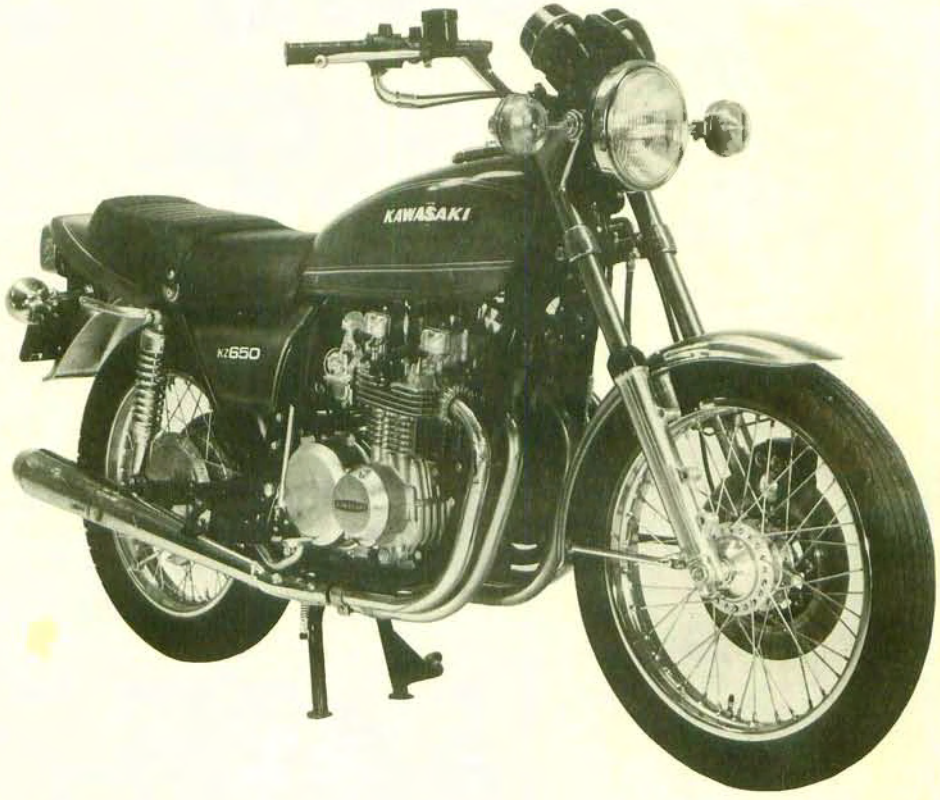
Kawasaki KZ650



MOTORCYCLE SHOP MANUAL

Printed in Japan

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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 caution 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 and Theory of Operation

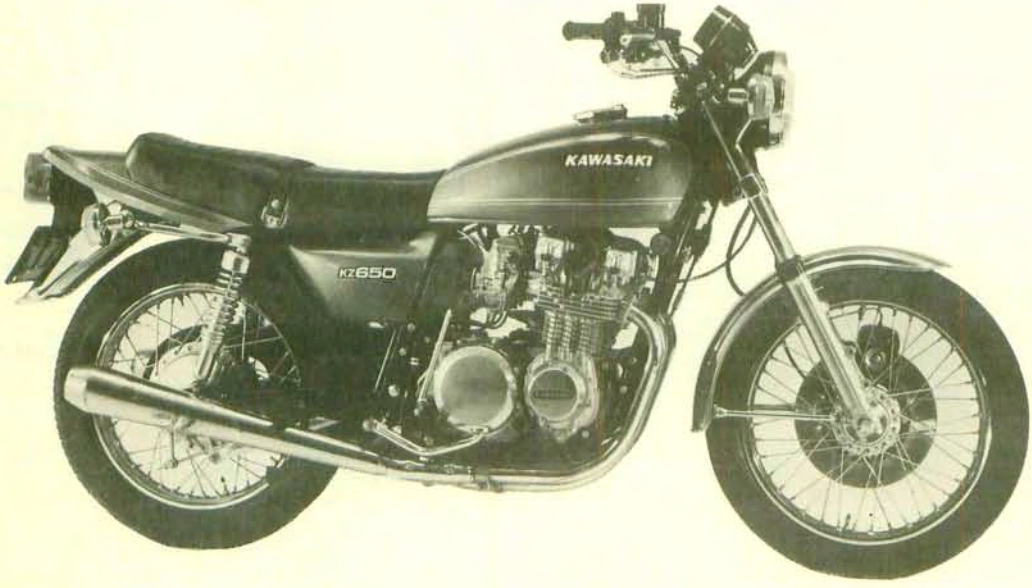
The procedures for inspection and repair are described in detail in this section. An explanation on the structure and functioning of each of the major parts and assemblies is given to enable the mechanic to better understand what he is doing.

Since the Shop Manual is based on the first production units of the KZ650, 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.

Model Identification



A

Specifications

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SPECIFICATIONS

Dimensions		
Overall length	US	2,170 mm
	European	2,220 mm
Overall width		850 mm
Overall height		1,145 mm
Wheelbase		1,420 mm
Road clearance	US	145 mm
	European	140 mm
Dry weight		211 kg
Fuel tank capacity		16.8 ℓ
Performance		
Climbing ability		30°
Braking distance		12 m @50 kph
Minimum turning radius		2.4 m
Engine		
Type		DOHC 4 cylinder, 4 stroke, air-cooled
Bore and stroke		62 x 54 mm
Displacement		652 cc
Compression ratio		9.5
Maximum horsepower		64 HP @8,500 rpm
Maximum torque		5.8 kg-m @7,000 rpm
Valve timing		
Inlet	Open	22° BTDC
	Close	52° ABDC
	Duration	254°
Exhaust	Open	60° BBDC
	Close	20° ATDC
	Duration	260°
Carburetors		Mikuni VM24SS
Lubrication system		Forced lubrication (wet sump)
Engine oil		SAE 10W40
Engine oil capacity		3.5 ℓ
Starting system		Electric and kick
Ignition system		Battery and coil
Ignition timing		From 10° BTDC @1,600 rpm to 35° BTDC @3,200 rpm
Spark plugs		NGK B8ES or ND W24ES
Transmission		
Type		5-speed, constant mesh, return shift
Clutch		Wet, multi disc
Gear ratio:	1st	2.33 (35/15)
	2nd	1.63 (31/19)
	3rd	1.27 (28/22)
	4th	1.04 (26/25)
	5th	0.89 (24/27)

Primary reduction ratio		2.55 (27/23 x 63/29)
Final reduction ratio		2.63 (42/16)
Overall drive ratio		5.95 (Top gear)

Electrical Equipment

Generator (Dynamo)		Nippon Denso ACQI05
Regulator		Nippon Denso 026000-2490
Ignition coil		Toyo Denso ZC002-14, ZC002-23
Battery		Yuasa YB10L (12V 10AH)
Starter		Mitsuba SM-224D
Headlight type	US	Sealed beam
	European	Semi-sealed
Headlight	US	12V 50/35W
	European	12V 45/40W
Tail/Brake light	US	12V 8/27W (3/32 CP)
	European	12V 5/21W
Speedometer lights		12V 3.4W
Tachometer lights		12V 3.4W
Neutral indicator light		12V 3.4W
High Beam indicator light		12V 3.4W
Turn signal lights	US	12V 23W (32 CP)
	European	12V 21W
Turn signal indicator lights		12V 3.4W
Oil pressure indicator light		12V 3.4W
Brake light failure indicator light		12V 3.4W
Horn		12V 2.5A
City light	European	12V 4W

Frame

Type		Tubular, double cradle
Steering angle		39.5° to either side
Castor		63°
Trail		108 mm
Tire size	Front	3.25H-19 4PR
	Rear	4.00H-18 4PR
Suspension	Front	Telescopic fork
	Rear	Swing arm
Suspension stroke	Front	140 mm
	Rear	80 mm
Front fork oil capacity (each fork)		186 ~ 194 cc
Front fork oil type		SAE 10W20

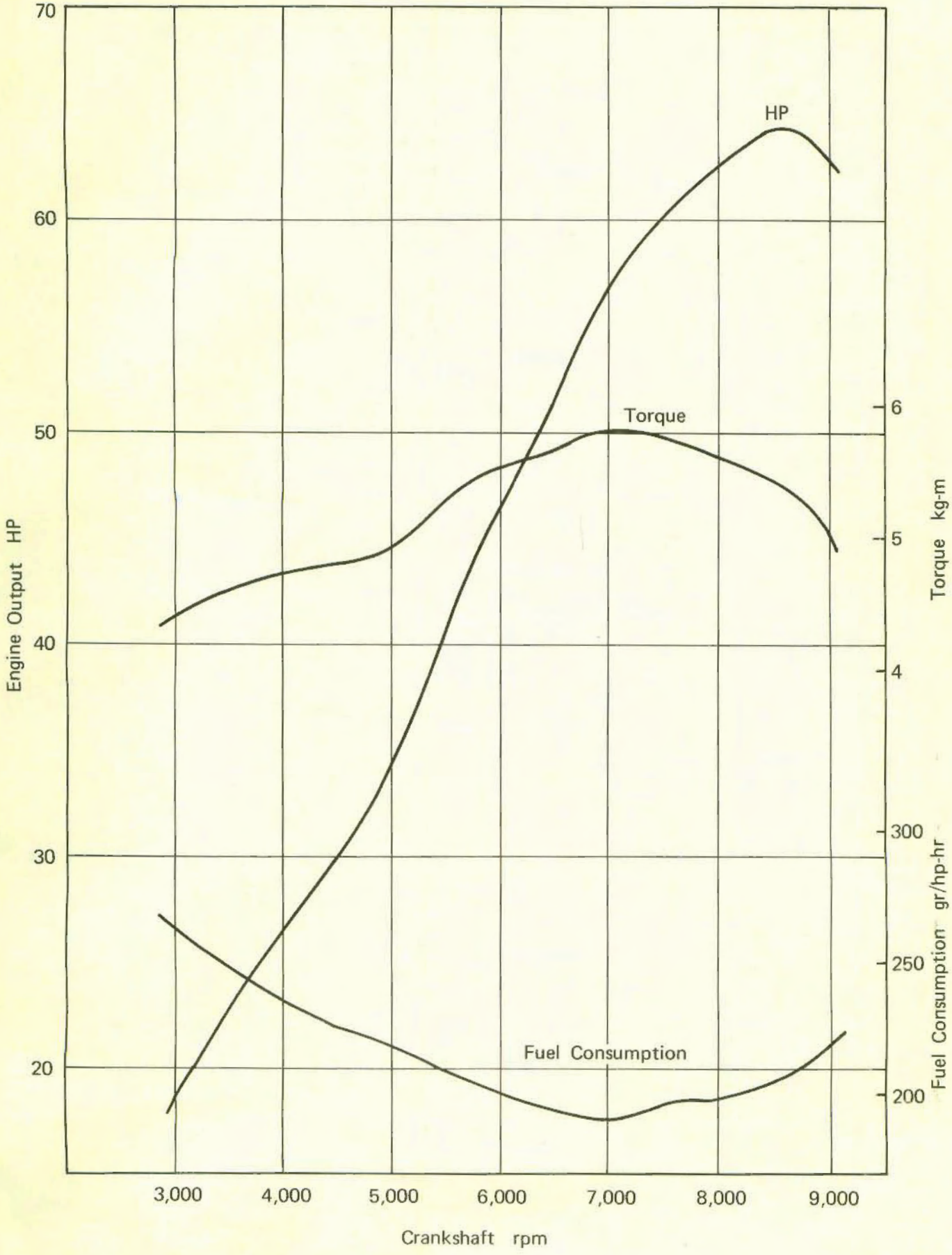
Brakes

Type	Front	Disc brake
	Rear	Internal expansion, leading-trailing
Effective disc diameter		245 mm
Brake drum inside diameter and width		180 x 40 mm

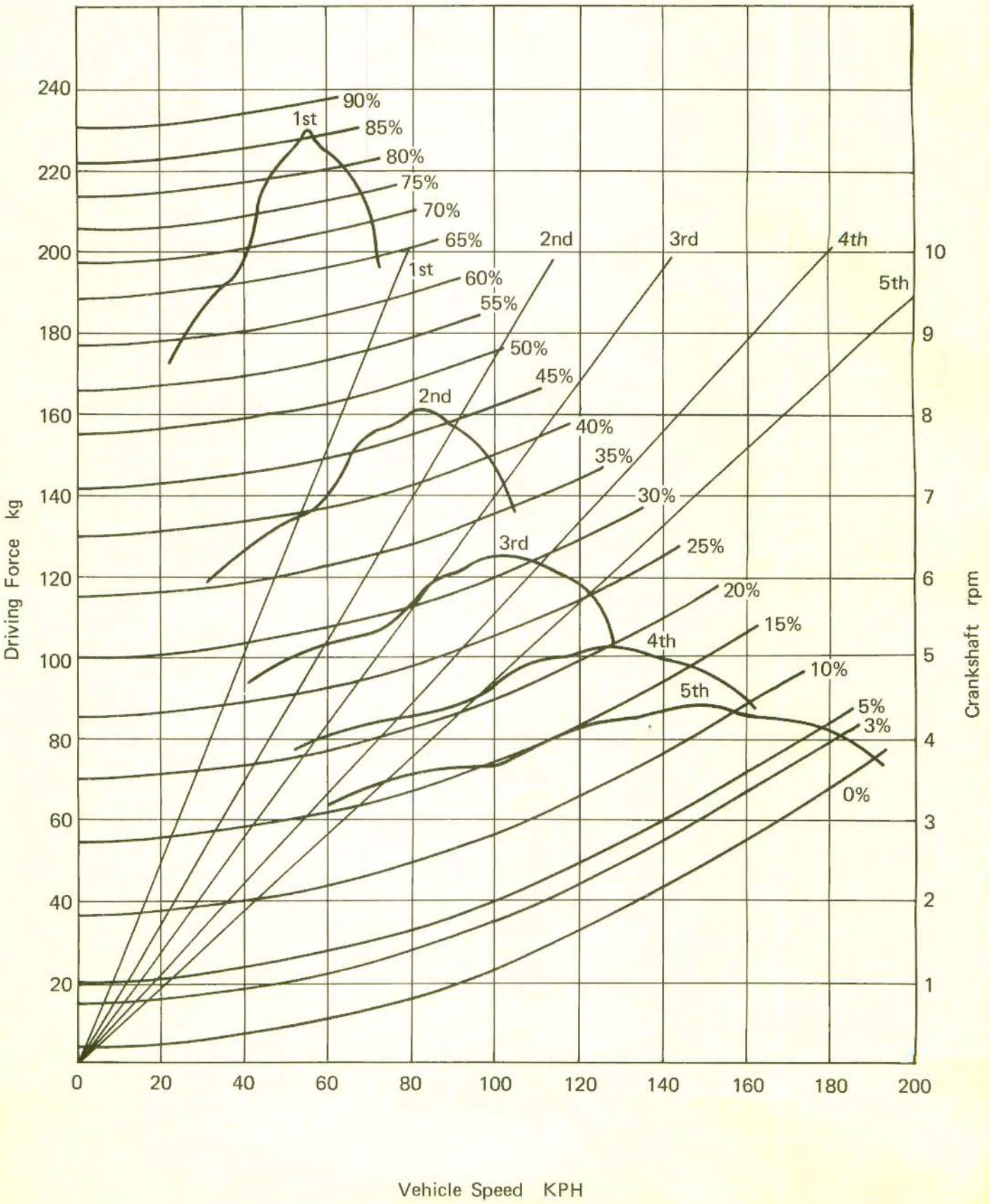
Specifications subject to change without notice, and may not apply to every country.

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	•	•	•		25
Check brake fluid level	•	•	•		25,181
Check, adjust clutch	•	•	•		20
Check, adjust carburetors	•	•	•		17
Check, adjust throttle cables	•	•	•		17
Check spoke tightness and rim runout	•	•	•		173
Clean fuel system	•	•	•		22
Clean, set spark plug gaps	•	•	•		12
Adjust camshaft chain	•		•		14
Check, adjust points, timing	•		•		12
Check valve clearance	•		•		15
Check steering play	•			•	26
Tighten bolts and nuts	•			•	35~38
Check tire pressure and tread wear	•	•	•		170
Check drive chain wear		•	•		175
Clean air cleaner element		•	•		131
Perform general lubrication		•	•		29
Change engine oil	•	Every subsequent 3,000 km			21
Change oil filter element	•	Every subsequent 6,000 km			166
Lubricate drive chain	Every 300 km				175
Check, adjust drive chain	Every 800 km				24
Change air cleaner element	*Every 10,000 km or after cleaning 5 times				131
Check brake wear	Every 10,000 km				177,183
Change front fork oil	Every 10,000 km				187
Lubricate timing advancer	Every 10,000 km				203
Change brake fluid	*Every year or 10,000 km				179
Regrease wheel bearings	*Every 2 years or 20,000 km				174
Regrease speedometer gear housing	*Every 2 years or 20,000 km				174
Regrease brake camshaft	*Every 2 years or 20,000 km				184
Lubricate steering stem bearings	*Every 2 years or 20,000 km				185

*Whichever occurs first.

Adjustment – Engine

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SPARK PLUGS

Neglecting the spark plug eventually leads to difficult starting and poor performance. If the spark plug is used for a long period, 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 plugs 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.

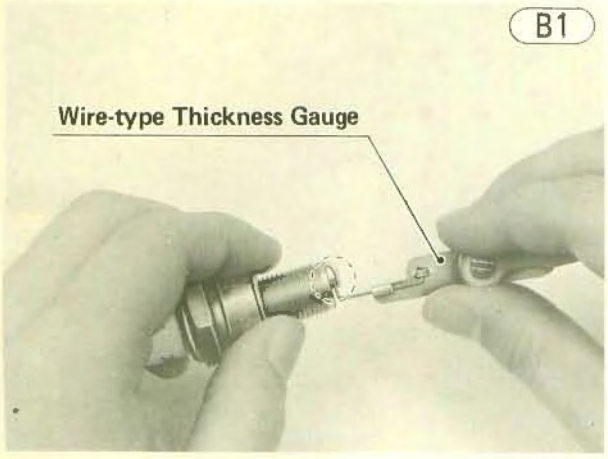


Table B1 Spark Plug

Plug	NGK B8ES, ND W24ES
Gap	0.7~0.8 mm
Tightening Torque	2.5~3.0 kg-m (18.5~22.0 ft-lbs)

- Tighten the spark plugs in the cylinder head with 2.5 ~3.0 kg-m (18.5~22.0 ft-lbs) of torque.

NOTE: Refer to electrical maintenance section, Pg. 203, 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 check whenever ignition related parts have been disassembled or replaced.

Correct ignition timing is achieved by first obtaining the correct contact breaker point gaps (this can also be achieved by adjusting the dwell angles to the specified amount) and then changing the position of the adjusting plates. 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.

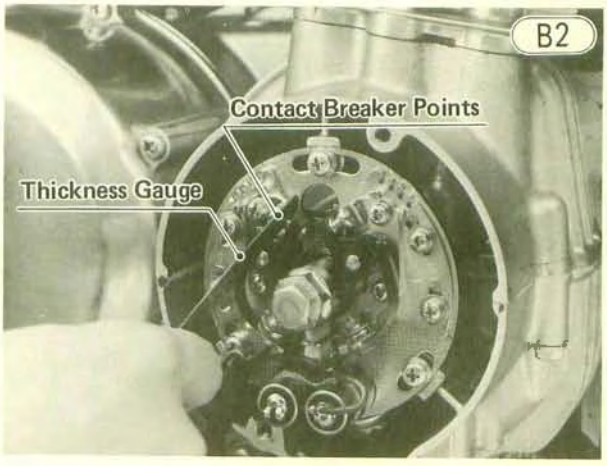
There are two sets of contact breaker points, the left set marked "1 4" fires spark plugs 1 and 4 simultaneously, and the right set marked "2 3" fires plugs 2 and 3 180° later. The gap for each set of points must be adjusted separately.

NOTE: Spark plugs and cylinders are numbered consecutively, starting from the left.

There are two "F" marks on the timing advancer, which can be viewed through the inspection window by turning the crankshaft. One set is marked "1 4" and the other one is marked "2 3". After the gap is adjusted for both sets of points, timing must also be adjusted twice, once using the "1 4" F mark, and once using the "2 3" F mark.

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 suitable point cam lubricant. Do not over lubricate. Replace the oil felt if it is worn.
- Using a 17 mm wrench on the crankshaft, turn the engine clockwise 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 screwdirver on the contact breaker base pry point, and insert a blade thickness of 0.35 mm between the points. Tighten the contact breaker base screws (2), and remove the blade. Again turn the crankshaft, and recheck the point gap.
- Repeat the steps above for the other set of points.
- Perform the timing test.

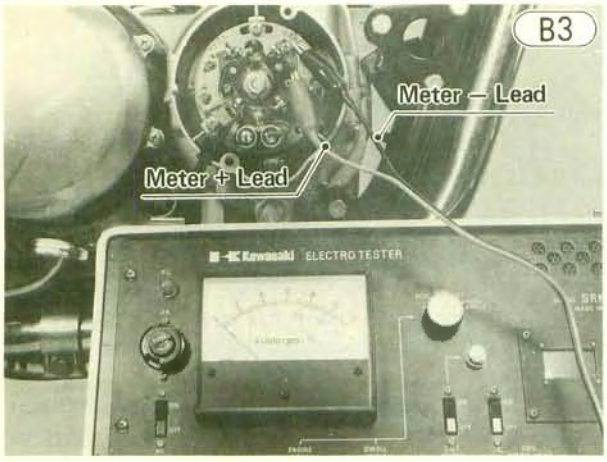
Point Gap Adjustment (using a dwell angle tester):

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 suittable 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 1,050 rpm).

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

- Note the reading on the tester. The dwell angle specification is 185 ~ 195° for a tester calibrated in degrees and 51 ~ 54% 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 Relation between Selector Knob Setting and Meter Reading†

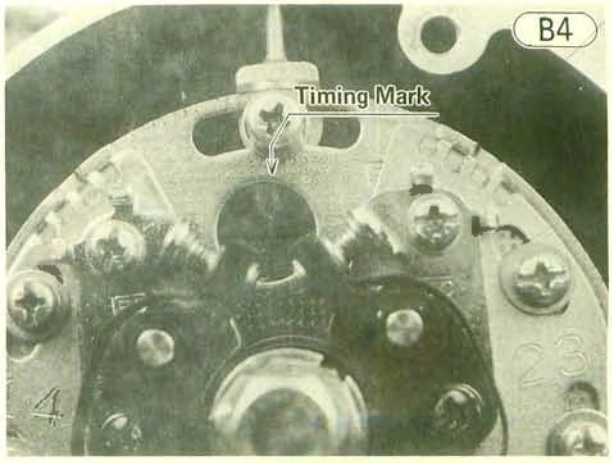
Selector Knob Setting	Dwell Angle Tester Reading
1 cyl.	185.0~195.0° (51.0~54.0 %)
2 cyls.	92.5~97.5° (25.5~27.0 %)
3 cyls.	62.5~65.0° (17.0~18.0 %)
4 cyls.	46.5~49.0° (13.0~13.5 %)

† Running the engine at idling speed.

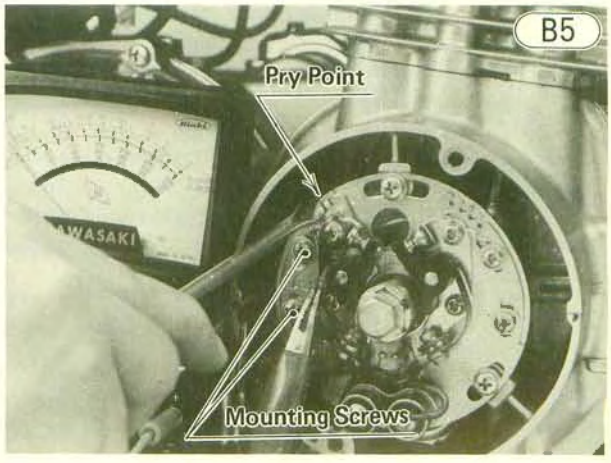
- If the dwell angle is not the same as the specification, loosen the contact breaker base screws (2) just enough so that a slot screwdriver at the contact breaker pry point will be able to change the gap (Fig. B2). Adjust the gap until the dwell angle specification is obtained. Tighten the screws (2).
- Repeat the steps above for the other set of points.
- Stop the engine, disconnect the tester.
- Perform the timing test.

Timing Test (Static):

- Turn the ignition switch off.
- Turn the engine stop switch off.
- Turn the crankshaft so that the "F" mark on the timing advancer is aligned with the timing mark as shown.



- Set an ohmmeter to the R x 1 range and connect it across the appropriate set of 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 its mounting screws (2), and turn the adjusting plate 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.



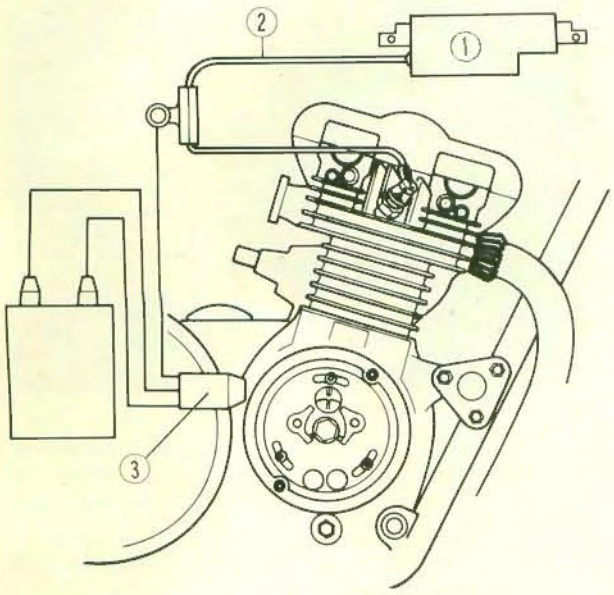
- If the adjusting plate will not travel far enough to allow correct timing adjustment, loosen the mounting plate screws (3) and turn the plate to provide more room for adjustment.

- Turning the crankshaft clockwise, 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.
- Repeat the steps above using the other "F" mark.
- Disconnect the ohmmeter leads.
- Install the contact breaker cover.

Timing Test (Dynamic)

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

Dynamic Ignition Timing Test B6

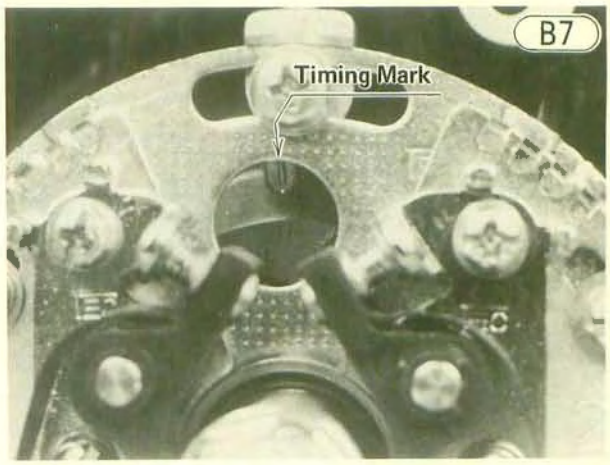


1. Ignition Coil
2. Spark Plug Lead
3. Strobe Light

- Start the engine, and direct the light at the timing mark. At low engine speed the timing mark and the "F" mark on the timing advancer must be aligned for correct low rpm ignition timing (Fig. B4). At high engine speed the timing mark and the pair of lines on the right side of the mark "3" or "4" on the timing advancer as shown in Fig. B7 must be aligned for correct high rpm ignition timing. 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. 203).

Table B3 Timing Advancing

	Engine Speed
Timing Advance Begins	1,400~1,800 rpm
Timing Advance Finishes	3,000~3,400 rpm



- Install the contact breaker cover.

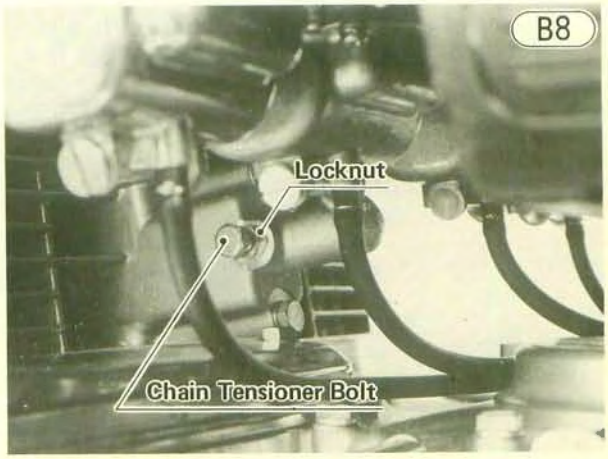
CAMSHAFT CHAIN

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 **During camshaft chain adjustment, never touch the engine and exhaust pipes or you may suffer burns.**

- Remove the contact breaker cover.
- Using a 17 mm wrench, turn the crankshaft clockwise about two turns, and set the #1 and #4 or the #2 and #3 T mark on the timing advancer so that it aligns with the mark on the right engine cover.
- Loosen the chain tensioner locknut and bolt. (With the bolt loose, a spring inside takes up slack automatically.)



- Tighten the bolt with 0.9 ~ 1.1 kg-m (78 ~ 95 in-lbs) of torque and then its locknut.

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.

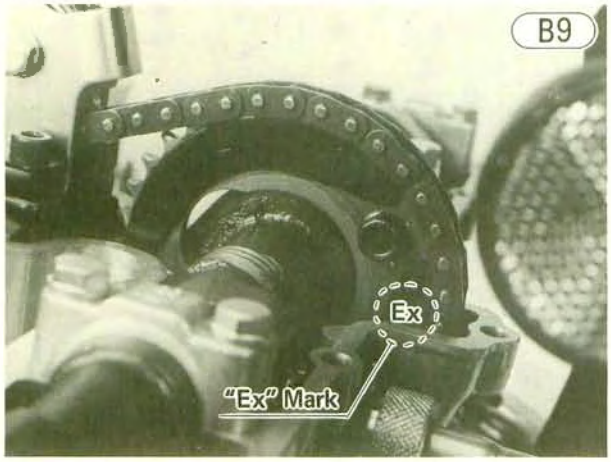
Valve clearance for each valve should be checked (and if incorrect adjusted) in accordance with the Periodic Maintenance Chart (Pg. 10) and any time that clearance may have been affected by disassembly.

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.

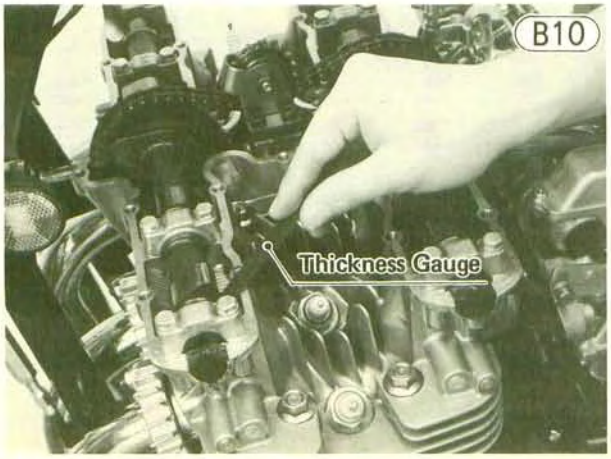
NOTE: Valve clearance must be checked when the engine is cold.

To check the valve clearance:

- Remove the fuel tank (Pg. 41).
- Remove the ignition coils (Pg. 46).
- Remove the cylinder head cover bolts (24), and remove the cylinder head cover.
- Remove the contact breaker cover.
- To check the exhaust camshaft valves, use a 17 mm wrench on the crankshaft to turn the crankshaft so that the line adjoining the "Ex" mark on the exhaust camshaft sprocket is pointing to the front aligned with the cylinder head surface.



- Insert a thickness gauge between the cam and the valve lifter, and measure the two valves (#1 and #3) for which there is clearance. The correct clearance is 0.08 ~0.18 mm.



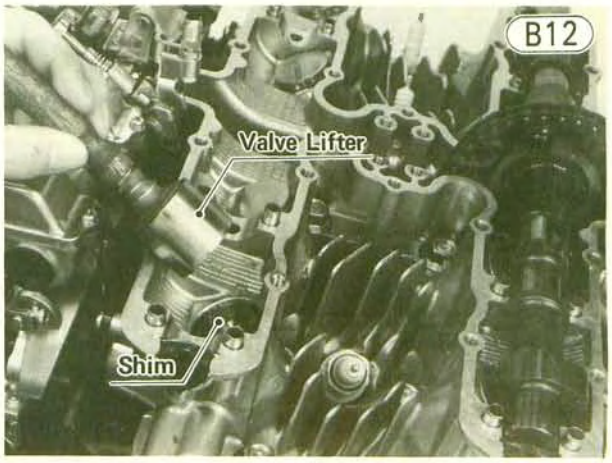
- Turn the crankshaft until the "Ex" marked line is pointing to the rear aligned with the cylinder head surface (½ rotation), and measure the other two valves (#2 and #4).
- To check the inlet camshaft valves, turn the crankshaft so that the inlet camshaft sprocket arrow adjoining the T mark is pointing to the rear aligned with the cylinder head surface, and measure the two valves (#5 and #7) for which there is clearance.

- Turn the crankshaft until the T marked arrow is pointing to the front aligned with the cylinder head, and measure the rest two valves (#6 and #8).
- If the valve clearance is incorrect, continue the following procedures to replace the present shim with a new shim, which will give the proper clearance.

NOTE: If there is no clearance between the valve lifter and cam, select a shim which is several sizes smaller and then remeasure the clearance once it is installed.

To adjust the valve clearance:

- Remove the camshaft (Pg. 46)
- Being careful not to damage the valve lifter, pull off the valve lifter with a suitable tool.



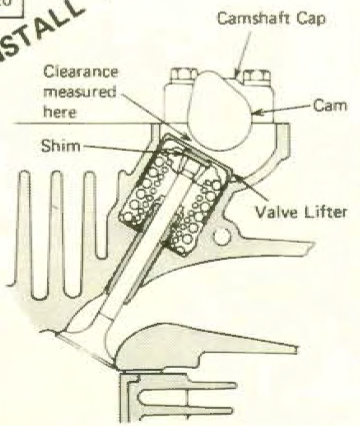
- Check the present shim thickness (shim size) which is printed on the shim surface, and referring to the Valve Adjustment Chart (Pg. 16), select a new shim which brings valve clearance within the specified limits. Shims are available in sizes from 2.0 ~ 3.2 mm, in increments of 0.05 mm.

VALVE ADJUSTMENT CHART

	PRESENT SHIM SIZE																								
PART NUMBER 12037-	076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095	096	097	098	099	100
MILIMETERS	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20

VALVE CLEARANCE

VALVE CLEARANCE	SPECIFIED CLEARANCE/NO CHANGE REQUIRED (INSTALL THIS SHIM)
0.00 ~ 0.03	2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05
0.04 ~ 0.08	2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10
	2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15
0.08 ~ 0.18 mm	
0.18 ~ 0.22	2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.23 ~ 0.27	2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.28 ~ 0.32	2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.33 ~ 0.37	2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.38 ~ 0.42	2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.43 ~ 0.47	2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.48 ~ 0.52	2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.53 ~ 0.57	2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.58 ~ 0.62	2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.63 ~ 0.67	2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.68 ~ 0.72	2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.73 ~ 0.77	2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.78 ~ 0.82	2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.83 ~ 0.87	2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.88 ~ 0.92	2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.93 ~ 0.97	2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
0.98 ~ 1.02	2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20
1.03 ~ 1.07	2.90 2.95 3.00 3.05 3.10 3.15 3.20
1.08 ~ 1.12	2.95 3.00 3.05 3.10 3.15 3.20
1.13 ~ 1.17	3.00 3.05 3.10 3.15 3.20
1.18 ~ 1.22	3.05 3.10 3.15 3.20
1.23 ~ 1.27	3.10 3.15 3.20
1.28 ~ 1.32	3.15 3.20
1.33 ~ 1.37	3.20



1. Align the sprocket mark with the cylinder head surface, and measure the clearance (cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Select one of the shims specified where the lines intersect. Either shim will give you the proper clearance.

NOTE: If there is no clearance between the valve lifter and the cam, select a shim which is several sizes smaller and then remeasure the clearance.

CAUTION

1. Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.
2. Do not grind the shim. This may cause it to fracture, causing extensive engine damage.
3. Check the valve clearance with the proper method in the text. Checking the clearance at any other cam position may result in improper valve clearance.

•Insert the new shim on the valve spring retainer.

CAUTION **1. Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.**

2. Do not grind the shim. This may cause it to fracture, causing extensive engine damage.

NOTE: If the smallest shim does not sufficiently increase clearance, the valve seat is probably worn. In this case, repair the valve seat (Pg. 143), and check the valve stem installed height (Pg. 145).

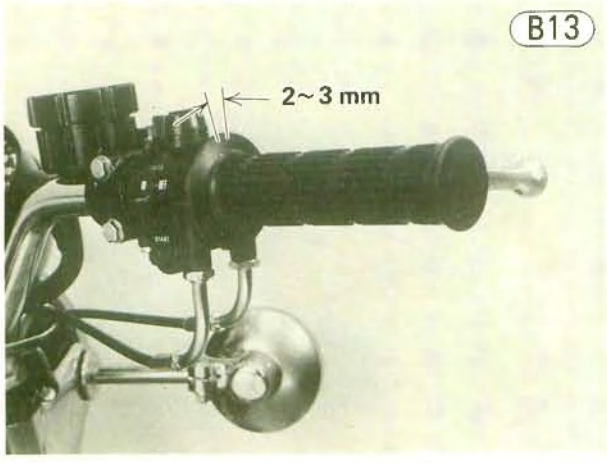
•Install the camshaft and camshaft chain guide sprocket (Pg. 47), remeasure the valve clearance that was adjusted, and readjust if necessary.

THROTTLE CABLES

There are two throttle cables, the accelerator cable for opening the throttle valves and decelerator cable for closing them. If the cables are too loose from either cable stretch or maladjustment, the excessive play in the throttle grip will cause a delay in throttle response, especially at low rpm. Also, the throttle valves may not open fully at full throttle. On the other hand, if the cables are too tight, the throttle will be hard to control, and the idling speed will be erratic.

To check the throttle cable adjustment:

•Check that there is 2~3 mm throttle grip play.

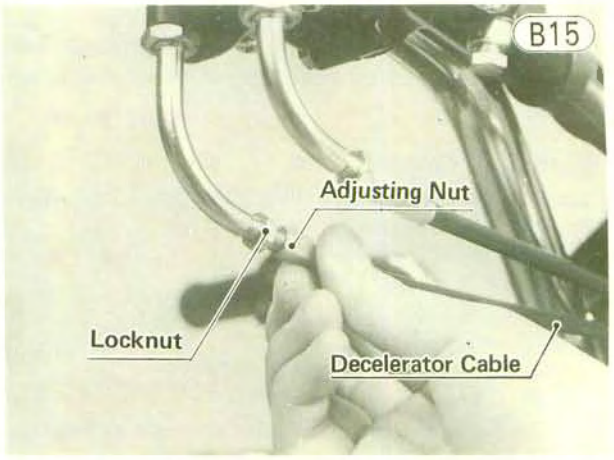


•Push the throttle grip completely closed. At this time there should be no clearance between the cable bracket and the stopper.

If any one of the above checks shows to be maladjusted, adjust the throttle cable as follows:

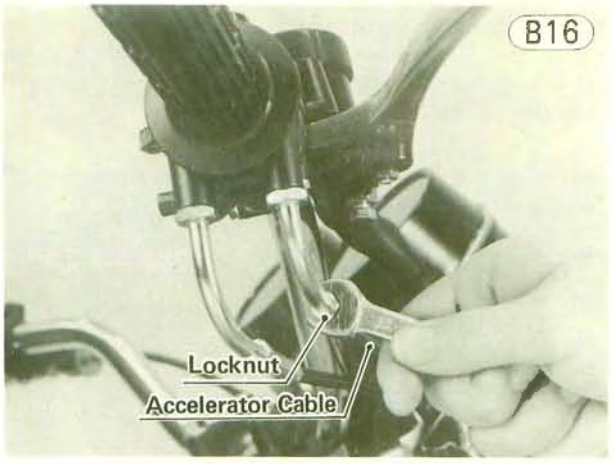
•Loosen the locknuts, and screw both throttle cable adjusting nuts in fully at the upper end of the throttle cables so as to give the throttle grip plenty of play.

•Turn out the decelerator cable adjusting nut until there is no clearance between the cable bracket and the stopper when the throttle grip is completely closed.



•Turn out the decelerator adjusting nut 2 turns from that point, and tighten the locknut.

•Turn the accelerator cable adjusting nut until 2 ~ 3 mm of throttle grip play is obtained. Tighten the locknut.



NOTE: If the throttle cables can not be adjusted by using the cable adjusting nuts at the upper end of the throttle cables, use the cable adjuster at the lower end of the throttle cables. Do not forget to securely tighten the adjuster mounting nuts.

CARBURETORS

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 idling setting has been disturbed. This procedure also includes the necessary steps for obtaining proper carburetor synchronization.

When the idling speed is too low, the engine may stall; when the idling speed is too high, the fuel consumption becomes excessive, and the resulting lack of engine braking may make the motorcycle difficult to control. Poor carburetor synchronization will cause unstable idling, sluggish throttle response, and reduced engine power and performance.

The following procedure consists of four parts: preliminary checks, preliminary adjustment (sometimes necessary), idling adjustment, and carburetor synchronization.

Preliminary Checks:

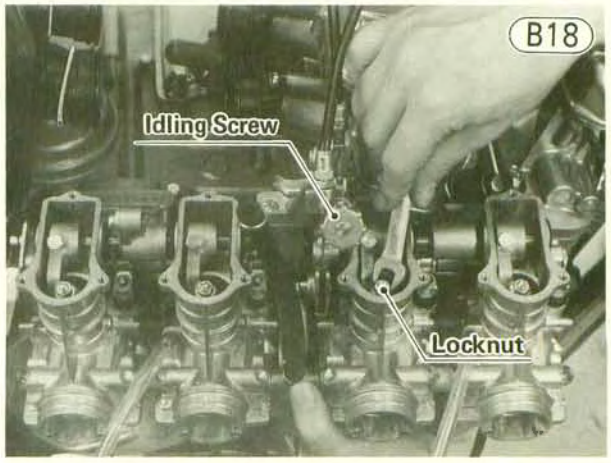
- In order to obtain correct idling adjustment, first check the following and adjust if necessary:
  - Engine Oil (Pg. 21)
  - Spark Plugs (Pg. 12)
  - Ignition Timing (Pg. 12)
  - Throttle Cables (Pg. 17)
  - Cylinder Compression (Pg. 147)
  - Air Cleaner Element (Pg. 131)
  - Air Cleaner Duct and Carburetor Holder Leakage (Pg. 42)
  - Camshaft Chain (Pg. 14)
  - Valve Clearance (Pg. 15)

Initial Synchronization–Mechanical

If the engine idling is especially rough, it may be necessary to synchronize the throttle valves before making the idling adjustment:

- Turn the idling screw so that there is 1.6 ~ 2.0 mm clearance between the throttle cable bracket end and the stopper on the pulley.

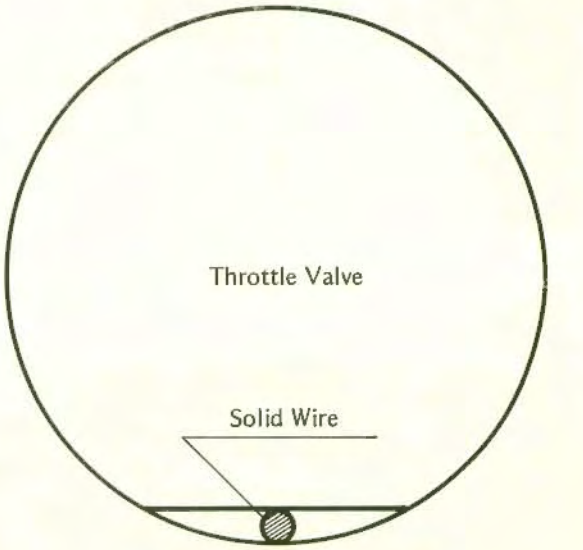
- Push the throttle grip completely closed, At this time there should be no clearance between the cable bracket and the stopper. When the throttle grip is released, there should be 1.6 ~ 2.0 mm clearance between the cable bracket and the stopper. Replace the cable bracket if it does not work as above.
- Remove the carburetors from the engine (Pg. 41).
- Synchronize the throttle valves using the following procedure.
- Remove the top covers (4), and loosen the locknut.



- Turn the idling screw to make a slight clearance between the throttle valve and the bottom of the carburetor bore. Turn each adjusting screw until the four clearances are the same. This is a very fine adjustment, so make it carefully.

NOTE: An easy method of performing this adjustment is to carefully insert a piece of 0.5 ~ 1.0 mm solid wire in the space between the bottom of the carburetor bore and the throttle valve, lifting the valve and slowly letting it seat on the wire. Then, with the carburetor throat facing downward, slowly turn the adjusting screw out until the wires fall out. Repeat the procedure above for each carburetor.

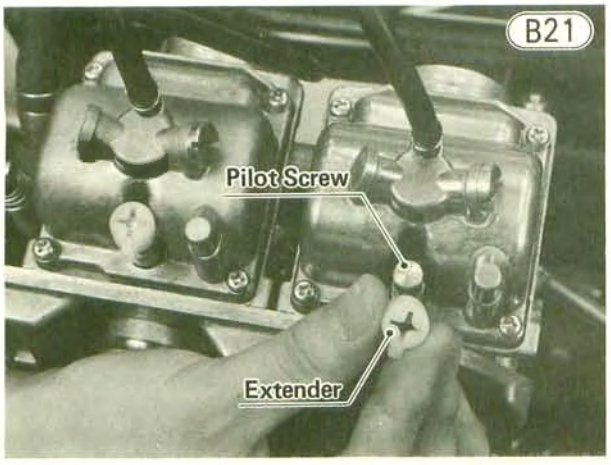
Throttle Valve Clearance



Bottom of Carburetor Bore

- Tighten the locknuts without changing the position of the screws. Install the top covers.
- Open the throttle so that the bottom edge of the lowest of the four carburetor throttle valves is even with the top of the carburetor bore. Turn the pulley stop screw so the pulley is stopped at that point.

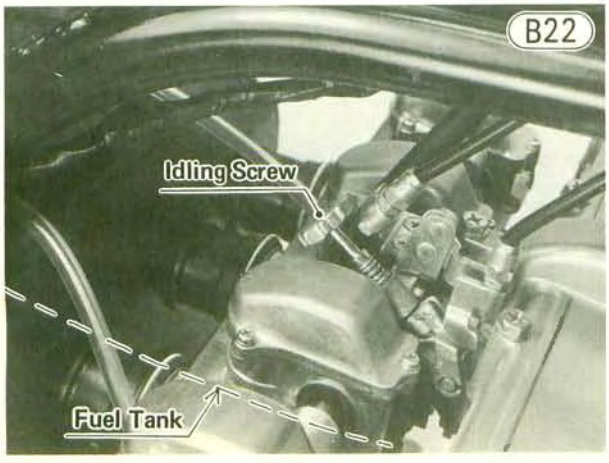
•For each carburetor, pull off the pilot screw extender.
•Turn in the pilot screw until it seats lightly, and then back it out ¾ turn.
•Push the extender onto the pilot screw with the ridge pointing to the front.



•Install the carburetors (Pg. 42), and adjust the play in the throttle cables (Pg. 17).

Idling Adjustment:

•Start the engine, and warm it up for 5 minutes.
•Adjust idling speed to 950~1,050 rpm by turning the idling screw.



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

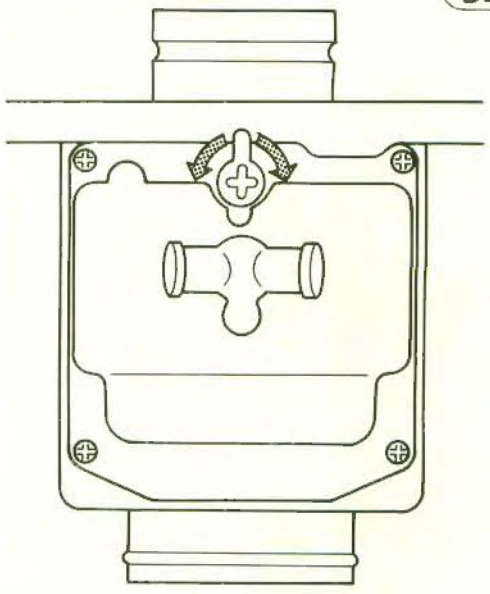
NOTE: With the engine idling, turn the handlebar to either side. If handlebar movement changes idling speed, the throttle cables may be improperly adjusted or incorrectly routed, or they may be damaged.

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

NOTE: A satisfactory result may be obtained by using the procedure just described, but an experienced mechanic can get a more precise adjustment of engine idle mixture by using the following three steps.

○Adjust the pilot screw of each carburetor, one at a time, to obtain highest idle rpm. Turn the pilot screw within the range that the ridge on the pilot screw extender stops against the carburetor float bowl. Normally, this pilot screw adjustment will be within $\frac{1}{8}$ turn in or not from the specified pilot screw setting.

Pilot Screw Adjustment B23



○Adjust idling speed to 950~1,050 rpm by turning the idling screw.
○Check to see if the engine rpm rises when the pilot screw positions are altered. If it rises, repeat the last two steps alternately until the engine is idling satisfactorily, and engine speed cannot be increased by further adjustment of the pilot screws.

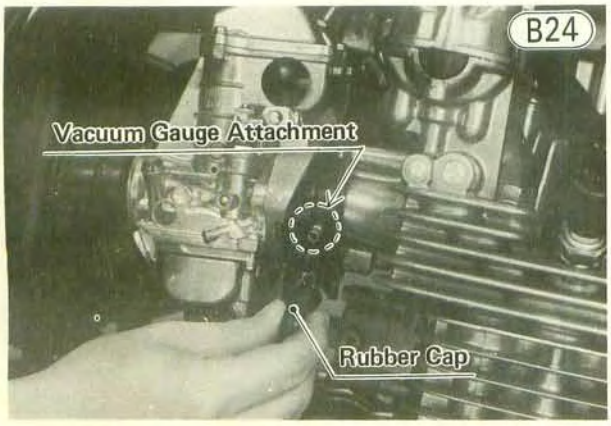
Fine Synchronization–Vacuum:

Fine adjustment of carburetor synchronization, necessary for smooth engine operation, requires the use of vacuum gauges. A difference between left two cylinders and right two cylinders might be found from exhaust noise and exhaust pressure; but to synchronize each carburetor, using vacuum gauges is essential.

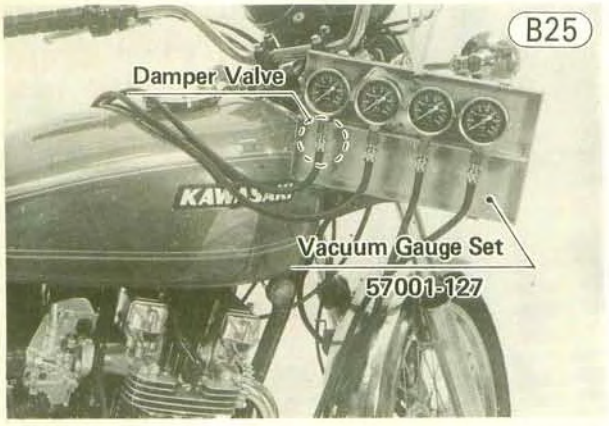
NOTE: During carburetor synchronization, the fuel tank will be removed. In most cases, it will be necessary to temporarily replace the standard fuel lines with lines long enough to reach the fuel tank while it is located on your workbench.

WARNING **Use extreme caution when working with gasoline, open fuel lines, etc. to avoid a fire or explosion.**

- Start the engine, and warm it up for 5 minutes.
- Perform idling adjustment (Pg. 19).
- Remove the rubber caps from the vacuum gauge attachments on the carburetor holder, and attach the vacuum gauges (special tool).



- With the engine running at idling speed, close the vacuum gauge damper valves until gauge needle flutter is less than 3 cm Hg. Normal vacuum gauge reading is 19 ~ 24 cm Hg, and the difference between any two cylinders should be less than 2 cm Hg.



- If the difference in vacuum readings between any two cylinders is greater than 2 cm Hg, re-adjust the individual throttle adjusting screws to make combustion uniform by the following procedure.
- Remove the fuel tank (Pg. 41), and supply fuel for carburetors by some means during adjustment.
- Remove the carburetor top covers (4) and loosen the locknuts (Fig. B18).
- With the engine running at idling speed, readjust the individual throttle adjusting screws to set all the carburetors to within 2 cm Hg of each other. Backing the screw out decereases vacuum and turning it in increases it. If any gauge reads less than 2 cm Hg after synchronizing the carburetors; recheck the points listed in Preliminary Checks (Pg. 18) and check and clean carburetor starter system.

CAUTION **Take care that no dirt or other foreign matter enters the tops of the carburetors during this operation, or else the throttle valves may stick.**

- Perform idling adjustment again.
- Open the throttle grip and let it snap shut a few times. Make sure the vacuum readings stay within the specified vacuum reading. If they do not, repeat the last two steps.
- After the carburetors are properly synchronized, tighten the locknuts without changing the positions of the screws. Install the top covers.
- Detach the vacuum gauge and install the rubber caps on the vacuum gauge attachments.
- Install the fuel tank (Pg. 41).
- For any carburetors readjusted, readjust the pilot screw as explained in Idling Adjustment (Pg. 19).
- Adjust idling speed to 950 ~ 1,050 rpm with the idling screw.

CLUTCH

Stretching of the clutch cable 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 adjusting screw to gradually diminish until the push rod touches the adjusting screw. When this play is lost, the clutch will not engage fully, causing the clutch to slip.

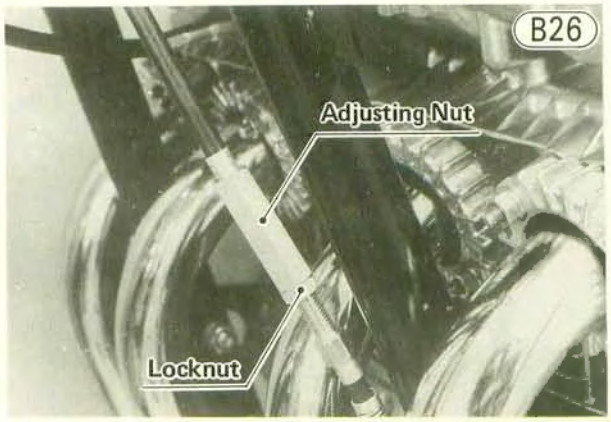
NOTE: Even though the proper amount of play exists at the clutch lever, clutch lever play alone cannot be used to determine whether or not the clutch requires adjustment.

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

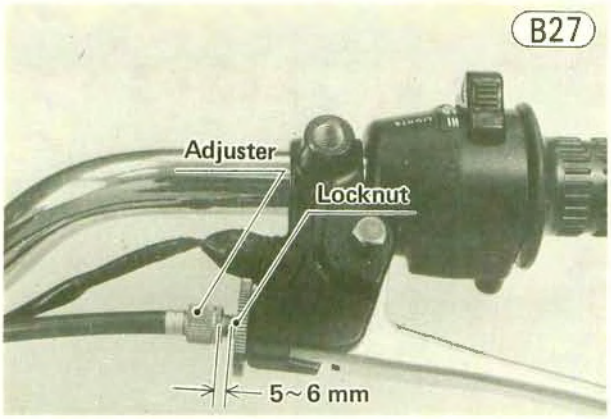
WARNING **To avoid a serious burn, never touch a hot engine or exhaust pipe during clutch adjustment.**

To adjust the clutch:

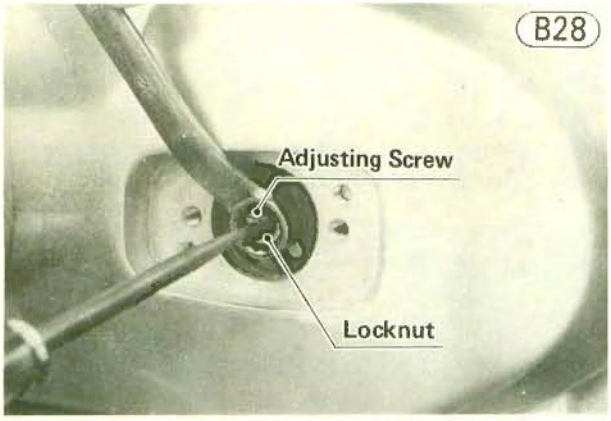
- Screw in fully the locknut and adjusting nut at the center of the clutch cable to give the cable plenty of play.



- Loosen the 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.



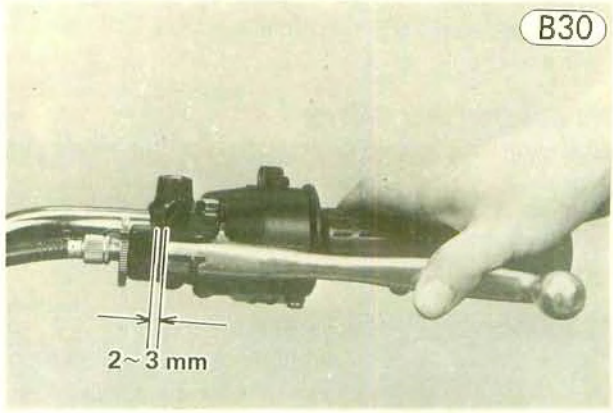
•Remove the clutch adjusting cover.
•Loosen the locknut, and back out the clutch adjusting screw a couple of turns.



•Turn the adjusting screw in until it becomes hard to turn. This is the point where the clutch is just starting to release.
•Back out the adjusting screw ½ turn from that point, and tighten the locknut without changing the adjusting screw position.
•Take up all the cable play with the adjusting nut at the center of the cable, and then tighten the locknut.
•Make sure the lower end of the clutch outer cable is properly fitted into the hole in the enigne sprocket cover.

WARNING **If the cable is not fully seated in the engine sprocket cover hole, it could slip into place later and the clutch would not disengage.**

•Turn the adjuster at the clutch lever so that the clutch lever will have 2~3 mm of play as shown in Fig. B30, and tighten the locknut.



•Install the clutch adjusting cover and gasket.

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 idling speed. This fills the oil filter with oil. Then wait several minutes until the oil settles.

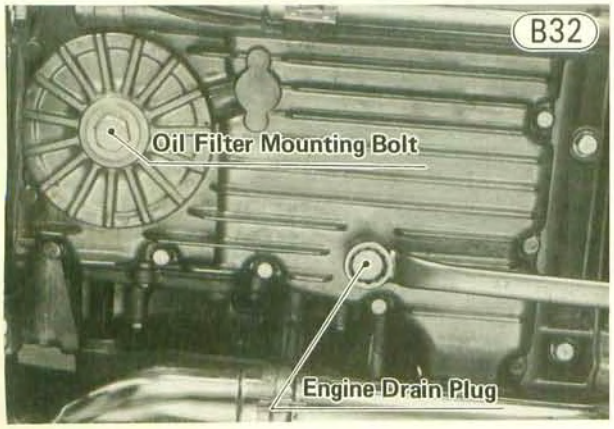
CAUTION **Run the engine at idling speed at least until the oil pressure light turns off. Racing the engine before the oil reaches every part can cause the engine seizure.**

•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 syringe or some other suitable device.
- If the amount of oil is insufficient, add the correct amount of oil through the oil filler opening. Fill, using the same type and make of oil that already is 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 filter mounting bolt and drop out the oil filter.
- Replace the oil filter with a new one. Check that it is properly assembled (Pg. 69~70).

NOTE: Check for **O** ring damage. If necessary, replace it with a new one.

- Install the oil filter, tightening its bolt.
- After the oil has completely drained out, install the engine drain plug. Proper torque for the drain plug is 1.3~1.7 kg-m (9.5~12 ft-lbs).
- Fill the engine up to the upper level with SE class SAE 10W40, 10W50 or 20W50 motor oil. It will take about 3.5 liters when the filter is changed. When the filter is not changed, a refill takes about 3.0 liters.

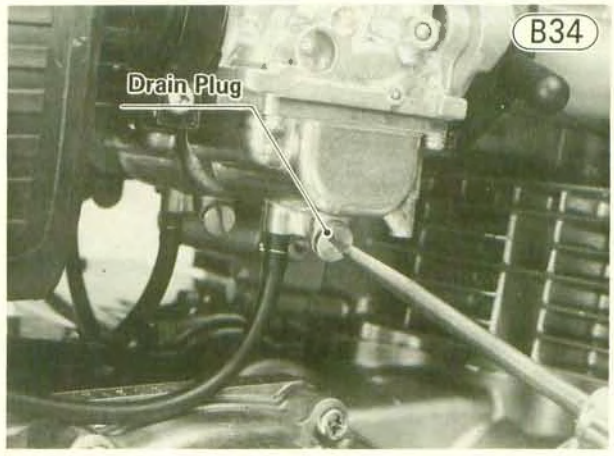
NOTE: After the engine has been run and then stopped for a few minutes, the oil level should come to between the upper and lower marks.

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 and dirt from it. Clean any dirt out of the fuel tap filter.

- 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 gasoline only 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 each carburetor float bowl to drain the bowls.



Adjustment – Chassis

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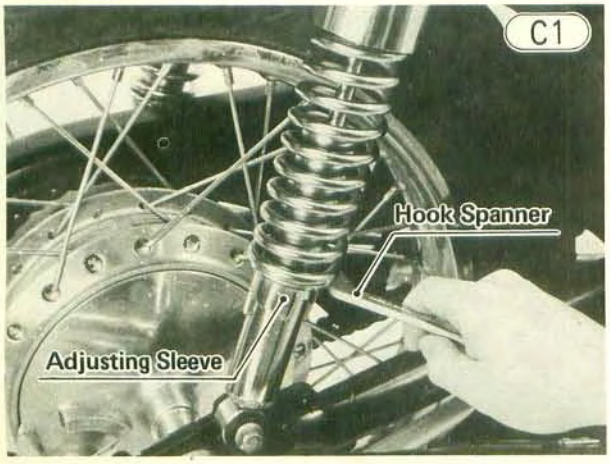
C

REAR SHOCK ABSORBERS

The rear shock absorbers can be adjusted to one of three 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.

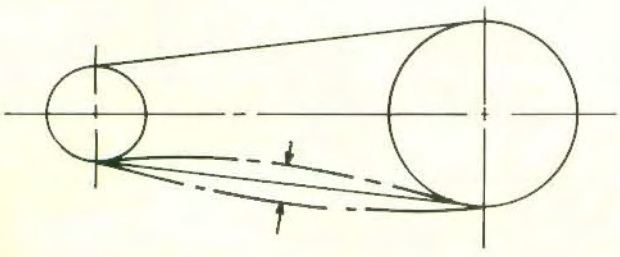
WARNING **If the shock absorber sleeves are not adjusted to the same position, an unsafe riding condition may result.**

DRIVE CHAIN

Chain and sprocket wear causes the chain to stretch, 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.

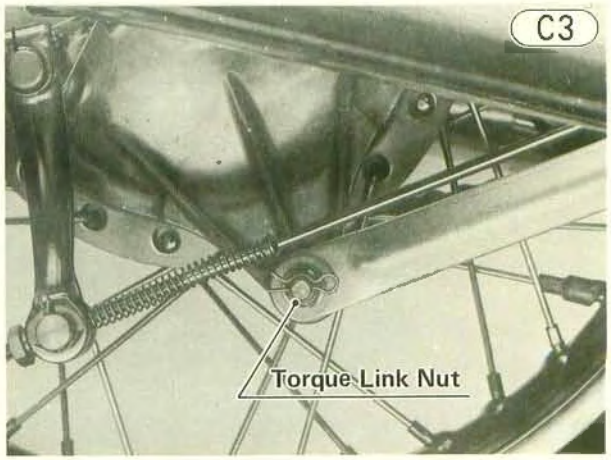
- To determine whether or not the chain requires adjustment, first set the motorcycle up on its center stand. Rotate the rear wheel to find the position where the chain is tightest, and measure the vertical movement midway between the sprockets. If it is less than 15 mm or more than 35 mm, adjust the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

Chain Slack C2

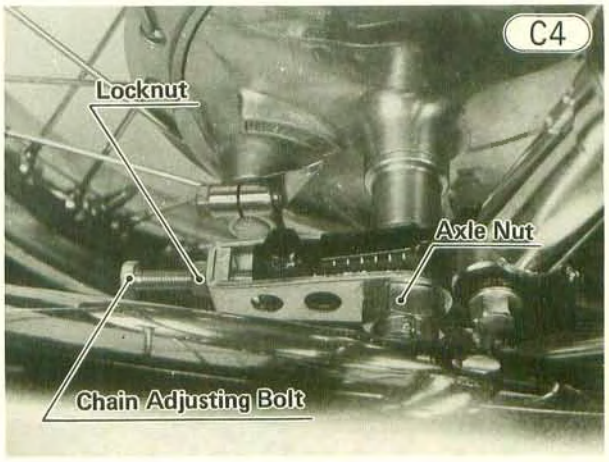


WARNING **A chain worn past the service limit (Pg. 175) must be replaced. Such wear cannot be adequately compensated for by adjustment.**

- 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 10 ~ 14 kg-m (72 ~ 101 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 2.6 ~ 3.5 kg-m (19 ~ 25 ft-lbs) of torque, insert the safety clip.

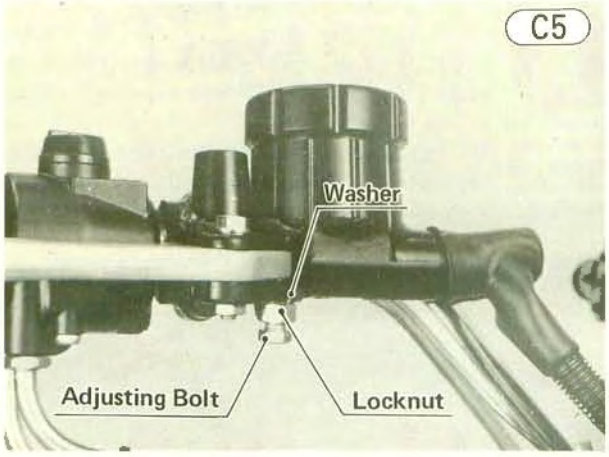
BRAKES

Front Brake

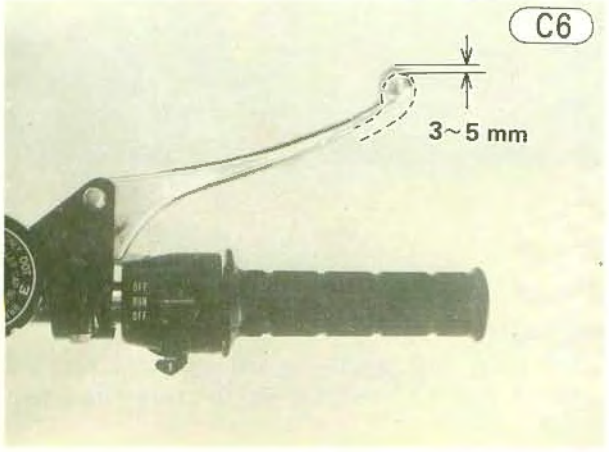
Disc and disc pad wear is automatically compensated for and has no effect on brake lever action. However, the brake lever may occasionally require adjustment due to wear inside the lever assembly itself, or in case of disassembly. Excessive play must be taken up to keep the lever from vibrating and to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

NOTE: Check the brake fluid level in accordance with the Periodic Maintenance Chart (Pg. 10). Before adjusting the brakes, be sure that all air is bled from the brake lines (Pg. 180).

- Straighten the part of the washer that is bent over the side of the adjusting bolt locknut.



- Loosen the locknut, and turn the adjusting bolt a fraction of a turn so that lever play is 3~5 mm.



- Tighten the locknut with 1.8 ~ 2.3 kg-m (13 ~ 16.5 ft-lbs) of torque.
- Bend back part of the washer over the side of the locknut.

Rear Brake

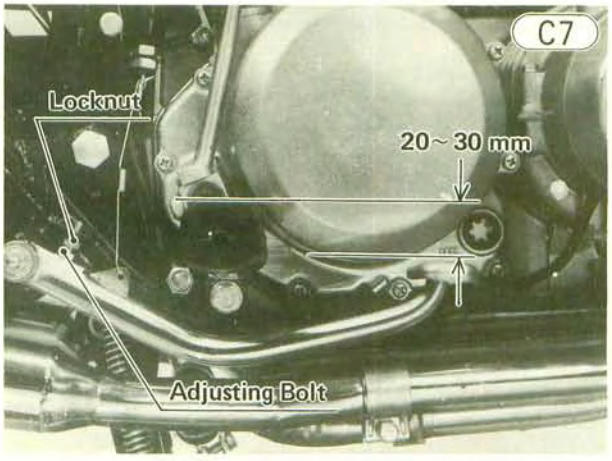
Brake lining and drum wear causes the rear brake to go out of adjustment, increasing pedal play and decreasing braking effectiveness. Rear brake adjustment to compensate for this actually consists of three successive adjustments: brake pedal position, cam lever angle, and brake pedal travel.

If brake drag is detected during brake adjustment, disassemble the brake (Pg. 106), and inspect for wear or damage (Pg. 183). 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. 24).

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 foot peg. If it is too high, screw out the adjusting nut to give the brake pedal plenty of play. If it is too low, go to next step.

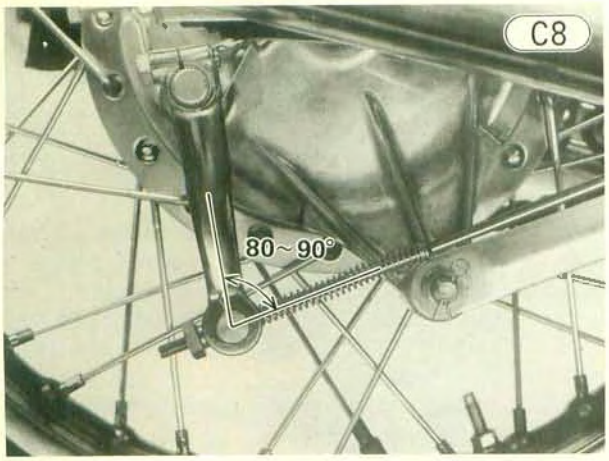


- Loosen the brake pedal adjusting bolt locknut, turn the adjusting bolt to obtain the correct pedal position, and tighten the locknut.

Cam Lever Angle

- When the brake is fully applied, the brake cam lever should come to an 80~90° angle with the brake rod.

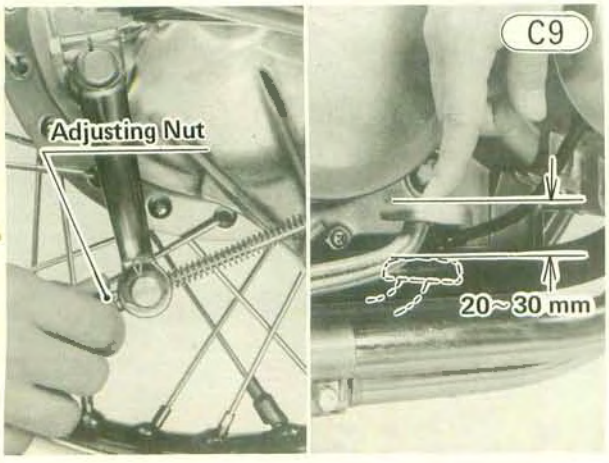
If it does not, remove the cam lever, and then remount it at a new position on the shaft for the proper angle.



WARNING **Since a cam lever angle greater than 90° reduces braking effectiveness, this adjustment should not be neglected. When remounting the cam, 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.

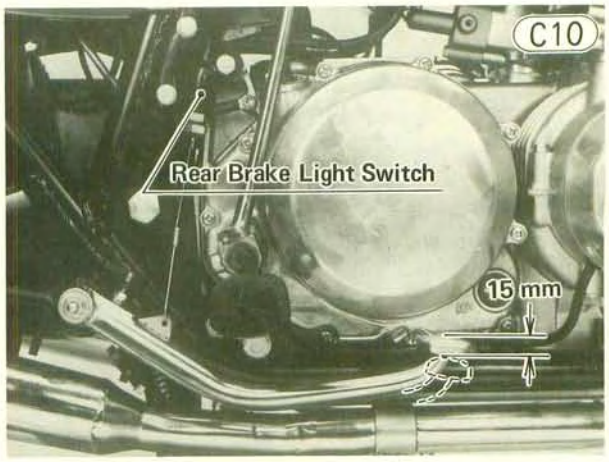


- Rotate the rear wheel to check for brake drag.
- Operate the pedal a few times to see that it returns to its rest position immediately upon release.
- Check the rear brake light switch operation.

BRAKE LIGHT SWITCH

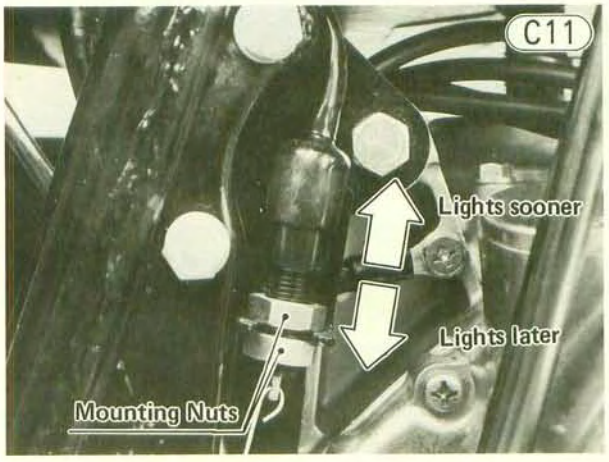
The front brake light switch, mounted on the steering stem base, operates hydraulically and is non-adjustable. However, the rear brake light switch, activated by a spring attached to the brake pedal, requires periodic adjustment to compensate for any change in spring shape or tension.

- 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 mounting nuts on the brake switch body.

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

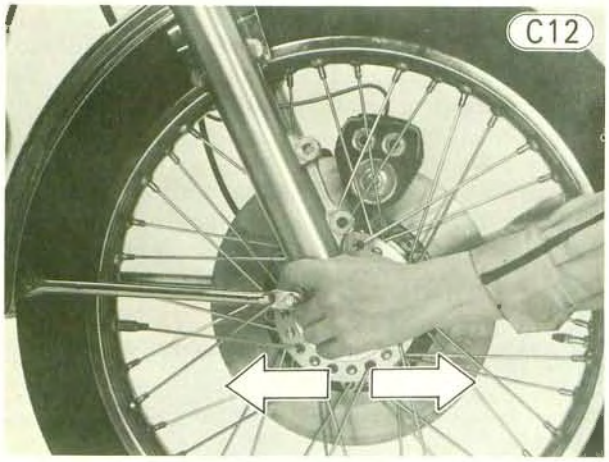


STEERING

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

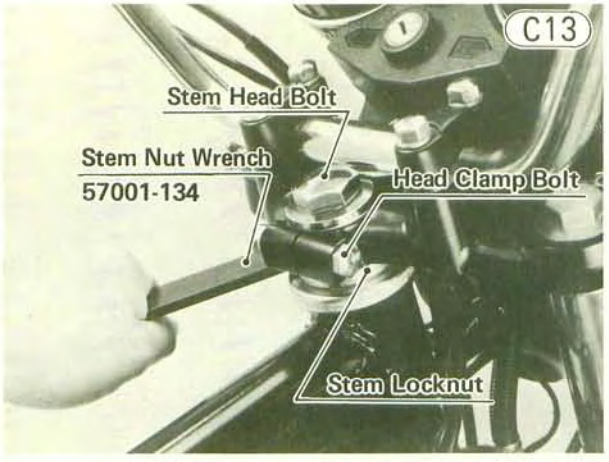
If the steering is too tight, it will be difficult to turn the handlebar quickly, the motorcycle may pull to one side, and the steering stem bearings may become damaged. If the steering is too loose, the handlebar will vibrate and the motorcycle will be unstable and difficult to steer in a straight line.

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.

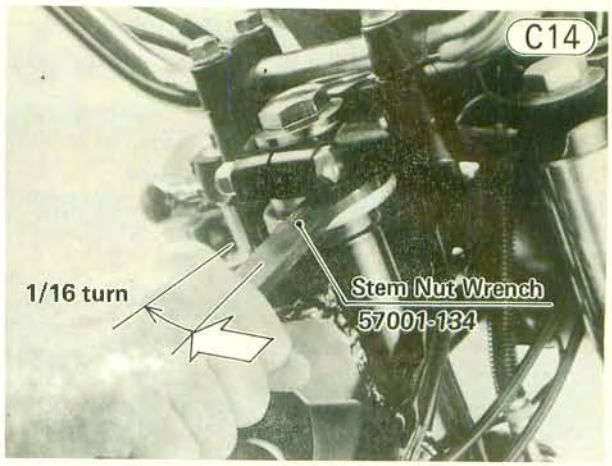


To adjust the steering:

- Put the motorcycle up on its center stand, and jack or prop up the engine so that the front wheel will be off the ground.
- Remove the fuel tank (Pg. 41) to avoid damaging the painted surface.
- Loosen the steering stem head bolt, head clamp bolt, and steering stem locknut using the stem nut wrench (special tool).



- Tighten the 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 4 ~ 5 kg-m (29~36 ft-lbs) of torque.
- Tighten the steering stem head clamp bolt with 1.6 ~ 2.2 kg-m (11.5~16 ft-lbs) of torque.
- Loosen the lower clamp bolts (2) on left and right fork legs to let the tubes reseat themselves, and then tighten the bolts with 3.4 ~ 4.6 kg-m (25 ~ 33 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. 184).
- Remount the fuel tank (Pg. 41).

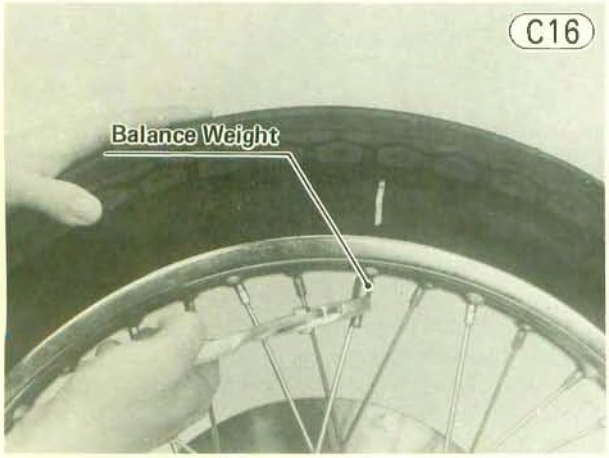
WHEEL BALANCE

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

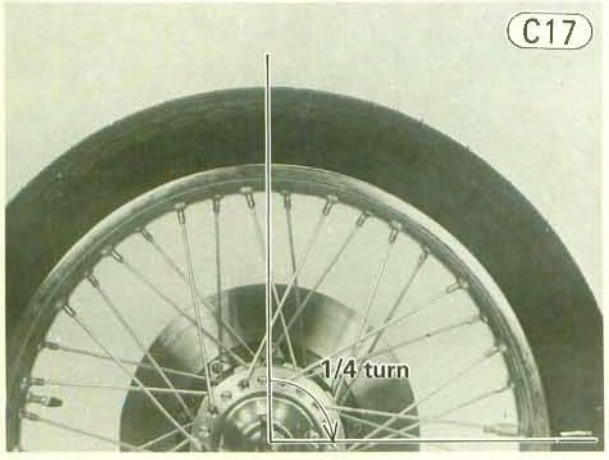
Check and balance the wheels when required, or when a tire is replaced with a new one:

- Remove the wheel (Pgs. 99, 106).
- Check that all the spokes are tightened evenly and the rim runout is within the service limit (Pg. 173).

- 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 stops 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 (Pg. 99, 106).

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 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

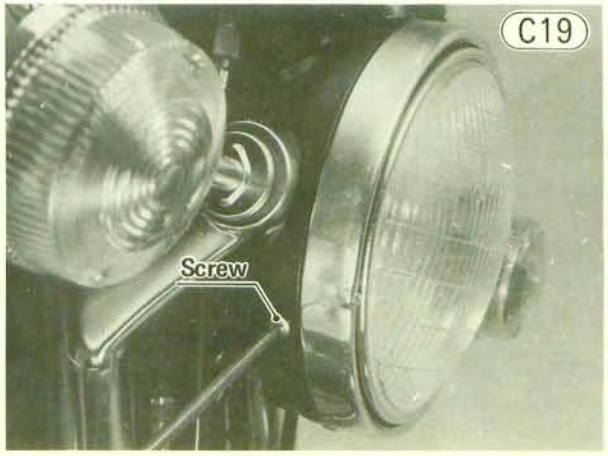
The headlight beam is adjustable both horizontally and vertically. If not properly adjusted horizontally, the beam will point to one side rather than straight ahead. If adjusted too low vertically, neither low nor high beam will illuminate the road far enough ahead. If adjusted too high vertically, high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

Horizontal Adjustment:

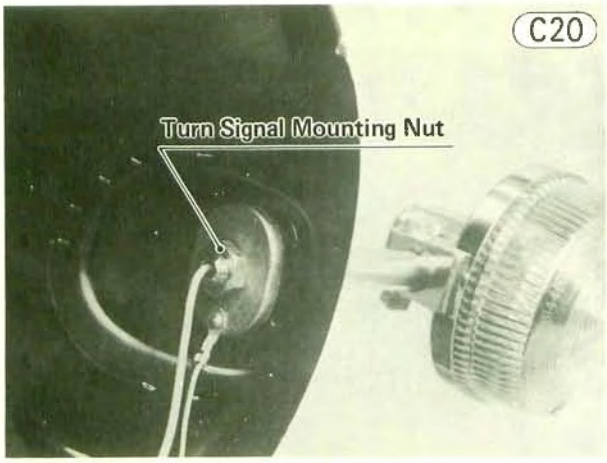
- Turn the small screw on the headlight rim in or out until the beam points straight ahead. Turning the adjusting screw clockwise makes the headlight beam point to the left.

Vertical Adjustment:

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

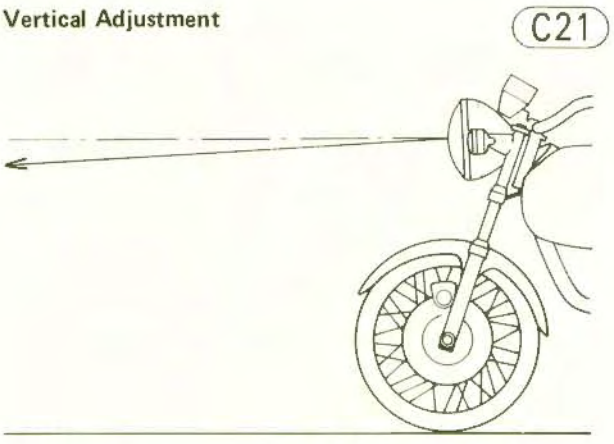


•Loosen the turn signal mounting nuts, and adjust the headlight vertically.



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

Vertical Adjustment



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

HORN

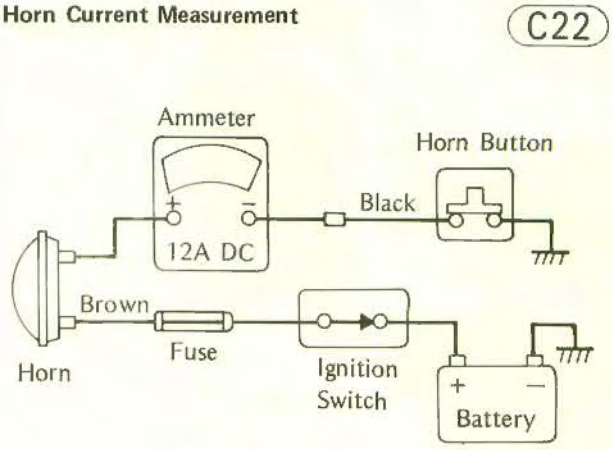
The hor contacts wear down after long use and may need to be adjusted from time to time. Turning in the adjusting screw compensates for contact wear. If satisfactory horn performance cannot be obtained by this adjustment when the rest of the electrical system is functioning properly, the horn must be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

WARNING **To avoid serious burn, never touch a 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.**

•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



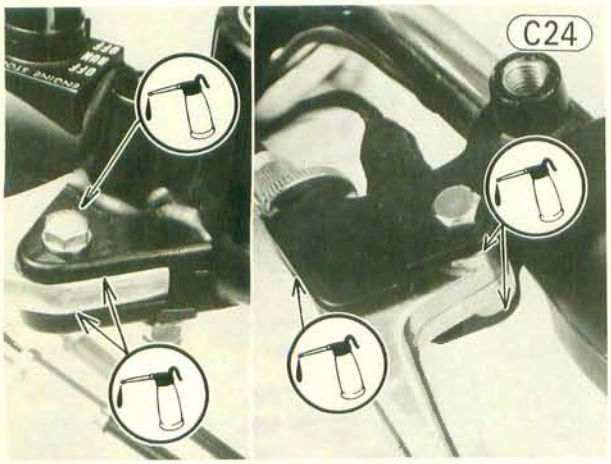
•Fully loosen the adjusting screw locknut.
•Turn on the ignition switch, and keep the horn button pressed while turning the horn adjusting screw. Adjust for the best horn sound while keeping the current between 2.0~3.0 amperes.

•Tighten the adjusting screw locknut.
NOTE: The horn will not sound properly if it is mounted incorrectly or if any cable or other part is touching it.

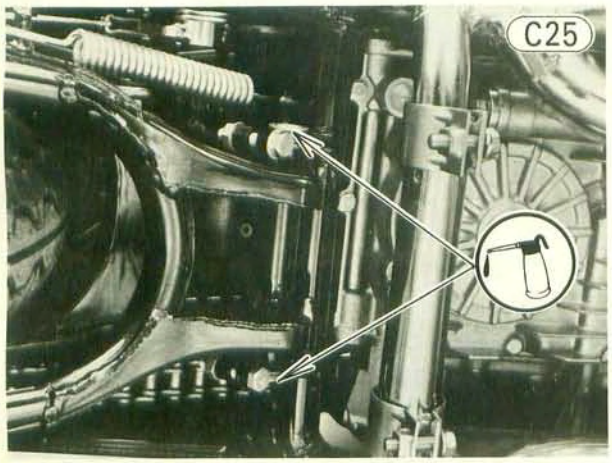
LUBRICATION

Lubricate 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 rainly 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.

Clutch and Brake Levers



Center Stand

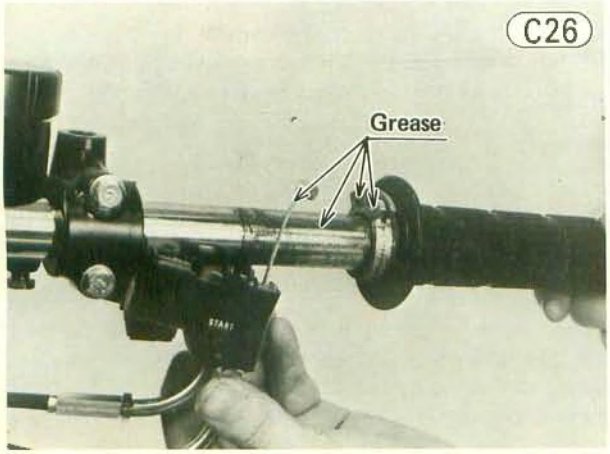


Throttle Grip

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 cables and their catches in the throttle grip.

Fit the throttle cables into the throttle grip. Refer to throttle cable installation (Pg. 112).

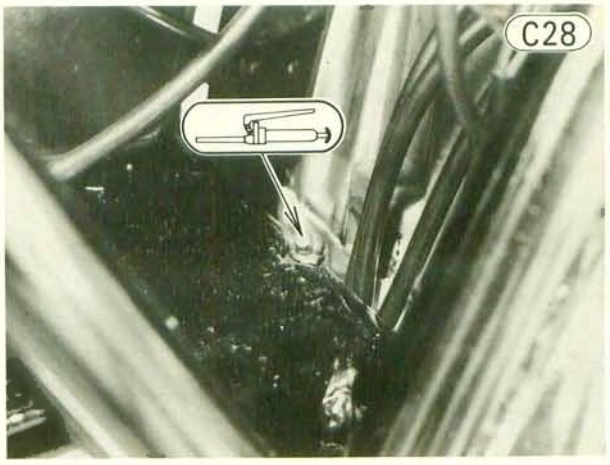


Clutch and Throttle Cables

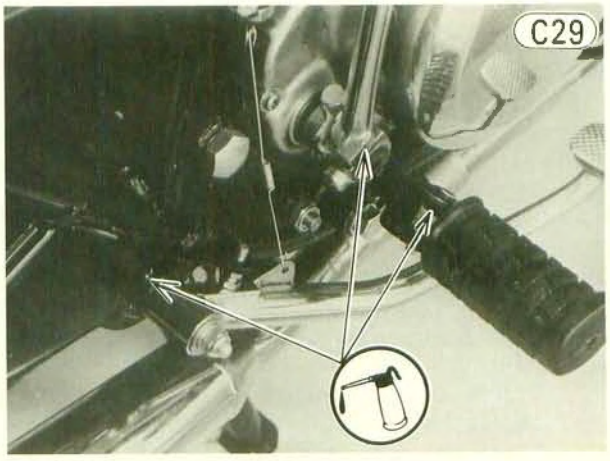
Lubricate the clutch cable and throttle cables, as shown in the figure. Refer to Pg. 111 and 112 for cable removal.

Swing Arm Pivot

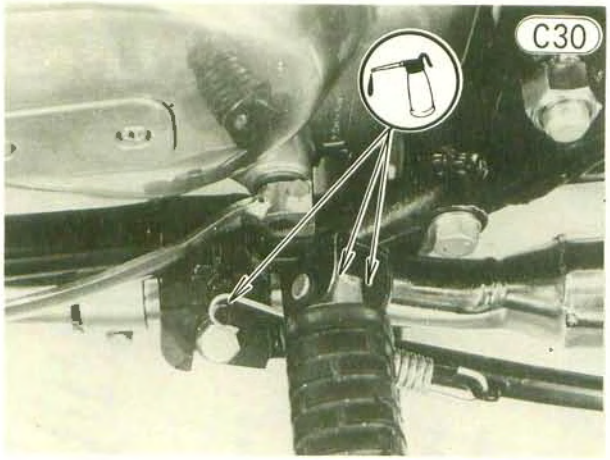
Force grease into the fitting until it comes out at both sides of the swing arm, and wipe off any excess.



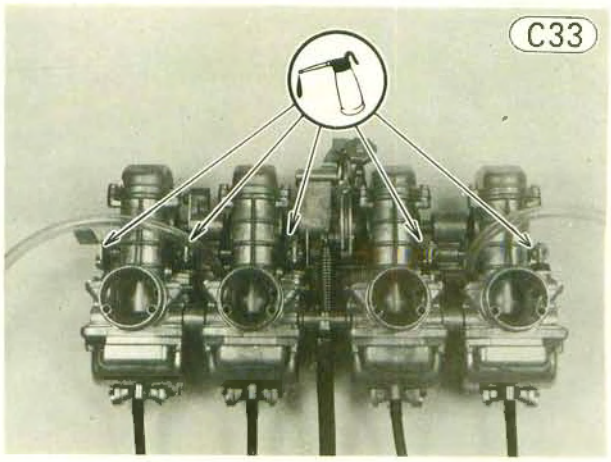
Kickstarter Pedal, Right Foot Peg, Brake Pedal, and Brake Push Rod



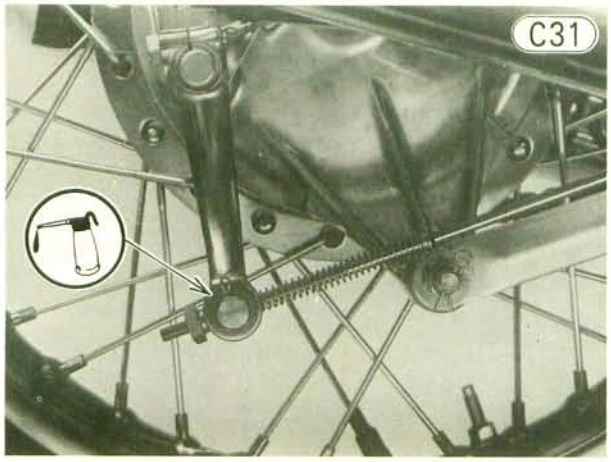
Left Foot Peg, Side Stand



Carburetor Choke Link Mechanism



Brake Rod Joint



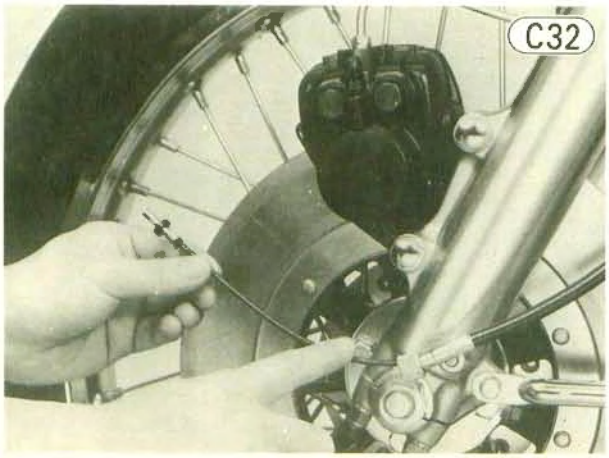
Others

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

NOTE: A few drops of oil are effective to keep bolts and nuts from rusting and sticking. This makes easy removal at your next work. Badly rusted nuts, bolt, etc. should be replaced with new ones.

Speedometer and Tachometer Cables

Apply grease sparingly to these inner cables.



Disassembly – Introduction

Table of Contents

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 Shop 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 Shop 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 counterclockwise, 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 for 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 over-tightening 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 cap bolts ϕ6 P1.0	–	16	1.1~1.3	95~113 in-lbs	48,139
Camshaft chain guide sprocket shaft bolt ϕ6 P1.0	•	1	0.8~1.0	69~87 in-lbs	–
Camshaft chain guide sprocket Allen bolts ϕ6 P1.0	•	4	0.9~1.1	78~95 in-lbs	48
Camshaft chain tensioner bolt ϕ6 P1.0	–	1	0.9~1.1	78~95 in-lbs	14
Camshaft chain tensioner body bolts ϕ6 P1.0	•	2	0.7~0.9	61~78 in-lbs	48
Camshaft sprocket bolts ϕ6 P1.0	•	4	1.3~1.7	9.5~12	49
Carburetor holder screws ϕ6 P1.0	•	8	–	–	–
Clutch hub nut ϕ20 P1.5	–	1	12~15	87~108	67,87
Clutch release screws	•	2	–	–	57
Clutch spring bolts ϕ6 P1.0	–	5	0.9~1.1	78~95 in-lbs	68,88
Connecting rod big end cap nut	–	8	2.6~3.0	19~22	96,151
Crankcase bolts					
upper ϕ6 P1.0	•	12	0.9~1.1	78~95 in-lbs	87,89
lower ϕ6 P1.0	•	8	0.9~1.1	78~95 in-lbs	86
lower ϕ8 P1.25	•	10	2.5~3.0	18~22	86
Cylinder head					
bolts ϕ6 P1.0	–	2	2.2~2.8	16.0~20.0	50
nuts ϕ10 P1.5	–	12	3.5~4.0	25~29	50
Cylinder head cover bolts ϕ6 P1.0	–	24	0.7~0.9	61~78 in-lbs	49

Engine Part	Locking Agent (•)	Quantity	Metric (kg-m)	English (ft-lbs)	See Pg.
Engine sprocket chain guard mounting bolt φ6 P1.0	•	3	–	–	60,89
Dynamo armature Allen bolts φ6 P1.0	•	3	–	–	61
Dynamo field coil Allen bolts	•	3	–	–	61
Dynamo rotor bolt φ10 P1.25	–	1	5.8~6.3	42~46	62,89
Engine drain plug φ12 P1.5	–	1	1.3~1.7	9.5~12	22,66,70,78
Engine mounting bolts φ10 P1.25	–	4	3.4~4.6	25~33	80
Engine mounting bracket bolts φ8 P1.25	–	6	2.0~2.8	14.5~20.0	80
Engine sprocket nut φ20 P1.5	–	1	7.5~8.5	54~61	58,81
Kick shaft bushing stopper screws φ6 P1.0	•	2	–	–	94
Neutral indicator switch φ12 P1.5	•	1	1.3~1.7	9.5~12.0	60
Oil pan bolts φ6 P1.0	–	15	0.7~0.9	61~78 in-lbs	70,71,87
Oil pressure indicator switch PT1/8	–	1	1.3~1.7	9.5~12	66,165
Oil pressure relief valve φ12 P1.5	•	1	1.3~1.7	9.5~12	70
Oil pump mounting					
bolts φ6 P1.0	•	2	–	–	71,86
screw	•	1	–	–	71,86
Ratchet gear stopper bolt φ6 P1.0	–	2	0.7~0.9	61~78 in-lbs	94
Return spring pin φ8 P1.25	•	1	–	–	59,88
Spark plugs φ14 P1.25	–	4	2.5~3.0	18.5~22.0	12
Starter clutch Allen bolts φ8 P1.25	•	3	2.5~3.0	18~22	74
Timing advancer bolt φ8 P1.25	–	1	2.3~2.7	16.5~19.5	65,88

Frame Part	Locking Agent (•)	Quantity	Metric (kg-m)	English (ft-lbs)	See Pg.
Brake Pedal pivot cap nut ϕ8 P1.25	–	1	1.6~2.2	11.5~16.0	–
Disc brake parts	See Table G1 in Pg. 102.				
Front axle clamp nuts ϕ8 P1.25	–	4	1.6~2.2	11.5~16.0	99
Front axle nuts ϕ16 P1.5	–	2	7.0~9.0	51~65	99
Front brake light switch PT 1/8	•	1	2.6~3.0	19.0~22.0	117
Front fork bottom Allen bolts ϕ10 P1.0	•	2	2.0~2.6	14.5~19.0	125
Front fork clamp bolts					
upper ϕ8 P1.25	–	2	1.6~2.2	11.5~16.0	121,123
lower ϕ12 P1.25	–	2	3.4~4.6	25~33	27,121 123
Front fork top bolts ϕ28 P1.0	–	2	2.5~3.0	18.0~22.0	123,125
Handlebar clamp bolts ϕ8 P1.25	–	4	1.6~2.2	11.5~16.0	118
Pad mounting screw ϕ6 P1.0	•	1	–	–	102
Rear axle nut ϕ18 P1.5	–	1	10.0~14.0	72~101	25
Rear shock absorber mounting bolts, nuts ϕ10 P1.5	–	4	2.6~3.5	19.0~25.0	125,126
Rear sprocket nuts ϕ10 P1.25	–	6	3.5~4.3	25~31	109
Spokes	–	80	0.2~0.4	17~35 in-lbs	110,111 173
Steering stem head bolt ϕ16 P1.5	–	1	4.0~5.0	29~36	27,121
Steering stem head rear clamp bolt ϕ8 P1.25	–	1	1.6~2.2	11.5~16.0	27,121
Steering stem locknut ϕ30 P1.5	–	1	2.7~3.3	19.5~24	26
Swing arm pivot shaft nut ϕ16 P1.5	–	1	8.0~12.0	58~87	126
Torque link nuts ϕ10 P1.25	–	2	2.6~3.5	19~25	25,127

38 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. 35 ~ 37 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. 35 ~ 37. All of the values are for use with dry solvent-cleaned threads.

