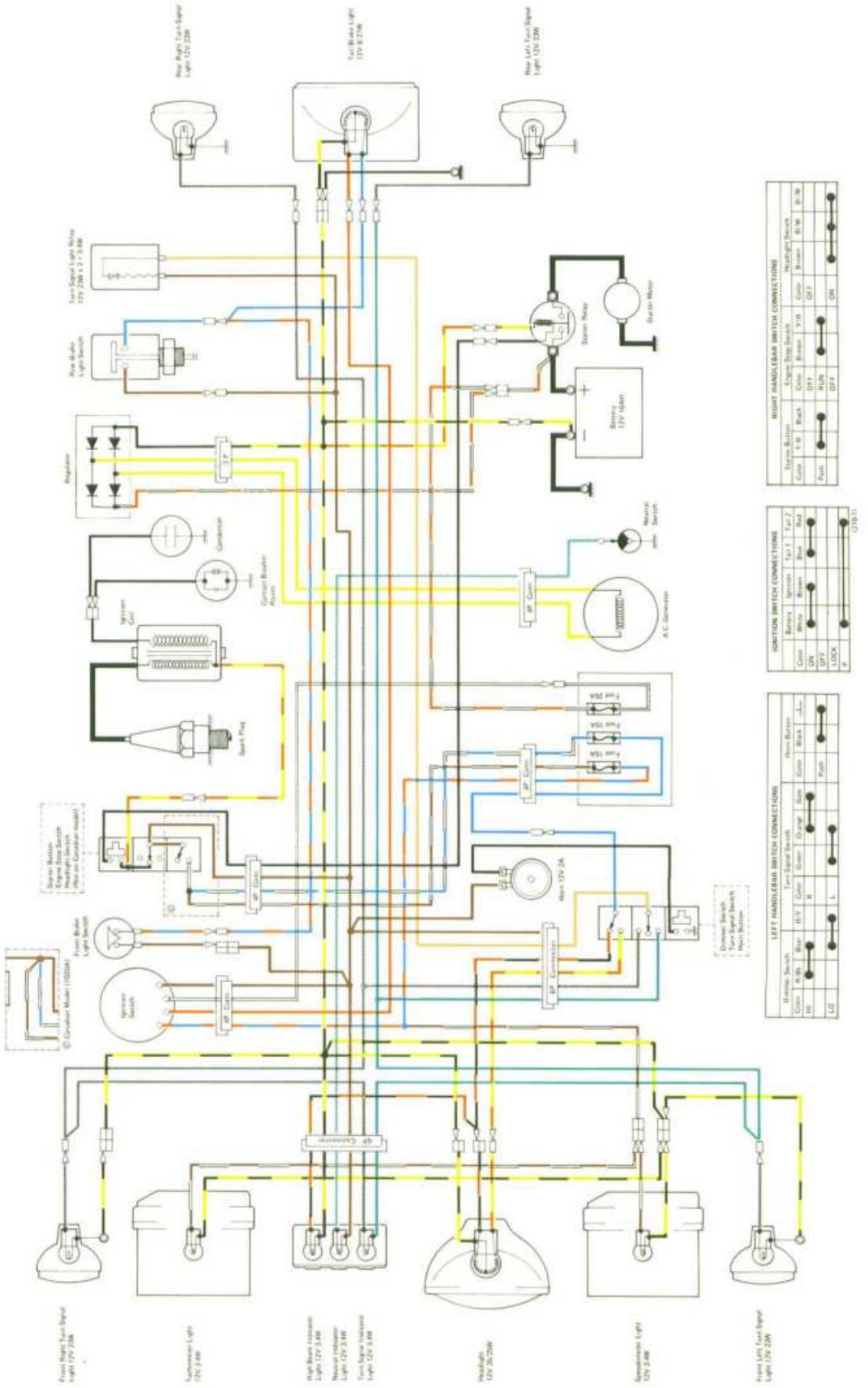


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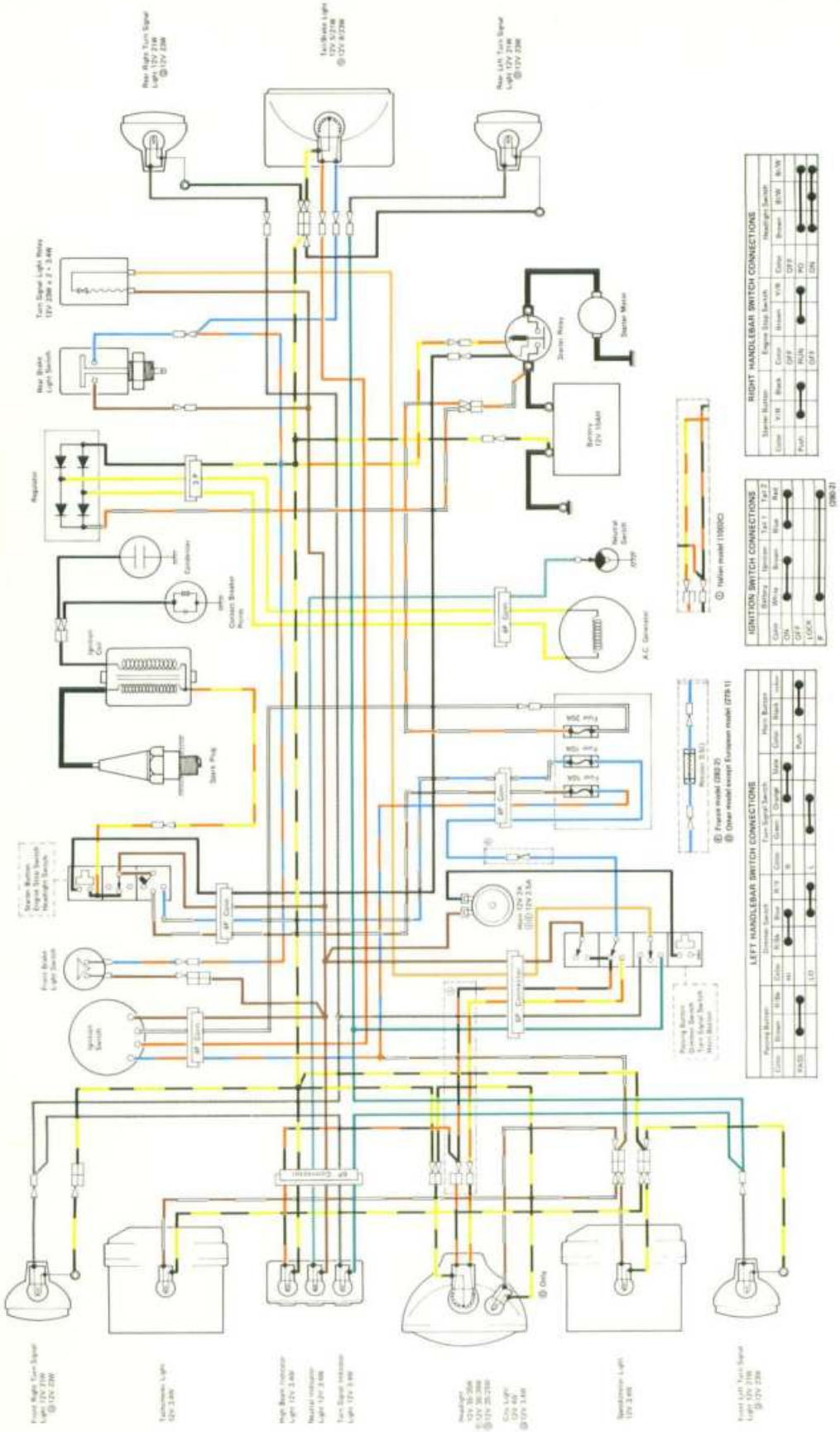


REF. NO.	PART NO.	DESCRIPTION
35	57001-123	COMPRESSION GAUGE ASSEMBLY
36	57001-208	FUEL LEVEL GAUGE
37	57001-980	ELECTRO TESTER
38	57001-983	HAND TESTER

KZ200-A1 Wiring Diagram (US, Canadian model)



KZ200-A1 Wiring Diagram (European model)



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Decimal Equivalents

INCH					MM INCH
1/64				.015625	
	1/32			.3125	1 mm= .03937 inch
3/64				.046875	
		1/16		.0625	
5/64				.078125	2 mm= .07874 inch
	3/32			.09375	
7/64				.109375	
			1/8	.125	3 mm= .11811 inch
9/64				.140625	
	5/32			.15625	
11/64				.171875	4 mm= .15748 inch
		3/16		.1875	
13/64				.203125	
	7/32			.21875	5 mm= .19685 inch
15/64				.234375	
			1/4	.25	
17/64				.265625	6 mm= .23622 inch
	9/32			.28125	
19/64				.296875	
		5/16		.3125	7 mm= .27559 inch
21/64				.328125	
	11/32			.34375	
23/64				.359375	8 mm= .31496 inch
			3/8	.375	
25/64				.390625	
	13/32			.40625	9 mm= .35433 inch
27/64				.421875	
		7/16		.4375	
29/64				.453125	10 mm= .39370 inch
	15/32			.46875	
31/64				.484375	
			1/2	.5	11 mm= .43307 inch