Coase threads

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

Fine threads

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

Disassembly–Engine Installed

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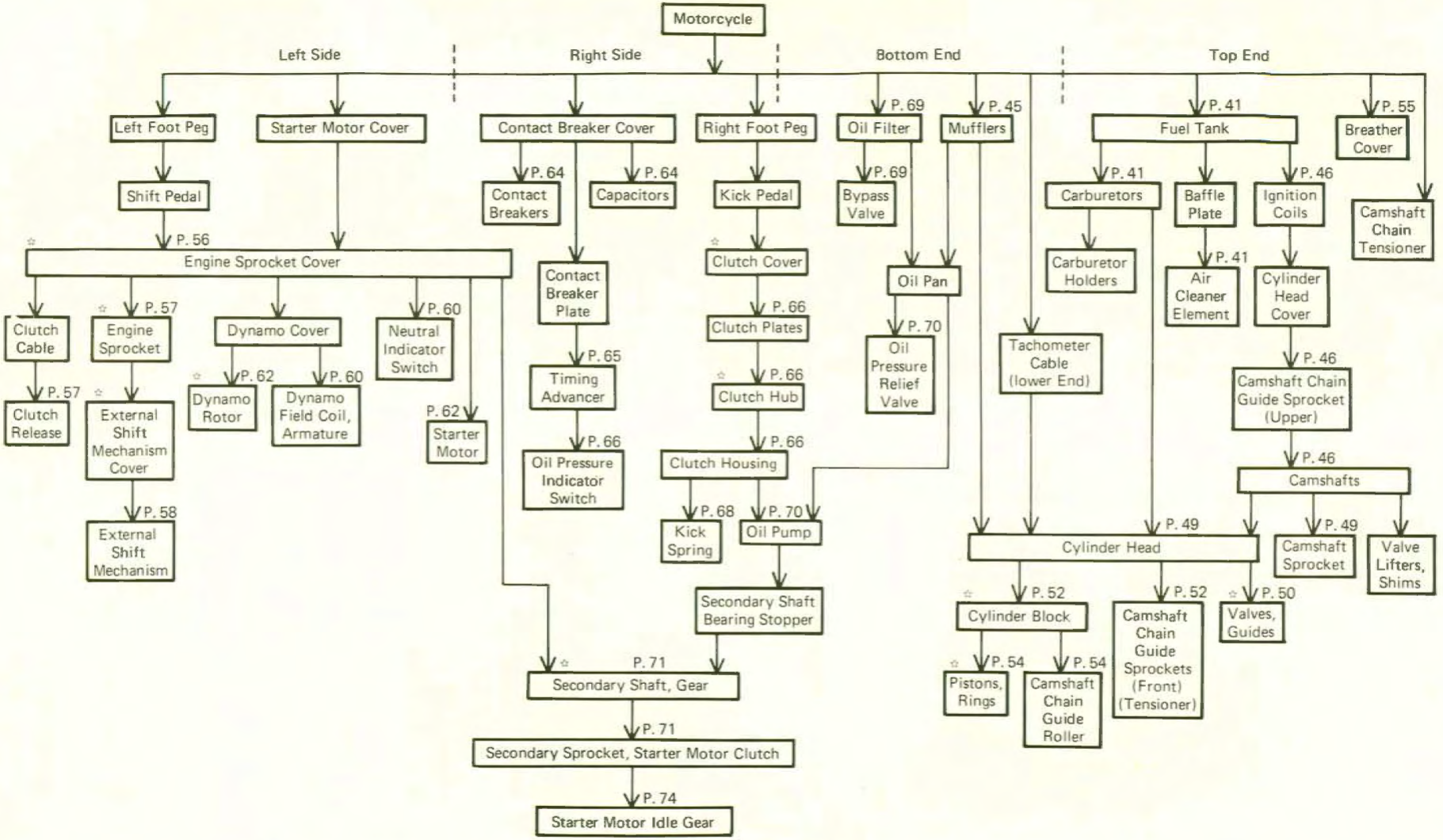
FLOW CHART
Disassembly – Engine Installed

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.

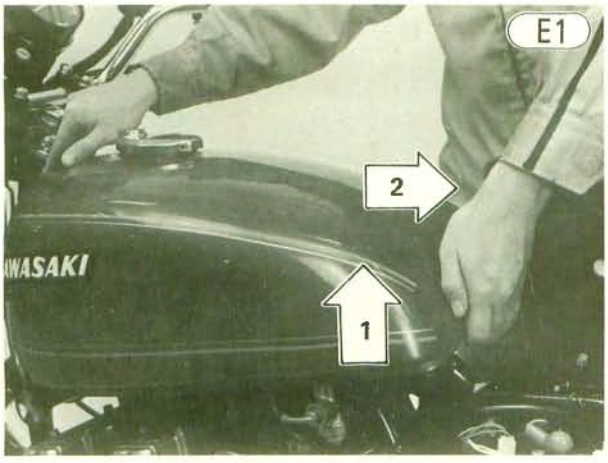


NOTES: 1. Before performing any disassembly operations, remove the ground (–) lead from the battery to prevent the possibility of accidentally turning the engine over.
2. Action with mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

FUEL TANK

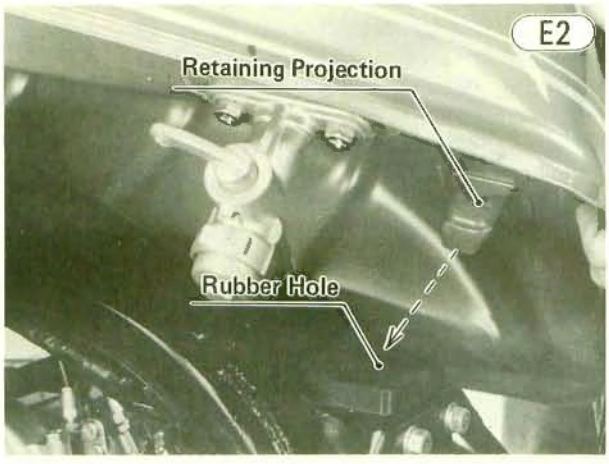
Removal:

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



Installation:

- Install the fuel tank. Be sure the retaining projection is seated in the retaining rubber hole.

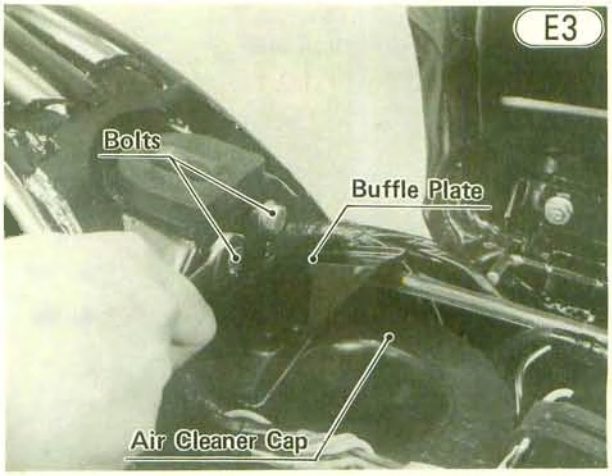


- Fit the fuel hose back onto the fuel tap, and slide the clamp back into place.
- Push the seat back down.

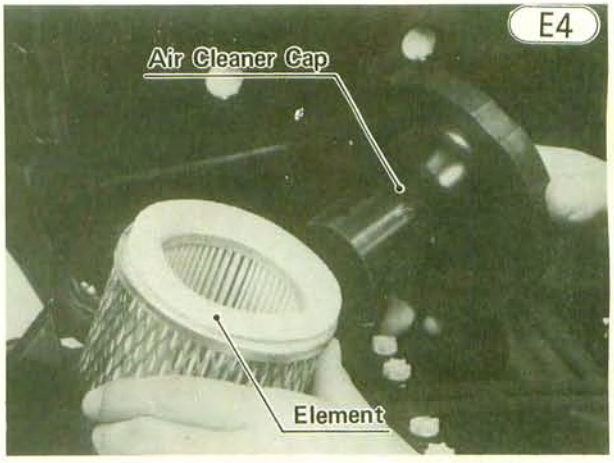
AIR CLEANER ELEMENT

Removal:

- Unlock the seat, and swing it open.
- Remove the bolts (2), lockwashers, and flat washers, and free the baffle plate from the frame.



- Unscrew the air cleaner cap.
- Pull out the element.



Installation:

NOTE: When installing the air cleaner cap, screw the cap on until you feel a click.

CARBURETORS

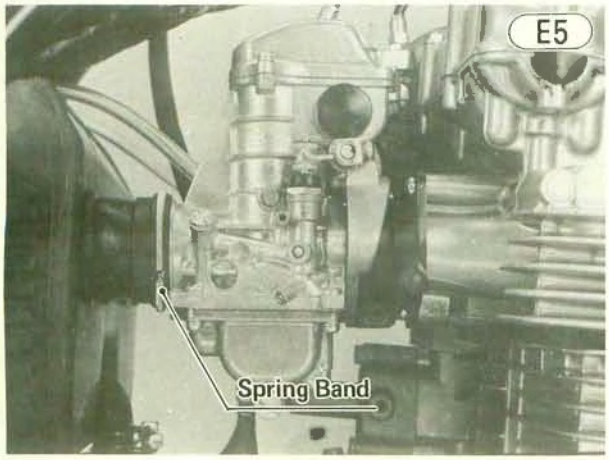
Removal:

- Remove the fuel tank (Pg. 41).
- Screw in fully the locknuts and adjusting nuts at the upper end of the throttle cables so as to give the cables plenty of play.

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

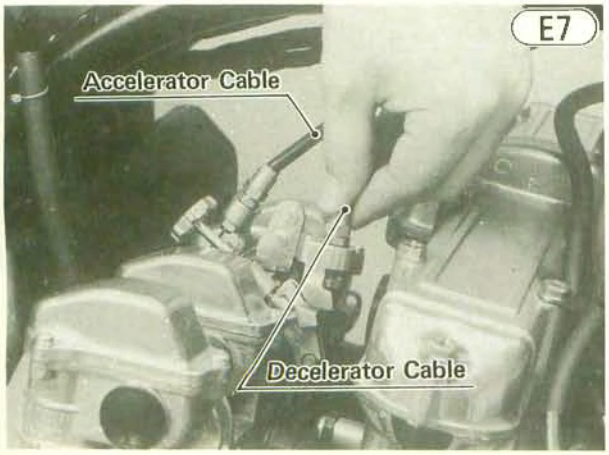
- Loosen the carburetor holder clamp for each carburetor.

•Slip the spring band that connects each air cleaner duct to its carburetor out of place.



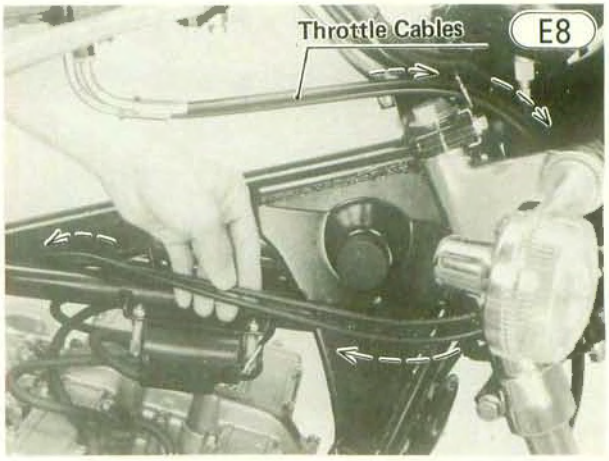
•Slip the carburetors out of place.

•Loosen the throttle cable adjuster mounting nuts (2 ea) fully remove the decelerator throttle cable adjuster from its bracket, and slip the tip of its inner cable out of the pulley. Then do the same with the accelerator throttle cable to complete carburetor removal.



Installation:

•Fit the tip of the accelerator throttle cable into the rear catch in the pulley, and install its adjuster into the cable bracket. Be sure that both throttle cables run between the frame top tube and the right side cradle tube without kinks or sharp bends, and that they do not twist around each other.



•Fit the tip of the other cable into the other catch, and install its adjuster onto the bracket. Turn the throttle grip at the same time, if necessary.

•Center each adjuster in place in the bracket, and tighten the locknuts.

NOTE: If the carburetors were disassembled, perform Initial Synchronization-Mechanical (Pg. 18).

•Slip the carburetors back into place reversing the removal procedure.

•Check that the ducts and holders are all properly fitted on the carburetors; tighten the clamps and fit the spring bands into their grooves.

•Route the carburetor overflow tubes (4) to the right rear of the engine.

•Route the carburetor air vent tubes (2) to the battery housing sides between the air cleaner housing and the baffle plate.

•Install the fuel tank (Pg. 41).

•Adjust the throttle cables (Pg. 17).

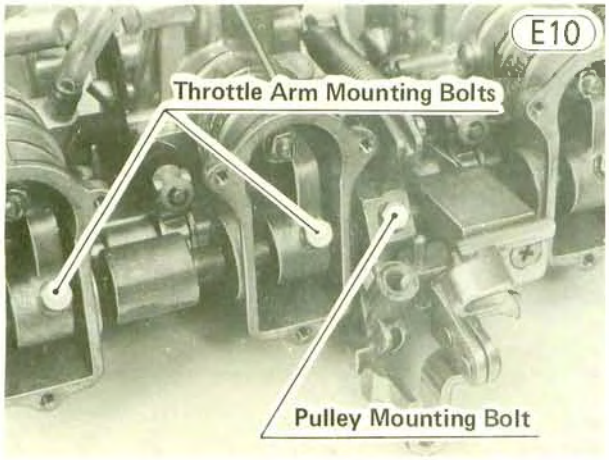
•Adjust the carburetors (Pg. 17).

Separation of Carburetors:

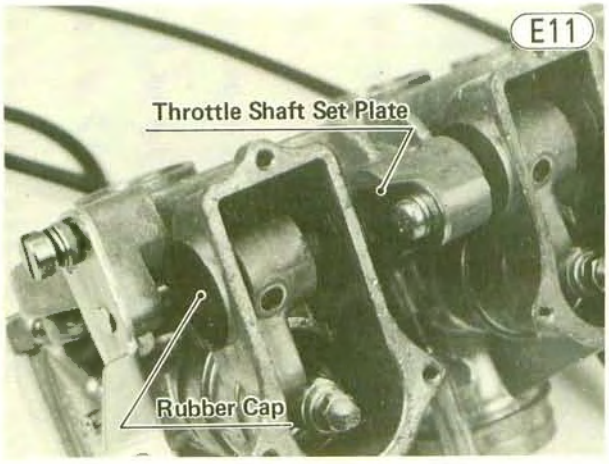
NOTES: 1. The four carburetors look the same, but they are slightly different from each other. Note the following prior to removal:
- ○Position of the air passage plug and drain plug
- ○Presence of the fuel hose 3-way joint and connecting pipe

2. All carburetor parts except the linkage mechanism and the starter plungers can be removed without separating the carburetors from the mounting plate.

- ●Remove the idling screw and spring.
- ●Remove the top covers 28 (4).
- ●Unscrew the throttle arm mounting bolts 2 (4) and pulley mounting bolt. Each bolt has a lockwasher.



- ●Remove the throttle return spring.
- ●Remove the screw and lockwasher, and remove the throttle shaft set plate.



- ●Remove the rubber caps from both sides of the carburetor assembly.
- ●Pull the throttle shaft off to the left by pushing the other end.
- ●Remove the mounting screws (8) and remove the carburetors from the plate.

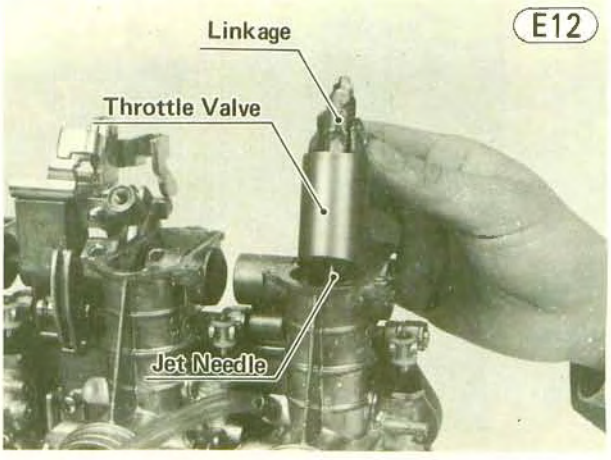
Assembly Notes:

1. Apply a non-permanent locking agent to the mounting screw threads.
2. Apply a thin coat of grease on the throttle shaft before inserting the shaft through the carburetors.
3. Perform Initial Synchronization-Mechanical (Pg. 18) before installing the top covers.
4. Replace the top cover gasket with a new one, if it is damaged.

Throttle Valve, Jet Needle Removal

NOTE: The throttle valve and jet needle can be removed without separating the carburetor from the mounting plate.

- ●Remove the idling screw and spring.
- ●Remove the screws and lockwashers, and remove the top covers 28 and gaskets 29 (4 ea).
- ●Remove the throttle arm mounting bolts 2 (4) and lockwashers 3 (4).
- ●Remove the pulley mounting bolt and lockwasher (Fig. E10).
- ●Remove the throttle return spring.
- ●Remove the screw and lockwasher, and remove the throttle shaft set plate (Fig. E11).
- ●Remove the rubber caps from both sides of the carburetor assembly.
- ●Pull the throttle shaft off by pushing the other end.
- ●Lift up the linkage, and pull out the throttle valve 4 and jet needle 34.



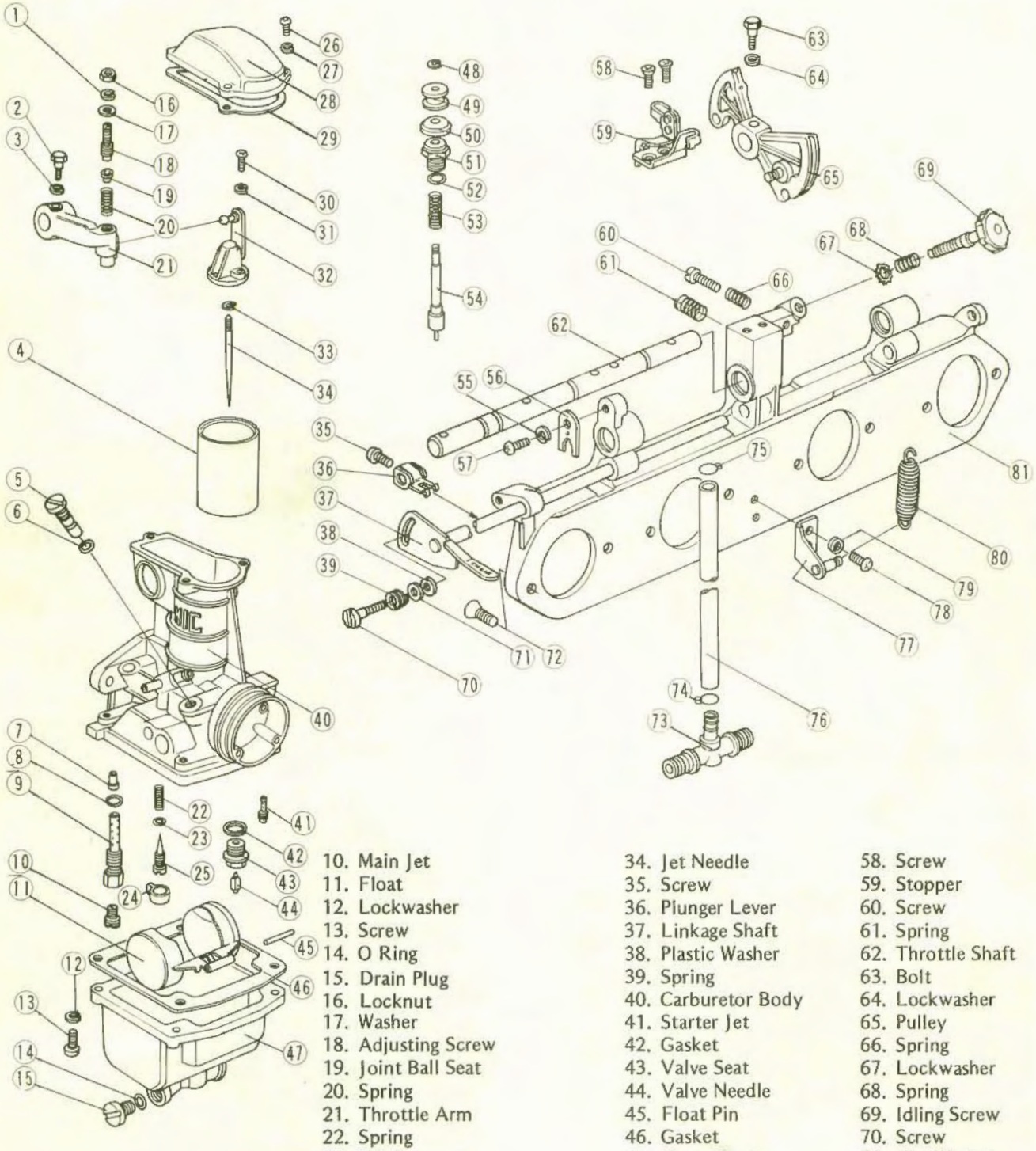
- ●Remove the two screws 30 and lockwashers 31, and take the jet needle out of the throttle valve.

Assembly Notes:

1. Apply a thin coat of grease on the throttle shaft before inserting the shaft through carburetors.
2. Replace the top cover gaskets with new ones, if they are damaged.

Carburetor

E13



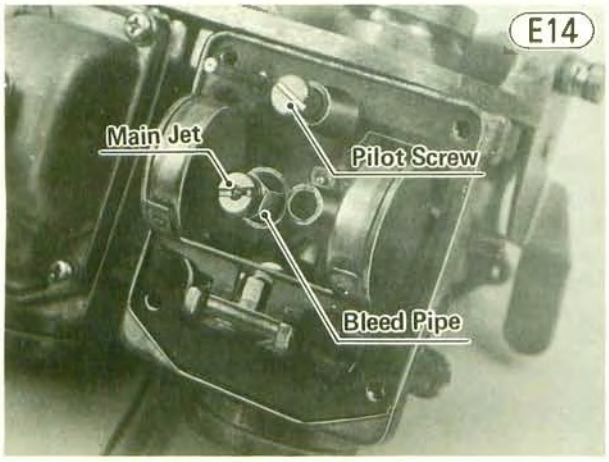
1. Lockwasher
2. Mounting Bolt
3. Lockwasher
4. Throttle Valve
5. Air Passage Plug
6. O Ring
7. Needle Jet
8. O Ring
9. Air Bleed Pipe
10. Main Jet
11. Float
12. Lockwasher
13. Screw
14. O Ring
15. Drain Plug
16. Locknut
17. Washer
18. Adjusting Screw
19. Joint Ball Seat
20. Spring
21. Throttle Arm
22. Spring
23. O Ring
24. Extender
25. Pilot Screw
26. Screw
27. Lockwasher
28. Top Cover
29. Gasket
30. Screw
31. Lockwasher
32. Throttle Valve Bracket
33. Circlip
34. Jet Needle
35. Screw
36. Plunger Lever
37. Linkage Shaft
38. Plastic Washer
39. Spring
40. Carburetor Body
41. Starter Jet
42. Gasket
43. Valve Seat
44. Valve Needle
45. Float Pin
46. Gasket
47. Float Bowl
48. Clip
49. Bush
50. Dust Seal
51. Plunger Cap
52. O Ring
53. Spring
54. Starter Plunger
55. Lockwasher
56. Set Plate
57. Screw
58. Screw
59. Stopper
60. Screw
61. Spring
62. Throttle Shaft
63. Bolt
64. Lockwasher
65. Pulley
66. Spring
67. Lockwasher
68. Spring
69. Idling Screw
70. Screw
71. Flat Washer
72. Screw
73. 3-way Joint
74. Clamp
75. Clamp
76. Fuel Hose
77. Bracket
78. Screw
79. Lockwasher
80. Spring
81. Mounting Plate

Carburetor Body Disassembly (per carburetor):

NOTE: Following procedure explains removal of the carburetor parts listed below, and these parts except the #1, #2, and #3 starter plungers can be removed without separating the carburetors from the mounting plate.

Main Jet	Float
Air Bleed Pipe	Valve Needle
Needle Jet	Valve Seat
Pilot Jet	Starter Plunger
Pilot Screw	

- Pull off the extender (24).
- Remove the pilot screw (25) and O ring (23), and remove the spring (22).
- Remove the screws (13) and lockwashers (12) (4 ea), and take off the float bowl (47) and gasket (46).
- Now, the main jet (10), air bleed pipe (9), and pilot screw can be removed.

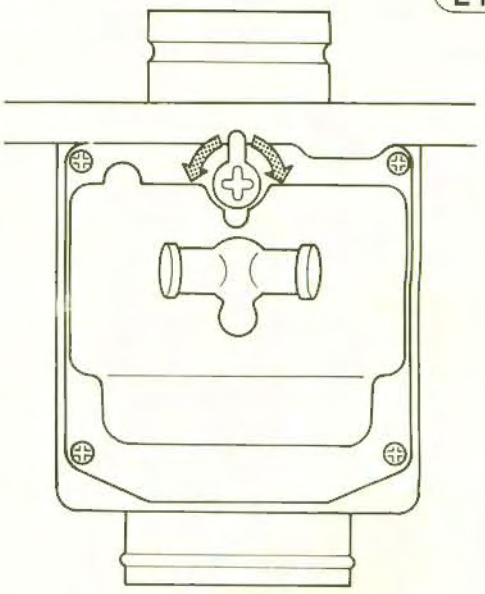


- To remove the float valve seat (43), first push out the float pin (45), remove the float (11), and pull out the float valve needle (44).
- Remove the float valve seat (43) and gasket (42).
- To remove the starter plunger (54), unscrew the plunger cap (51), and pull out the unit.
- Remove the clip (48) and pull out the starter plunger and spring (53).
- To remove the needle jet (7), remove the throttle valve (Pg. 43) and air bleed pipe.
- Make sure that the float is removed so that it does not get damaged during needle jet removal. Push on top of the needle jet with a wooden or other soft rod; it will fall out the bottom of the carburetor.

Assembly Notes:

1. Replace any O rings and gaskets if damaged or deteriorated.
2. Install the plug (15) securely if it was removed.
3. Special care must be taken care of during pilot screw installation and extender installation. First turn in the pilot screw until it seats lightly, and then back it out ¾ turn. Push the extender onto the pilot screw with the ridge pointing to the front. This procedure is a must for later successful carburetor adjustment.

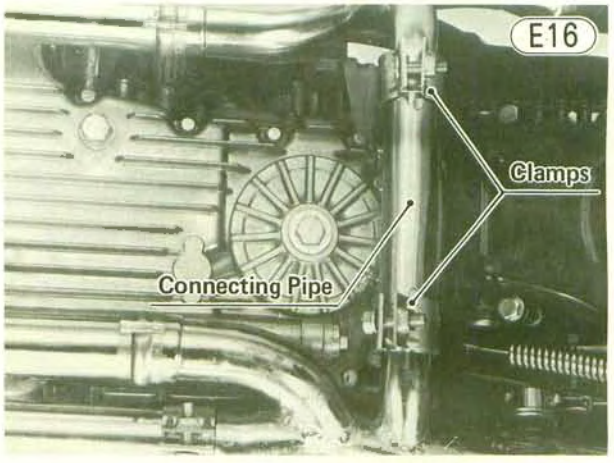
Pilot Screw Extender



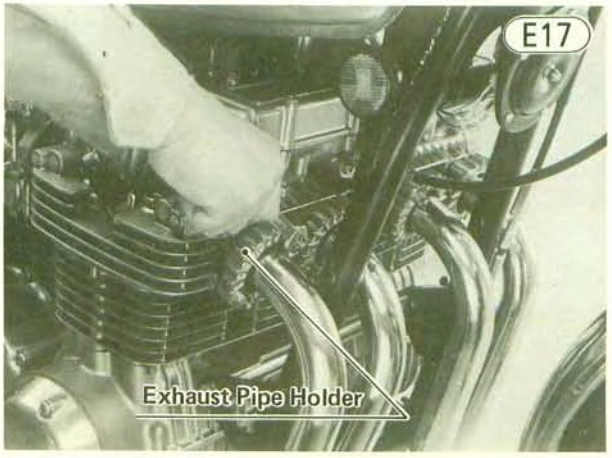
MUFFLER

Removal (each muffler):

- Loosen both clamps securing the muffler connecting pipe to the mufflers, and loosen the clamp securing the exhaust pipe to the mufflers.



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



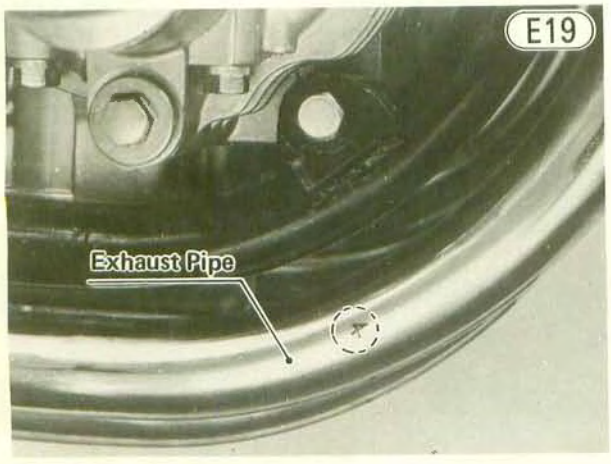
- Remove the split keepers, and pull the outer exhaust pipe off the muffler.
- Remove the inner exhaust pipe holder nuts (2), and slide the holder off its cylinder head studs.
- Remove the split keepers.
- Remove the rear foot peg mounting bolt to complete muffler removal. Also, remove the exhaust pipe holders and gaskets.

Installation (each muffler):

- Fit the connecting pipe to the muffler.
- Fit a gasket into the inner exhaust port, and place an exhaust pipe holder on the stud bolts.
- Fit the end of the exhaust pipe into the exhaust port, and attach the muffler to the frame with the rear foot peg mounting bolt finger tight.
- Fit the split keepers back into place, holding it in place with the exhaust pipe holder, tighten the holder nuts evenly to avoid an exhaust leak, and then tighten the rear foot peg mounting bolt.

- Fit a gasket into the outer exhaust port and place an exhaust pipe holder on the stud bolts.
- Fit the outer exhaust pipe into the exhaust port and into the muffler.

NOTE: There is an identification mark on the exhaust pipes. Do not mix up those exhaust pipes.



- Fit the split keeper back into place, tighten the exhaust pipe holder nuts evenly, and then tighten the clamp bolt.
- Tighten the clamp bolts of the muffler connecting pipe.

IGNITION COIL

Removal (each ignition coil):

- Remove the fuel tank (Pg. 41).
- Pull the spark plug lead from each spark plug and free the lead from its clamp on the cylinder head cover.
- Disconnect the black or green lead, and red/yellow lead of the ignition coil.

- Remove the nuts (2) to take off the ignition coil.

Installation (each ignition coil):

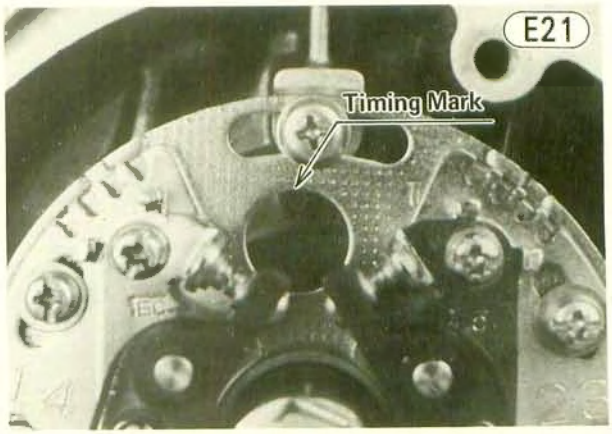
NOTE: Install the ignition coil (#1, 4) under the right bracket and the ignition coil (#2, 3) under the left bracket.

- Install the ignition coil with locknuts (2) so that the spark plug leads point to the rear.
- Connect the spark plug lead to each spark plug and insert each lead into its clamp.
- Connect the ignition coil leads (green or black, yellow/red).

CAMSHAFT, UPPER CHAIN GUIDE SPROCKET

Removal:

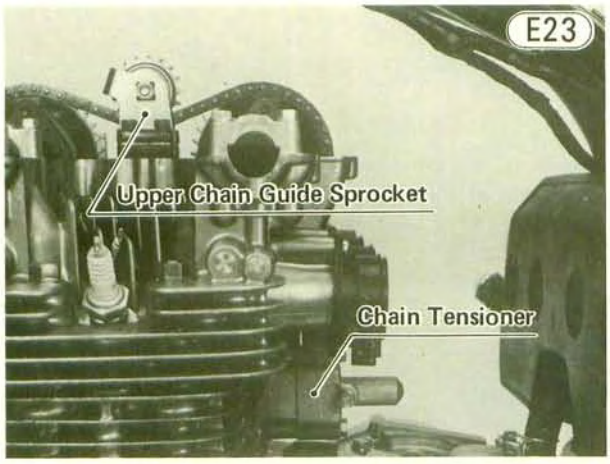
- Remove the fuel tank (Pg. 41).
- Remove the ignition coils (Pg. 46).
- Remove the contact breaker cover and gasket.
- Using a 17 mm wrench on the crankshaft, set the 1, 4 pistons at TDC by aligning the timing advancer "T" mark on the 1, 4 side (the line adjoining the "T") with the timing mark.



•Unscrew the tachometer cable from the cylinder head. Remove the screw, and remove the tachometer pinion holder stopper. Pull out the tachometer pinion holder and pinion.

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

•Remove the cylinder head cover bolts (24), and slip the cover off the cylinder head.
•Remove the cylinder head cover gasket.
•Remove the chain tensioner.
•Remove the Allen bolts (4), and remove the upper chain guide sprocket.



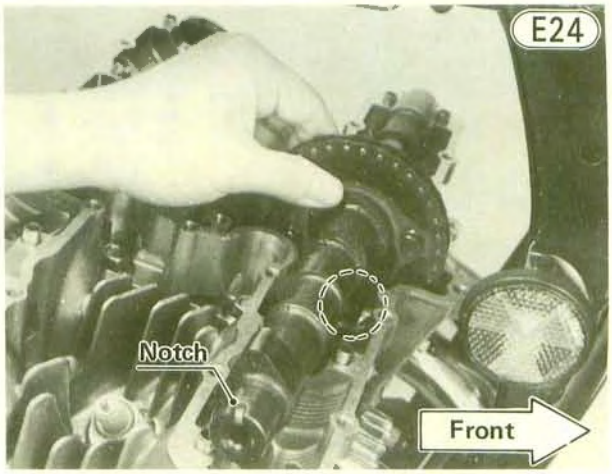
•Remove the camshaft cap bolts (16), and take off the camshaft caps (8).
•Remove the camshafts. Use a screwdriver or wire to keep the chain from falling down into the cylinder block.

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.**

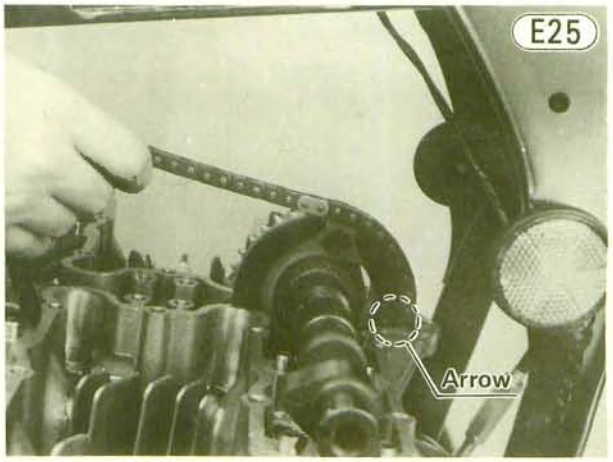
Installation:

NOTE: If a new camshaft, cylinder head, valve, or valve lifter was installed; check valve clearance (Pg. 15).

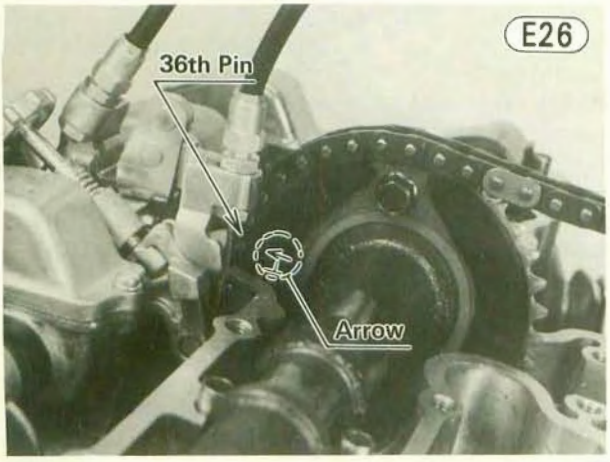
•Check that the tachometer pinion is removed from the cylinder head, and all camshaft cap knock pins (16) are fitted.
•Check crankshaft position to see that the 1, 4 pistons are still at TDC, and readjust if necessary. Remember to pull the camshaft chain taut before rotating the crankshaft.
•Apply clean engine oil to all cam parts.
•Feed the exhaust camshaft (tachometer gear is affixed) through the chain and remove the screwdriver. The notched camshaft end must be on the right side of the engine.



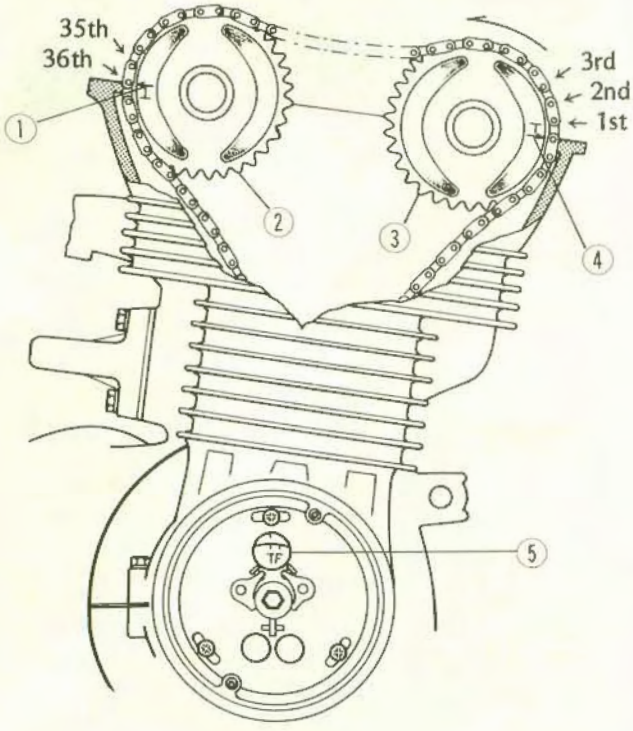
•Turn the exhaust camshaft so that the arrow adjoining the T mark on the sprocket is pointing to the front aligned with the cylinder head surface.
•Pull the chain taut and fit it onto the exhaust camshaft sprocket.



•Feed the inlet camshaft through the chain, and align the arrow adjoining the T mark on the sprocket with the cylinder head surface and pointing to the rear. Find the pin on the link pointed at by the exhaust camshaft sprocket arrow adjoining the T mark, starting with this pin as zero (0), count to the 36th pin. Check to see that the inlet camshaft sprocket arrow adjoining the T mark points to that 36th pin. If not, the camshafts are installed incorrectly.

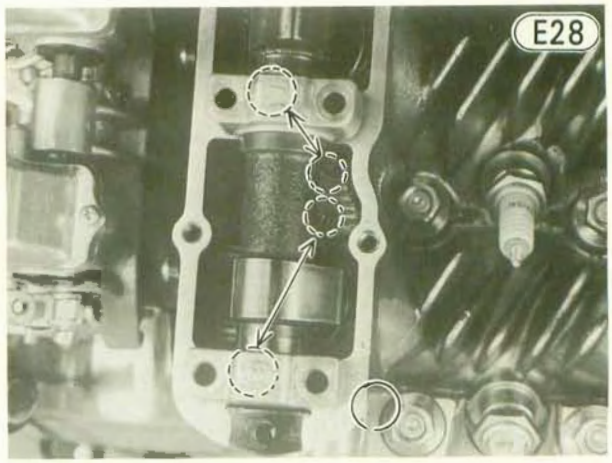


Cam Chain Timing



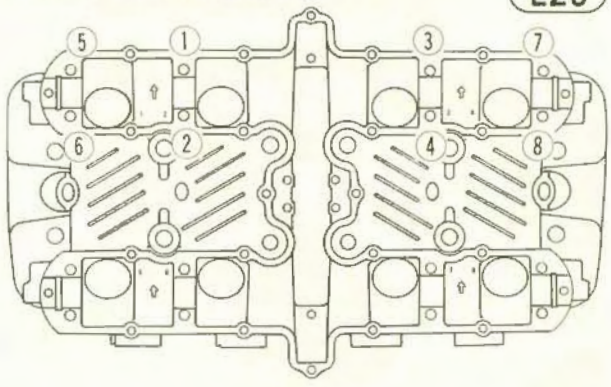
1. T-marked Arrow
2. Inlet Camshaft Sprocket
3. Exhaust Camshaft Sprocket
4. T-marked Arrow
5. #1, 4 TDC Mark

•The camshaft caps are machined together with the cylinder head, so match the number on the camshaft caps with the number on the cylinder head. The arrow on the cap points forward (toward the exhaust).

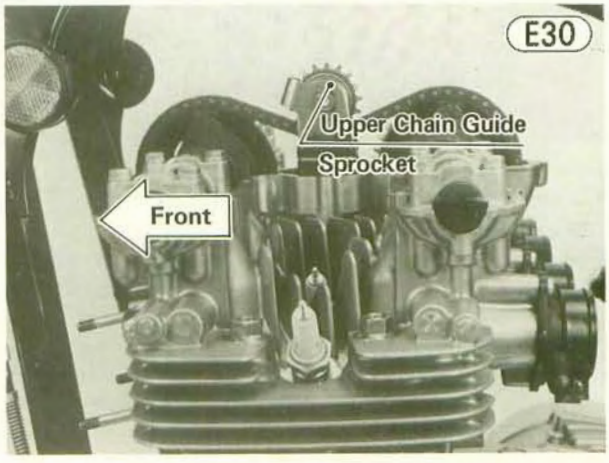


•Partially tighten the left inside camshaft cap bolts first, to seat the camshaft in place. Fully tighten all the bolts with 1.1 ~ 1.3 kg-m (95 ~ 113 in-lbs) of torque, following the tightening sequence shown in the diagram.

Camshaft Cap Tightening Order



•Apply a non-permanent locking agent to Allen bolts (4). Install the upper chain guide sprocket assembly, and tighten the allen bolts with 0.9~1.1 kg-m (78~95 in-lbs) of torque. The projection of the assembly must point to the front.



•Install the chain tensioner assembly, and tighten its bolts with 1.3 ~ 1.7 kg-m (9.5 ~ 12 ft-lbs) of torque.
•Before rotating the crankshaft, check that, with the crankshaft positioned so #1 and #4 pistons are at TDC,

the timing marks on the exhaust and inlet camshaft sprockets are aligned with the cylinder head surface.

CAUTION **Rotation of the crankshaft with improper camshaft timing could cause the valves to contact each other or the piston, and bend.**

- Turn the crankshaft over clockwise until pistons #1 and #4 are at TDC, and re-check the camshaft timing. If the three timing mark pairs are aligned (Fig. E27), the cam timing is correct.

CAUTION **1. If any resistance is felt when turning over the crankshaft, stop immediately, and check the camshaft chain timing. Valves may be bent, if the timing was not properly set.**

2. Do not try to turn the crankshaft and camshafts with a wrench on the camshaft sprocket. Use a 17 mm wrench on the end of the crankshaft.

NOTE: If a new camshaft, cylinder head, valve or valve lifter wear installed, check valve clearance at this time (Pg. 15), and adjust if necessary.

- Apply a small amount of high temperature grease to the tachometer pinion shaft, insert the pinion and pinion holder. Install the holder stopper with a screw, and reconnect the cable to the cylinder head.
- Apply a liquid gasket to the circumference of each cylinder head rubber plug, and fit they in place.
- Install the cylinder head cover with a new cylinder head cover gasket. The arrow on the cover must point toward the front. Tighten the cover bolts (24) with 0.7 ~ 0.9 kg-m (61 ~ 78 in-lbs) of torque. Do not forget to install the spark plug lead clamps (4) when the cylinder head cover is installed.
- Install the ignition coils (Pg. 46).
- Install the fuel tank (Pg. 41).
- Install the contact breaker cover and gasket.

CAMSHAFT SPROCKET

Removal(on each camshaft):

- Remove the camshaft (Pg 46).
- Remove the camshaft sprocket nuts (2), and slide the sprocket off the camsahft.

Installation:

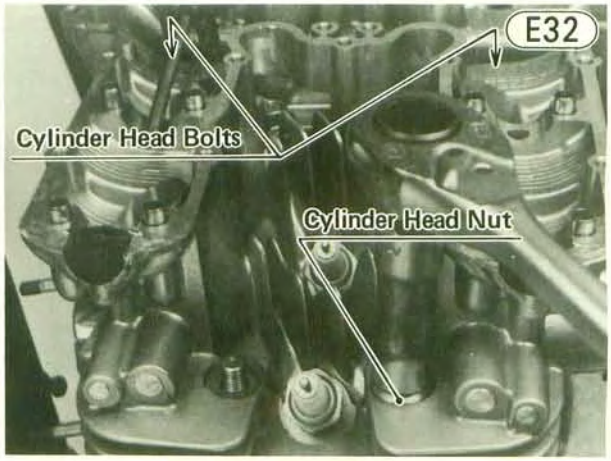
- Set the sprocket on the camshaft, aligning the bolt holes. The arrow marked side of the camshaft sprocket must face the notch on the shaft end.

- Apply a non-permanent locking agent to the sprocket bolts (2) and install the bolts, tightening them with 1.3~1.7 kg-m (9.5~12 ft-lbs) of torque.
- Install the camshaft (Pg. 47).

CYLINDER HEAD

Removal:

- Remove the mufflers (Pg. 45).
- Remove the carburetors (Pg. 41).
- Remove the camshafts (Pg. 46).
- Remove the cylinder head bolts (2) and nuts (12) from the upper cylinder head. Each nut has a flat washer.

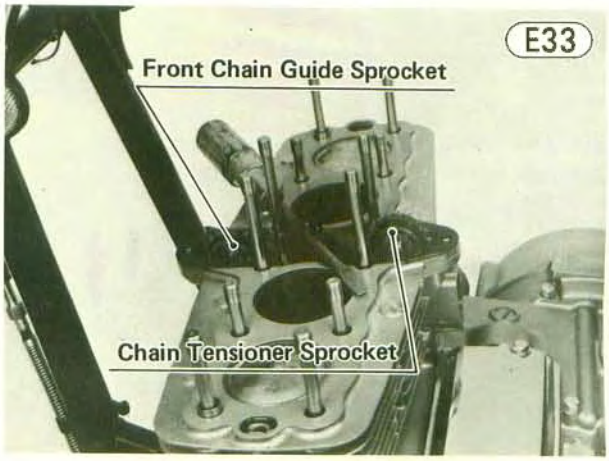


- Pull off the cylinder head, and remove the cylinder head gasket and **O** rings.

Installation:

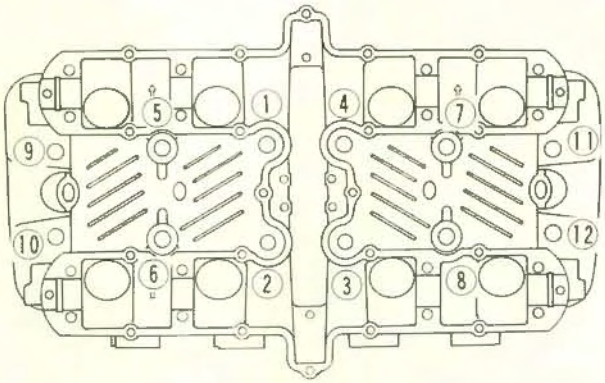
NOTE: The camshaft caps are machined together with the cylinder head, so, if a new cylinder head is installed, use the caps that are supplied with the new head.

- Using compressed air, blow out any particles which may obstruct the oil passages.
- Install new **O** rings.
- Check to see that the front chain guide sprocket and chain tensioner sprockets are in place.



- Install the gasket, and O rings (2).
- Install the cylinder head.
- Tighten the cylinder head nuts (12) first with about 2.5 kg-m (18 ft-lbs) and finally with 3.5~4.0 kg-m (25~29 ft-lbs) of torque, following the tightening sequence shown in Fig. E34. Each nut has a flat washer.

Cylinder Head Nut Tightening Order E34



- Tighten the cylinder head bolts (2) with 2.2 ~ 2.8 kg-m (16~20 in-lbs) of torque.
- Lift up the camshaft chain, and use a screwdriver to keep the chain from falling down into the cylinder block.
- Install the camshafts (Pg. 47).

NOTE: If a new camshaft, cylinder head, valve, or valve lifter was installed, check valve clearance (Pg. 15), and adjust if necessary.

- Install the carburetors (Pg. 42).
- Install the mufflers (Pg. 46).
- Adjust the throttle cable play (Pg. 17).
- Check the idling and adjust the carburetors if necessary (Pg. 17).
- Throughly warm up the engine, wait until the engine grows cold, and retighten the cylinder head nuts (12) with 3.5~4.0 kg-m (25~29 ft-lbs) of torque (Fig. E34).

WARNING **To avoid serious burn, never touch the engine or exhaust pipes while they are hot.**

VALVE, VALVE GUIDE

Removal (each valve and valve guide):

- Remove the cylinder head (Pg. 49).
- Pull out the valve lifters (8) and shims (8) with a suitable tool, marking them as to location (Fig. B12).

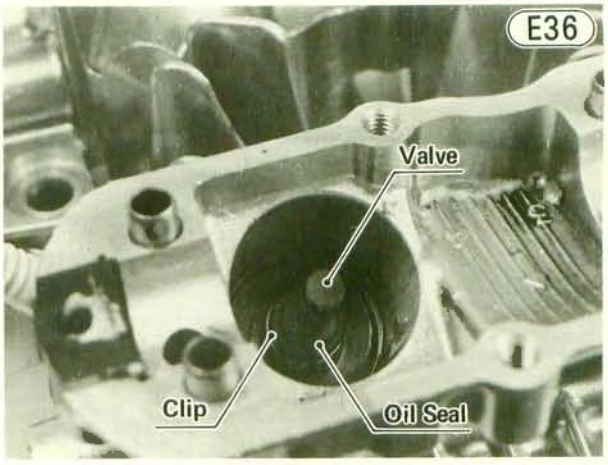
NOTE: If more than one valve is to be removed, mark them as to location so they can be reinstalled in the proper place.

- Using the valve spring compressor assembly (special tool) to press down the valve spring retainer ⑦, remove the *split keeper* ⑥.

E35

- Remove the tool, and then remove the spring retainer, outer spring ⑨, inner spring ⑧, and spring seat.
- Push out the valve ② or ③.
- Remove the clip ⑩ and pull off the oil seal ⑪.

E36

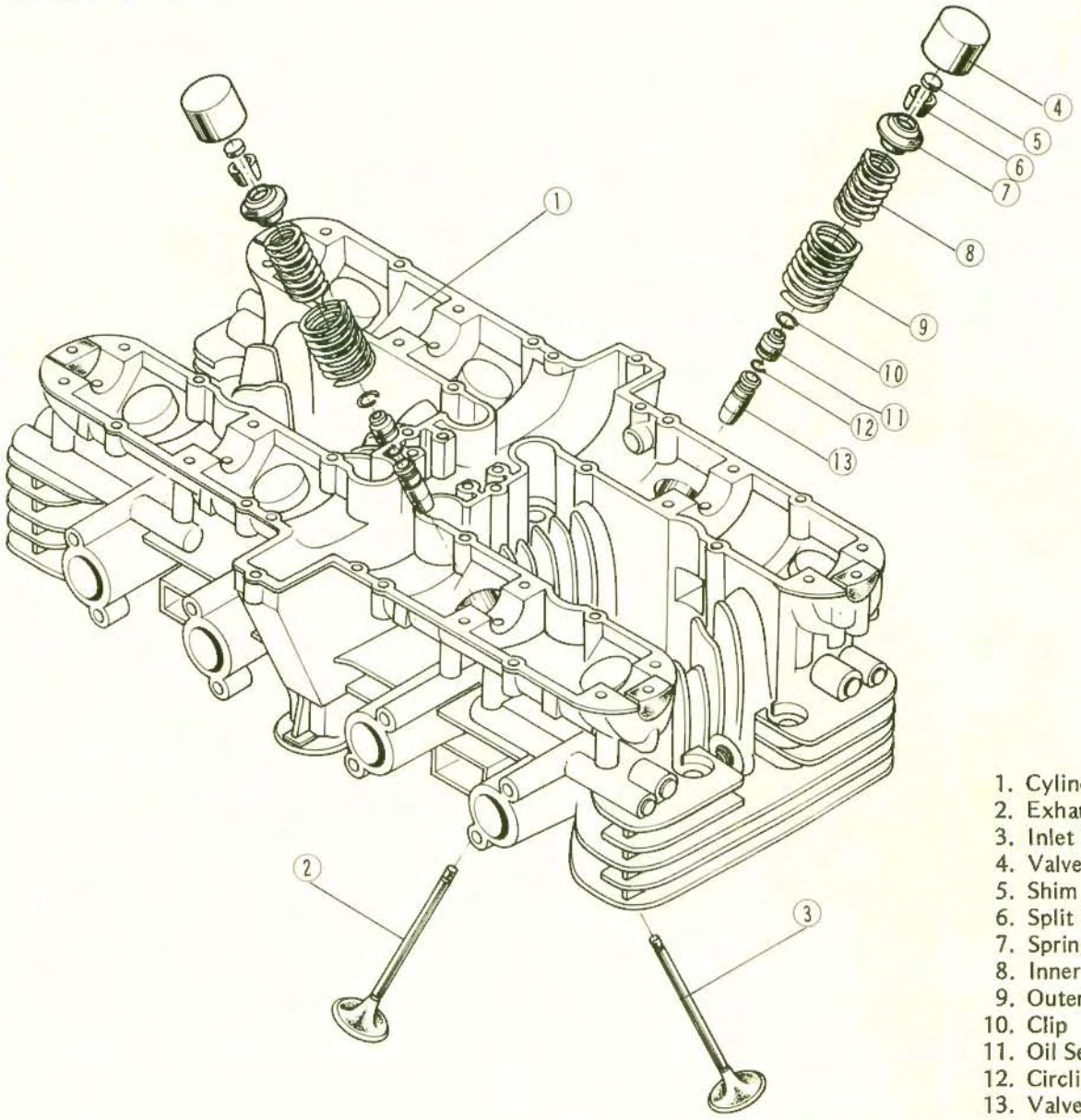


- Remove the circlip from the valve guide ⑬.
- Heat the area around the guide to about 120~150°C (248~302°F), and hammer lightly on valve guide arbor (special tool) to remove the guide from the top of the head.

E37

Valve and Valve Guide

E38



1. Cylinder Head
2. Exhaust Valve
3. Inlet Valve
4. Valve Lifter
5. Shim
6. Split Keeper
7. Spring Retainer
8. Inner Spring
9. Outer Spring
10. Clip
11. Oil Seal
12. Circlip
13. Valve Guide

Installation (each valve and valve guide):

NOTE: If a new valve or valve guide are installed, check the valve/valve guide clearance (Pg. 143).

- Apply oil to the valve guide, and install a new **O** ring on 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).
- Install the circlip on the valve guide.
- Ream the valve guide with the valve guide reamer (special tool) even if the old guide is re-used (Fig. E39).
- Lap the valve to check that it is seating properly. If it is uneven, refer to the Maintenance Section (Pg. 143).
- 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 spring seat and the outer and inner springs.

E39

- Install the spring retainer, press it down with the valve spring compressor assembly, 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.
- Mount the shims and valve lifters in their original locations.
- Install the cylinder head (Pg. 49).
- Check valve clearance (Pg. 15), and adjust if necessary.

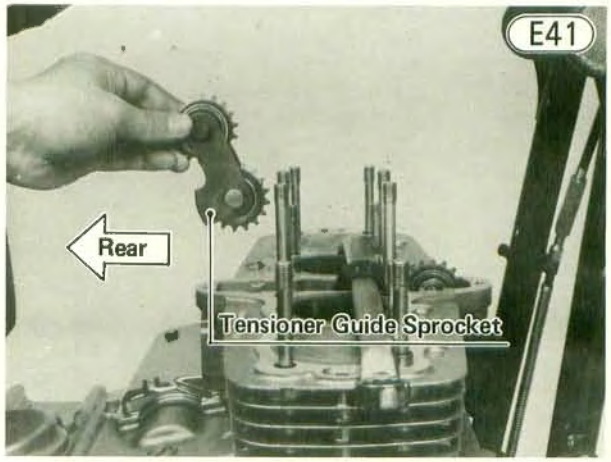
CAMSHAFT CHAIN GUIDE SPROCKETS (Front, Tensioner)

Removal:

- Remove the cylinder head (Pg. 49).
- Remove the cylinder head gasket and **O** rings.
- Remove the front chain guide sprocket and tensioner guide sprockets.

Assembly Note:

- Install the tensioner guide sprockets so that the sprocket bracket side points to the rear.



CYLINDER BLOCK

Removal:

- Remove the cylinder head, gasket, and **O** rings (Pg. 49).
- Remove the front chain guide sprocket and chain tensioner sprocket assembly.
- With a large screwdriver, pry at the gap in each side of the cylinder base to free the cylinder block from the crankcase, and lift off the cylinder.

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

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

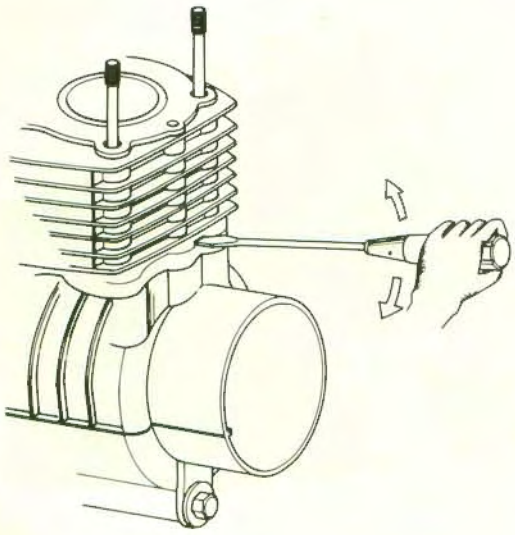
Installation:

NOTE: If the cylinder block is replaced with a new one, piston to cylinder clearance must be checked against the specified value (Pg. 148).

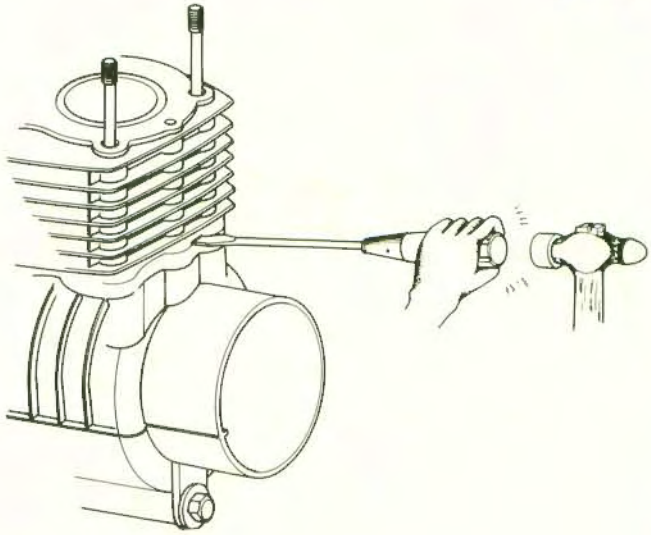
- With compressed air, blow out the oil passages and orifices to remove dirt or particles which may obstruct oil flow.

Cylinder Block Pry Point

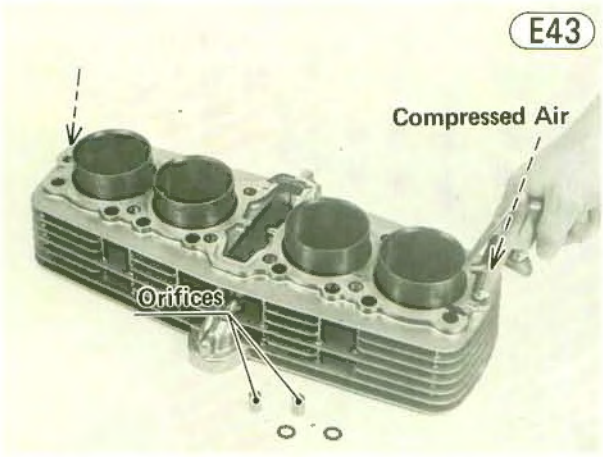
E42



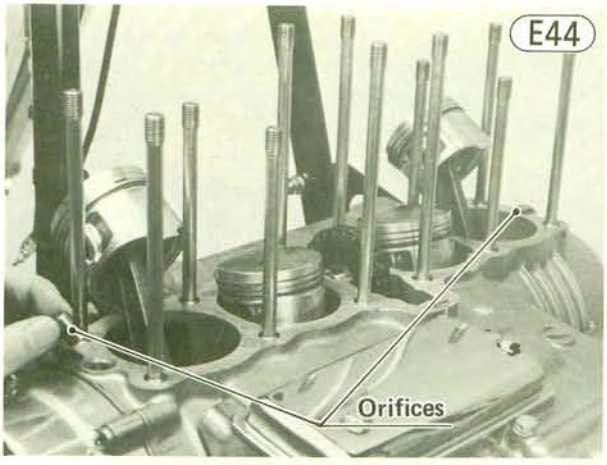
Good



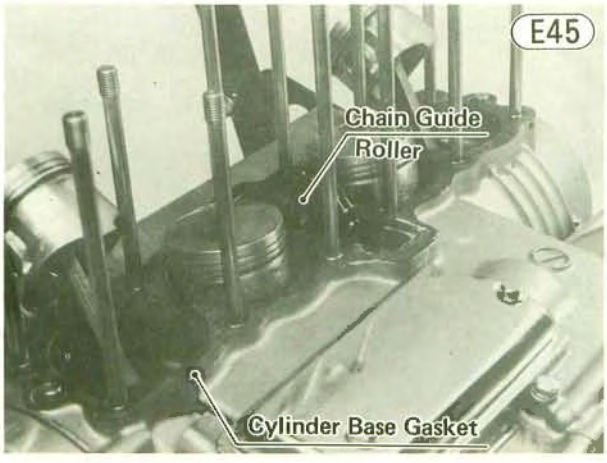
Bad



- Remove the cloth from under each piston.
- Check to see that the oil passage orifices (2) are in place, and that the small hole in each orifice faces up. Install the new orifice **O** rings (2).



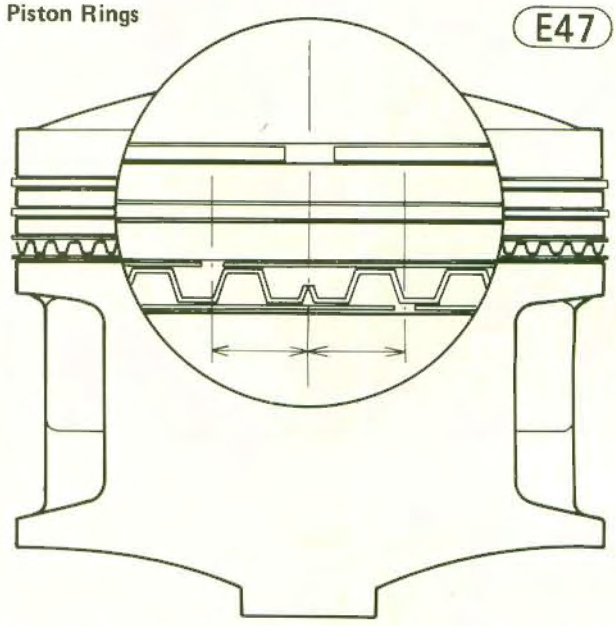
- Check to see that the chain guide roller is in place.
- Install new cylinder block large **O** rings (4) and a cylinder base gasket.



- Pull the chain taut to avoid kinking the chain, and using a 17 mm wrench on the crankshaft, turn the crankshaft so that all the pistons are at about the same height.
- Slip the piston bases (special tools) under the pistons to hold them level.

- Position each piston ring so that the opening in the top and oil ring of each piston is facing forwards, 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.

Piston Rings



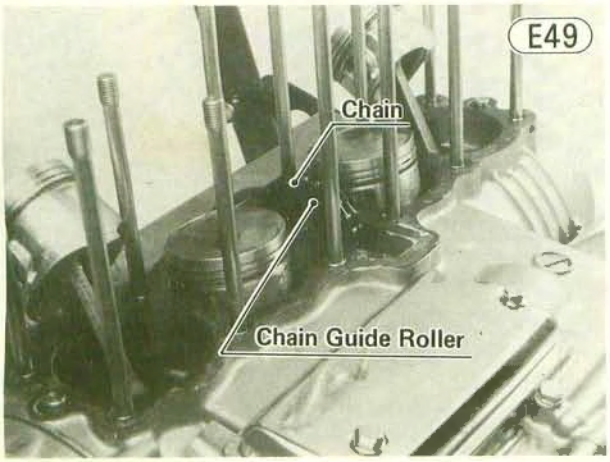
- Apply engine oil to the piston rings and the inside cylinder surfaces.
- Compress the piston rings using a piston ring compressor (special tool) on each piston.

- Fit the cylinder block on the crankcase studs, and rest the bottom of the cylinders on the piston ring compressors.
- Pull the camshaft chain up through the cylinders and insert a screwdriver through it to prevent the chain from falling into the crankcase.
- Work the bottom of each cylinder past the rings, and set the cylinder block in place while removing the special tools. 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 cylinder head (Pg. 49).
- Adjust camshaft chain (Pg. 14).

CAMSHAFT CHAIN GUIDE ROLLER

Revmoal:

- Remove the cylinder block (Pg. 52).
- Remove the chain guide roller.

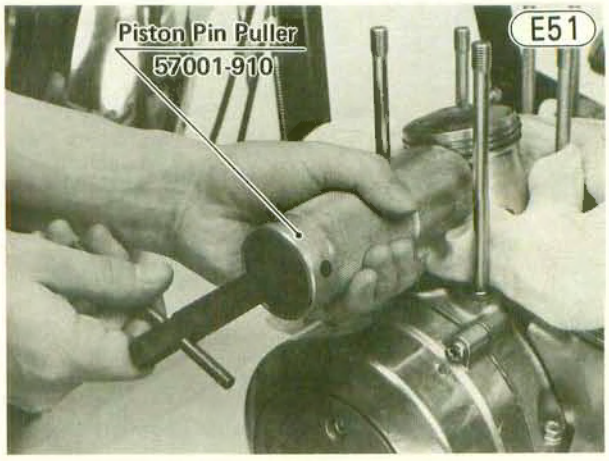


PISTON, PISTON RINGS

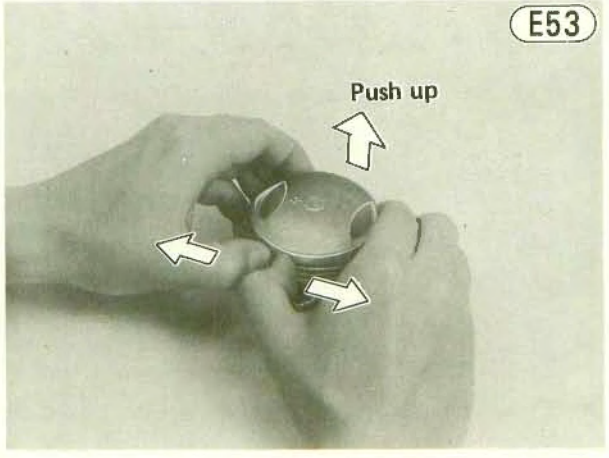
Removal:

- Remove the cylinder block (Pg. 52).
- Wrap a clean cloth around the base of each piston so that no parts and dirt will fall into the crankcase.
- Remove the piston pin snap rings from the outside of each piston.

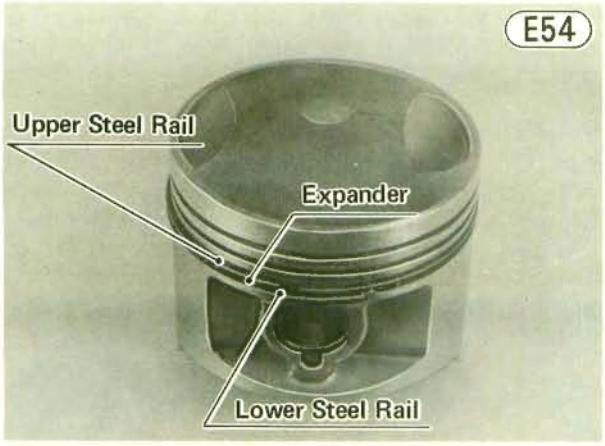
- Remove each piston by pushing its piston pin out the side that the snap ring was removed. Use the piston pin puller and adapter "B" (special tools) if necessary.



- 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.



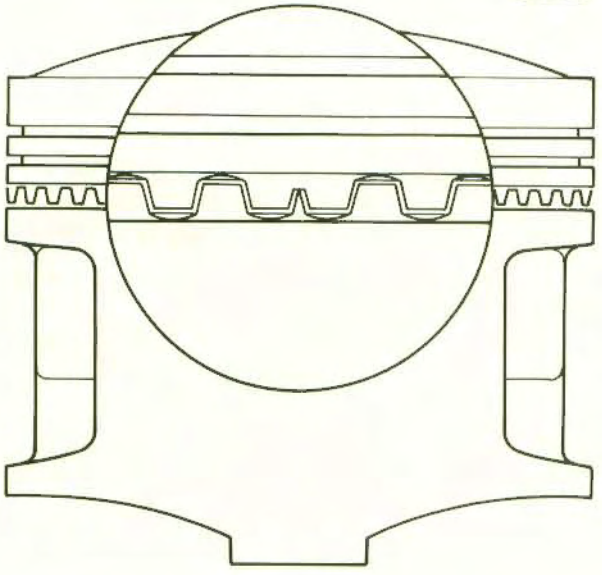
- Remove the upper and lower piston ring steel rails, and then remove the expander.



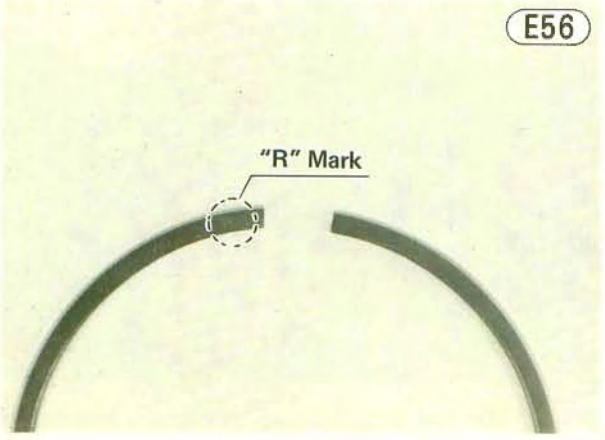
Installation:

- 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.

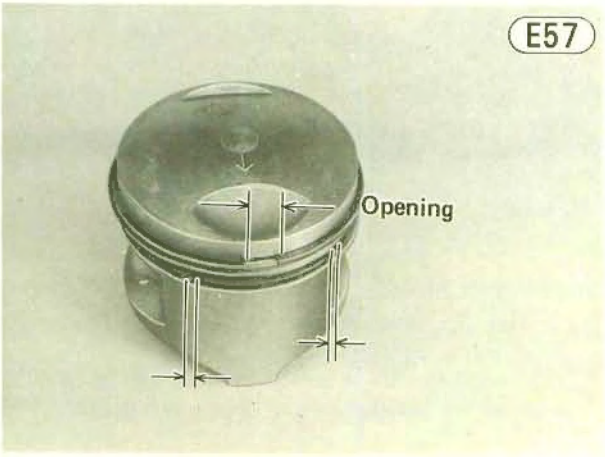
Oil Ring Installation



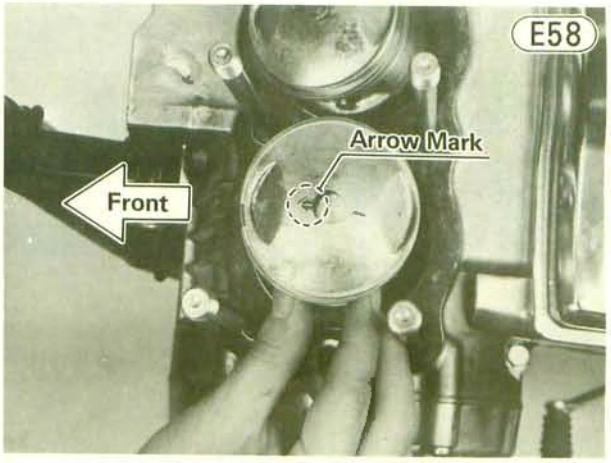
- Install the top and second rings so that the correct side (marked "R") faces up. The top and second rings are identical.



- Turn the rings so that the opening in the top ring and oil ring of each piston faces forward and the opening in the second ring 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.



- Apply a little engine oil to the piston pins, and install the pistons and piston pins. The arrow on the top of each piston must point towards the front.

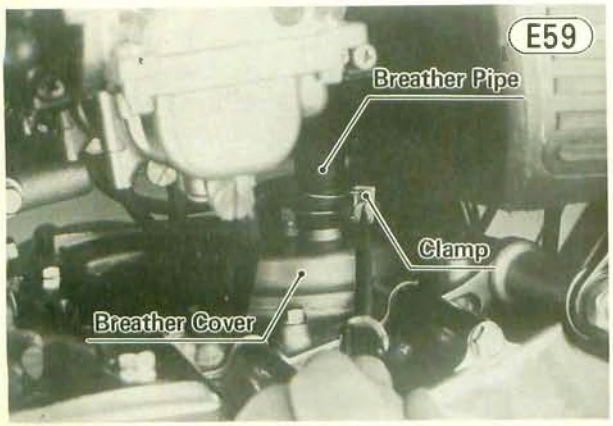


- Fit a new piston pin snap ring into the side of each piston, as removal weakens and deforms the snap ring.
- Install the cylinder block (Pg. 53).

BREATHER COVER

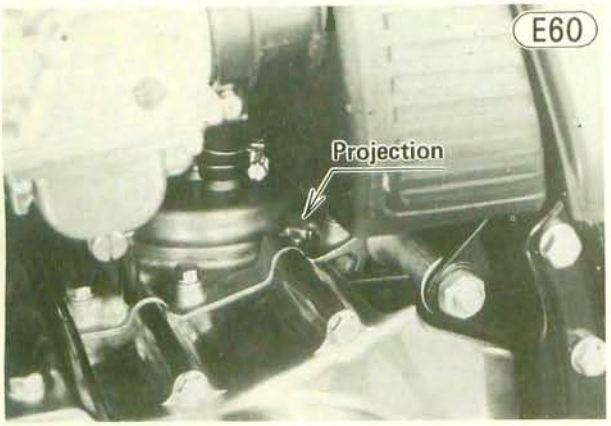
Removal:

- Loosen the breather hose clamp bolt, and remove the breather hose from the breather cover.
- Remove the breather cover bolt and cover.



Installation Notes:

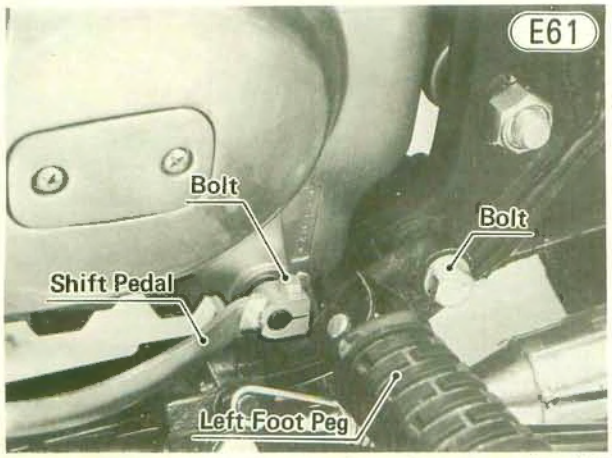
1. Replace the breather cover O ring with a new one if deteriorated or damaged.
2. The projection of the breather cover must be installed between the positioning pins on the crankcase.



ENGINE SPROCKET COVER

Removal:

•Remove the left foot peg bolt and left foot peg.



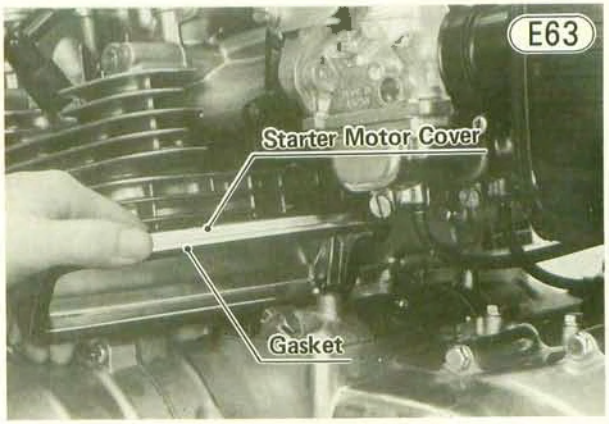
•Take out the shift pedal bolt, and remove the shift pedal.

•Remove the starter motor cover bolts (2) and cover.
•Remove the engine sprocket cover bolts (4), and pull the cover free from the crankcase.

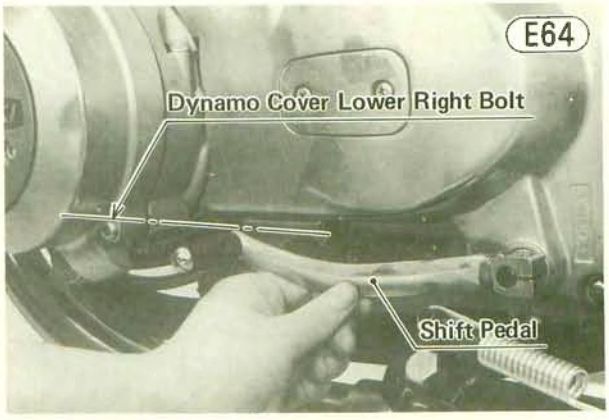
Installation:

•Check that the knock pin is in place, install the engine sprocket cover using the shift shaft oil seal guide (special tool) to protect the oil seal in the cover, and tighten its bolts.

•Check that the starter motor cover gasket is in place, and install the cover with the bolts (2) and flat washer (2).



•Mount the shift pedal so that its end matches the level of the dynamo cover lower right bolt.

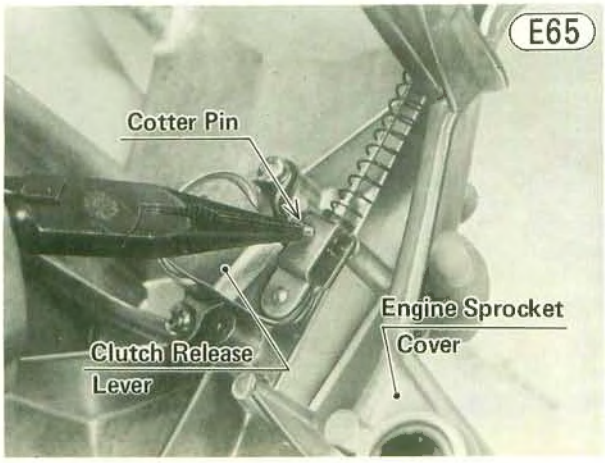


•Mount the left foot peg with its bolt and lockwasher.

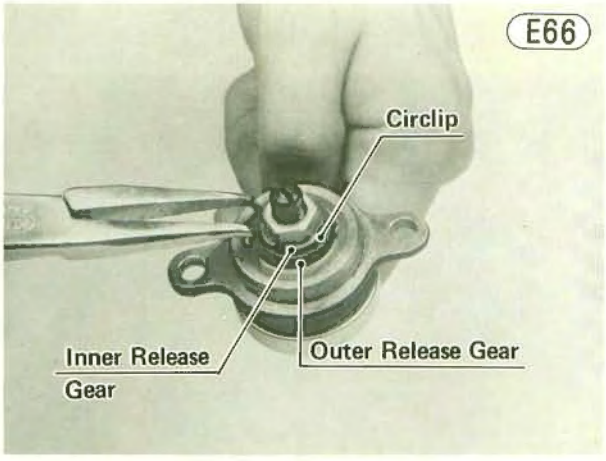
CLUTCH RELEASE

Removal:

- Remove the engine sprocket cover (Pg. 56).
- Remove the cotter pin from the clutch release lever, and free the clutch inner cable tip from the lever and engine sprocket cover.

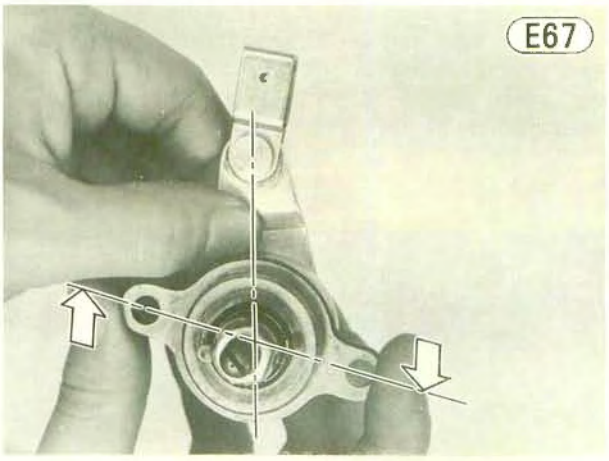


- Remove the clutch release assembly mounting screws (2), and remove the release assembly.
- Take out the circlip, and separate the outer release gear and the inner release gear.



Installation:

- Wash and clean the release balls and inner release gear with a high flash-point solvent. Dry and then lubricate them with grease.
- Fit the inner gear back into the outer release gear. When the two gears are fully meshed, the clutch release lever and the outer release gear must be positioned as shown in Fig. E67. The machined side of the outer release gear must face upward.

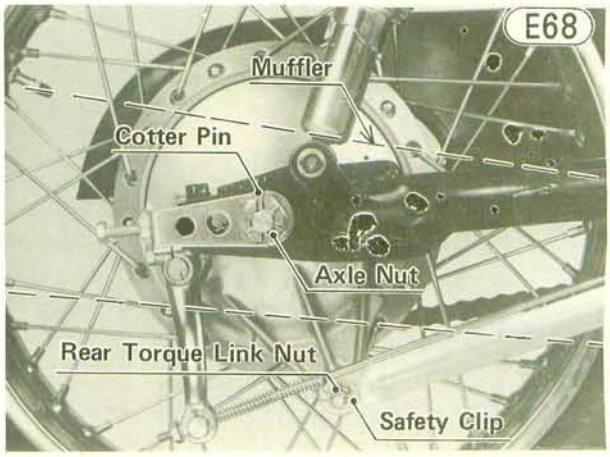


- Install the circlip on the inner release gear.
- Fit the clutch release lever assembly back into the engine sprocket cover, apply a non-permanent locking agent to the screws, and tighten the screws. The clutch release lever must be positioned as shown in Fig. E65, when the gears are fully meshed.
- Run the clutch cable into the engine sprocket cover and spring, and fit the tip of the inner cable into the clutch release lever.
- Using a new cotter pin, secure the cable tip to the release lever.
- Install the engine sprocket cover (Pg. 56).
- Adjust the clutch (Pg. 20).

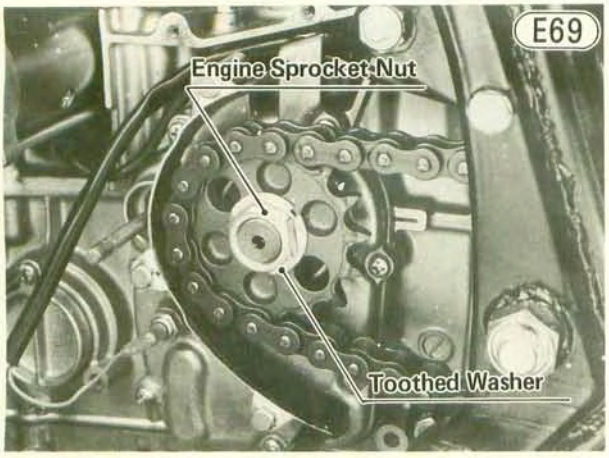
ENGINE SPROCKET

Removal:

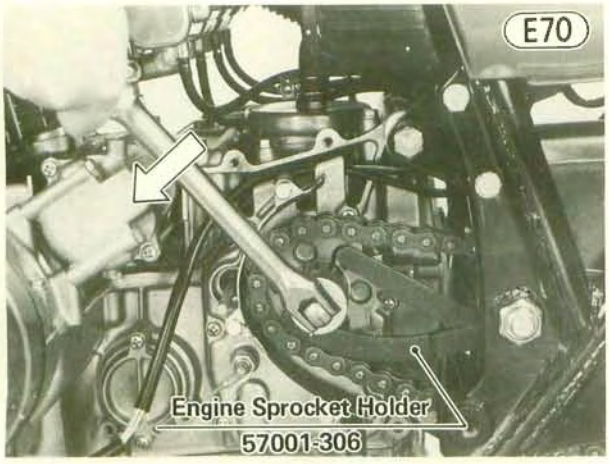
- Stand the motorcycle up on its center stand.
- Check that the transmission is in neutral.
- Remove the engine sprocket cover (Pg. 56).
- Remove the cotter pin, and loosen the axle nut. Remove the safety clip, and loosen the nut at the rear end of the torque link.



- Loosen the left and right chain adjusting bolt locknuts, and then back out the chain adjusting bolts. Kick the wheel forward to give the chain plenty of play.
- 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 the engine sprocket off along with the drive chain.



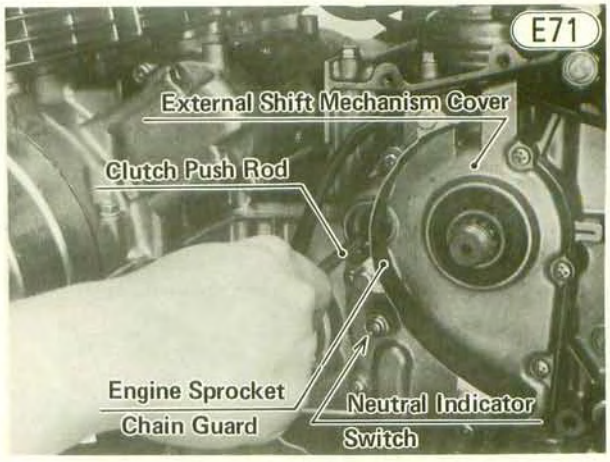
Installation:

- Mount the engine sprocket while meshed with the drive chain. Install the toothed washer engaging it with a hole in the sprocket.
- Install the engine sprocket nut, and then tighten the nut with 7.5 ~ 8.5 kg-m (54 ~ 61 ft-lbs) of torque while using the engine sprocket holder to keep the sprocket steady.
- Bend back one side of the toothed washer over the side of the nut.
- Install the engine sprocket cover (Pg. 56).

EXTERNAL SHIFT MECHANISM

Removal:

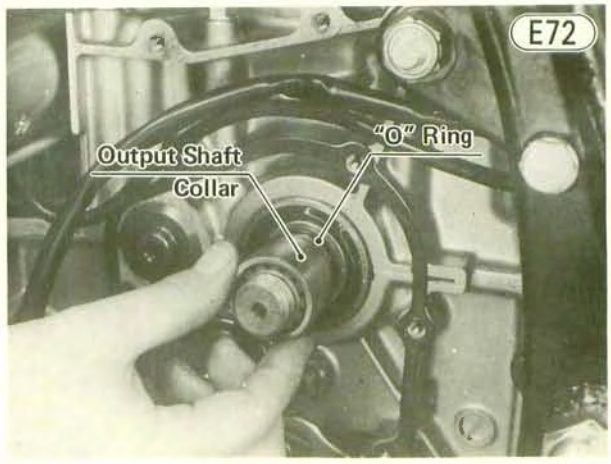
- Remove the engine sprocket cover (Pg. 56).
- Remove the engine sprocket (Pg. 57).
- Disconnect the neutral indicator switch lead and pull out the clutch push rod.



- Remove the engine sprocket chain guard.
- Remove the external shift mechanism cover screws (7), and pull off the external shift mechanism cover and gasket.

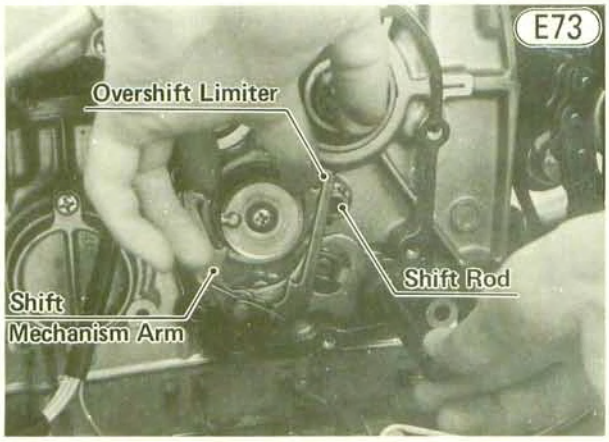
NOTE: Engine oil will drain through the lower left side screw hole of the cover. Plug the hole with one of the screws, if necessary.

- Remove the output shaft collar, using a bearing puller if it is difficult to remove, and take off the **O** ring.

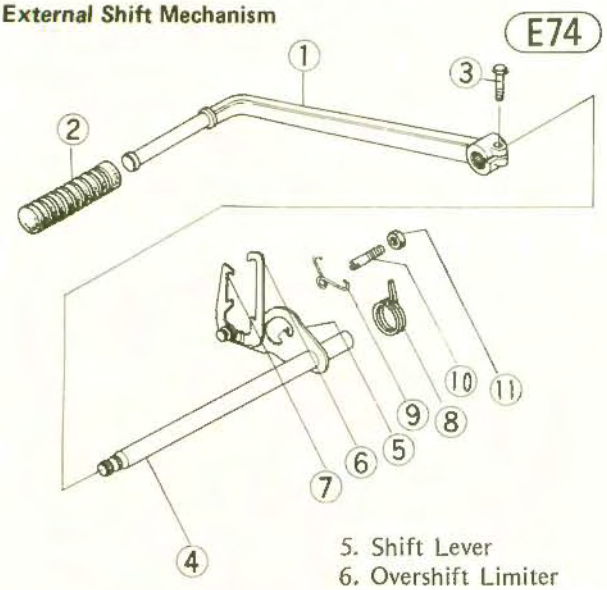


- Move the shift mechanism arm and overshift limiter out of their positions on the end of the shift drum, and pull out the external shift mechanism.

NOTE: Do not pull the shift rod more than 40 mm out of the crankcase, or the shift forks inside the crankcase will fall to the bottom of the oil pan, requiring removal of the crankcase to install them.



External Shift Mechanism



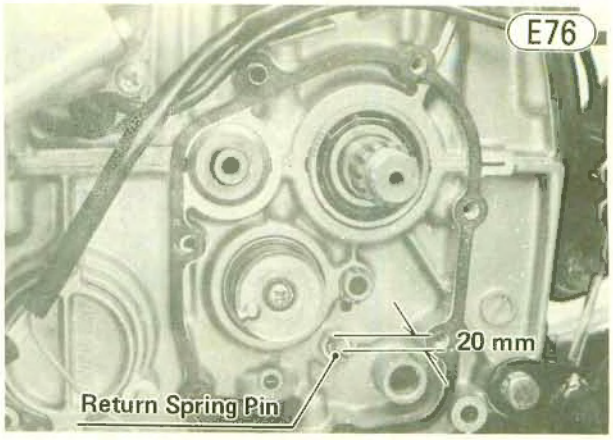
1. Shift Pedal
2. Pedal Rubber
3. Bolt
4. Shift Shaft
5. Shift Lever
6. Overshift Limiter
7. Shift Mechanism Arm
8. Return Spring
9. Pawl Spring
10. Return Spring Pin
11. Locknut

Installation:

- If the shift drum pins were removed, make sure the one long pin is assembled in the position shown. If this pin is assembled in the wrong position, the neutral indicator light will not light when the gears are in neutral.

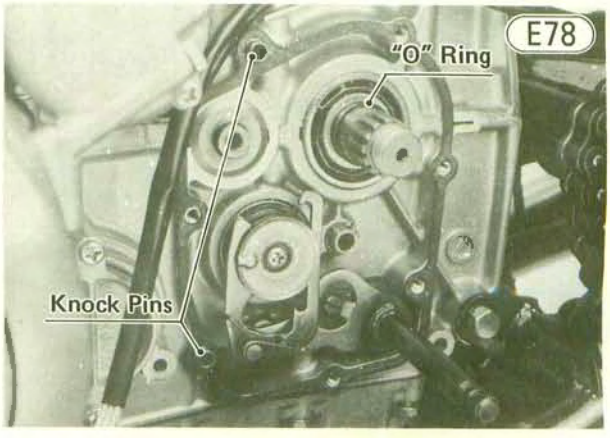
- Check that the external shift mechanism return spring pin is not loose. If it is loose, remove it, apply a non-permanent locking agent to the threads, re-install it, and tighten the locknut.

NOTE: The return spring pin must be screwed in until it protrudes approximately 20 mm from the crankcase, so that it can work satisfactorily as an external shift mechanism lever stopper.

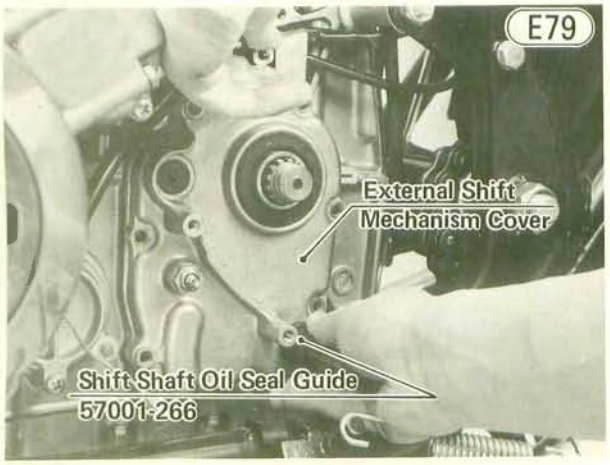


- Check that the return spring is properly fitted on the shaft, install the external shift mechanism, and place the shift mechanism arm and overshift limiter on the shift drum pins.

- Check that the two knock pins are in place.
- Replace the output shaft **O** ring with a new one if it is damaged, and install it next to the ball bearing inner race.



•Apply a high temperature grease to the lips of the clutch push rod oil seal and the output shaft collar oil seal.
•Insert the shift shaft oil seal guide (special tool) in the external shift mechanism cover oil seal, install the cover, and then tighten the screws (7). An aluminum washer must be replaced with a new one, and installed with the left lower side screw of the cover.

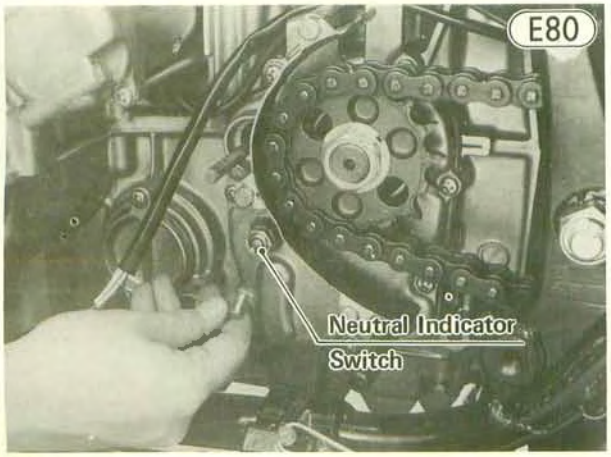


•Install the output shaft collar on the output shaft.
•Apply non-permanent locking agent to the bolts (3), and install the engine sprocket chain guard.
•Fit the neutral indicator switch lead back on the switch and install the clutch push rod.
•Install the engine sprocket (Pg. 58).
•Install the engine sprocket cover (Pg. 56).
•Adjust the drive chain (Pg. 24).
•Check the oil level (Pg. 21).

NEUTRAL INDICATOR SWITCH

Removal:

•Remove the engine sprocket cover (Pg. 56).
•Pull the neutral indicator switch lead off the switch.



•Unscrew the neutral indicator switch and gasket.

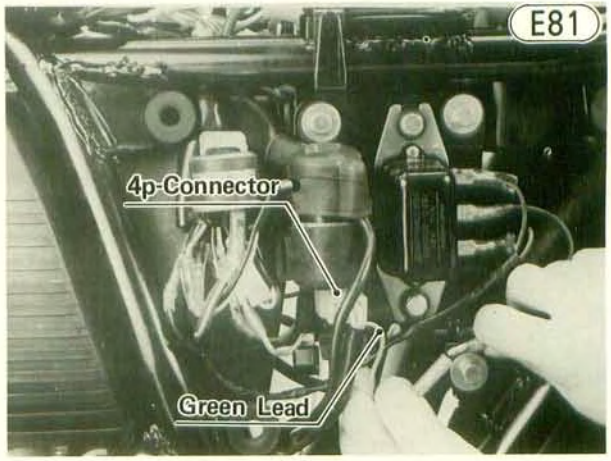
Installation:

•Install the neutral indicator switch and gasket tightening it with 1.3 ~ 1.7 kg-m (9.5 ~ 12 ft-lbs) of torque.
•Fit the lead back on the switch.
•Install the engine sprocket cover (Pg. 56).

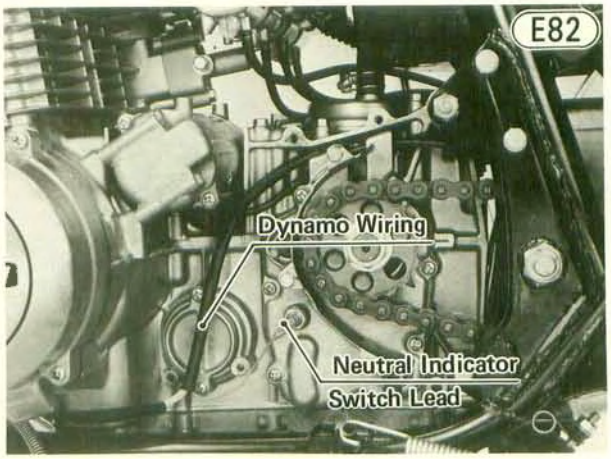
DYNAMO FIELD COIL, ARMATURE

Removal:

•Remove the left side cover, and disconnect the dynamo wiring 4-p connector and light green lead.

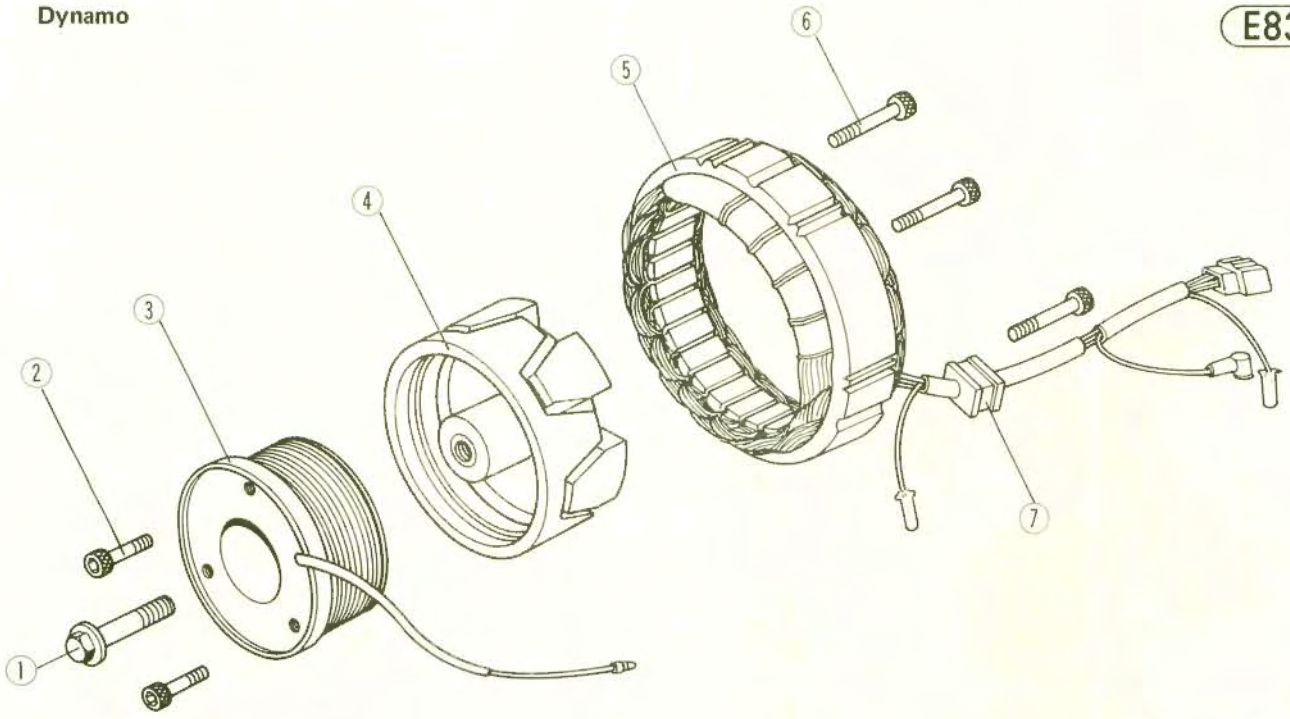


•Remove the engine sprocket cover (Pg. 56).
•Disconnect the neutral indicator switch lead, and pull out the wiring towards the left side.



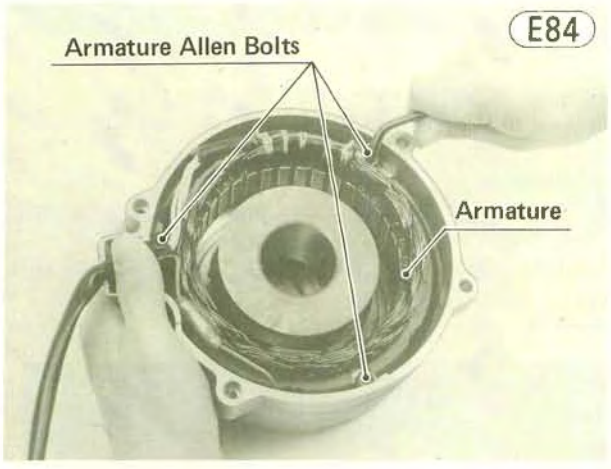
Dynamo

E83



1. Rotor Bolt
2. Field Coil Mounting Allen Bolt
3. Field Coil
4. Dynamo Rotor
5. Armature
6. Armature Allen Bolt
7. Grommet

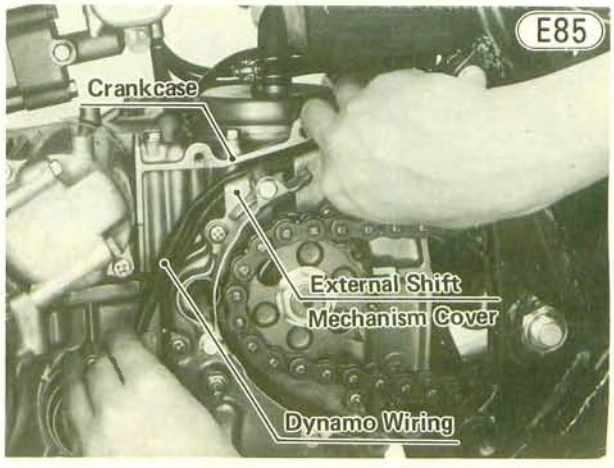
- Remove the dynamo cover screws (4), and pull off the dynamo cover and gasket.
- Remove the armature Allen bolts ⑥ (3), and pull out the armature ⑤.



- Remove the field coil mounting Allen bolts ② (3), and remove the field coil ③ and the grommets ⑦.

Installation:

- Install the grommet, and set the field coil into place. Apply a non-permanent locking agent on each Allen bolt, and tighten the bolts.
- Apply a liquid gasket around the circumference of each armature grommet, install the grommet, and fit the armature into place. Use a non-permanent locking agent on each Allen bolt, and tighten the bolts.
- Check that the knock pins (2) are in place, install the dynamo cover using a new gasket, and tighten its screws (4).
- Connect the neutral indicator switch lead.
- Fit the dynamo wiring between the external shift mechanism cover and the crankcase.

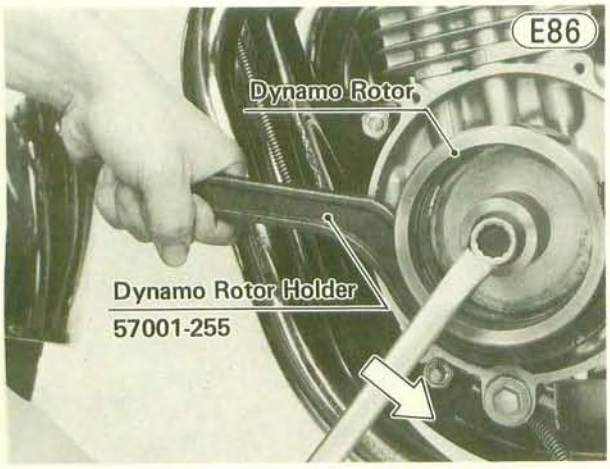


- Install the engine sprocket cover (Pg. 56).
- Reconnect the plug and green lead.
- Install the left side cover.

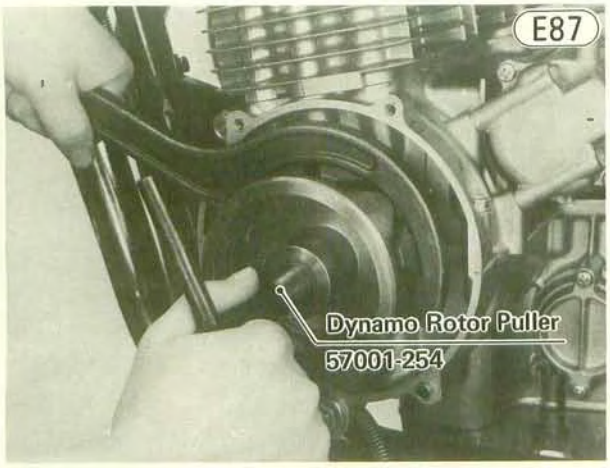
DYNAMO ROTOR

Removal:

- Remove the left side cover, and disconnect the dynamo wiring 4-pin connector and light green lead.
- Remove the engine sprocket cover (Pg. 56).
- Disconnect the neutral indicator switch lead, and pull out the wiring towards the left side (Fig. E82).
- Remove the dynamo cover screws (4), and pull off the dynamo cover and gasket.
- Hold the dynamo rotor ④ steady with the dynamo rotor holder (special tool), and remove the rotor bolt ①.



- Using the special tool to hold the rotor steady, remove the rotor with the dynamo rotor puller (special tool).



Installation:

- Using a high flash-point solvent, clean off any oil or dirt that may be on the crankshaft taper or rotor hub, and place the rotor back on the crankshaft.
- Tighten the bolt with 5.8 ~ 6.3 kg-m (42 ~ 46 ft-lbs) of torque while holding the dynamo rotor steady with the dynamo rotor holder (special tool).
- Check that the knock pins (2) are in place, replace the dynamo cover using a new gasket, and tighten its screws (4).
- Connect the neutral indicator switch lead.
- Fit the dynamo wiring between the external shift mechanism cover and the crankcase (Fig. E85).
- Install the engine sprocket cover (Pg. 56).
- Reconnect the plug and light green lead.
- Install the left side cover.

STARTER MOTOR

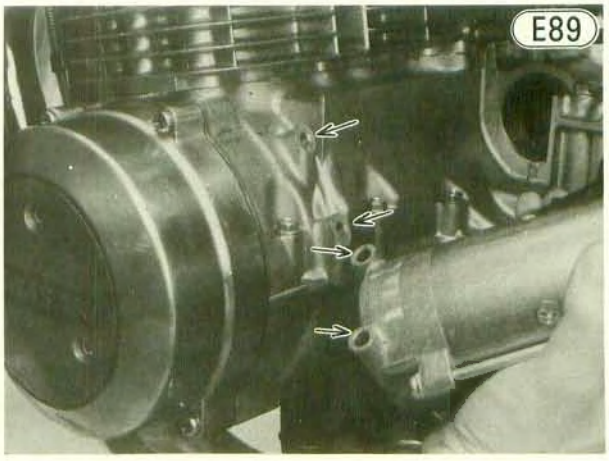
Removal:

- Remove the engine sprocket cover (Pg. 56).
- Slide out the rubber cap, remove the starter motor relay terminal nut and lockwasher, and take the lead off the relay.

- Remove the starter motor retaining bolts (2).
- Pull off the starter motor.

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 idle gear.
- Tighten the starter motor retaining bolts (2).
- Reconnect the motor lead onto the terminal with its nut and lockwasher, and tighten the nut.
- Reinstall the rubber cap.
- Install the engine sprocket cover (Pg. 56).

Disassembly:

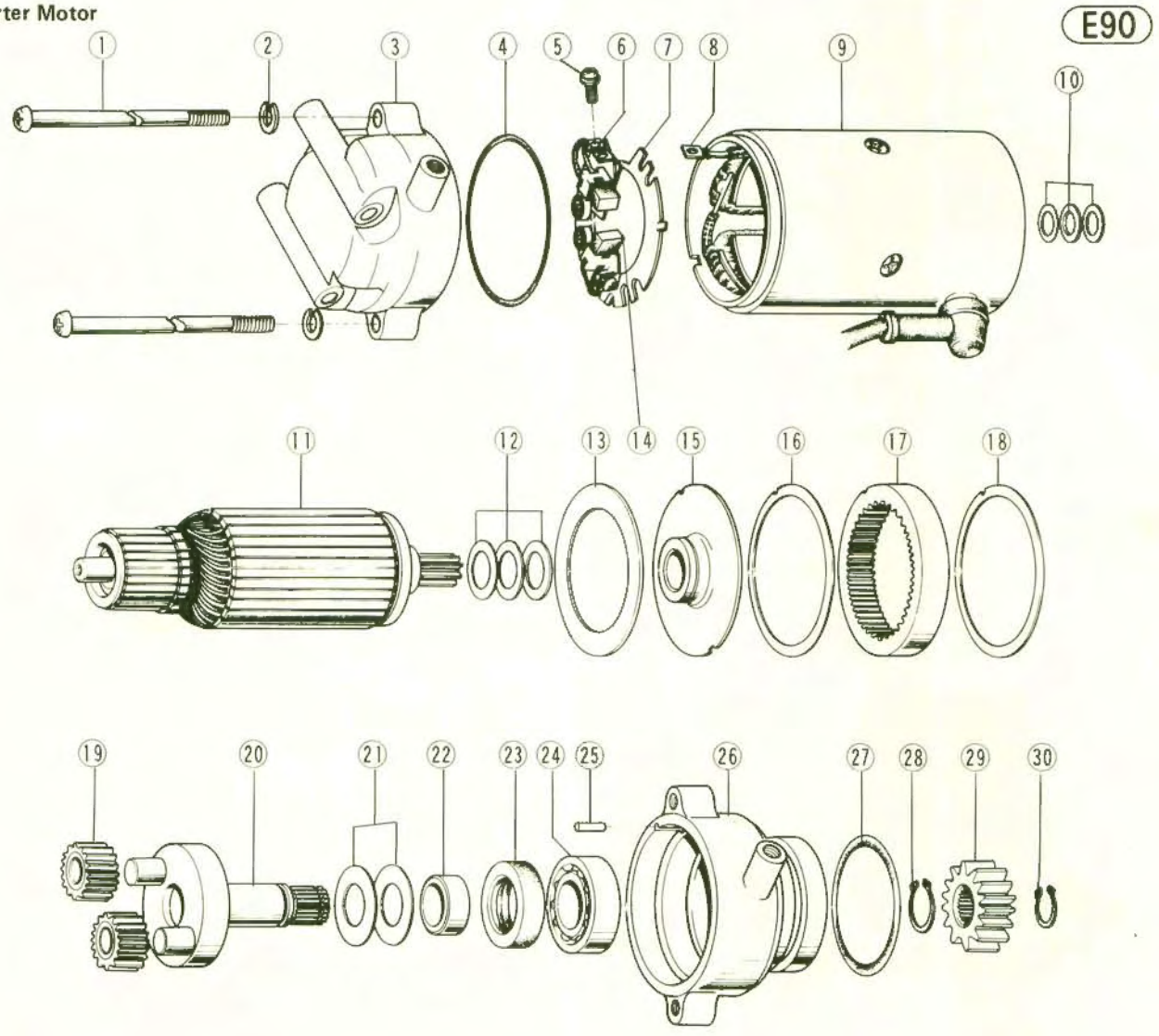
- Remove the screws ① (2), lockwashers ② (2), and remove the end covers ③, ㉖.
- Remove the gasket ⑯, end plate ⑮, gasket ⑬, thrust washers ⑫ and armature ⑪ from the shaft side.
- Remove the screw which connects the brush lead ⑥ to the field coil lead ⑧, and remove the brush plate ⑦. The screw has a lockwasher. There is an **O** ring ④ at the brush side of the housing.

NOTE: The yoke assembly ⑨ is not meant to be disassembled.

- Remove the planet pinions ⑲, internal gear ⑰, and pin ㉕.

Starter Motor

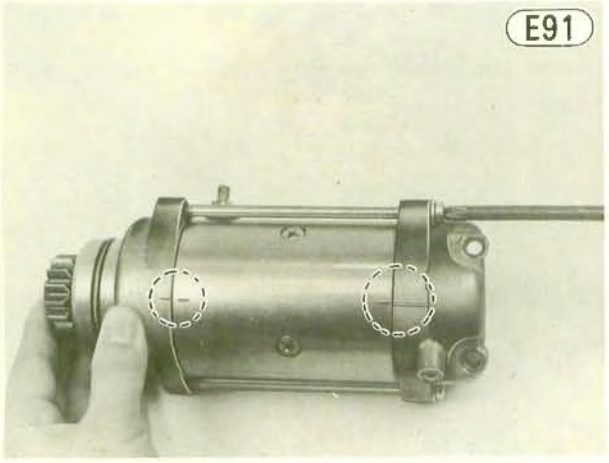
E90



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

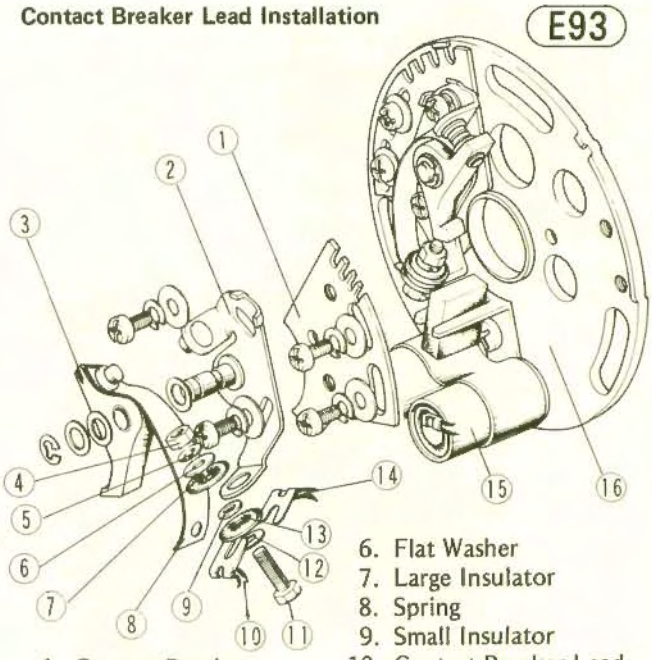
Assembly Notes:

1. Replace and **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 ⑲ and internal gear ⑰.

Contact Breaker Lead Installation



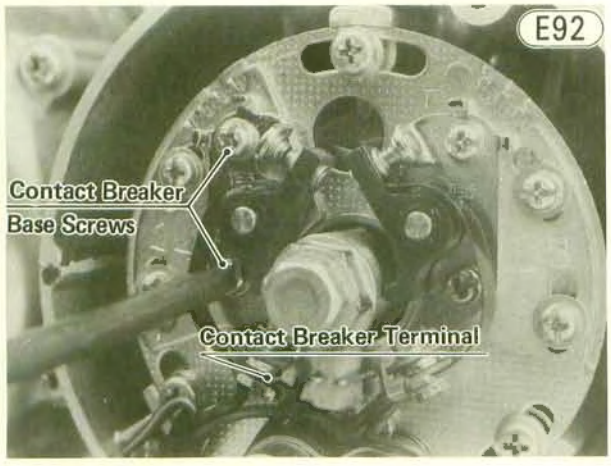
1. Contact Breaker Adjusting Plate
2. Contact Breaker Base Plate
3. Contact Breaker
4. Nut
5. Lockwasher
6. Flat Washer
7. Large Insulator
8. Spring
9. Small Insulator
10. Contact Breaker Lead
11. Bolt
12. Flat Washer
13. Large Insulator
14. Capacitor Lead
15. Capacitor
16. Contact Breaker Plate

2. After installation, adjust the ignition timing (Pg. 12).

CONTACT BREAKER

Removal (each contact breaker):

- 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 two leads.

Installation Notes:

1. The sequence of installation on the contact breaker bolt is: bolt ⑪, flat washer ⑫, capacitor lead ⑭, contact breaker lead ⑩, spring ⑧, large insulator ⑬, small insulator ⑨ (in contact breaker hole), large insulator ⑦, flat washer ⑥, lockwasher ⑤, and nut ④.

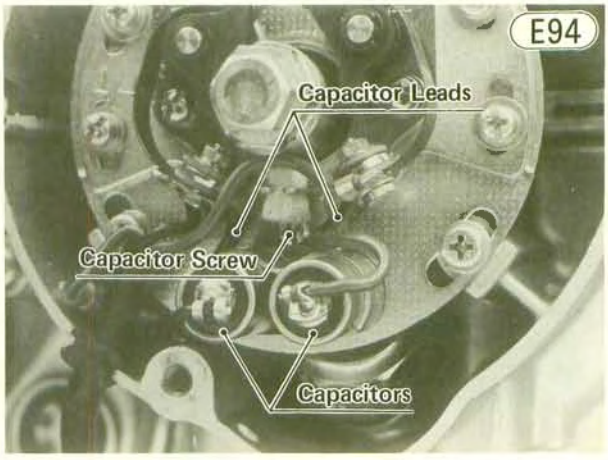
CAPACITORS

Removal:

- Remove the contact breaker cover and gasket.
- Loosen each contact breaker nut, and remove the capacitor lead to complete capacitor removal.
- Remove the capacitor screw. The screw has a flat and lockwasher.

Installation Note:

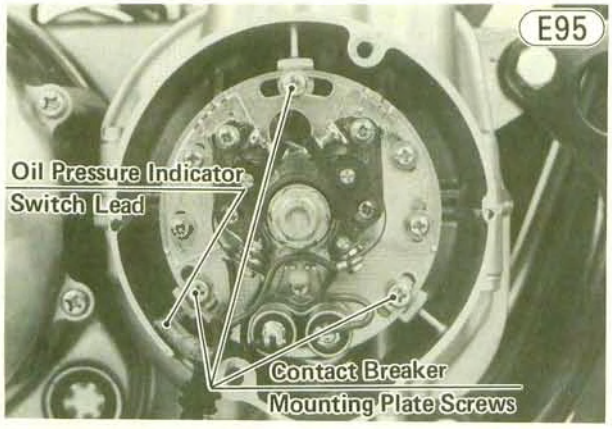
The sequence of installation on the contact breaker bolt is: bolt, flat washer, capacitor lead, contact breaker lead, spring, large insulator, small insulator (in contact breaker hole), large insulator, flat washer, lockwasher, and nut (Fig. E93).



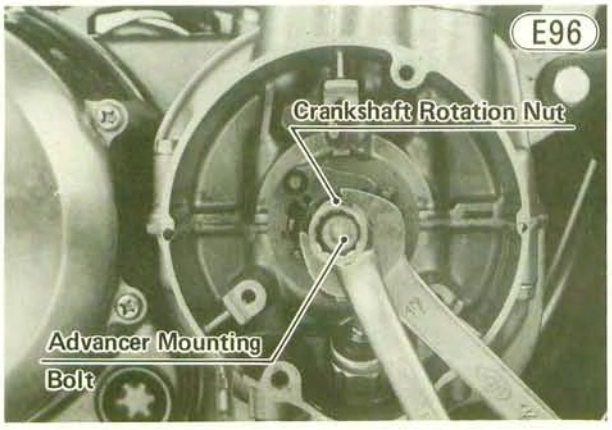
TIMING ADVANCER

Removal:

- Remove the contact breaker cover and gasket.
- Take out the contact breaker mounting plate screws, lockwashers, and flat washers (3 ea), and remove the plate. Disconnect the oil pressure indicator switch lead.

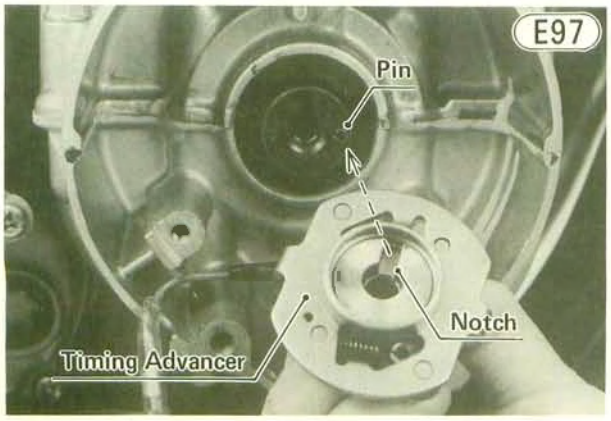


- With a 17 mm wrench on the crankshaft rotation nut to keep the shaft from turning, remove the advancer mounting bolt, and take off the rotation nut and the timing advancer.



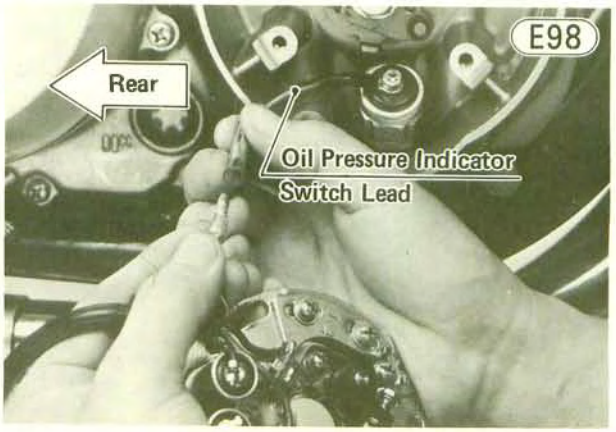
Installation:

- Fit the timing advancer onto the crankshaft, matching its notch with the pin in the end of the crankshaft, and install the crankshaft rotation nut and the advancer mounting bolt. The notches in the nut fit the projections on the timing advancer. Tighten the bolt with 2.3~2.7 kg-m (16.5~19.5 ft-lbs) of torque.



- Connect the oil pressure indicator switch lead.

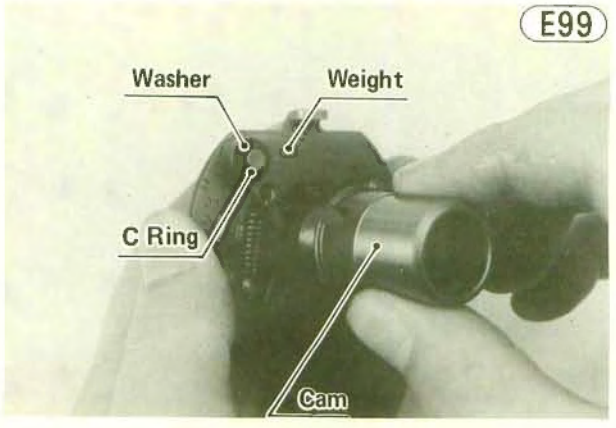
NOTE: The indicator switch lead must point to the rear.



- Mount the contact breaker mounting plate, and tighten its screws (3) loosely. Each screw has a lockwasher and flat washer.
- Adjust the ignition timing (Pg. 12).

Disassembly:

- Pull off the cam.

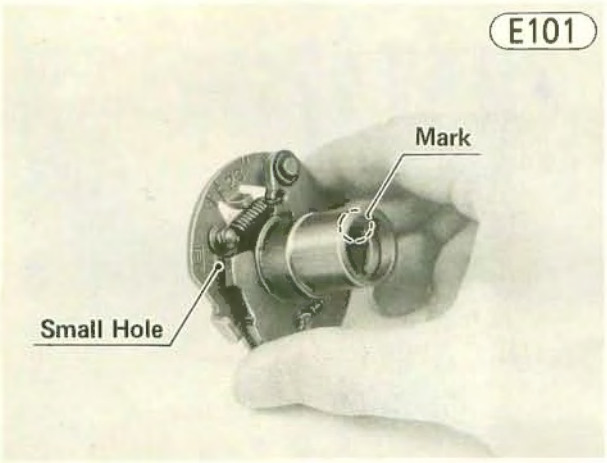


- Remove the C rings (2), washers (4), and weights (2).
- Remove the thrust washer from each weight shaft.

Assembly Notes:

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

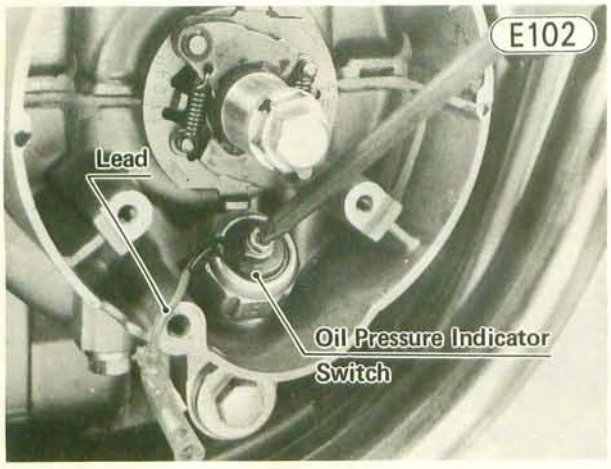
2. When installing the cam, align the mark on the cam with the small hole in the advancer body.



OIL PRESSURE INDICATOR SWITCH

Removal:

- Remove the timing advancer (Pg. 65).
- Remove the bolt and lockwasher, and free the lead from the oil pressure indicator switch.



- Remove the oil pressure indicator switch.

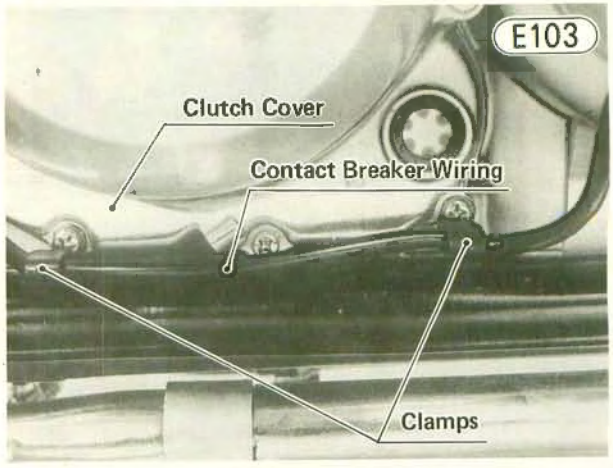
Installation Notes:

1. Tighten the oil pressure indicator switch with 1.3 ~1.7 kg-m (9.5~12 ft-lbs) of torque.
2. The switch lead must point to the rear (Fig. E102).

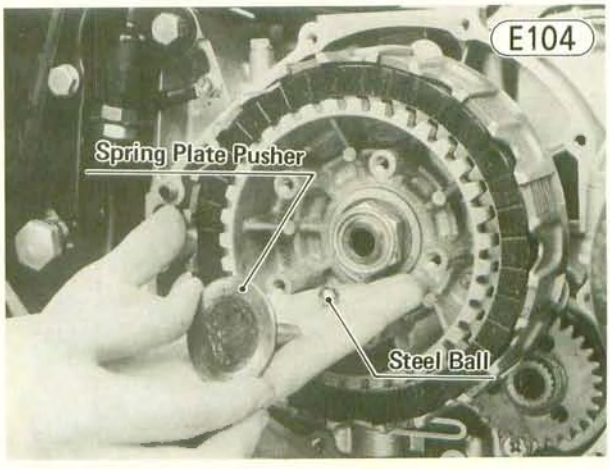
CLUTCH

Removal:

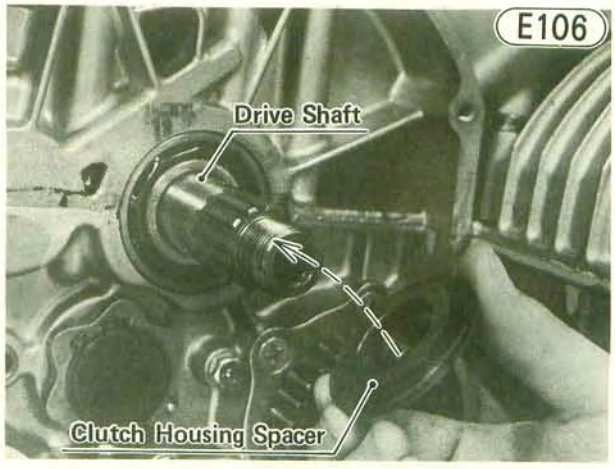
- With the motorcycle on its center stand, place an oil pan beneath the engine, and remove the engine drain plug and washer to drain out the oil.
- After the oil has drained, tighten the drain plug with 1.3~1.7 kg-m (9.5~12 ft-lbs) of torque.
- Remove the rear brake light switch spring.
- Back the rear 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 bolt and lockwasher, and remove the right foot peg.
- Note 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 then pull off the kickstarter pedal.
- Free the contact breaker wiring from the clamps under the clutch cover.



- Remove the screws (10), and pull off the clutch cover and gasket.
- Remove the clutch spring bolts ⑯ (5), washers ⑮ (5), and springs ⑭ (5).
- Pull off the spring plate ⑬, pull out the spring plate pusher ⑫, and tilt the motorcycle so that the steel ball ⑪ will fall out.



- Remove the friction plates ④ (7) and steel plates ⑤ (6).
- Hold the clutch hub from turning using a clutch holder (special tool), and remove the clutch hub nut ⑩ and lockwasher ⑨.

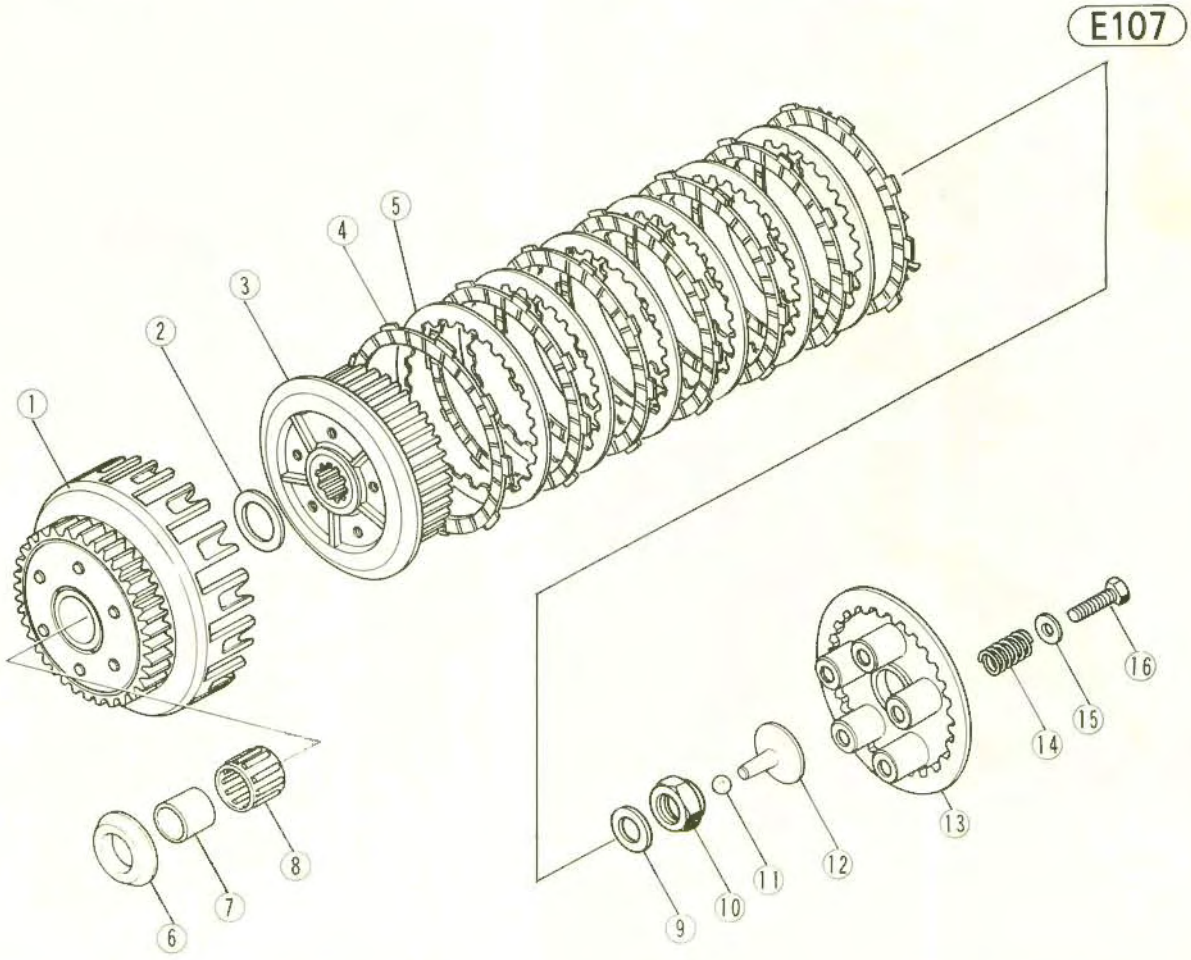


- Pull off the clutch hub, clutch housing, needle bearing, drive shaft sleeve, and spacer. There is a thrust washer between the clutch hub and clutch housing.

Installation:

- Put the clutch housing spacer on the drive shaft. The spacer must be installed with its flat side facing toward the end of the shaft.
- Install the drive shaft sleeve, needle bearing, and clutch housing.
- Put on the thrust washer, clutch hub, and lockwasher. Replace the clutch hub nut with a new one, screw on the nut and tighten it with 12 ~ 15 kg-m (87 ~ 118 ft-lbs) of torque, while holding the hub stationary with the clutch holder (special tool).

Clutch



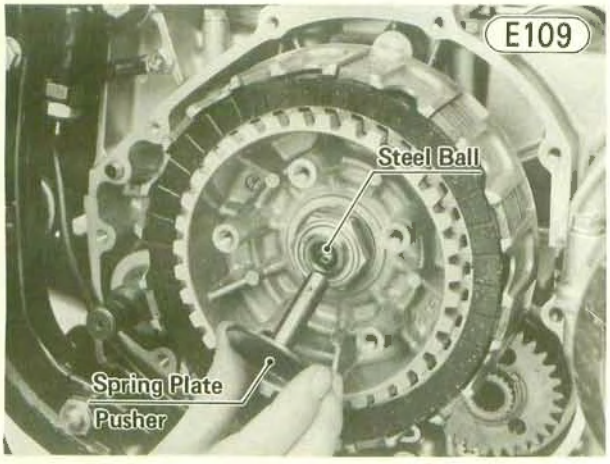
1. Clutch Housing
2. Thrust Washer
3. Clutch Hub
4. Friction Plate
5. Steel Plate
6. Spacer
7. Sleeve
8. Needle Bearing
9. Lockwasher
10. Nut
11. Steel Ball
12. Spring Plate Pusher
13. Spring Plate
14. Clutch Spring
15. Washer
16. Bolt

WARNING **The washer between the clutch hub and the clutch hub nut msut be installed with the marked side, "out side", facing out. If this washer is installed backwards, the hub nut might loosen during operation. This causes clutch disengagement resulting in loss of motorcycle control.**

- Install the friction plates (7) and steel plates (6), 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 clutch steel ball, and spring plate pusher, applying a thin coat of a high temperature grease to their surfaces.

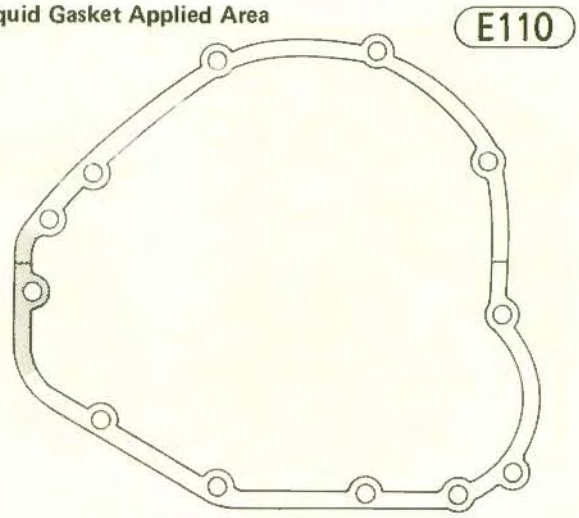


- Install the spring plate, spring washers, and spring bolts (5 ea). Cross tighten the bolts evenly with 0.9~1.1 kg-m (78~95 in-lbs) of torque.

NOTE: The spring plate can be installed on the clutch hub in any position, so there is no mark on either the spring plate or the clutch hub.

- Check that the thrust washers (2) are on the kick shaft.
- Check that the two knock pins are in place, apply liquid gasket, and fit a new clutch cover gasket.

Liquid Gasket Applied Area



- Insert the kick shaft oil seal guide (special tool) in the clutch cover oil seal, and fit the clutch cover onto the crankcase. Tighten the screws (10) firmly. Be sure to include the contact breaker lead clamps (2) with their clutch cover screws.

- Fit the contact breaker wiring with the wiring clamps under the clutch cover.
- Install the right foot peg.
- Adjust the rear brake pedal (Pg. 25).
- Install the rear brake light switch spring.
- Adjust the rear brake light switch (Pg. 26).
- Fill the engine with oil, check the oil level (Pg. 21), and add more if necessary.
- Adjust the clutch (Pg. 20).

KICKSTARTER SPRING

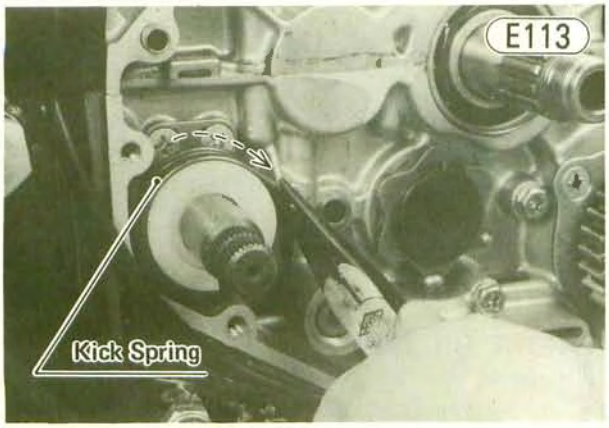
Removal:

- Remove the clutch (Pg. 66).
- Pull out the thrust washers (2) and spring guide.

•Remove the kick spring.

Installation:

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

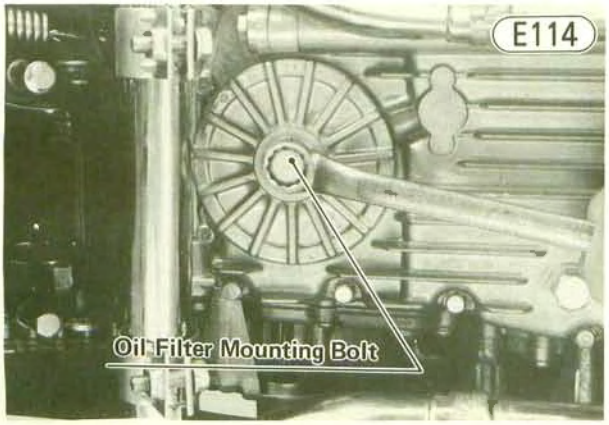


•Put the thrust washers (2) on the kick shaft. The thinner thrust washer goes on first.
•Install the clutch (Pg. 67).

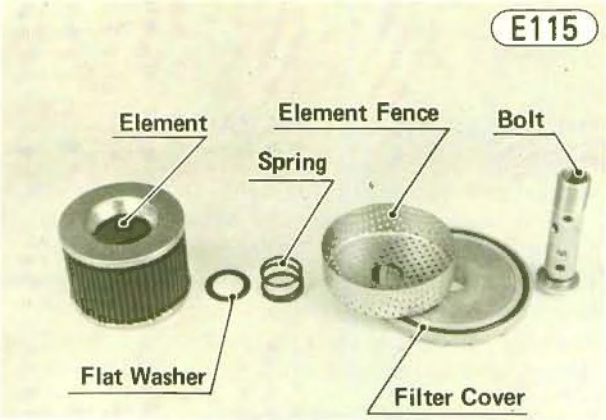
OIL FILTER, BYPASS VALVE

Removal:

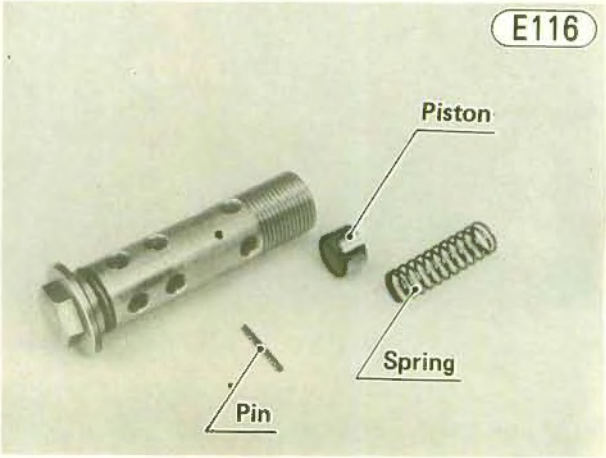
•With the motorcycle up on its center stand, place an oil pan beneath the engine, and remove the oil filter mounting bolt and oil filter.



•Holding the element steady, turn the mounting bolt to work the element free.
•Remove the flat washer, spring, and element fence, and pull the filter cover off the bolt.



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



Installation:

CAUTION **Using damaged or deteriorated O rings instead of replacing them with new ones will cause oil leaks and eventually result in little or no oil left in the engine. This will cause serious engine damage. The oil in the oil filter housing is pressurized by the engine oil pump, so these O rings must be inspected with special care. Look for discoloration (indicating the rubber has deteriorated), hardening (the sides which face the mating surfaces are flattened), scoring, or other damage.**

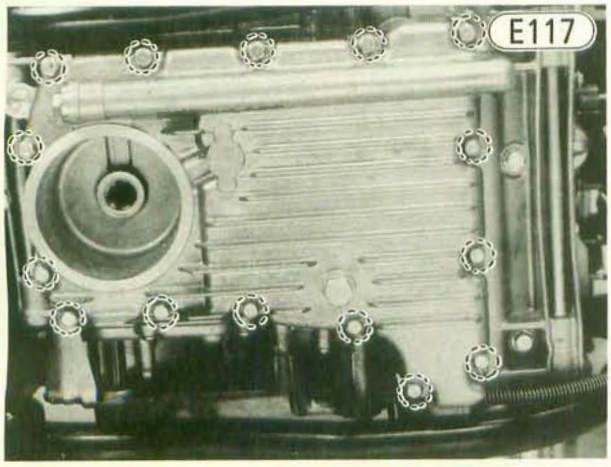
•Fit the piston and spring into the moutning bolt, and drive in the pin while pressing the spring.
•Apply a little engine oil to the O ring on the filter mounting bolt, fit the filter cover and element fence on the bolt, and install the spring and flat washer.
•Apply a little engine oil to the oil *filter grommets* on the both sides of the element, and holding the filter steady, turn the filter mounting bolt to work the element into place. Be careful that the element grommets do not slip out of place.

•Install the oil filter, tighten its mounting bolt.
•Check the oil level (Pg. 21).

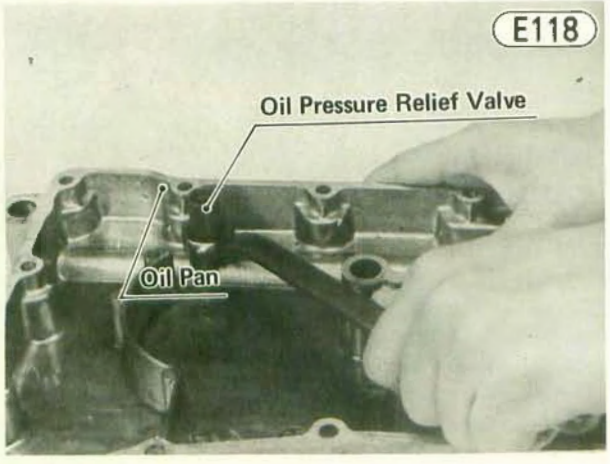
OIL PRESSURE RELIEF VALVE

Removal:

•With the motorcycle on its center stand, place an oil pan beneath the engine, and remove the engine oil drain plug and oil filter to drain out the oil.
•After the oil has drained out, install the drain plug
•Remove the mufflers (Pg. 45).
•Remove the oil pan bolts (15), and remove the oil pan, gasket, and oil passage O rings (3).



•Unscrew the oil pressure relief valve from the oil pan.

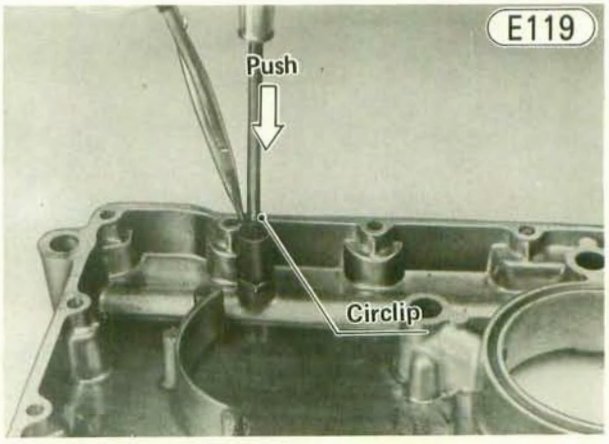


Installation Notes:

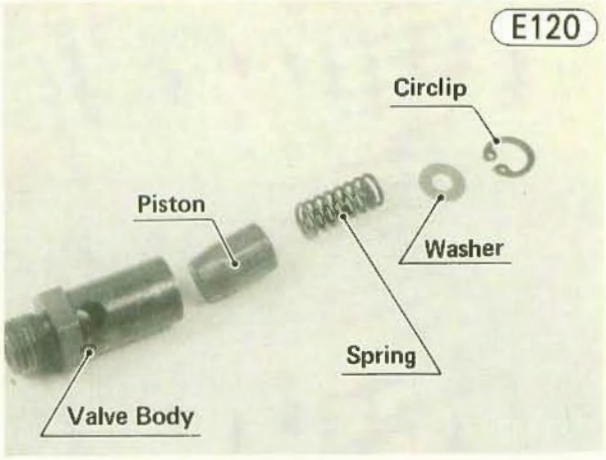
1. Use a non-permanent locking agent on the valve thread.
2. Replace the oil passage O rings and oil pan gasket with new ones.
3. Tighten the oil pan bolts (15) with 0.7 ~ 0.9 kg-m (61 ~ 78 in-lbs) of torque.

Disassembly:

•Using a screwdriver, press the washer, and remove the circlip.



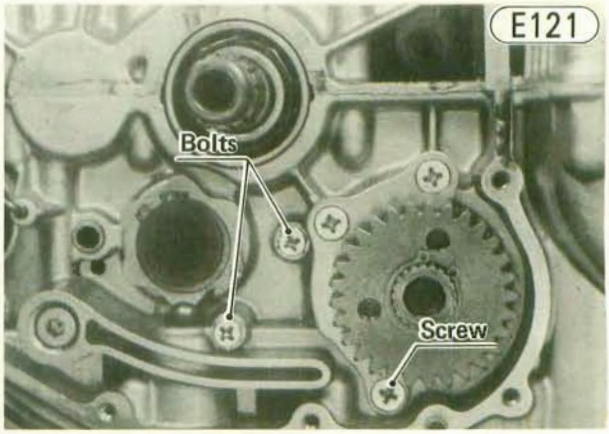
•Take off the washer, spring, and piston.



ENGINE OIL PUMP

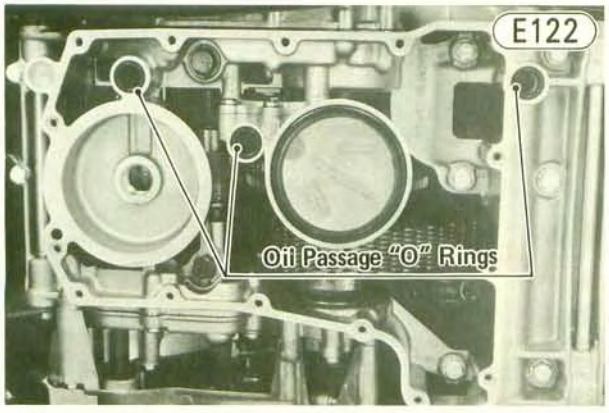
Removal:

•With the motorcycle on its center stand, place an oil pan beneath the engine, and remove the engine oil drain plug and oil filter to drain out the oil.
•After the oil has drained out, install the drain plug and tighten it with 1.3 ~ 1.7 kg-m (9.5 ~ 12 ft-lbs) of torque.
•Remove the mufflers (Pg. 45).
•Remove the clutch (Pg. 66).
•Remove the oil pan bolts (15), and remove the oil pan gasket, and oil passage O rings (3) (Fig. E117).
•Remove the bolts (2) and screw, and pull off the oil pump. There are two knock pins on the crankcase.



Installation Notes:

1. Fill the oil pump with engine oil for initial lubrication.
2. Check to see that the knock pins (2) are in place.
3. Be sure the oil pump gear and pump drive gear at the secondary shaft mesh properly.
4. Apply non-permanent locking agent to the engine oil pump bolts (2) and screw, and tighten them.
5. Replace the oil passage **O** rings and oil pan gasket with new ones.



6. Tighten the oil pan bolts (15) with 0.7 ~ 0.9 kg-m (61~78 in-lbs) of torque.
7. Install the oil filter (Pg. 69).

Disassembly:

- Remove the circlip ④ and washer ⑦ on the pump shaft end.
- Remove the oil pump cover screws ⑥ (3), and take off the oil pump cover ⑧ and gasket ⑨.
- Take out the rotors ⑩, ⑪.
- Take out the pin ③, and pull off the oil pump gear ① and shaft ②.
- Slide off the pump gear, and take out the pin ③ from the shaft.

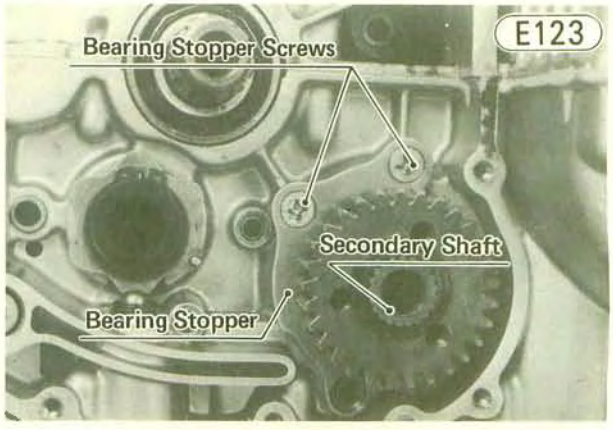
Assembly Notes:

1. Replace the gasket with a new one.
2. After completing the oil pump assembly, check that the rotor shaft and rotor turn smoothly.

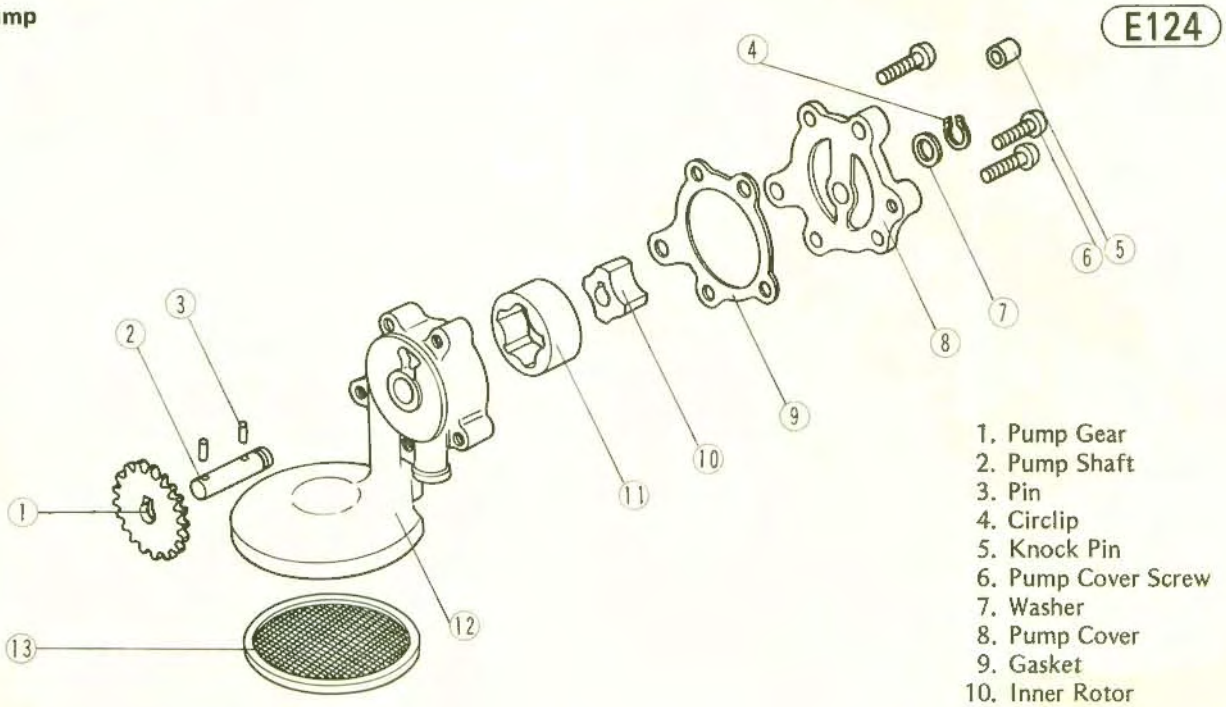
SECONDARY SHAFT, STARTER MOTOR CLUTCH

Removal:

- Remove the mufflers (Pg. 45).
- Remove the engine sprocket cover (Pg. 56).
- Remove the clutch (Pg. 66).
- Remove the oil pump (Pg. 70).
- Remove the secondary shaft bearing stopper screws (2) to pull off the secondary shaft. The bearing stopper is removed with the secondary shaft.

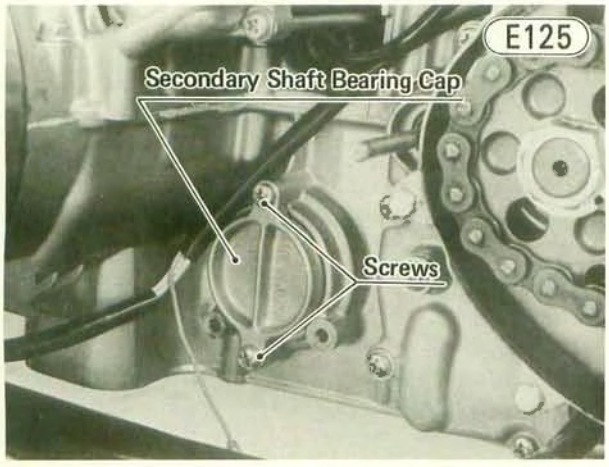


Oil Pump

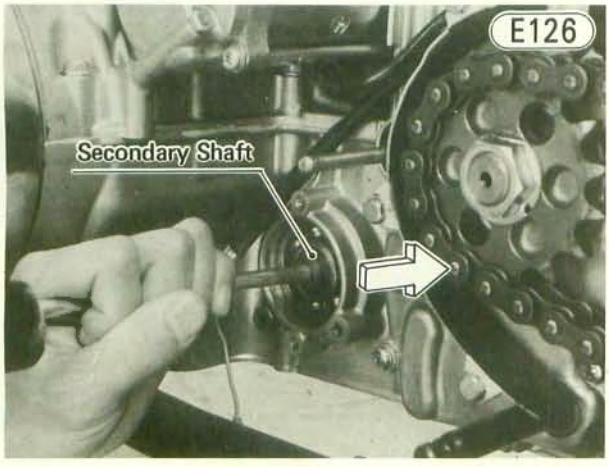


1. Pump Gear
2. Pump Shaft
3. Pin
4. Circlip
5. Knock Pin
6. Pump Cover Screw
7. Washer
8. Pump Cover
9. Gasket
10. Inner Rotor
11. Outer Rotor
12. Pump Body
13. Screen

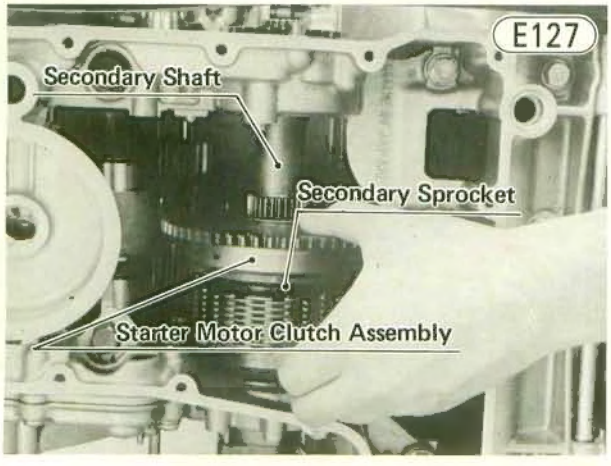
•Remove the screws (2), and pull off the secondary shaft bearing cap.



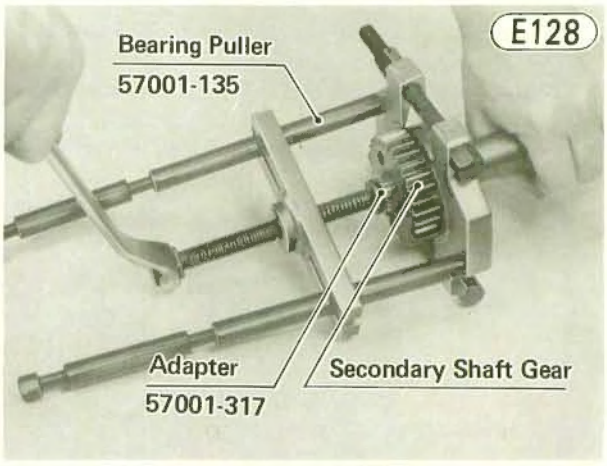
•Tap the secondary shaft from the left side of the crankcase until the right bearing comes out of place.



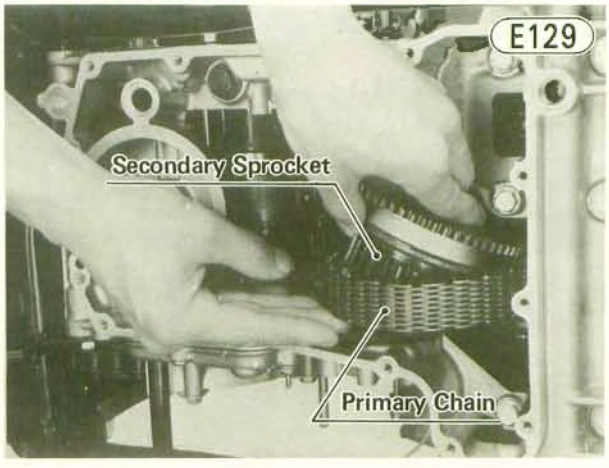
•Holding the secondary sprocket and starter motor clutch assembly, pull out the secondary shaft.



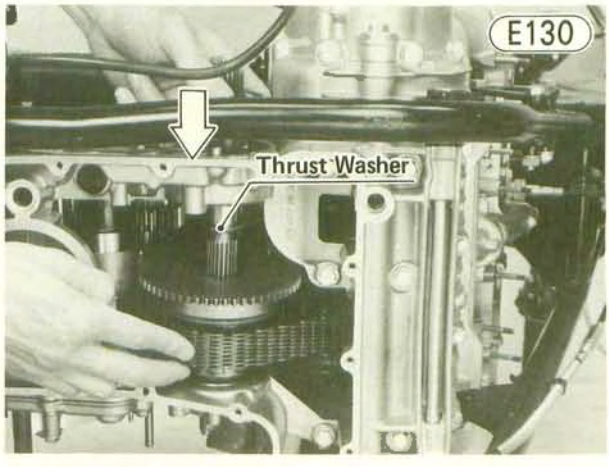
•Slip the secondary sprocket and starter motor clutch assembly from the primary chain, and take them out.
•Remove the secondary shaft gear circlip. Using the bearing puller and adapter (special tools), pull the secondary shaft gear off the shaft.



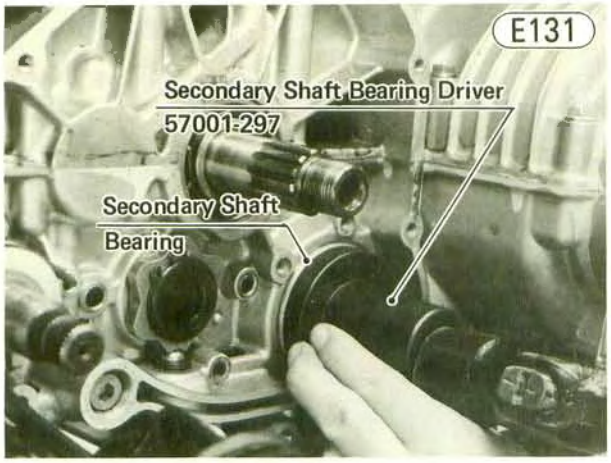
Installation:
•Put the thrust washer, starter motor clutch, and needle bearing into the secondary sprocket and starter motor clutch assembly.
•Fit the primary chain on the secondary sprocket.



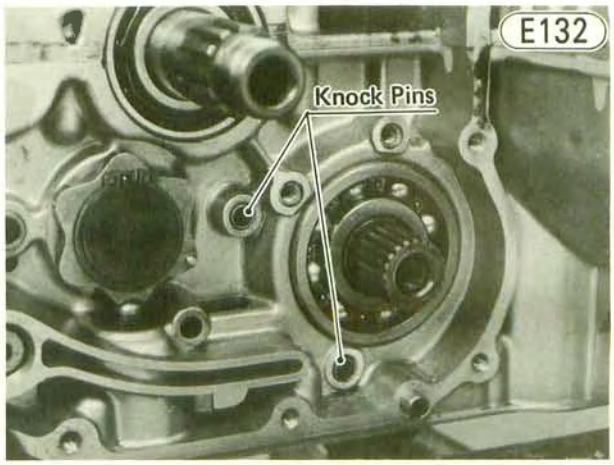
•Put the thrust washer on the secondary shaft, and put the secondary shaft into the secondary sprocket and starter motor clutch assembly, fitting their splines.



•Using the bearing driver (special tool), tap the secondary shaft bearing into the crankcase with the secondary shaft until the bearing stops at the bottom of the crankcase beairng hole.

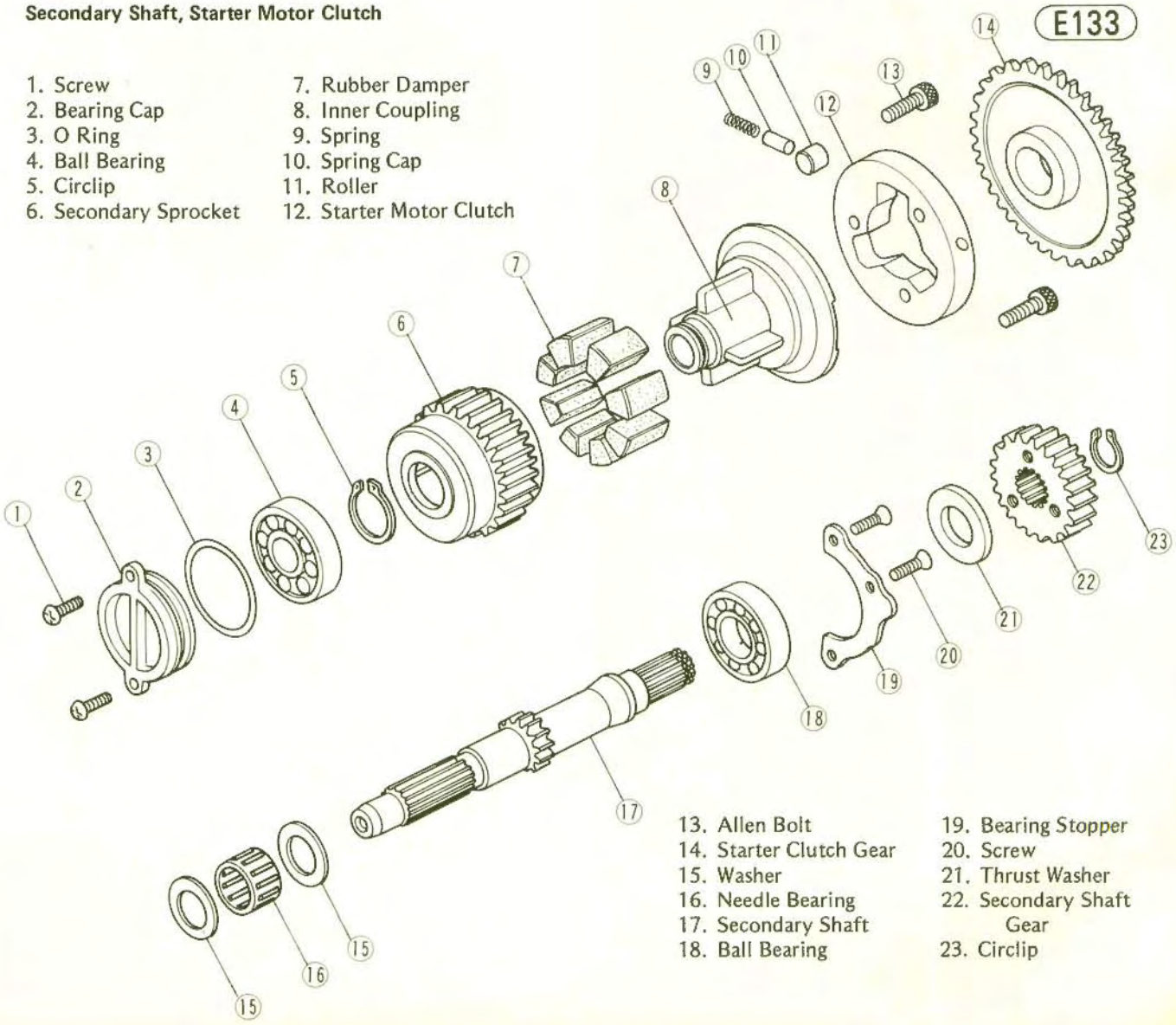


•Check to see that the oil pump knock pins (2) are in place.

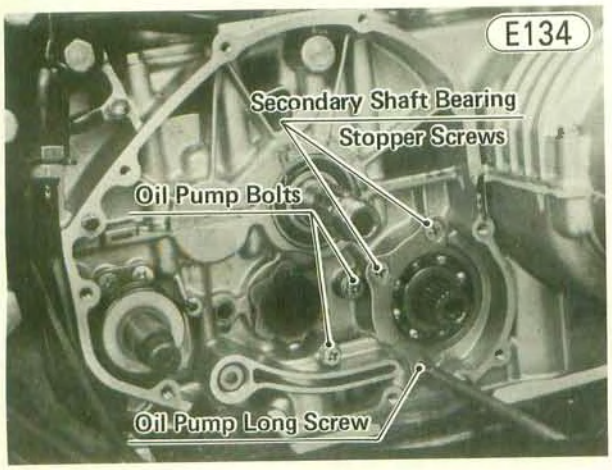


•Install the secondary shaft bearing stopper with the two short screws, and tighten the screws lightly. Install the oil pump, making sure the oil pump gear and pump drive gear at the secondary shaft mesh properly.
•Apply non-permanent locking agent to the oil pump bolts (2) and long screw, and tighten the bolts (2) and screw. Then tighten the secondary shaft bearing stopper screws (2).

Secondary Shaft, Starter Motor Clutch



1. Screw
2. Bearing Cap
3. O Ring
4. Ball Bearing
5. Circlip
6. Secondary Sprocket
7. Rubber Damper
8. Inner Coupling
9. Spring
10. Spring Cap
11. Roller
12. Starter Motor Clutch
13. Allen Bolt
14. Starter Clutch Gear
15. Washer
16. Needle Bearing
17. Secondary Shaft
18. Ball Bearing
19. Bearing Stopper
20. Screw
21. Thrust Washer
22. Secondary Shaft Gear
23. Circlip



- Install the secondary shaft beairng cap, and tighten its screws (2).
- Put the large flat washer on the secondary shaft.
- Apply a little oil on the secondary shaft, and push the secondary shaft gear on the shaft by rotating the gear pusher (special tool).

- Install the circlip on the secondary shaft.
- Install the oil pan and oil filter according to the oil pump installation (Pg. 71).
- Install the clutch (Pg. 67).
- Install the engine sprocket cover (Pg. 56).
- Install the mufflers (Pg, 46).
- Fill the engine with oil and check the oil level (Pg. 21).

Disassembly:

- Pull off the starter clutch gear⑭, needle bearing ⑯, and flat washer ⑮.
- Remove the rollers ⑪, springs ⑨, and spring caps ⑩ (3 ea) from the starter motor clutch.
- Remove the circlip ⑤, and pull off the secondary sprocket ⑥. There are rubber dampers ⑦ (8).
- Holding the secondary shaft coupling steady, remove the Allen bolts (3) to separate the coupling and starter motor clutch.

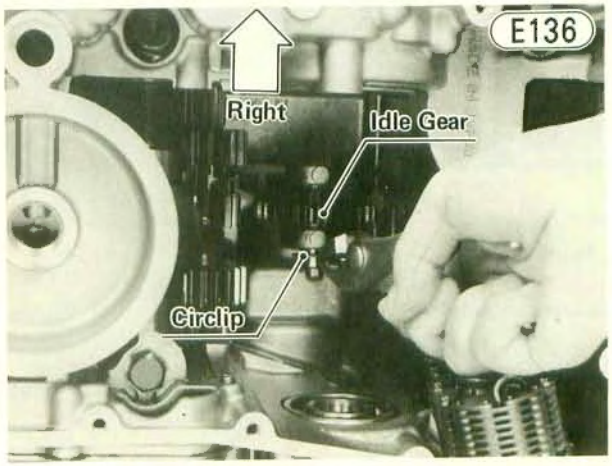
Assembly Notes:

1. Apply a little oil on the rubber dampers (8) to assemble the secondary sprocket and coupling.
2. Apply a non-permanent locking agent to the Allen bolts (3), and tighten the bolts with 2.5 ~ 3 kg-m (18~22 ft-lbs) of torque.

STARTER MOTOR IDLE GEAR

Removal:

- Remove the secondary shaft and starter motor clutch (Pg. 71).
- Remove the circlip, pull off the shaft, and remove the idle gear.



Installation Note:

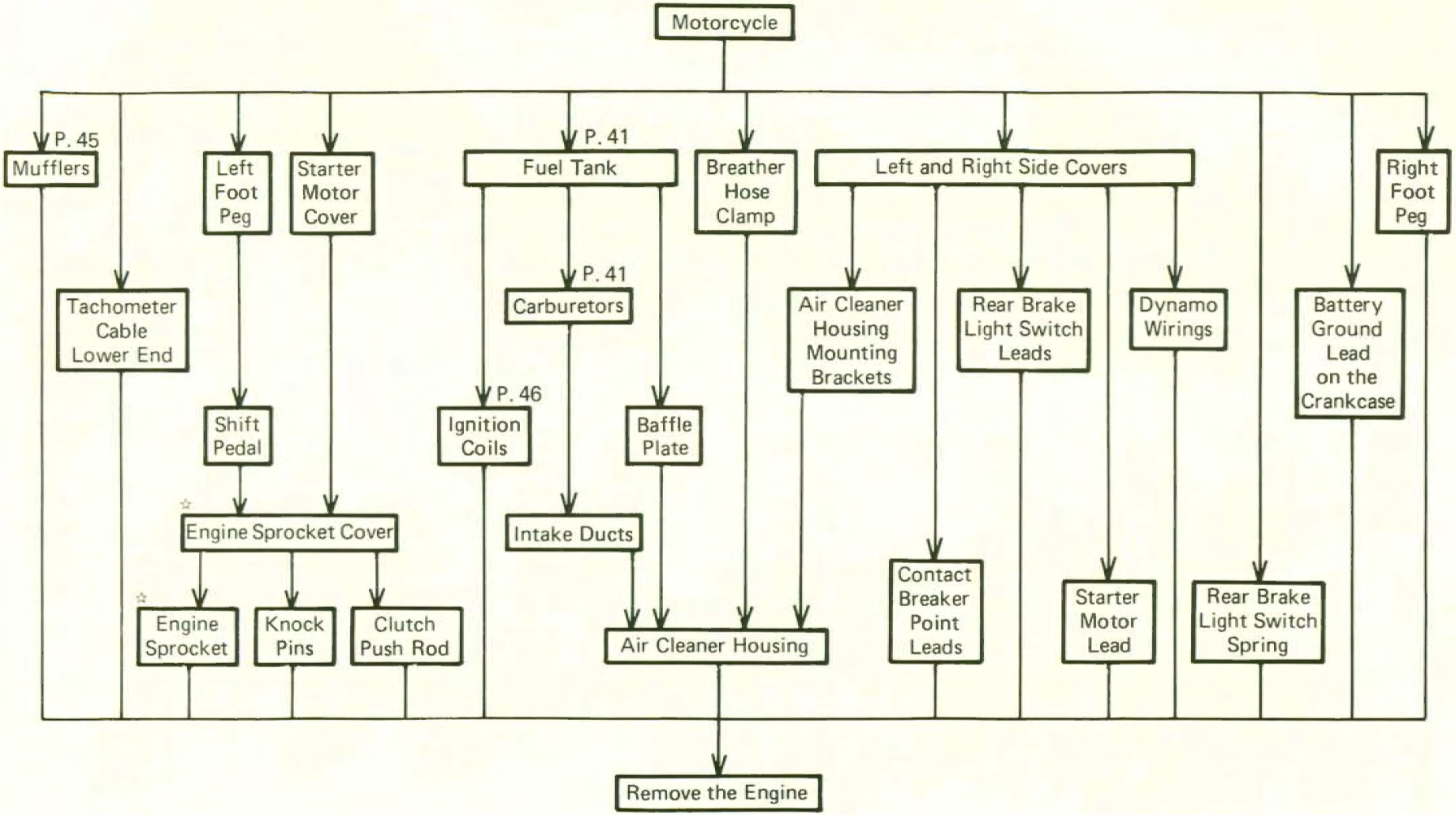
- The idle gear must be installed so that the protruding side points to the right.

Disassembly–Engine Removed

Table of Contents

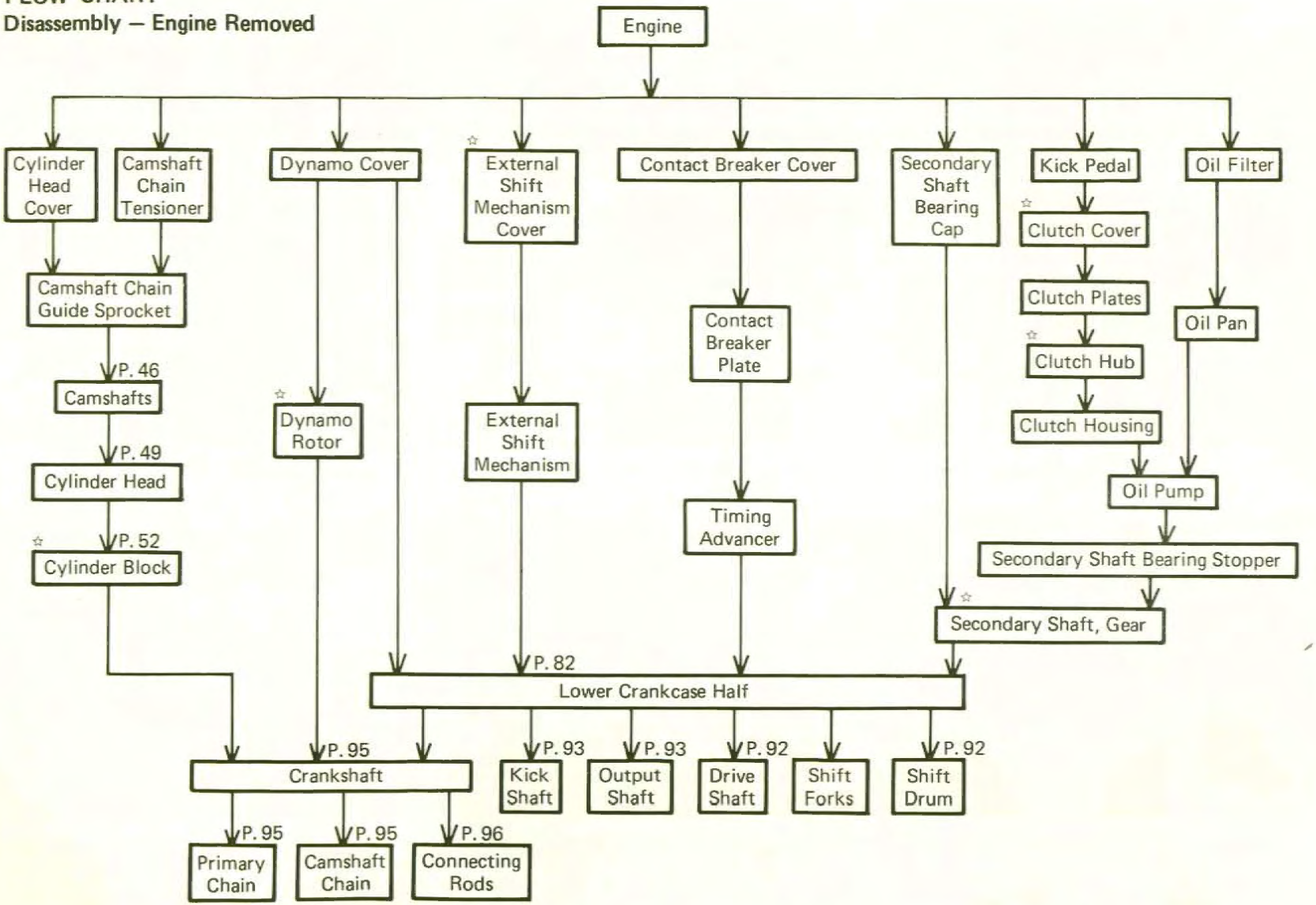
FLOW CHART
Engine Removal

The following charts are 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 a mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

FLOW CHART
Disassembly – Engine Removed

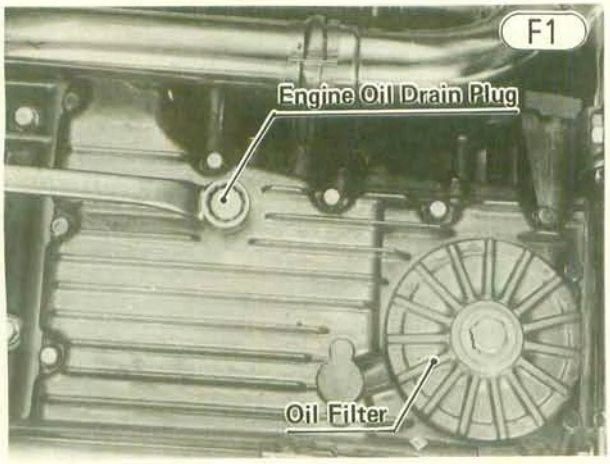


NOTES: 1. Action that has been already done in the engine removal procedure is omitted. Action that is not necessarily required for engine disassembly off the motorcycle is also omitted.
2. Action with a mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

ENGINE REMOVAL

Removal:

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



•After draining the oil, replace the drain plug with its aluminum gasket and tighten the plug with 1.3 ~ 1.7 kg-m (9.5 ~ 12 ft-lbs) of torque and install the oil filter, tightening its bolt.

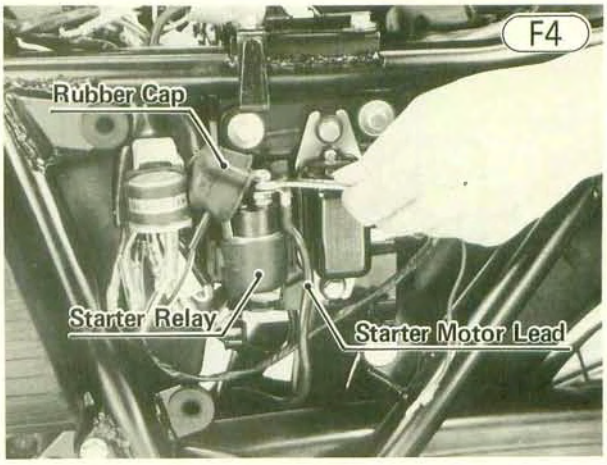
•Remove the fuel tank (Pg. 41).

•Take off the right and left side covers.

•Remove the ignition coils (Pg. 46).

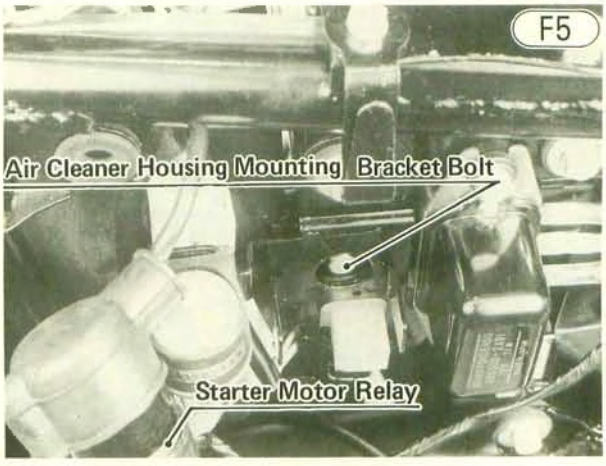
•Disconnect the dynamo wiring 4-pin connector and light green lead.

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

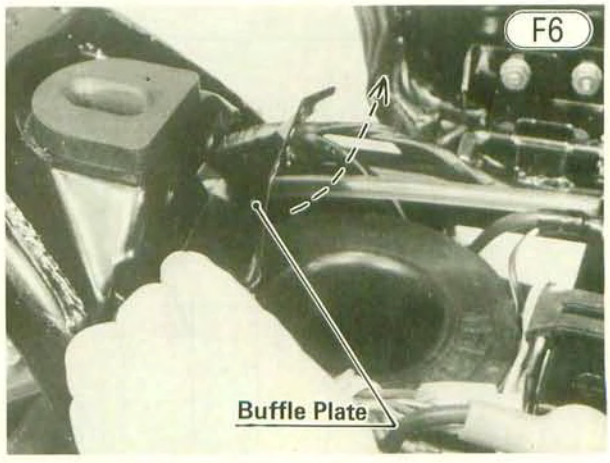


•Pull the starter motor relay off the electrical panel.

•Remove the air cleaner housing mounting bracket bolts and flat washers from both sides of the battery housing.



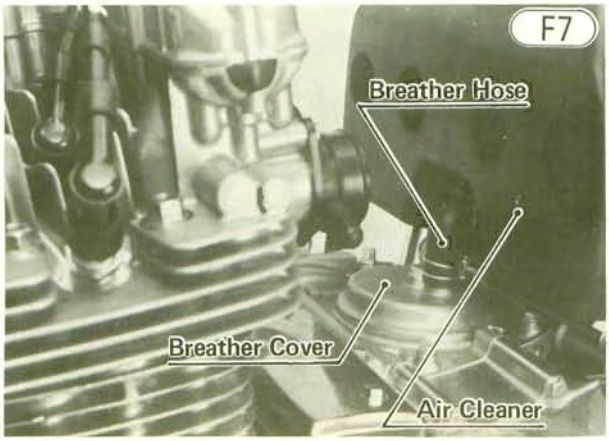
•Remove the bolts, lockwashers and flat washers, and remove the baffle plate.



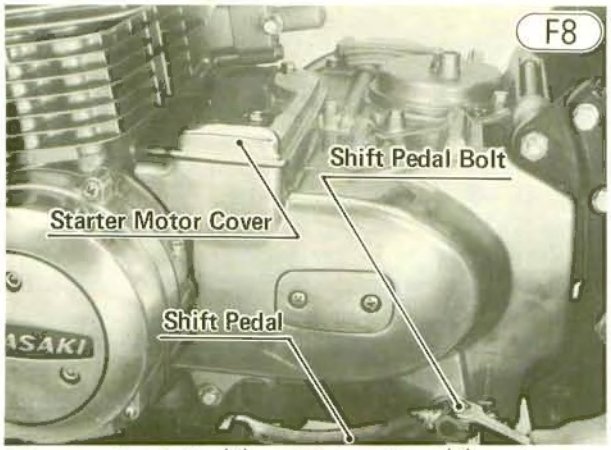
•Remove the carburetors (Pg. 41).

•Pull the ducts off the air cleaner.

•Loosen the bolt, slide the clip out of place, and remove the breather hose from the breather cover.

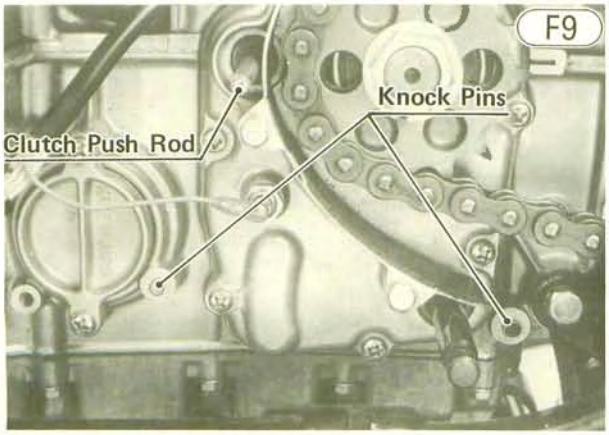


•Remove the air cleaner.
•Remove the left foot peg bolt and lockwasher, and remove the foot peg.
•Check to see that the transmission is in neutral, then take out the shift pedal bolt, and remove the shift pedal.



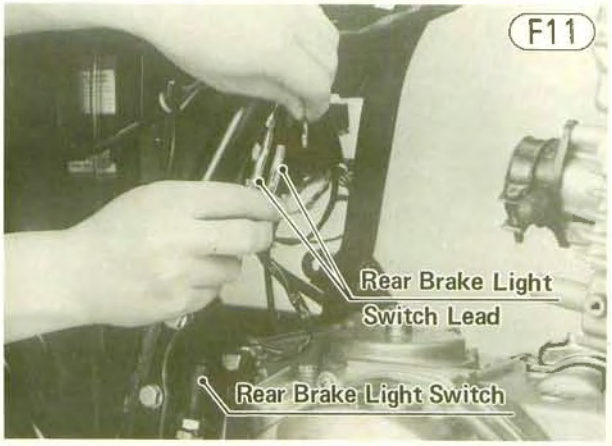
•Remove the bolts (2) and flat washers (2), and remove the starter motor cover.
•Remove the clutch cable clamps (2) from the frame.
•Remove the engine sprocket cover bolts (4), and pull the cover free from the crankcase.
•Pull out the engine sprocket cover knock pins, if they are still in the engine.

NOTE: This prevents the knock pin from catching the engine mounting bracket when the engine is lifted up.



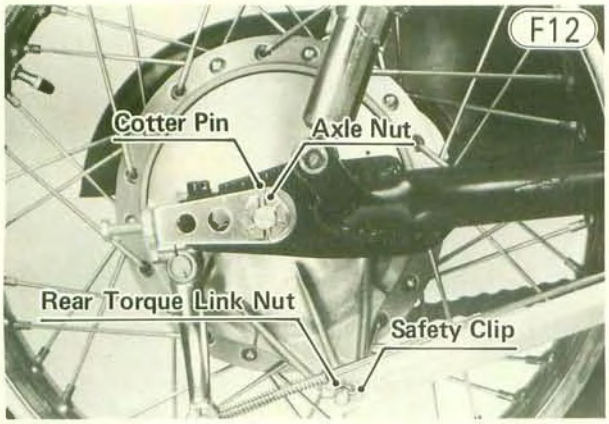
•Take the clutch push rod off the crankcase.
•Disconnect the neutral indicator switch lead from the switch.
•Loosen the locknut on the clutch lever, and screw in the adjuster.
•Line up the slots in the clutch lever, locknut, and adjuster and free the cable from the lever.
•Pull the cable free from the motorcycle, with the engine sprocket cover.

•Remove the left and right mufflers (Pg. 45).
•Remove the rear brake light switch spring.
•Remove the bolt and lockwasher, and remove the battery negative ground lead from the engine.
•Disconnect the rear brake light switch leads (blue and brown).



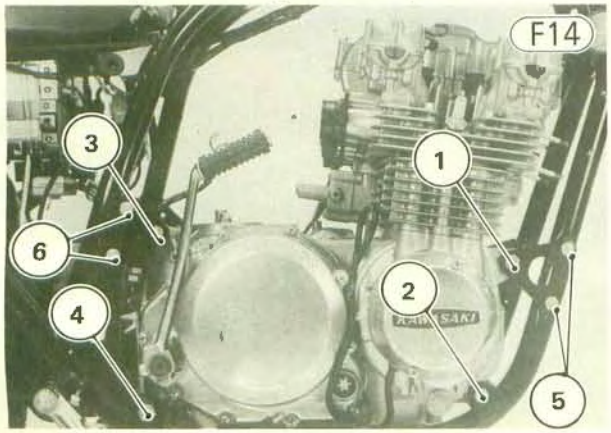
•Disconnect the contact breaker point leads (black, green, and blue/red).
•Back the rear brake adjusting nut off to the end of the brake rod to give the pedal play. Loosen the brake pedal adjusting bolt locknut, and back out the adjusting bolt until the pedal is held down out of the way.
•Remove the bolt and lockwasher, and remove the right foot peg.
•Unscrew the tachometer cable from the cylinder head and pull off the cable from the cylinder head.

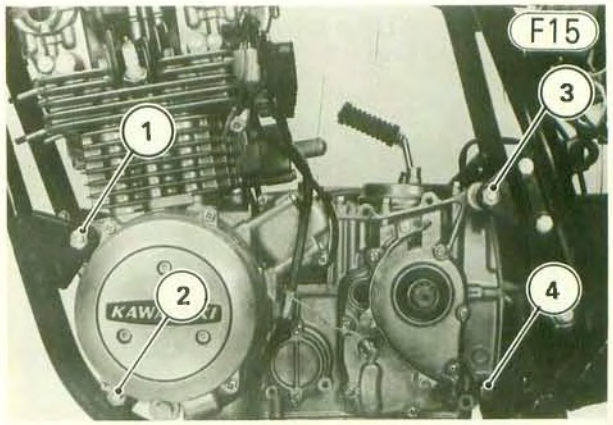
•Take out the safety clip from the rear torque link nut and cotter pin from the rear axle nut.



•Loosen the rear torque link nut, rear axle nut, and chain adjusting bolt locknuts, and then turn out the chain adjusting bolts in order to give the chain plenty of play. Kick the wheel forward until the chain is slack. This will facilitate removal of the engine sprocket.
•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 from the output shaft with the drive chain.

•Jack or lever the engine up slightly to take the weight off the mounting bolts.
•Remove the engine mounting bolt nuts ①, ②, ③, ④. The rear upper mounting bolt has a spacer.





1. Front upper mounting bolt
2. Front lower mounting bolt
3. Rear upper mounting bolt
4. Rear lower mounting bolt
5. Front upper mounting bracket bolts
6. Rear upper mounting bracket bolts

•Remove the front upper mounting bracket bolt nuts ⑤ and lockwashers, and remove the bracket.
•Remove the rear upper mounting bracket bolts ⑥ and lockwashers, and remove the bracket with the rear brake light switch.
•Pull out the engine mounting bolts ①, ②, ③, ④. Be careful not to damage the threads upon 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 point leads, dynamo wiring, and throttle cables.
•Lift the engine straight up keeping it level, then move it to the right slightly so the rear and front of the engine slips over the lower right rear and the lower right front engine mounts.
•Lift up the right side so that the oil pan at the bottom of the engine clears the frame, and pull the engine out to the right side.

Installation:

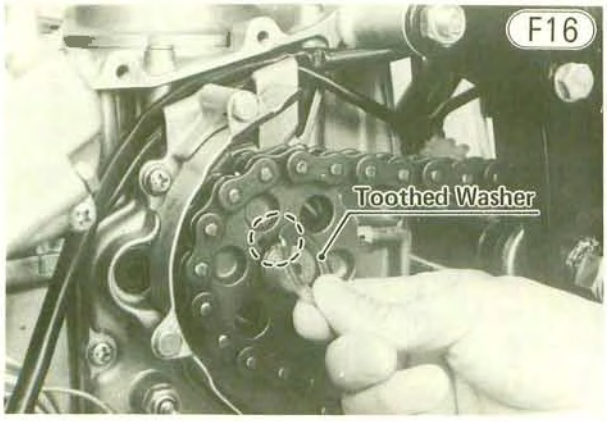
•Place the engine into the frame the reverse of how it was removed.
•Install the rear upper and the front upper mounting brackets, and tighten four bracket bolts ⑤, ⑥ loosely. The rear two bolts and front two nuts have lockwashers.
•Lifting the engine as necessary so that the mounting bolt threads do not get damaged, insert the four engine mounting bolts and tighten them loosely. The rear upper mounting bolt ③ has a spacer.

Table F1 Mounting Bolt Length

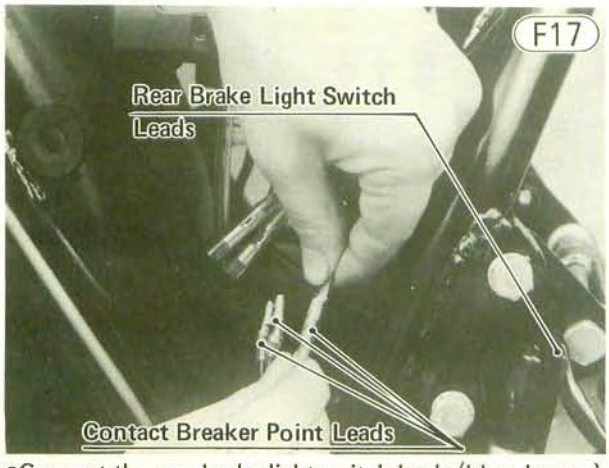
Front Upper	296 mm
Front Lower	323 mm
Rear Upper	250 mm
Rear Lower	225 mm

•Tighten four bracket bolts with 2.0 ~ 2.8 kg-m (14.5 ~ 20 ft-lbs) of torque, and then tighten four engine mounting bolts with 3.4 ~ 4.6 kg-m (25 ~ 33 ft-lbs) of torque.

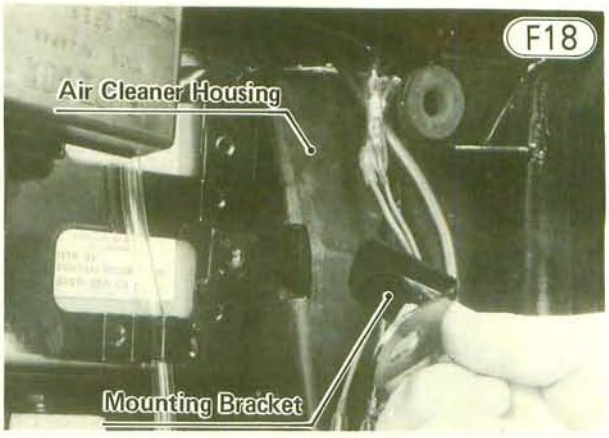
•Fit the drive chain back on the engine sprocket, and install the engine sprocket with the drive chain and a new toothed washer. Tighten the engine sprocket nut with 7.5~8.5 kg-m (54~61 ft-lbs) of torque while using the engine sprocket holder (special tool) to keep the sprocket steady. The washer tooth goes into the sprocket hole.



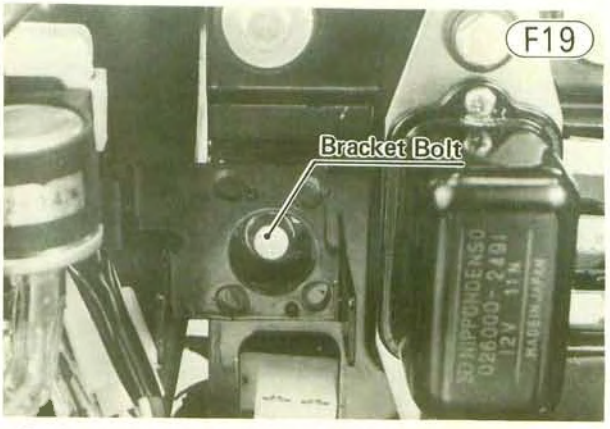
•Bend one side of the toothed washer over the side of the nut.
•Install the push rod, applying a thin coat of a high temperature grease to its surface.
•Run the clutch cable between the left down tube and the lower part of the engine, and run the upper end of the cable between the left front fork and head pipe.
•Fit the tip of the cable back into the clutch lever.
•Fasten the clutch cable to the frame down tube with the clamps (2).
•Connect the neutral indicator switch lead to switch terminal.
•Connect the dynamo wiring 4-pin connector and light green lead.
•Fit the engine sprocket cover knock pin.
•Install the engine sprocket cover, shift pedal, and left footpeg (Pg. 56).
•Adjust the drive chain (Pg. 24).
•Install the right footpeg with its bolt and lockwasher.
•Adjust the rear brake pedal (Pg. 25).
•Connect the contact breaker point leads (green, black, and blue/red).



•Connect the rear brake light switch leads (blue, brown).
•Install the rear brake light switch spring.
•Install the battery negative ground lead on the engine right side and tighten its bolt. The bolt has a lockwasher.
•Install the air cleaner housing, and put the mounting brackets into both sides of the housing. The bracket bolts are tightened after carburetor installation.



•Install the baffle plate with the bolts. Each bolt has a flat washer and lockwasher. Be sure not to catch the wiring.
•Fit the breather hose onto the breather cover, slide back the clip, and tighten its bolt.
•Put on the carburetor holder clamps (4).
•Install the carburetors (Pg. 42).
•Fix the air cleaner housing to battery housing with the left and right side bracket bolts.



•Fit the starter relay on the electrical panel.
•Fit the starter lead to the starter relay terminal. After tightening the nut, slide the rubber cap back onto the relay terminal.

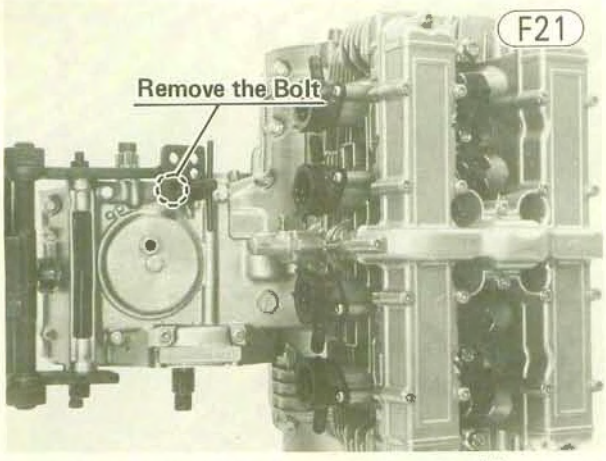
- Install the ignition coils (Pg. 46).
- Install the mufflers (Pg. 46).
- Fit the fuel hose back onto the fuel tap, and slide the clamp back into place.
- Push the seat back down.
- Fit the right and left side covers.
- Fill the engine with oil, check the level (Pg. 21), and add more if necessary.
- Adjust the clutch (Pg. 20).
- Adjust the throttle cables (Pg. 17).
- Adjust the rear brake light switch (Pg. 26).
- Adjust the ignition timing (Pg. 12).

CRANKCASES SPLIT

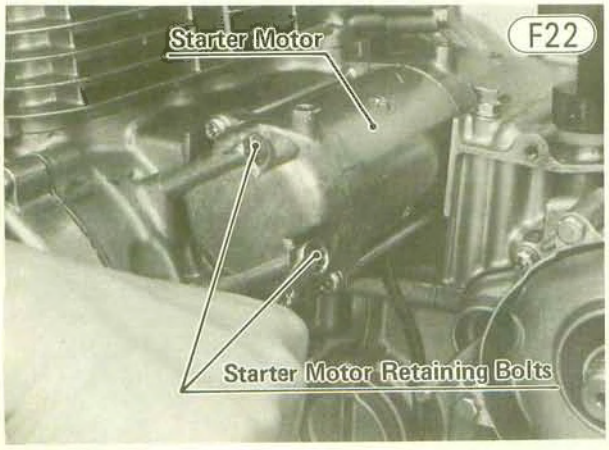
Disassembly:

- Remove the engine (Pg. 78).
- Set the engine on a clean surface or, preferably, into a disassembly apparatus with some means of holding the engine steady while parts are being removed.

NOTE: If the engine is to be set onto the Kawasaki engine disassembly apparatus, one of the upper crankcase half bolts (12) shown in Fig. F21 must be removed before positioning the engine.

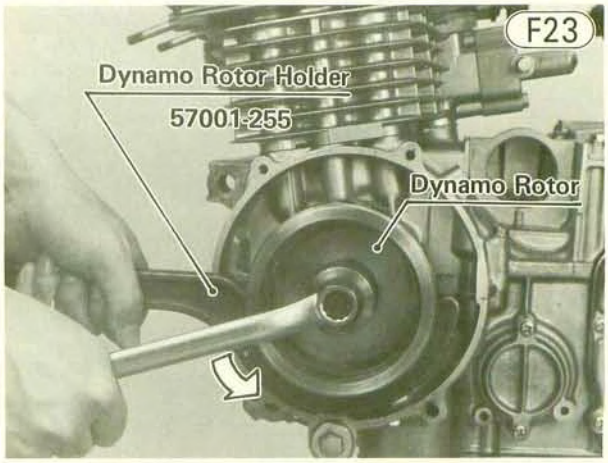


- Remove the starter motor retaining bolts (2), and pull off the starter motor.

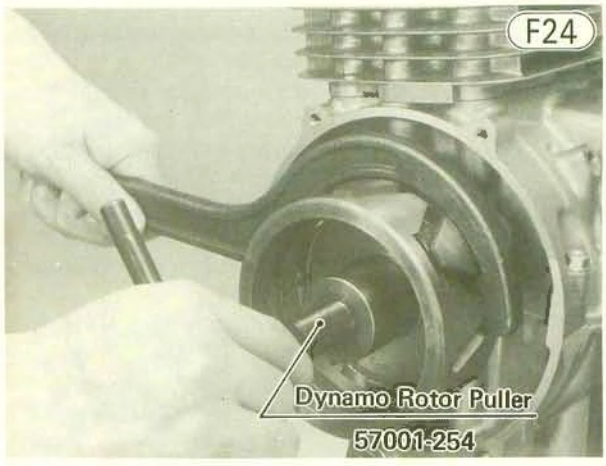


- Check that the neutral indicator switch lead is free from the switch.
- Remove the dynamo cover screws (4), and pull off the dynamo cover and gasket.