INCH					MM INCH
33/64				.515625	
	17/32			.53125	12 mm= .47244 inch
35/64				.546875	
		9/16		.5625	
37/64				.578125	13 mm= .51181 inch
	19/32			.59375	
39/64				.609375	
			5/8	.625	14 mm= .55118 inch
41/64				.640625	
	21/32			.65625	
43/64				.671875	15 mm= .59055 inch
		11/16		.6875	
45/64				.703125	
	23/32			.71875	16 mm= .62992 inch
47/64				.734375	
			3/4	.75	
49/64				.765625	17 mm= .66929 inch
	25/32			.78125	
51/64				.796875	
		13/16		.8125	18 mm= .70866 inch
53/64				.828125	
	27/32			.84375	
55/64				.859375	19 mm= .74803 inch
			7/8	.875	
57/64				.890625	
	29/32			.90625	20 mm= .78740 inch
59/64				.921875	
		15/16		.9375	
61/64				.953125	21 mm= .82677 inch
	31/32			.96875	
63/64				.984375	
			1	1.	22 mm= .86614 inch

					MM INCH
					23 mm= .90551 inch
					24 mm= .94488 inch
					25 mm= .98425 inch

AFQ3796
629.28795 011600
K221

Unit Conversion Table

cc	x	.0610	=	cu in
cc	x	.02816	=	fl oz (imp)
cc	x	.03381	=	fl oz (U S)
cu in	x	16.39	=	cc
fl oz (imp)	x	35.51	=	cc
fl oz (U S)	x	29.57	=	cc
ft-lbs	x	12	=	in-lbs
ft-lbs	x	.1383	=	kg-m
gal (imp)	x	4.546	=	liters
gal (imp)	x	1.201	=	gal (U S)
gal (U S)	x	3.7853	=	liters
gal (U S)	x	.8326	=	gal (imp)
grams	x	.03527	=	oz
in	x	25.40	=	mm
in-lbs	x	.0833	=	ft-lbs
in-lbs	x	.0115	=	kg-m
kg	x	2.2046	=	lb
kg	x	35.274	=	oz
kg/cm²	x	14.22	=	lbs/sq in
kg-m	x	7.233	=	ft-lbs
kg-m	x	86.796	=	in-lbs
km	x	.6214	=	miles
lb	x	.4536	=	kg
lb/sq in	x	.0703	=	kg/cm²
liter	x	28.16	=	fl oz (imp)
liter	x	33.81	=	fl oz (U S)
liter	x	.8799	=	qt (imp)
liter	x	1.0567	=	qt (U S)
meter	x	3.281	=	ft
mile	x	1.6093	=	km
mm	x	.03937	=	in
oz	x	28.35	=	grams
qt (imp)	x	1.1365	=	liters
qt (imp)	x	1.201	=	qt (U S)
qt (U S)	x	.9463	=	liters
qt (U S)	x	.8326	=	qt (imp)

$$°C \rightarrow °F: \frac{9(°C + 40)}{5} - 40 = °F$$

$$°F \rightarrow °C: \frac{5(°F + 40)}{9} - 40 = °C$$

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List of Abbreviations

ABDC	after bottom dead center
ATDC	after top dead center
BBDC	before bottom dead center
BDC	bottom dead center
BTDC	before top dead center
cc	cubic centimeters
cu in	cubic inches
fl oz	fluid ounces
ft	foot, feet
ft-lbs	foot-pounds
gal	gallon, gallons
hp	horsepower
in	inch, inches
in-lbs	inch-pounds
kg	kilogram, kilograms
kg/cm²	kilograms per square centimeter
kg-m	kilogram-meters
km	kilometer
kph	kilometers per hour
lb, lbs	pound, pounds
lbs/sq in	pounds per square inch
ℓ	liter
m	meter, meters
mi	mile, miles
mm	milimeters
mph	miles per hour
oz	ounce, ounces
psi	pounds per square inch
qt	quart, quarts
rpm	revolutions per minute
sec	second, seconds
SS	standing start
TDC	top dead center
"	inch, inches