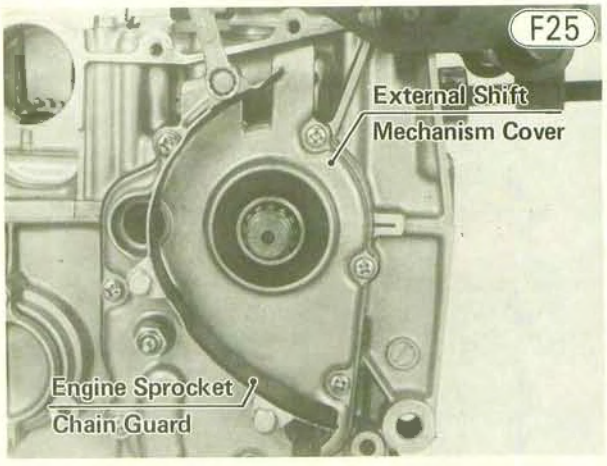
○Hold the dynamo rotor steady with the dynamo rotor holder (special tool), and remove the rotor bolt.



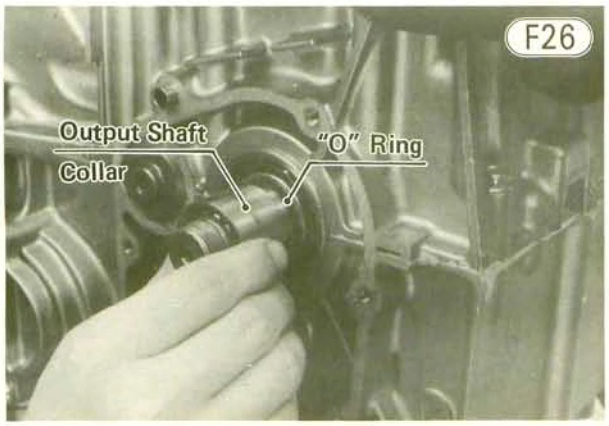
○Using the special tool to hold the rotor steady, remove the rotor with the dynamo rotor puller (special tool).



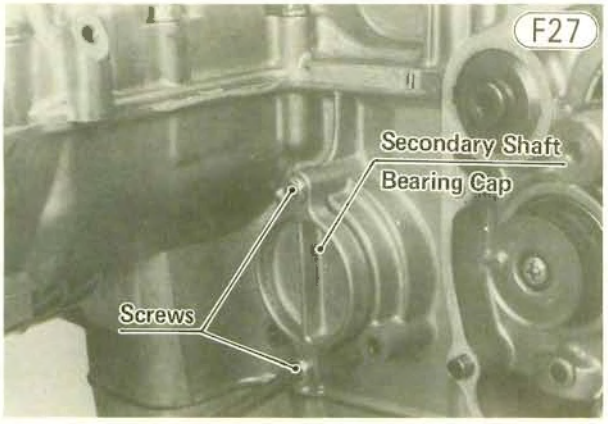
- Remove the engine sprocket chain guard.



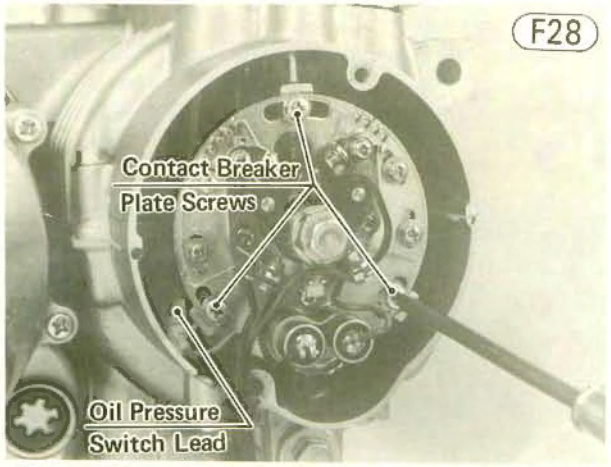
- Remove the external shift mechanism cover screws (7), and pull off the external shift mechanism cover and gasket.
- Take off the output shaft collar, using a bearing puller if it is difficult to remove, and take off the **O** ring.



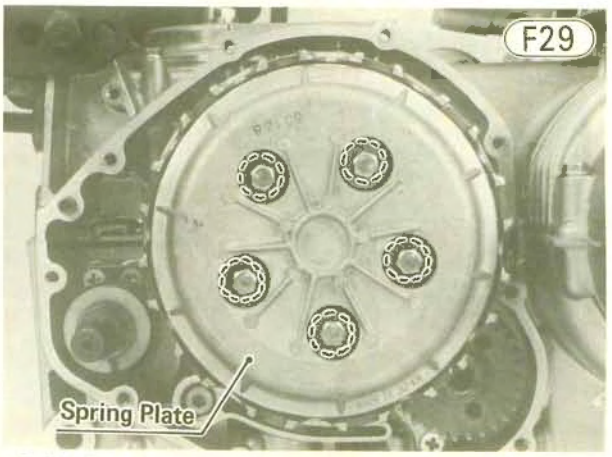
- Move the external shift mechanism lever arms out of their positions on the end of the shift drum, and pull out the external shift mechanism.
- Remove the screws (2), and pull off the secondary shaft bearing cap.



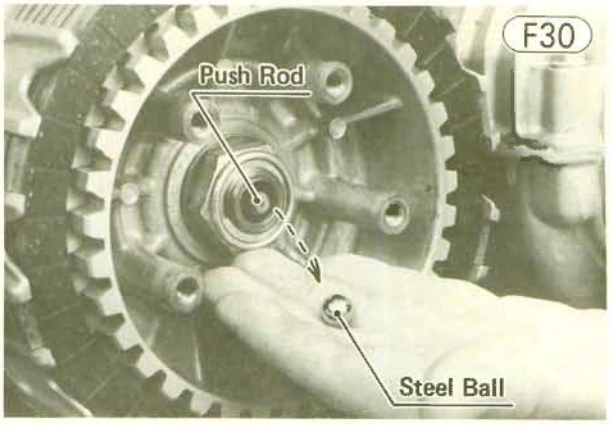
- Remove the contact breaker cover and gasket.
- Free the contact breaker point leads from the clamps under the clutch cover.
- Take out the contact breaker plate screws, lockwashers, and flat washers (3 ea), disconnect the oil pressure switch lead (blue/red) and remove the plate.



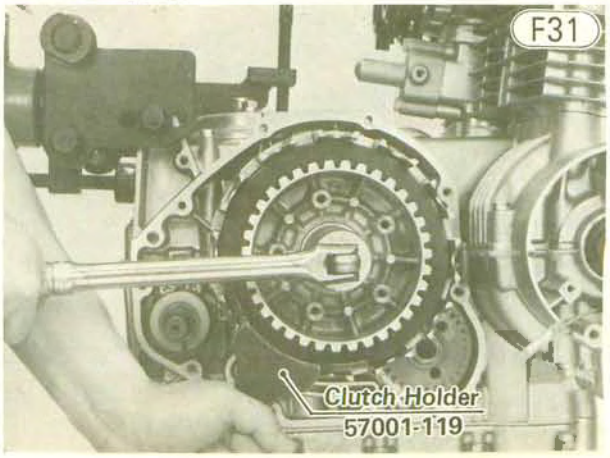
- With a 17 mm wrench on the crankshaft rotation nut to keep the shaft from turning, remove the advancer mounting bolt, and take off the timing advancer.
- Note the position of the kickstarter pedal so that it can later be replaced on the kick shaft in the same position.
- Take out the kickstarter pedal bolt, slightly widen the gap in the kickstarter pedal with a screwdriver, and then pull off the kickstarter pedal.
- Remove the screws (10), and pull off the clutch cover and gasket.
- Pull the thrust washers (2) off the kick shaft.
- Remove the clutch spring bolts (5), washers (5), and springs (5).



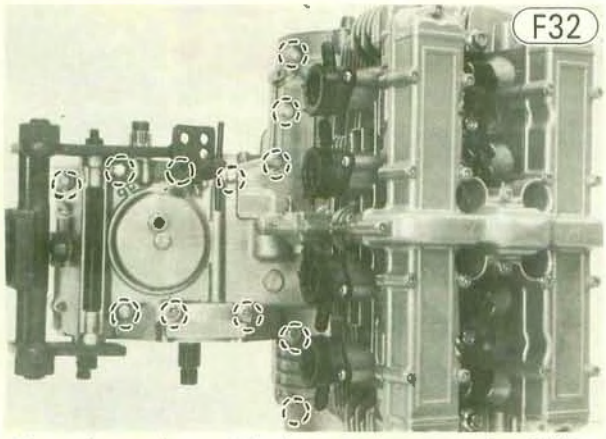
- Pull off the spring plate and spring plate pusher.
- Push in the push rod to remove the steel ball, and pull out the push rod.



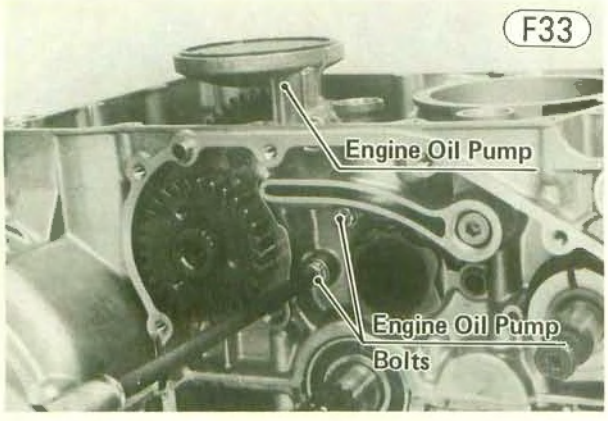
- Remove the friction plates (7) and steel plates (6).
- Hold the clutch hub from turning using a clutch holder (special tool), and remove the clutch hub nut and washer.



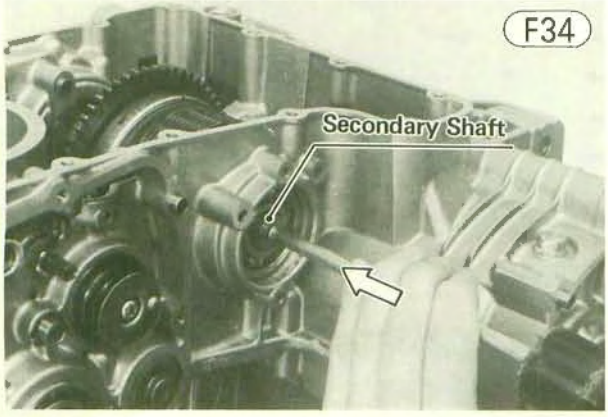
- Pull off the clutch hub, clutch housing, needle bearing, collar, and large flat washer. There is a thrust washer between the clutch hub and clutch housing.
- Remove the secondary shaft bearing stopper screws (3) to pull off the secondary shaft. The bearing stopper is removed with the secondary shaft.
- Remove the upper crankcase half bolts (12, or 11 if one was removed just after engine removal).



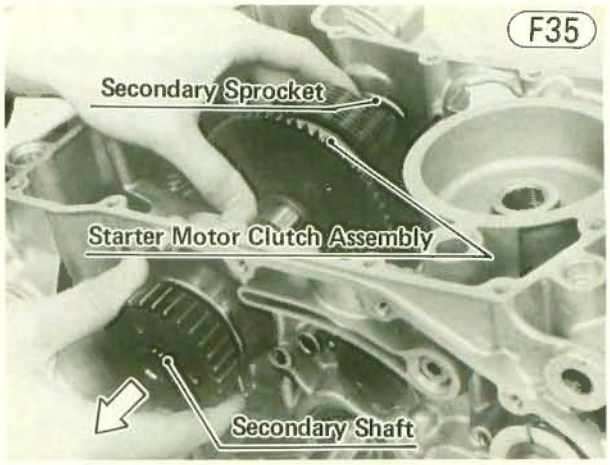
- Turn the engine upside down, and remove the oil filter.
- Remove the oil pan bolts (15), and remove the oil pan, gasket, and oil passage O rings (3).
- Remove the engine oil pump bolts (2), and take off the engine oil pump.



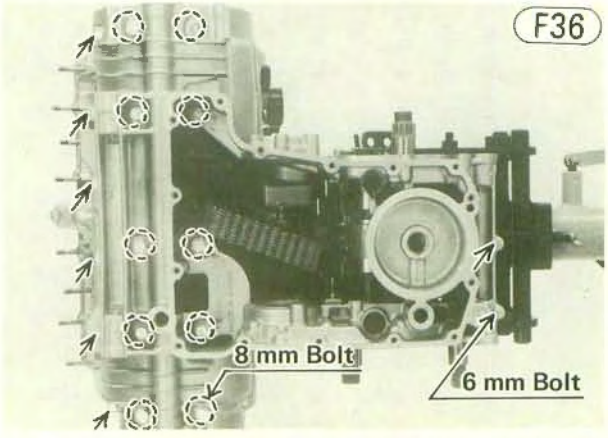
- Tap the secondary shaft from the left side of the crankcase until the right bearing comes out of place.



- Holding the secondary sprocket and starter motor clutch assembly, pull out the secondary shaft.



- Slip the secondary sprocket and starter motor clutch assembly from the primary chain, and take them out.
- Remove the 6 mm lower crankcase half bolts (8) and 8 mm bolts (10), pry the two points shown in Fig. F36 to split the two crankcase halves apart, and lift off the lower crankcase half.



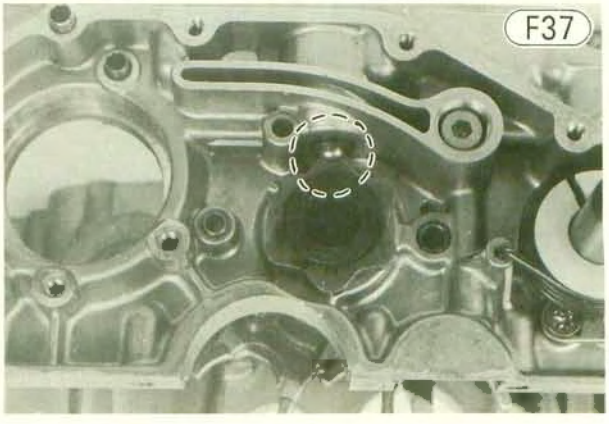
- Take out the drive shaft and output shaft assemblies.

Assembly:

NOTES: 1. The upper crankcase half and the lower crankcase half are machined at the factory in the assembled state, so the crankcase halves must be replaced together as a set.

2. Replace the 8 mm lower crankcse half bolts (10) with new ones if they have already been removed 5 times.

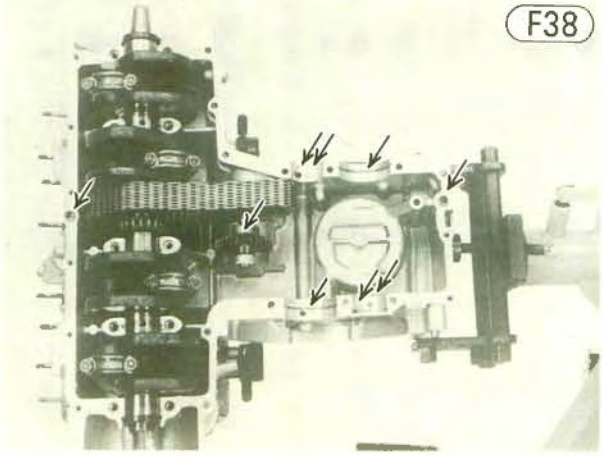
- Set the shift drum in neutral position as shown in Fig. F37.



•Check to see that the following parts are in place on both the upper crankcase half and the lower crankcase half, and blow the oil passage nozzles clean with compressed air.

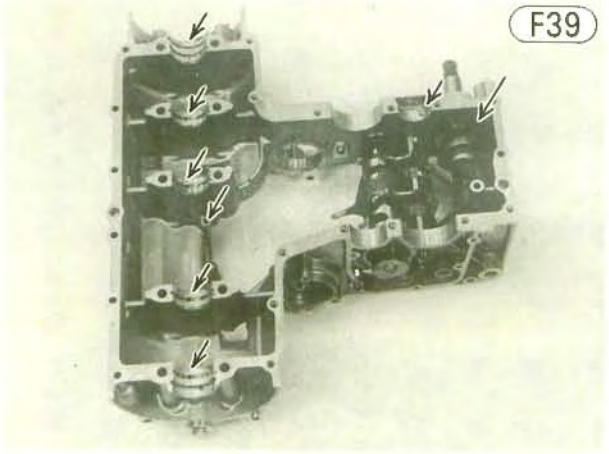
Upper crankcase half:
Knock pins (2); drive shaft and output shaft set rings (2), and set pins (2); oil passage plug; and starter motor idle gear.

F38



Lower crankcase half:
Kick shaft assembly; oil passage nozzles (2); and crankshaft main bearing inserts (5).

F39



•With a high flash-point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.

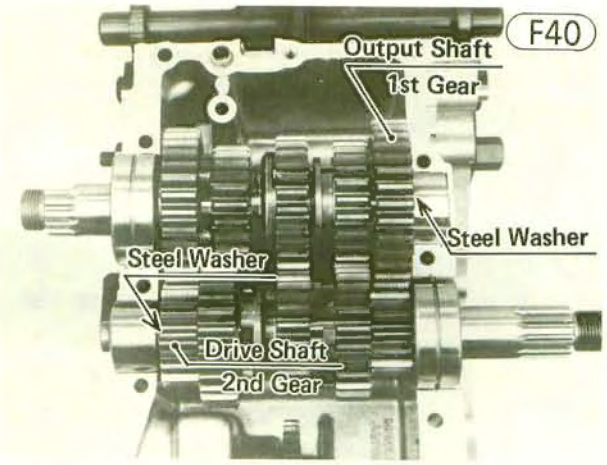
•Fit the output and drive shaft assemblies on the upper crankcase half. When installing the output and drive shafts, the crankcase set pins must go into the holes in the respective bushings, and the set rings must fit into the grooves in each ball bearing.

CAUTION **Make sure the crankcase set pins are properly aligned to avoid damage to the crankcases upon installation.**

•Apply a little engine oil to the transmission gears, ball bearings, shift drum, and crankshaft main bearing inserts.

•Check to see that the drive shaft 2nd gear and the output shaft 1st gear turn freely. If the gear does not turn freely, replace the steel washer with the thinner (0.5 mm) steel washer to make proper side clearance.

F40

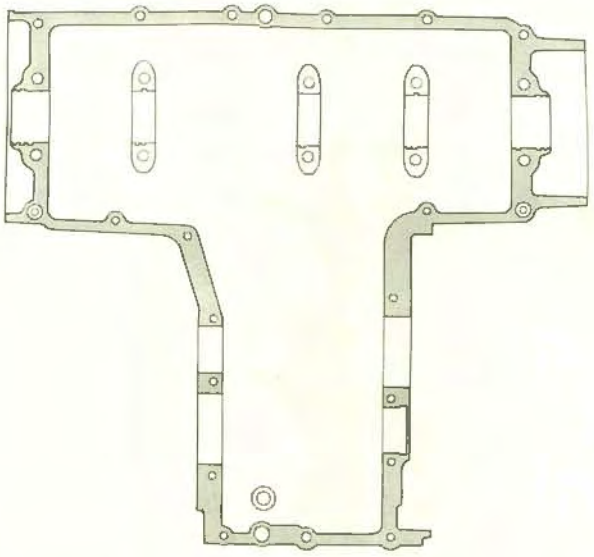


•Apply a liquid gasket to the mating surface of the lower crankcase half in the areas shown in Fig. F41.

CAUTION **If liquid gasket adheres to any areas not indicated, the engine oil passages may be obstructed, causing engine seizure.**

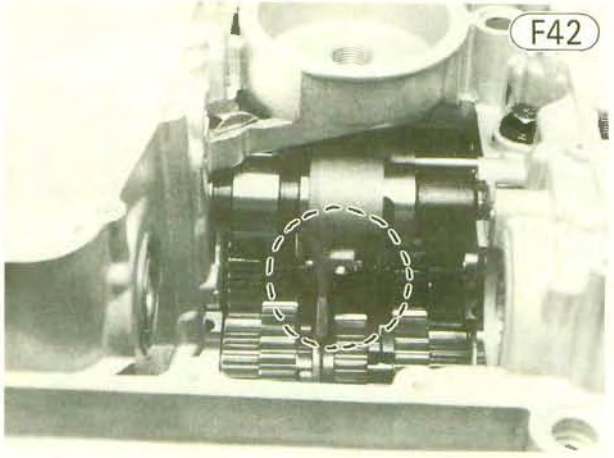
Liquid Gasket Applied Area

F41

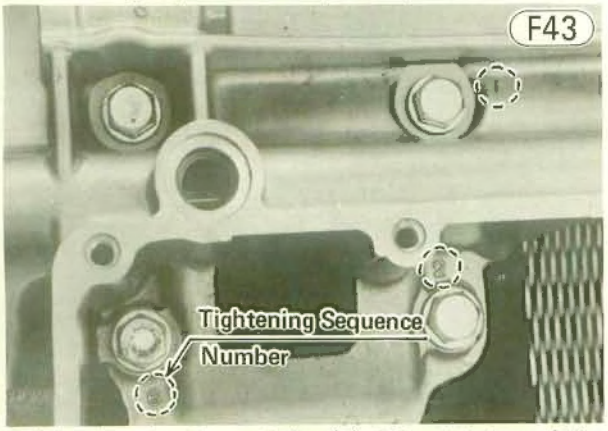


•Fit the lower crankcase half on the upper crankcase half. Each shift fork must fit in its gear groove.

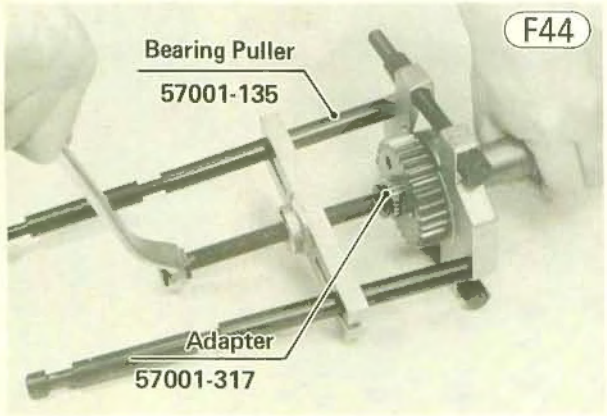
F42



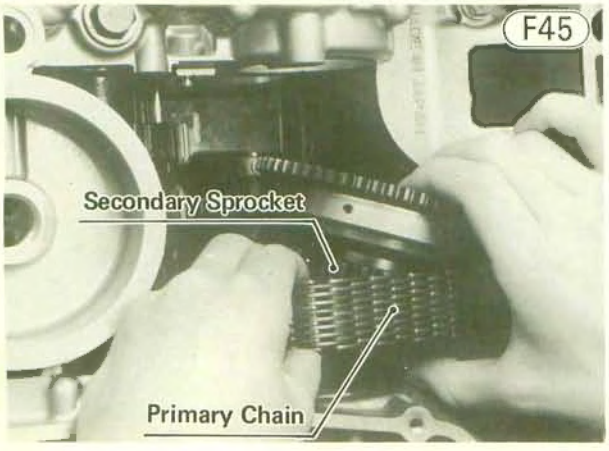
- Install and lightly tighten the lower crankcase half 8 mm bolts (10) and 6 mm bolts (8).
- Following the tightening sequence numbers on the lower crankcase half, tightening the 8 mm bolts (10) first with about 1.5 kg-m (11 ft-lbs) and finally with 2.5~3.0 kg-m (18~22 ft-lbs) of torque.



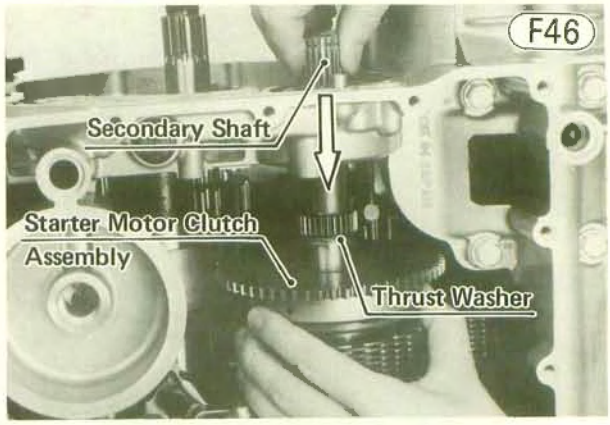
- Tightening the 6 mm bolts (8) 0.9 ~ 1.1 kg-m (78 ~ 95 in-lbs) of torque.
- Check to see that the drive shaft and output shaft turn freely, and, spinning the drive shaft, shift the transmission through all gears to make certain there is no binding and that all gears shift properly.
- Remove the secondary shaft gear circlip. Using the bearing puller and adapter (special tools), pull the secondary shaft gear off the shaft.



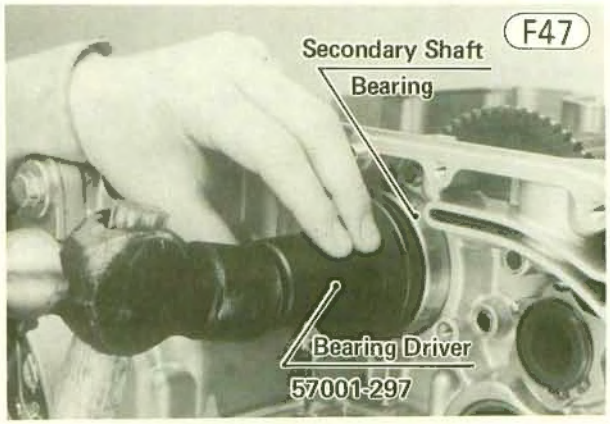
- Put the thrust washer, starter motor clutch, and needle bearing into the secondary sprocket and starter motor clutch assembly.
- Fit the primary chain on the secondary sprocket.



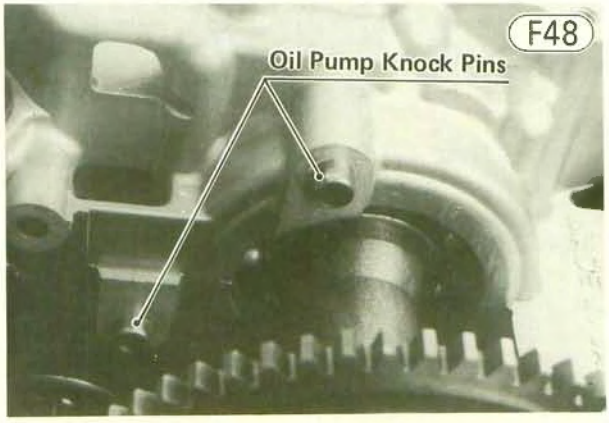
- Put the thrust washer on the secondary shaft, and put the secondary shaft into the secondary sprocket and starter motor clutch assembly, fitting their splines.



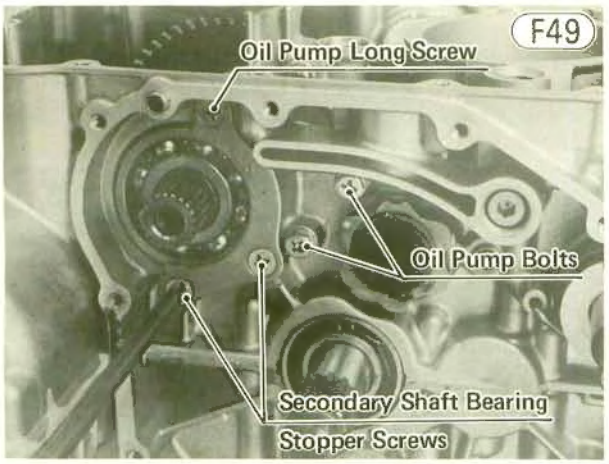
- Using the bearing driver (special tools), tap the secondary shaft bearing into the crankcase with the secondary shaft until the bearing stops at the bottom of the crankcase bearing hole.



- Check to see that the oil pump knock pins (2) are in place.

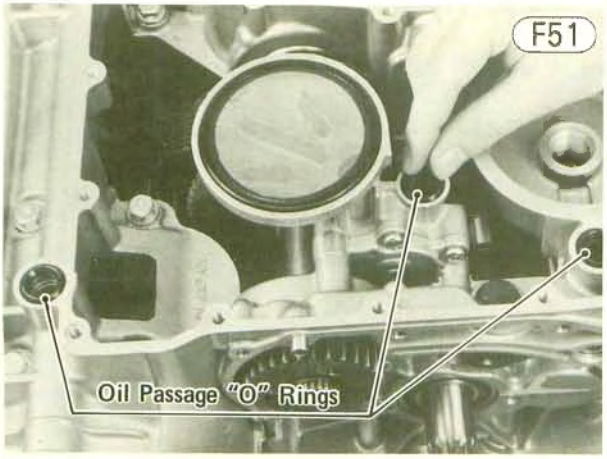


- Install the secondary shaft bearing stopper with the two short screws, and tighten the screws lightly. Install the oil pump, making sure the oil pump gear and pump driver gear at the secondary shaft mesh properly. Apply non-permanent locking agent to the oil pump bolts (2) and long screw, and tighten the bolts (2) and screw (1). Then tighten the secondary shaft bearing stopper screws (2).

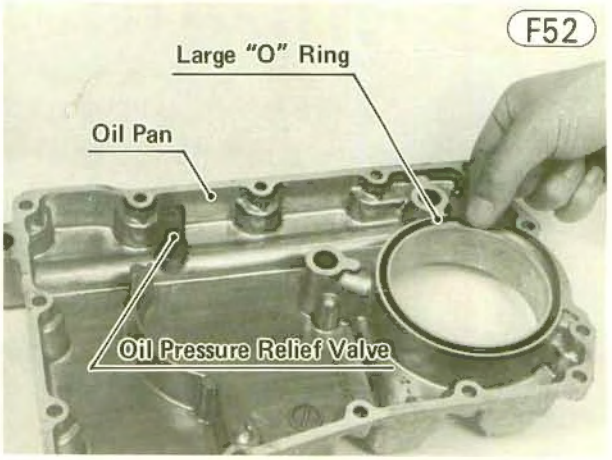


- Install the secondary shaft bearing cap, and tighten its screws (2).
- Put the large flat washer on the secondary shaft.
- Apply a little oil on the secondary shaft, and push the secondary shaft gear on the shaft by rotating the *gear pusher* (special tool).

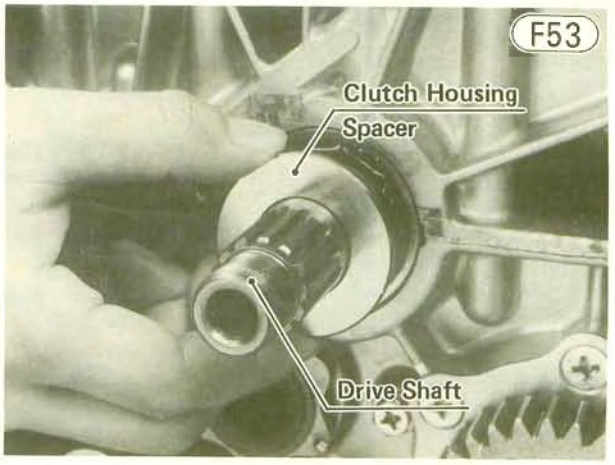
- Install the circlip on the secondary shaft.
- Fit the oil passage **O** rings (3) on the lower crankcase. Replace the **O** rings with new ones, if deteriorated or damaged.



- Check that the large **O** ring and oil pressure relief valve are in place, and install a new oil pan gasket, and the oil pan with its mounting bolts (15). Tighten the bolts with 0.7 ~ 0.9 kg-m (61 ~ 78 in-lbs) of torque.



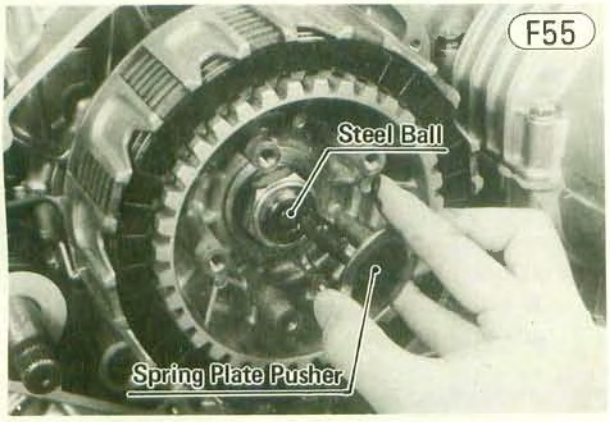
- Check that the large **O** ring is in place, and install the oil filter, tightening its bolt.
- Turn the engine right side up.
- Install the upper crankcase bolts (12, or 11 if the engine is set on the Kawasaki engine disassembly apparatus), and tighten them with 0.9 ~ 1.1 kg-m (78 ~ 95 in-lbs) of torque.
- Put the clutch housing spacer on the drive shaft. The spacer must be installed with its flat side facing toward the end of the shaft.



- Install the drive shaft sleeve, needle bearing, and clutch housing.
- Put on the thrust washer, clutch hub, and flat washer. Replace the clutch hub nut with a new one, screw on the nut and tighten it with 12 ~ 15 kg-m (87 ~ 108 ft-lbs) of torque, while holding the hub stationary with the clutch holder (special tool).

WARNING **The washer between the clutch hub and the clutch hub nut must be installed with the marked side, "out side", facing out. If this washer is installed backwards, the hub nut might loosen during operation. This causes clutch disengagement, resulting in loss of motorcycle control.**

- Install the friction plates (7) and steel plates (6), starting with a friction plate and alternating them.
- Insert the clutch steel ball, and spring plate pusher, applying a thin coat of a high temperature grease to their surfaces.

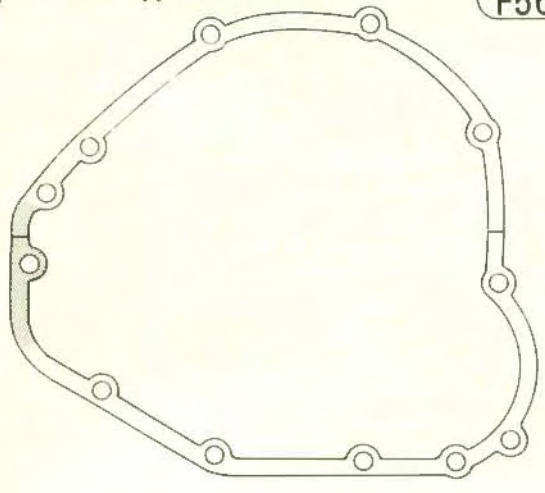


- Install the spring plate, spring washers, and spring bolts (5 ea). Cross tighten the bolts evenly with 0.9~1.1 kg-m (78~95 in-lbs) of torque.

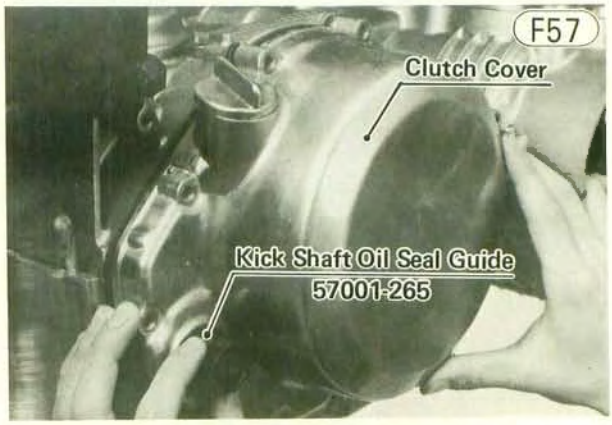
NOTE: The spring plate can be installed on the clutch hub in any position, so there is no mark on either the spring plate or the clutch hub.

- Put the thrust washers (2) on the kick shaft. The thinner thrust washer goes on first.
- Check that the two knock pins are in place, apply liquid gasket, and fit a new clutch cover gasket.

Liquid Gasket Applied Area



- Insert the kick shaft oil seal guide (special tool) in the clutch cover oil seal, and fit the right engine cover onto the crankcase. Tighten the screws (10) firmly. Be sure to include the contact breaker lead clamps (2) with their clutch cover screws.



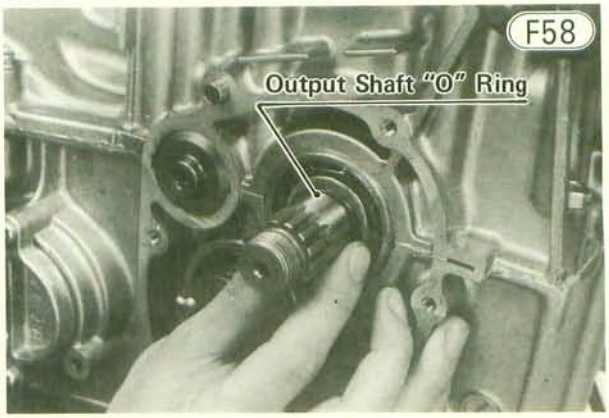
- Fit the timing advancer onto the crankshaft, *matching* its notch with the pin in the end of the crankshaft, and install the crankshaft rotation nut and the advancer mounting bolt. The notches in the nut fit the projections on the timing advancer. Tighten the bolt with 2.3~2.7 kg-m (16.5~19.5 ft-lbs) of torque.
- Connect the oil pressure indicator switch leads (blue/red), mount the contact breaker plate, and tighten its screws (3) loosely. Each screw has a lockwasher and flat washer.

NOTE: These screws will be tightened securely during ignition timing adjustment.

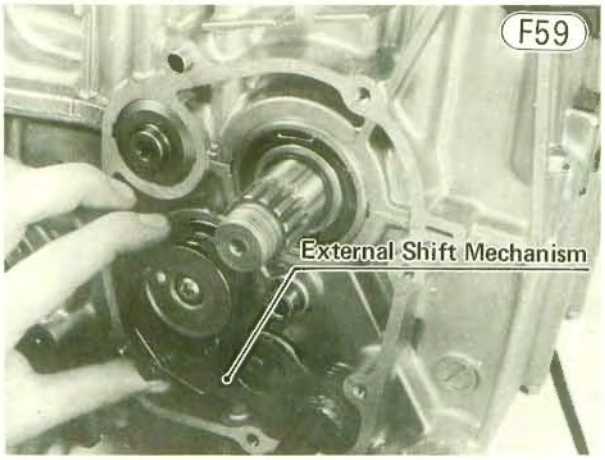
- Fit the wiring grommet, and install the gasket and contact breaker cover with the screws (2).
- Clamp the contact breaker wiring with the wiring clamps under the clutch cover.
- Install the kick pedal in the position marked during disassembly, and then tighten the bolt.
- Check that the external shift mechanism return spring pin is not loose. If it is loose, remove it, apply non-permanent locking agent to the threads, re-install it, and tighten the locknut.

NOTE: The return spring pin must be screwed in until it protrudes approximately 20 mm from the crankcase, so that it can work satisfactorily as an external shift mechanism lever stopper (Fig. E76).

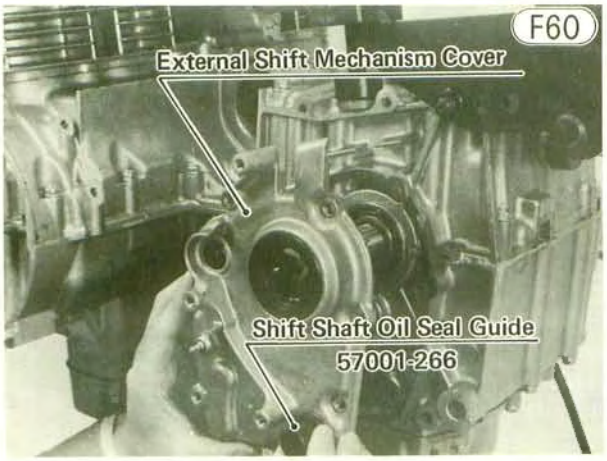
- Replace the output shaft **O** ring with a new one if it is damaged, and install it next to the ball bearing inner race.



•Check that the external shift mechanism cover knock pins (2) are in place.
•Check that the return spring is properly fitted on the shaft, mount the external shift mechanism, and place its arms on the shift drum pins.



•Apply a high temperature grease to the lips of the *clutch* push rod oil seal and the output shaft collar oil seal.
•Insert the shift shaft oil seal guide (special tool) in the external shift mechanism cover oil seal, install the cover, and then tighten the screws (7). An aluminium washer must be replaced with a new one, and installed with the left lower side screw of the cover.



•Install the output shaft collar.
•Apply non-permanent locking agent to the bolts (3), and install the engine sprocket chain guard.
•Clean the starter motor lugs and crankcase where the starter motor is grounded.
•Apply a little oil to the **O** ring and install the starter motor. Tighten the starter motor retaining bolts (2).
•Using a high flash-point solvent clean off an any oil or dirt that may be on the crankshaft taper or rotor hub, and install the dynamo rotor.
•Tighten the bolt to 5.8 ~ 6.3 kg-m (42 ~ 46 ft-lbs) of torque while holding the dynamo rotor steady with the dynamo rotor holder (special tool).
•Check that the knock pins (2) are in place, install the gasket and dynamo cover, and tighten the screws (4).

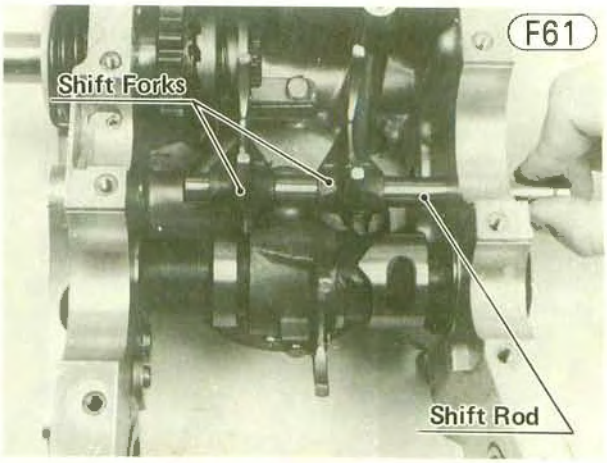
NOTE: Before installing the engine, tighten the remaining upper crankcase bolt if not already tightened. Tightening torque of the bolt is 0.9 ~ 1.1 kg-m (78 ~ 95 in-lbs).

•Install the engine (Pg. 80).
•Fill the engine with oil, check the oil level (Pg. 21), and add more if necessary.
•Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 82).

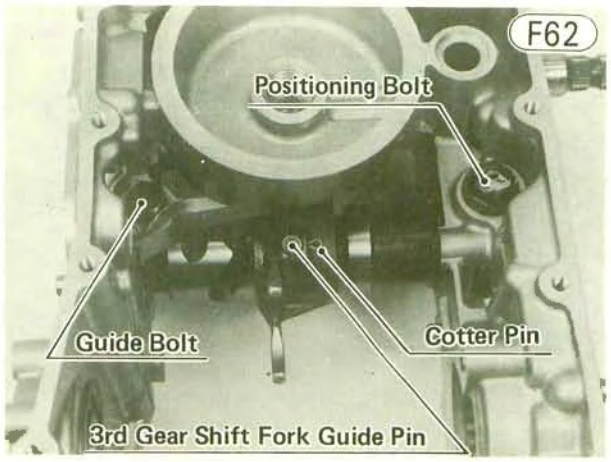
TRANSMISSION

Removal:

•Remove the engine (Pg. 78).
•Split the crankcases (Pg. 82).
•Pull out the shift rod, and remove the two shift forks in the lower crankcase half.



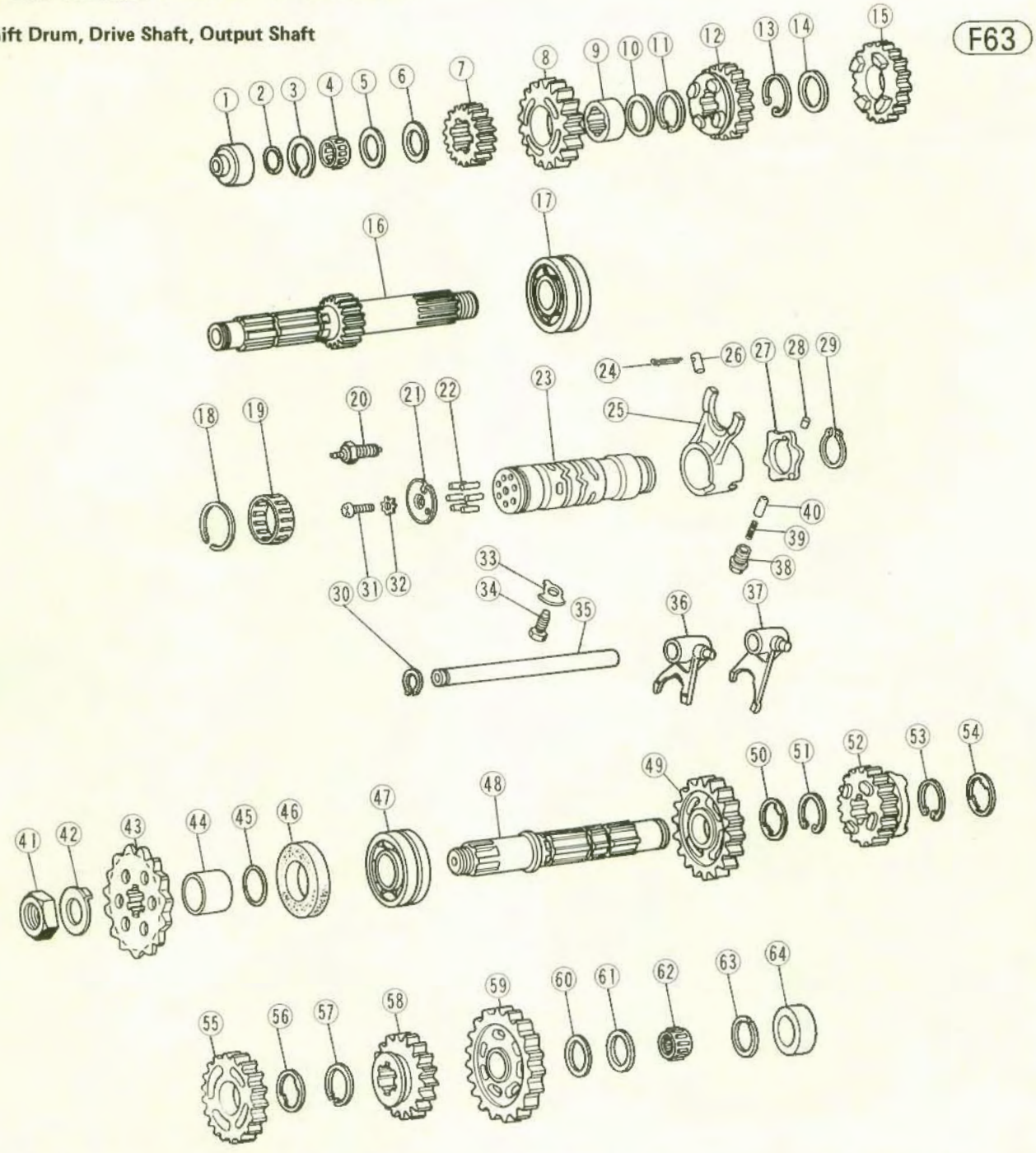
•Remove the shift drum positioning bolt, spring, and pin.



•Straighten the side of the lockwasher that is bent over the side of the shift drum guide bolt, and remove the bolt.
•Remove the cotter pin, and pull out the drive shaft 3rd gear shift fork guide pin.
•Remove the operating plate circlip and operating plate.

Shift Drum, Drive Shaft, Output Shaft

F63

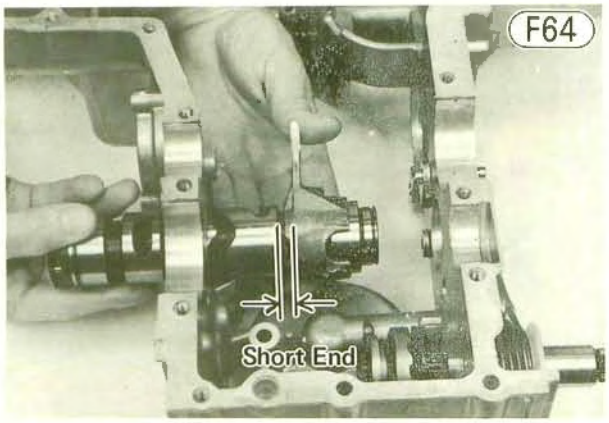


1. Bearing Outer Race
2. O Ring
3. Circlip
4. Needle Bearing
5. Steel Washer
6. Copper Washer
7. 2nd Gear (D)
8. 5th Gear (D)
9. Copper Bushing
10. Washer
11. Circlip
12. 3rd Gear (D)
13. Circlip
14. Washer
15. 4th Gear (D)
16. Drive Shaft
17. Ball Bearing
18. Circlip
19. Needle Bearing
20. Neutral Indicator Switch
21. Shift Drum Pin Plate
22. Shift Drum Pin
23. Shift Drum
24. Cotter Pin
25. 3rd Gear Shift Fork
26. Guide Pin
27. Operating Plate
28. Pin
29. Circlip
30. Circlip
31. Screw
32. Lockwasher
33. Lockwasher
34. Drum Guide Bolt
35. Shift Rod
36. 5th Gear Shift Fork
37. 4th Gear Shift Fork
38. Positioning Bolt
39. Spring
40. Positioning Pin
41. Nut
42. Toothed Washer
43. Engine Sprocket
44. Collar
45. O Ring
46. Oil Seal
47. Ball Bearing
48. Output Shaft
49. 2nd Gear (O)
50. Splined Washer
51. Circlip
52. 5th Gear (O)
53. Circlip
54. Splined Washer
55. 3rd Gear (O)
56. Splined Washer
57. Circlip
58. 4th Gear (O)
59. 1st Gear (O)
60. Copper Washer
61. Steel Washer
62. Needle Bearing
63. Circlip
64. Bearing Outer Race

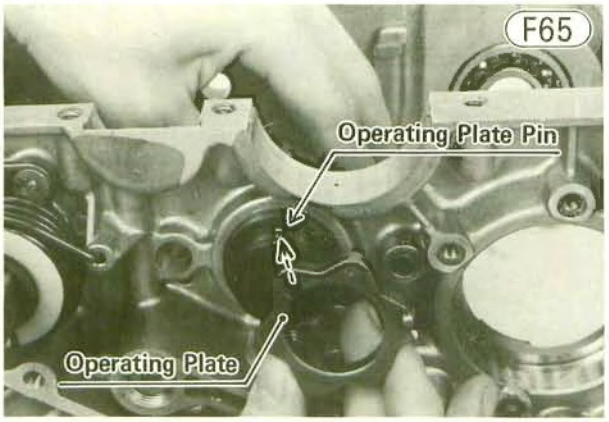
•Pull out the shift drum slightly, and remove the drive shaft 3rd gear shift fork. Pull the shift drum free from the crankcase.

Installation:

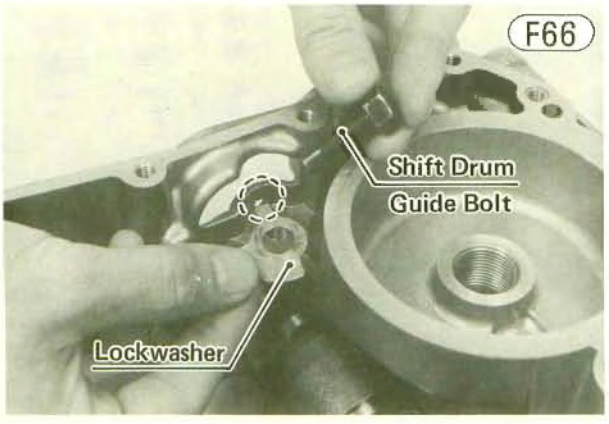
•Insert the shift drum into the crankcase part way, install the 3rd gear shift fork with the short end facing the neutral switch, i.e., the short end goes onto the drum first.



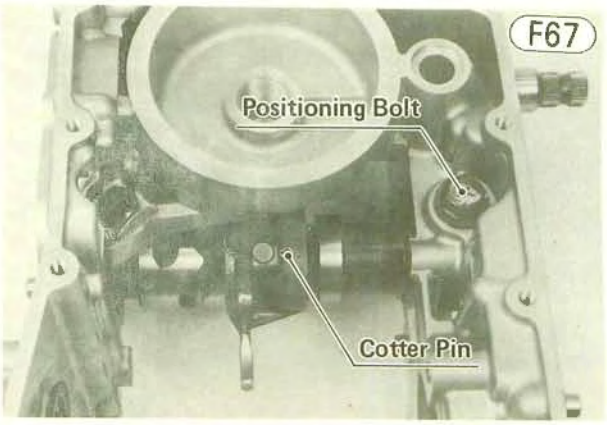
•Push the shift drum in the rest of the way.
•Check to see that the operating plate pin is in place, fit the operating plate onto the end of the shift drum, and install the circlip.



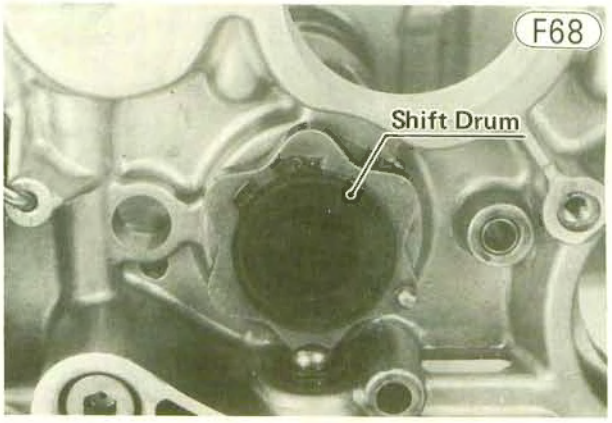
•Tighten the shift drum guide bolt, and bend the side of the lockwasher over the side of the bolt. The lockwasher must seat in the crankcase.



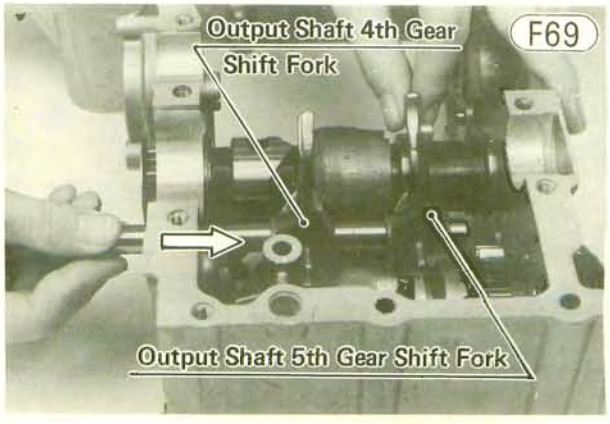
•Put the 3rd gear shift fork gudie pin into the 3rd gear shift fork. The guide pin rides in the middle groove of the three guide pin grooves.
•Insert a new cotter pin through the 3rd gear shift fork and guide pin from the long end side of the shift fork, and spread the cotter pin long end inward.



•Install the shift drum positioning pin, spirng, and bolts.
•Set the shift drum in neutral position as shown in Fig. F68.

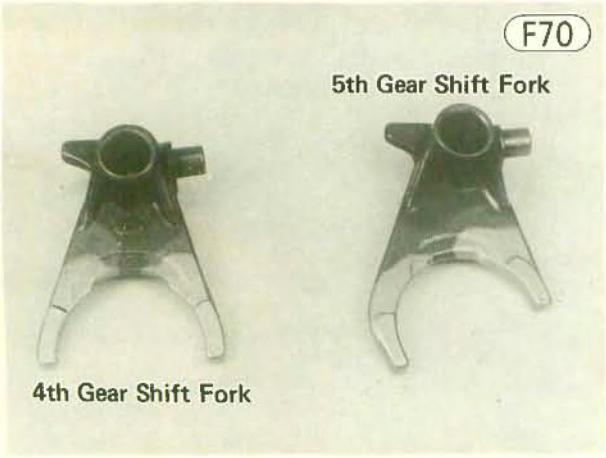


•Apply a little engine oil to the shift rod and shift fork fingers. Insert the shift rod, running it through the output shaft 5th gear shift fork, and then through the output shaft 4th gear shift fork, fitting each shift fork guide pin into the shift drum groove.



NOTE: Identification of the shift forks
4th gear shift fork: two fingers have the same length.
5th gear shift fork: one of two fingers is longer than the other and bends about 30° inward.

F70



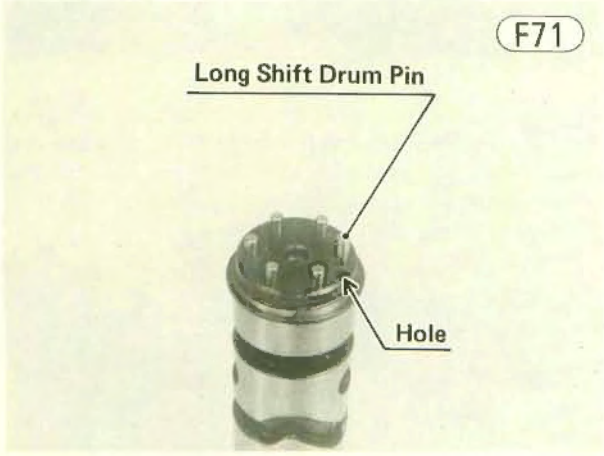
Shift Drum Disassembly:

- Drop out the operating plate pin (28).
- Remove the shift drum pin plate (21). The screw (31) has a lockwasher (32).
- Pull out the pins (22) (6).

Assembly Notes:

1. Use a new lockwasher, and be sure that the screw is firmly tightened.
2. The long shift drum pin must be in the position shown in Fig. F71. If the pin is assembled in the wrong position, the neutral indicator light will not light when the gears are in neutral.

F71



Drive Shaft Disassembly:

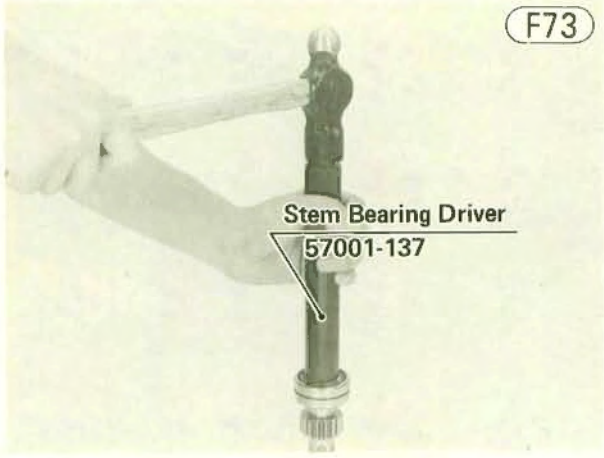
- Pull off the drive shaft sleeve and spacer.
- Remove the needle bearing outer race (1).
- Remove the circlip (3) and pull off the needle bearing (4), steel washer (5), and copper washer (6).
- Pull off 2nd gear (7), 5th gear (8), the copper bushing (9), and washer (10).
- Remove the circlip (11), and pull off 3rd gear (12).
- Remove the circlip (13), and pull off the washer (14) and 4th gear (15).
- Remove the ball bearing (17) using the stem bearing puller and adapter (special tools).

F72

Assembly Notes:

1. Install the drive shaft ball bearing using the steering stem bearing driver (special tool).

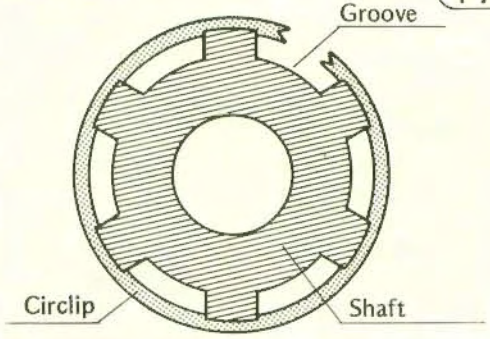
F73



2. Replace any circlips that were disassembled with new ones, and install the circlip so that the opening coincides with one of the splined grooves in the drive shaft.

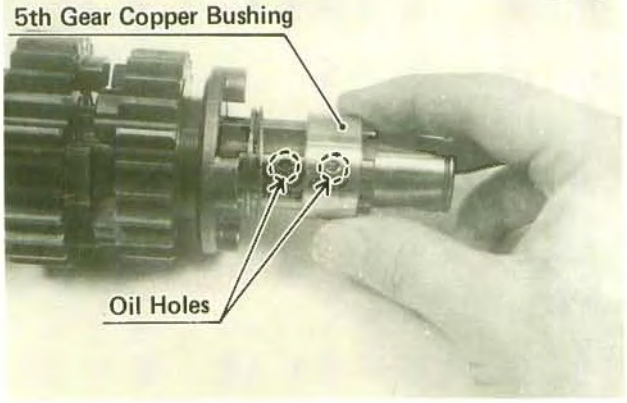
Circlip Installation

F74



3. When assembling the 5th gear copper bushing to the drive shaft, align its oil holes with the holes in the shaft.

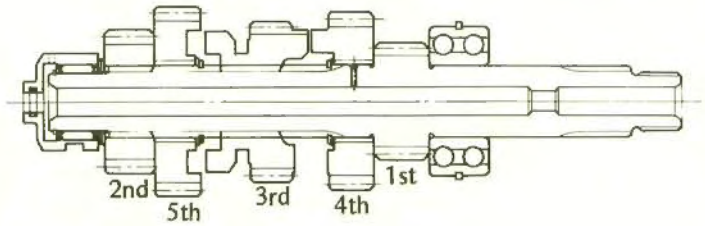
F75



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

Drive Shaft Gears

F76



Output Shaft
Disassembly:

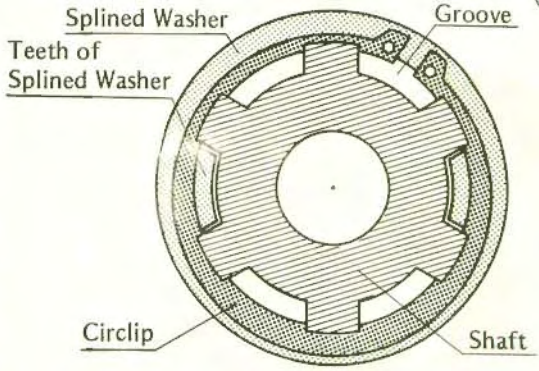
- Pull off the needle bearing outer race (64).
- Remove the circlip (63), and pull off the needle bearing (62), steel washer (61), and copper washer (60).
- Pull off 1st gear (59) and 4th gear (58).
- Remove the circlip (57), and pull off the splined washer (56), 3rd gear (55), and another splined washer (54).
- Remove the circlip (53), and pull off 5th gear (52).
- Remove the circlip (51), and pull off the splined washer (50) and 2nd gear (49).
- Remove the output shaft ball bearing (47) using the stem bearing puller (special tool).

Assembly Notes:

1. Install the output shaft ball bearing using the steering stem bearing driver (special tool).
2. 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. F77).
3. Install the splined washer so that its teeth do not coincide with the circlip opening.

Circlip, Splined Washer Installation

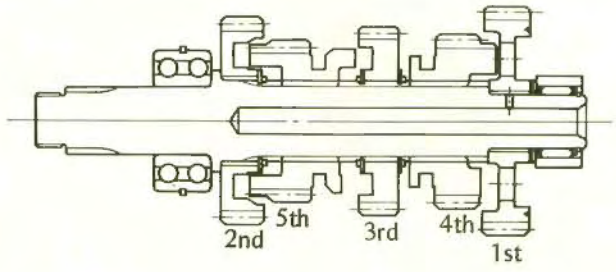
F77



4. 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, splined washer, circlip, 5th gear, circlip, splined washer, 3rd gear, splined washer, circlip, 4th gear, 1st gear, copper washer, steel washer, needle bearing, circlip, and needle bearing outer race.
5. 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

F78

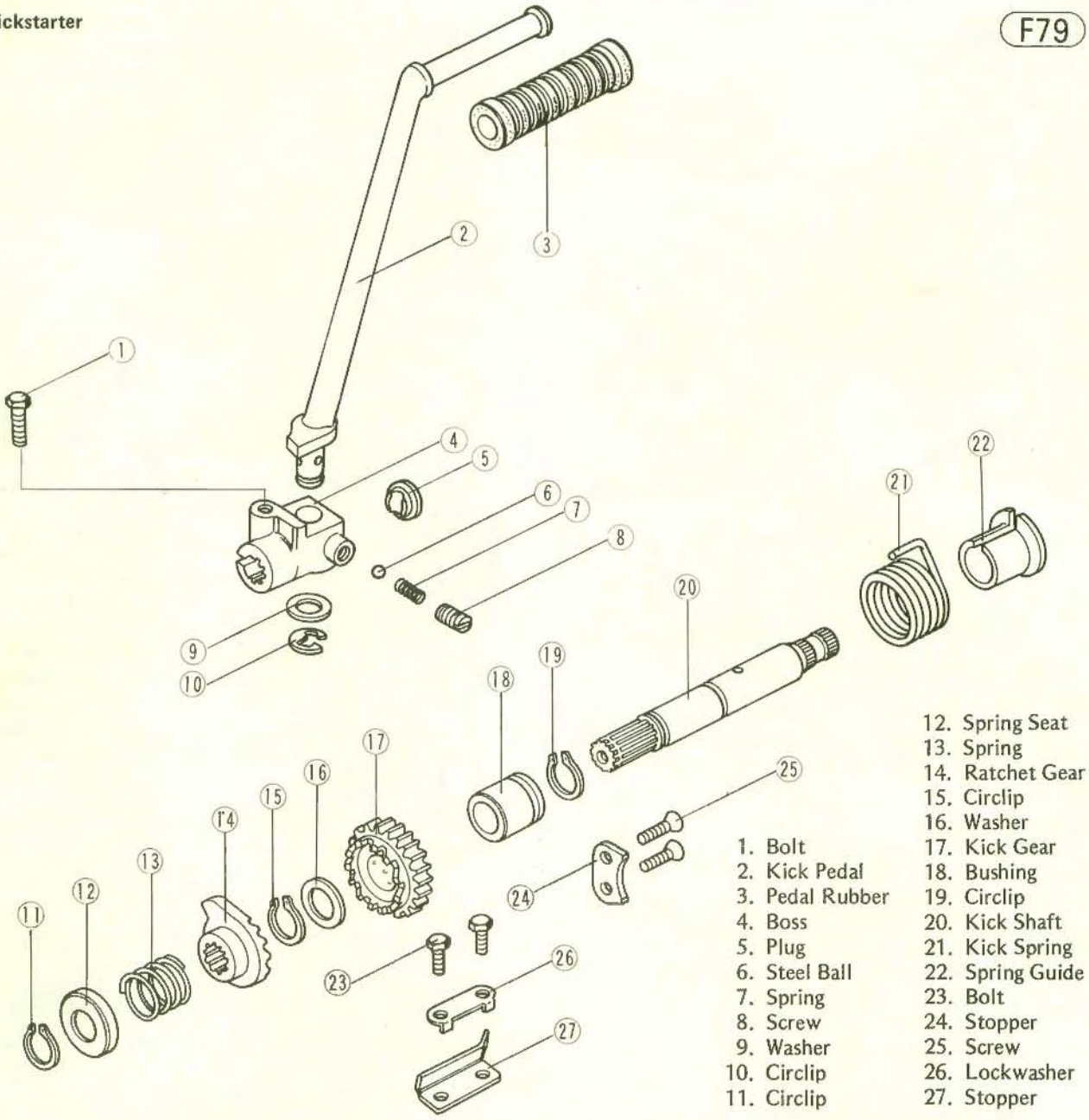


KICKSTARTER
Removal:

- Split the crankcase as explained in transmission removal (Pg. 89). The transmission itself does not require removal.
- Pull off the spring guide (22).
- Remove the kick spring (21).
- Remove the circlip (19) from the kick shaft bushing (18).
- Remove the kick shaft stopper screws (25) *(2)* and stopper (24), and pull off the bushing.
- Remove the kick shaft assembly from the lower crankcase half.

Kickstarter

F79



1. Bolt
2. Kick Pedal
3. Pedal Rubber
4. Boss
5. Plug
6. Steel Ball
7. Spring
8. Screw
9. Washer
10. Circlip
11. Circlip
12. Spring Seat
13. Spring
14. Ratchet Gear
15. Circlip
16. Washer
17. Kick Gear
18. Bushing
19. Circlip
20. Kick Shaft
21. Kick Spring
22. Spring Guide
23. Bolt
24. Stopper
25. Screw
26. Lockwasher
27. Stopper

Installation Note:

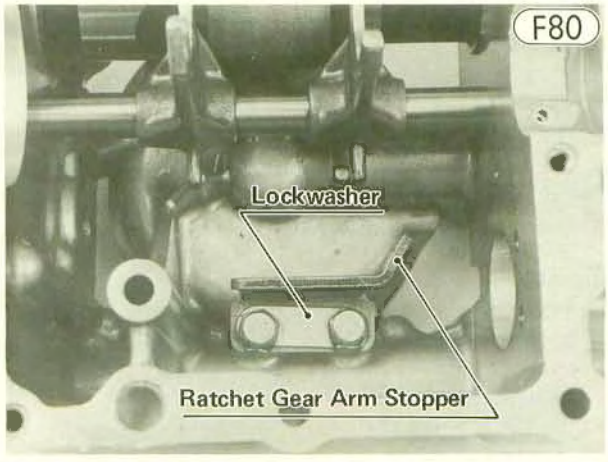
- Apply a non-permanent locking agent to the kick shaft stopper screws (2), and tighten them.

Kickstarter Disassembly:

- Straighten out the lockwasher ㉖ ends which are bent over the side of the ratchet gear arm stopper bolts ㉓, and remove the stopper ㉗.
- Remove the circlip ⑪ on the kick shaft end, and take off the spring seat ⑫, spring ⑬, and ratchet gear ⑭.
- Remove the circlip ⑮, and pull off the washer ⑯, kick gear ⑰.

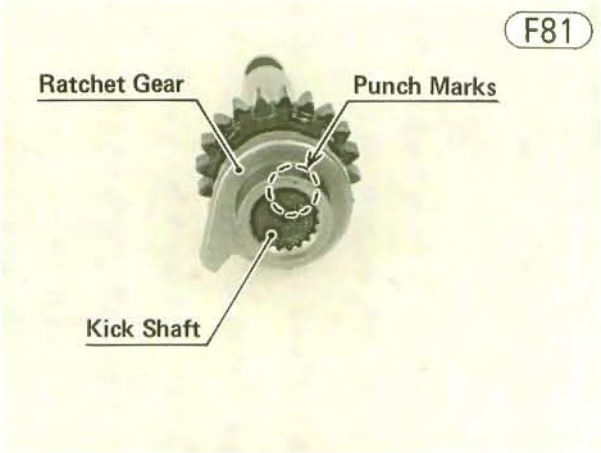
Kickstarter Assembly Notes:

1. Install the ratchet gear arm stopper in the direction shown in Fig. F80. Use a new lockwasher and, after tightening the stopper bolts (2), be sure to bend the ends of the lockwasher over the stopper bolts.



2. Apply a little engine oil to the inside of the bushing, 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.



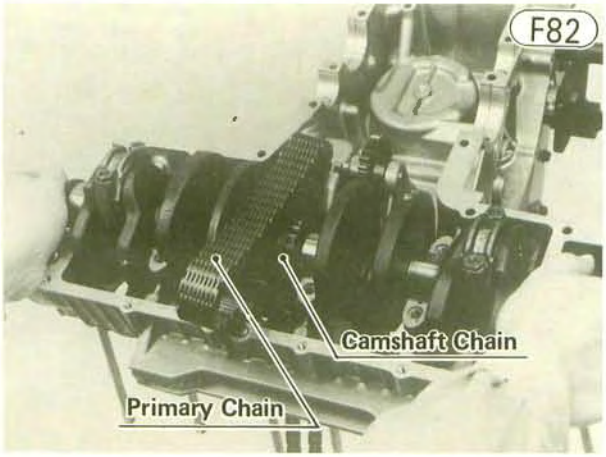
CRANKSHAFT (including connecting rods), CAMSHAFT CHAIN, AND PRIMARY CHAIN

Removal:

- Remove the engine (Pg. 78).
- Set the engine on a clean surface or, preferably, into a disassembly apparatus with some means of holding the engine steady while parts are being removed.

NOTE: If the engine is to be set onto the Kawasaki engine disassembly appratus, one of the upper crankcase half bolts (12) shown in Fig. F21 must be removed before positioning the engine.

- Remove the camshafts as explained in camshaft removal (Pg. 46).
- Remove the cylinder block (Pg. 52).
- Remove the pistons (Pg. 54).
- Remove the transmission (Pg. 89).
- Lift off the crankshaft with the camshaft chain and primary chain.

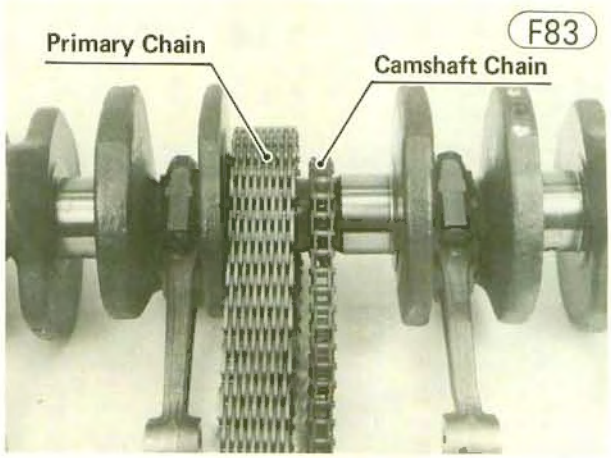


- Remove the camshaft chain from the crankshaft.
- Remove the primary chain.

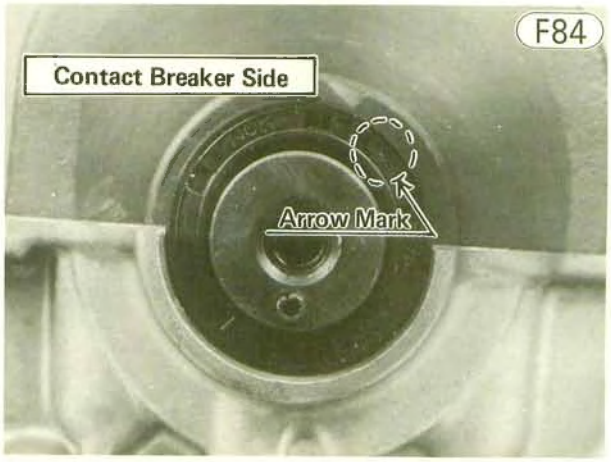
Installation:

NOTE: If a new crankshaft and/or connecting rod is used, select the proper bearing insert in accordance with the combination of connecting rod and crankshaft marks (Fig. 87, Table F2).

- Apply engine oil to the crankshaft bearing inserts.
- Fit the camshaft chain and primary chain back onto their sprockets, and set the crankshaft back in its place on the upper crankcase half.



- Apply a high temperature grease to the lip of the oil seals, and fit the oil seals onto both sides of the crankshaft with the arrow mark on the oil seal facing out. The arrow mark should shown the same direction of the crankshaft rotation (clockwise, watching from the contact breaker side).



- Assemble the crankcase as explained in transmission installation (Pg. 91).
- Install the pistons (Pg. 55).
- Install the cylinder block (Pg. 53).
- Install the camshafts (Pg. 47).
- Install the engine (Pg. 80).
- Fill the engine with oil, check the oil level (Pg. 21), and add more if necessary.
- Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 82).

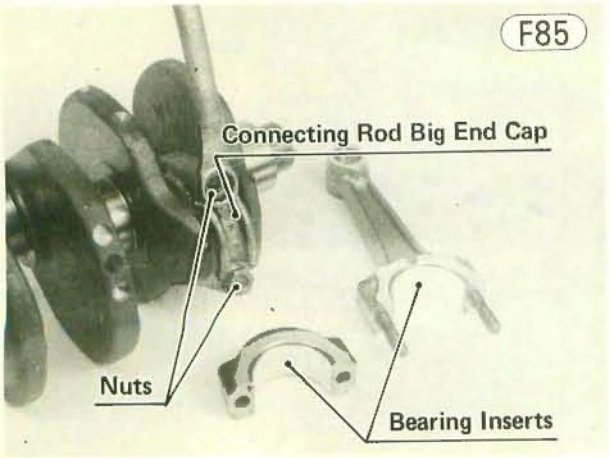
CONNECTING ROD

Removal (each side):

- Remove the crankshaft (Pg. 95).
- Remove the nuts (2) and pull off the connecting rod big end cap.

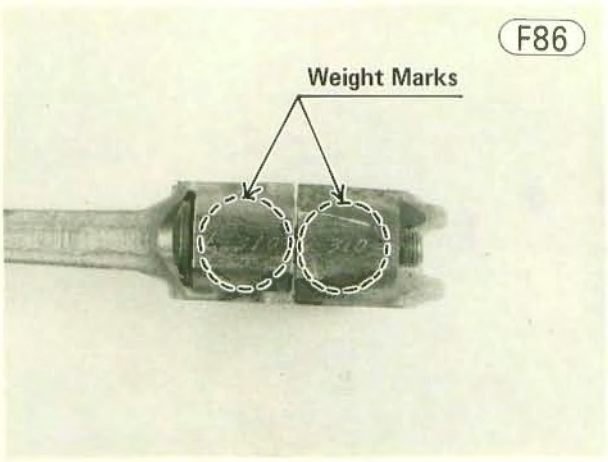
CAUTION **To prevent damage to the crankshaft journals, do not allow the big end cap bolts to bump against them.**

- Remove the connecting rod bearing insert halves from the connecting rod big end and the big end cap.



Installation Notes:

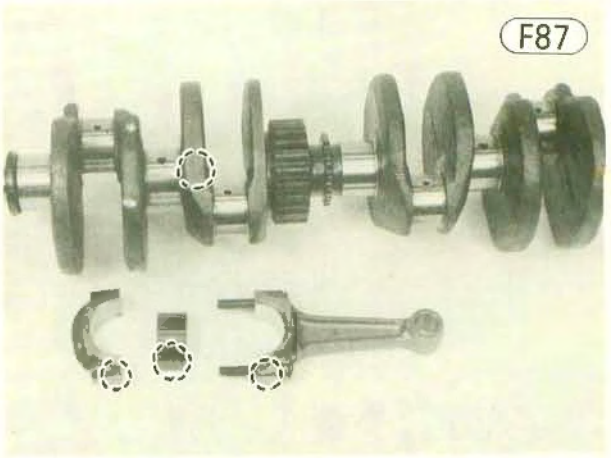
1. Apply engine oil to the rod bearing inserts.
2. A pair of connecting rods (#1 and #2, or #3 and #4) should have the same weight mark in each pair. This weight mark, indicated using a capital letter, is stamped on the connecting rod big end.



3. The connecting rod big end cap is machined with the connecting rod as a set, so fit them together so that the weight marks align (Fig. F86). The big end cap must be replaced together with the connecting rod as a set.
4. If a new crankshaft and/or connecting rod is used, select the right rod bearing insert in accordance with the combination of the connecting rod and the crankshaft marks (Fig. F87). If the connecting rod only is replaced with a new one, first measure the diameter of the crank pin, mark its flywheel in accordance with the diameter (Pg. 151), and then select the right bearing insert in accordance with Table F2.

Table F2 Bearing Insert Selection

Crank-shaft Marking \ Con-Rod Marking	1	2
1	B PN 13034-051	C PN 13034-052
No mark	A PN 13034-050	B PN 13034-051



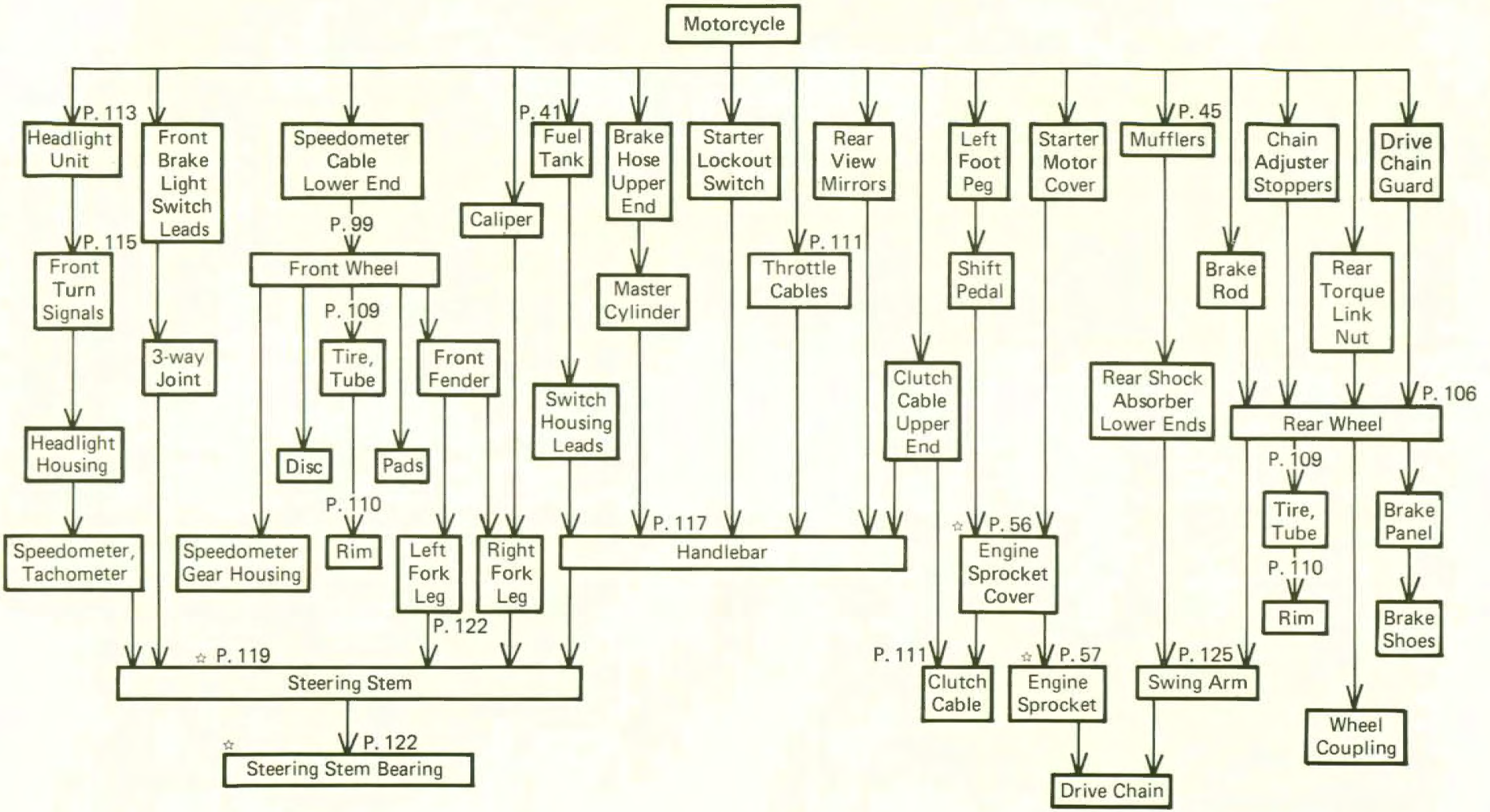
5. Hand tighten both nuts first, and then tighten each nut with 2.6 ~ 3.0 kg-m (19 ~ 22 ft-lbs) of torque.

Disassembly – Chassis

Table of Contents

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.

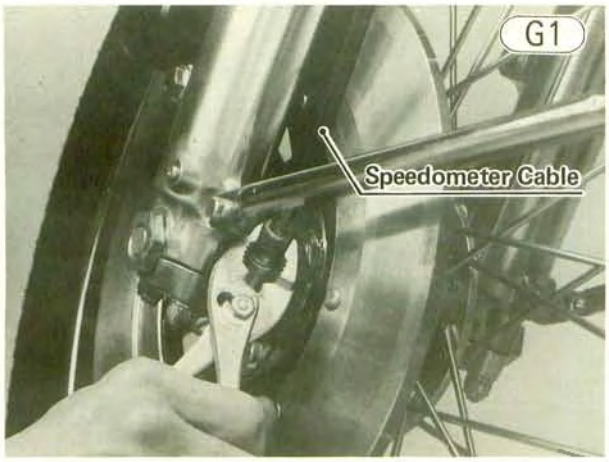


NOTE: Action with mark (☆) requires special tool(s) for removal, installation, disassembly, or assembly.

FRONT WHEEL

Removal:

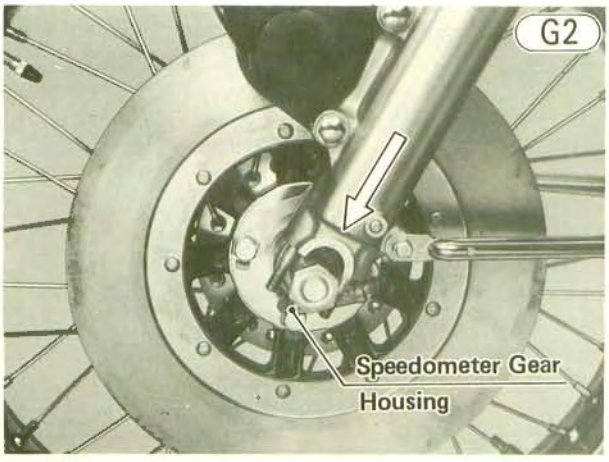
•Disconnect the lower end of the speedometer cable with pliers.



•Loosen the front axle clamp nuts (4) but do not remove them. Then loosen the front axle nuts (2).
•Remove the front axle clamp nuts, lockwashers, and clamps.
•Use a jack under the engine or other suitable means to lift the front of the motorcycle. Drop the front wheel out of the forks, and remove it.
•Insert a wood wedge (7 ~ 8 mm thick) between the disc brake pads. This prevents them from being moved out of their proper position, should the brake lever be squeezed accidentally.

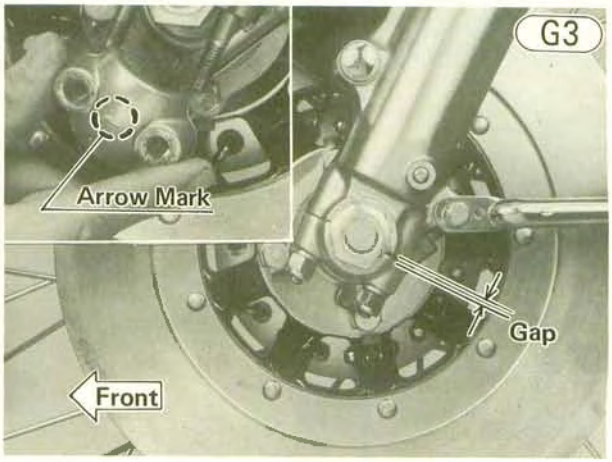
Installation:

•Remove the wedge from between the disc brake pads.
•Position the front wheel in its place between the front fork tubes, and slowly lower the front fork tube bottom ends onto the front axle.
•Mount the front axle clamps, and tighten the nuts loosely. The arrow at the bottom of the clamp must point to the front (Fig. G3).
•Turn the speedometer gear housing so that it points to the two o'clock position. Be sure that the small projection on the gear housing does not catch on the lower part of the left tube.

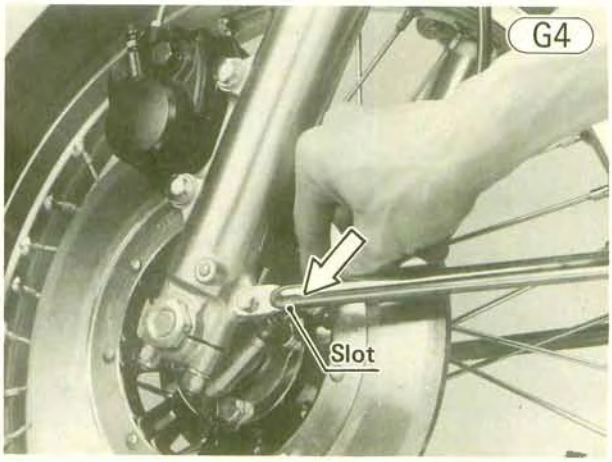


•Tighten the axle nuts with 7 ~ 9 kg-m (51 ~ 65 ft-lbs) torque, and position the speedometer housing by turning it counterclockwise until it stops.
•Tighten first the front axle clamp nut and then the rear nut with 1.6 ~ 2.2 kg-m (11.5 ~ 16 ft-lbs) of torque. There will be a gap at the rear of the clamp after tightening.

WARNING **If the clamps are installed incorrectly or improperly tightened, the clamps 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:

•Remove the left axle nut ①, and pull the speedometer gear housing ② off the hub ⑰.
•Pull out the grease seal ④ using a hook.
•Pull out the speedometer gear ③.
•If the speedometer cable bushing ⑩ or speedometer pinion ⑧ needs to be removed, first drill the housing through the pin ⑥ 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.**

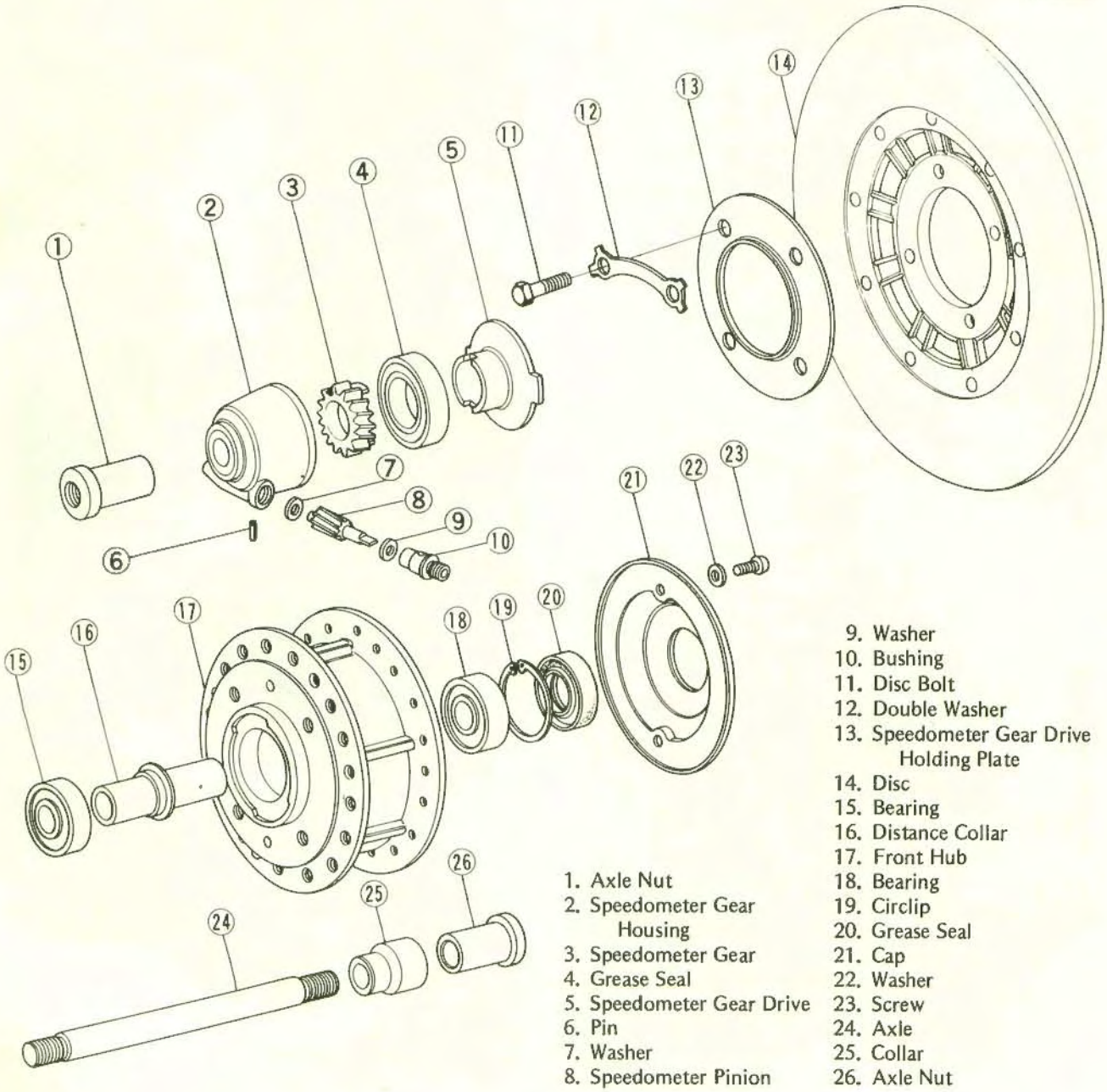
Speedometer Gear Housing Assembly Notes:

1. Replace the grease seal with a new one. 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. Install the speedometer gear housing so that it fits in the speedometer gear drive notches (Fig. G10). When properly fitted, the clearance between the speedometer gear housing and the gear drive holding plate is a little less than 3 mm.

G5

Front Hub

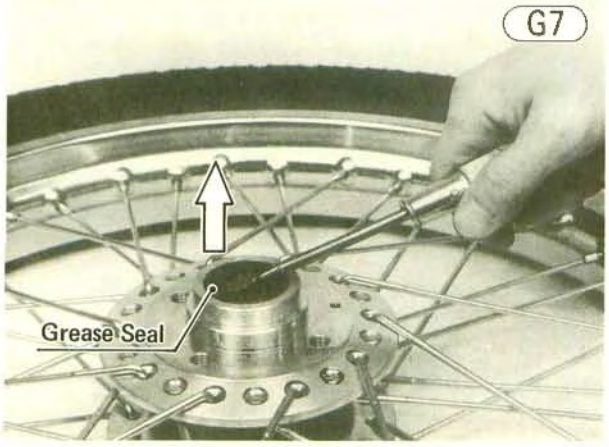
G6



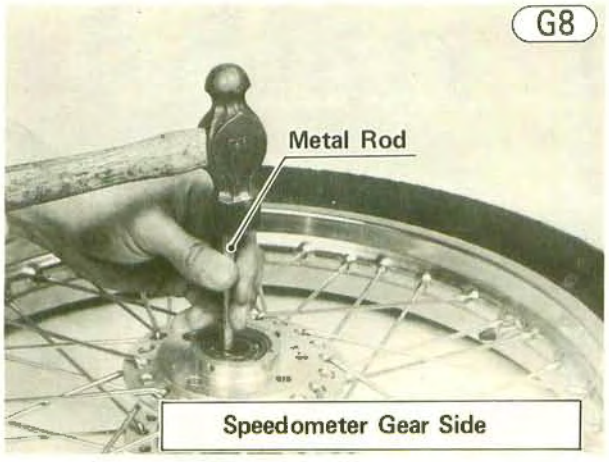
1. Axle Nut
2. Speedometer Gear Housing
3. Speedometer Gear
4. Grease Seal
5. Speedometer Gear Drive
6. Pin
7. Washer
8. Speedometer Pinion
9. Washer
10. Bushing
11. Disc Bolt
12. Double Washer
13. Speedometer Gear Drive Holding Plate
14. Disc
15. Bearing
16. Distance Collar
17. Front Hub
18. Bearing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

Front Hub Disassembly (including disc removal):

- Remove the disc side axle nut ①, and pull off the speedometer gear housing ②.
- Straighten the tabs on the disc double washers ⑫ bent over the disc bolts ⑪ (4). Remove the bolts, double washers (2), speedometer gear drive holding plate ⑬, speedometer gear drive ⑤, and disc ⑭.
- Pull out the axle ㉔ along with the right axle nut ㉖, and remove the collar ㉕.
- Remove the screws ㉓ (2) and washers ㉒ (2), and take the cap ㉑ off the right side of the hub.
- Using a hook, pull out the grease seal ⑳ and remove the circlip ⑲.



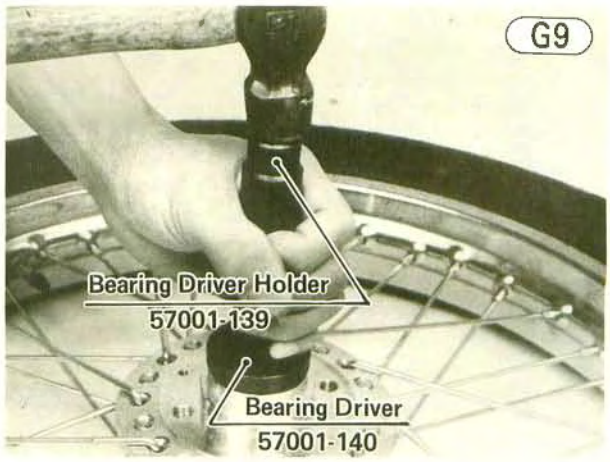
- Insert a metal rod into the hub from the speedometer gear side, and remove the bearing ⑱ on the right side by tapping evenly around the bearing inner race. The distance collar ⑯ will come out with the bearing.



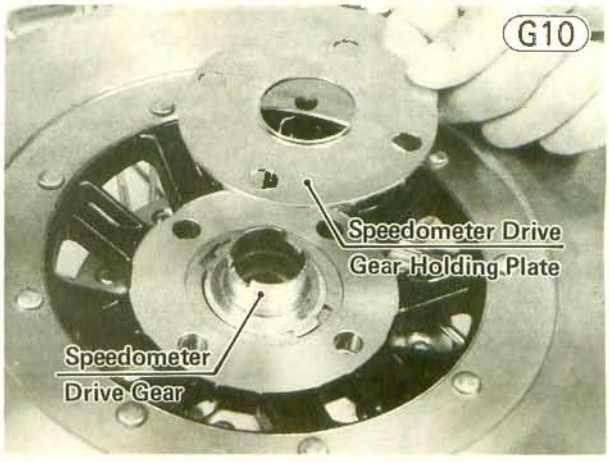
- Insert the metal rod into the hub from the right side, and remove the other bearing ⑮ by tapping evenly around the bearing inner race.

Front Hub Assembly Notes:

1. Inspect the bearings and replace if necessary (Pg. 174). 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). Press the seal so that the face of the seal is level with the surface of the front hub.
3. Wheel installing the speedometer drive gear, fit it in the hub notches. The speedometer drive gear holding plate must be installed with the plain side facing in.



4. After tightening the disc mounting bolts (4) with 3.4 ~ 4.6 kg-m (25 ~ 33 ft-lbs) of torque, bend the washer tabs back over the bolts.
5. Install the speedometer gear housing so that it fits in the speedometer gear drive notches (Fig. G5).
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 DISC BRAKE

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

Pad Removal
Pad Installation

NOTE: Disc removal and disc installation are covered in front hub disassembly and front hub assembly section (Pg. 101).

Before working on the disc brake, note the following precautions:

CAUTION

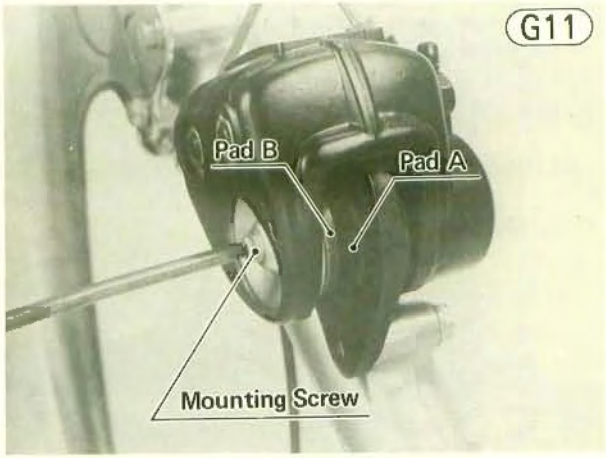
1. **Except for the disc pads and disc; use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, motor oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely, and will eventually deteriorate the rubber used in the disc brake.**
2. **When handling the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high flash-point solvent. Replace the pads with new ones if they cannot be cleaned satisfactorily.**
3. **Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely wiped up immediately.**
4. **If any of the brake line fittings or the bleed valve is opened at any time, AIR MUST BE BLED FROM THE BRAKE SYSTEM (Pg. 180).**
5. **When installing or assembling the disc brake, tighten the disc brake fittings to the values given in Table G1. Improper torque may cause the brake to malfunction.**

Table G1 Disc Brake Torque

Brake lever	0.5~0.7 kg-m	43~61 in-lbs
Brake lever adjuster locknut	1.8~2.3 kg-m	13.0~16.5 ft-lbs
Master cylinder clamp	0.6~0.9 kg-m	52~78 in-lbs
Fitting (banjo) bolts	2.9~3.1 kg-m	21~22 ft-lbs
Brake pipe nipple	1.7~1.9 kg-m	12~13.5 ft-lbs
3-way joint	0.7~0.9 kg-m	61~78 in-lbs
Front brake light switch	2.6~3.0 kg-m	19~22 ft-lbs
Caliper holder shafts	2.4~2.8 kg-m	17.5~20 ft-lbs
Caliper mounting bolts	3.4~4.6 kg-m	25~33 ft-lbs
Bleed valve	0.7~1.0 kg-m	61~87 in-lbs
Disc mounting bolts	3.4~4.6 kg-m	25~33 ft-lbs

Pad Removal:

- Remove the front wheel (Pg. 99).
- Take out the mounting screw for pad B, and remove the pad. A lockwasher and metal plate also come off.

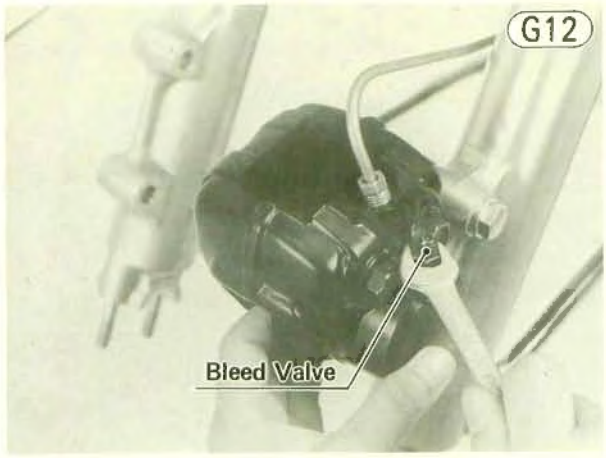


- After pad B is removed, slide the caliper body to the right side of the motorcycle and remove pad A.

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

Pad Installation:

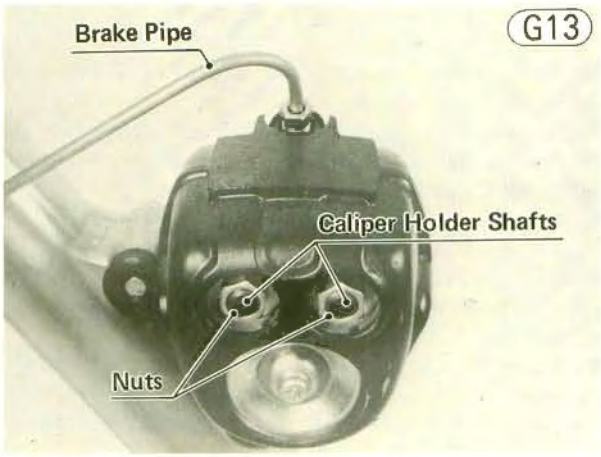
- Remove the bleed valve cap, open (loosen) the valve slightly, push the piston in by hand as far as it will go, and then close (tighten) the valve. Wipe up any spilled fluid, and recap the bleed valve.



- Install pad A in the caliper holder.
- Fit pad B, aligning the tongue on the pad with the groove in the caliper. Install the metal plate, lockwasher and mounting screw; using a non-permanent locking agent on the screw.
- Since brake fluid was spilled when the bleed valve was opened, check the fluid level in the master cylinder and bleed the air from the brake system (Pg. 180).
- Install the front wheel (Pg. 99).

Caliper Removal:

- If the piston or the caliper holder is to be removed, loosen the caliper holder shaft nuts (2).



- Remove the brake pipe from the caliper. Cap the end of the pipe with the rubber bleed valve cap to prevent fluid from flowing out.
- Remove the mounting bolts (2), each with a flat washer and lockwasher, and then take off the caliper.

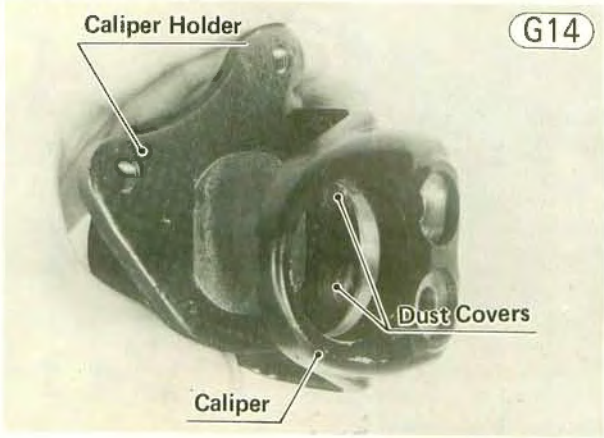
Caliper Installation Notes:

1. Tighten the mounting bolts with 3.4 ~ 4.6 kg-m (25~33 ft-lbs) of torque.
2. Tighten the caliper holder shaft nuts with 2.4~2.8 kg-m (17.5~20 ft-lbs) of torque.
3. Connect the brake pipe to the caliper, tightening it with 1.7~1.9 kg-m (12~13.5 ft-lbs) of torque.
4. Check the fluid level in the master cylinder, and bleed the brake line (Pg. 180).

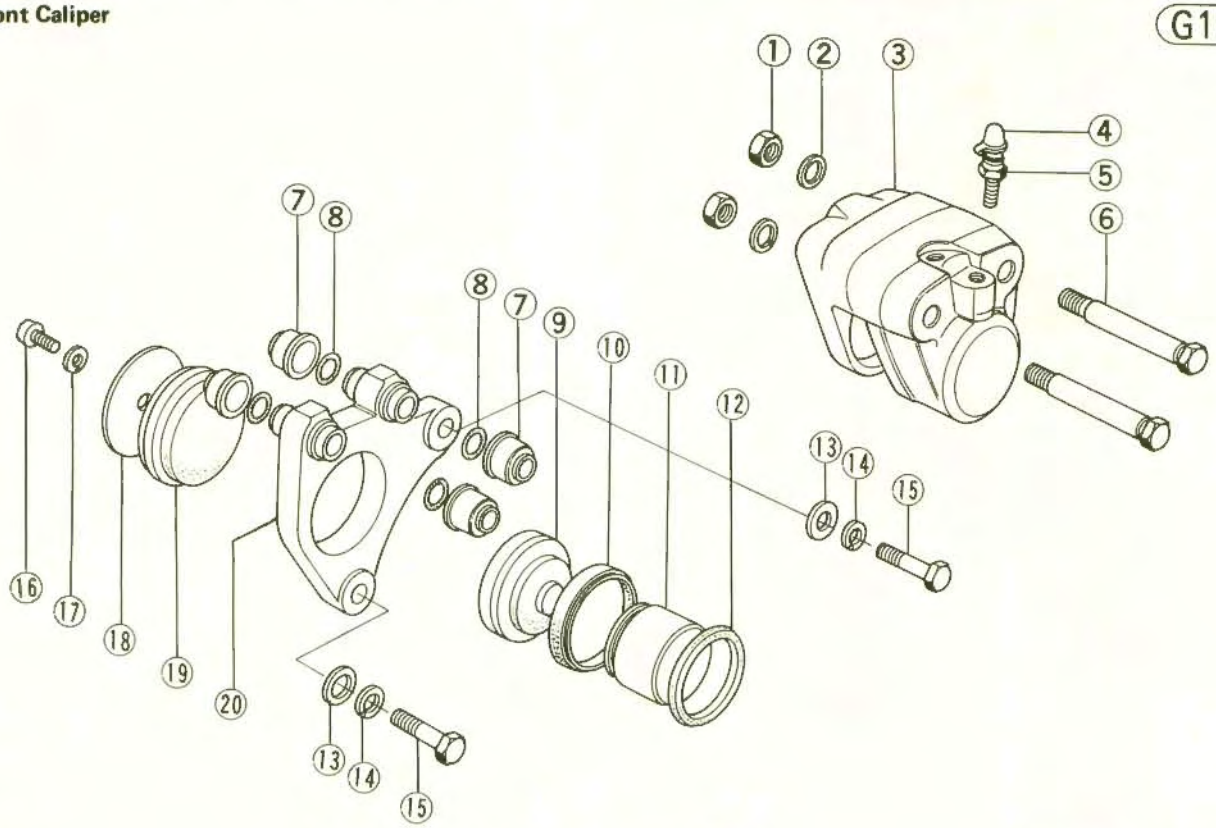
Caliper Disassembly:

- Take out the mounting screw ⑯ for pad B ⑲, and remove the pad. A lockwasher ⑰ and metal plate ⑱ also come off.
- Remove the caliper holder shaft nuts ① (2), and pull out the caliper holder shafts ⑥ (2) and the spacers ② (2) taking care not to damage the dust covers ⑦ (4). Remove the caliper holder ⑳, and push out pad A ⑨.

CAUTION **To avoid damage to the dust seals and O rings, unscrew each shaft a little at a time.**



Front Caliper



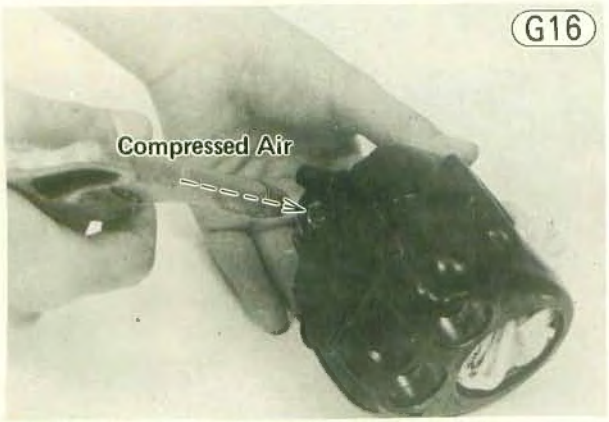
1. Nut
2. Spacer
3. Caliper
4. Bleed Valve Cap
5. Bleed Valve
6. Caliper Holder Shaft
7. Dust Cover
8. O Ring
9. Pad A
10. Dust Seal
11. Piston
12. Fluid Seal
13. Flat Washer
14. Lockwasher
15. Caliper Mounting Bolt
16. Mounting Screw
17. Lockwasher
18. Metal Plate
19. Pad B
20. Caliper Holder

•Remove the dust seal ⑩ around the piston ⑪.
•Cover the caliper opening with a clean, heavy cloth, and remove the piston by lightly applying compressed air to where the brake line fits into the caliper.

WARNING **To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the piston may crush your hand or fingers.**

NOTE: If compressed air is not available, reconnect the brake line and pump the piston out with the brake lever.

G16



•Taking care not to damage the cylinder surface, remove the fluid seal ⑫ with a hook.

Caliper Assembly:

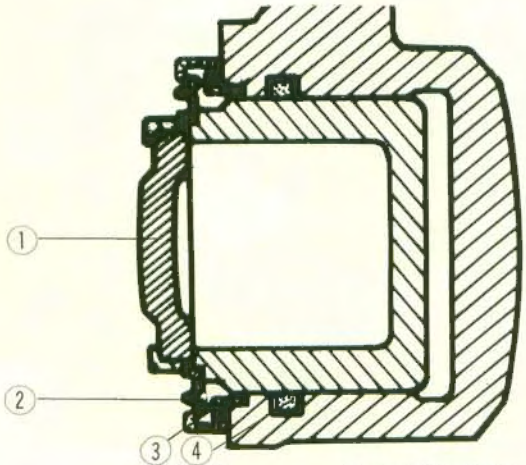
•Clean the caliper parts with brake fluid or alcohol (See CAUTION–Pg. 102).
•Fit the fluid seal in place inside the cylinder.

NOTE: It is recommended that the fluid seal, which is removed, be replaced with a new one.

•Apply brake fluid to the outside of the piston and the fluid seal, and push the piston into the cylinder by hand. Take care that neither the cylinder nor the piston skirt get scratched.
•Install the dust seal around the dust seal stopper. Check that the dust seal is properly fitted into the groove in the piston and on the dust seal stopper.

***Caliper* Dust Seal**

G17



1. Piston
2. Dust Seal
3. Dust Seal Stopper
4. Fluid Seal

•Apply a thin coat of PBC (Poly Butyl Cuprysil) grease to the caliper holder shafts and the holder holes. (PBC is a special high-temperature, water-resistant grease.)

NOTE: Replace the dust cover and **O** rings if they were damaged.

•With the caliper holder properly positioned, insert the caliper holder shafts while carefully turning the shafts to prevent damage to the dust covers.
•Install the spacers (with the protruding side facing in) and the nuts, and tighten the nuts loosely.

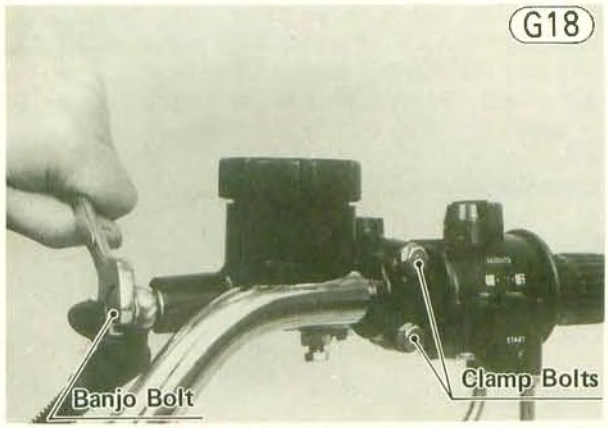
NOTE: Do not forget to tighten the nuts after installing the caliper on the motorcycle (Pg. 103).

•Install pad A in the caliper holder.
•Fit pad B, aligning the tongue on the pad with the groove in the caliper. Install the metal plate, lock-washer, and mounting screw; using a non-permanent locking agent on the screw.

Master Cylinder Removal:

•Take off the right rear view mirror.
•Pull back the dust cover, and remove the banjo bolt to disconnect the upper brake hose from the master cylinder. There is a flat washer on each side of the hose fitting.

G18

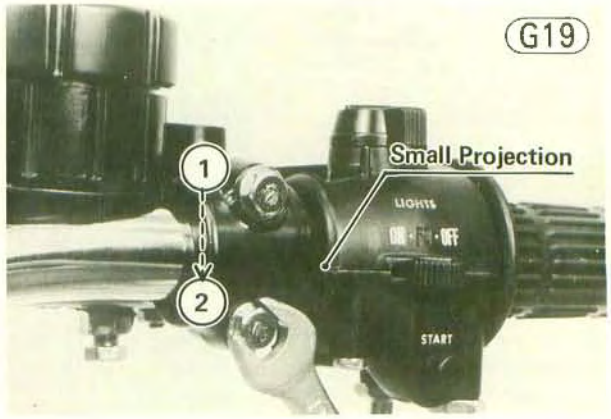


•Remove the clamp bolts (2), and take off the master cylinder. There is a flat washer for each master cylinder clamp bolt. Immediately wipe up any brake fluid that spills.

Master Cylinder Installation Notes:

1. The master cylinder clamp is installed with the small projection towards the throttle grip. Tighten the upper clamp bolt first, and then the lower clamp bolt, both with 0.6 ~ 0.9 kg-m (52 ~ 78 in-lbs) of torque.

G19

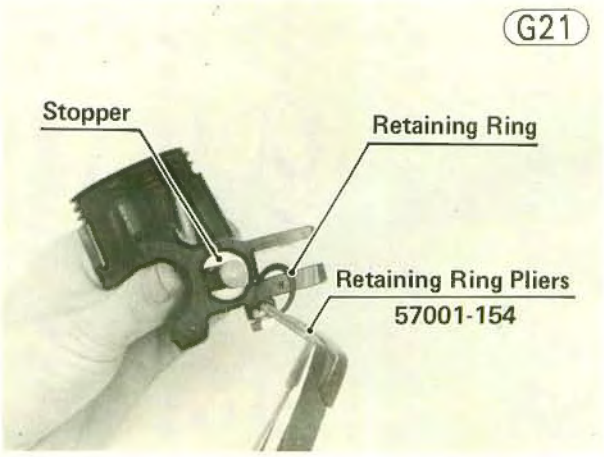


2. Bleed the brake line after master cylinder installation (Pg. 180).

Master Cylinder Disassembly:

- Take off the master cylinder cap ① and diaphragm ③, and empty out the brake fluid.
- Take off the brake lever ⑩. Use the master cylinder stopper remover (special tool) to remove the dust seal stopper ㉖, and then remove the dust seal ㉕.

- Remove the retaining ring ㉔ with retaining ring pliers (special tool), and take the stopper ㉓, piston ㉒, primary cup ⑳, and spring ⑲ out of the master cylinder body. Do not remove the secondary cup ㉒ from the piston since removal will damage the cup.

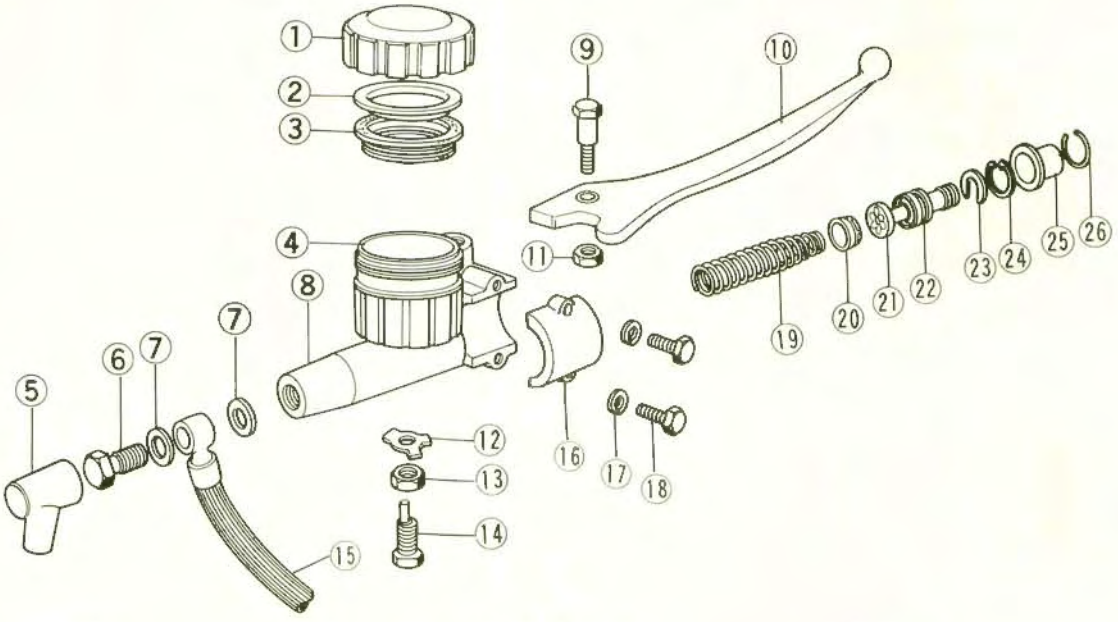


Master Cylinder Assembly Notes:

1. Before assembly, clean all parts including the master cylinder with brake fluid or alcohol (See CAUTION –Pg. 102). Apply brake fluid to the removed parts and to the inner wall of the cylinder.

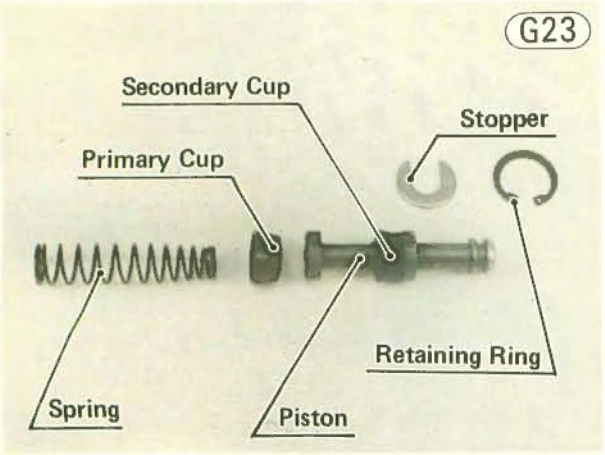
Front Master Cylinder

G22



1. Cap
2. Ring Plate
3. Diaphragm
4. Reservoir
5. Dust Cover
6. Banjo Bolt
7. Flat Washer
8. Master Cylinder Body
9. Bolt
10. Brake Lever
11. Nut
12. Lockwasher
13. Nut
14. Adjusting Bolt
15. Brake Hose
16. Clamp
17. Lockwasher
18. Bolt
19. Spring
20. Primary Cup
21. Piston
22. Secondary Cup
23. Stopper
24. Retaining Ring
25. Dust Seal
26. Dust Seal Stopper

2. Be sure that the primary cup is not installed backwards, and is not turned sideways after insertion.

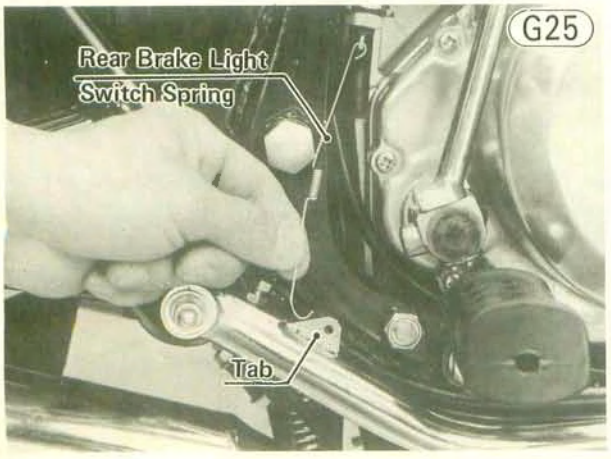


3. Use a new retaining ring for assembly, pushing it into place in the cylinder wall groove with the master cylinder ring driver (special tool). Use the same tool for installing the dust seal and dust seal stopper.

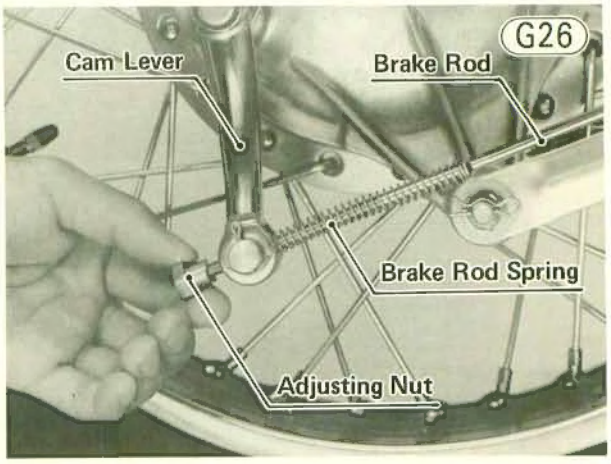
REAR WHEEL, REAR BRAKE

Removal:

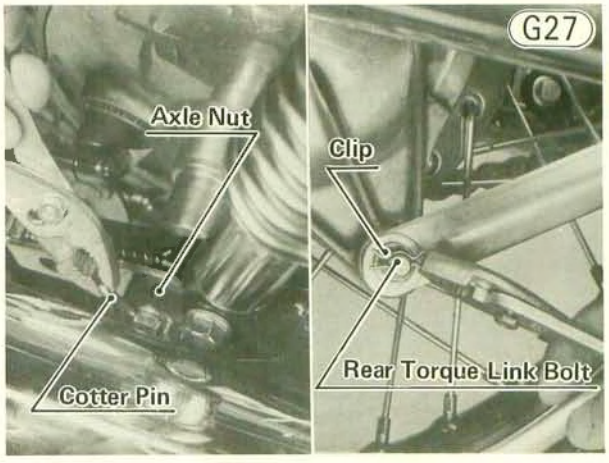
- Put the motorcycle up on its center stand.
- Being careful not to bend or otherwise damage it, free the rear brake light switch spring from the tab on the brake pedal.



- 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.



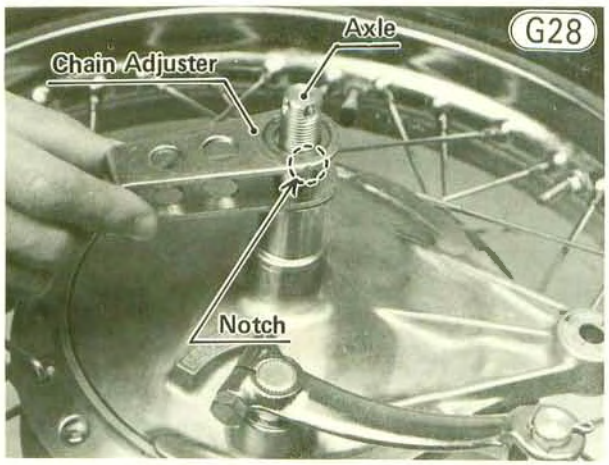
- Take out the clip from the rear torque link bolt, remove the nut, lockwasher, and bolt.
- Take out the cotter pin, and loosen the axle nut.



- Remove the drive chain guard.
- Loosen the left and right chain adjuster locknuts, back out the chain adjusting bolts, and kick the wheel forward until the chain is too loose.
- Remove the bolts and take out the chain adjuster stoppers.
- Slip the chain off the sprocket, and then pull off the wheel.
- Remove the axle nut, and pull off the axle.

Installation:

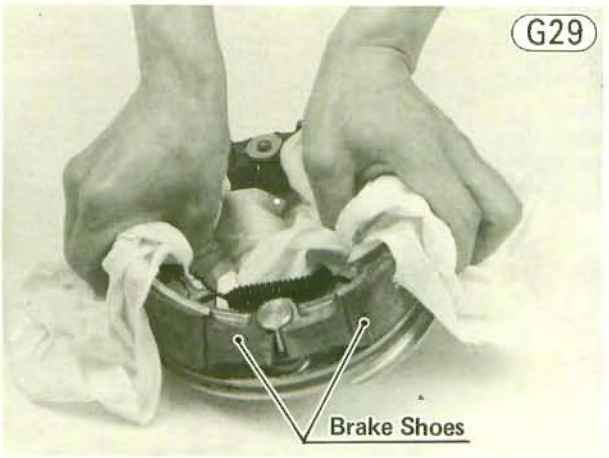
- Check to see that the coupling sleeve, rubber damper, and brake panel are in place.
- Slide the axle through the left chain adjuster, coupling, rear hub, brake panel, spacer, and right chain adjuster from the left to right. The chain adjusters should be installed with the notch mark side facing out.



- Fit the drive chain onto the rear sprocket.
- Install the chain adjuster stoppers, and tighten their bolts.
- Install the chain guard.
- Insert the axle nut, and tighten the nut loosely.
- Insert the torque link bolt into the brake panel, and install the torque link, lockwasher, and nut. Tighten the nut loosely.
- Adjust the drive chain (Pg. 24).
- 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. 25), and check the rear brake light switch adjustment (Pg. 26).

Rear Brake Disassembly:

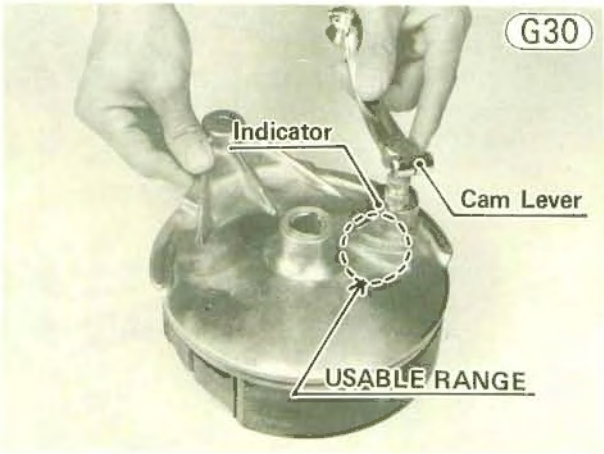
- Remove the brake panel ⑲ from the wheel.
- Using a clean cloth around the linings to prevent grease or oil from getting on them, remove the brake shoes ⑮ by pulling up on the center of the linings as shown in Fig. G29.



- Remove the springs (2) ⑯ to separate the two brake shoes.
- Mark the position of the cam lever ㉙ so that it can be installed later in the same position.
- Unbolt and remove the cam lever, brake lining wear indicator ㉗, dust seal ㉙, and camshaft ⑰.

Rear Brake Assembly:

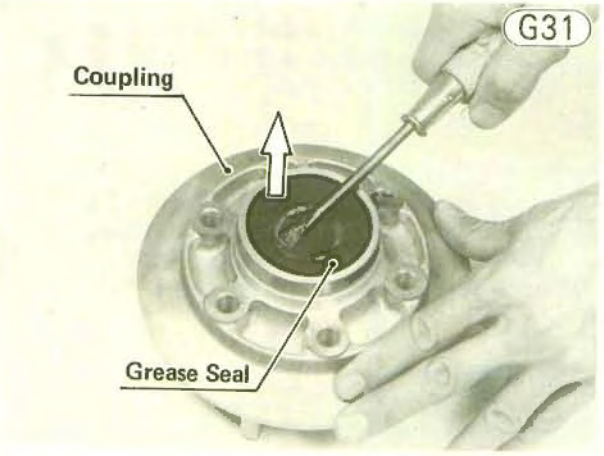
- Clean the old grease from the camshaft, and regrease using regular cup grease. Apply grease to the center of the shaft and on the cam surfaces. Do not over-grease.
- Put the camshaft back into the panel.
- Fit the springs onto the brake shoes, and wrapping a clean cloth around the linings to prevent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

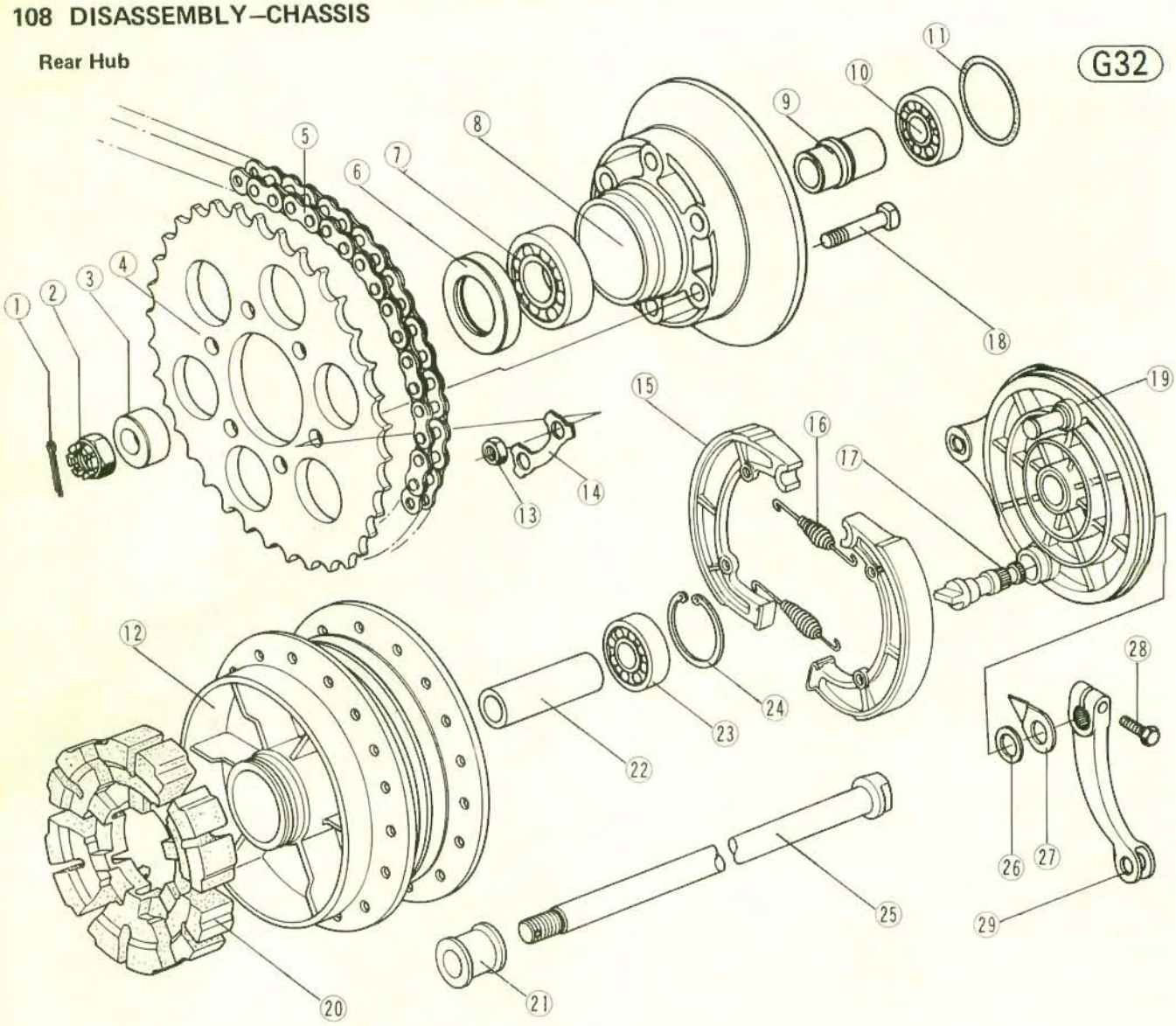
Wheel Coupling Disassembly:

- Pull out the coupling collar ③ from the left, and the coupling sleeve ⑨ from the right.
- Install the rubber damper ⑳ 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 ⑬ (6), the double washers, and the sprocket bolts ⑱ (6) to separate the rear sprocket ④ and wheel coupling ⑧.
- Remove the coupling from the rear wheel.
- Using a hook, pull out the grease seal ⑥.



Rear Hub

G32



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

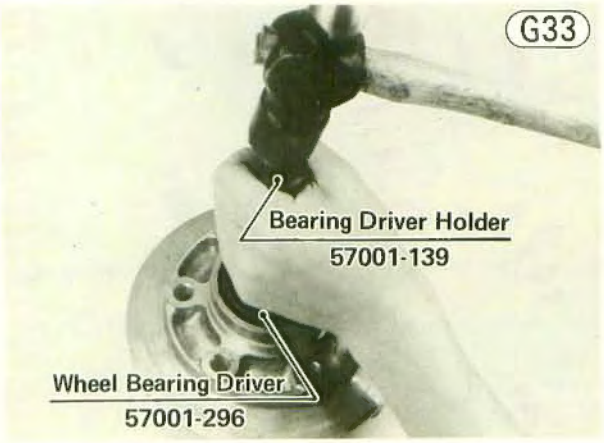
●Remove the bearing (7) by tapping from the wheel side evenly around the bearing inner race.

Wheel Coupling Assembly:

●Inspect the bearing, and replace if necessary (Pg. 174). Lubricate it (Pg. 174), and install it using the wheel bearing driver and the bearing driver holder (special tools). Drive the bearing until it stops at the bottom of the hole (Fig. G33).

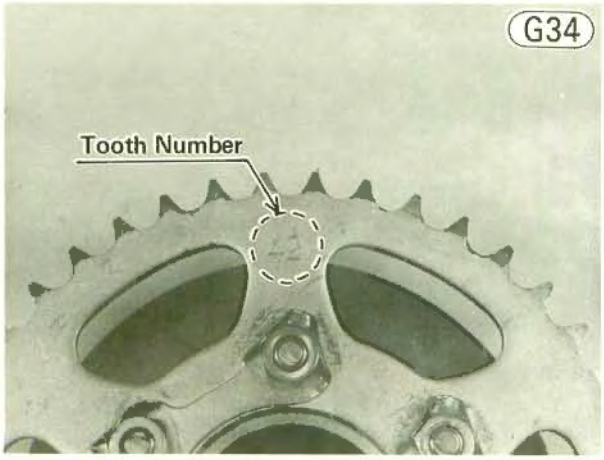
●Replace the grease seal with a new one using the same special tools used for the bearing installation. Drive the seal so that the face of the seal is level with the end of the grease seal hole.

G33



●Install the rear sprocket, bolts (6), double washers (3), and nuts (6), and tighten the nuts 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 dampers and wheel coupling on the rear hub, and then tighten the sprocket nuts with 3.5~4.3 kg-m (25~31 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 grease seal ⑥ using a hook, and remove the circlip ㉔.
●Insert a metal rod into the hub from the brake panel slide, and remove the left side bearing ⑦ by tapping evenly around the bearing inner race. The distance collar ㉑ will come out with the bearing.
●Insert the metal rod into the hub from the other side, and tap out the remaining bearing ⑩.

Rear Hub Assembly Notes:

1. Inspect the bearings and replace if necessary (Pg. 174). Install them using the wheel bearing driver and the bearing driver holder (special tools).

2. Inspect the grease seal and replace if necessary (Pg. 174). Press it in until it stops at the bottom of the hole using the wheel bearing driver and the bearing driver holder (special tools 57001-139, 290).
3. Inspect the **O** ring ⑪ and replace if necessary.

TIRE, TUBE

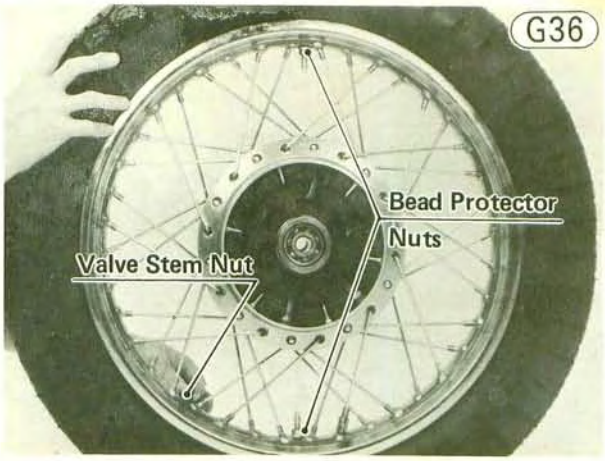
Removal:

●Remove the wheel from the motorcycle (Pg. 99 or 106).

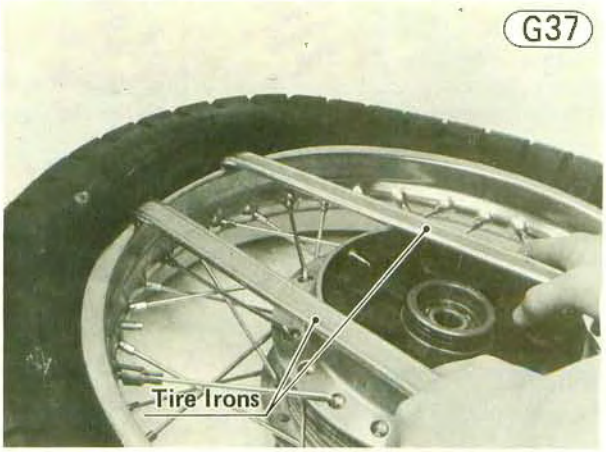
CAUTION **Do not lay the wheel on the ground with the disc facing down. This can damage or warp the disc.**

●Mark the valve stem position on the tire with chalk so that the tire will 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, and fully loosen the two bead protector nuts.

NOTE: Front tire has not tire bead protectors.



●Use a rubber mallet to break the tire beads 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 one of the bead protectors and then pry the other side of 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 inside the tire with talcum powder, and insert the tube *into* the tire now, 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 back onto the rim and fit the bead protectors into the tire. Be sure that the tire does not go on backwards; the rear tire has an arrow molded into the sidewall to show the direction of tire rotation. Align the chalk mark on the tire with the valve stem.

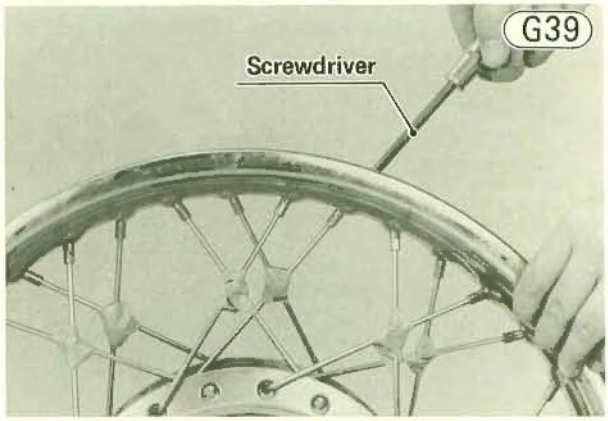
NOTE: If a new tire is installed, the yellow paint mark on the tire should be aligned with the valve stem for best balancing results.

- 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. 170).
- Tighten the bead protector and valve stem nuts, and put on the valve cap.
- Balance the wheel (Pg. 27).
- Mount the wheel on the motorcycle (Pg. 99 or 106).
- Adjust the drive chain (Pg. 24), if the rear wheel was removed.

RIM

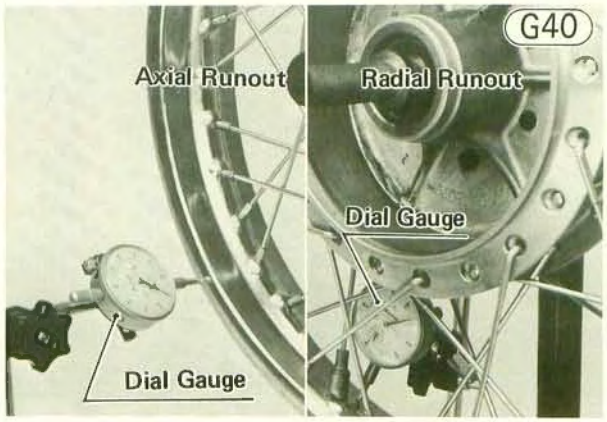
Removal:

- Remove the wheel from the motorcycle (Pg. 99 or 106).
- Take the tire and tube off the rim (Pg. 109).
- Remove the bead protectors (only on the rear wheel) and the rubber band.
- 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:

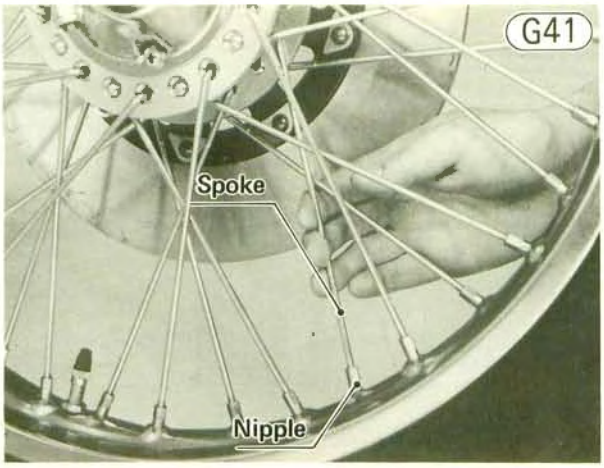
- Fit all the spokes through the holes, and screw all the nipples onto the spokes tightening them partially.
- Suspend the wheel by the axle, and set up a dial gauge to measure rim runout. Fix the axle in place if necessary to prevent horizontal movement.



- Tighten the spokes evenly so that the radial (out from the axle) runout is less than 1.0 mm and the axial (side to side) runout is less than 0.8 mm.
- Make sure that the spokes are tightened evenly. Standard torque is 0.2 ~ 0.4 kg-m (17 ~ 35 in-lbs).
- Mount the tube and tire (Pg. 110).
- Balance the wheel (Pg. 27).
- Mount the wheel on the motorcycle (Pg. 99 or 106).
- Adjust the drive chain (Pg. 24), 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.

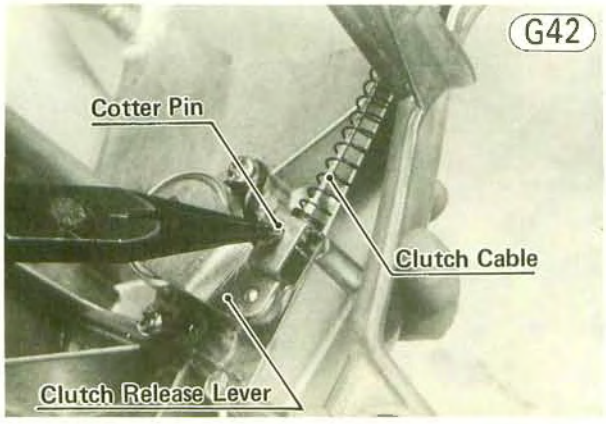


- Tighten with a spoke wrench. Standard torque is 0.2~0.4 kg-m (17~35 in-lbs).
- Inflate the tire to standard pressure (Pg. 170).

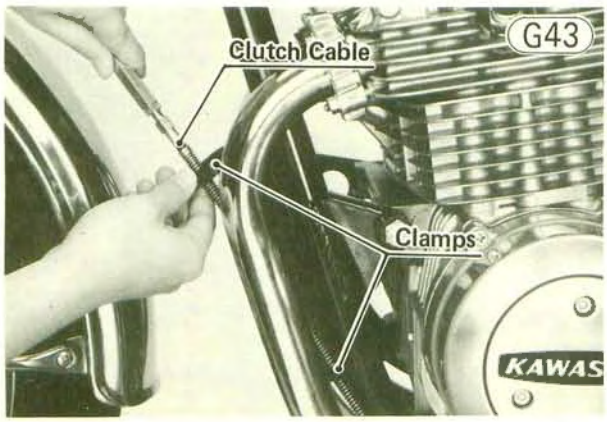
CLUTCH CABLE

Removal:

- Remove the clutch cable clamps (2) from the cable.
- Remove the engine sprocket cover (Pg. 56).
- Remove the cotter pin, and disconnect the tip of the clutch cable from the clutch release lever.



- Loosen the locknut on the clutch lever, and screw in the adjuster.
- Line up the slots in the clutch lever, locknut, and adjuster and free the cable from the lever.
- Pull the cable free from the motorcycle with the clamps (2).



Installation:

NOTE: Before installing the clutch cable, lubricate it.

- Run the upper end of the cable between the left fork leg and the head pipe to the clutch lever.
- Fit the tip of the cable back into the clutch lever.
- Run the lower end of the clutch cable between the left down tube and the lower part of the engine, and spring. Fit the tip of the inner cable into the clutch release lever.
- Using a new cotter pin, secure the cable tip to the release lever.
- Install the engine sprocket cover (Pg. 56).
- Fasten the clutch cable to the frame down tube with the clamps (2).
- Adjust the clutch (Pg. 20).

THROTTLE CABLES

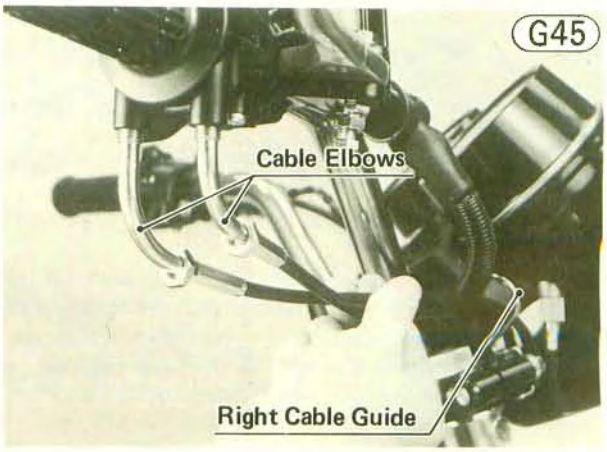
Removal:

- Remove the fuel tank (Pg. 41).
- Screw in fully the locknuts and adjusting nuts at the upper end of the throttle cables so as to give the cables plenty of play.

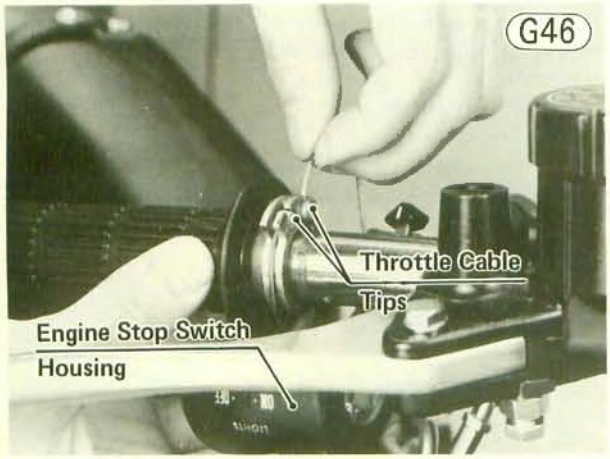
CAUTION **Removing the throttle cables from the carburetors without enough cable play, may cause throttle cable damage.**

- Loosen the throttle cable adjuster mounting nuts (2 ea) fully, remove the accelerator throttle cable adjuster from its bracket, and slip the tip of its inner cable out of the pulley. Then do the same with the decelerator throttle cable.

- Loosen both cable elbow nuts, and pull out the cables through the right cable guide on the stem head.

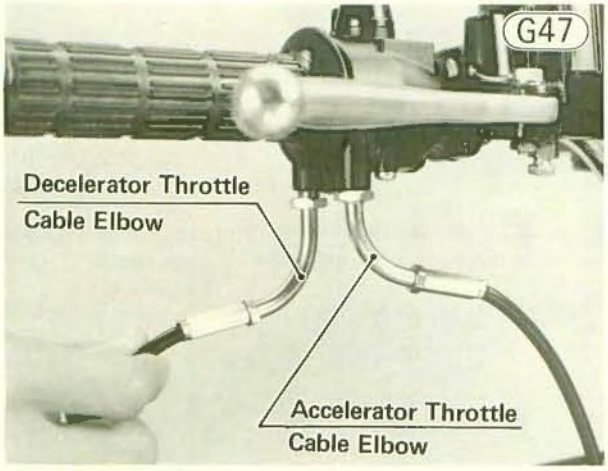


•Remove the engine stop switch housing screws (2), and open the housing.
•Slip both throttle cable tips from their catches in the throttle grip.

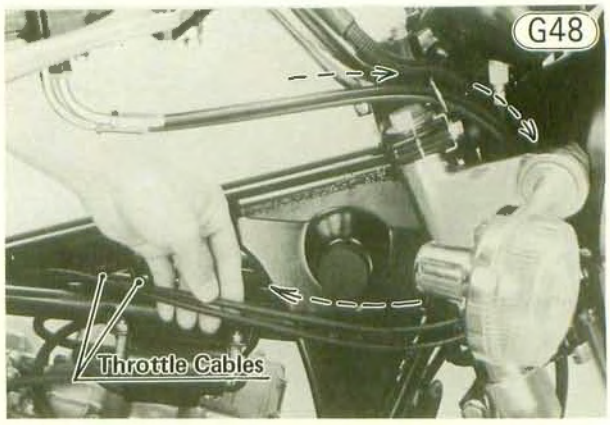


•Unscrew the decelerator throttle cable elbow (the elbow next to the starter button), and pull the cable out of the engine stop switch housing. Then do the same with the accelerator throttle cable elbow to free the throttle cables from the motorcycle.

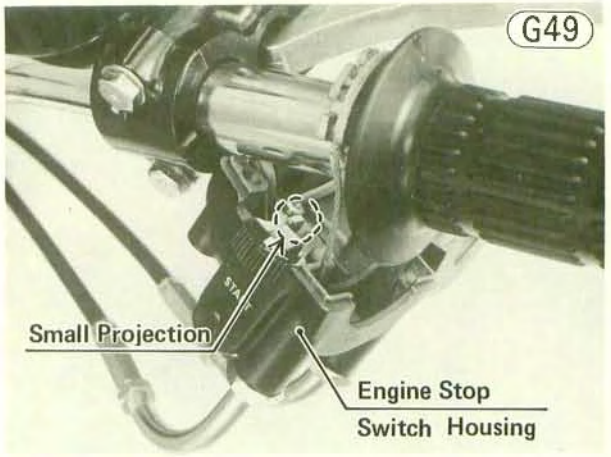
Installation:
NOTE: Before installing the throttle cables, lubricate them.
•Screw the accelerator throttle cable elbow (shorter than the decelerator throttle cable elbow) into the side of the engine stop switch opposite the starter button. Screw it in almost all the way, and then lightly tighten the elbow nut.



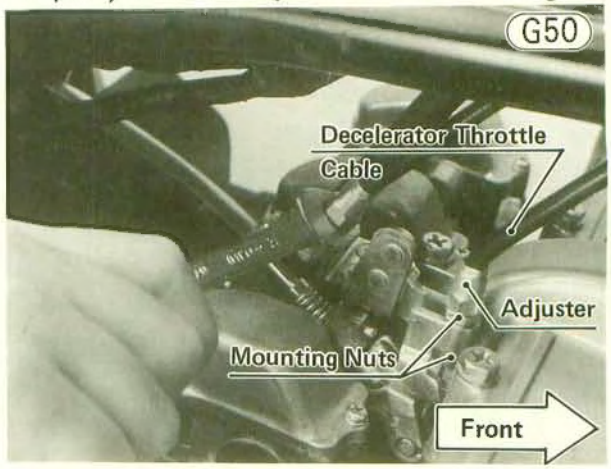
•Screw in the decelerator cable elbow almost all the way, and then lightly tighten the elbow nut.
•Run both cables through the right cable guide on the stem head, between the right front shock absorber and the head pipe, and between the right top tube and upper tube to the carburetors. The cables should be naturally routed, neither one twisted about the other.



•Turn the throttle grip so that the cable catches are facing up, fit the accelerator throttle cable tip in the front catch and the other cable tip in the rear catch.
•Put together the engine stop switch housing, and tighten its screws. The lower half of the housing has a small projection which fits into the small hole in the handlebar. The front switch housing screw is longer than the rear screw.



•Turn each elbow in the direction of its cable, and tighten its nut to secure the elbow in the proper position.
•Fit the tip of the decelerator throttle cable into the front catch in the pulley, and install its adjuster into the cable bracket. Holding the lower mounting nut in place, screw the adjuster into the mounting nut.

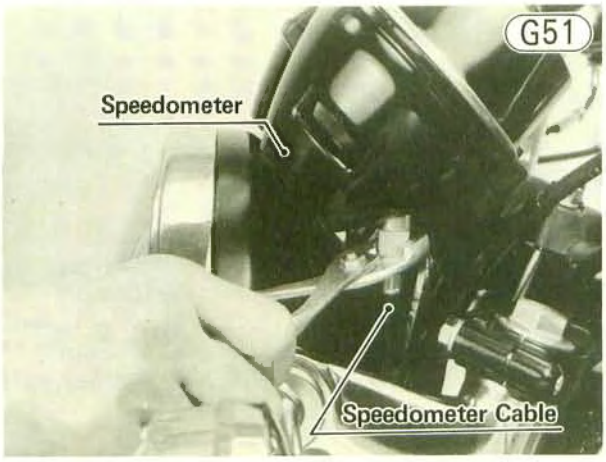


- Fit the tip of the other cable into the other catch, install its adjuster onto the bracket while turning the throttle grip at the same time, if necessary, and install the lower mounting nut.
- Center each adjuster in its place in the bracket, and tighten the mounting nuts.
- Adjust the throttle cables (Pg. 17).

SPEEDOMETER CABLE

Removal:

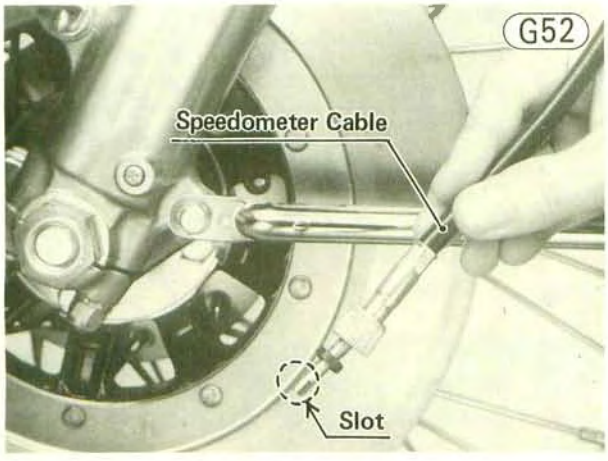
- Disconnect the upper and lower ends of the speedometer cable with pliers.



- Pull the cable free.

Installation:

- Run the speedometer cable through its guides at the 3-way joint and the front fender left side, 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.



TACHOMETER CABLE

Removal:

- Disconnect the upper end of the tachometer cable with pliers and the lower end of the cable with a wrench.
- Free the cable from the motorcycle.

Installation:

- Run the tachometer cable through its guide at the 3-way joint, 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. Turn it if necessary so that it fits all the way into place, and tighten its nut with a wrench.

HEADLIGHT UNIT

Removal:

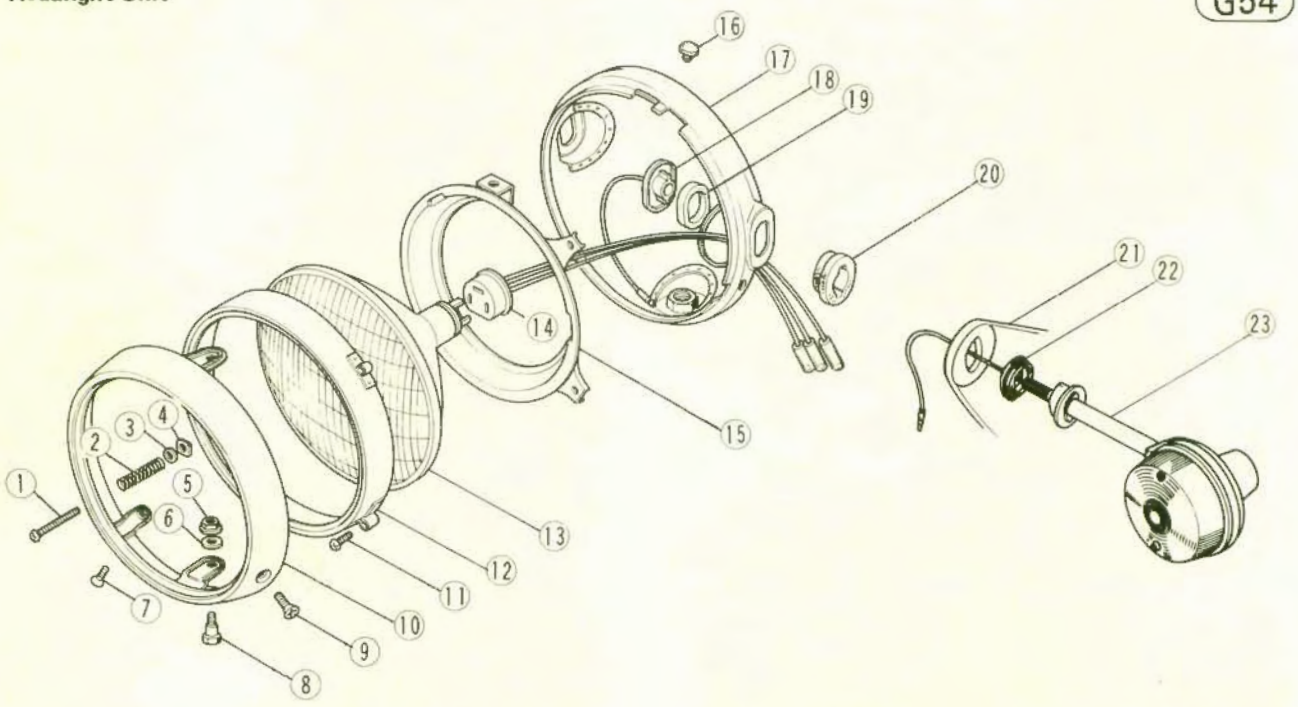
- Take out the retaining screws ⑨ (2), and swing the unit ⑬ from the housing ⑰.
- Disconnect the headlight socket ⑭ from the rear of the unit. For semi-sealed beam units, the bulb can now be removed.
- Remove the pivot screws ⑧, nuts ⑤, washer ⑥, and rubber dampers (2 ea), and the beam horizontal adjusting screw ①. A nut ④, spring seat ③, and spring ② come off with the adjusting screw.
- Separate the outer rim ⑩ from the inner rim ⑫.
- Remove the screws ⑪ (2), and separate the sealed beam unit from the inner rim and mounting rim ⑮.

Installation Notes:

1. Place the sealed beam unit into the mounting rim, fitting the raised portion into its holders on the mounting rim. 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.

Headlight Unit

G54



1. Adjusting Screw
2. Spring
3. Spring Seat
4. Nut
5. Nut
6. Washer
7. Screw
8. Pivot Screw
9. Retaining Screw
10. Outer Rim
11. Screw
12. Inner Rim
13. Sealed Beam Unit
14. Socket
15. Mounting Rim
16. Plug
17. Housing
18. Collar
19. Damper
20. Damper
21. Fork Cover
22. Damper
23. Turn Signal

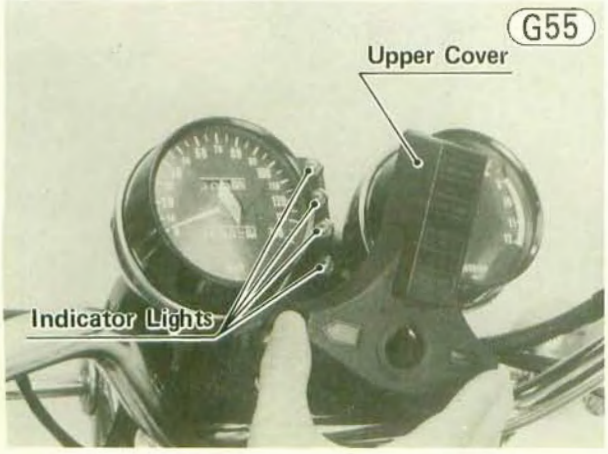
2. The washer on the adjusting screw goes between the spring and the bracket.
3. Carry out horizontal beam adjustment after installation (Pg. 28).

INDICATOR LIGHTS (Neutral, High Beam, Oil, Stop Lamp, Left and Right Turn)

Removal:

- Remove the ignition switch mounting nut and take off the upper cover.

G55



- Remove the indicator lights (6) the same way as illuminator light removal (Fig. G61).

Installation Note:

- Use the bulbs shown in Table G2 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.

Table G2 Indicator Lights

Bulb Wattage	Indicator Lights	Lead Color
12V 3.4W	Neutral	Green/Red, Brown
	High Beam	Black/Yellow, Red/Black
	Oil	Blue/Red, Brown
	Stop Lamp	Green/White, Brown
	Left Turn Signal	Black/Yellow, Green
	Right Turn Signal	BLack/Yellow, Gray

TURN SIGNAL LIGHT (Burn out Replacement)

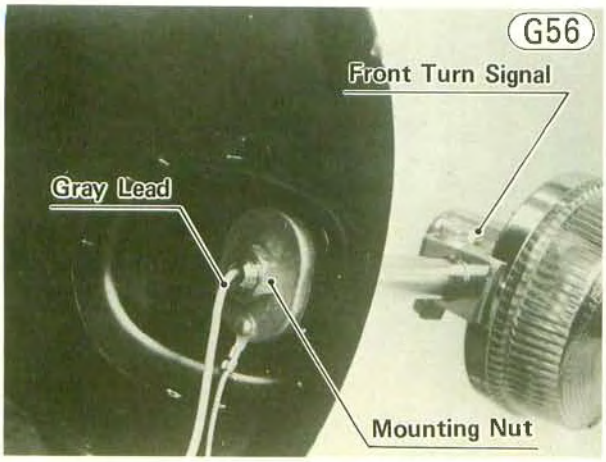
- Remove the lens mounting screws, and take off the lens.
- Press the bulb inwards, and holding the bulb in this position, twist it to the left and pull it out.

- Install a new 12 volt bulb of the correct wattage (see the wiring diagram).
- Fit the rubber gasket in place, if removed, 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 from the housing.
- Disconnect the headlight socket from the rear of the unit.
- Disconnect the turn signal gray 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. G54.
2. Connect the turn signal leads referring to Table G3.

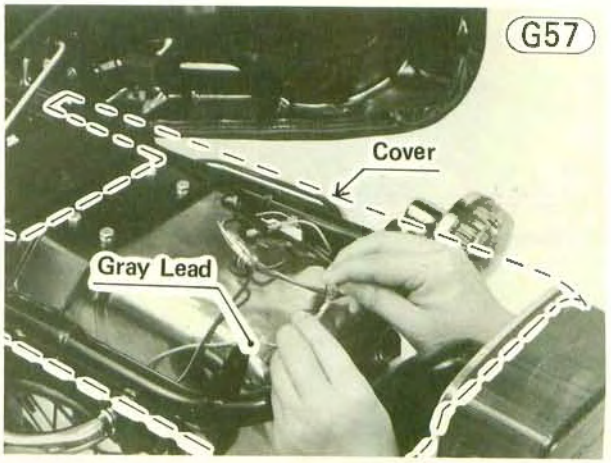
Table G3 Turn Signal Lead Color

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

3. Adjust the headlight vertically.

Removal (rear, either side):

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

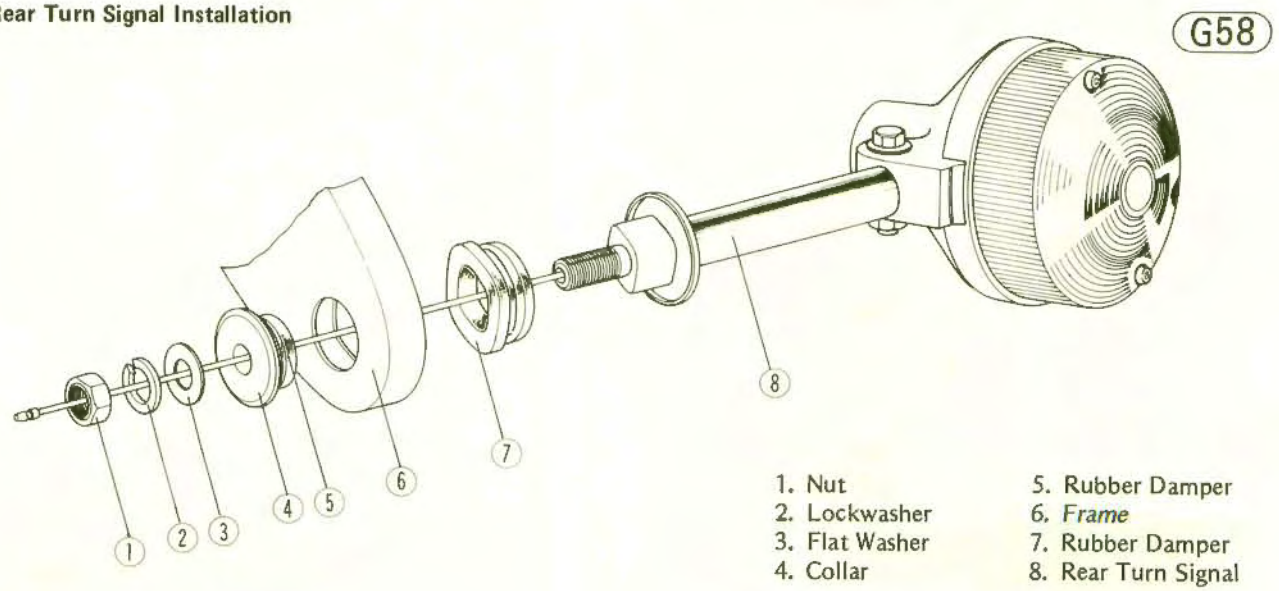


- Remove the nut and lockwasher, and pull the rear turn signal from the frame.

Installation Notes (rear, either side):

1. If the rear turn signal dampers have been removed, install them as illustrated.
2. Connect the turn signal leads according to Table G3.

Rear Turn Signal Installation

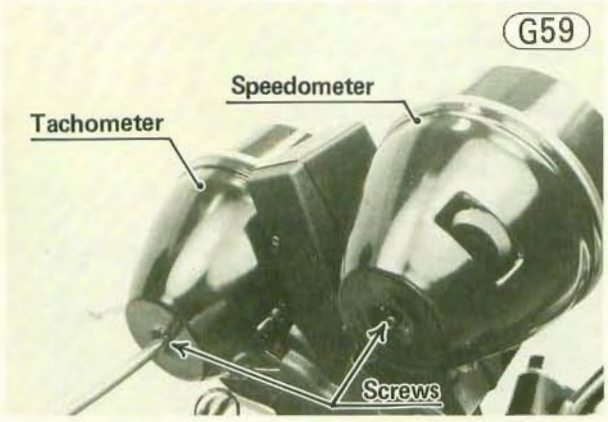


1. Nut
2. Lockwasher
3. Flat Washer
4. Collar
5. Rubber Damper
6. Frame
7. Rubber Damper
8. Rear Turn Signal

SPEEDOMETER, TACHOMETER, ILLUMINATOR LIGHTS

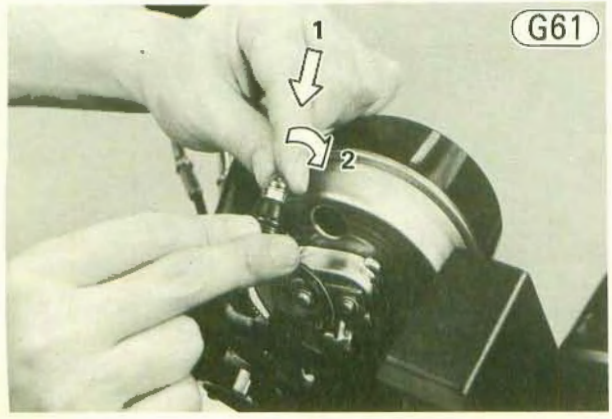
Removal:

- Remove the left and right front turn signal assemblies (Pg. 115), and move the headlight housing down slightly.
- Disconnect the upper end of the speedometer cable and tachometer cable with pliers.
- Remove the screw and lockwasher, and wiring grommet from the meter cover, and pull off the cover.



- Remove the nuts, lockwashers, flat washers, dampers, and collars (2 ea) from the bottom of the meter holder.

- Pull up on the front of the meter, and pull out the illuminator lights (2) from their base to complete meter removal.
- 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.

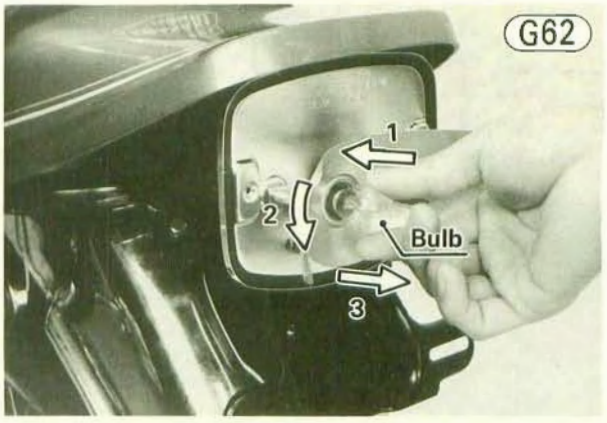


Installation Notes:

1. Use 12V 3.4W bulbs for illuminator light replacement.
2. If the headlight housing dampers have been removed, install the dampers as illustrated in Fig. G54.
3. Carry out the vertical headlight adjustment after installation (Pg. 28).

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.

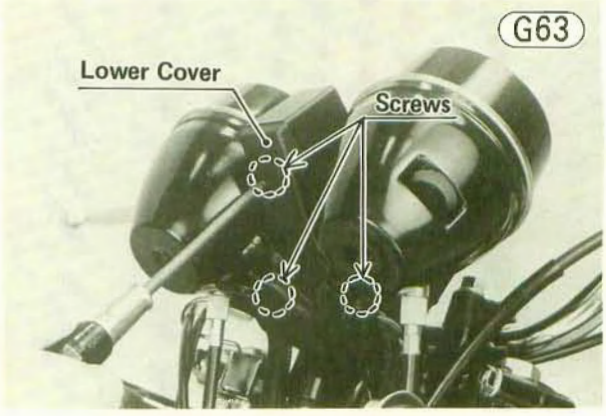


- Replace a burned out bulb with a new 12 volt bulb of the correct wattage (see the wiring diagram).
- Fit the rubber gasket in place, if removed, and install the lens. Be careful not to overtighten the mounting screws.

IGNITION SWITCH

Removal:

- Remove the left and right front turn signal assemblies (Pg. 115).
- 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 screws and lockwashers (3 ea) from the bottom of the indicator light panel, and remove the lower cover.



•Unscrew the ignition switch mounting nut, and pull out the ignition switch holder and ignition switch.

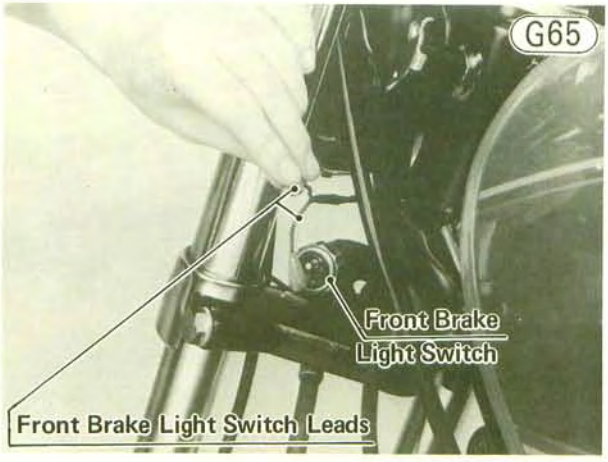
Installation:

•Fit the ignition switch and its holder in place, and screw the ignition switch mounting nut onto the switch.
•Install the lower cover and tighten the screws (3). Each screw has a lockwasher.
•Connect the ignition switch wiring harness socket to its plug in the headlight housing.
•Install the turn signal assemblies (Pg. 115).
•Adjust the headlight vertically (Pg. 28).

FRONT BRAKE LIGHT SWITCH

Removal:

•Disconnect the front brake light switch leads from the switch.



•Unscrew the front brake light switch from the 3-way joint.

CAUTION **If brake fluid spills when the switch is removed, painted surfaces may be damaged. Wipe up any spilled fluid immediately.**

Installation Notes:

1. Apply a small, amount of a non-permanent locking agent to the switch threads before mounting the switch. So that no locking agent will get mixed in with the brake fluid, do not apply any on the lower one-fourth of the threads.
2. Tighten the front brake light switch with 2.6 ~ 3.0 kg-m (19~22 ft-lbs) of torque.
3. After the switch has been installed, bleed the front brake lines.

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.
•Loosen the lower mounting nut fully, and remove the rear brake light switch.

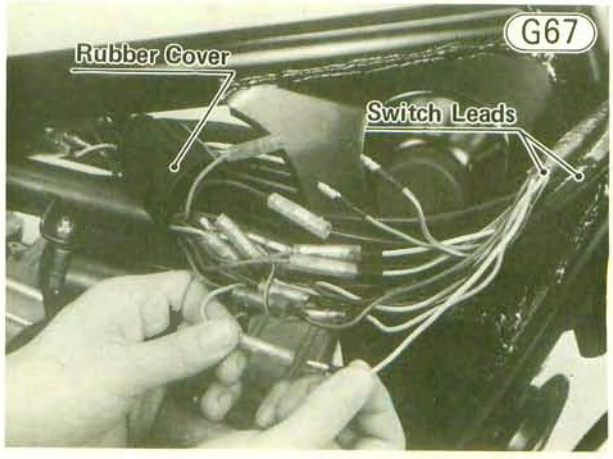
Installation Note:

•Adjust the switch after installation (Pg. 26).

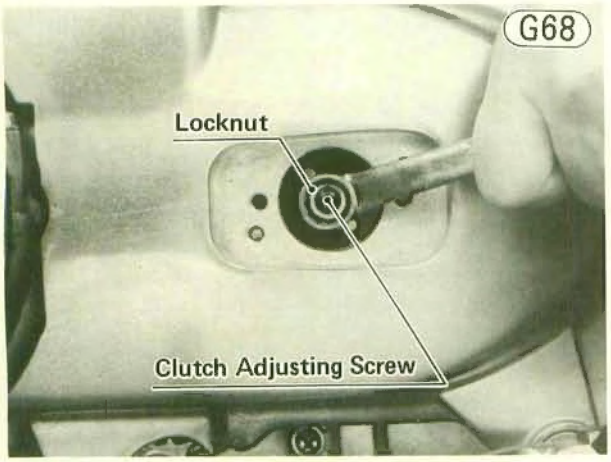
HANDLEBAR

Removal:

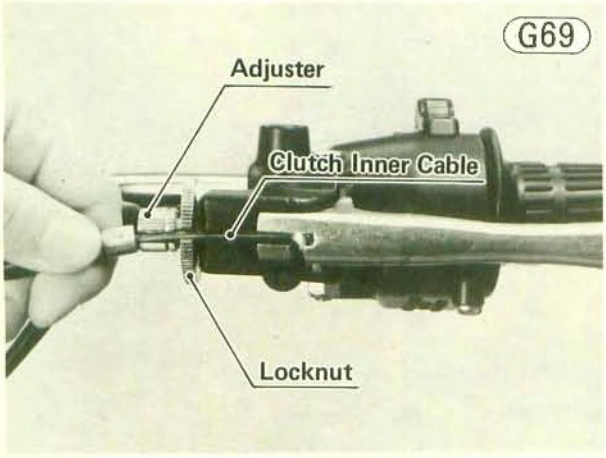
•Take off the rear view mirrors.
•Remove the fuel tank (Pg. 41).
•Remove the throttle cables (Pg. 111).
•Slide the rubber cover out of place and disconnect all leads from the left and right switch housings and the starter lockout switch under the frame top tube.



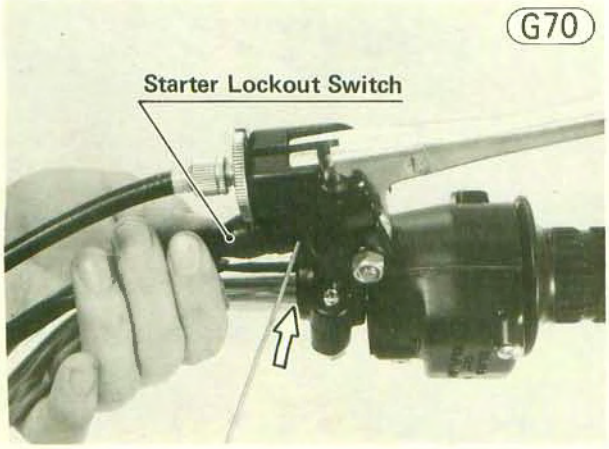
- Remove the clutch adjusting cover.
- Loosen the locknut, and back out the clutch adjusting screw a couple of turns to give the clutch cable plenty of play.



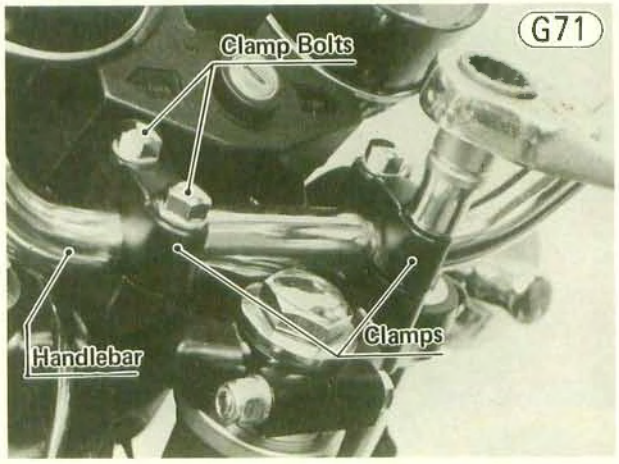
- Loosen the locknut on the clutch lever, and screw in the adjuster and line up the slots in the clutch lever, locknut, and adjuster. Free the inner cable from the lever.



- Using a thin-bladed screwdriver or some other suitable tool, press in the starter lockout switch tab which catches in the hole in the underside of the clutch lever holder, and then remove the switch.



- Remove the master cylinder clamp bolts and washers (2 ea), and remove the master cylinder.
- Remove the handlebar clamp bolts and lockwashers (4 ea), and remove the clamps and handlebar.



Installation:

- Run the switch leads between the stem head and the meter holder, and install the handlebar.
- 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 1.6 ~ 2.2 kg-m (11.5~16.0 ft-lbs) of torque.

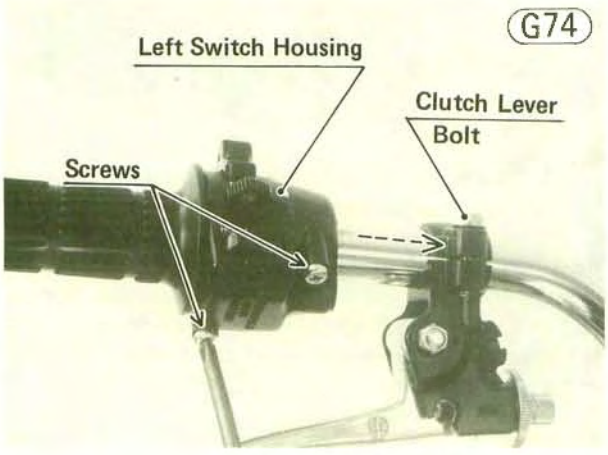
- Push the starter lockout switch into the clutch lever holder.
- With the brake lever mounted at the proper angle and with the master cylinder clamp installed with the small projection towards the throttle grip, tighten first the upper and then the lower master cylinder clamp bolt with 0.6 ~ 0.9 kg-m (52~78 in-lbs) of torque (Fig. G19).
- Connect the right and left switch leads to the same color leads of the main wiring harness.

NOTE: Connect one of the two black leads come from starter lockout switch to the main wiring harness black lead, and the other black lead to the black lead come from the right switch housing.

•Cover the lead connections with the rubber cover.
•Fit the tip of the clutch cable back into the clutch lever.
•Install the throttle cables (Pg. 112).
•Install the rear view mirrors.
•Adjust the clutch (Pg. 20).
•Adjust the throttle cables (Pg. 17).
•Adjust the rear view mirrors.

Disassembly

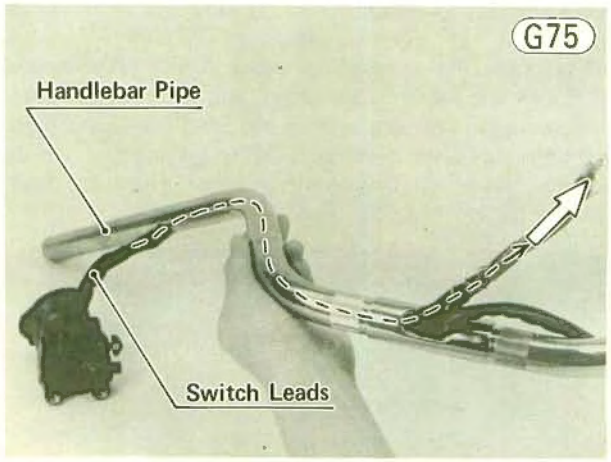
•Pull the right switch housing leads out of the handlebar.
•Take out the left switch housing screws (2), and open the switch housing. If necessary, loosen the clutch lever bolt, and slide the clutch lever to the right.



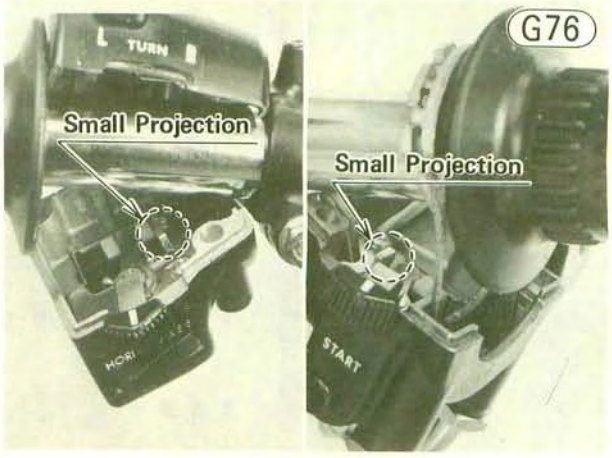
•To remove the clutch lever, loosen the clutch lever bolt, cut off the left handlegrip, which is bonded to the handlebar, and slide off the clutch lever.

Assembly Notes:

1. If it is difficult to run the switch leads through the handlebar pipe as they are; connect the end of the switch leads to a fine wire, run this wire through the handlebar, and pull the leads through and out the opening at the center of the handlebar. Take care not to damage the leads.



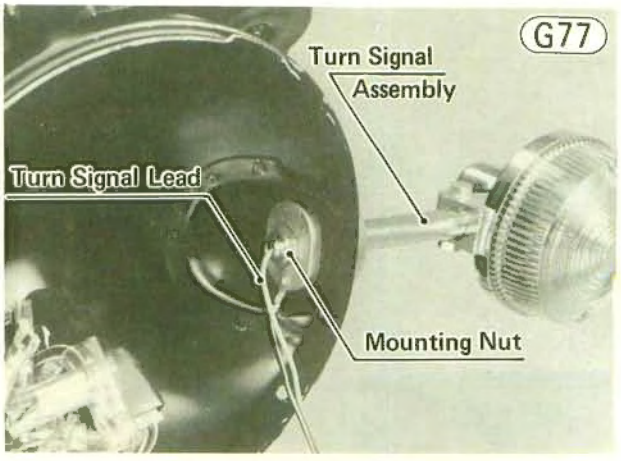
2. The lower half of each switch housing has a small projection fits into a small hole in the handlebar.



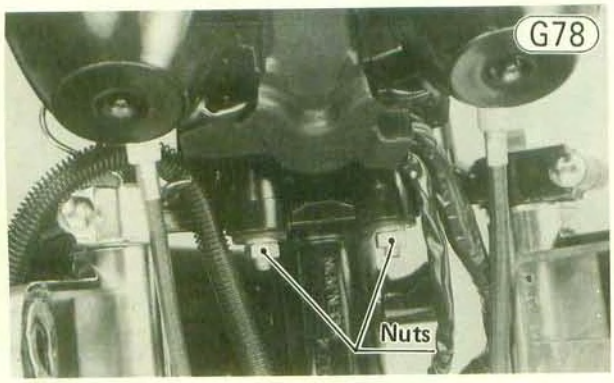
STEERING STEM

Removal:

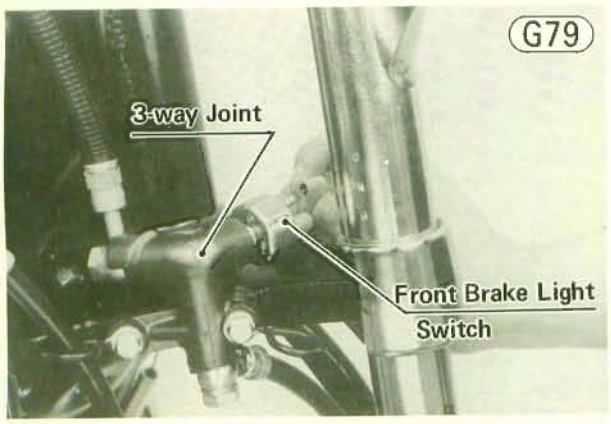
•Remove the fuel tank (Pg. 41).
•Remove the front wheel (Pg. 99).
•Remove the handlebar (Pg. 117).
•Disconnect the turn signal leads, main harness plugs (9-pin and 4-pin).
•Remove the turn signal mounting nuts (2), and take off the turn signal assemblies.



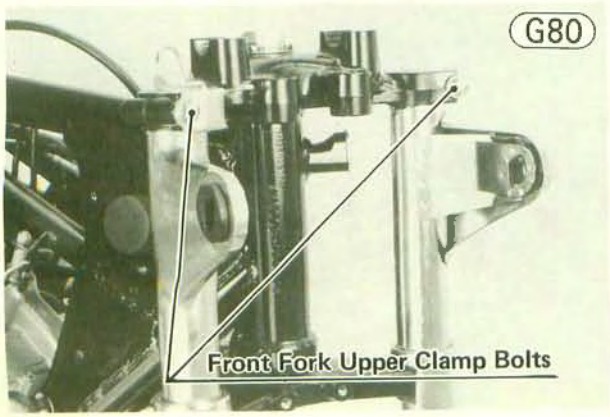
- Remove the headlight housing and starter lockout switch.
- Disconnect the tachometer cable at the tachometer.
- Remove the nuts, lockwashers, and flat washers that secure the instrument unit to the stem head, and then remove the instrument unit while pulling the speedometer cable out through its guides. There are four rubber dampers.



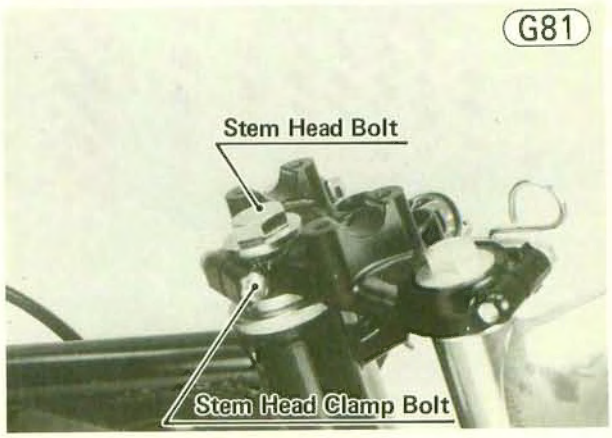
- Remove the caliper (Pg. 102).
- Remove the fender bolts (6), and take off the fender.
- Disconnect the front brake light switch leads from the switch.



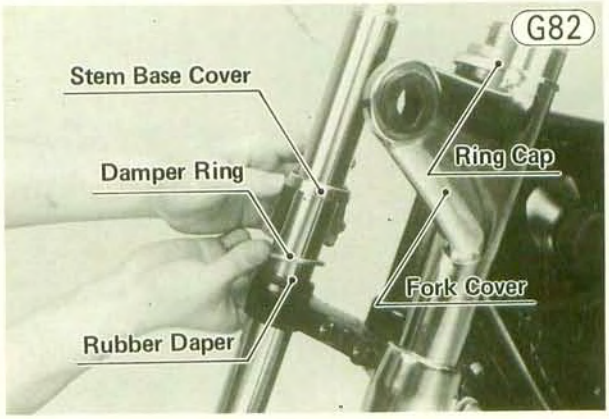
- Remove the 3-way joint with the two cable guides and the headlight housing stay.
- Remove the master cylinder together with the upper and lower brake hoses, 3-way joint, and brake pipe.
- Loosen the front fork upper clamp bolts (2).



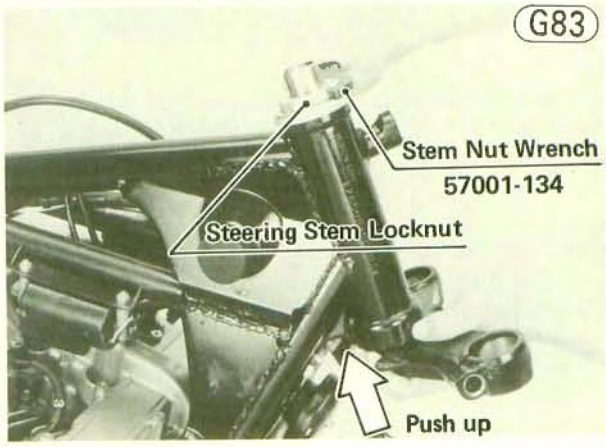
- Loosen the stem head clamp bolt, and remove the stem head bolt, lockwasher, and flat washer.



- 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 stem base cover, damper ring, and rubber damper at the bottom.



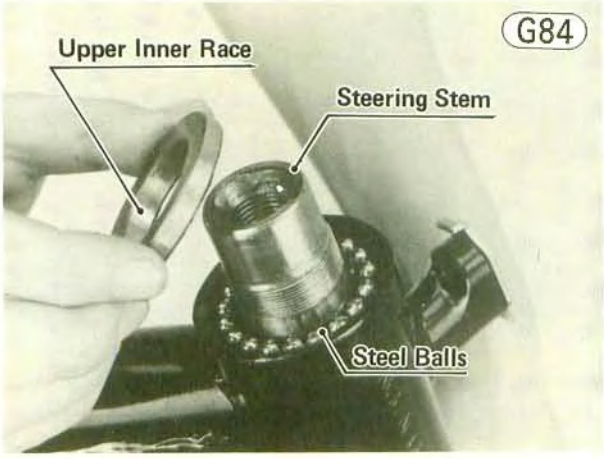
- Loosen the lower clamp bolts, and pull out each fork leg with a twisting motion.
- Push up on the stem base, and remove the steering stem locknut with the stem nut wrench (special tool); then remove the steering stem and stem base (single unit). As the stem is removed, some of the steel balls will drop out of the lower outer race. Remove the rest. There are 20 steel balls at the lower outer race.



•Remove the steering stem cap and upper inner race, and remove the upper steel balls (19).

Installation:

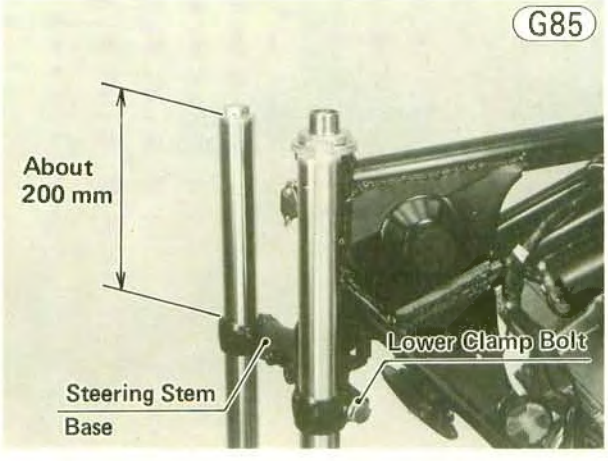
•Apply grease to the upper and lower outer races in the head pipe so that the steel balls will stick in place during stem insertion, and install the upper steel balls (19) and lower steel balls (20). All upper and lower steel balls are one size.



•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 provisional. The tightness changes with steering stem adjustment (Pg. 26).

•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 200 mm above the steering stem base.

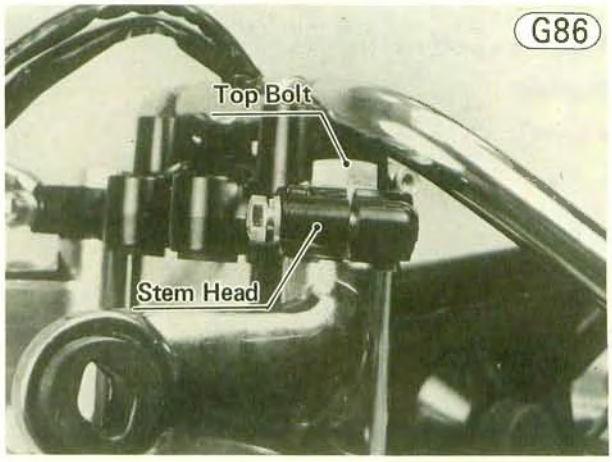


•Install the rubber damper, damper ring, base cover, fork cover, and ring cap on each tube in this order.

•Install the stem head, and the stem head lockwasher and flat washer (flat side facing down). Screw in the stem head bolt loosely. Be sure the wiring harness and all cables go in front of the stem head.

•Fit the handlebar onto the steering stem. Be sure there are two rubber dampers on each handlebar holder stem.

•For each fork leg, loosen the lower clamp, and align the upper surface of the top bolt flange with the upper surface of the stem head. Tighten the upper clamp bolt with 1.6~2.2 kg-m (11.5~16.0 ft-lbs).



•Tighten the stem head bolt with 4~5 kg-m (29~36 ft-lbs) of torque and the rear clamp bolt with 1.6~2.2 kg-m (11.5~16 ft-lbs) of torque.

•Tighten the fork leg lower clamp bolts with 3.4~4.6 kg-m (25~33 ft-lbs) of torque.

•Hook the upper brake hose on the guide on the stem head, and install the 3-way joint. Be sure to include the cable guide with each bolt. Tighten the bolt with 0.7~0.9 kg-m (61~78 in-lbs) of torque.

•Secure the instrument unit to the stem head. Be sure the light switch wiring harness and the engine stop 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 3-way joint. Run the tachometer cable through its guide, fit the inner cable into the tachometer, and tighten the cable nut with pliers.

•Connect the front brake light switch leads onto the switch. The leads may connect to either terminal.

•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, flat washer, and nut (Fig. G54).

•Connect the turn signal leads. The left turn signal lead goes ot 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.

•Install the handlebar (Pg. 118).

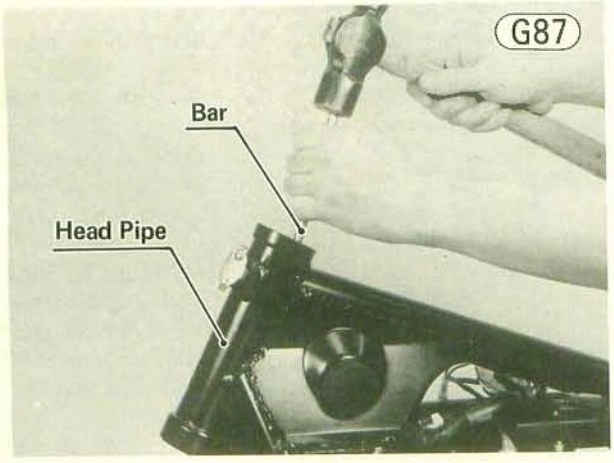
•Install the front fender between the front fork leg. First screw in the right side 3 mounting bolts, insert the guide holder plate between the left front fork leg and the front fender, then install the left side 3 mounting bolts. Tighten the bolts securely. Each bolt has a lockwasher.

- Run the speedometer cable lower end through its guide next to the front brake hose guide.
- Install the front wheel (Pg. 99).
- Install the caliper (Pg. 102).
- Install the fuel tank (Pg. 41).
- Refill the brake lines and bleed the air (Pg. 180).
- Check the steering (Pg. 26), and adjust if necessary.
- Adjust the headlight (Pg. 28).

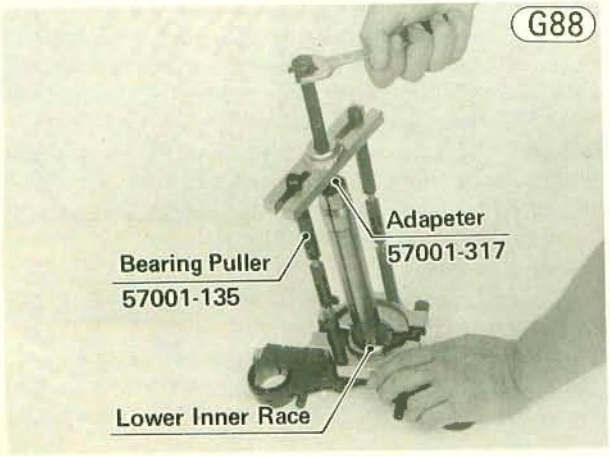
STEERING STEM BEARING

Removal:

- Remove the steering stem (Pg. 119).
- 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.

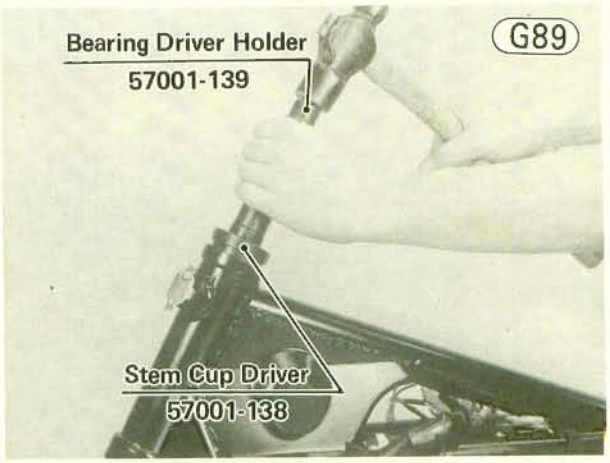


- Remove the lower inner race, which is pressed onto the steering stem, with a stem bearing puller and adapter (special tools). Be careful not to damage the grease seal under the race during race removal.



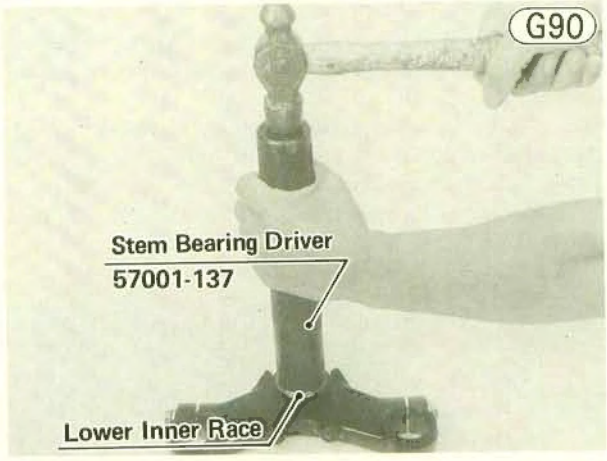
Installation:

- Apply oil to the outer races, and drive them into 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 damaged.

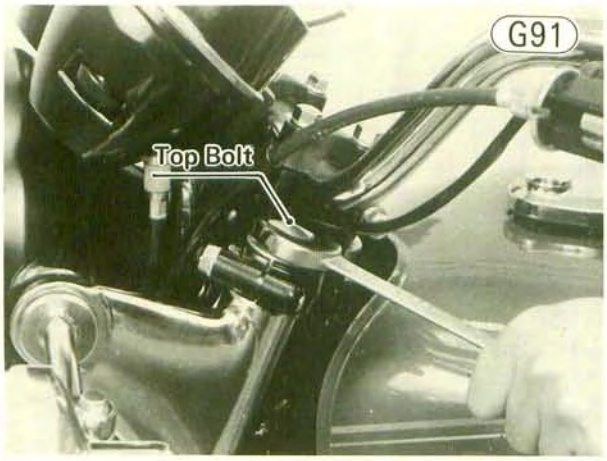


- Install the steering stem (Pg. 121).

FRONT FORK

Removal (left fork leg):

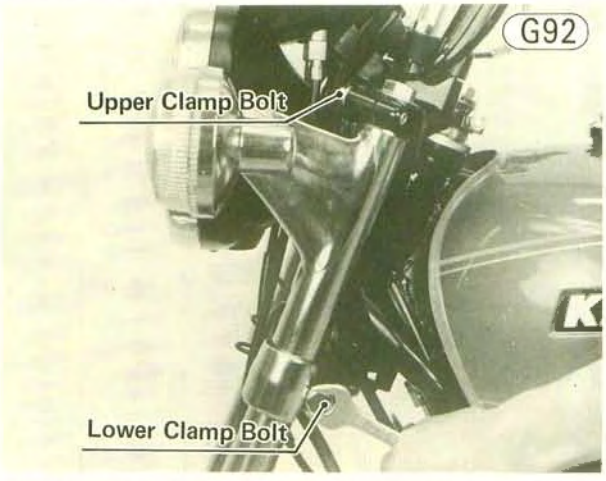
- Remove the front wheel (Pg. 99).
- Remove the bolts (3) that hold the front fender to the left fork leg.
- Remove the caliper mounting bolts (2), and rest the caliper on some kind of stand so that the brake fluid pipe is not bent.
- If the fork leg is to be disassembled after removal, loosen the top bolt now.



- 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 top bolt flange is even with the upper surface of the stem head. Tighten the upper clamp bolt with 1.6 ~ 2.2 kg-m (11.5 ~ 16 ft-lbs) of torque and the lower clamp bolt with 3.4 ~ 4.6 kg-m (25 ~ 33 ft-lbs).



- If the top bolt was loosened during removal, tighten it with 2.5 ~ 3 kg-m (18 ~ 22 ft-lbs) of torque.
- Install the caliper, tightening the caliper mounting bolts with 3.4 ~ 4.6 kg-m (25 ~ 33 ft-lbs) of torque.
  Each mounting bolt has a flat washer and lockwasher.
- Install the fender bolts (with lockwashers) through the guide holder plate, and position the plate between the front fender and the left front fork leg.
- Install the front wheel (Pg. 99).

Removal (right fork leg):

- Remove the front wheel (Pg. 99).
- Remove the bolts (3) that hold the front fender to the right fork leg.
- If the fork leg is to be disassembled after removal, loosen the top bolt now.
- Loosen the upper and lower clamp bolts.
- With a twisting motion, work the fork leg down and out.

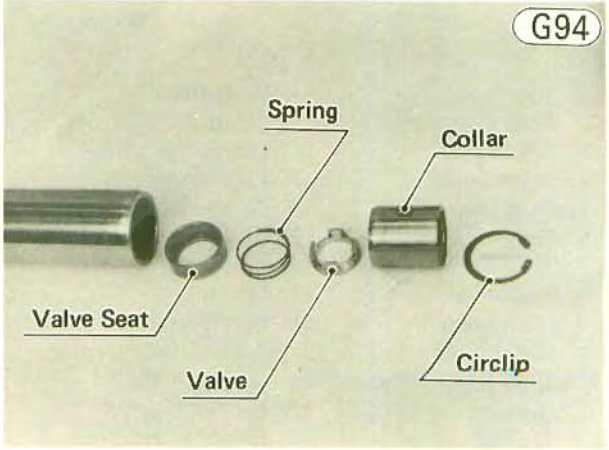
Installation (right fork leg):

- Slide the fork leg up through the lower and upper clamps until the upper surface of the top bolt flange is even with the upper surface of the stem head Fig. G86. Tighten the upper clamp bolt with 1.6 ~ 2.2 kg-m (11.5 ~ 16 ft-lbs) of torque and the lower clamp bolt with 3.4 ~ 4.6 kg-m (25 ~ 33 ft-lbs).
- If the top bolt was loosened during removal, tighten it with 2.5 ~ 3 kg-m (18 ~ 22 ft-lbs) of torque.
- Install the fender bolts. There is a lockwasher for each bolt.
- Install the front wheel (Pg. 99).

Disassembly:

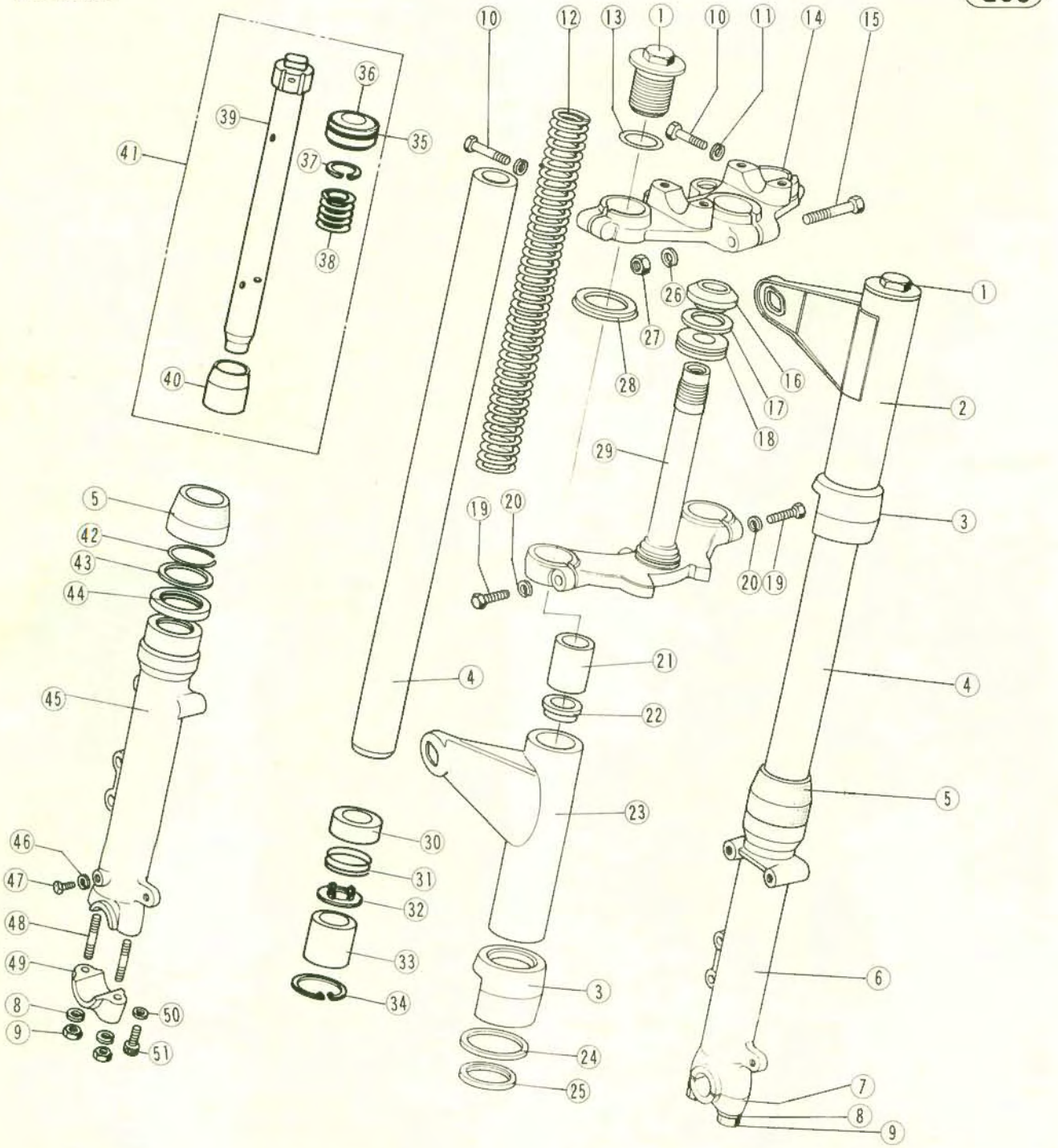
- Remove the top bolt ①, and pull out the spacer ㉑, spring seat ㉒, and spring ⑫.
- Pour the oil into a suitable container, pumping as necessary to empty out all the oil.
- Slide the dust seal ⑤ off the inner tube ④.
- Stop the cylinder ㊴ from turning by using the front fork cylinder holder (special tool). Unscrew the Allen bolt ㊶ from the bottom of the outer tube ㊺, and then separate the inner tube from the outer tube by pulling it out.

- Slide or push the cylinder and piston unit ㊶ and its spring ㊳ out the top of the inner tube.
- Remove the cylinder base ㊵ out the top of outer tube.
- Remove the circlip ㉞ inside the end of the inner tube and pull out the collar ㉝, non-return valve ㉜, spring ㉛, and valve seat ㉚.



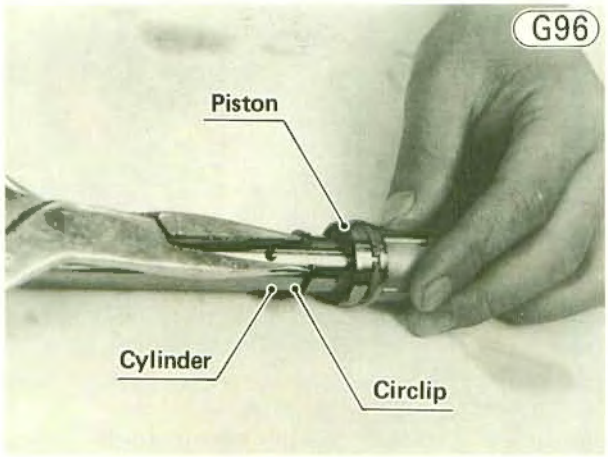
Front Fork

G95



1. Top Bolt
2. Fork Cover
3. Base Cover
4. Inner Tube
5. Dust Seal
6. Outer Tube
7. Axle Clamp
8. Lockwasher
9. Clamp Nut
10. Clamp Bolt
11. Lockwasher
12. Spring
13. O Ring
14. Stem Head
15. Clamp Bolt
16. Lower Inner Race
17. Flat Washer
18. Grease Seal
19. Clamp Bolt
20. Lockwasher
21. Spacer
22. Spring Seat
23. Fork Cover
24. Damper Ring
25. Rubber Damper
26. Lockwasher
27. Nut
28. Ring Cap
29. Steering Stem
30. Valve Seat
31. Valve Spring
32. Non-return Valve
33. Collar
34. Circlip
35. Piston Ring
36. Piston
37. Circlip
38. Spring
39. Cylinder
40. Cylinder Base
41. Cylinder and Piston Unit
42. Retainer
43. Washer
44. Oil Seal
45. Outer Tube
46. Gasket
47. Drain Screw
48. Stud
49. Axle Clamp
50. Gasket
51. Allen Bolt

●Remove the spring (38) and circlip (37), and pull the piston (36) off the cylinder (39).



●Remove the retainer (42) from the outer tube with a sharp hook. Remove the washer (43), and then pull out the oil seal (44). It must be necessary to heat the outer tube around the oil seal before pulling it out.

Assembly Notes:

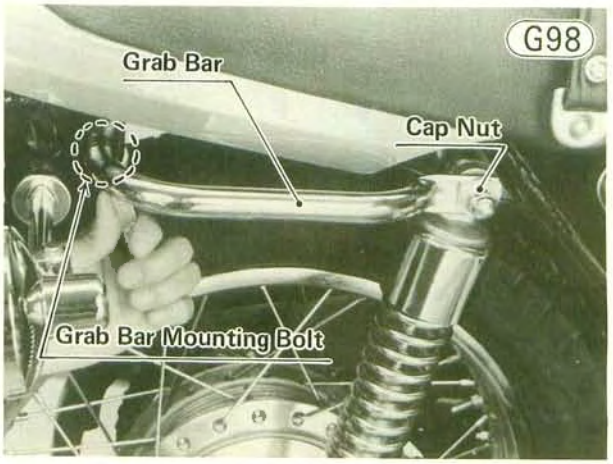
1. Install the collar in the inner tube, and insert the cylinder and piston unit from the top end of the inner tube.
2. Apply a non-permanent locking agent to the Allen bolt, and tighten it using the front fork cylinder holder and holder adapter (special tools) to stop the cylinder from turning. The torque for the Allen bolt is 2~2.6 kg-m (14.5~19 ft-lbs).
3. 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).

4. Refill with 186~194 cc of fresh SAE 10W oil.
5. After installing the front fork legs, tighten the top bolts with 2.5~3.0 kg-m (18~22 ft-lbs) of torque.

REAR SHOCK ABSORBERS

Removal (each side):

●Set the motorcycle up on its center stand.
●Remove the muffler (Pg. 45).
●Remove the grab bar mounting bolt, lockwasher, and flat washer.



●Remove the cap nut, lockwasher, and flat washer, and take off the grab bar.
●Lift up on the rear wheel as necessary to avoid damaging the shock absorber bolt threads, and remove the shock absorber bolt.
●Pull off the flat washer and 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 2.6~3.5 kg-m (19~25 ft-lbs) of torque.
●Install the flat washer and grab bar.
●Install and tighten the bar mounting bolt. The bolt has a lockwasher and flat washer.
●Install the flat washer, lockwasher, and cap nut, and then tighten the cap nut with 2.6~3.5 kg-m (19~25 ft-lbs) of torque.
●Mount the muffler (Pg. 46).

SWING ARM

Removal:

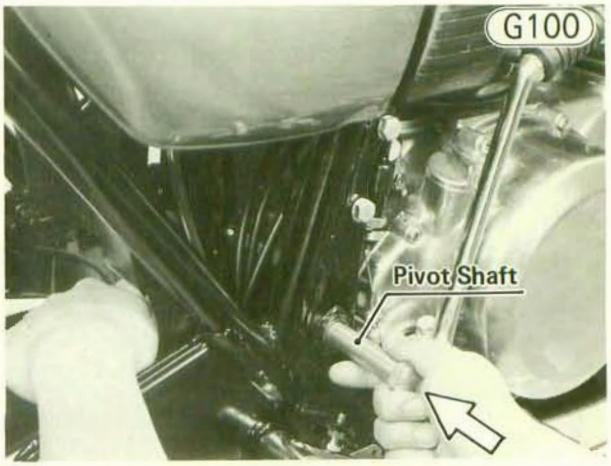
●Set the motorcycle up on its center stand.
●Remove the mufflers (Pg. 45).
●Remove the rear wheel (Pg. 106).
●Remove the mounting bolt from each shock absorber bottom. A lockwasher comes off with the bolt.
●Move the swing arm up and down to check for abnormal friction.
●Remove the pivot shaft nut and 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, and put the left side of the swing arm through the drive chain loop.

•Position the pivot of the swing arm into its place in the frame, and slide in the pivot shaft from the right to left.



•Install the pivot shaft nut and tighten the nut with 8~12 kg-m (58~87 ft-lbs) of torque.

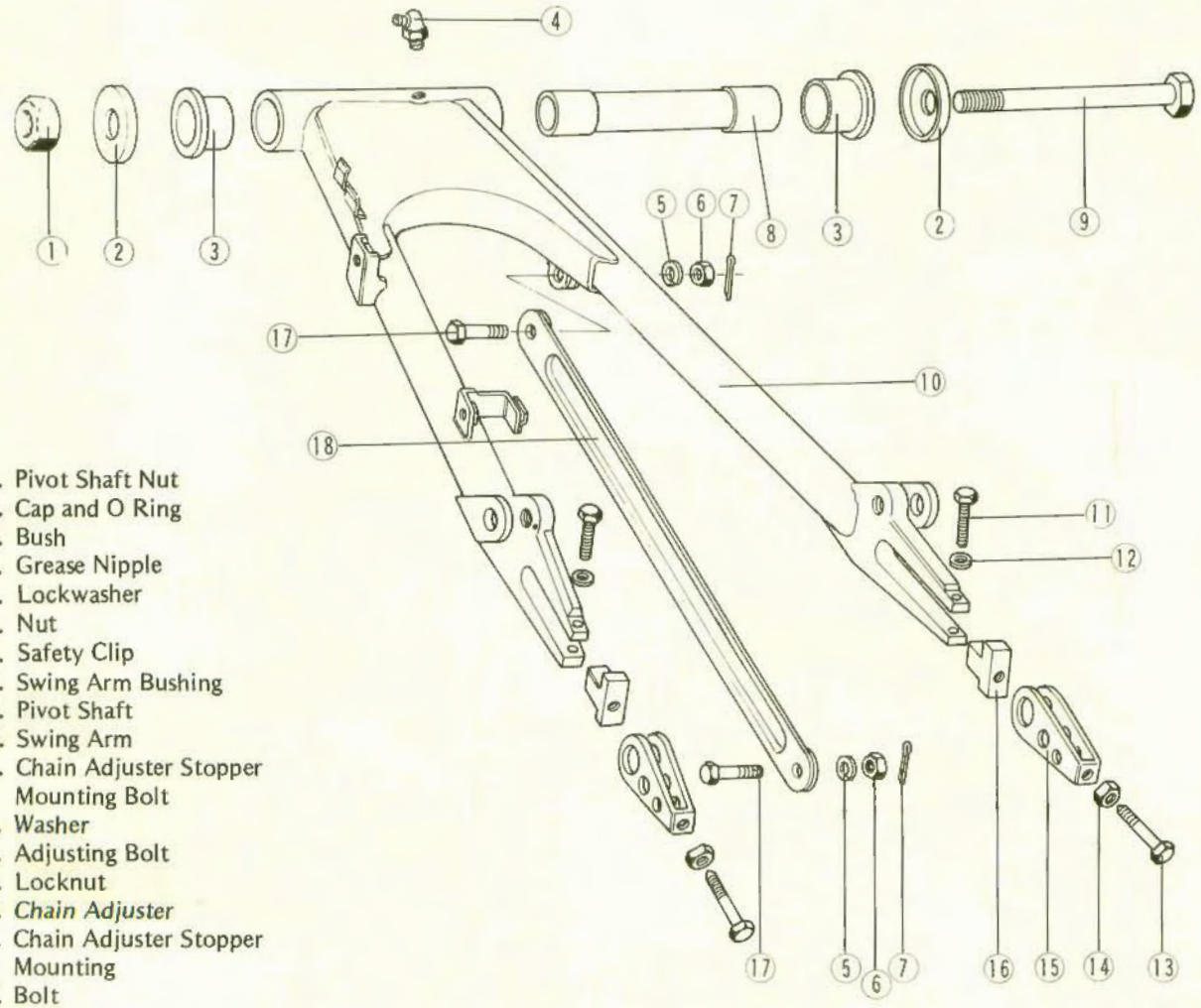
•Install the rear shock absorber bolts and lockwashers, tightening each bolt with 2.6 ~ 3.5 kg-m (19 ~ 25 ft-lbs) of torque.

•Install the rear wheel (Pg. 106).

•Install the mufflers (Pg. 46).

•Adjust the drive chain (Pg. 24).

Swing Arm

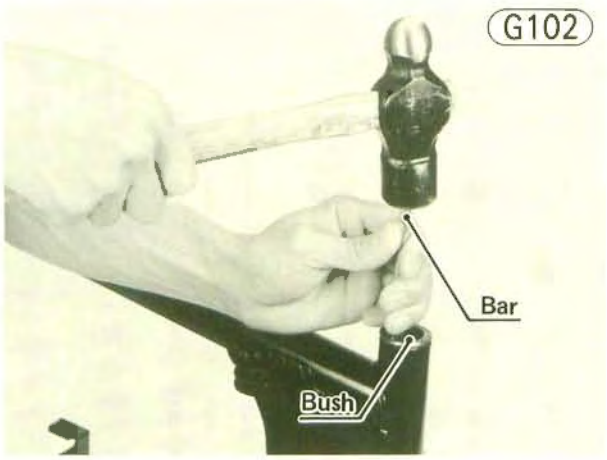


1. Pivot Shaft Nut
2. Cap and O Ring
3. Bush
4. Grease Nipple
5. Lockwasher
6. Nut
7. Safety Clip
8. Swing Arm Bushing
9. Pivot Shaft
10. Swing Arm
11. Chain Adjuster Stopper Mounting Bolt
12. Washer
13. Adjusting Bolt
14. Locknut
15. Chain Adjuster
16. Chain Adjuster Stopper Mounting
17. Bolt
18. Torque Link

Disassembly:

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

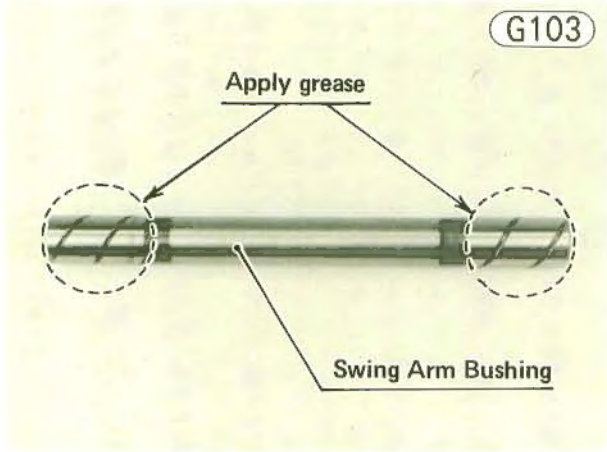
- Pull off the safety clip ⑦ from the torque link bolt ⑰. Take out the nut ⑥ and bolt, and remove the torque link ⑱ from the swing arm ⑩.
- Pull out the swing arm bushing ⑧.
- Insert a bar into one side, hammering on it lightly to knock out the bush ③ on the opposite side.



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

Assembly Notes:

1. Replace the bushings with new ones if either one has worn past the service limit (Pg. 189) or has been removed. Apply oil to the bushings before installing them with a press.
2. Wipe the old grease off the swing arm bushing, and inspect the swing arm bushing (Pg. 189). Apply fresh grease, especially in each bushing groove.



3. Install the torque link and tighten the torque link nut with 2.6~3.5 kg-m (19~25 ft-lbs) of torque, insert a safety clip.
4. Adjust the drive chain (Pg. 24) after installing the swing arm.

DRIVE CHAIN

Removal:

WARNING **The chain must not be cut for installation, as this may result in subsequent chain failure and loss of control.**

- Remove the mufflers (Pg. 45).
- Remove the rear wheel (Pg. 106).
- Remove the swing arm (Pg. 125).
- Remove the engine sprocket (Pg. 57) and take off the chain.

Installation:

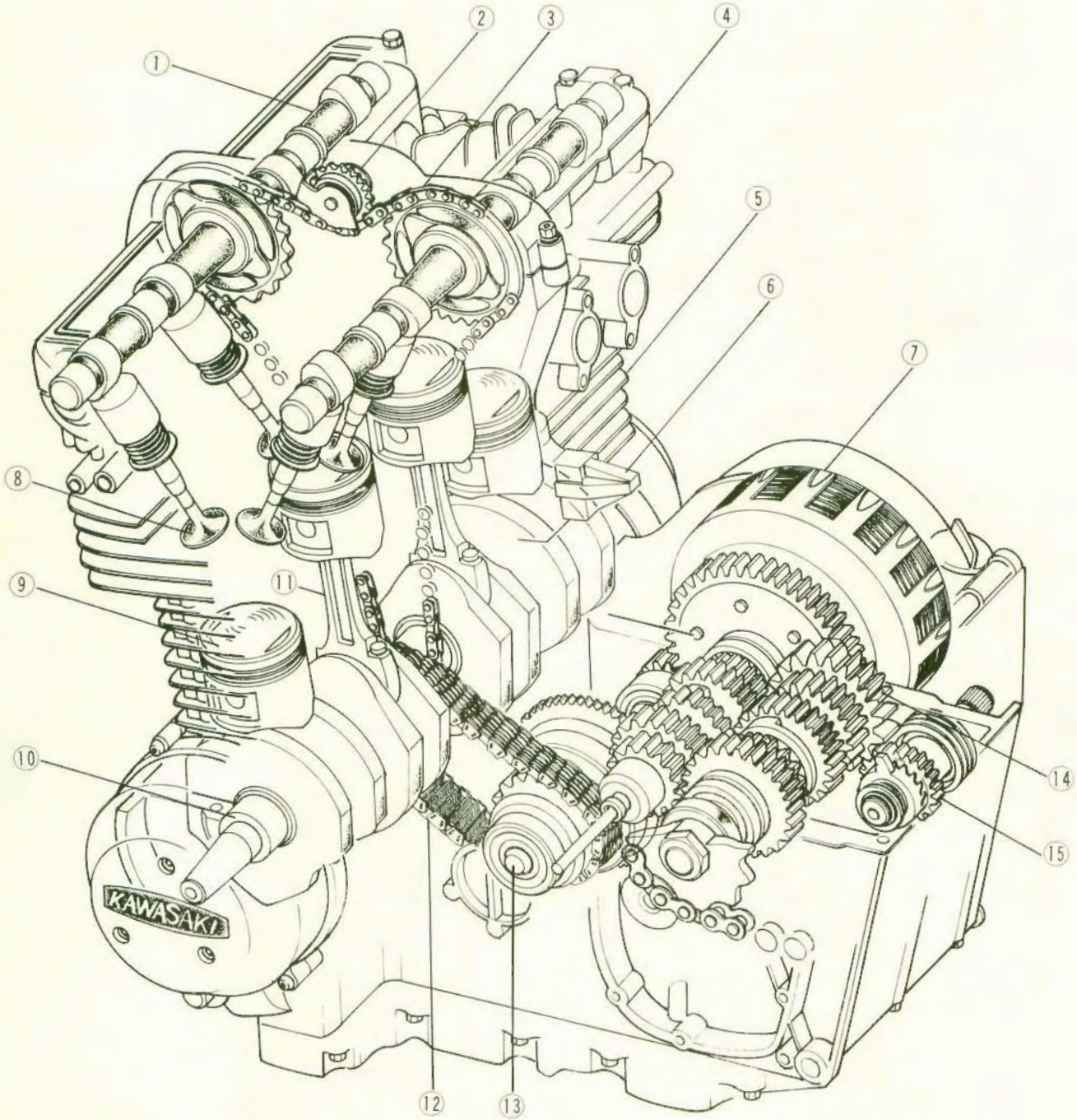
- Install the engine sprocket (Pg. 58).
- Install the swing arm (Pg. 126).
- Install the rear wheel (Pg. 106).
- Install the muffler (Pg. 46).
- Adjust the drive chain (Pg. 24).

Maintenance – Engine

Table of Contents

ENGINE PERSPECTIVE

H1



1. Camshaft
2. Guide Sprocket
3. Camshaft Chain
4. Cylinder Head
5. Cylinder Block
6. Camshaft Chain Tensioner
7. Clutch
8. Valve
9. Piston
10. Crankshaft
11. Connecting Rod
12. Primary Chain
13. Secondary Shaft
14. Transmission
15. 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.

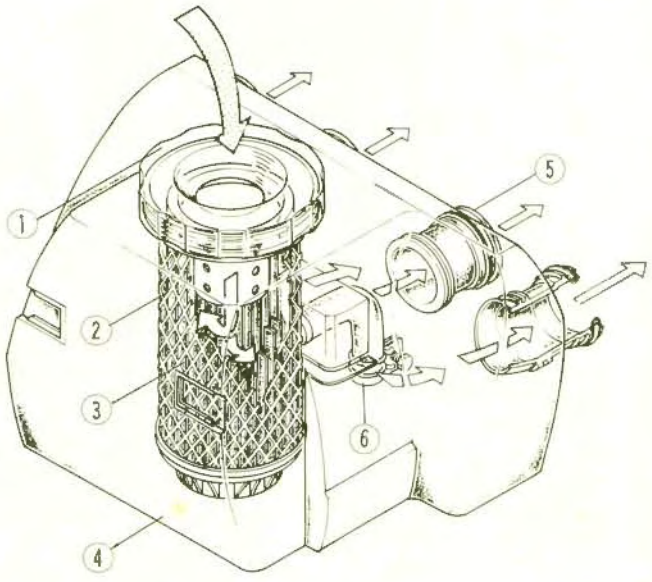
Cleaning and replacement

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. 41). 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.**

Air Cleaner H2



1. Air Cleaner Cap
2. Air Cleaner Element Frame
3. Air Cleaner Element
4. Air Cleaner Housing
5. Intake Duct
6. Breather Hose

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.

CARBURETORS

The carburetors perform the function of mixing the fuel and air in the proportions necessary for good engine performance at varying speeds and loads. In order for them to function satisfactorily, they must be properly adjusted and maintained. The throttle cable adjustment (Pg. 17) and the pilot screw, idling, and synchronizing adjustments (Pg. 18) 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.

A linkage mechanism opens each carburetor throttle valve the same amount in response to throttle grip movement so that the carburetors operate in unison. As the throttle grip is turned counterclockwise, the throttle accelerator cable turns the carburetor pulley. Through the linkage mechanism the pulley opens the throttle valves. As the throttle grip is turned clockwise or is released, the linkage mechanism return spring, together with the throttle decelerator cable, closes the throttle valves.

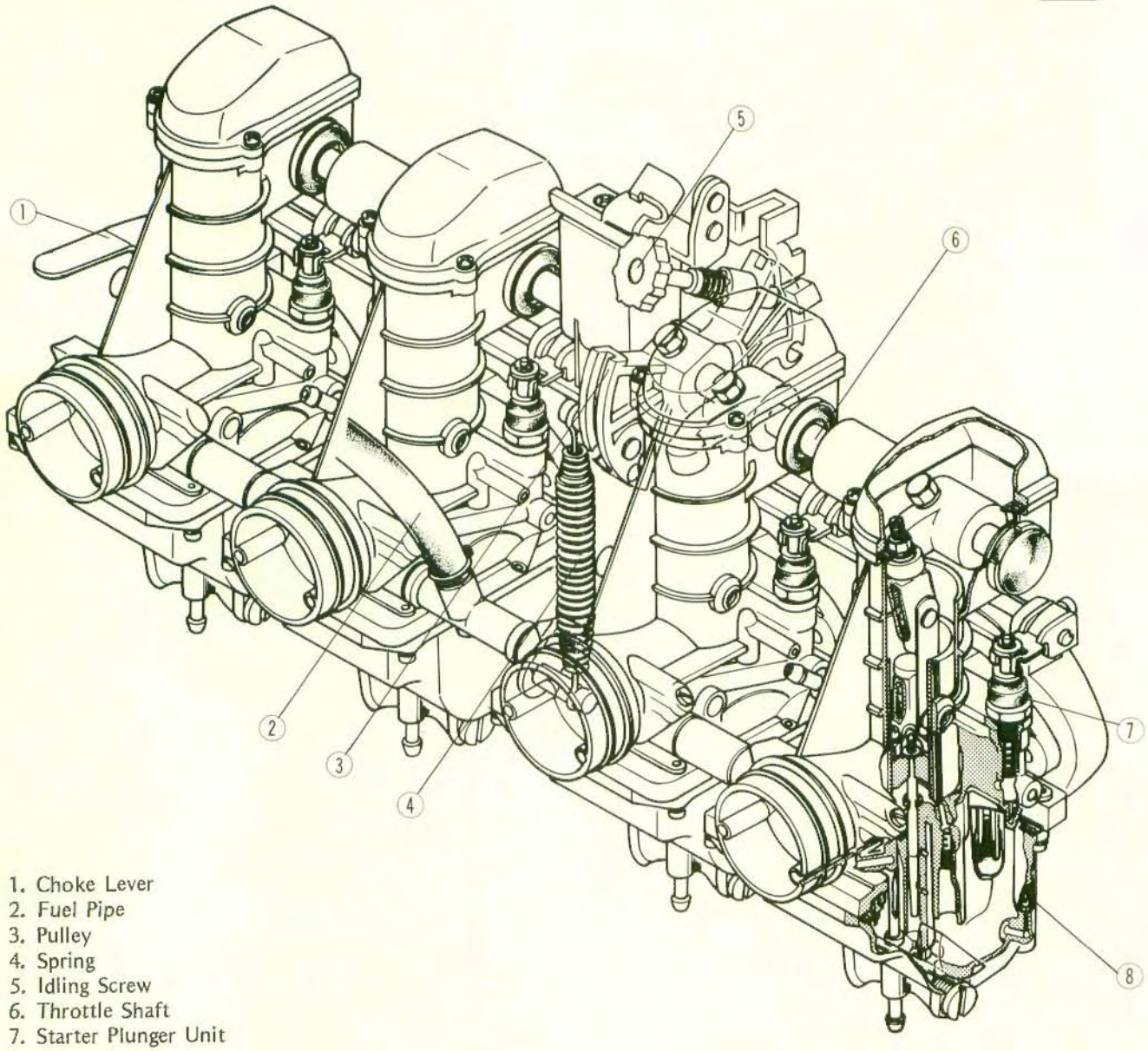
One of the basic principles in carburetor operation is that the pressure exerted by a moving body of air is less than atmospheric pressure. As the engine draws air in through the carburetor bore, the air pressure in the carburetor bore is less than the air pressure in the float chamber, which is vented 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.

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 engine rpm are correlated through carburetor design so that, when properly adjusted, the

Carburetors

H3



1. Choke Lever
2. Fuel Pipe
3. Pulley
4. Spring
5. Idling Screw
6. Throttle Shaft
7. Starter Plunger Unit
8. Starter Jet

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 screw
1/8 ~ 1/4 throttle	throttle valve cutaway, pilot 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.

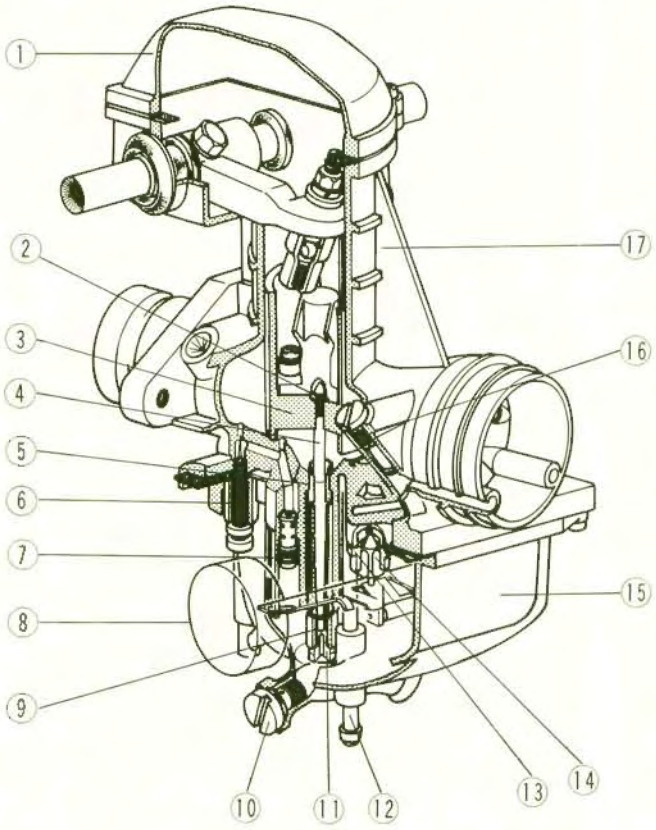
Since the carburetor regulates and mixes fuel and air going to the engine, there are two general types of carburetor trouble: too rich a mixture (too much fuel); or too lean a mixture (too little fuel). Such trouble can be caused by dirt, wear, maladjustment, or improper fuel level in the float chamber.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

Table H1 Carburetor Specifications

Type	Main Jet	Needle Jet Badge #	Jet Needle	Pilot Jet	Pilot Screw	Throttle Valve Cutaway	Design Fuel Level	Service Fuel Level
VM24SS	100	O-8	5DL31-4†	16	¾ ± ⅛ turn out	1.5	30 ± 1 mm	3.5 ± 1 mm

† The "31" of "5DL31-4" shows lot number, and may vary. The "4" is the groove number for the **C** ring.

Carburetor Constractions H4



1. Top Cover
2. Clip
3. Throttle Valve
4. Jet Needle
5. Needle Jet
6. Pilot Screw
7. Pilot Jet
8. Float
9. Air Bleed Pipe
10. Drain Plug
11. Main Jet
12. Overflow Pipe
13. Float Valve Seat
14. Float Valve Needle
15. Float Bowl
16. Air Passage Plug
17. Carburetor Body

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 carburetors covers the four main systems for fuel regulation and supply.

Table H3 Carburetor Systems

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

CAUTION

1. Remove the rubber and plastic parts (Table H4) before cleaning the carburetor, or deteriorated by the cleaning solution.
2. The carburetor body has plastic parts (Table H4) that cannot be removed. DO NOT use a strong carburetor cleaning solution which could attack these parts: instead, use a mild cleaning solution safe for plastic parts.
3. Do not use wire for cleaning as this could damage the jets.

Table H4 Carburetor Rubber Parts or Plastic Parts

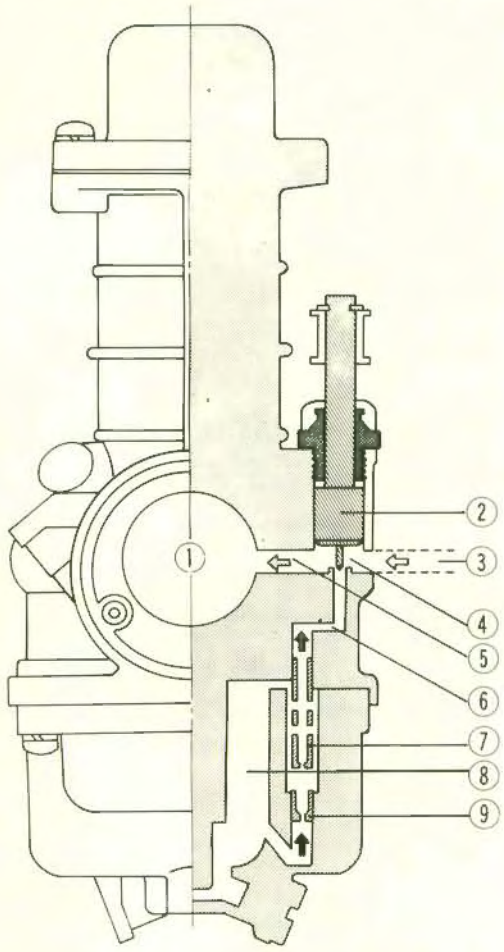
Parts	Quantity	Removable
Link Shaft Dust Seal	6	Yes
Link Shaft End Cap	2	Yes
Throttle Valve Guide Pin	4	No
Pilot Screw **O** Ring	4	Yes
Starter Plunger Seat Rubber	4	No
Fuel Hose	1	Yes
Over Flow Tube	4	Yes
Breather Hose	2	Yes
Air Bleed Pipe **O** Ring	4	Yes
Starter Plunger Dust Seal	4	Yes
Starter Plunger Bush	4	Yes
Drain Plug **O** Ring	4	Yes
Float	4	Yes

Starter System

Fig. H5 shows the starter system, which includes the starter jet ⑨, starter pipe ⑦, starter plunger ②, starter air passage ③, plunger chamber ④, and mixture passage ⑤.

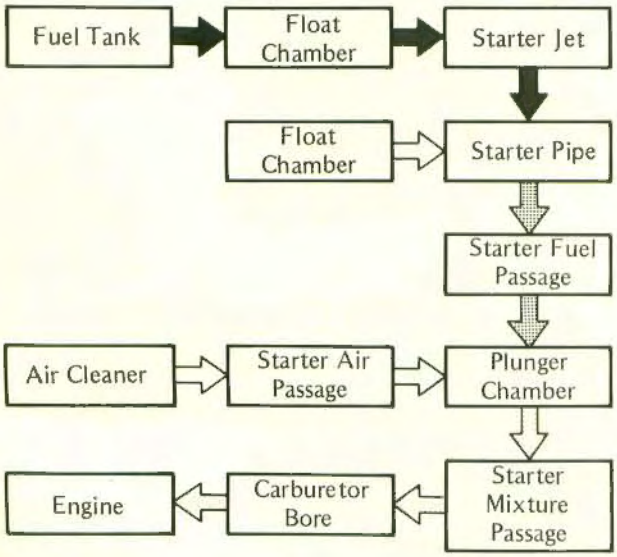
The starter system provides the exceptionally rich 1:1 fuel/air ratio that is necessary to enable easy starting when the engine is cold. When starting the engine, the throttle is left closed, and the starter plunger is pulled fully open by pulling up the choke lever. Since the

Starter System H5



1. Carburetor Bore
2. Starter Plunger
3. Starter Air Passage
4. Plunger Chamber
5. Starter Mixture Passage
6. Starter Fuel Passage
7. Starter Pipe
8. Float Chamber
9. Starter Jet

Starter System Fuel and Air Supply H6



throttle valve is closed, a high intake vacuum (suction or low pressure) is developed at the engine side of the carburetor bore. The starter plunger, when raised, opens up the starter fuel passage and an air passage so that they connect to the engine side of the carburetor bore. As the engine is cranked over, it draws in air through this air passage and fuel from the float chamber through the starter fuel passage. Fuel metered by the starter jet mixes with a small amount of air drawn in through air bleed holes in the starter pipe as it rises in the starter fuel passage. This small amount of air prepares the fuel for better atomization once it reaches the plunger chamber (the area just below the raised plunger) where the fuel mixes with the air drawn in through the air passage. Through the mixture passage, this mixture is then drawn into the carburetor bore where it, together with a small amount of mixture supplied by the pilot system, is drawn into the engine.

In order for the starter system to work properly, the throttle must be kept closed so that sufficient vacuum can be built up at the starter outlet. Also, the choke lever must be pulled up fully so that the starter plunger will fully open the air and starter fuel passages to the carburetor bore. Clogged starter pipe air bleed holes will cause insufficient atomization, thus impairing starter system efficiency. Fuel mixture trouble results if the plunger does not seat properly in its rest position after the choke lever is returned. This may be caused by dirt, gum, a defective spring, a deformed plunger chamber bore, or a damaged plunger seat rubber.

Cleaning (See caution Pg. 133)

Remove the float bowl. Blow the starter pipe, starter air passage, mixture passage, and starter jet clean with compressed air.

Remove the starter plunger, and clean it with a high flash-point solvent.

Pilot System

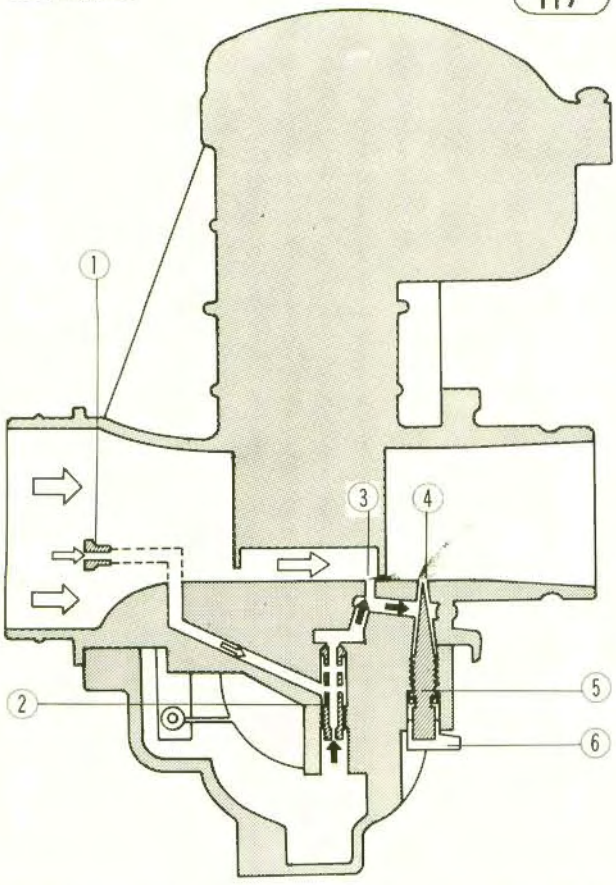
Fig. H7 shows the pilot system, which includes the pilot jet ②, pilot air jet ①, pilot screw ⑤, pilot outlet ④, and bypass outlet ③.

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 and bypass outlet.

The supply of the fuel and air in the pilot system is shown in Fig. H8. Fuel is metered by the pilot jet. It mixes with air metered by the pilot air jet, and flows through the pilot passage. The pilot screw controls flow to the pilot outlet, where the mixture enters the carburetor bore.

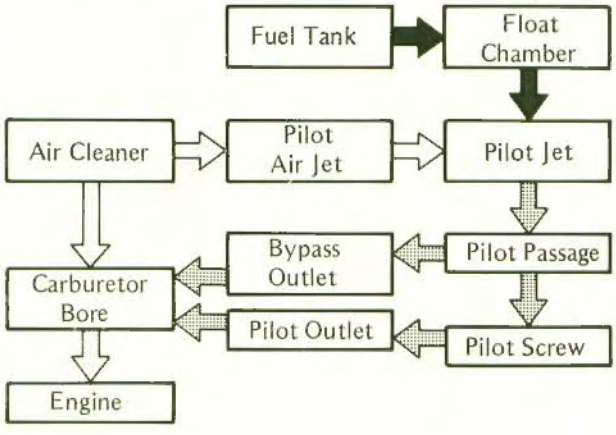
At the idling position of the thorttle valve restricts the carburetor bore air flow, preventing it from relieving the low pressure around the pilot outlet created by the engine's suction, while the venturi effect (i.e., the narrower the air passage, the faster the flow of air) at the engine side of the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

Pilot System H7



1. Pilot Air Jet
2. Pilot Jet
3. Bypass Outlet
4. Pilot Outlet
5. Pilot Screw
6. Extender

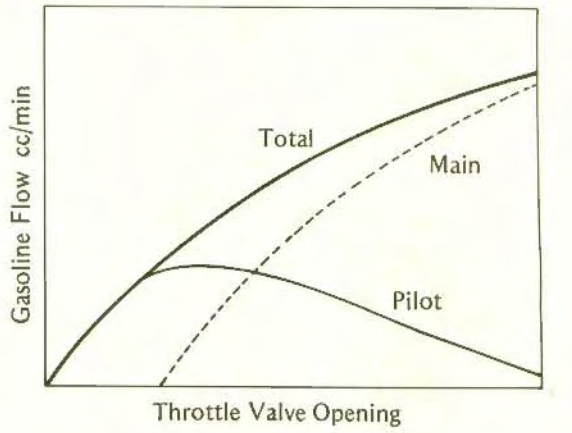
Pilot System Fuel and Air Supply H8



As the throttle valve rises, its position extends the low pressure area to the bypass outlet, allowing fuel to "bypass" part of the pilot passage and go directly to the carburetor bore. The mixture enters the carburetor bore through both the pilot outlet and bypass outlet. Once the throttle valve rises, it no longer concentrates the low pressure area around just the pilot outlet and bypass outlet.

Fig. H9 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 pilot air jet passage.

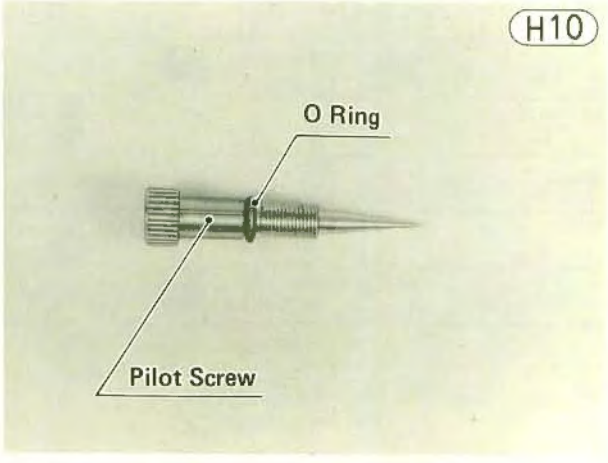
Flow Characteristic H9



Cleaning and replacement (See cautions Pg. 133)

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 pilot screw, and check that the tapered portion is not worn or otherwise deformed. If it is, replace the screw. If the screw **O** ring is damaged, replace the **O** ring.

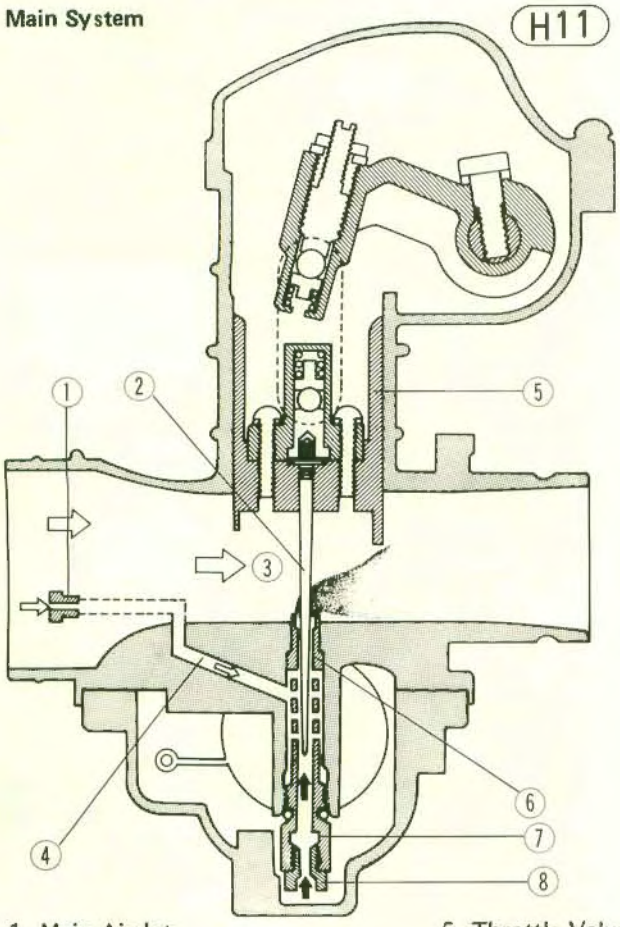


Main System

Fig. H11 shows the main system, which consists of the main jet ⑧, bleed pipe ⑦, needle jet ⑥, jet needle ②, throttle valve ⑤, and air jet ①.

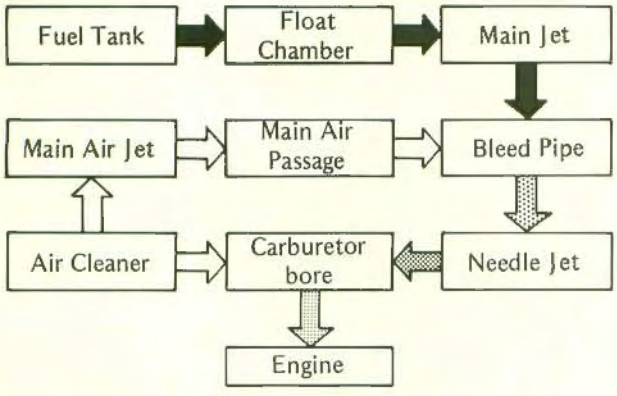
From about ¼ throttle opening, the air flow past the needle jet outlet is sufficient to cause most of the engine's fuel supply to be drawn through the main system. Fuel passes through the main jet and the bleed pipe, through the space in the needle jet around the jet needle, and into the carburetor bore, where it is atomized by the air flow to the engine.

Main System H11



1. Main Air Jet
2. Jet Needle
3. Carburetor Bore
4. Main Air Passage
5. Throttle Valve
6. Needle Jet
7. Bleed Pipe
8. Main Jet

Main System Fuel and Air Supply H12

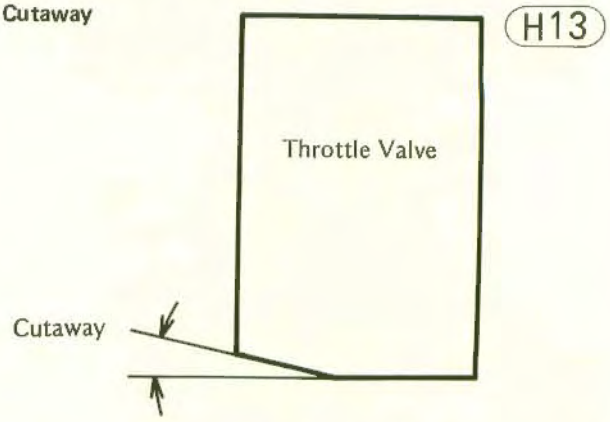


The bleed pipe has holes to admit the air metered by the main air jet. This air mixes with the fuel in the needle jet to prepare the fuel for better atomization in the carburetor bore.

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 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 H13



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. 133)

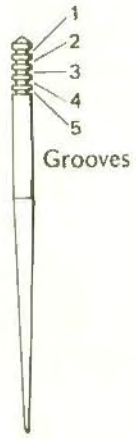
Disassemble the carburetor and wash the main jet, bleed pipe, needle jet, jet needle, air jet, and air passage with a high flash-point solvent, blowing them clean with compressed air. If necessary, use a bath of automotive type carburetor cleaner.

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 ("4" of 5DL31-4) 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 (Fig. H14).

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 (2.5) difference from the standard jet.

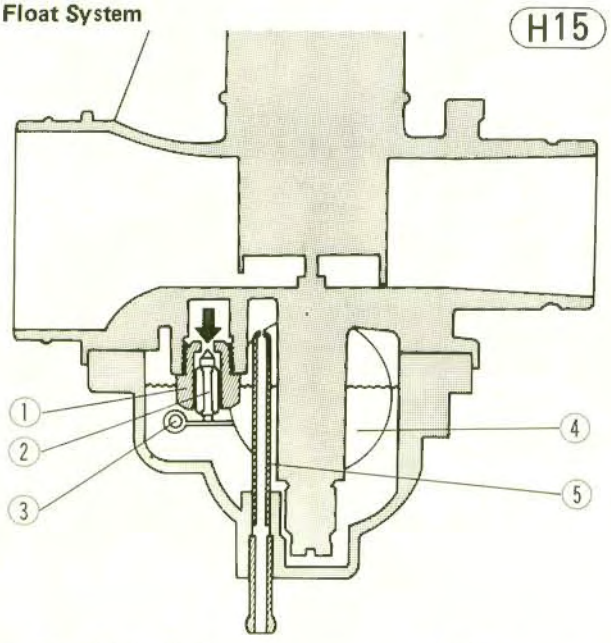
Jet Needle



Float System

Fig. H15 shows the float system which consists of the float ④, float valve needle ②, float valve seat ①, and overflow pipe ⑤.

Float System



1. Float Valve Seat
2. Float Valve Needle
3. Float Pin
4. Float
5. Overflow 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 center of the carburetor bore to the surface of the fuel in the float chamber. The fuel level is maintaind 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.

Fuel Level Measurement

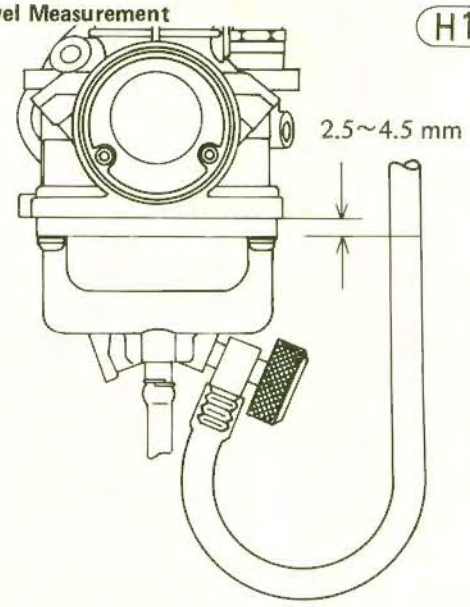


Table H5 Service Fuel Level

Standard
2.5 ~ 4.5 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 down closes the valve sooner and lowers the fuel level; bending it up raises the level.

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

Cleaning and replacement (See caution Pg. 133)

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

Valve Needle (H18)

Good Bad

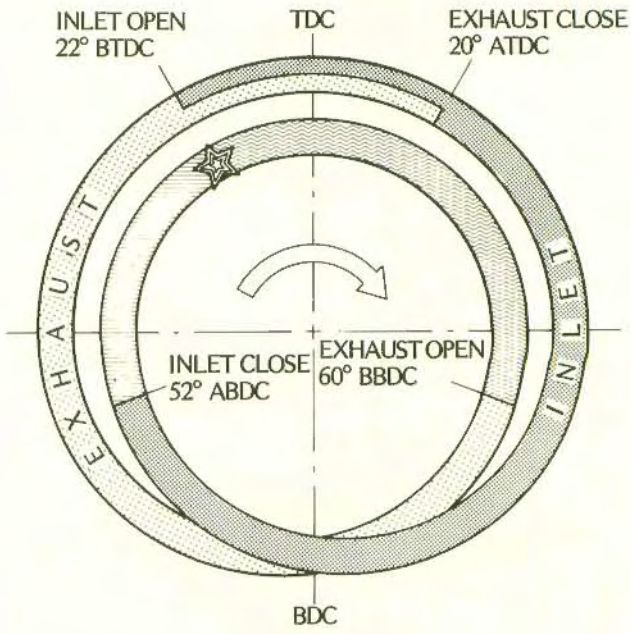
CAMSHAFTS

Since this engine is a DOHC (Double Over Head Camshaft) type, there are two camshafts mounted in the top of the cylinder head. One is the inlet camshaft, and is manufactured with four cam lobes, one to open the inlet valve for each cylinder. The other is the exhaust camshaft, and has four cam lobes to open the exhaust valves. There is a sprocket at the center of the crankshaft and at the center of each camshaft. A chain placed over these sprockets enables the crankshaft to turn both camshafts so that the valves will be opened and closed at the proper times during each rotation of the engine.

Each 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. 46).

However, since the time, amount, and duration that each valve is opened (valve timing) changes with cam wear, journal wear, and camshaft runout (bend), 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 (H19)



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 (H20)

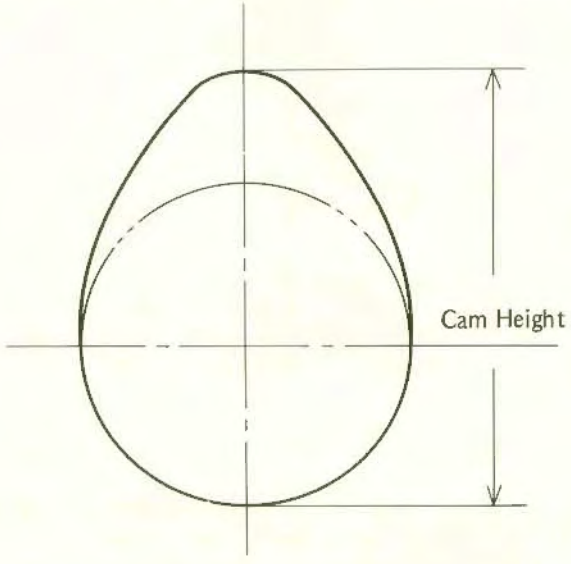


Table H6 Cam Height

Standard	Service Limit
35.73 ~ 35.87 mm	35.65 mm

Journal, bearing wear

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

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

Now, fit the chain over the camshaft sprocket so the shaft won't turn, and install the camshaft, tightening the bolts in the correct sequence with the specified torque (Pg. 48).

CAUTION **While installing the camshaft, be sure to reset it correctly (Pg. 47). If it is installed incorrectly, valves may be bent.**

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

If any clearance exceeds the limit, measure the diameter of the camshaft journal and the bearing inside diameter.

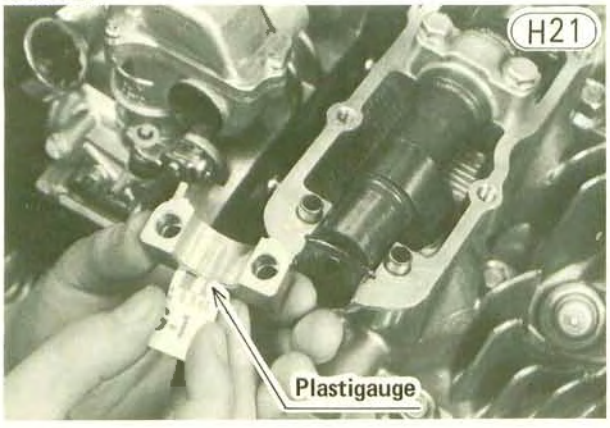


Table H7 Camshaft Journal/Camshaft Cap Clearance

Standard	Service Limit
0.040 ~ 0.081 mm	0.17 mm

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

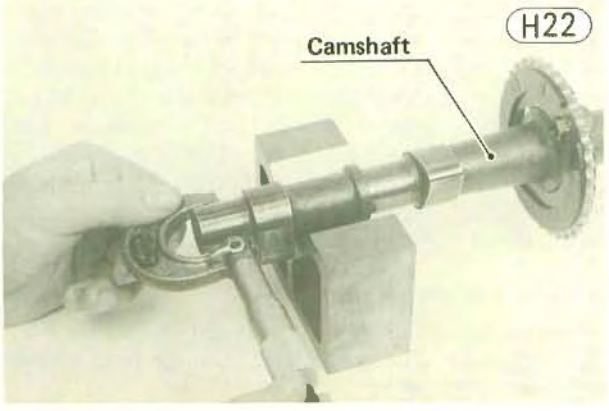


Table H8 Camshaft Journal Diameter

Standard	Service Limit
21.940 ~ 21.960 mm	21.900 mm

Remove the camshafts, and tighten the camshaft caps with 1.1 ~ 1.3 kg-m (95 ~ 113 in-lbs) of torque. Measure the vertical inside diameter of each bearing with a cylinder gauge. If it exceeds the service limit, replace the cylinder head and camshaft *caps as a set* since the camshaft caps are machined together with the cylinder head.

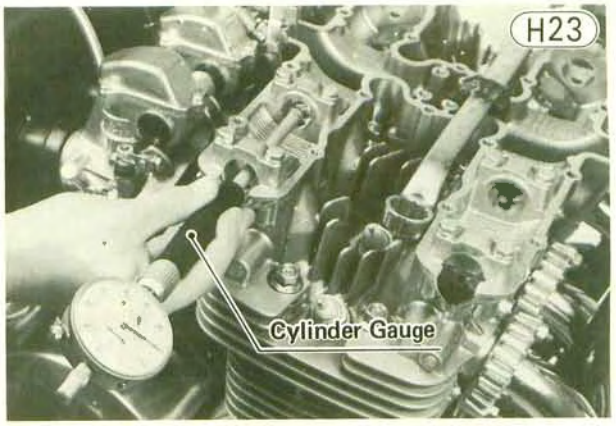


Table H9 Camshaft Bearing Inside Diameter

Standard	Service Limit
22.000 ~ 22.021 mm	22.06 mm

Camshaft runout

Remove the camshaft and take the sprocket off the shaft.

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

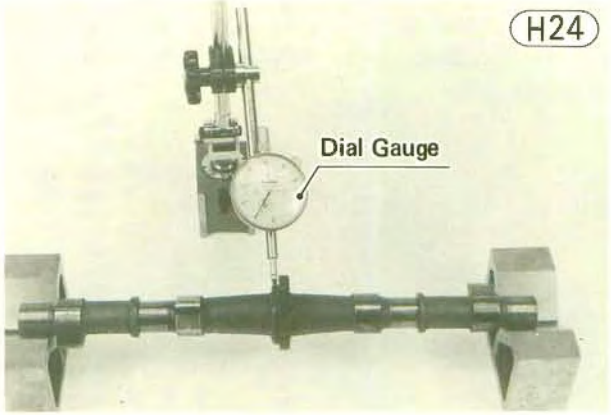


Table H10 Camshaft Runout

Standard	Service Limit
under 0.01 mm	0.1 mm

CAMSHAFT CHAIN, GUIDES, TENSIONER

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

When the chain can no longer be adjusted enough to stop it from making noise, remove the chain for inspection.

Camshaft chain wear

Hold the chain taut with a force of about 5 kg in some manner, and measure a 20-link length. If the chain has lengthened beyond the service limit, replace it with a new one.

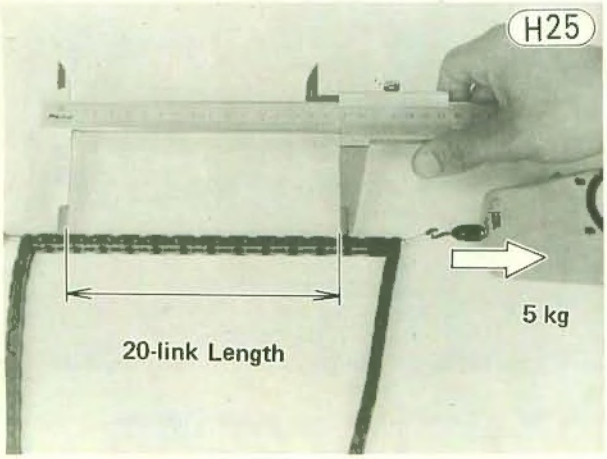
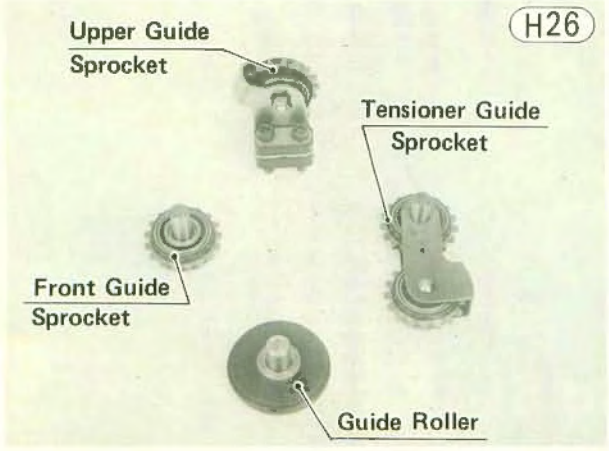


Table H11 Camshaft Chain Length

Standard	Service Limit
160.0 mm	162.4 mm

Chain guide wear

Remove all the chain guides, and inspect them visually. Replace them if the rubber or any other portion shows wear or damage.



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.

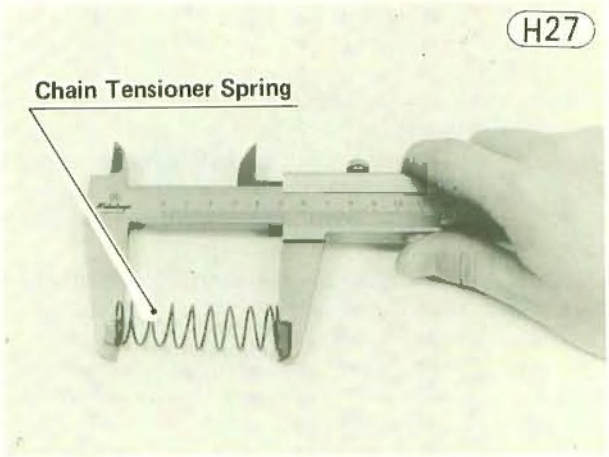


Table H12 Chain Tensioner Spring Free Length

	Standard	Service Limit
Long	64.2 mm	61.0 mm
Short	21.3 mm	20.2 mm

CYLINDER HEAD, VALVES

The valves are mounted in the head; they are pushed open by the cams, 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. It also prevents the valve from overheating by allowing efficient heat transfer.

Cylinder Head

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

Cleaning and inspection

Remove the cylinder head (Pg. 49) and valves (Pg. 50). 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. If warp exceeds the service limit, replace the cylinder head.

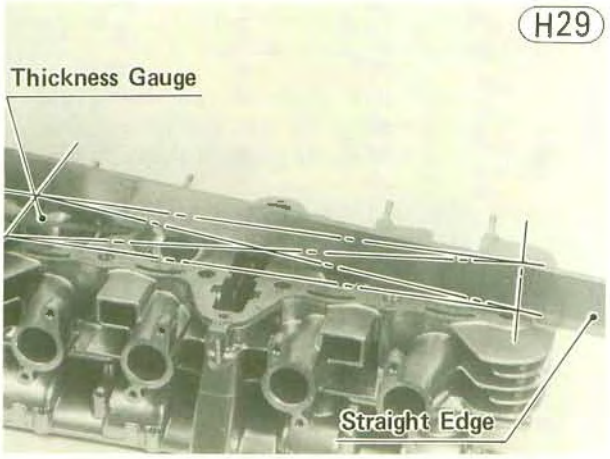


Table H13 Cylinder Head Warp

Standard	Service Limit
under 0.05 mm	0.25 mm

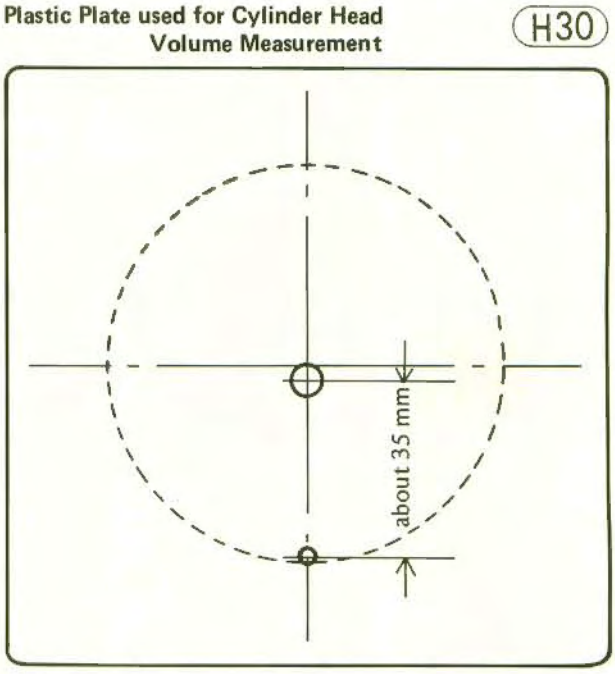
Combustion chamber volume measurement

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.

Plastic Plate used for Cylinder Head Volume Measurement

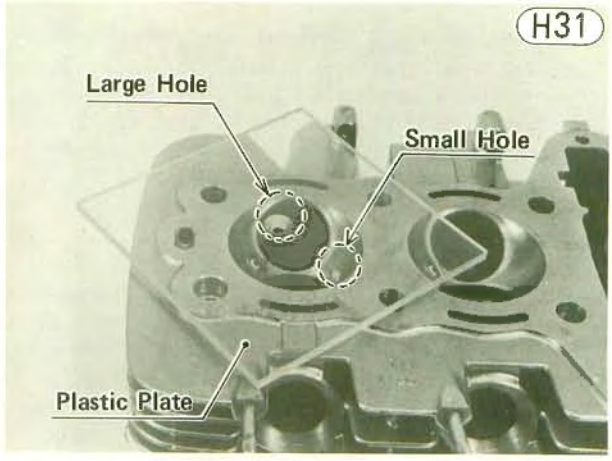


3. Obtain a burette or syringe which is calibrated at one-cc or smaller graduations. Fill it with thin oil.

Prior to the combustion chamber volume measurement, clean off any carbon 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 or mission oil until the chamber is completely filled but not overly. 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.

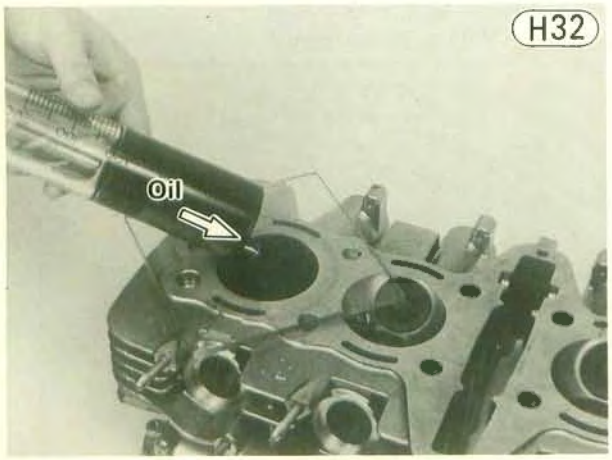


Table H14 Combustion Chamber Volume

Standard
23.7 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 is damaged or badly worn, repair the valve with a valve refacer. The angle of the seating surface is 45°.

If the end of the valve stem is damaged or badly worn, replace the valve with a new one.

CAUTION **Do not grind the valve stem end to repair it or to permit additional valve clearance. If the valve end is ground, the shim may contact the spring retainer and/or split keepers during operation, allowing the keeper to loosen. Consequently, the valve may drop into the engine, causing serious damage.**

Valve Shape

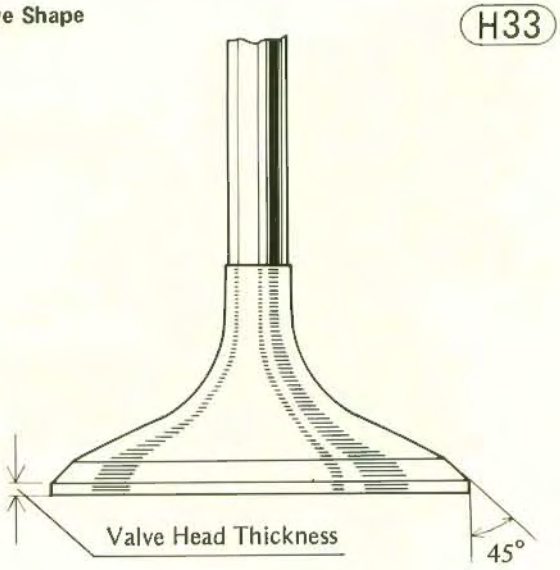


Table H15 Valve Head Thickness

Standard	Service Limit
1.0 mm	0.5 mm

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

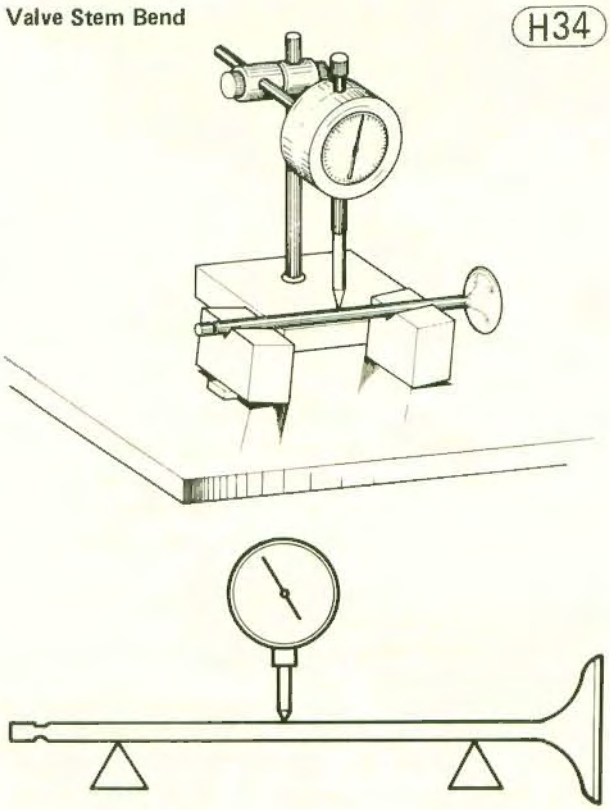


Table H16 Valve Stem Bend

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.

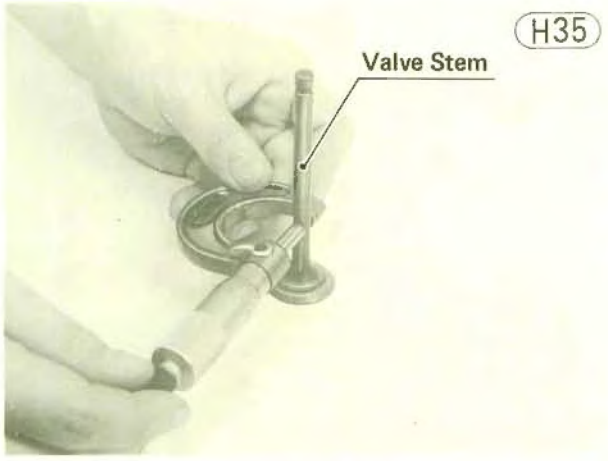


Table H17 Valve Stem Diameter

	Standard	Service Limit
Inlet	6.965 ~ 6.980 mm	6.90 mm
Exhaust	6.950 ~ 6.970 mm	6.89 mm

Valve guide inspeciton

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.

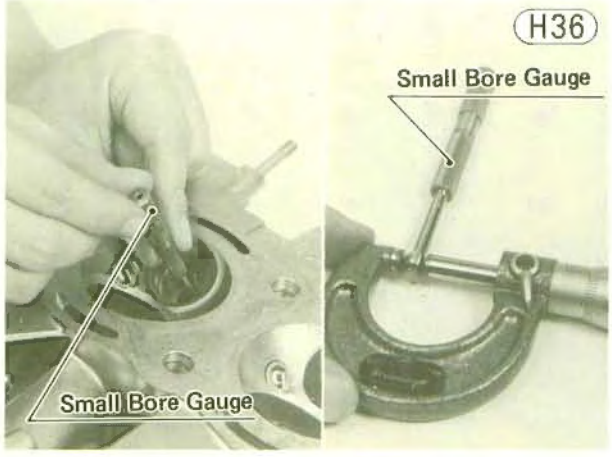


Table H18 Valve Guide Inside Diameter

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 perpendicular to it as close as possible to the cylinder head mating surface. Move the stem back and force 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.

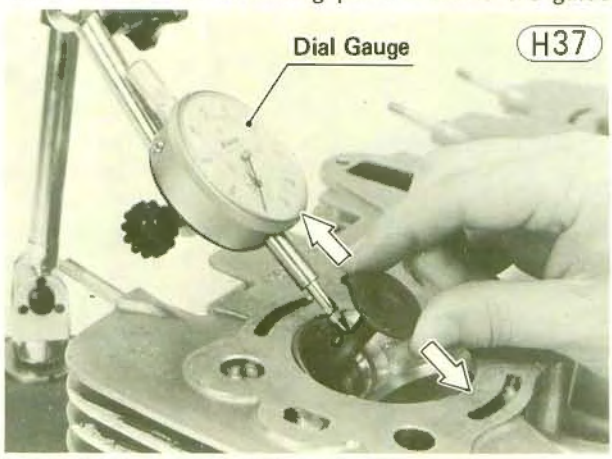


Table H19 Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Inlet	0.049~0.085 mm	0.24 mm
Exhaust	0.057~0.124 mm	0.19 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

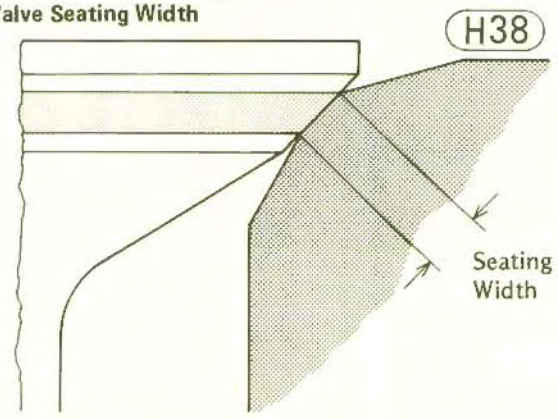
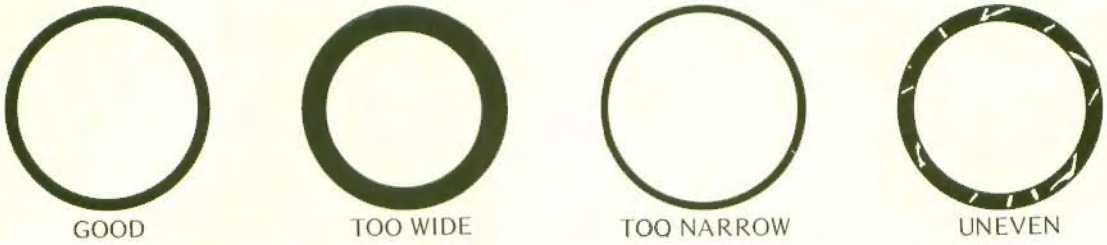


Table H20 Valve Seating Width

Standard
0.5 ~ 1.0 mm

Valve/Valve Seat Contact Area

H39

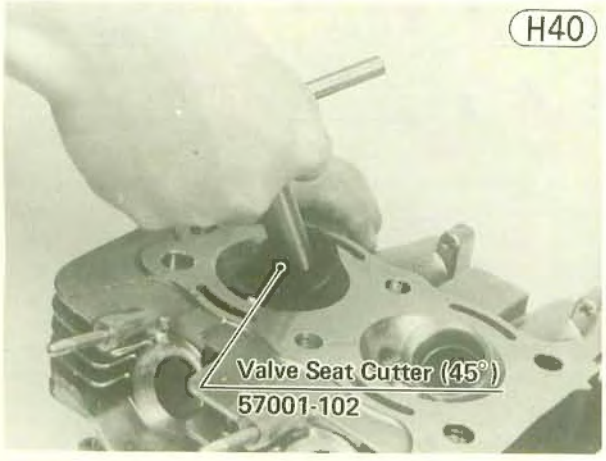


To determine whether or not the valve seat requires repair, first remove the valve, apply machinist's dye to the valve seat, and then use a lapper to tap the valve lightly into place. Remove the valve, and note where the dye adheres to the valve seating surface. The valve seating surface should be in 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).

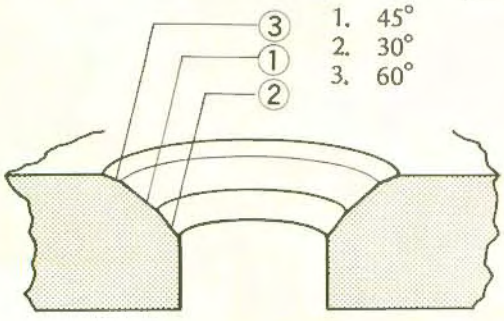
First, cut the seating surface of the valve seat with the 45° cutter. Cut only the amount necessary to make a good surface; overcutting will reduce the valve clearance, possibly making it no longer adjustable.

H40



Cutting Angle of Valve Seat

H41

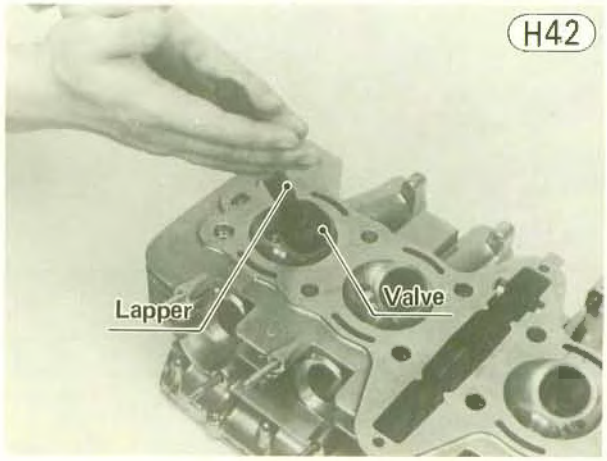


Next, use the 30° cutter (inlet valve seat only) to cut the surface inside the seating surface, and then use the 60° cutter to cut the outermost surface. Cut these two surfaces so that the seating surface will have the specified width.

After cutting, lap the valve to properly match the valve and valve seat surfaces. Start off 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 with a lapping. Repeat this until a smooth, matched surface is obtained.

H42



After grinding the valves or valve seats and before assembling the cylinder head, measure the installed valve height from the bottom of the cylinder head lifter hole to the end of the valve stem with a vernier caliper. Refer to Table H21 for the recommended repair.

Valve Stem Height

H43

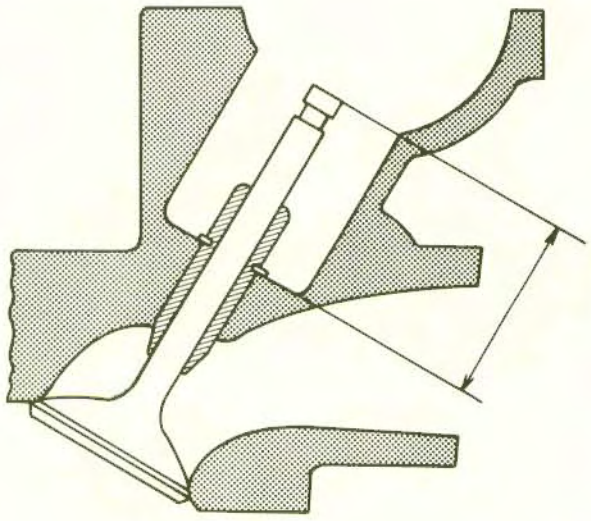


Table H21 Valve Stem Installed Height Procedure

Table H21 Valve Stem Installed Height Procedure

Measurement	Probable Cause	Recommendation	
		Assembly with this shim:	After checking valve clearance, final shim may be in this range:
36.60~36.64 mm	Normal/acceptable	2.85 mm	2.85~3.20 mm
36.65~36.69		2.80	2.80~3.20
36.70~36.74		2.75	2.75~3.15
36.75~36.79		2.70	2.70~3.10
36.80~36.84		2.65	2.65~3.05
36.85~36.89		2.60	2.60~3.00
36.90~36.94		2.55	2.55~2.95
36.95~36.99		2.50	2.50~2.90
37.00~37.04		2.45	2.45~2.85
37.05~37.09		2.40	2.40~2.80
37.10~37.14		2.35	2.35~2.75
37.15~37.19		2.30	2.30~2.70
37.20~37.24		2.25	2.25~2.65
37.25~37.29		2.20	2.20~2.60
37.30~37.34		2.15	2.15~2.55
37.35~37.39		2.10	2.10~2.50
37.40~37.44		2.05	2.05~2.45
37.45~37.49		2.00	2.00~2.40
37.50~37.54		2.00	2.00~2.35
More than 37.54 mm	Valve face and valve seat worn out.	1. Replace valve. Remeasure. 2. Replace cylinder head. Remeasure.	

Be sure to mark each valve so it may be properly matched to its corresponding valve seat during assembly.

A selection of various thickness valve shims are available for adjusting the valve clearance. There is however, a limit to the amount of adjustment possible using the shims. Resurfacing of the valve face and valve seat inevitably drops the valve deeper into the valve seat, allowing the valve stem end to come closer to the camshaft. Consequently, a thinner shim must be used to compensate for the reduced valve clearance.

Over a period of long use and repeated resurfacing, the valve may drop so far into the valve seat. In this case, the installed height becomes so large that even the thinnest shim cannot give adequate clearance, and it should be necessary to replace the valve and remeasure the installed height. If this is not successful, it will be necessary to replace the cylinder head. Replacement valve seats are not available.

Valve Springs

When the valve is not being pushed open by the cam, 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 (H44)

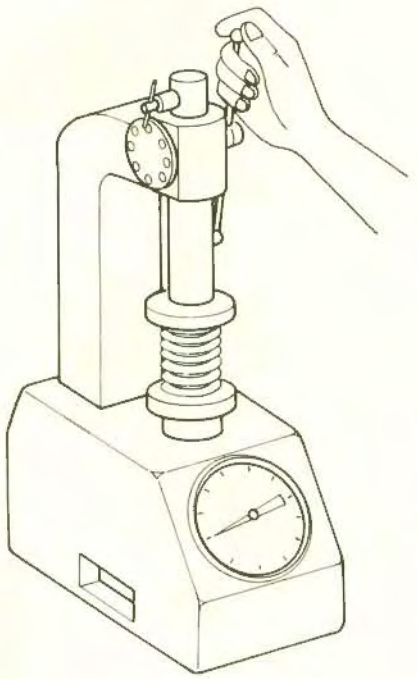


Table H22 Valve Spring Tension

	Length	Standard	Service Limit
Inner	23.6 mm	26.20~28.96 kg	24.7 kg
Outer	25.6 mm	49.06~54.22 kg	46.2 kg

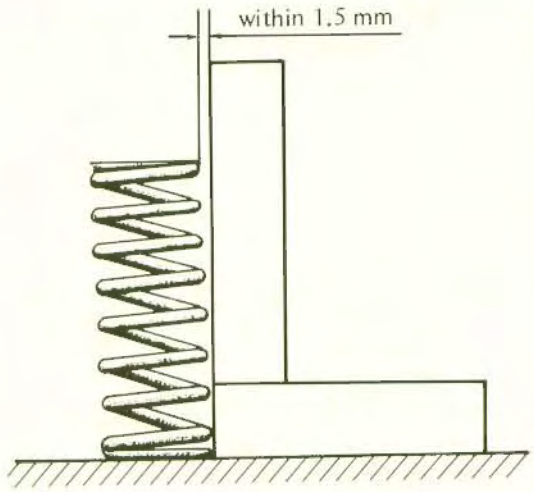
Squareness

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

Table H23 Valve Spring Squareness

Standard	Service Limit
under 1.1 mm	1.5 mm

Valve Spring Squareness (H45)



Oil Seals

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

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

CYLINDER BLOCK, PISTONS

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

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

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

A full floating type piston pin is used to connect each piston to its connecting rod. The middle part of the piston pin passes through the small end of the connecting rod, and a snap ring is fitted at each end of the piston pin in a groove to prevent the pin from coming out of the piston. Since the pin is the full floating type, a small amount of clearance exists between the

piston pin and the piston when the engine is at normal operating temperatures.

Proper inspection and maintenance of the cylinder block and the pistons include checking the compression; removing carbon from the piston heads, piston ring grooves, and cylinder head exhaust ports; and checking for wear and proper clearances during top end overhaul. A worn cylinder, worn piston, or worn or stuck piston rings may cause a loss of compression from gas blowby past the rings. Blowby may result in difficult starting, power loss, excessive fuel consumption, contaminated engine oil, and possibly engine destruction. Oil leakage into the combustion chambers causes carbon to build up on top of the pistons, which may result in preignition, overheating, and detonation. A worn piston pin causes piston rattle, 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 oil supply, or incorrect ignition timing. Whenever knocking, pinging, piston rattle, or other abnormal engine noise is heard; the cause should be determined as soon as possible. Neglect of proper maintenance will result in wear, overheating, detonation, piston seizure, or engine destruction.

Compression measurement

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

Before measuring compression, check that the cylinder head is tightened down with the specified torque (Pg. 35) and that the battery is fully charged (Pg. 192), and thoroughly warm up the engine so that engine oil between the pistons and cylinder walls will help seal compression as it does during normal running. While the engine is running, check that there is no gas leakage from around the cylinder head gasket and from the spark plugs.

Stop the engine, remove all spark plugs, and screw the compression gauge (special tool) firmly into one 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. Repeat the measurement for the other cylinder.

Table H24 Cylinder Compression

Standard	Service Limit
11~13 kg/cm² (156~185 psi)	8 kg/cm² (114 psi) and less than 1 kg/cm² (14 psi) difference between the cylinders.

†Engine hot, all spark plugs 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 gaskets for the cylinder head and base. The use of gaskets of the incorrect thickness will change the compression.
3. Valve stem oil seals and piston rings – rapid carbon accumulation in the combustion chambers may be caused by damaged valve stem oil seals and/or damaged piston oil rings. This may be indicated by white exhaust smoke.
4. Cylinder head volume (Pg. 141).

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

1. Gas leakage around the cylinder head – replace the damaged gasket and check the cylinder head for warp (Pg. 141).
2. Condition of the valve seating (Pg. 143).
3. Valve clearance – if a valve requires an unusually thick shim to obtain proper clearance, the valve may be bent, and not seating completely.
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 oversize and then honed. However, if the amount of boring necessary would make the inside diameter greater than 63.0 mm, the cylinder block must be replaced.

Cylinder Inside Diameter Measurement (H46)

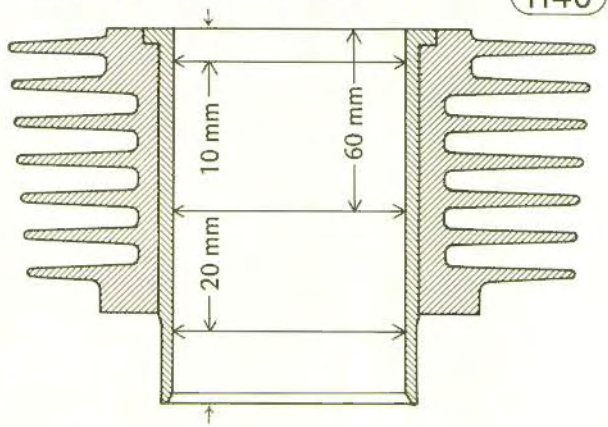


Table H25 Cylinder Inside Diameter

Standard	Service Limit
61.995 ~ 62.003 mm, and less than 0.006 mm difference between any two measurements	62.10 mm, and more than 0.05 mm difference between any two measurements

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

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

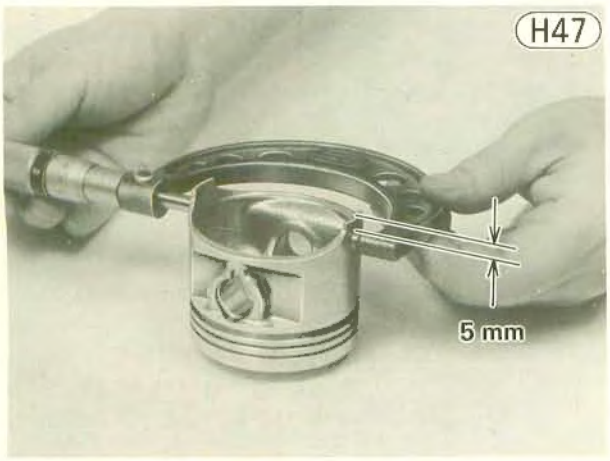


Table H26 Piston Diameter

Standard	Service Limit
61.948 ~ 61.963 mm	61.8 mm

Table H25 applies only to cylinder that has not been bored oversize, and Table H26 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 to which the cylinder was bored plus 0.1 mm; 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 H27 Piston/Cylinder Clearance

Standard
0.032 ~ 0.055 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 H27, determine the diameter of the rebore.
2. To avoid cylinder distortion due to unbalanced metal temperatures, bore the cylinders in 2-4-1-3 or 3-1-4-2 order.
3. Cylinder inside diameter must not vary more than 0.006 mm at any point.
4. Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.
5. There are two sizes of oversize pistons available: 0.5 mm and 1.0 mm. Oversize pistons require oversize rings.

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. 54), 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. The two rails and the expander of the oil ring must be replaced as a set.

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.

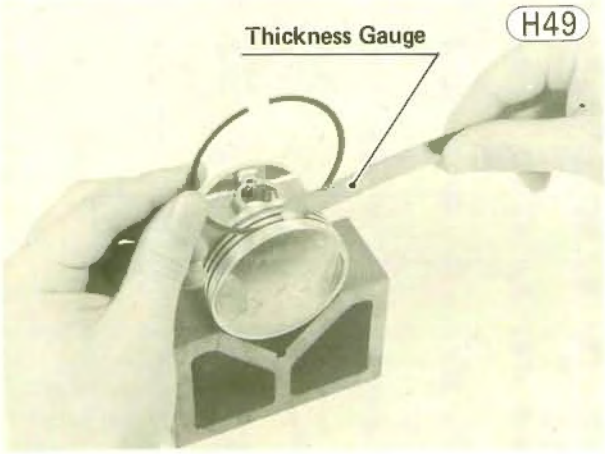


Table H28 Piston Ring/Groove Clearance

	Standard	Service Limit
Top	0.04 ~ 0.08 mm	0.15 mm
2nd	0.03 ~ 0.07 mm	0.15 mm

Table H29 Piston Ring Thickness

	Standard	Service Limit
Top and 2nd	1.17 ~ 1.19 mm	1.10 mm

Table H30 Piston Ring Groove Width

	Standard	Service Limit
Top	1.23 ~ 1.25 mm	1.33 mm
2nd	1.22 ~ 1.24 mm	1.32 mm
Oil	2.51 ~ 2.53 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.

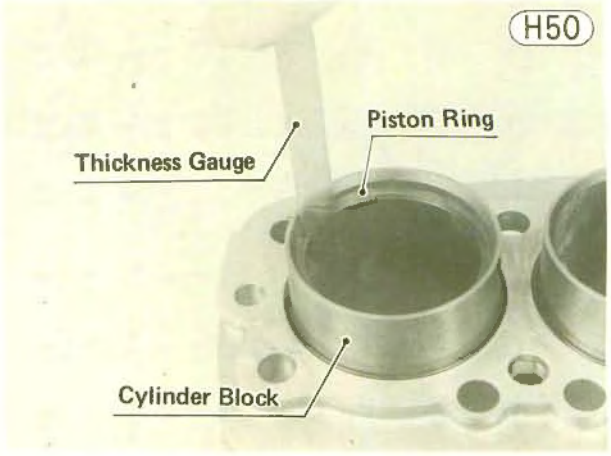


Table H31 Ring End Gap

Standard	Service Limit
0.15 ~ 0.3 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.

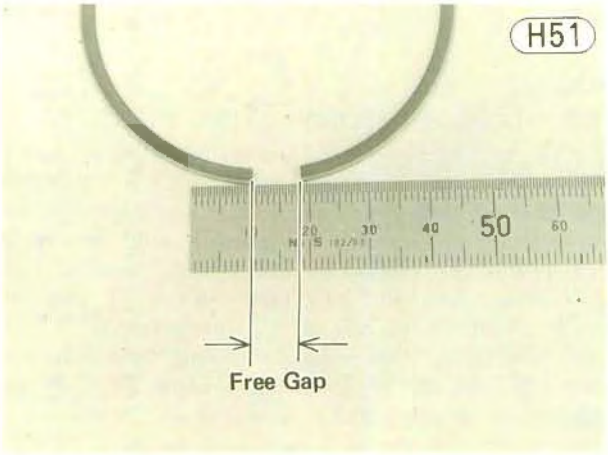


Table H32 Ring Free Gap

Standard	Service Limit
8.0 mm	5.0 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 H33 Piston Pin, Piston Pin Hole, Small End Diameter

	Standard	Service Limit
Piston Pin	14.994~14.998 mm	14.96 mm
Piston Pin Hole	15.004~15.009 mm	15.07 mm
Small End	15.003~15.014 mm	15.05 mm

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

CRANKSHAFT, CONNECTING RODS

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

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

Connecting rod bend, twist

Remove the connecting rod big end bearing inserts and replace the connecting rod big end cap. Select an arbor of the same diameter as the connecting rod big end and of optional length, and insert it through the big end of the connecting rod. 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.

On a surface plate, set the big-end arbor on **V** blocks so that it is parallel to the surface plate. Using a height gauge or dial gauge, measure the difference in the height of the small-end arbor 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, replace the connecting rod.

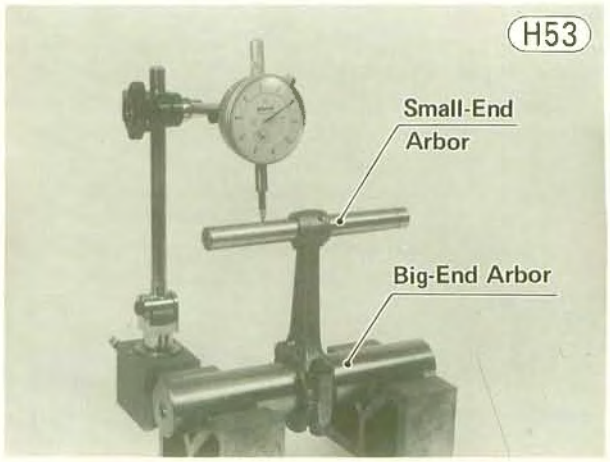


Table H34 Connecting Rod Bend

Standard	Service Limit
under 0.05/100 mm	0.2/100 mm

Swing the connecting rod 90° to one side and support it parallel to the surface plate as shown in Fig. H54. Measure the difference in the height of the small-end arbor above the surface plate over a 100 mm length to determine the amount the connecting rod is twisted.

If the measurement exceeds the service limit, replace the connecting rod.

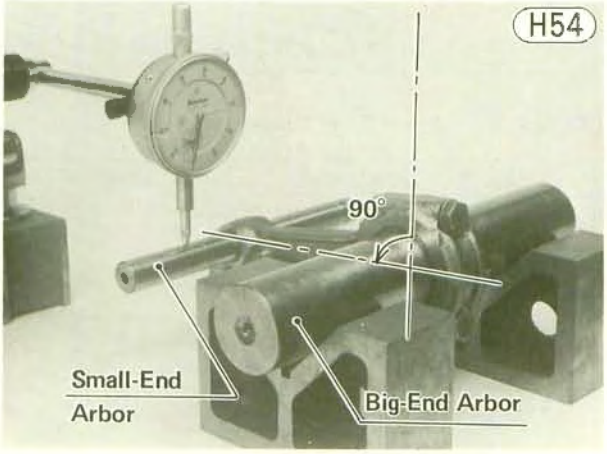


Table H35 Connecting Rod Twist

Standard	Service Limit
under 0.05/100 mm	0.2/100 mm

Connecting rod bearing insert/journal wear

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

Remove the connecting rods. Cut strips of plastigauge to bearing insert width. Place a strip on the connecting rod bearing insert on each connecting rod parallel to the crankshaft so the plastigauge will be compressed between the bearing insert and the connecting rod journal. Install the connecting rods, tightening the nuts with the specified torque (Pg. 35).

Remove the connecting rods, and measure the plastigauge width to determine the bearing insert/journal wear.

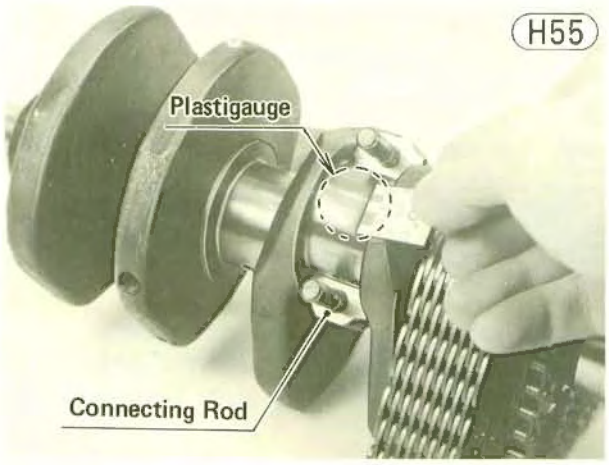


Table H36 Connecting Rod Bearing Insert/Journal Clearance

Standard	Service Limit
0.041 ~ 0.067 mm	0.1 mm

If the clearance exceeds the service limit, replace the bearing inserts as follows:

1. With a micrometer, measure the diameter of the crankshaft journals on which the connecting rods fit. Mark each flywheel in accordance with the journal diameter (Table H37).

If the measurement is less than the service limit, replace the crankshaft.

If the measurement is less than the standard value, but is not under the service limit; use bearing inserts marked "A".

NOTE: Any mark already on the flywheel should not be referred to during servicing.

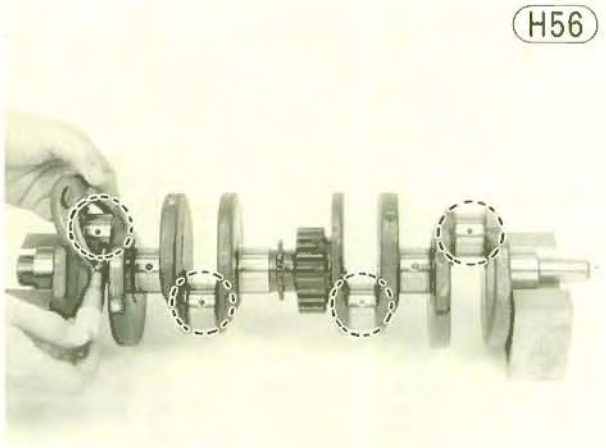


Table H37 Connecting Rod Journal Diameter

Marking	Standard Diameter	Service Limit
No mark	34.984~34.994 mm	34.97 mm
1	34.995~35.000 mm	

2. Put the connecting rod big end caps on the rods and tighten the nuts with the specified torque (Pg. 35). Measure the inside diameter, and mark each connecting rod big end in accordance with the inside diameter (Table H38).

NOTE: The mark already on the big end should almost coincide with the measurement.

Table H38 Connecting Rod Big End Diameter

Marking	Standard
1	38.009~38.016 mm
2	38.000~38.008 mm

3. Select the proper bearing insert in accordance with the combination of the connecting rod and crankshaft coding.

Table H39 Bearing Insert Selection

Crank shaft Marking \ Con-Rod Marking	1	2
1	B PN 13034-051	C PN 13034-052
No mark	A PN 13034-050	B PN 13034-051

Table H40 Bearing Insert Thickness

A	1.485 ~ 1.490 mm
B	1.480 ~ 1.485 mm
C	1.475 ~ 1.480 mm

Connecting rod side clearance

Measure the side clearance of the connecting rod with a thickness gauge as shown. Replace the crankshaft and the connecting rod if the clearance exceeds the service limit.

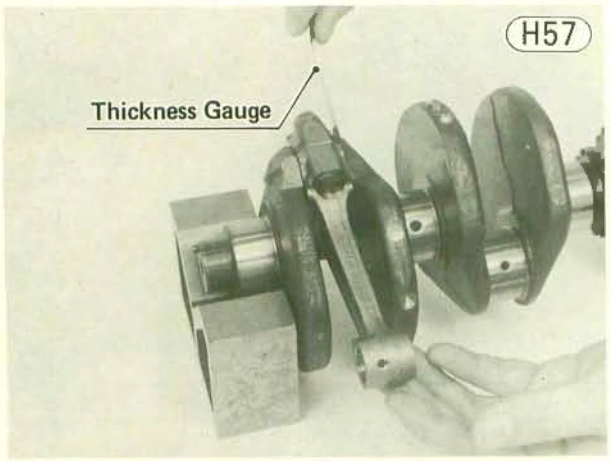


Table H41 Connecting Rod Big End Side Clearance

Standard	Service Limit
0.15~0.25 mm	0.45 mm

Crankshaft runout

Set the crankshaft in a flywheel alignment jig or on V blocks, and place a dial gauge against the points indicated. Turn the crankshaft slowly. The maximum difference in gauge readings is the crankshaft runout.

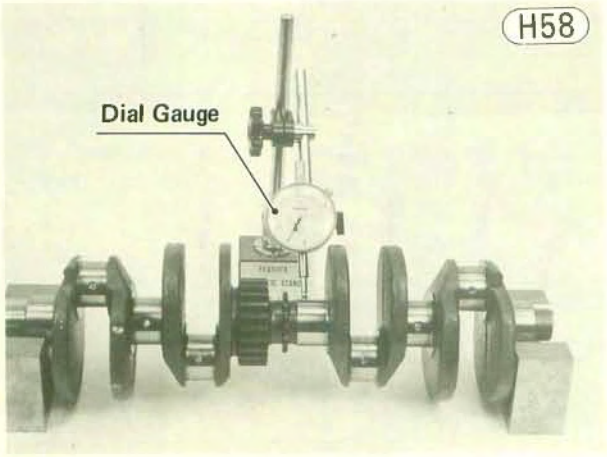


Table H42 Crankshaft Runout

Standard	Service Limit
under 0.02 mm	0.05 mm

Crankshaft bearing insert/journal wear

Remove the crankshaft. Cut strips of plastigauge to bearing insert width. Place a strip on each bearing insert parallel to the crankshaft so the plastigauge will be compressed between the insert and the crankshaft journal. Install the crankshaft and the lower crankcase half without turning the crankshaft, and tighten the bolts in the correct sequence with the specified amount of torque (Pg. 35).

Remove the crankshaft (making sure that the crankshaft does not turn at any time), and measure the plastigauge width to determine the bearing insert/journal wear. If any clearance exceeds the service limit, replace all bearing inserts (10), and check the crankshaft journals.

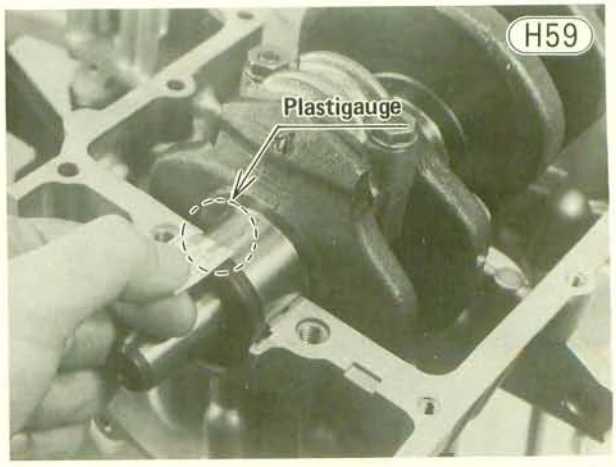


Table H43 Crankshaft Bearing Insert/Journal Clearance

Standard	Service Limit
0.034 ~ 0.076 mm	0.11 mm

Measure the journals which wear on these bearing inserts. If the micrometer reading is less than the service limit, replace the crankshaft.

Table H44 Crankshaft Journal Diameter

Standard	Service Limit
35.984 ~ 36.000 mm	35.94 mm

Crankshaft side clearance

Measure the crankshaft side clearance with a thickness gauge as shown. Replace the crankcase halves as a set, if the clearance exceeds the service limit.

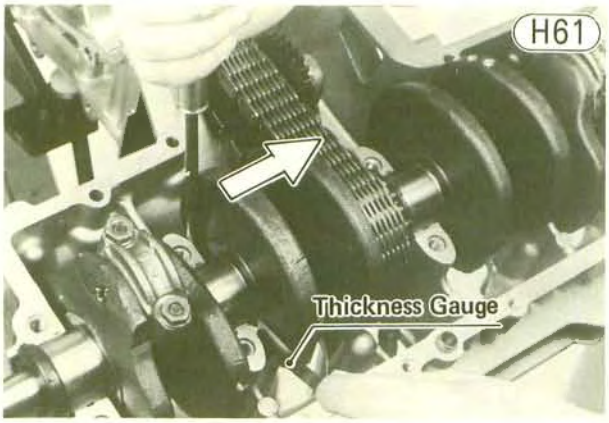


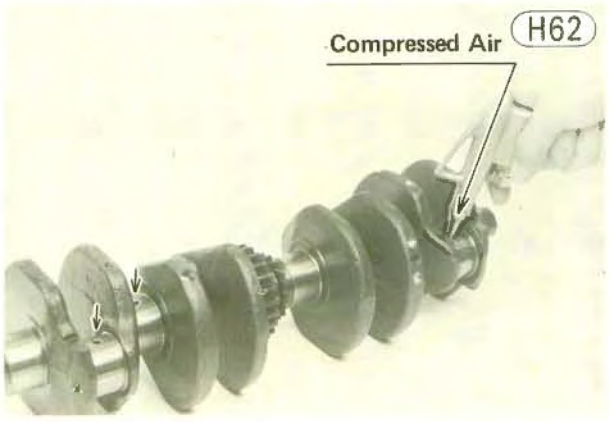
Table H45 Crankshaft Side Clearance

Standard	Service Limit
0.05 ~ 0.15 mm	0.40 mm

NOTE: The upper crankcase half and the lower crankcase half are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

Oil passage cleaning

There are oil passages running between the carnkshaft journals. Use compressed air to remove any foreign particles or residue that may have accummulated in these passages.



SECONDARY SHAFT

The secondary shaft has the secondary sprocket, coupling starter motor clutch, and secondary shaft gear on it. The secondary sprocket is chain-driven by the crankshaft, and the secondary shaft gear transmits the power to the clutch housing gear. The secondary shaft coupling connects the secondary sprocket to the shaft. Rubber dampers in the coupling absorb the pulsations of the engine torque.

Check both of the end ball bearings of the secondary shaft, and replace if necessary (Pg. 166).

Secondary sprocket damage

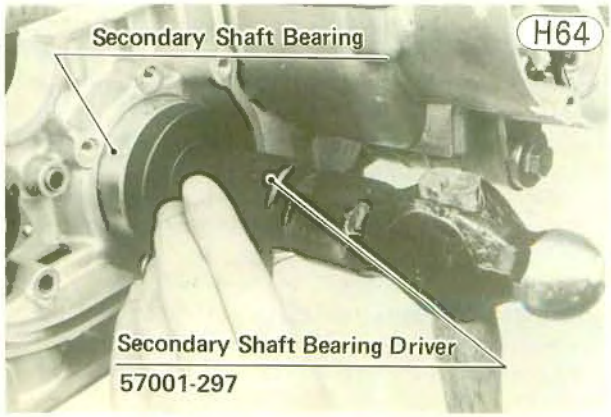
Inspect the teeth on the secondary sprocket. Any light damage can be corrected with an oilstone, but the secondary sprocket must be replaced if the teeth are badly damaged. Damaged teeth on the secondary sprocket indicate that the primary chain, by which it is driven, may also be damaged. At the same time that the secondary sprocket is repaired or replaced, the primary chain should be inspected, and then replaced if necessary.

PRIMARY CHAIN

The power transmission from the crankshaft to the secondary shaft is chain-drive, utilizing a Hy-Vo (high velocity) chain. The Hy-Vo chain is a *rocker-joint type* with a pin and rocker construction. Some of the special features of the Hy-Vo chain are its capacity to transmit much power at high speed, its resistance to heat seizure due to a construction which employs rolling rather than sliding friction, quiet operation even at high rpm, and low power loss.

Wear

A primary chain which has worn so that it is 1.4% or more longer than when new is no longer safe for use and should be replaced. To inspect the chain wear by measuring the chain slack, remove the crankshaft (Pg. 95). Install the crankshaft in the lower crankcase half, and temporarily install the secondary shaft with the secondary sprocket by tapping the secondary shaft bearing into the crankcase until it seats lightly (Fig. H64).



Measure the chain slack, and replace the chain if it has worn past the service limit. The replacement chain must be a Tsubakimoto Hy-Vo 3/8P-1W, 76-link chain.

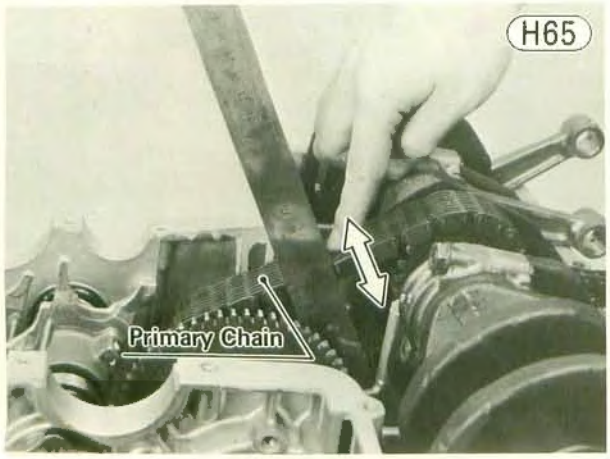


Table H46 Primary Chain Play

Service Limit
27 mm

CLUTCH

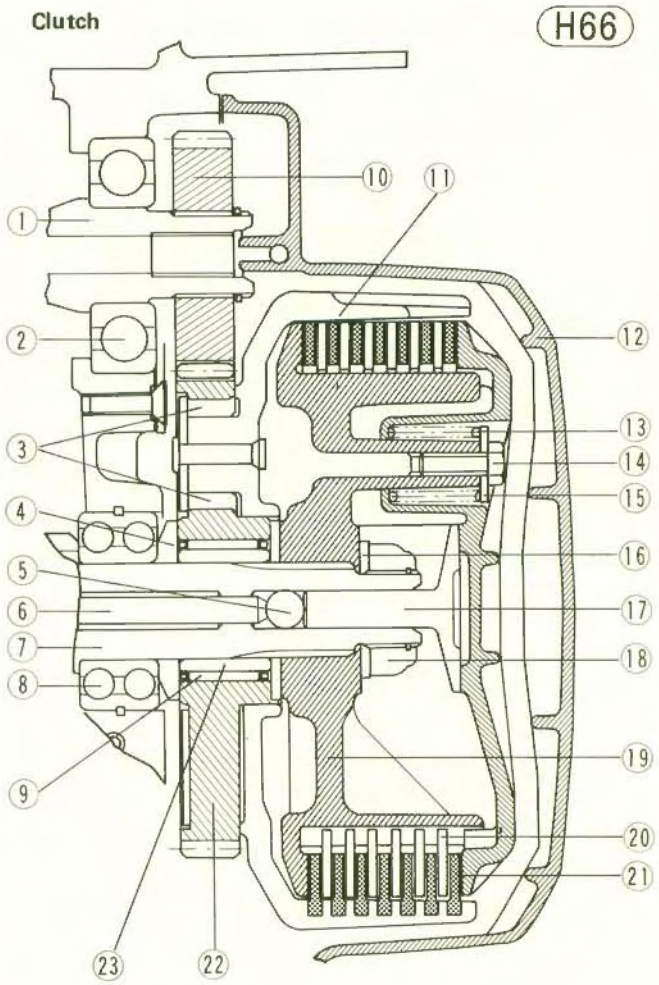
Fig. H66 shows the construction of the clutch, which is a wet, multi-plate type with 7 friction plates ㉑ and 6 steel plates ⑳. The friction plates are made of cork, used for its high coefficient of friction, bonded on a steel core, which provides durability and warp resistance. The clutch housing ⑪ has a reduction gear on one side and contains rubber dampers to absorb shock from the drive train.

The clutch release mechanism is shown in Fig. H67. The clutch release outer worm gear ⑥ and the inner worm gear ⑦ are made of steel. Balls ④ are installed between the outer and inner worm gears to reduce the friction between them. Assembled into the center of the inner worm gear is the clutch adjusting screw ②, which pushes on the push rod ⑪ and steel ball inside the drive shaft to release the clutch.

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 secondary shaft, 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.

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.

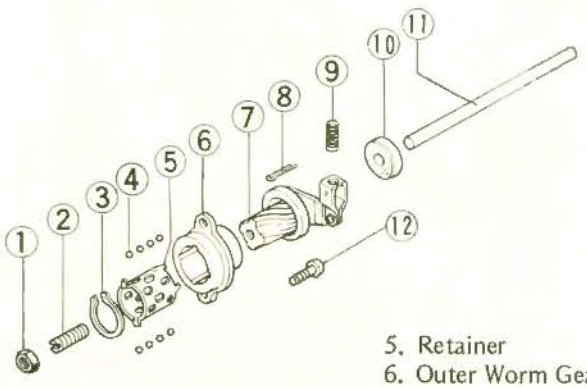
Clutch



1. Secondary Shaft
2. Ball Bearing
3. Shock Rubber Damper
4. Spacer
5. Steel Ball
6. Push Rod
7. Drive Shaft
8. Ball Bearing
9. Needle Bearing
10. Secondary Shaft Gear
11. Clutch Housing
12. Right Engine Cover
13. Spring
14. Bolt
15. Washer
16. Lockwasher
17. Spring Plate Pusher
18. Clutch Hub Nut
19. Clutch Hub
20. Steel Plate
21. Friction Plate
22. Clutch Housing Gear
23. Drive Shaft Sleeve

When the clutch lever is pulled to release (disengage) the clutch, the clutch cable turns the clutch release inner worm gear in towards the clutch. The clutch adjusting screw, assembled inside the clutch release inner worm gear, then pushes the push rod, which (through the steel ball and spring plate pusher) pushes the spring plate. Since the spring plate moves the same distance that the inner worm gear moves and the clutch hub remains stationary, the springs are compressed and pressure is taken off the clutch plates. Because the plates are no longer pressed together, power transmission from the crankshaft to the transmission drive shaft is interrupted. 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.

Clutch Release Mechanism (H67)



1. Locknut
2. Adjusting Screw
3. Circlip
4. Steel Ball
5. Retainer
6. Outer Worm Gear
7. Inner Worm Gear
8. Cotter Pin
9. Spring
10. Grease Seal
11. Push Rod
12. Screw

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. Needle bearing worn or damaged.
5. Weak or damaged damper rubber(s).

Spring tension

Remove the clutch 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.

Table 47 Clutch Spring Tension

Length	Standard	Service Limit
23.5 mm	23.5 ~ 26.5 kg	21.5 kg

Friction plate wear, damage

Visually insepct 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 (H68)

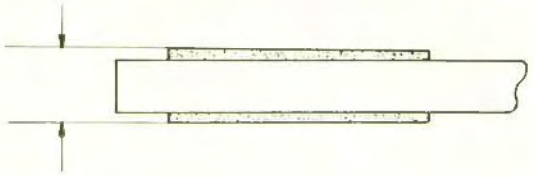


Table H48 Friction Plate Thickness

Standard	Service Limit
3.7 ~ 3.9 mm	3.5 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.

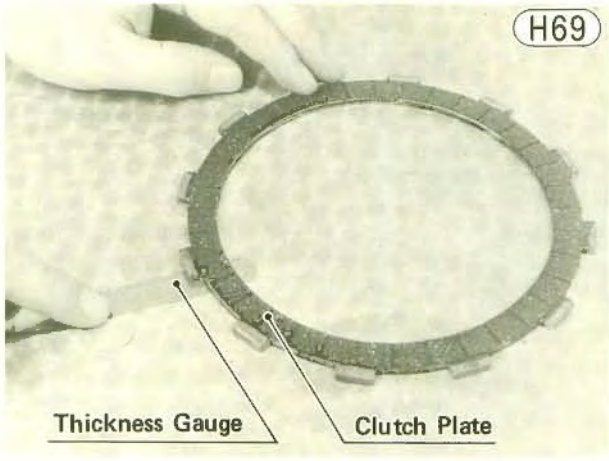


Table H49 Clutch Plate Warp

	Standard	Service Limit
Friction Plate	under 0.15 mm	0.3 mm
Steel Plate	under 0.12 mm	0.4 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 (H70)

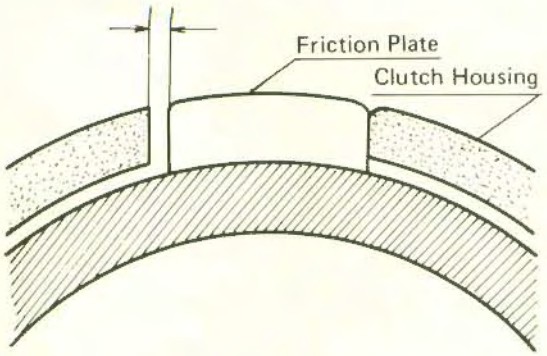


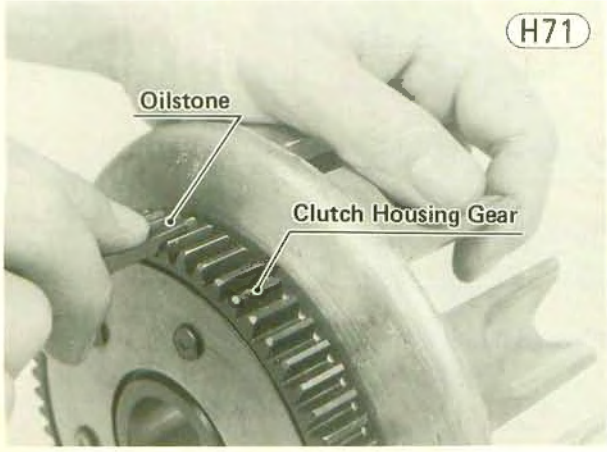
Table H50 Friction Plate/Clutch Housing Clearance

Standard	Service Limit
0.34~0.75 mm	1.0 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 cut 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 secondary shaft gear, by which it is driven, may also be damaged. Whenever the clutch housing gear is repaired or replaced, the secondary shaft gear should be inspected, and then replaced if necessary.



Clutch housing gear/secondary shaft gear backlash

Measure the backlash between the clutch housing gear and secondary shaft 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 secondary shaft gear wherever the amount of backlash exceeds the service limit.

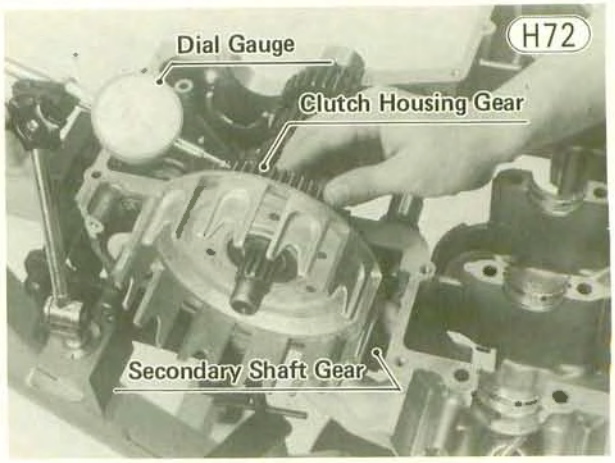


Table H51 Clutch Housing/Secondary Shaft Gear Backlash

Standard	Service Limit
0~0.08 mm	0.12 mm

Clutch housing/drive shaft sleeve wear

Measure the diameter of the drive shaft sleeve with a micrometer. Replace the drive shaft sleeve if the diameter is less than the service limit. Measure the inside diameter of the clutch housing with a cylinder gauge. Replace the clutch housing if the diameter exceeds the service limit. Check the clutch housing needle bearing (Pg. 166). When replacing the clutch housing and/or drive shaft sleeve, replace the clutch housing needle bearing also.

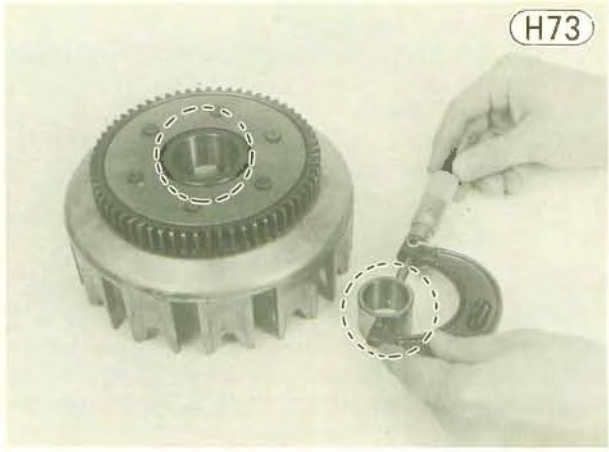


Table 52 Clutch Housing, Clutch Sleeve Diameter

	Standard	Service Limit
Housing	37.000~37.016 mm	37.03 mm
Sleeve	31.980~31.995 mm	31.96 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 gear wear

With the clutch release assembled, push the inner worm gear back and forth in the direction of the shaft without turning it. If there is excessive play, replace the clutch release assembly.

Lubrication

Lubricate the clutch release worm gear with grease.

TRANSMISSION

The transmission is a 5-speed, constant mesh, return shift type. Its cross section is shown in Fig. H74, and the external shift mechanism is shown in Fig. H81. 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.

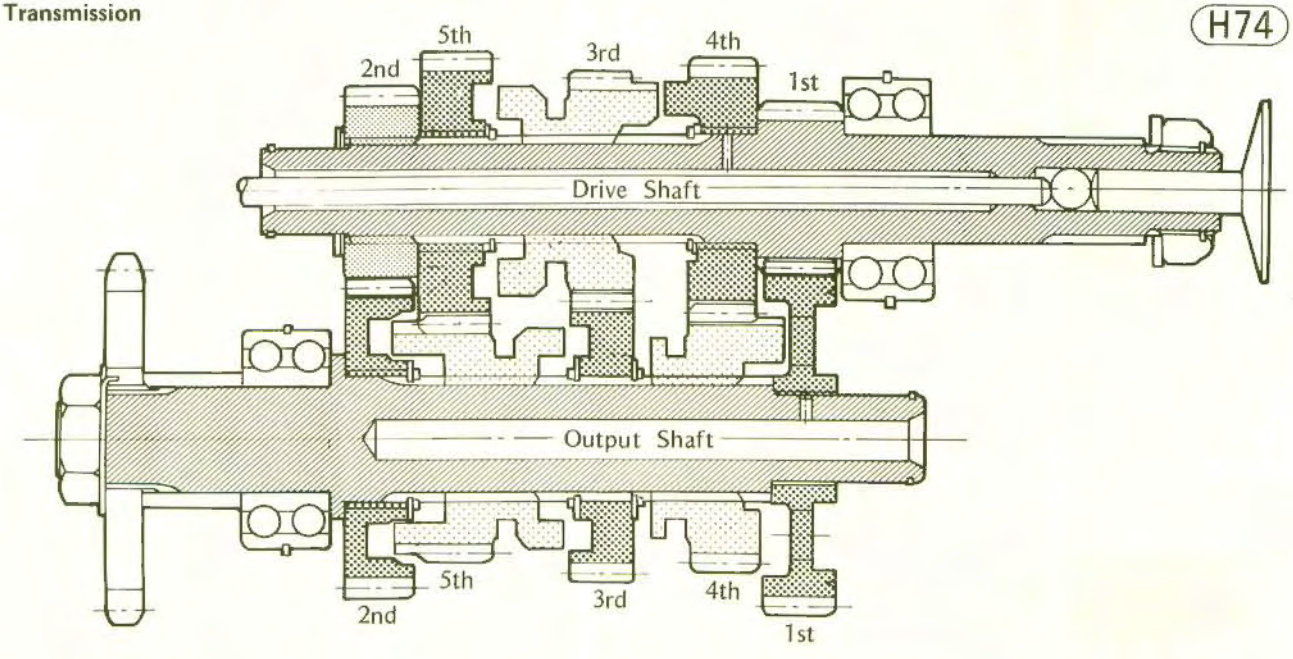
Shift Mechanism

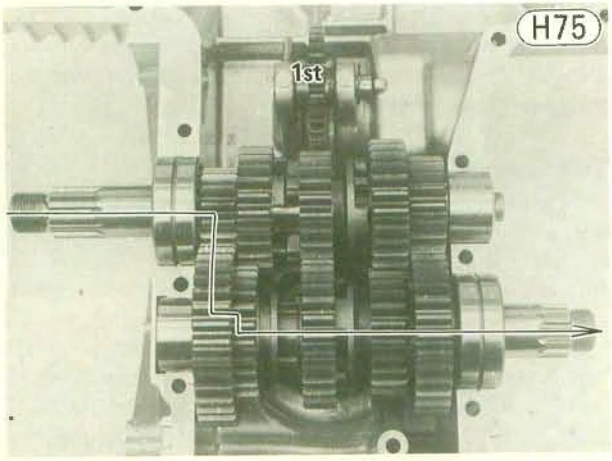
When the shift pedal ㉔ is raised or lowered, the shift shaft ㉓ turns, a pawl on the external shift mechanism arm ⑤ catches on one of the shift drum pins ⑧, and the shift drum ⑨ turns. At the same time, the overshift limiter ⑳ on the shift lever ⑲ catches another pin as shown in Fig. H82. As the shift drum turns, the shift fork guide pins ⑪ (3), each riding in a groove in the shift drum, change the position of one or another of the shift forks ⑩, ⑯, ⑰, in accordance with the winding of the grooves. The shfit fork ears then determine the position of gears D3 ②, O4 ⑬, and O5 ⑫. Refer to Fig. H75 through H80 for the gear position and drive path for neutral and each of the 5 gears. A pawl spring ④ is fitted on the external shift mechanism to keep the shift arm and overshift limiter pressed against the shift drum pins to ensure proper pawl and pin contact. When the shift pedal is released after shifting, the return spring ㉒ returns the shift lever and shift pedal to their original positions. So that the transmission will remain where it was shifted, the shift drum positioning pin spring pushes the shift drum positioning pin ⑮ into one of six notches on the shift drum operation 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.

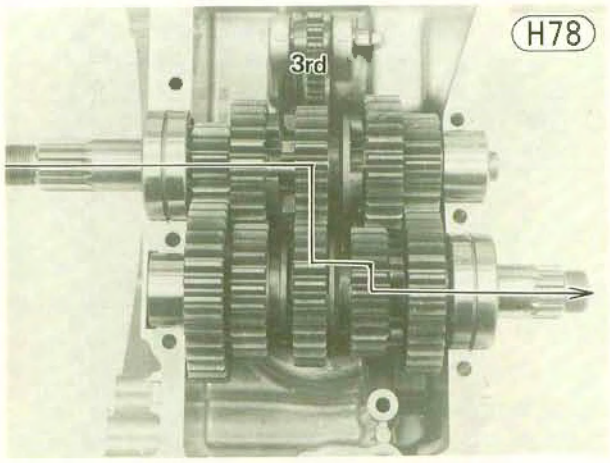
The return spring pin ㉑ on the side of the crankcase passes through a cutout on the shift mechanism lever. This pin engages between the two ends of the shift mechanism return spring. Normally, the return spring pin should not make contact with the cutout on the lever, because the overshift limiter is the primary control for shift lever movement.

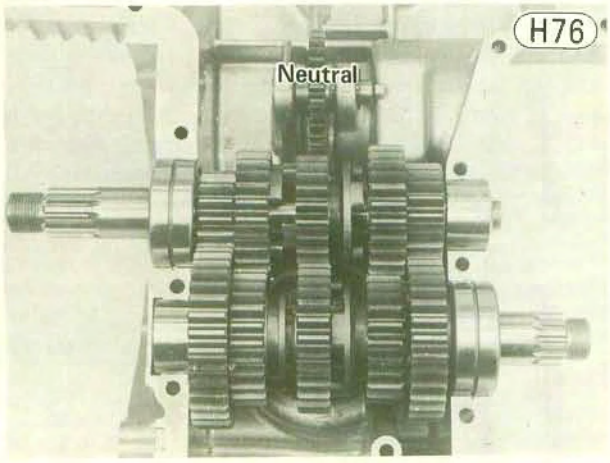
Transmission

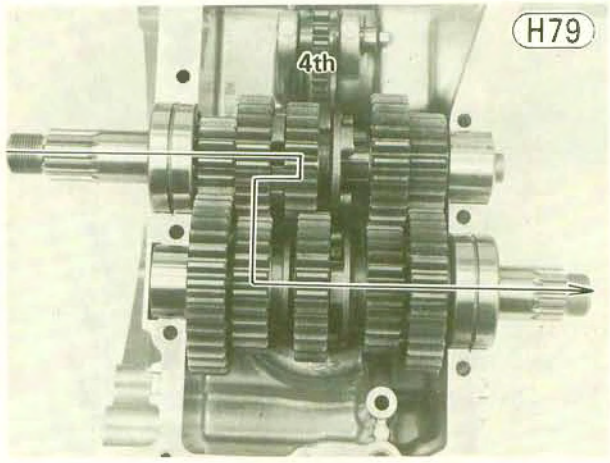
H74

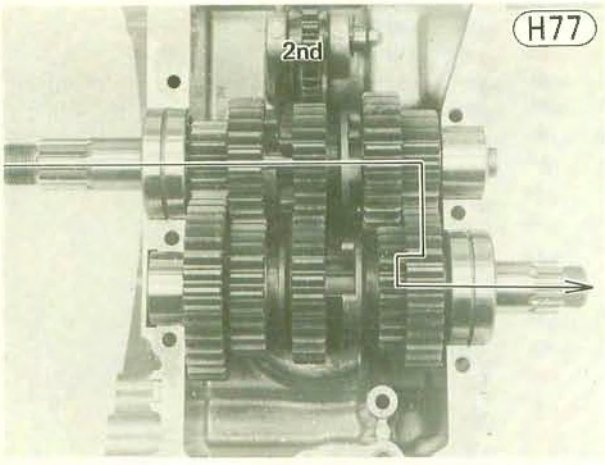


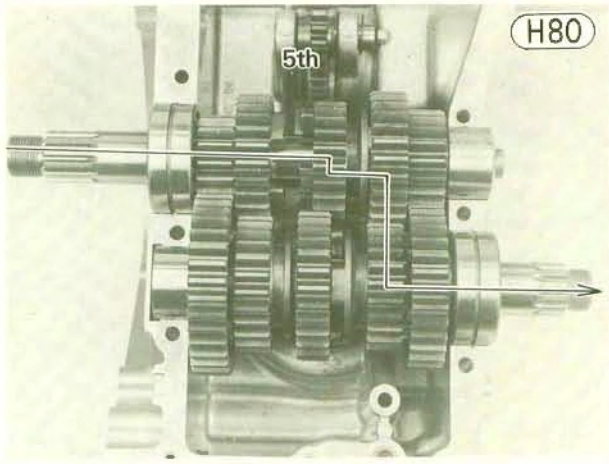












Overshift Limiter

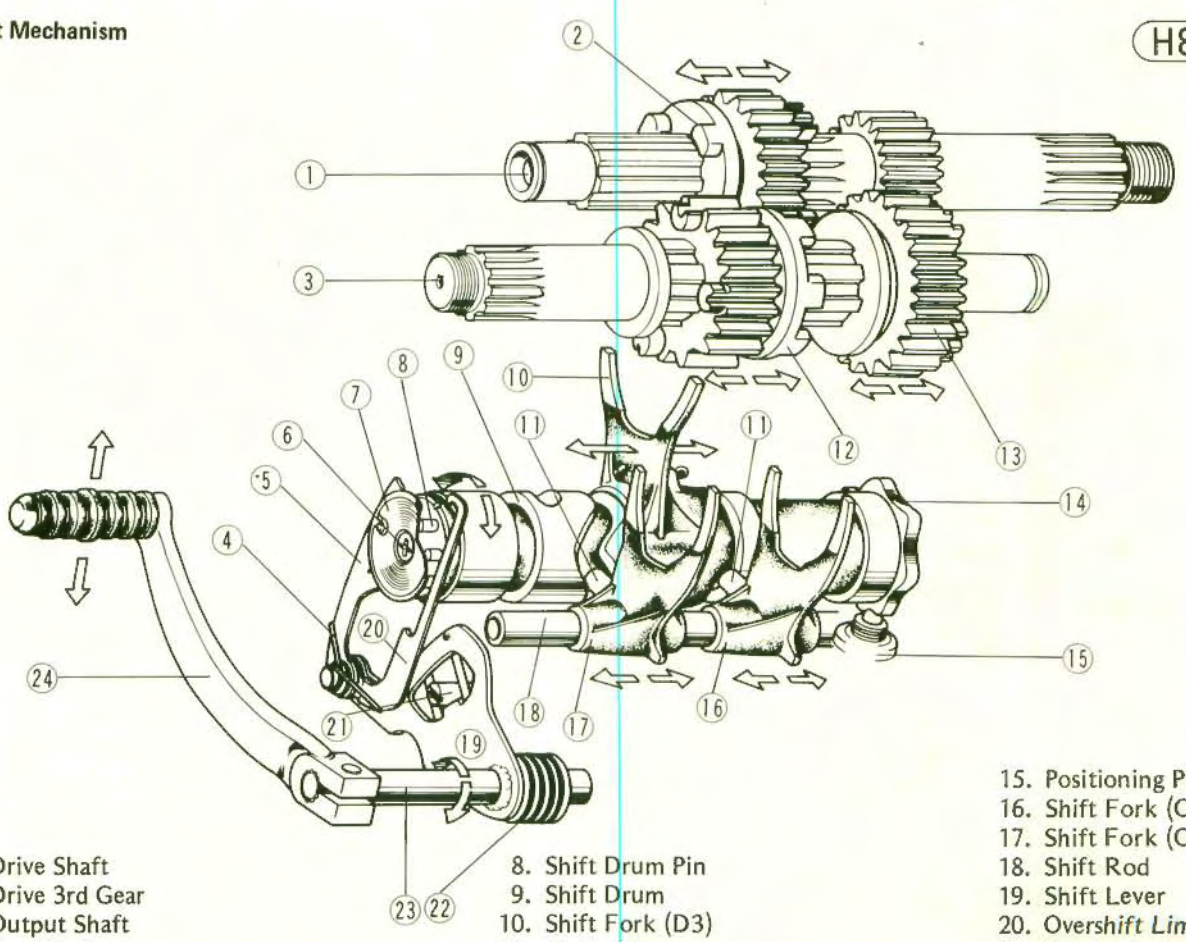
Each time that the shift pedal is operated, the overshift limiter interlocks with the shift drum pins to prevent overshifting. On a full upshift or downshift stroke, the limiter "hooks" catch the shift drum pins to keep the inertia of the heavy shift drum from allowing it to rotate boyond the intended 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.

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 indicator switch, installed in the external shift mechanism cover, consists of a spring loaded pin which contacts a nub on the shift drum pin holder when the transmission is in neutral. This completes the neutral indicator light circuit, which turns on the neutral indicator light.

Shift Mechanism

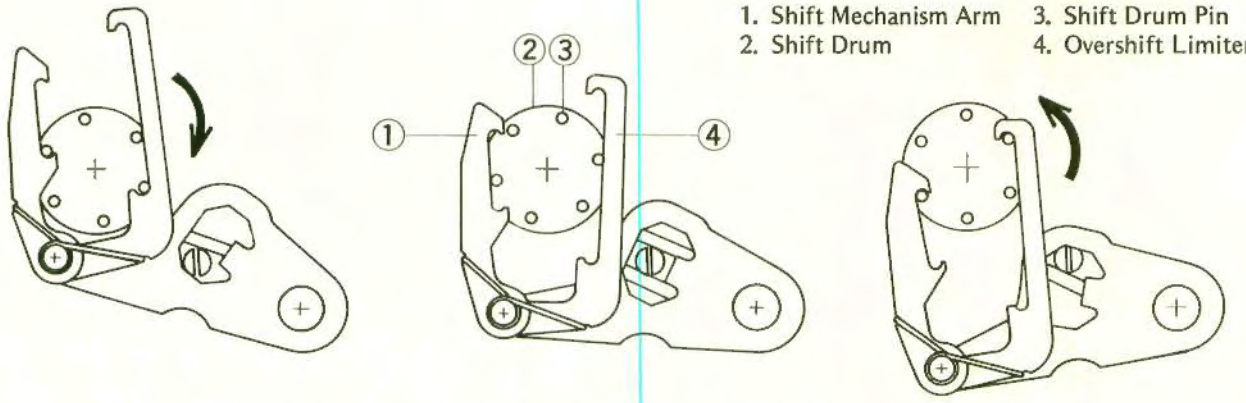
H81



1. Drive Shaft
2. Drive 3rd Gear
3. Output Shaft
4. Pawl Spring
5. Shift Mechanism Arm
6. Screw
7. Shift Drum Pin Plate
8. Shift Drum Pin
9. Shift Drum
10. Shift Fork (D3)
11. Guide Pin
12. Output 5th Gear
13. Output 4th Gear
14. Operating Plate
15. Positioning Pin
16. Shift Fork (O4)
17. Shift Fork (O5)
18. Shift Rod
19. Shift Lever
20. Overshift Limiter
21. Return Spring Pin
22. Return Spring
23. Shift Shaft
24. Shift Pedal

Shift Mechanism Arm and Over Shift Limiter Operation

H82



1. Shift Mechanism Arm
2. Shift Drum
3. Shift Drum Pin
4. Overshift Limiter

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. Loose return spring pin
2. Broken or weakened return spring or shift drum positioning pin spring
3. Broken or weakened shift pawl spring
4. Damaged shift mechanism arm and/or over shift limiter
5. Loose shift drum guide bolt
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.

External shift mechanism inspection

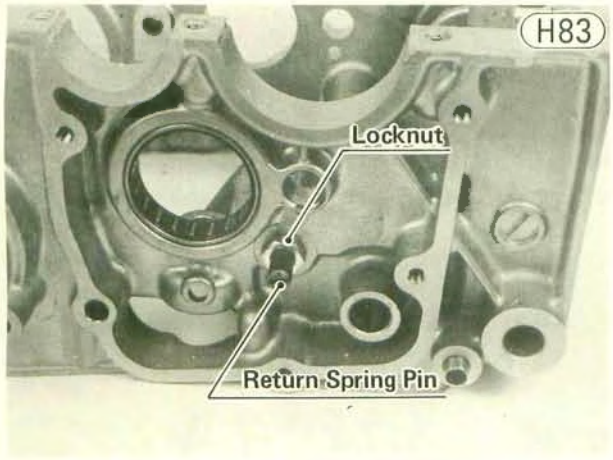
Inspect the shift pawl spring, shift pawls, and return spring. Replace any broken or other wise damaged parts.

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 H53 Shift Drum Positioning Pin Spring Length

Standard	Service Limit
32.3 mm	30.7 mm

Check to see if the return spring pin is loose. If it is, remove it and apply a locking agent to the threads. Then screw it back in, tightening its locknut.

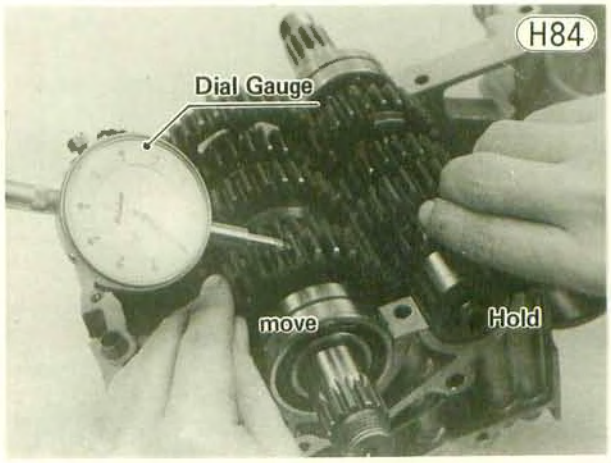


Gear backlash

Split the crankcase. Leaving the transmission in place, measure the backlash between gears O1 and D1, O2 and D2, O3 and D3, O4 and D4, O5 and D5. To measure the backlash, set a dial gauge against the teeth on 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 gears if the amount of backlash exceeds the service limit.

Table H54 Gear Backlash

Standard	Service Limit
0 ~ 0.17 mm	0.25 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 H55 Shift Fork Thickness

Standard	Service Limit
4.9 ~ 5.0 mm	4.7 mm

Table H56 Gear Shift Fork Groove Width

Standard	Service Limit
5.05 ~ 5.15 mm	5.25 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.

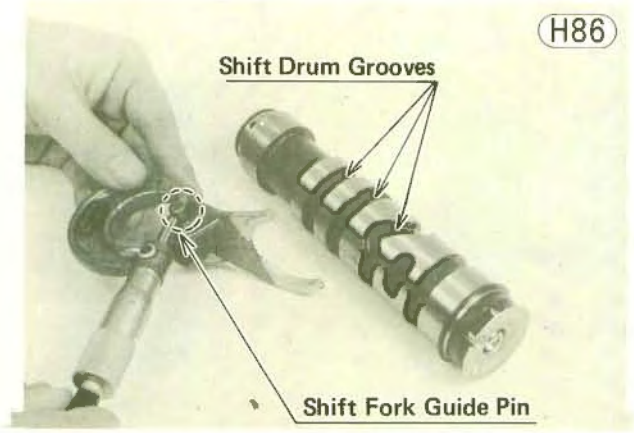


Table H57 Shift Fork Guide Pin Diameter

	Standard	Service Limit
4th, 5th	7.9~8.0 mm	7.85 mm
3rd	7.985~8.000 mm	7.93 mm

Table H58 Shift Drum Groove Width

Standard	Service Limit
8.05 ~ 8.20 mm	8.25 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 where clearance exceeds the service limit.

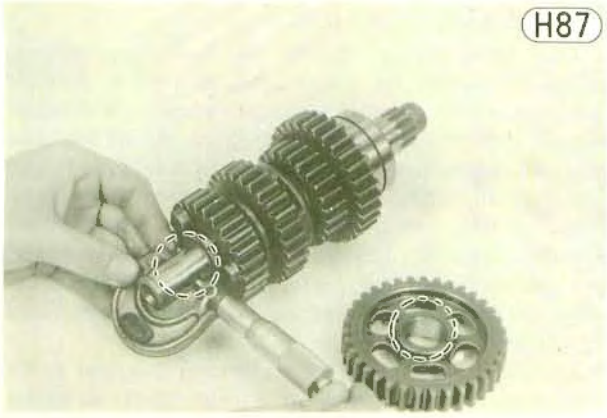


Table H59 Gear/Shaft, Gear/Bush Clearance

Gear	Standard	Service Limit
O2, O3, D4, D5	0.020~0.062 mm	0.16 mm
O1	0.014~0.048 mm	0.15 mm

Shaft/bushing wear

Measure the diameter of the drive and output shafts where it passes through the needle bearing. Replace the shaft if the diameter is less than the service limit. Measure the inside diameter of the bushing with a cylinder gauge. Replace the bushing if the diameter exceeds the service limit. When replacing the shaft and/or bushing, replace the needle bearing also.

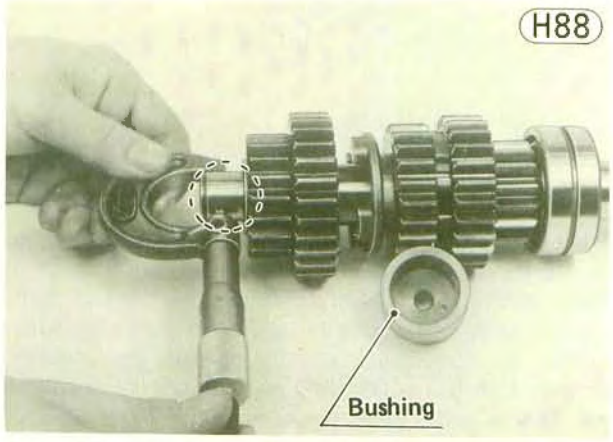


Table H60 Shaft, Bushing Wear

	Standard	Service Limit
Shaft	19.980~19.993 mm	19.96 mm
Bushing	26.014~26.024 mm	26.04 mm

Ball bearing, needle bearing wear, damage

Check the ball bearing and needle bearing (Pg. 166).

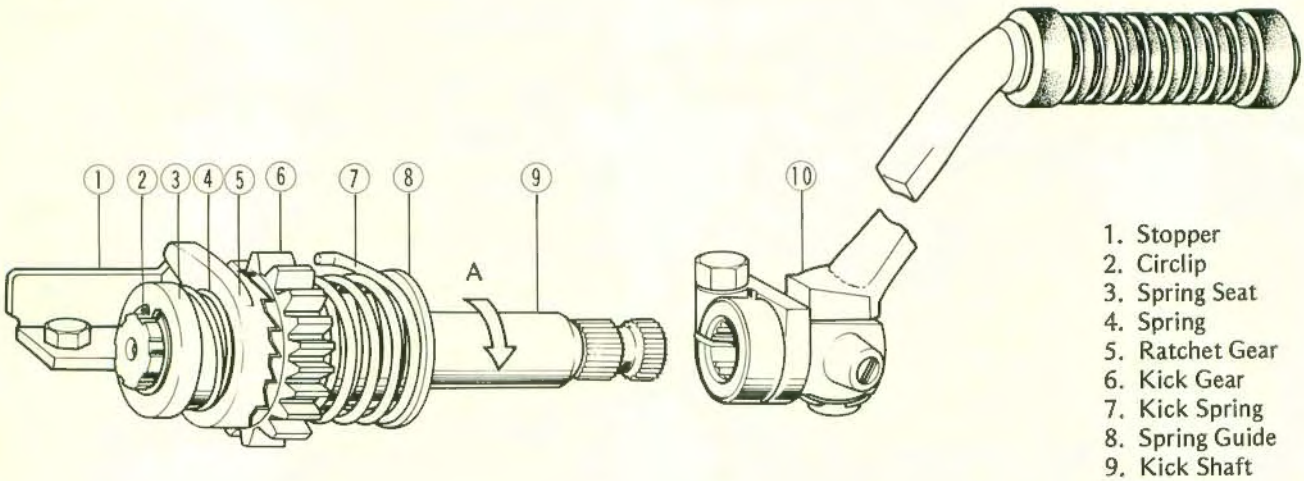
KICKSTARTER

Kickstarter construction is shown in Fig. H89. The kick gear is connected to the primary gear on the crankshaft through the output shaft 1st gear, drive shaft 1st gear, and clutch housing gear, secondary shaft gear, secondary shaft, secondary sprocket, and primary chain.

The kick gear ⑥, constructed with a ratchet on one side, is always meshed with the output shaft 1st gear and turns freely anytime the output shaft is turning. The ratchet gear ⑤, 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 ④ presses the ratchet gear toward the kick gear. But when the kick pedal ⑩ is not being operated, an arm on the ratchet gear is caught on the stopper ①, which prevents the ratchet gear from meshing with the ratchet on the kick gear.

Kickstarter

H89



1. Stopper
2. Circlip
3. Spring Seat
4. Spring
5. Ratchet Gear
6. Kick Gear
7. Kick Spring
8. Spring Guide
9. Kick Shaft
10. Kick Pedal

When the kick pedal is operated, the ratchet gear arm is free from the stopper 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. 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. H89, 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, collar, 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.

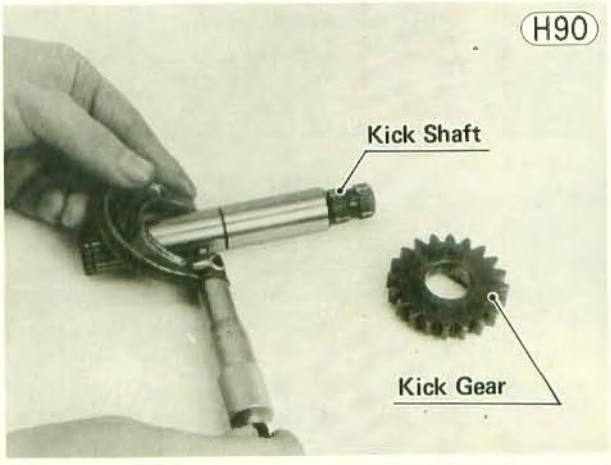
Table H61 Kick Gear Inside Diameter

Standard	Service Limit
20.000~20.021 mm	20.07 mm

Table H62 Kick Shaft Diameter at Kick Gear

Standard	Service Limit
19.959~19.980 mm	19.94 mm

H90



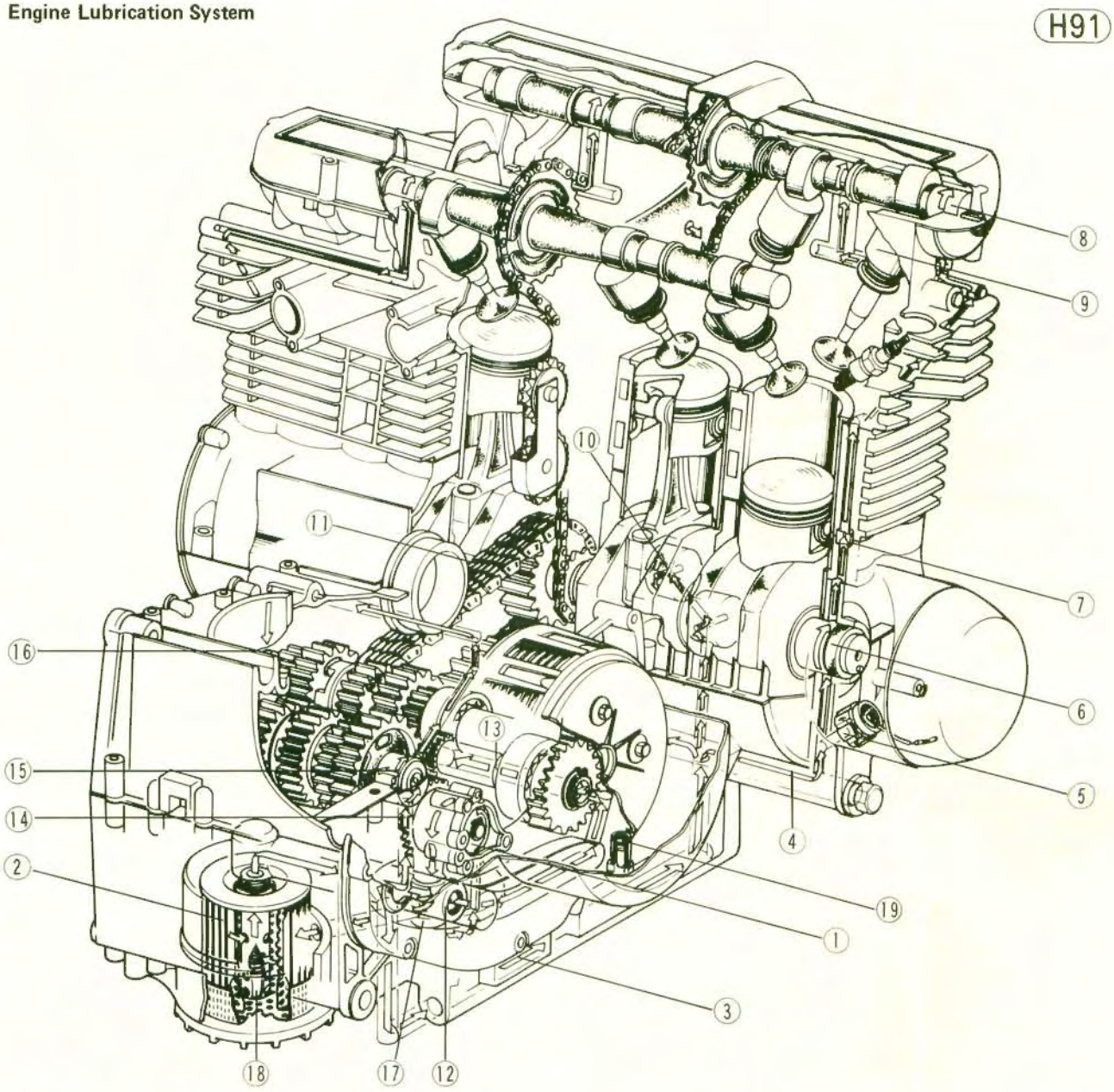
ENGINE LUBRICATION

The engine lubrication system includes the oil screen, engine oil pump, oil filter, oil bypass valve, and oil passages. An oil pressure indicator switch is provided to warn in case of insufficient oil pressure. 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, how the oil reaches the various parts of the engine, and how to check the oil pressure. Details on the engine oil pump, oil filter, and oil breather are given in the sections (Pgs. 165~166) following engine lubrication.

Since the engine lubrication system is a wet sump type, there is always supply of oil in the crankcase at the

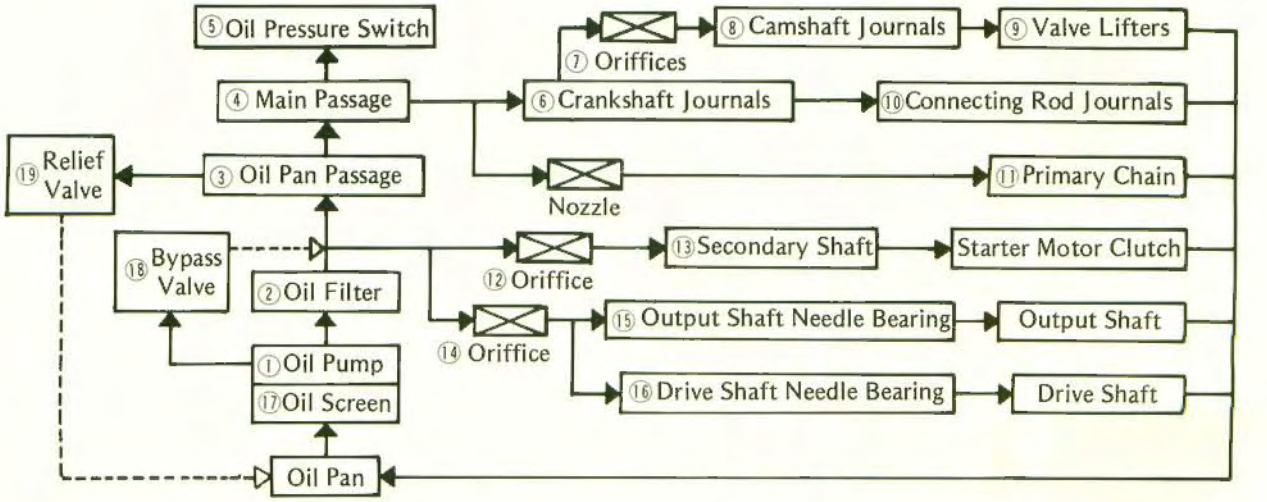
Engine Lubrication System

H91



Engine Oil Flow Chart

H92



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 secondary shaft. 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 bolt. After passing through the filter, the oil branches into two lubrication routes.

One of these routes is through the oil pan passage to the crankcase main oil passage. Through the main oil passage, the oil flows to the crankshaft main bearings, then to the connecting rod journals. 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. An oil passage at each side of the cylinder block takes oil up to the top of the cylinder head. After lubricating the camshaft journals, the oil flows out over the cams and down around the valve lifters to lubricate these areas. This oil return to the sump via the oil return holes at the base of the valve lifters, and via the cam chain opening in the center of the head and cylinder. A nozzle in the main oil passage squirts the oil to the primary chain.

The other route for filtered oil is to the transmission. The oil flows through the orifice and passage between the right side of the crankcase and clutch cover to the secondary shaft. Then, the oil lubricates the secondary shaft coupling and starter motor clutch gear. The oil flows through an orifice to the output shaft needle bearing and drive shaft needle bearing. Finally the oil drops down into the crankcase after lubricating the bearings and gears.

Both the oil pressure indicator switch and the oil pressure relief valve are important for maintaining constant oil pressure. The oil pressure indicator switch, mounted on the right side of the main oil passage (inside of the contact breaker plate), checks on the oil pressure in the main oil passage and lights the oil pressure warning light if the pressure falls below a safe level. If the oil pressure is insufficient, the oil pump is worn or malfunctioning or there is an insufficient oil supply to the pump. On the other hand, if the oil pressure becomes excessive, such as when the engine is first started (especially in cold weather), the relief valve reduces the oil pressure. The relief valve opens whenever a pressure of 5.2 kg/cm^2 (74 psi) is exerted on the valve spring.

Oil pressure measurement

Warm up the engine. With the motorcycle on its side stand, stop the engine, remove the oil passage plug from the right side of the crankcase, and connect the oil pressure gauge and adapter (special tools) in its place to measure oil pressure.

WARNING **Hot engine oil will drain through the oil passage; take care against burns.**

Start the engine again. Run the engine at the specified speed (Table H63), and read the oil pressure gauge.

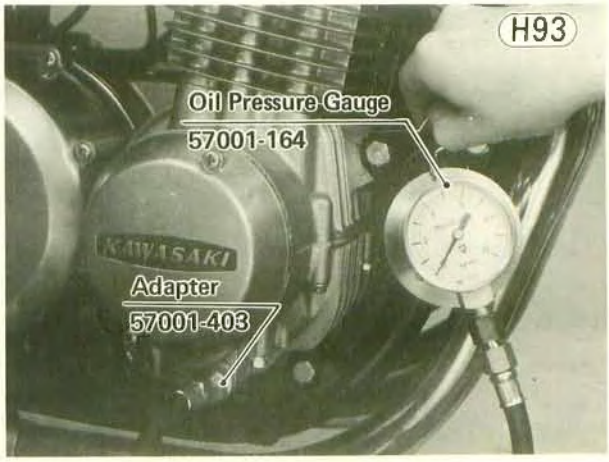


Table H63 Oil Pressure †

Standard
2.0~2.5 kg/cm^2 (28~36 psi)

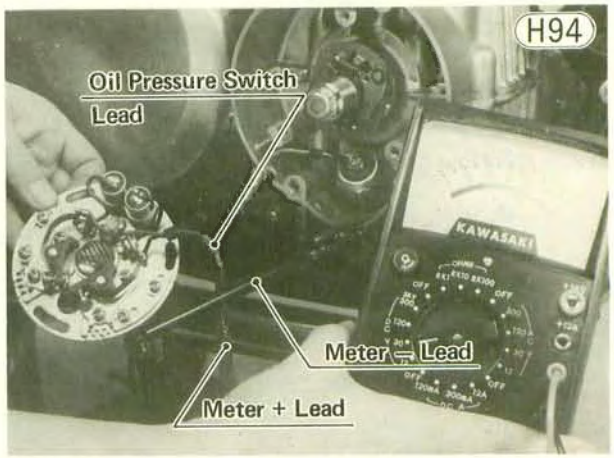
† @4,000 rpm, 90°C (194°F)

If the oil pressure is significantly below the standard pressure, inspect the engine oil pump (Pg. 165). If the pump is not at fault, inspect the rest of the lubrication system.

Oil pressure indicator switch inspection

The switch should turn on the warning light whenever the ignition switch is on with the engine not running.

If the light does not go on, disconnect the switch lead. Connect the positive lead of a 30 VDC range voltmeter to the switch lead and ground the voltmeter negative lead to the engine. Turn the ignition switch to the "ON" position, and read the boltmeter. If the voltmeter does not indicate battery voltage, the trouble is either defective wiring or a burned-out indicator bulb.



If the voltmeter does indicate battery voltage, then the oil pressure indicator switch may be defective. Use an ohmmeter to check for continuity between the switch terminal and the switch body. With the switch lead disconnected, any reading other than zero ohms indicates that the switch is at fault.

The switch should turn off the warning light whenever the engine is running faster than the specified speed.

If the light stays on, stop the engine and measure the oil pressure (Pg. 164). If the oil pressure is more than the specified value with the engine running at the specified speed, the oil pressure indicator switch is defective, and must be replaced.

NOTE: When installing a new switch, tighten it with 1.3~1.7 kg-m (9.5~12 in-lbs) of torque.

Relief valve wear

Measure the diameter of the valve piston and the inside diameter of the valve body. The difference between these two values is the piston-to-body clearance. If the clearance exceeds the service limit, replace the valve piston. If the piston or the inside wall of the valve body are scratched, repalce the relief valve.

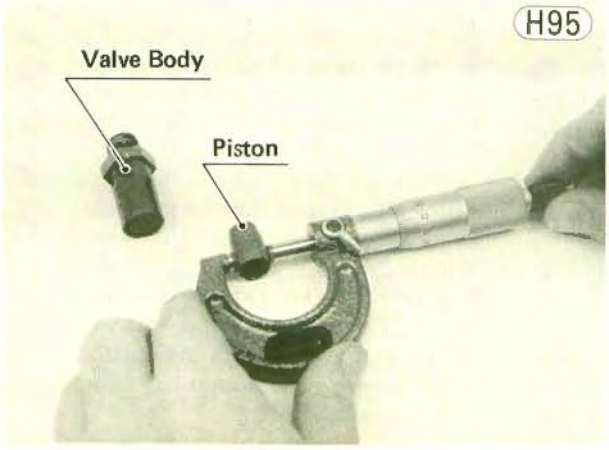


Table H64 Relief Valve Piston/Body Clearance

Standard	Service Limit
0.020~0.103 mm	0.13 mm

Relief valve spring tension

Measure the valve spring free length with vernier calipers. If the length is less than the service limit, replace the spring.

Table H65 Valve Spring Free Length

Standard	Service Limit
20.1 mm	19.1 mm

Engine Oil Pump

The oil pump, installed in the right side of the lower crankcase half, 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 secondary shaft.

If the oil pump becomes worn, it may no longer be able to supply oil to lubricate the engine adequately.

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.

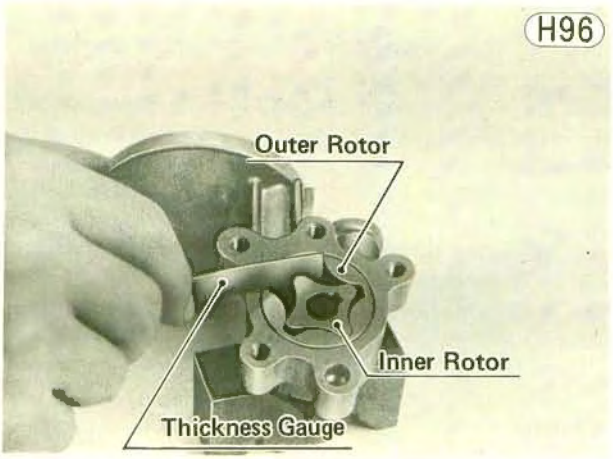


Table H66 Outer Rotor/Inner Rotor Clearance

Standard	Service Limit
0.05 ~ 0.23 mm	0.30 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, replace the rotors or the oil pump assembly. The standard inside diameter for the pump body and outside diameter for the outer rotor are 40.71~40.74 mm and 40.50~40.59 mm.

Table H67 Outer Rotor/Pump Body Clearance

Standard	Service Limit
0.15~0.21 mm	0.30 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.

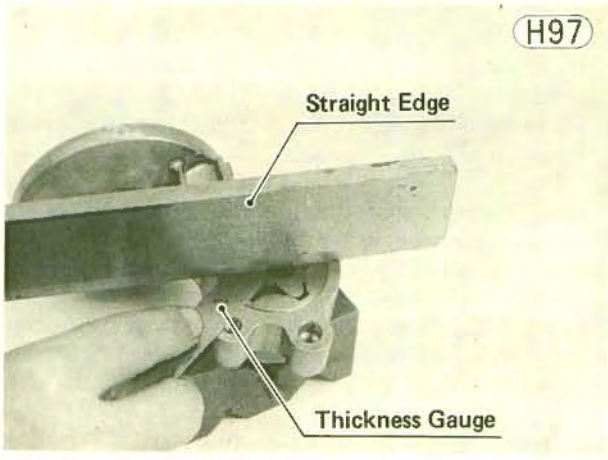


Table H68 Rotor Side Clearance

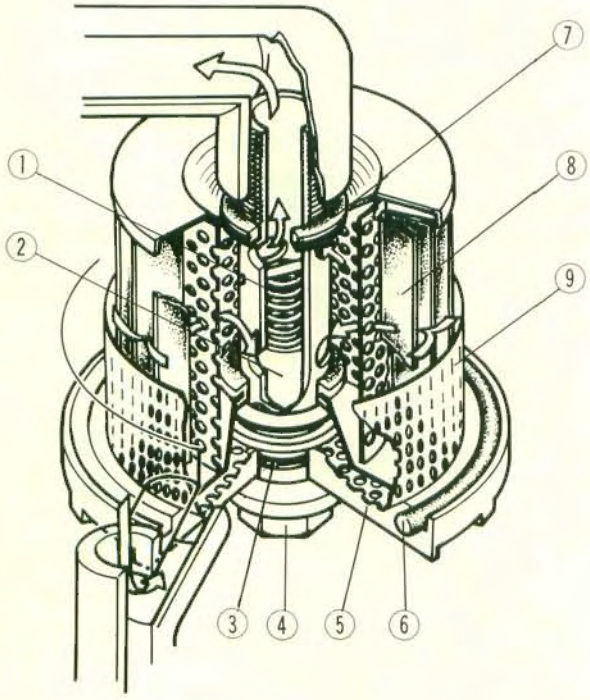
Standard	Service Limit
0.02 ~ 0.07 mm	0.12 mm

Oil Filter

The oil filter, located in the lower part 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 crankcase 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 inlet 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 main oil passage, bypassing the filter.

Oil Filter (H98)



1. Bypass Valve Spring
2. Bypass Valve
3. O Ring
4. Filter Mounting Bolt
5. Filter Cover
6. O Ring
7. Grommet
8. Filter Element
9. Element Fence

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 and check the condition of the **O** rings. If the **O** rings are worn or deteriorated, replace them to avoid oil leakage.

Oil Breather

The oil breather is located on the top of the crankcase. The front right side of the breather opens to the crankcase, while the upper part 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 which have escaped combustion chamber gas 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 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 carburetors 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 BEARINGS, NEEDLE BEARINGS

The engine ball bearings and needle bearings are listed in Table H69.

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.

Table H69 Ball Bearings, Needle Bearings

Secondary Shaft		Drive Shaft		Output Shaft	
Left	Right	Left	Right	Left	Right
#6304	#6305	92046-055	#5205	#5205	92046-055

Table H70 Oil Seals

Crankshaft		Clutch Push Rod	Output Shaft	Shift Shaft	Kick Shaft
Left	Right				
HSCY223907	HSCY253907	AK071807	AJ325211	AJ13225.5	AJ20285.5

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 engine oil seals are listed in Table H70. The crankshaft oil seal in the right engine cover forms a seal between the crank 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.

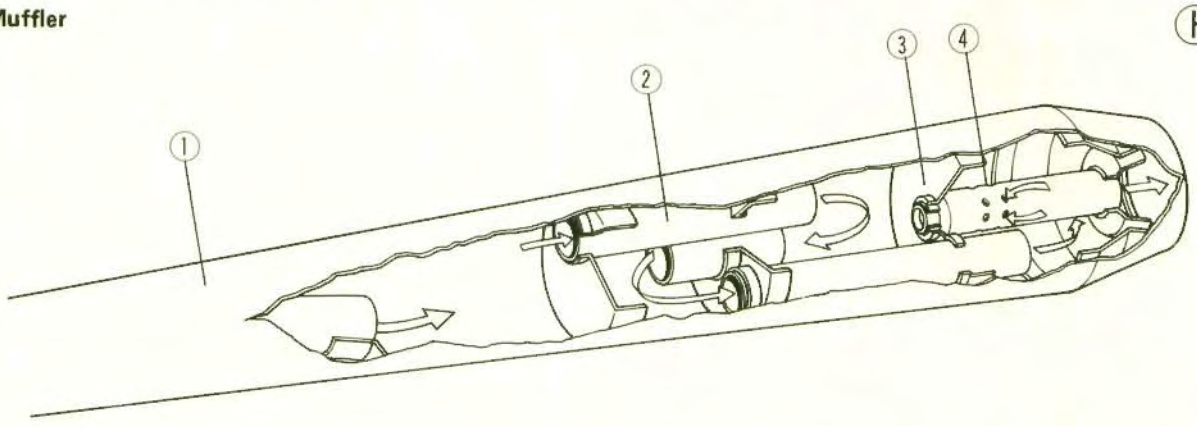
MUFFLERS

The mufflers reduce exhaust noise and conduct 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 mufflers connect to the cylinder head, or if the gaskets appear damaged, replace the gaskets. If either muffler is badly damaged, dented, cracked or rusted, replace it with a new one.

Muffler

H99



1. Muffler
2. Connecting Pipe
3. Partition Wall
4. Buffle Tube

Maintenance—Chassis

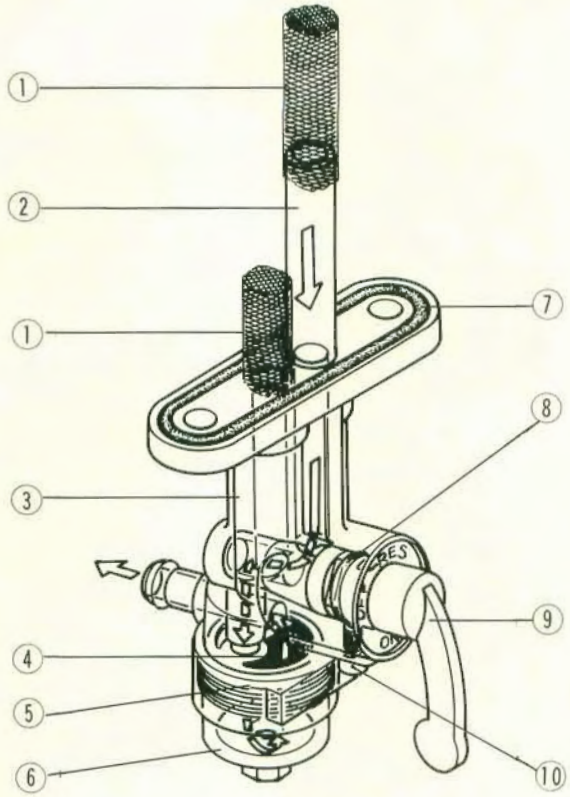
Table of Contents

FUEL TANK

The fuel tank capacity is 16.8 liters, 2.4 liters 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 carburetors.

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. Screen
2. Pipe
3. Body
4. Filter
5. Gasket
6. Sediment Cup
7. O Ring
8. O Ring
9. Lever
10. Screw

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 hoses, remove the fuel tap, and flush out the tank with a high flash-point solvent.

To drain the carburetor float bowls, remove the plug at the bottom of each carburetor. For thorough cleaning, remove and disassemble the carburetors (Pg. 41).

WHEELS

Wheel construction is shown in Fig. J2 and J3. The following sections, Pgs. 170~175, cover the tires, rims, spokes, axles, wheel bearing, and grease seals. For the brakes, see Pgs. 177~184.

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, riding becomes 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. However, for continuous high speed travel, increase the tire pressure 0.2 ~ 0.4 kg/cm^2 (3 ~ 6 psi) in order to minimize heat buildup. Also, a certain variation from the standard pressure may be desired depending on road surface conditions (rain, ice, rough surface, etc.).

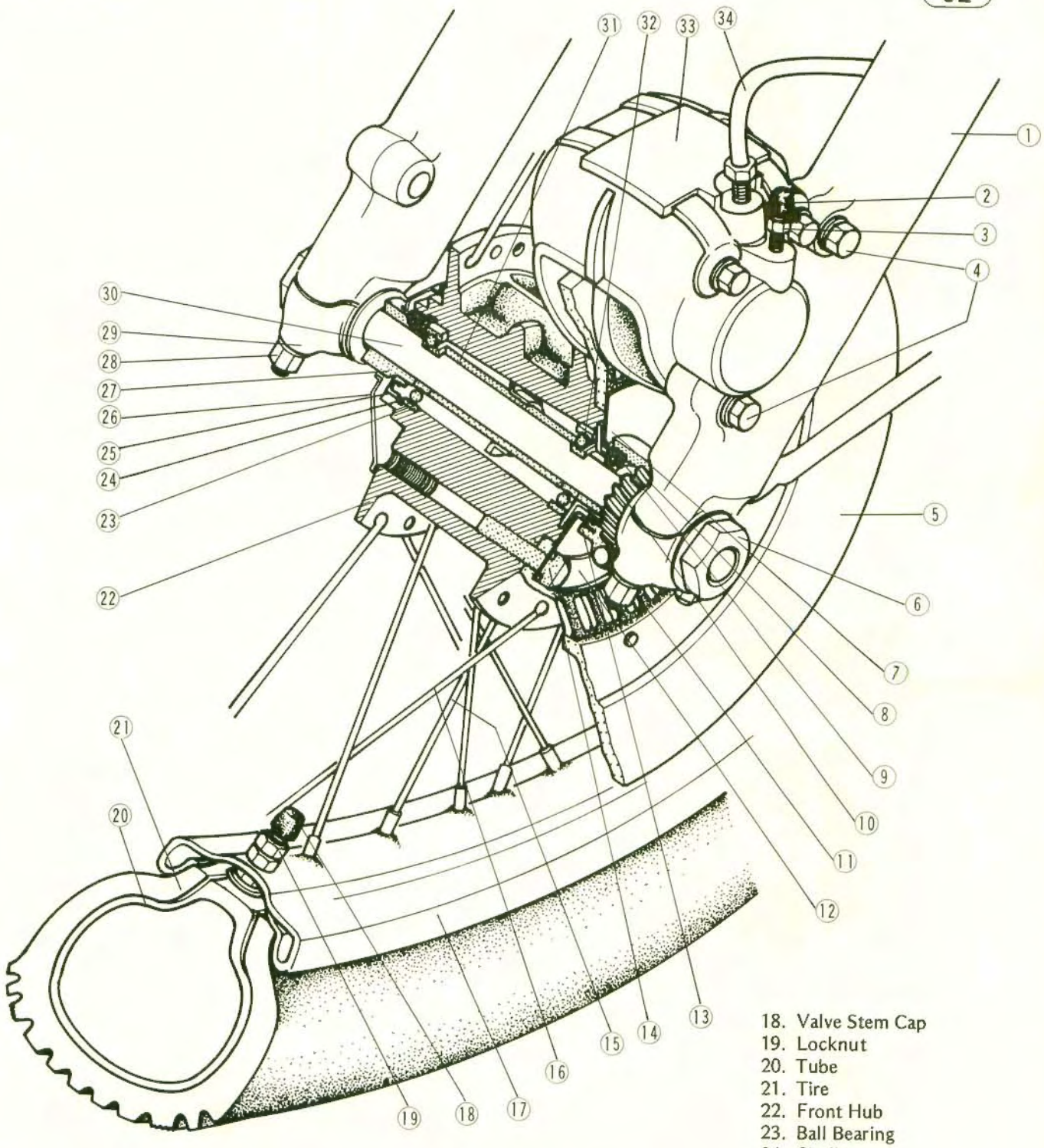
Bead protectors are provided on the rear wheel to keep the tire from slipping on the rim and damaging the tube when extreme braking or driving forces are applied.

Table J1 Tires, Air Pressure (measured when cold)

	Air Pressure		Size	Make, Type
Front	2.0 kg/cm^2 (28 psi)		3.25H-19 4PR	DUNLOP F6B
Rear	Up to 97.5 kg	2.25 kg/cm^2 (32 psi)	4.00H-18 4PR	DUNLOP K87 MARKIIM
	Over 97.5 kg	2.50 kg/cm^2 (36 psi)		

Front Wheel

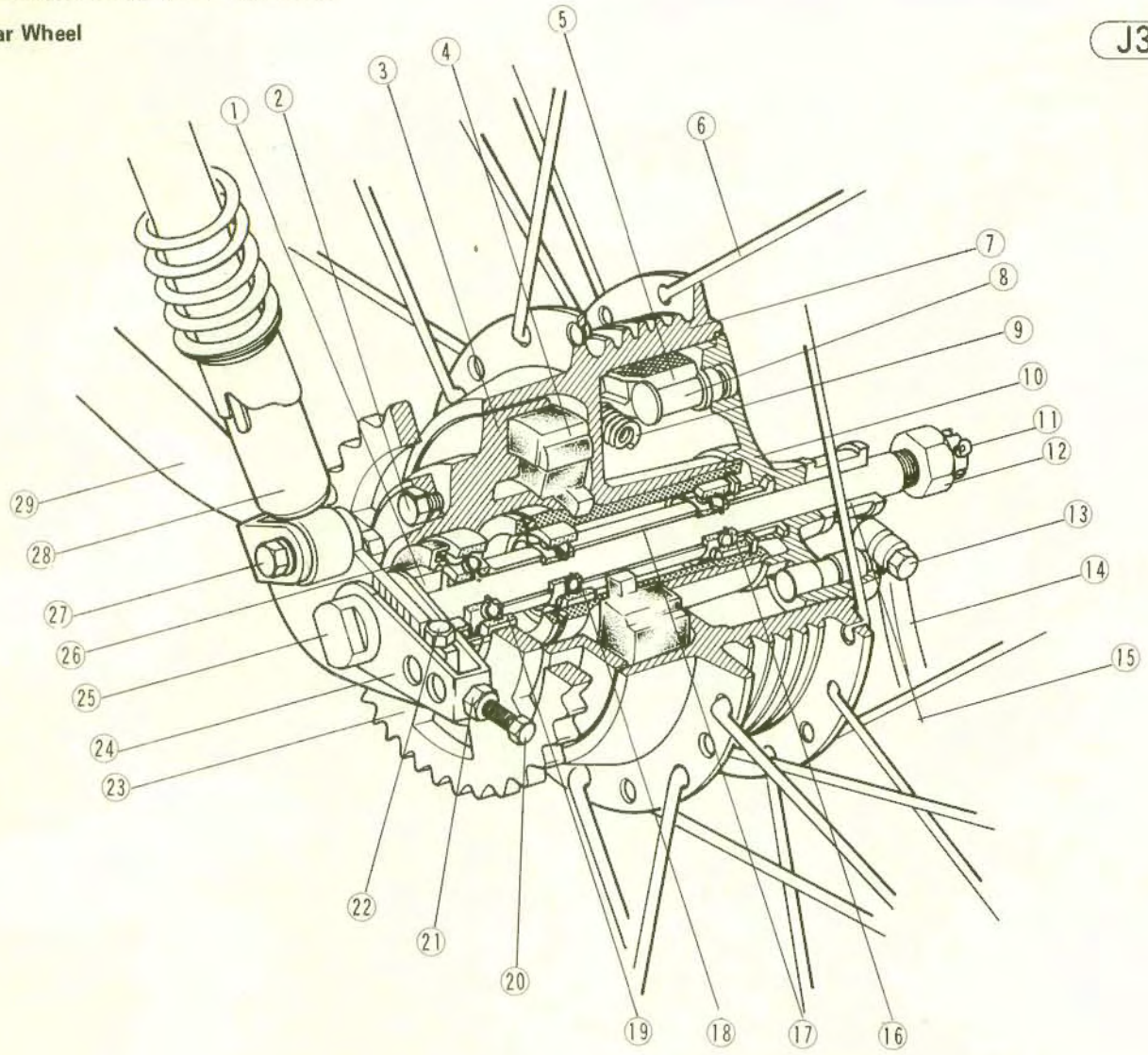
J2



1. Left Fork Leg
2. Bleed Valve Cap
3. Bleed Valve
4. Caliper Mounting Bolts
5. Disc
6. Axle Nut
7. Speedometer Gear Drive Holding Plate
8. Speedometer Gear Housing
9. Speedometer Gear Drive
10. Speedometer Gear
11. Speedometer Pinion
12. Double Washer
13. Grease Seal
14. Disc Mounting Bolt
15. Inner Spoke
16. Outer Spoke
17. Rim
18. Valve Stem Cap
19. Locknut
20. Tube
21. Tire
22. Front Hub
23. Ball Bearing
24. Circlip
25. Grease Seal
26. Cap
27. Collar
28. Front Axle Clamp Nut
29. Front Axle Clamp
30. Front Axle
31. Distance Collar
32. Ball Bearing
33. Caliper Assembly
34. Brake Pipe

Rear Wheel

J3



1. Coupling Collar
2. Rear Sprocket Bolt
3. Wheel Coupling
4. Rubber Damper
5. Brake Shoe
6. Spoke
7. Rear Hub
8. Shoe Anchor Pin
9. Shoe Spring
10. Panel Assembly
11. Cotter Pin
12. Axle Nut
13. Bolt
14. Cam Lever
15. Collar
16. Ball Bearing
17. Distance Collar
18. Ball Bearing
19. Ball Bearing
20. Adjusting Bolt
21. Locknut
22. Chain Adjuster Stopper
23. Rear Sprocket
24. Chain Adjuster
25. Rear Axle
26. Grease Seal
27. Rear Shock Absorber Mounting Bolt
28. Rear Shock Absorber
29. Swing Arm

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 tread depth is less than the service limit.

Table J2 Tire Tread Depth

Tire	Standard	Service Limit	
		Normal Speed	Over 130 kph
Front	3.5 mm	1 mm	1 mm
Rear	7.3 mm	2 mm	3 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 rim and 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. J6 A), 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 J4 is the outer width and diameter, both in inches. The spoke size is diameter number 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 tightening torque is 0.2 ~ 0.4 kg-m (17 ~ 35 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 to 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.

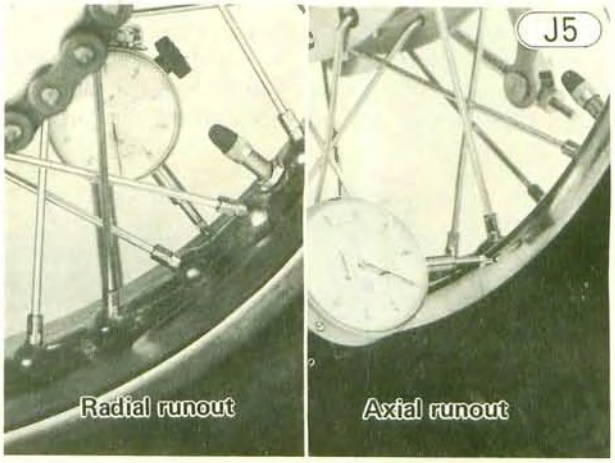


Table J3 Rim Runout

	Standard	Service Limit
Axial	under 0.8 mm	3.0 mm
Radial	under 1.0 mm	2.0 mm

Spoke Force

J6

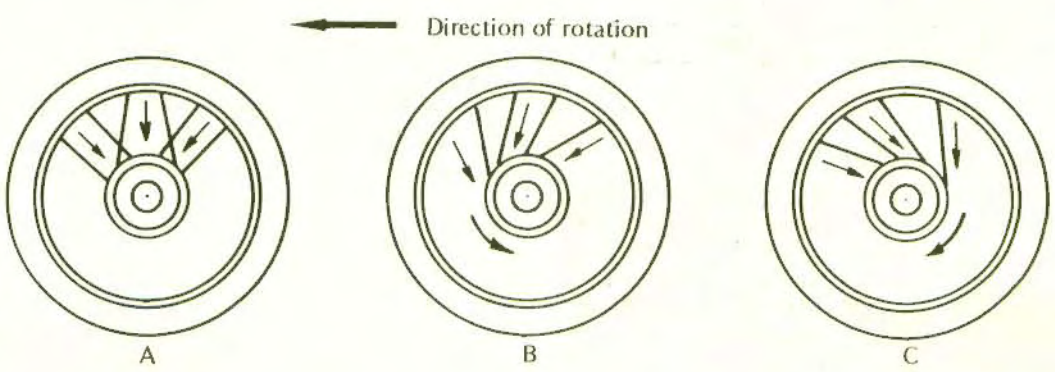


Table J4 Rim, Spoke Size

	Front		Rear	
	Inner	Outer	Inner	Outer
Spokes	#8 x #9 x 184.5 x 97°	#8 x #9 x 184.0 x 83.5°	#8 x #9 x 147.5 x 103°	#8 x #9 x 146.5 x 84°
Rim	1.85 x 19		2.15B x 18	

A certain amount of rim warp (runout) can be corrected by recentering the rim. Loosen some spokes and tighten others to change 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 to 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 0.7 mm, replace the axle.

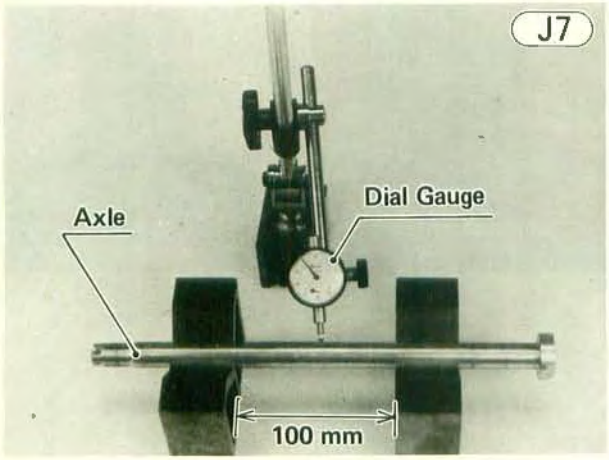


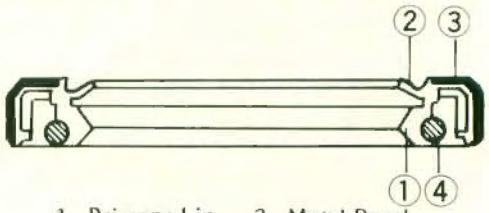
Table J5 Axle Runout/100 mm

	Standard	Service Limit
Front	under 0.1 mm	0.2 mm
Rear	under 0.05 mm	0.2 mm

Wheel Bearings, Grease Seals

A grease seal is fitted in the speedometer gear housing, in the right side of the front and rear hubs, 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 J8



1. Primary Lip 3. Metal Band
2. Secondary Lip 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, 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).

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.

Table J6 Grease Seals, Wheel Bearings

	Front Hub			Rear Hub		
	Hub Left	Hub Right	Speedometer Gear Housing	Coupling	Hub Left	Hub Right
Grease Seal	——	PJA254008	PJA304208	AJ386209	——	——
Bearing	#6203	#6203	——	#6305	#6303	#6303

Damper inspection

Remove the rear wheel coupling (Pg. 106), and inspect the rubber damper.

Replace the damper if it appears damaged or deteriorated.

DRIVE CHAIN

The drive chain is an "endless" type in which the weakest link, the master link, has been eliminated by constructing the chain in a closed loop. To preserve chain strength and reliability, never cut the chain to install it; 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, since only this chain has been especially designed to withstand the extremely high torque developed by the engine.

Chain construction is shown in Fig. J10. 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 pin and bushing is greatly reduced by providing **O** rings to seal in the lubricant between the pin and bushing. The wear between bushing and roller can be minimized by frequent and sufficient lubrication.

Table J7 Drive Chain

Make	Type	Link
Enuma	EK530SH-T_2O	106 link

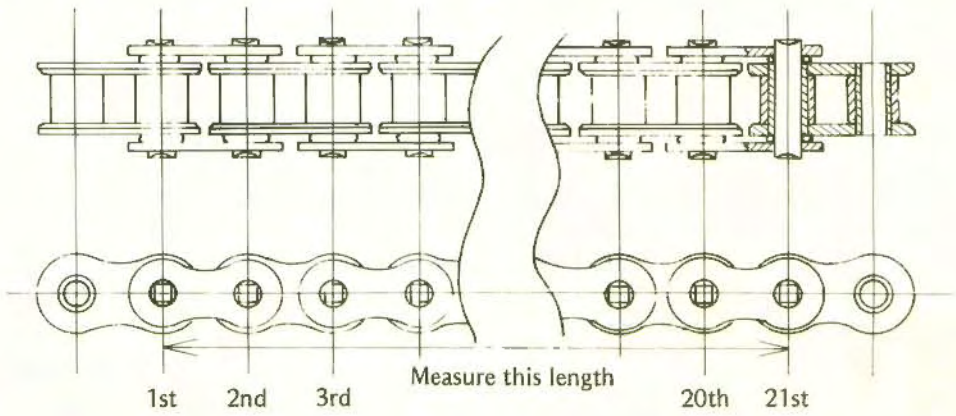
Wear

When the chain has worn so much that it is more than % 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 176 ("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

Drive Chain

J10



a straight part of the chain from pin center of the 1st pin to pin center of the 21st pin. If the length is greater than the service limit, the chain should be replaced.

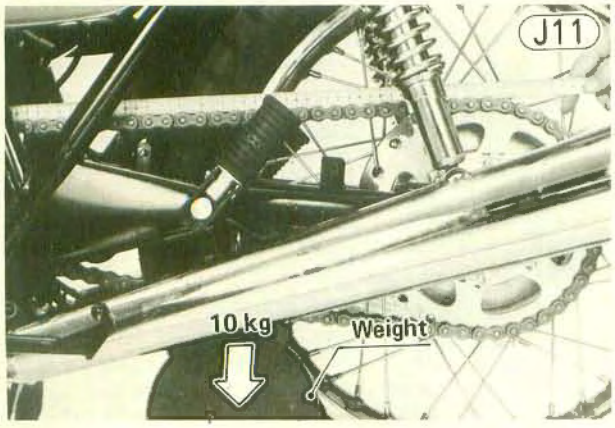


Table J8 Drive Chain Length

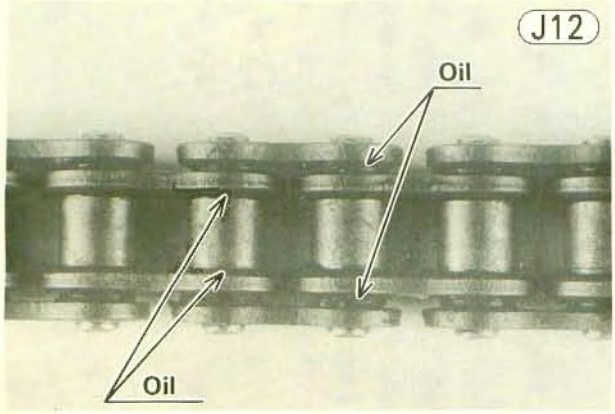
	Standard	Service Limit
20-link Length	317.5 mm	323 mm

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 adequately lubricated on the spot in order to avoid rust.

The chain should be lubricated with a lubricant which will both prevent the exterior from rusting and also absorb shock 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.

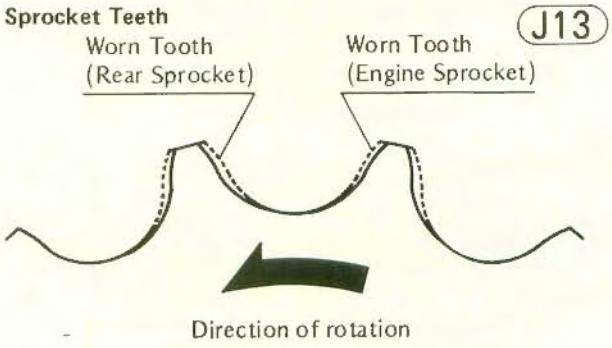
SPROCKETS

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 such that the chain may break or jump from 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.



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.

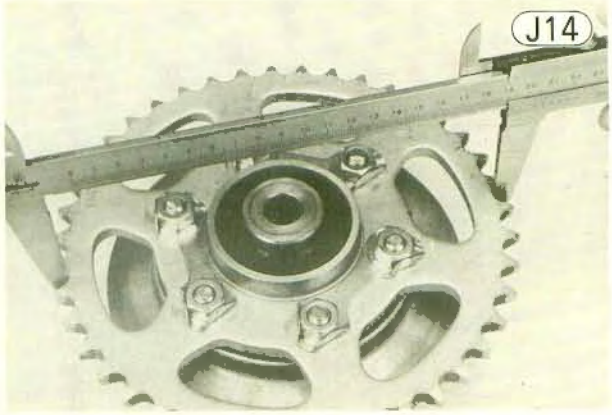


Table J9 Sprocket Diameter

	Standard	Service Limit
Engine	71.01 ~ 71.21 mm	70.2 mm
Rear	201.77 ~ 202.27 mm	200.3 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.

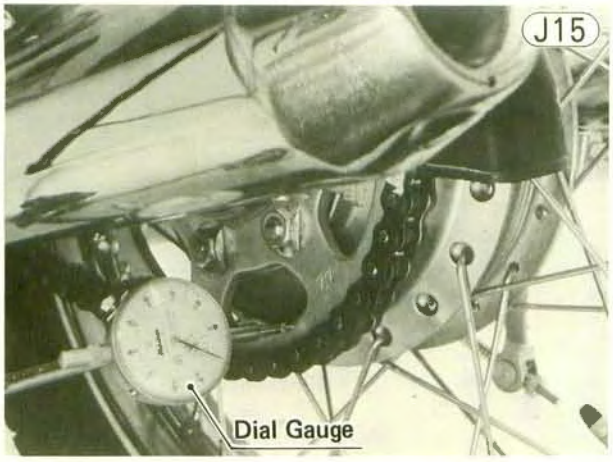


Table J10 Rear Sprocket Warp

Standard	Service Limit
under 0.3 mm	0.5 mm

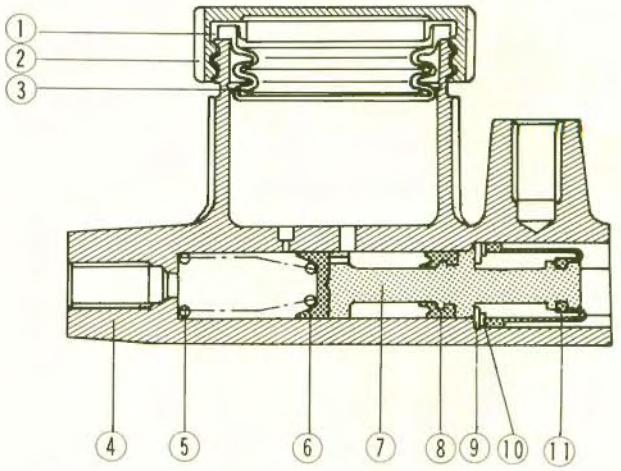
FRONT BRAKE

A hydraulic disc brake is used on the front wheel for superior braking performance and high reliability. The major components of the disc brake are the brake lever, master cylinder, brake line, caliper assembly, and disc. The brake lever is pulled to move a piston in the master cylinder and pressurize the brake fluid. Fluid pressure is transmitted through the brake line to operate the caliper. The caliper grips the disc attached to the wheel, slowing wheel rotation. Fluid pressure operates the brake light switch. The switch turns on the brake light.

The brake fluid is an extra heavy duty type with a high boiling point to withstand the heat produced by friction of the caliper pads on the disc. Since the boiling point and thus the performance of the fluid would be reduced by contamination with water vapor or dirt from the air, the reservoir is sealed with a rubber diaphragm under the cap. This diaphragm also prevents fluid evaporation and spillage should the motorcycle fall over. The fluid is further protected by rubber seals in the caliper assembly and at the master cylinder brake line fitting.

The master cylinder assembly includes the reservoir, piston, primary and secondary cups, non-return valve, and spring. The reservoir has two holes at the bottom: a relatively large supply port to supply fluid to the lines and a small relief port to admit excess fluid from the line. The primary and secondary cups stop the fluid from leaking back around the piston while the piston is moving forward to pressurize the line. The non-return valve is in the head of the piston; it stops backward fluid flow when the brake is applied. When the brake lever is released, the valve allows flow around the cup to fill the vacuum in front of the piston so that the piston can return easily.

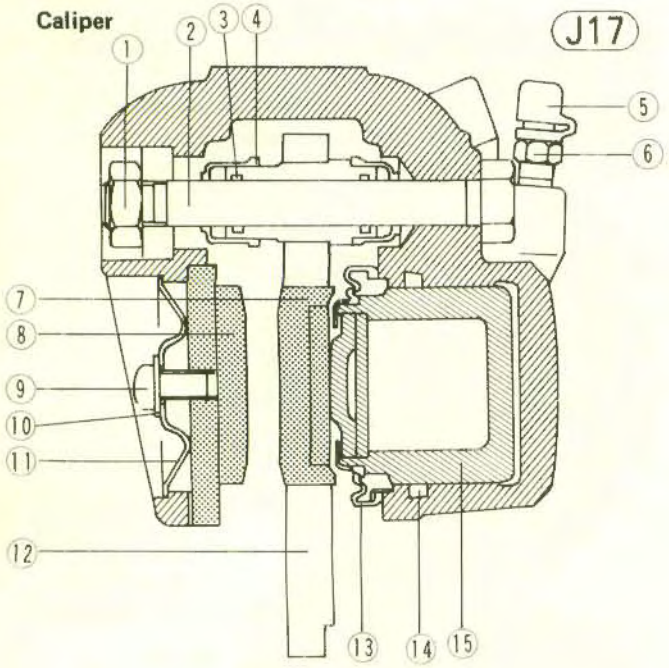
Master Cylinder J16



1. Ring Plate
2. Cap
3. Diaphragm
4. Master Cylinder Body
5. Spring
6. Primary Cup
7. Piston
8. Secondary Cup
9. Piston Stopper
10. Circlip
11. Dust Seal

The caliper assembly includes pad A, pad B, and the piston, which is inside the caliper cylinder. Through the caliper run two shafts, which also pass through the caliper holder to mount the assembly to the left fork leg. When the piston 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 paralled to the disc.

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



1. Nut
2. Caliper Holder Shaft
3. O Ring
4. Dust Cover
5. Bleed Valve Cap
6. Bleed Valve
7. Pad A
8. Pad B
9. Screw
10. Lockwasher
11. Metal Plate
12. Caliper Holder
13. Dust Seal
14. Fluid Seal
15. Piston

air flow past the motorcycle. This provides for excellent dissipation of the heat from brake friction, and minimizes the possibility of brake fade common to drum brakes.

Automatic Wear Adjustment

When fluid pressure develops in the cylinder, the piston is pushed exerting pressure against the brake pad, which in turn presses against the brake disc. The pressurized fluid is prevented from leaking by a fluid seal fitted into the cylinder wall. The seal is pressed against the piston, and instead of sliding when the piston moves, the seal is only distorted, allowing no fluid leakage at all. When the brake lever is released and fluid pressure lowers, the elasticity of the seal returns the piston to its original position. After the brakes are used for a while and the pads wear slightly, the rubber seal will no longer be able to distort the additional amount that the piston travels. Instead, when piston travel forces the seal past its limit, the seal slips on the piston. The seal then returns the piston to a new rest position that is closer to the disc.

A small amount of fluid from the reservoir supplements the fluid in the brake line to compensate for the difference in piston position. Consequently, the length of the brake lever stroke remains unchanged, and the brake never needs adjustment.

The seal and the cup at the head of the master cylinder piston are made of special heat resistant rubber for best performance and to prevent deterioration. For this reason, only standard parts should be used.

Braking Stroke

When the brake lever is pulled, the piston ① in the master cylinder is pushed and moves forward against the force of the return spring ⑥. At this time, the primary cup ⑦ at the head of the piston closes the small relief port ③, which connects the pressure chamber and the reservoir ⑤. Until this port is fully closed, the brake fluid does not start being pressurized, in spite of the forward movement of the piston.

The pressure stroke starts as soon as the relief port is closed. The piston compresses the brake fluid, which is being used as the pressure medium, forcing it out into the brake line. The pressure is transmitted through the line to the cylinder portion of the caliper assembly, where it forces the piston towards the disc. The piston presses pad A against the disc, but since the disc is immovable, further pressure cannot move the pad any farther. Instead, the entire caliper assembly moves in the opposite direction such that pad B is also forced against the disc. In this manner, the disc is gripped between the two pads, and the resulting friciton slows wheel rotation.

Braking Release Stroke

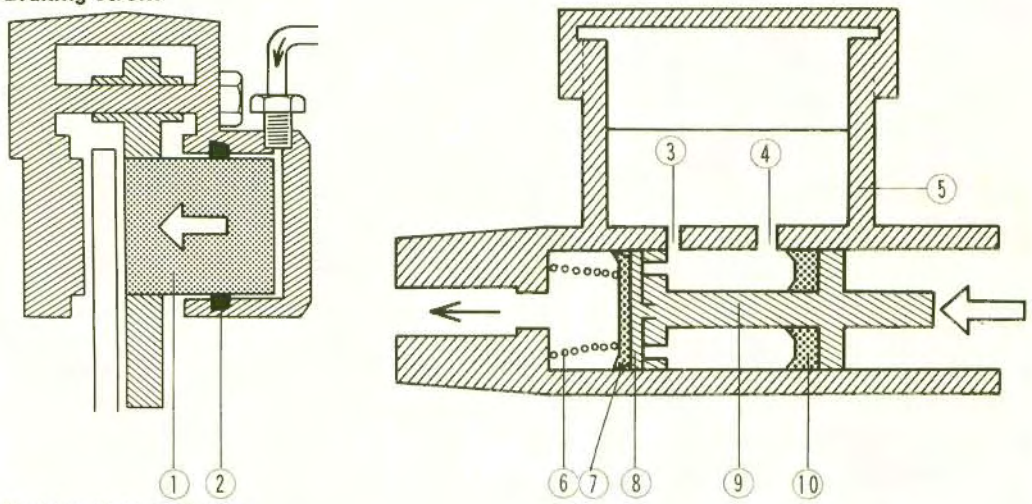
When the brake lever is released, the piston in the master cylinder is quickly returned toward its rest position by the spring ⑥, and brake fluid pressure drops in the line and in the caliper cylinder. The elasticity of the fluid seal ② in the cylinder then returns the piston. This leaves no pressure against either pad A or B so that slight friction against the disc pushes them both slightly away from the disc.

As the master cylinder piston moves back further, the brake fluid in the line rushes to fill the low pressure area in front of the primary cup at the piston head. At this time, fluid from the reservoir flows through the large supply port ④ into the space between the primary and secondary cups, through the non-return valve, and passes around the edges of the primary cup to fill the vacuum. When the piston has returned to its rest position against the stopper, the small relief port is uncovered. As the brake fluid returns from the line, excess fluid passes through the relief port into the reservoir until the brake line pressure returns to zero.

Brake Fluid

When the brake is applied, heat is generated by the friction between the disc and the brake pads. While much of this heat is immediately dissipated, some of it is transmitted to the brake fluid and may raise fluid temperature to as high as 150°C (300°F) during brake operation. This temperature could boil the brake fluid and cause a vapor lock in the lines unless fluid with a high boiling point is used and has been kept from being contaminated with dirt, moisture, or a different type of fluid. Poor quality or contaminated fluid can also deteriorate the rubber parts of the brake mechanism, although a special rubber is used to make them resistant to brake fluids.

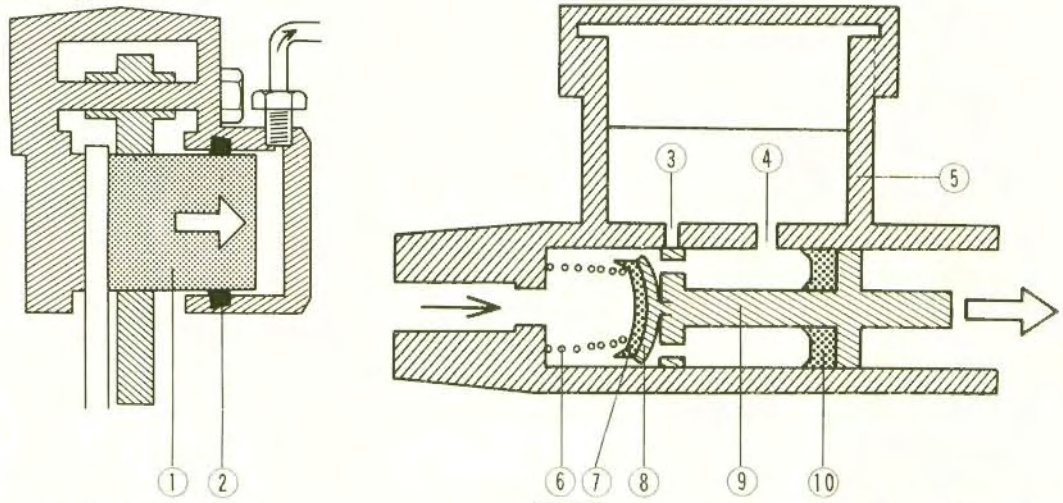
Braking Stroke



J18

1. Piston
2. Fluid Seal
3. Relief Port
4. Supply Port
5. Reservoir
6. Spring
7. Primary Cup
8. Non-return Valve
9. Piston
10. Secondary Cup

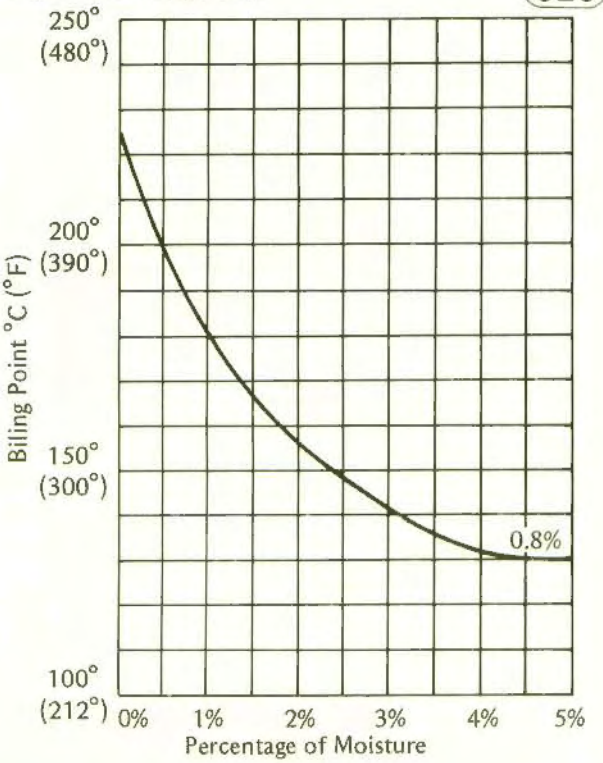
Braking Release Stroke



J19

Brake Fluid Biling Point

J20



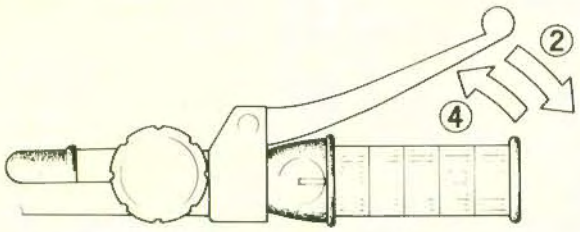
The graph of Fig. J20 shows how brake fluid contamination with moisture lowers the fluid boiling point. Although not shown in the graph, the boiling point also lowers as the fluid gets old, is contaminated with dirt, or if two different types of brake fluid are mixed.

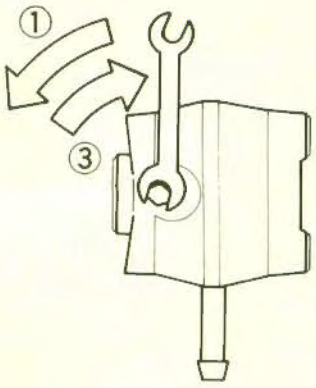
Changing the brake fluid

The brake fluid should be changed in accordance with the Periodic Maintenance Chart (Pg. 10) and whenever it becomes contaminated with dirt or water.

- Attach a clear plastic hose to the bleed valve on the caliper, and run the other end of the hose into a container.
- Open the bleed valve (counterclockwise to open), and pump the brake lever until all the fluid is drained from the line.
- Close the bleed valve, and fill the reservoir with fresh brake fluid.
- Open the bleed valve, apply the brake by the brake lever, close the valve with the brake held applied, and then quickly release the lever. Repeat this operation until the brake line is filled and fluid starts coming out of the plastic hose. *Replenish the fluid* in the reservoir as often as necessary to keep it from running completely out.
- Bleed the air from the lines.

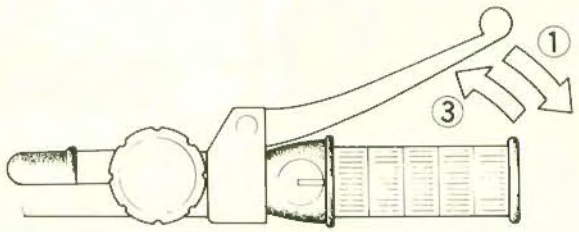
Filling up the Brake Line J21

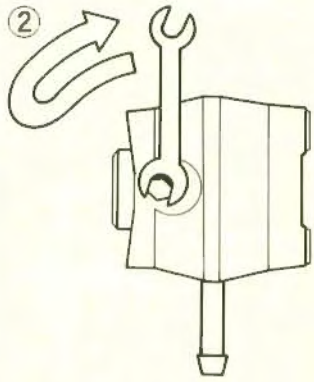




1. Open the bleed valve.
2. Apply the brake, keeping the brake applied.
3. Close the bleed valve.
4. Then quickly release the brake.

Bleeding the Brake Line J22





1. Hold the brake applied.
2. Quickly open and close the valve.
3. Release the brake.

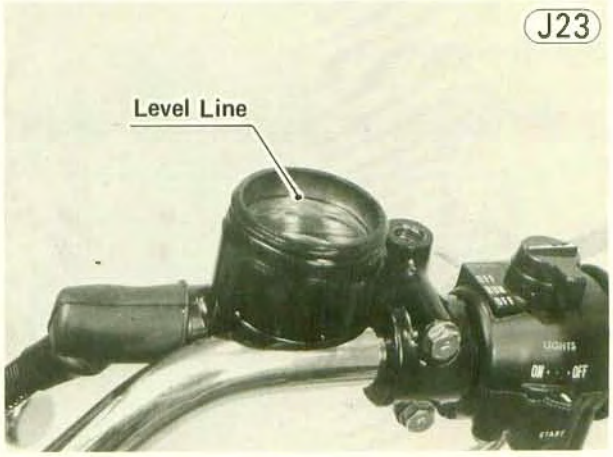
Bleeding the brake

The brake fluid has very low compression coefficient so that almost all the movement of the brake lever is transmitted directly to the caliper for braking action. Air, however, is easily compressed. When air enters the brake lines, brake lever movement will be partially used in compressing the air. This will make the lever feel spongy, and there will be a loss in braking power.

Bleed the air from the brake whenever brake lever action feels soft or spongy, after the brake fluid is changed, or whenever a brake line fitting has been loosened for any reason.

- Remove the reservoir cap, and check that there is plenty of fluid in the reservoir. The fluid level must be checked several times during the bleeding operation and replenished as necessary. If the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.
- With the reservoir cap off slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from the holes at the bottom of the reservoir. This bleeds the air from the master cylinder end of the line.
- Install the reservoir cap, and connect a clear plastic hose to the bleed valve at the caliper, running the other end of the hose into a container. Pump the brake lever a few times until it becomes hard. Then, holding the lever squeezed, quickly open (turn counterclockwise) and close the bleed valve. Then release the lever. Repeat this operation until no more air can be seen coming out into the plastic hose. Check the fluid level in the reservoir every so often, replenishing it as necessary.
- When air bleeding is finished, install the rubber cap on the bleed valve, and check that the brake fluid is filled to the line marked in the reservoir (handlebar turned so that the reservoir is level).

J23



Master cylinder parts wear

When master cylinder parts are worn or damaged, proper brake fluid pressure cannot be obtained in the line, and the brake will not hold.

If the small relief port becomes plugged, especially with a swollen or damaged primary cup, the brake pads will drag on the disc.

- Check that there are no scratches, rust or pitting on the inside of the master cylinder, and that it is not worn past the service limit.
- Check the piston for these same faults.

WARNING

When working with the disc brake, observe the precautions listed below.

1. Never reuse old brake fluid.
2. Do not use fluid from a container that has been left unsealed or that has been open for a long time.
3. Do not mix two types of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective. It may also cause the rubber brake parts to deteriorate. Recommended fluids are given in the table.
   NOTE: The type of fluid originally used in the disc brake is not available in most areas, but it should be necessary to add very little fluid before the first brake fluid change. After changing the fluid, use only the same type thereafter.

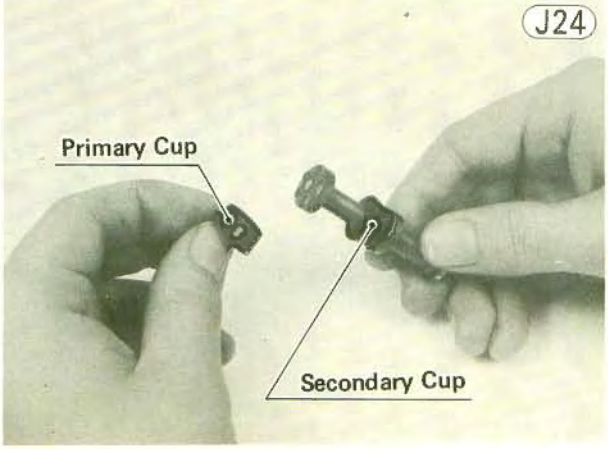
Table J11 Recommended Disc Brake Fluid

Atlas Extra Heavy Duty
Shell Super Heavy Duty
Texaco Super Heavy Duty
Wagner Lockheed Heavy Duty
Castrol Girling-Green
Castrol GT(LMA)

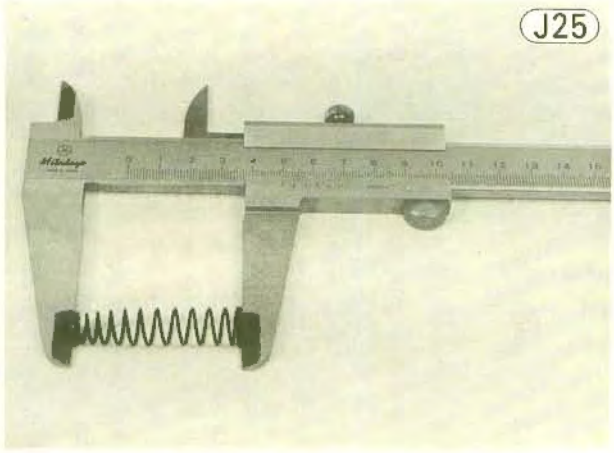
The correct fluid will come in a can labeled D.O.T.3. Do not use fluid that does not have this marking.

4. Don't leave the reservoir cap off for any length of time to avoid moisture contamination of the fluid.
5. Don't change the fluid in the rain or when a strong wind is blowing.
6. Except for the disc pads and discs, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, motor oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually reach and break down the rubber used in the disc brake.
7. When handling the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high flash-point solvent. Do not use one which will leave an oily residue. Replace the pads with new ones if they cannot be cleaned satisfactorily.
8. Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely wiped up immediately.
9. If any of the brake line fittings or the bleed valve is opened at any time, the **AIR MUST BE BLED FROM THE BRAKE.**
10. When installing or assembling the disc brake, tighten the disc brake fittings to the values given in Table G1. Improper torque may cause the brake to malfunction.

●Inspect the primary and secondary cups. If a cup is worn, damaged, softened (rotted), or swollen, replace it. When inserting the cup into the cylinder, see that it is slightly larger than the cylinder (standard values given in the table). If fluid leakage is noted at the brake lever, the cups should be replaced. (The secondary cup is part to the piston assembly. Replace the piston if the secondary cup requires replacement).



●Check that the spring is not damaged and is not shorter than the service limit.



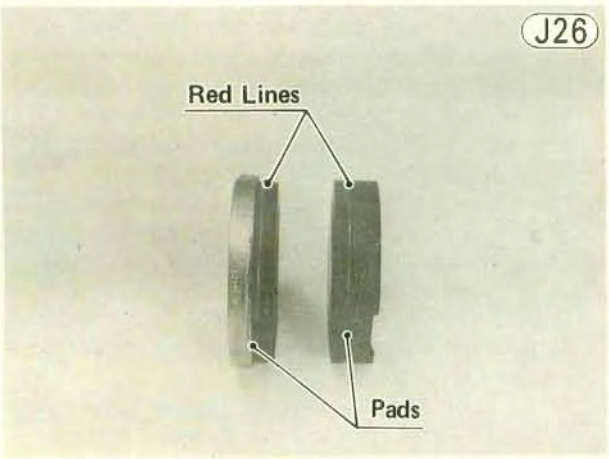
●Replace the dust seal if damaged.

Table J12 Master Cylinder Parts

	Standard	Service Limit
Cylinder Inside Dia.	14.000~14.043 mm	14.08 mm
Piston Outside Dia.	13.957~13.984 mm	13.90 mm
Primary, Secondary Cup Dia.	14.65~15.15 mm	14.50 mm
Spring Free Length	51.1 mm	48.0 mm

Caliper parts 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.



The fluid seal around the piston maintains the proper pad/disc clearance. If this seal is not satisfactory, one pad will wear more than the other, pad wear will increase, and constant pad drag on the disc will raise brake and brake fluid temperature.

Replace the fluid seal under any of the following conditions: (a) fluid leakage around pad A; (b) brakes overheat; (c) there is a large difference in A and B pad wear; (d) the seal is stuck to the piston. If the fuid seal is replaced, replace the dust seal as well. Also replace both seals every other time the pads are changed.

Check both seals and the **O** rings, and replace any that are cracked, worn, swollen or otherwise damaged.

Measure the cylinder inside diameter and piston outside diameter.

Replace the cylinder and piston if they are worn out of tolerance, badly scored, or rusty.

Table J13 Caliper Parts

	Standard	Service Limit
Cylinder Inside Dia.	42.850~42.900 mm	42.92 mm
Piston Outside Dia.	42.788~42.820 mm	42.75 mm

Brake line damage

The high pressure inside the brake line can cause fluid to leak or the hose to burst if the line is not properly maintained.

Bend and twist the rubber hose while examining it. Replace it if any cracks or bulges are noticed.

The brake pipe is made of plated steel, and will rust if the plating is damaged. Replace the pipe if it is rusted or cracked (especially check the fittings), or if the plating is badly scratched.

Disc wear, warp

Besides wearing down, the disc may warp. A warped disc will cause the brake pads to drag 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 J14 Disc Runout

Standard	Service Limit
under 0.1 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.

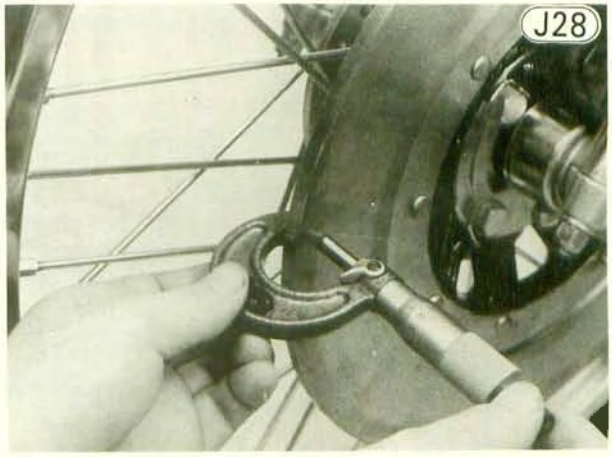


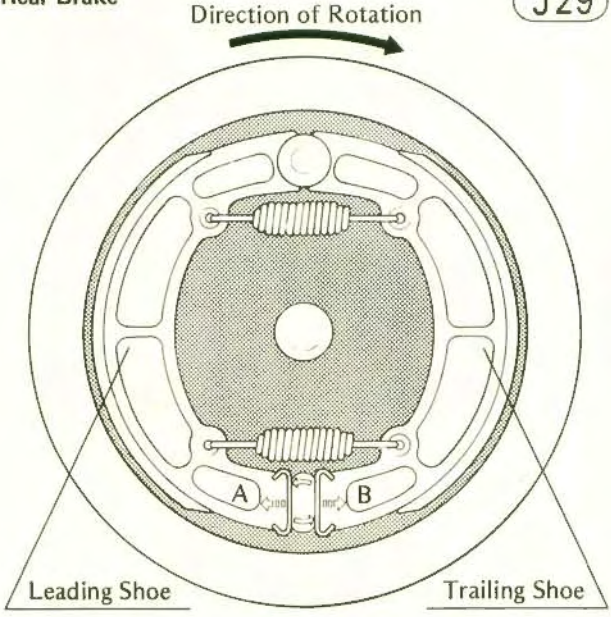
Table J15 Disc Thickness

Standard	Service Limit
6.9 ~ 7.1 mm	6 mm

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 rotaion.

Rear Brake J29



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 together 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 direction "A" and the trailing shoe in direction "B" as shown in the diagrams.

The friction between the linings and the drum, which decelerates the motorcycle, gradually wears down the brake show 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" is 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 ot 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 measurements 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. (Do not run 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.

Table J16 Brake Drum Inside Diameter

Standard	Service Limit
180.00 ~ 180.14 mm	180.75 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 replaced.

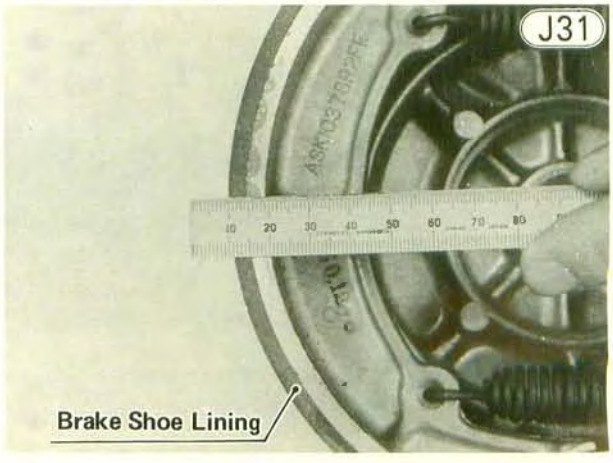


Table J17 Brake Lining Thickness

Standard	Service Limit
4.85 ~ 5.80 mm	2.5 mm

Brake shoe spring tension

If the brake springs become 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.

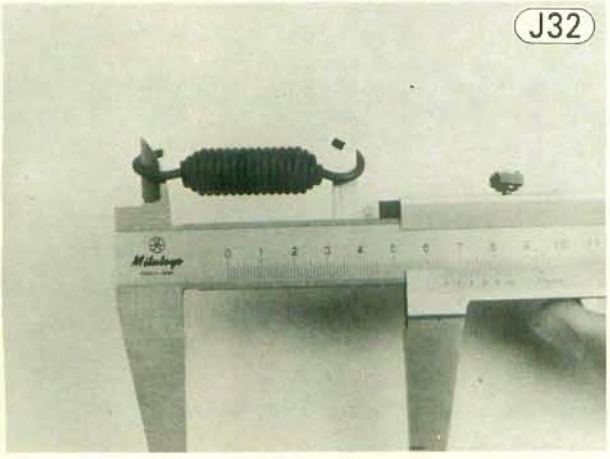


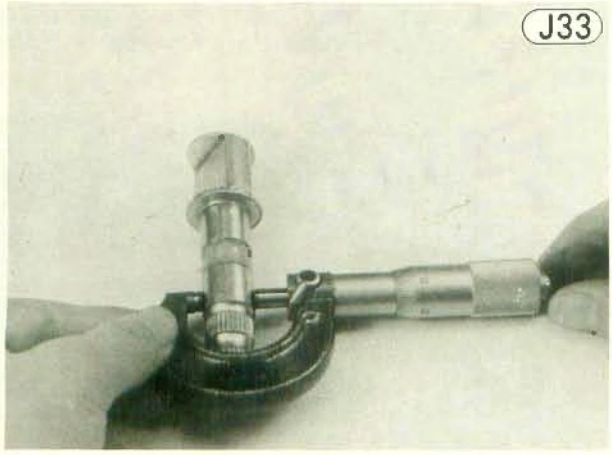
Table J18 Brake Spring Free Length

Standard	Service Limit
66.0 ~ 67.0 mm	69.0 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.

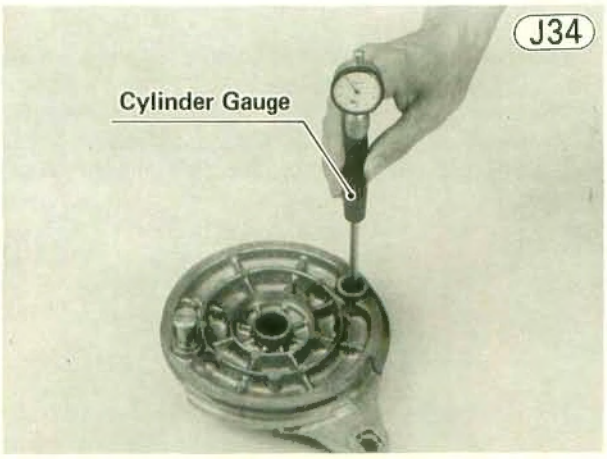
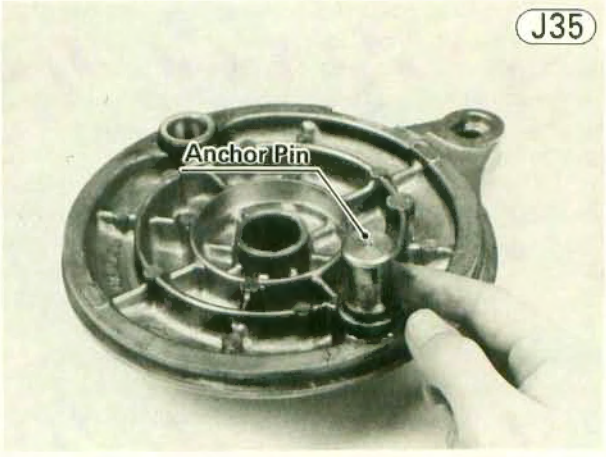


Table J19 Camshaft, Hole Diameter

	Standard	Service Limit
Camshaft	16.957 ~ 16.984 mm	16.83 mm
Shaft Hole	17.000 ~ 17.070 mm	17.22 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

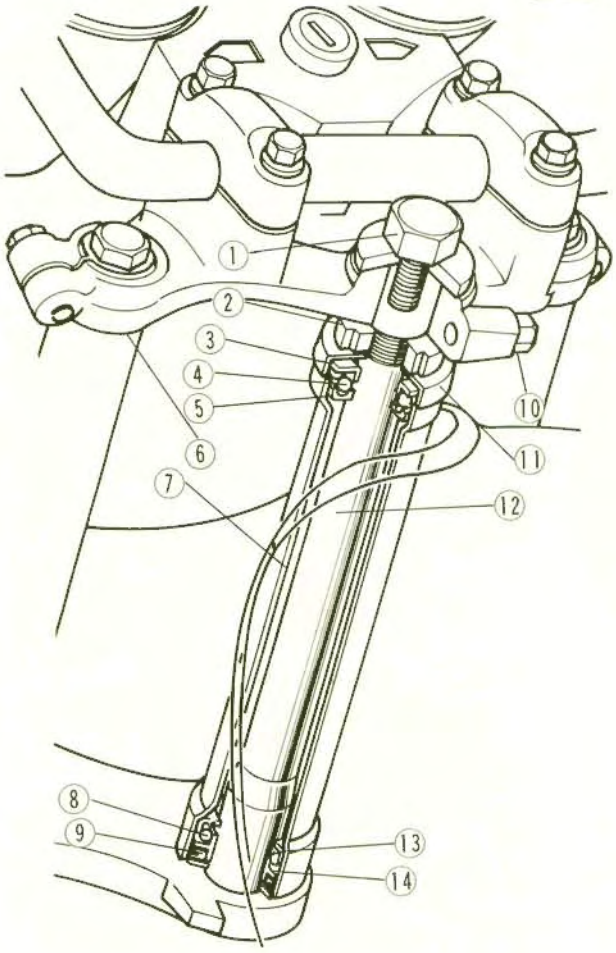
The steering stem supports the handlebar and front fork legs, and turns inside the frame head pipe. Ball bearings in the upper and lower ends of the head pipe enable the steering stem to turn smoothly and easily.

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 becomes loose due to bearing wear. Overtightening during adjustment, however, will make the steering stiff and cause accelerated bearing wear. Lack of proper lubrication will also bring about the same results.

From overtightening or from a heavy shock to the steering stem, the bearing race surfaces may become dented. Damaged bearing races will cause the handlebar to jerk or catch when turned.

Steering J36



1. Stem Head Bolt
2. Stem Locknut
3. Upper Inner Race
4. Steel Ball
5. Upper Outer Race
6. Stem Head
7. Frame Head Pipe
8. Steel Ball
9. Grease Seal
10. Stem Head Clamp Bolt
11. Stem Cap
12. Steering Stem
13. Lower Outer Race
14. Lower Inner Race

Table J20 Bearing Ball Specifications

	Size	Quantity
Upper	¼"	19
Lower	¼"	20

Steering stem warp

Examine the steeting 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.

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.

J37

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.

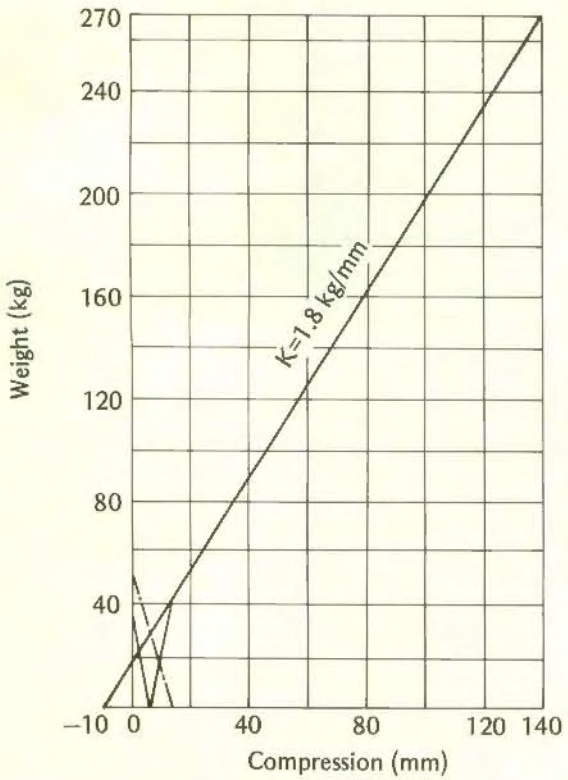
FRONT FORK

Front fork construction is shown in Fig. J39 and Fig. J40. It consists of two shock absorbers 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 shock absorber is a telescopic tube including an inner tube ⑦, outer tube ⑧, cylinder ⑮, piston ④, collar ⑬, and cylinder base ⑯. 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 ⑤) is secured to the top of the cylinder. The collar (coupled with a non-return valve ⑫), 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 (2) in the upper part of the cylinder bring about an oil lock at the end of the extension stroke to prevent the inner tube from strikng 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.

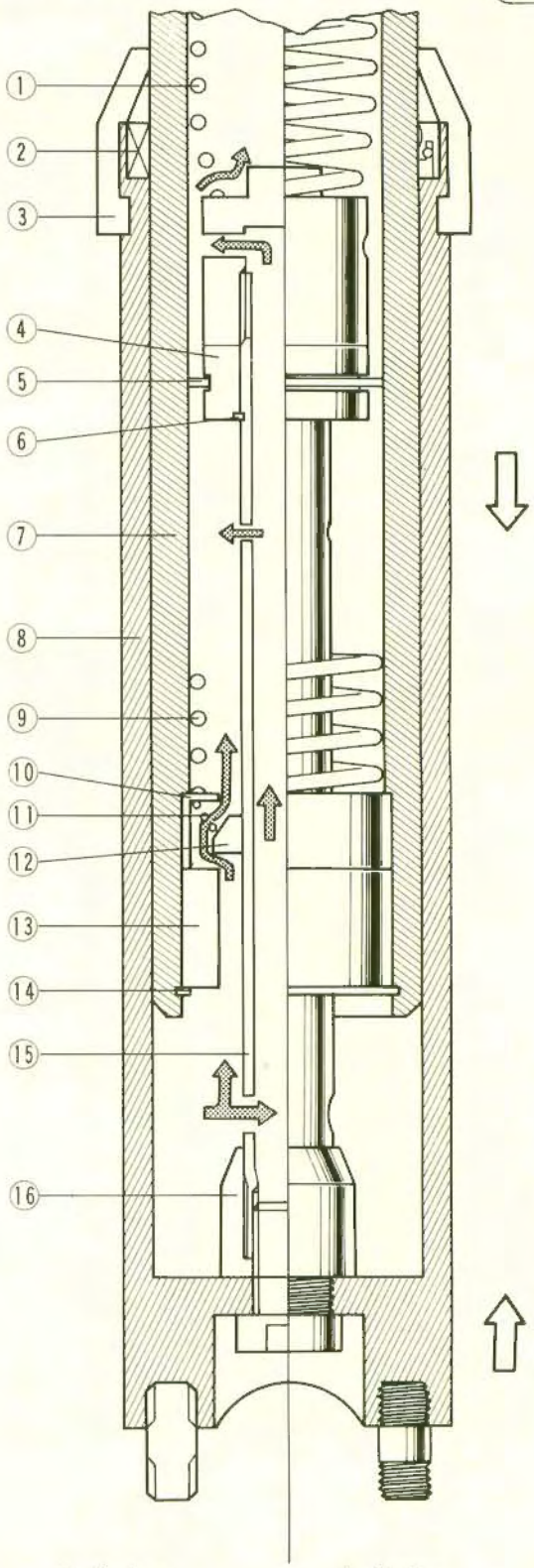
Front Fork Spring Force J38



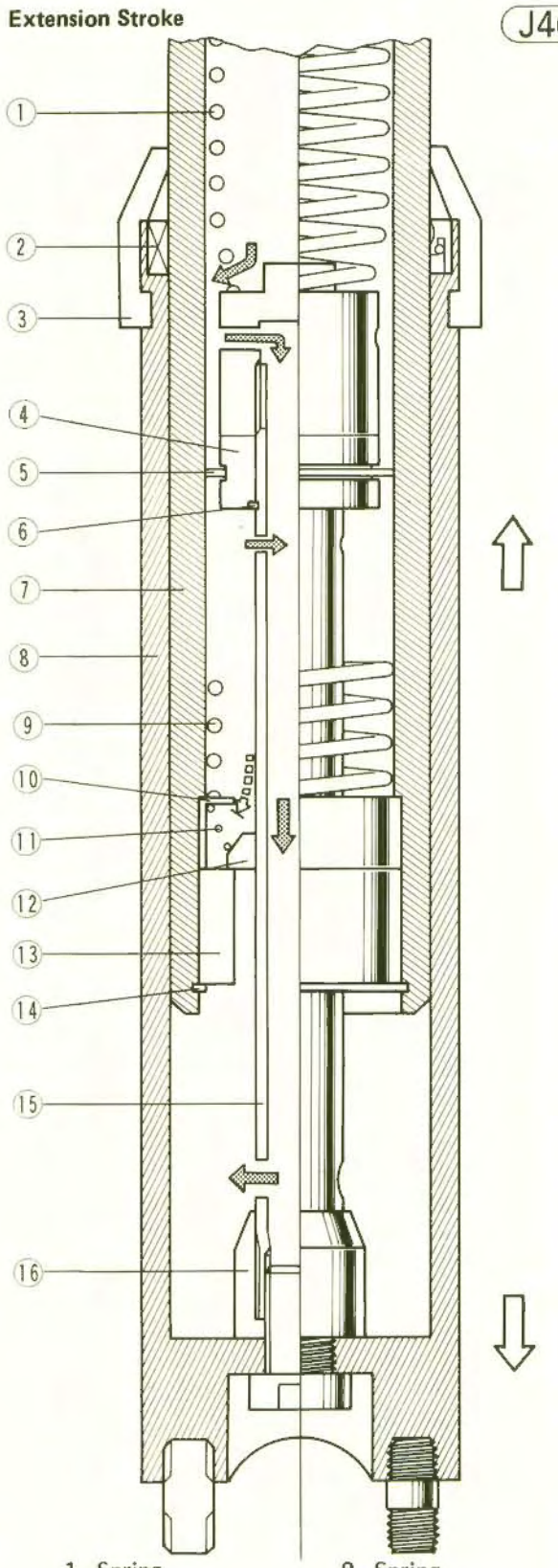
Compression Stroke

Whenever a load is placed on the front fork and whenever the front wheel receives a shock, the inner tube ⑦ moves down inside the outer tube ⑧, compressing both the spring ⑨ 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 ⑮, and oil is drawn in from a diminishing chamber (lower chamber) formed between the outer tube and the cylinder. As the lower chamber

Compression Stroke J39



1. Spring
2. Oil Seal
3. Dust Seal
4. Piston
5. Piston Ring
6. Circlip
7. Inner Tube
8. Outer Tube
9. Spring
10. Spring Seat
11. Spring
12. Non-return Valve
13. Collar
14. Circlip
15. Cylinder
16. Cylinder Base



1. Spring
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6. Circlip
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8. Outer Tube
9. Spring
10. Spring Seat
11. Spring
12. Non-return Valve
13. Collar
14. Circlip
15. Cylinder
16. Cylinder Base

shrinks in size with oil passing freely through the non-return valve 12 into the upper chamber, oil also passes freely through the cylinder lower orifices into the cylinder as the inner tube approaches the cylinder base 16. 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 downward movement, finally forming an oil lock to finish the compression stroke.

Extention Stroke

Following the compression stroke is the extension stroke, in which the inner tube is pushed back out by the compressed spring. 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.

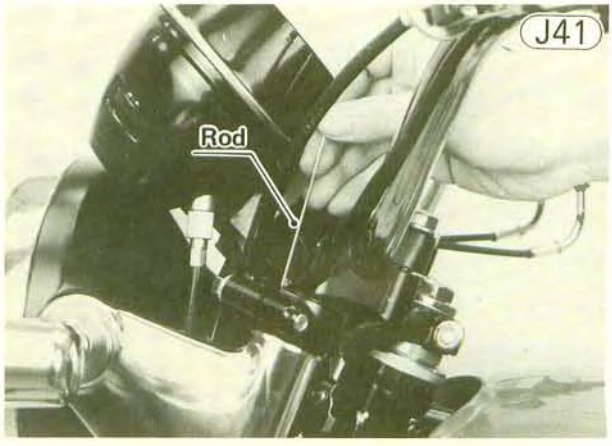
Either too much or too little oil in the shock absorbers will adversely affect shock damping. Too much oil or too heavy an oil makes the action too stiff; too little oil or too light an oil makes the action soft, decreases damping potential, and may cause noise during fork movement.

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 bolt 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 out 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 bolt from the inner tube, and pour in the type and amount of oil specified in Table J21. Check the oil level, and install the top bolt. If the oil is below the specified level, add oil and re-check the oil level.

NOTE: *After the front* fork oil is changed, before checking the oil level, pump the forks several times to expel air from the upper and lower chambers.

Table J21 Fork Oil

Type	Filling fork oil capacity		Oil level
	When changing oil	After disassembly and completely dry	
SAE 10W20	about 165 cc	186~194 cc	385 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 shock absorber 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 shock absorbers balanced for motorcycle stability.

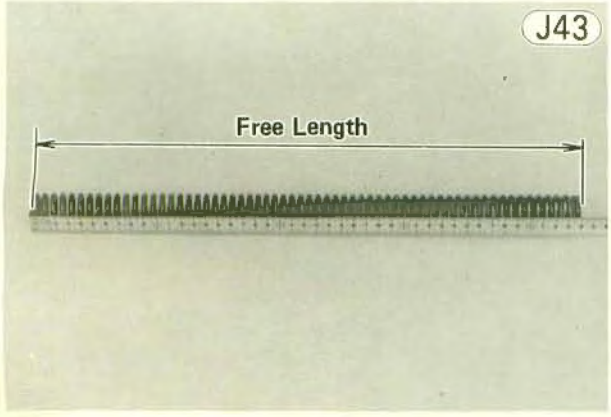


Table J22 Fork Spring Free Length

Standard	Service Limit
444.4 mm	456.7 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 outer tubes, and pump them back and forth manually to check for smooth operation.

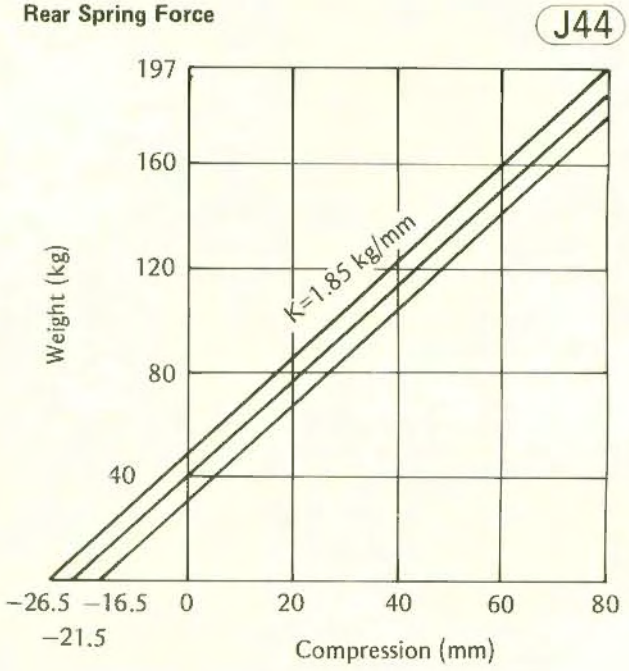
CAUTION **If the inner tube is bent or badly creased, replace it. Excessive bending, followed by subsequent straightening, can weaken the inner tube.**

REAR SHOCK ABSORBERS

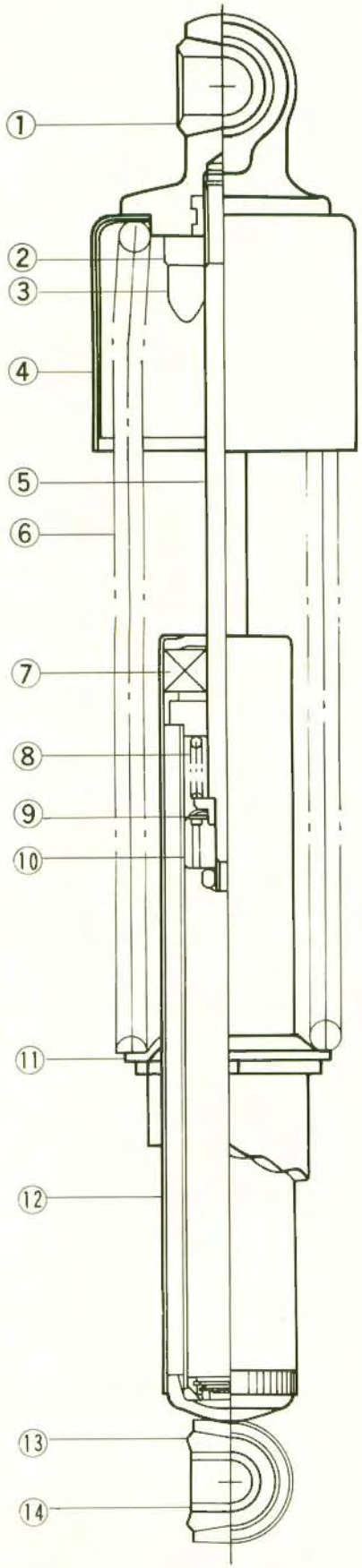
The rear shock absorbers serve to damp shocks transmitted to the frame and rider from the rear wheel. For this purpose, they are connected between the frame and the rear end of the swing arm. Shock absorption is performed by the spring and by the resistance to the flow of oil inside each unit. Shock absorption is further aided by the use of rubber bushings in both the upper and lower shock absorber mountings.

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 to 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

Rear Spring Force



Rear Shock Absorber



1. Rubber Bushing
2. Nut
3. Stopper Rubber
4. Cover
5. Piston Rod
6. Outer Spring
7. Oil Seal
8. Inner Spring
9. Check Valve
10. Piston
11. Spring Seat
12. Outer Shell
13. Rubber Bushing
14. Collar

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 3 different settings is shown in Fig. J44.

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.

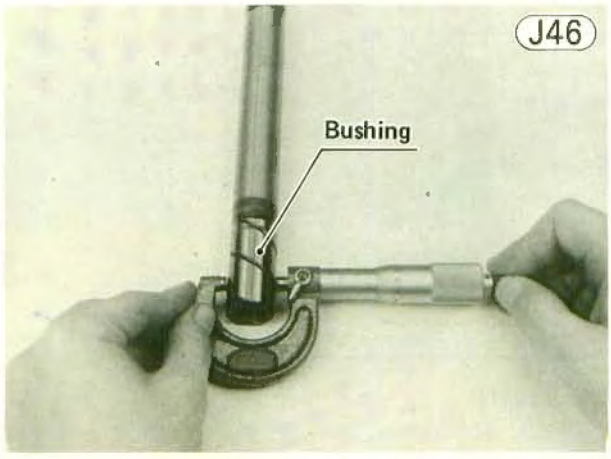
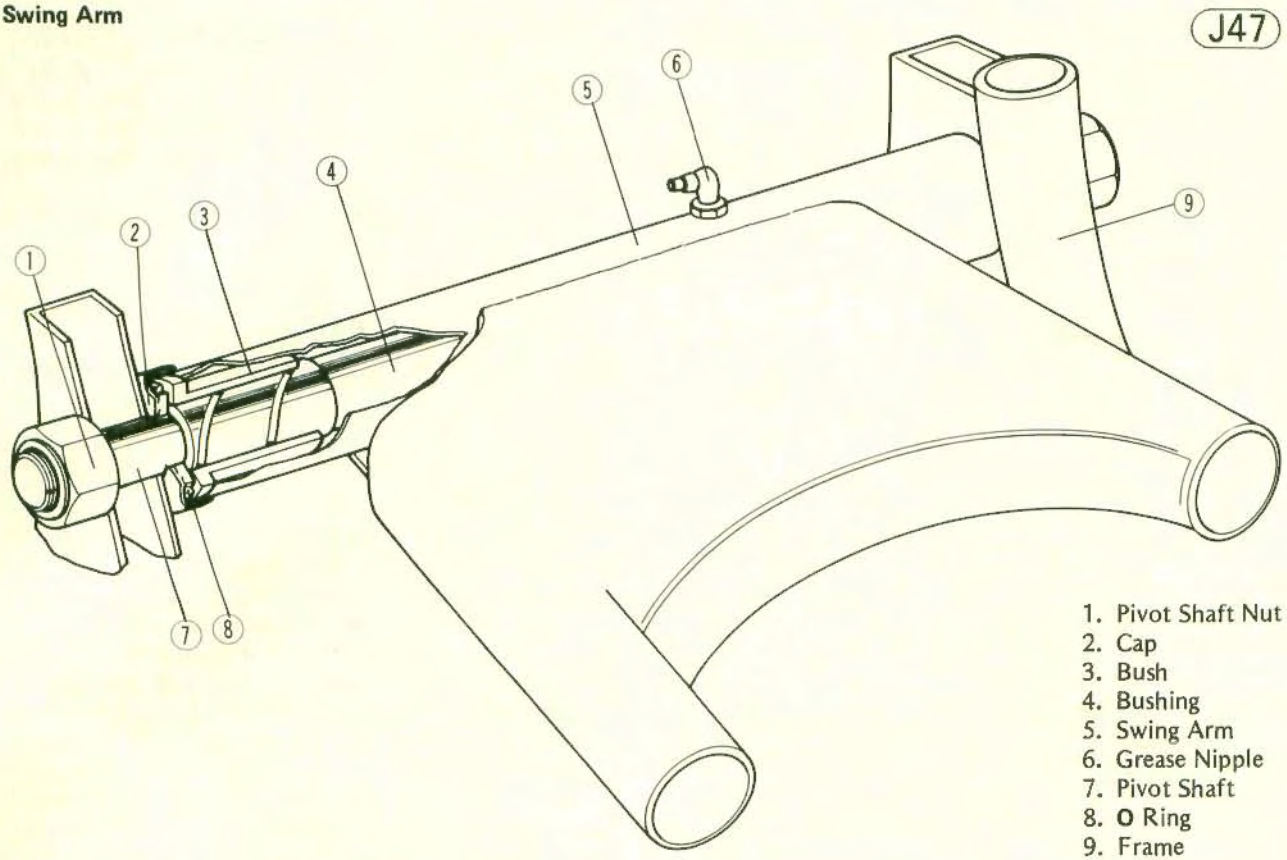


Table J23 Bushing Outside Diameter

Standard	Service Limit
21.979 ~ 22.000 mm	21.95 mm

Swing Arm



1. Pivot Shaft Nut
2. Cap
3. Bush
4. Bushing
5. Swing Arm
6. Grease Nipple
7. Pivot Shaft
8. **O** Ring
9. Frame

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.

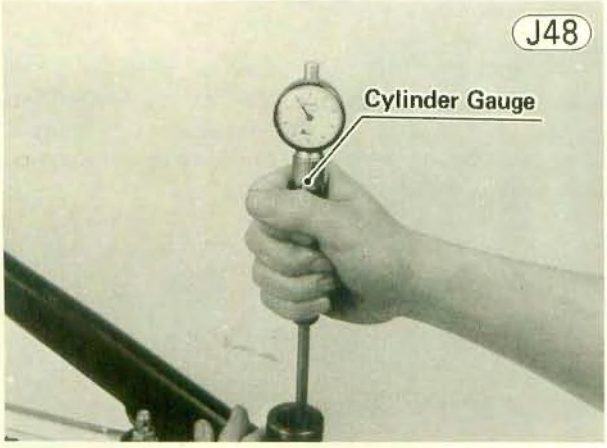


Table J24 Bush Inside Diameter

Standard	Service Limit
22.055 ~ 22.088 mm	22.29 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 to 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 0.7 mm, replace the shaft.

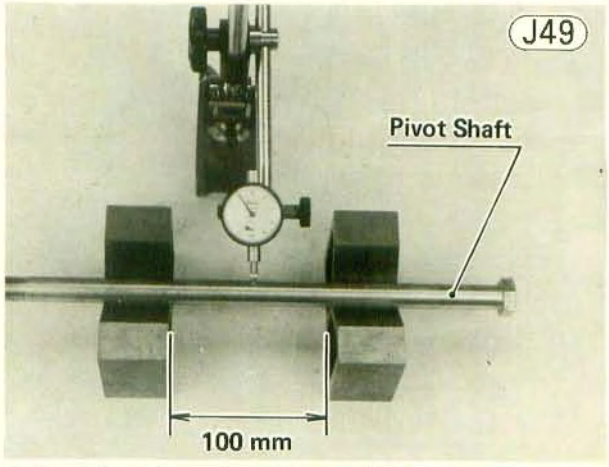


Table J25 Pivot Shaft Runout/100 mm

Standard	Service Limit
under 0.1 mm	0.2 mm

Swing arm lubrication

There is a grease nipple on the swing arm for lubrication. Grease the swing arm with regular cup grease as a part of general lubrication (Pg. 29) with the frequency given in the Periodic Maintenance Chart (Pg. 10). Force the grease into the nipple until it comes out of both sides of the swing arm, and wipe off any excess. If the grease does not come out, first check that the nipple is not clogged with dirt or old grease. If the nipple is clear but will still not take grease, remove the swing arm pivot shaft, bushing, and bushes, and clean out the old grease first.

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.

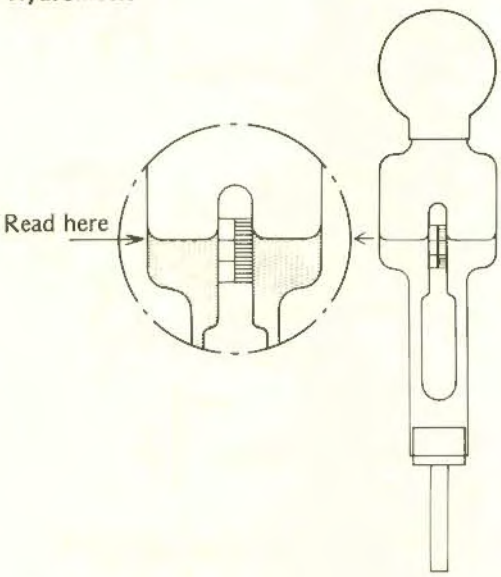
1. When the level of the electrolyte in the battery is low, add only distilled water to each cell, until the level is at the upper level line marked on the outside of the battery. Ordinary tap water is not a substitute for distilled water and will shorten the life of the battery.
2. Never add sulphuric 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 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 meniscus (curved surface of the fluid). Fig. K2 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

$S_{20}=S_t + [0.007\ (t-20)]$

○Fahernheit

$S_{68}=S_t + [0.004\ (t-68)]$

S_t=specific gravity at the present temperature

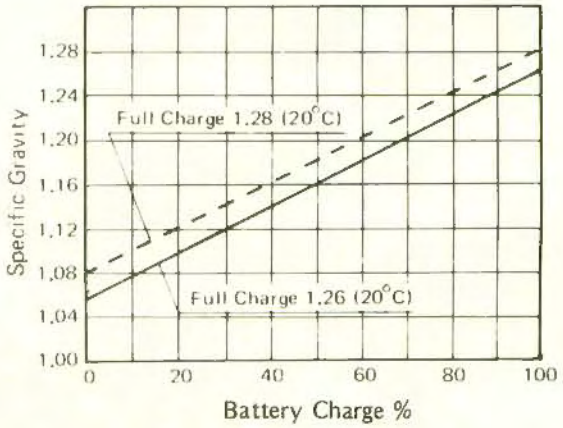
S_{20}=specific gravity at 20°C

S_{68}=specific gravity at 68°F

t=present temperature of solution

Generally speaking, a battey should be charged if a specific gravity reading shows it to be discharged to 50% or less of full 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 braking 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.

$$\text{Charging time (hours)} = \frac{\text{Amount of discharge (AH)}}{\text{charging current (A)}} \times 1.2 \sim 1.5$$

- 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:

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

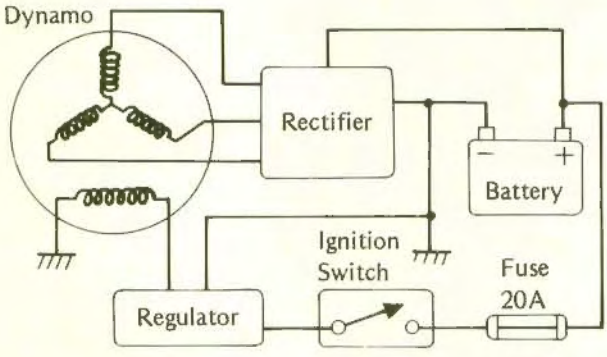
★ If the voltage suddenly jumps to over 13 volts just after the start of charging, the plates are probably sulphated. A good battery will rise to 12 volts immediately and then gradually go up to 12.5 ~ 13 volts in about 30 to 60 minutes after charging is started.
★ If one cell produces no gas bubbles, or has a very low specific gravity, it is probably shorted.
★ If there does not appear to be enough sediment to short the plates, but one cell has a low specific gravity after the battery is fully charged, the trouble may be just that there is insufficient acid in that cell. In this instance only, sulphuric acid solution may be added to correct the specific gravity.
★ If a fully charged battery not in use loses its charge after 2 to 7 days, or if the specific gravity drops markedly, the battery is defective. The self-discharge rate of a good battery is only about 1% per day.

CHARGING SYSTEM

The charging system consists of a dynamo (an alternator), rectifier, and voltage regulator.

The dynamo generates the current required by the electrical circuits. The generated current is a 3 phase alternating current (AC), which is changed to direct current (DC) by a rectifier and controlled by a 2 point regulator 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 in 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 regulator and alternator for evidence of physical damage.

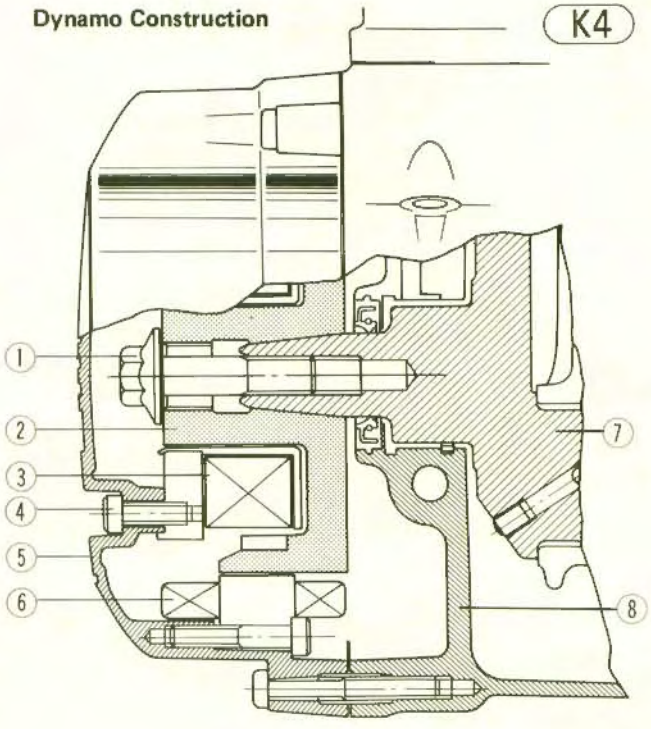
A worn out or badly sulphated battery will produce numerous problems that cannot be corrected until the battery is replaced. **ALWAYS CHECK BATTERY CONDITION BEFORE CONDEMNING OTHER PARTS OF THE SYSTEM. A FULLY CHARGED BATTERY IS A MUST FOR CONDUCTING ACCURATE SYSTEMS TESTS.**

Charging system malfuctions 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.

Dynamo

The dynamo consists of a stationary field coil ③, an armature ⑥, and a revolving rotor ②, all of which are separately mounted. The field coil and armature are both mounted in the dynamo cover, while the rotor is secured to the left end of the crankshaft ⑦ and rotates at engine rpm. This rotor/stationary field coil combination characterizes the dynamo used on this motorcycle. This is different from a conventional dynamo, since there are no brushes needed to supply the field coil with the magnetizing current.

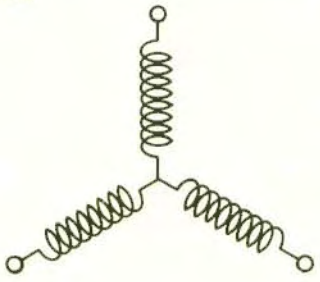
Dynamo Construction K4



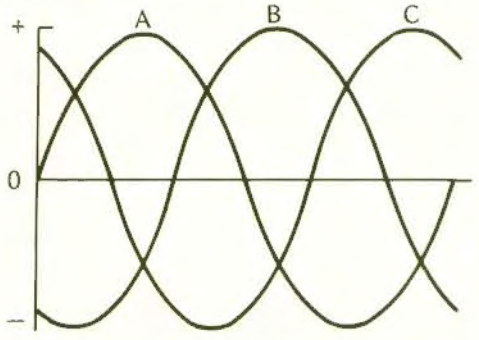
1. Rotor Bolt
2. Rotor
3. Field Coil
4. Allen Bolt
5. Dynamo Cover
6. Armature
7. Crankshaft
8. Crankcase

When the ignition switch is turned on, current controlled by the regulator flows to the field coil, and the resulting magnetic field (that accompanies electron flow) is concentrated in the rotor. When starting the engine, the kick starter or starter motor turns the crankshaft, and magnetic lines of force cut through the armature windings (3), generating current. These windings are connected in a wye circuit (Fig. K5) to produce a 3 phase alternating current (Fig. K6). Since the voltages of these 3 phases overlap, there is a continuous, even supply of current for the circuit components.

Wye Connection K5



Dynamo Current K6



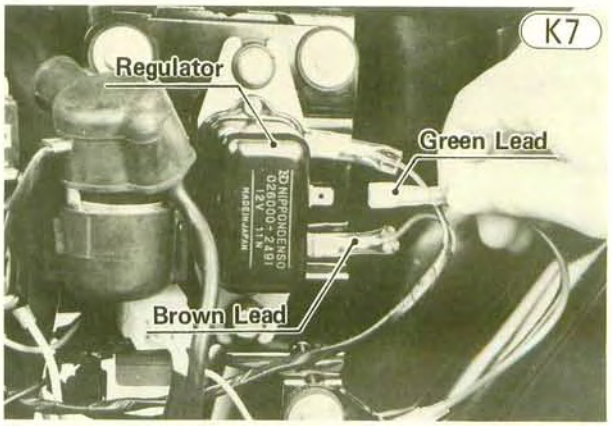
If the battery, rectifier, and regulator are all good but there is low voltage or insufficient charging current, the dynamo may be defective. A defective dynamo is due to either an electrical short or open in the field coil or armature. Either an electrical short or open will result in a low output or no output at all.

Dynamo output test

Before making this test, check the condition of the battery (Pg. 192) and rectifier (Pg. 197). If the battery voltage is less than 12 volts, charge the battery. Both the output voltage and output amperage should be checked. Before starting the dynamo test warm up the engine to obtain actual dynamo operating conditions. **NOTE:** In this explanation of dynamo output test, the use of two multimeters at the same time is described. If two multimeters are not available, this test can be performed by measuring the charging amperage and the charging voltage separately.

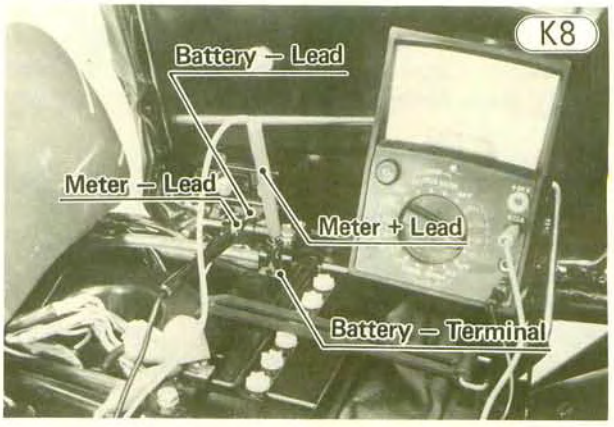
To check the dynamo output:

- Remove the left side cover.
- Check that the ignition switch is turned off.
- Disconnect the regulator green and brown leads from the regulator terminals. Connect the green and brown leads together electrically.

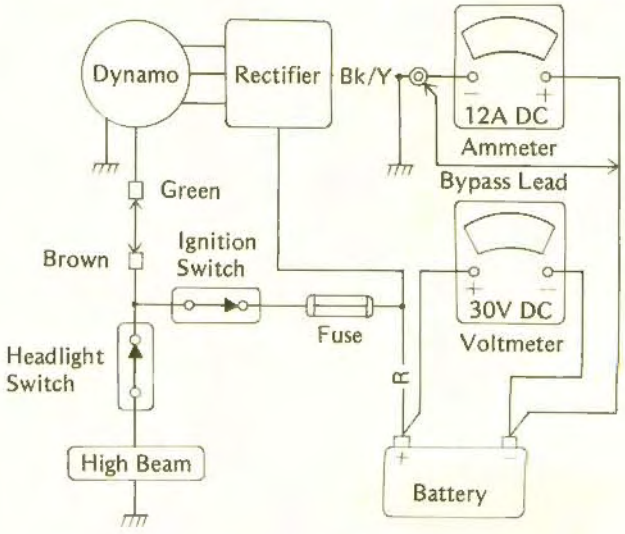


CAUTION **When connecting the green and brown leads, be certain that the connection does not get shorted to chassis ground. Also, to avoid battery discharge, do not leave these leads connected any longer than necessary; disconnect them after finishing the test.**

- Unlock the seat, and swing it open.
- Disconnect the battery – lead from the battery – terminal. Set the multimeter to the 12A DC range, and connect the meter – lead to the battery – lead and the meter + lead to the battery – terminal. This puts the ammeter in series with the battery so that battery charging current can be measured.



Dynamo Output Test K9



•Connect a temporary lead, with alligator clips, to the battery – terminal and meter – lead. This works as a bypass and prevents damage to the multimeter from back current when the engine is not running enough speed to charge the battery.
•Set another multimeter to 30V DC, and connect the meter + lead to the battery + terminal and the meter – lead to the battery – terminal.

•Start the engine with the **kickstarter**.

CAUTION

1. Make sure that all connections are firm. A loose connection allows the generator output voltage to increase instantly. This may cause damage to the rectifier or other electrical components.
2. To prevent damage to the multimeter caused by reverse starting current, DO NOT use the electric starter when starting the engine.

•Turn on the headlight switch with the headlight on high beam.
•Disconnect one end of the bypass lead.
•Run the engine at the rpm in Table K2, and note the readings of voltage and amperage. A much lower reading indicates that the dynamo is defective.
•Turn off the ignition switch to stop the engine.

If the dynamo was found to be defective, carry out the following checks to determine which part is defective.

Dynamo resistance test

•Disconnect the 4-pin connector on the electrical panel.
•Set the multimeter to the R x 1 range, and measure for continuity between each of the three armature yellow leads (3 measurements). If there is more resistance than shown in Table K3, or no meter reading (infinity) for any two armature leads, the armature has an open and must be replaced.

Table K2 Battery Charging Voltage and Amperage

Meter	Connections	Reading @4,000 rpm
30V DC	Meter + Lead ↔ Battery + Terminal, Meter – Lead ↔ Battery – Terminal	about 15V
12A DC	Meter + Lead ↔ Battery – Terminal, Meter – Lead ↔ Battery – Lead	about 3A

Table K3 Armature Resistance

Meter	Reading
R x 1	0.4 ~ 0.6Ω

•Using the highest resistance range of the multimeter, measure the resistance between each of the three armature leads and chassis ground. There should be no meter reading (infinity). Any meter reading indicates a short, necessitating armature replacement.
•Disconnect the green lead from the dynamo field coil.
•Using the R x 1 range, measure the resistance between the field coil green lead and chassis ground. Refer to Table K4 for standard resistance values. A lesser reading than the standard resistance indicates a short in the coil, and a higher reading or no reading at all indicates an open. If the field coil is found to be open or shorted, replace the field coil with a new one.

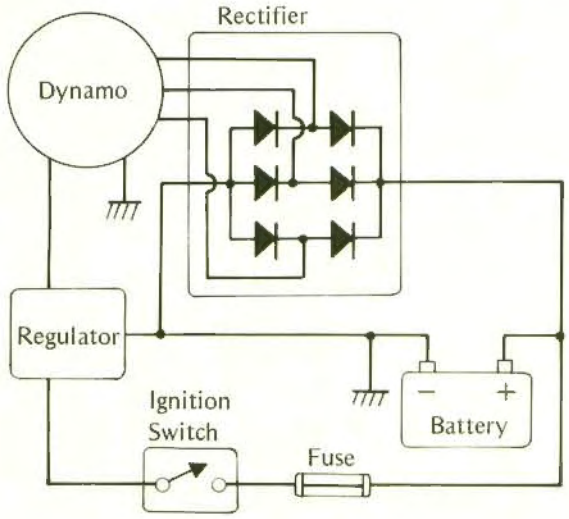
Table K4 Field Coil Resistance

Meter	Reading
R x 1	2.7 ~ 3.4 Ω

Rectifier

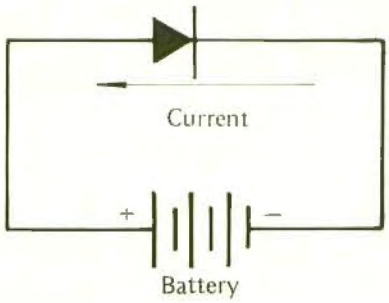
The rectifier is used to change the alternating current (AC) from the dynamo to direct current (DC) for the battery charging, ignition, lighting, and other circuits. It contains six silicon diodes to rectify (change to DC) the three phases of the dynamo output. The diodes are connected in a bridge circuit arrangement for efficient, full-wave rectification.

Rectifier Circuit (K13)



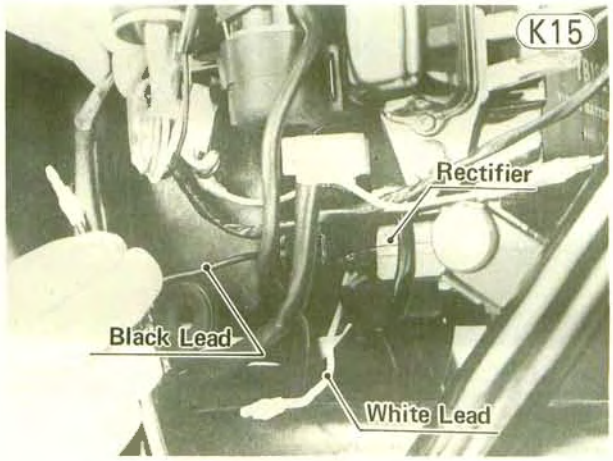
The reason that a diode only permits direct current to flow in the part of the circuit in which it is connected is that a diode conducts current only in one direction. The current of electrons flows only from the – to the + side of the diode. However, a defective diode will conduct in both directions (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 charge adequately.

Diode (K14)

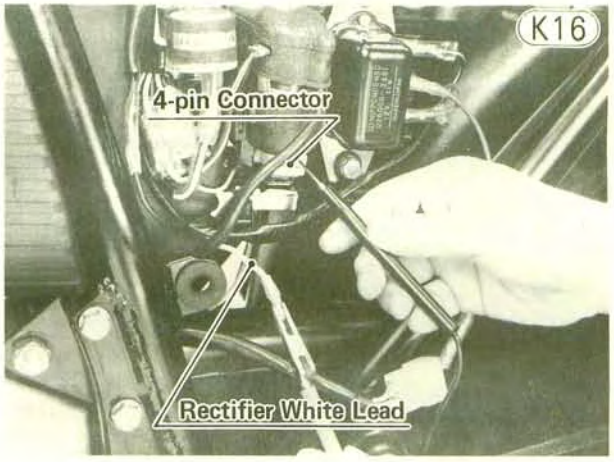


Inspection

- With the engine off, remove the left side cover, disconnect the rectifier white lead from the battery + side, and disconnect the rectifier black lead.



- Disconnect the 4-pin connector on the electrical panel.
- Using the R x 10 or R x 100 ohmmeter range, check the resistance in both directions between the white lead and each yellow lead, and between the black lead and each yellow lead. There is a total of 12 measurements. The resistance should be low in one direction and more than ten times as much in the other direction. If any two leads are low or high in both directions, the rectifier is defective and must be replaced.



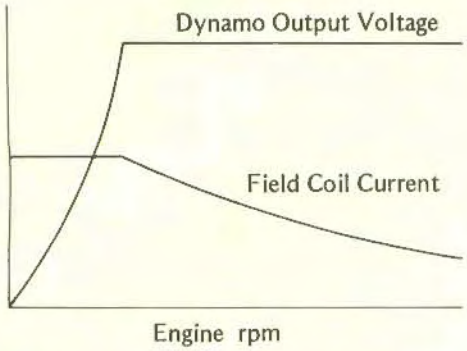
NOTE: The actual meter reading varies with the meter used and the individual rectifier, but, generally speaking, the lower reading should be within $^1/_3$ scale of zero ohms.

CAUTION **Be careful not to strike, scratch, or in any other way damage the rectifier. Such damage may cause the rectifier to short.**

Regulator

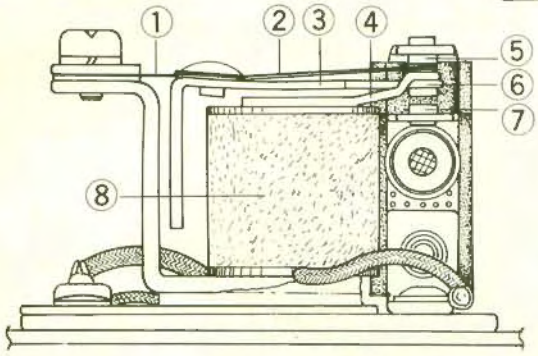
When the field coil current is constant, the dynamo output voltage increases with an increase in engine rpm. However, the voltage will become excessive at high engine rpm, burning out the lights and overcharging the battery unless the field current is reduced at higher rpm. The regulator is included in the circuit to reduce the field coil current at higher rpm, keeping the voltage between 14 ~ 15 V for all electrical equipment as shown in Fig. K17.

Field Coil Current, Dynamo Output Voltage/Engine rpm (K17)



The regulator includes the armature ③, relay coil ⑧, resistor (Rf), and three contact points (P_1, P_0, and P_2). Resistor Rf is in series with the field coil, while the relay coil is connected to chassis ground. Point P_0 and the end of the armature is the movable contact point, which may be in contact with point P_1, in contact with point P_2, or in contact with neither point.

Regulator Construction (K18)



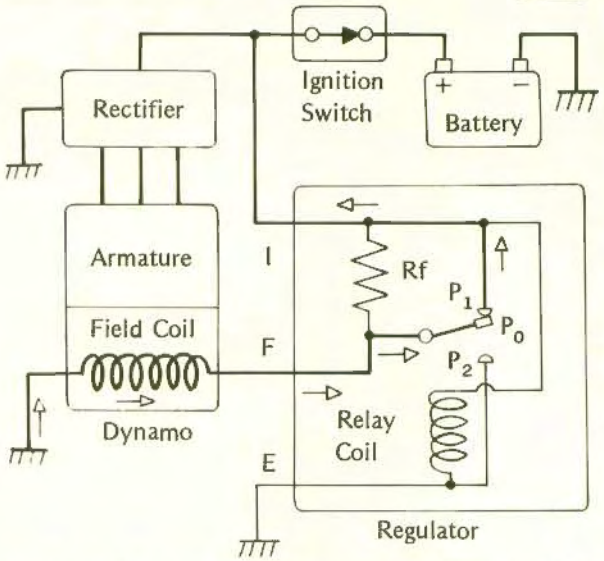
1. Spring 2. Spring 3. Armature 4. Adjuster Arm
5. Point P_1 6. Point P_0 7. Point P_2 8. Relay Coil

At low rpm (Fig. K19) the dynamo output voltage magnetizes the relay coil only slightly, and point P_0 is held against point P_1 by spring force. At this time the field coil current (I_f) flows through chassis ground → field coil → terminal F → point P_0 and P_1 → terminal I. The regulator circuit here has only negligible resistance to current I_f.

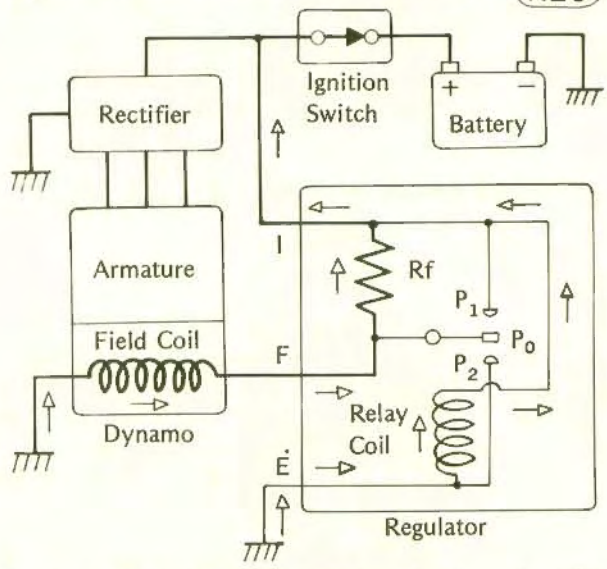
At moderate rpm (Fig. K20) the dynamo output voltage magnetizes the relay coil enough that it pulls point P_0 from P_1. At this time current I_f flows through chassis ground → field coil → terminal F → resistance Rf → terminal I. The regulator circuit now provides resistance Rf for current I_f, reducing current I_f. This reduces the dynamo output voltage from what it would be otherwise, keeping it still between 14~15 V.

At high rpm (Fig. K21) the dynamo output voltage magnetizes the relay coil sufficiently so that it pulls point P_0 into contact with point P_2. At this time, no current flows to the field coil, and the dynamo output depends on residual magnetism in the rotor. Then, as the output voltage drops, and the relay coil loses its magnetism, point P_0 separates from point P_2, and current again flows to the field coil.

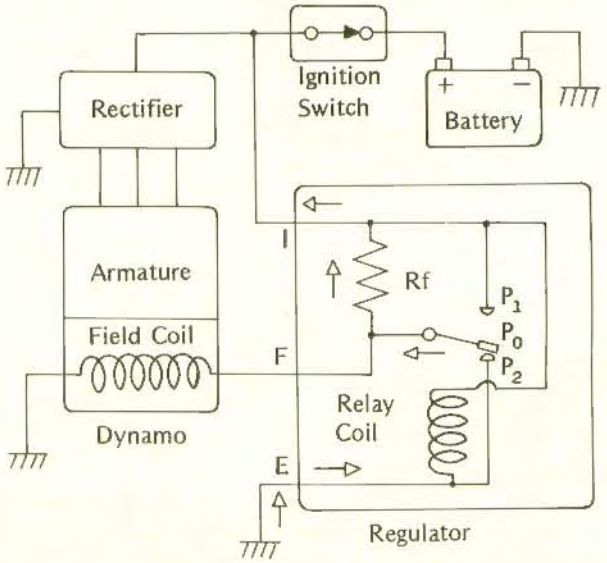
Regulator Operation at Low Engine Speed (K19)



Regulator Operation at Moderate Engine Speed (K20)



Regulator Operation at High Engine Speed (K21)



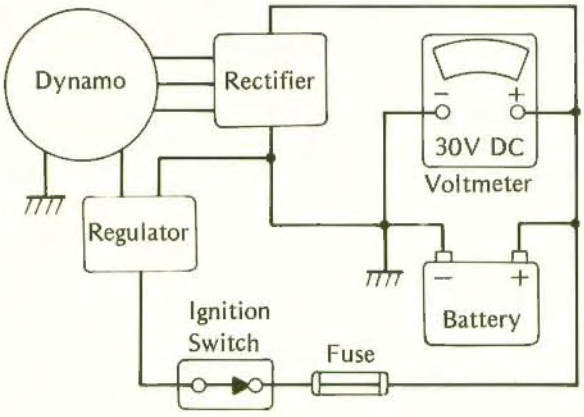
Regulator test

If the battery continually discharges or if it overcharges, the regulator may be defective. Symptoms of excessive voltage are:
(a) distilled water must be added often to all battery cells and (b) lights burn out when running at high rpm.

Check the battery before making the following test and charge the battery if it has less than 12V. If the battery is defective or discharged, the regulator will not function properly.

- Remove the headlight unit (Pg. 113), and disconnect the 9-pin connector which is in the headlight housing. This removes the electrical load from the dynamo.
- Check that all lights are turned off.
- Set a multimeter to the 30V DC range, and connect the + meter lead to the battery + terminal and the – meter lead to the battery – terminal.

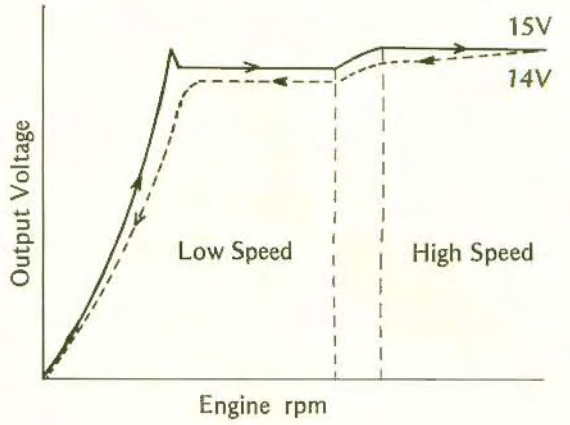
Regulator Test (K22)



- Start the engine, hold the speed at 1,600 rpm, and note the meter reading. The reading should be between 14~15V.
- Gradually increase engine speed (do not decrease it at any point), and check the meter reading when the engine speed has reached 4,000 rpm. The reading should be between 14~15V.

NOTE: If in the above test the engine speed is decreased before the meter is read at 1,600 rpm or 4,000 rpm, return the engine rpm to idling and then again gradually increase the speed to 1,600 rpm or 4,000 rpm. Due to hysteresis, there is a difference in the voltage depending on whether the engine speed is increasing or decreasing.

Regulator Controlled Dynamo Output Voltage (K23)



If the voltage was between 14~15V in both checks, the regulator is working satisfactorily. However, if the voltage was not 14 ~ 15V in either one of the tests, carry out the following steps:

NOTE: The following steps are necessary only if regulator operation is faulty. Do not otherwise open the regulator cover. If the motorcycle is still under warranty, replace a faulty regulator; do not attempt to open or adjust it.

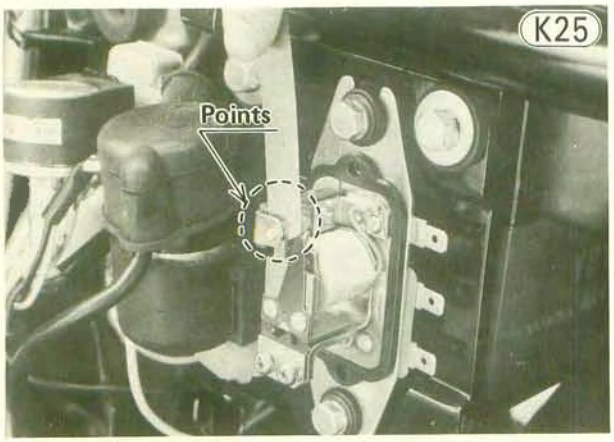
- Remove the left side cover, and disconnect the regulator leads, black, green, and brown, from the regulator terminals.
- Remove the regulator cover.
- Set the multimeter to the R x 1 or R x 10 range, and measure the resistance in accordance with Table K5.

Table K5 Regulator Resistance

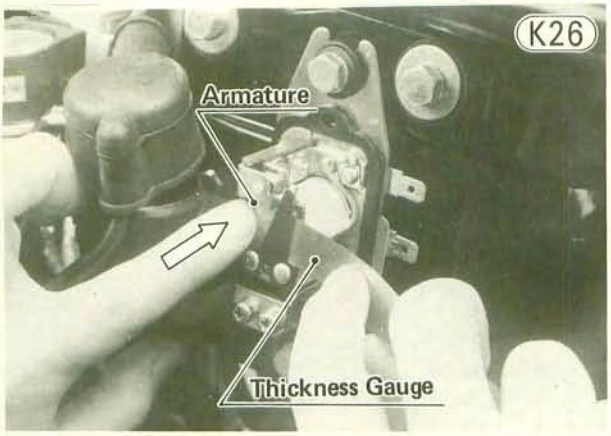
Terminal	Point P_0	Resistance	Remarks
F–I	Position 1	0 Ω	If more than 0 Ω, points P_0 & P_1 are dirty or fouled.
	Position 2	about 9 Ω	If no reading, resistor Rf is open. If no resistance, there is a short.
F–E	Position 1	about 100 Ω	If no reading, the relay coil is open. If no resistance, there is a short.
	Position 2	0 Ω	If more than 0 Ω, points P_0 & P_2 are dirty or fouled.

Position 1 Points P_0 & P_1 are in contact by spring force.
Position 2 Points P_0 & P_2 are in contact by pressing on the armature with a finger.

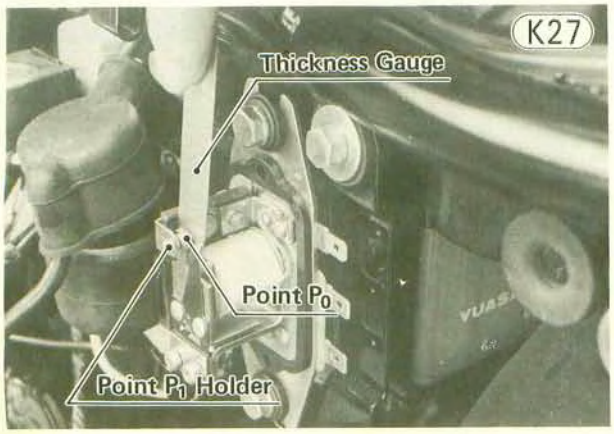
•If the points are fouled clean them with clean paper or cloth, using an oil free solvent if necessary. To *repair light* damage, use emery cloth. If the points cannot be repaired so that there will be zero ohms resistance across them, replace the regulator with a new one. Also, if the resistor Rf, the relay coil, or any other internal part is defective, replace the regulator with a new one.



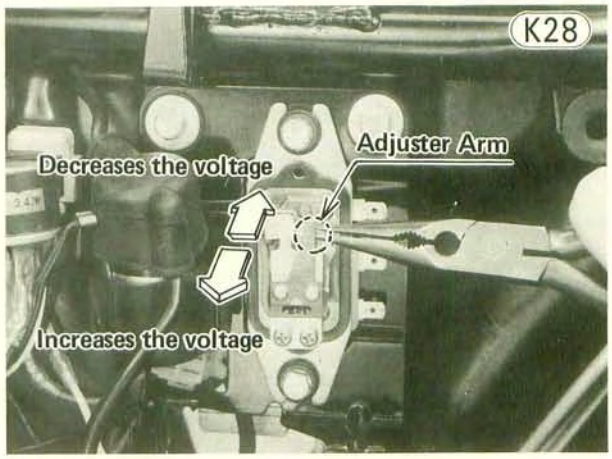
•Press down the armature, and inspect the armature gap with a thickness gauge. The gap should be 0.3 mm or more. If it is not, correct it by bending the holder for point P_2.



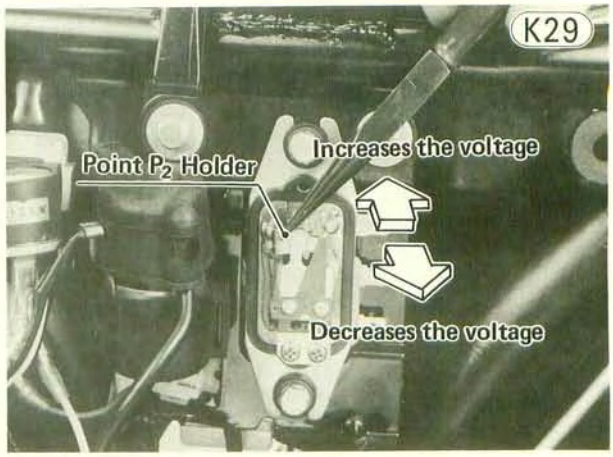
•Inspect the gap between points P_2 and P_0 with a thickness gauge. The gap should be 0.30~0.45 mm. If the gap is incorrect, adjust it by bending the holder for point P_1.



•Set the multimeter to the 30V DC range, and connect the meter + lead to the battery + terminal and the meter – lead to the battery – terminal (Fig. K24).
•Start the engine, and note the voltage at various engine speeds.
•Turn off the ignition switch to stop the engine.
•If the voltage was abnormal, either too high or too low, adjust the regulator by bending the adjuster arm. Bending the arm up increases the voltage, and bending the arm down decreases the voltage.



•Start the engine, and read the voltage with the engine below 1,600 rpm. The reading should be 14 ~ 15V.
•Turn off the ignition switch to stop the engine.
•If the voltage was too low, bend the adjuster arm up, if the voltage was too high, bend the adjuster arm down.
•Start the engine, and read the voltage with the engine at 4,000 rpm. The reading should be 14~15V.
•Turn off the ignition switch to stop the engine.
•If the voltage was too low, bend the holder for point P_2 down; if the voltage was too high, bend the holder for point P_2 up.

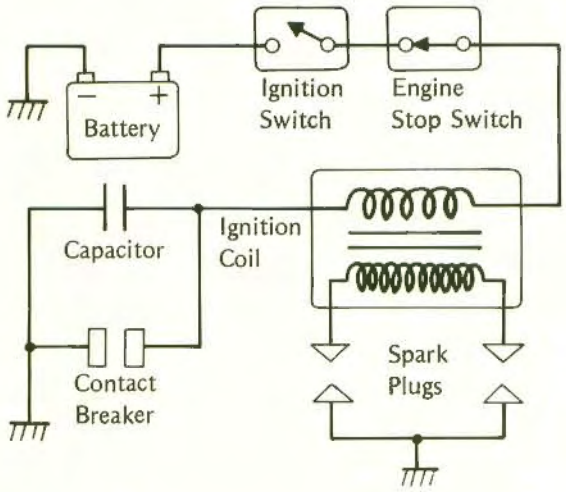


•Install the regulator cover, and again check the voltage with the engine below 2,000 rpm and at 4,000 rpm. This recheck is necessary because the inner magnetic field is influenced by the metal cover, possibly changing regulator operation.
•If the voltage is still not correct, continue adjusting the regulator until the voltage is between 14~15V.

IGNITION SYSTEM

The working electrical part of the ignition system consists of the battery, two sets of contact breaker points, two capacitors, two ignition coils, and four spark plugs. The timing advancer is attached to advance the ignition timing as engine rpm rises.

Ignition Circuit (K30)



A wiring diagram of one half of the ignition system is shown in Fig. K30. The other half is identical, 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 two spark plugs. The two sets of points and two coils take the place of a distributor, which is left out to increase the reliability of the system. Each set of points fires two spark plugs every time the two pistons rise, that is, once every 360° of crankshaft rotation. Since the two sets of points (and the two sets of pistons) are 180° out of phase, plugs 2 and 3 fire 180° of crankshaft rotation after plugs 1 and 4 fire, and vice versa. For this system to function properly, all igniton 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).

Ordinarily in a 4-stroke engine, a spark jumps across the spark plug electrodes only every other time that the piston for that spark plug 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. However, even if a spark does jump across the electrodes during the exhaust stroke, there is no effect since there is no compression and no fuel to burn. Therefore, to eliminate any need for a distributor (thus simplifying the system and making it more reliable), the system is constructed so that both spark plugs fire every time both pistons rise (once every 360° of crankshaft rotation) although one piston is on the compression stroke and the other on the exhaust stroke.

Because the two spark plugs are connected in series, the current through one spark plug also must go through the other. Consequently, if a spark will not jump across the electrodes of one spark plug (due to dirty electrodes, faulty plug lead, etc.), no spark will jump across the electrodes of the other plug as well.

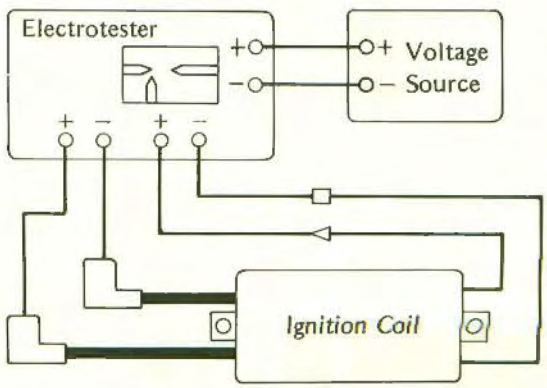
Ignition Coil

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 inducing a current in the winding. 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 electrotester. 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 an electrotester other than the Kawasaki electrotester may produce a different arcing distance, the Kawasaki electrotester is recommended for a reliable result.

Ignition Coil Test (K31)



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 range, and connect one ohmmeter lead to the red/yellow lead and the other to the green or black lead from the ignition coil. To measure the secondary winding resistance, set the ohmmeter to the R x 100 range, and connect one ohmmeter lead to one of the spark plug leads and the other ohmmeter lead to the remaining spark plug lead.

Table K6 Ignition Coil Resistance

	Meter	Reading
Primary Winding	R x 1	about 4.0Ω
Secondary Winding	R x 100	about 23kΩ

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 red/yellow lead and the coil core and between the plug leads and the coil core. If there is any reading, the coil is shorted and must be replaced. Also, replace the ignition coil if either 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 crankshaft rotates, the heel rides on the cam surface, and, as the crankshaft 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 tunning 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

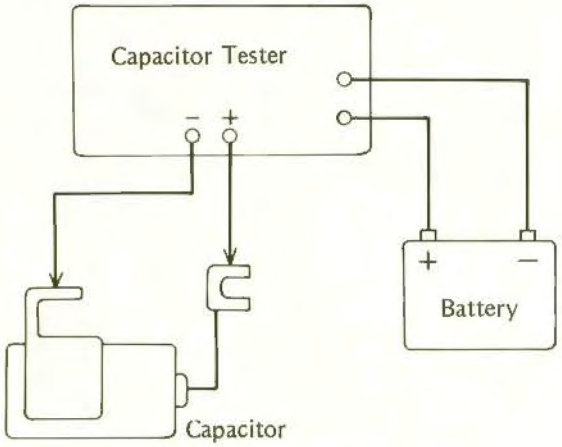
A capacitor is connected in parallel across each set of contact breaker points and serves to prevent current from arcing across the points as they open. Arcing across the points would reduce the sharpness of the voltage drop in the primary winding, thus weakening the spark plug spark, and also damaging 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: 0.24 ± 0.02μF, 1,000 WVDC.

Capacitor Test K34

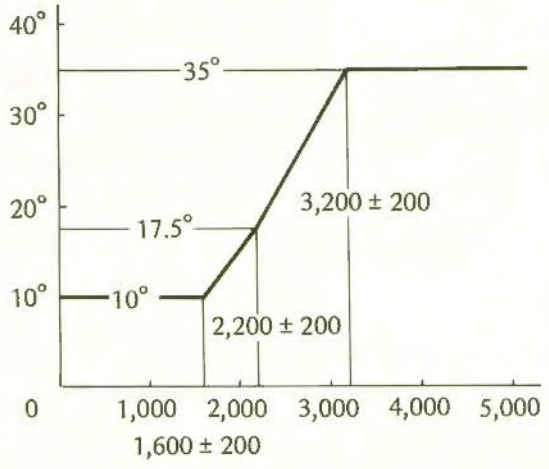


Timing Advancer

The timing advancer is a device that advances the ignition timing (makes the spark plugs 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 crankshaft 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 K35



Inspection and lubrication

Remove the timing advancer (Pg. 65), 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.

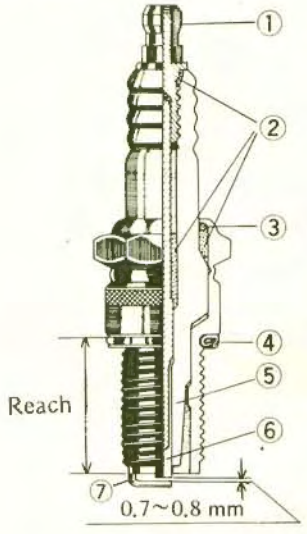
K36

Install the advancer (Pg. 65), adjust the timing (Pg. 12), and check it with a strobe light for both low and high speed operation (Pg. 14). If the timing differs from that which is shown in the graph (Fig. K35), replace the timing advancer with a new one.

Spark Plugs

The spark plugs ignite the fuel/air mixture in the combustion chamber. To do this effectively and at the proper time, the correct spark plugs must be used, and the spark plugs must be kept clean and adjusted.

Spark Plug K37



1. Terminal
2. Cement
3. Wire Ring
4. Gasket
5. Insulator
6. Center Electrode
7. Side Electrode

Tests have shown the NGK B8ES or 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 for 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 saprk 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 constant 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 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.**

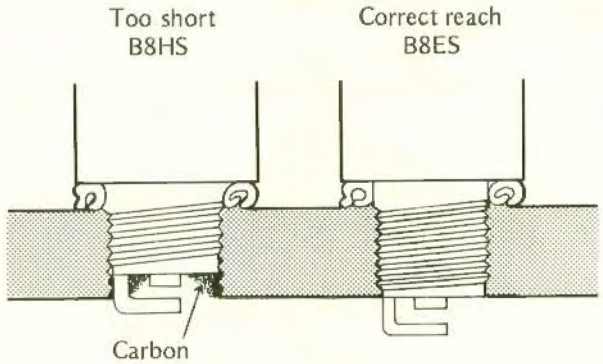
Table K7 Spark Plug Specifications

Required plug threads	NGK Number (ND Number)	Riding Conditions
14 mm diameter 19.0 mm reach	B7ES (hot)	Low Speed
	B8ES (W24ES) (standard)	Normal Riding
	B9ES (cold)	Racing

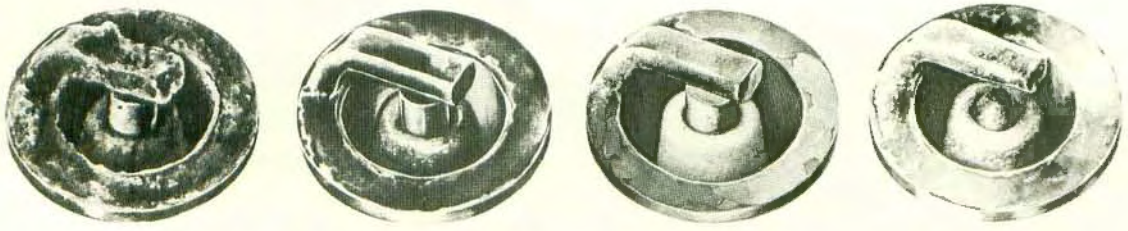
If the plug reach is too short, carbon will build up on the plug hole threads in the cylinder head, causing overheating and making it very difficult to insert the correct spark plug later.

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.

Plug Reach K38



Spark Plug Condition K39



Carbon Fouling | Oil Fouling | Normal Operation | Overheating

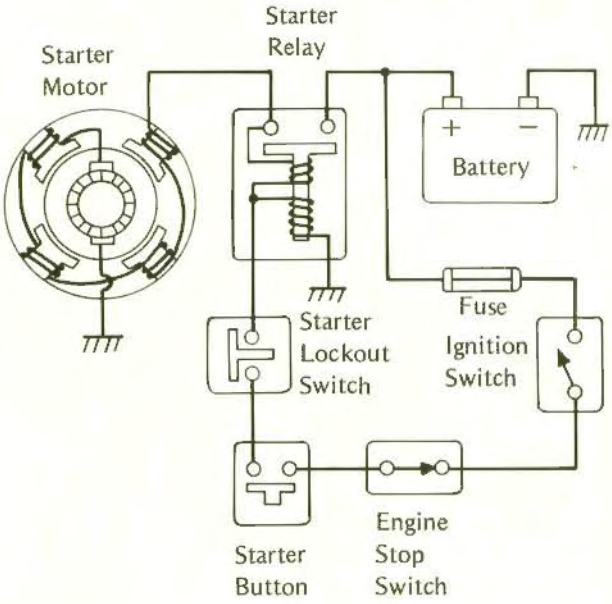
ELECTRIC STARTER SYSTEM

Starter Motor Circuit

The starter motor circuit includes the starter button (switch), starter lockout switch, starter relay, battery, and starter motor. The starter lockout switch mounted on the clutch lever bracket is designed to prevent starter motor operation unless the clutch is disengaged. When the ignition switch is on, the clutch lever is pulled (the starter lockout switch is on), and the starter button is pushed, a small amount of current flows through the switches 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.**

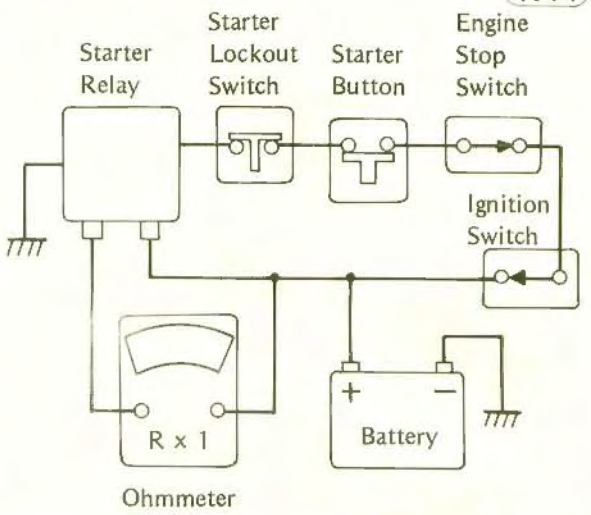
Starter Motor Circuit K40

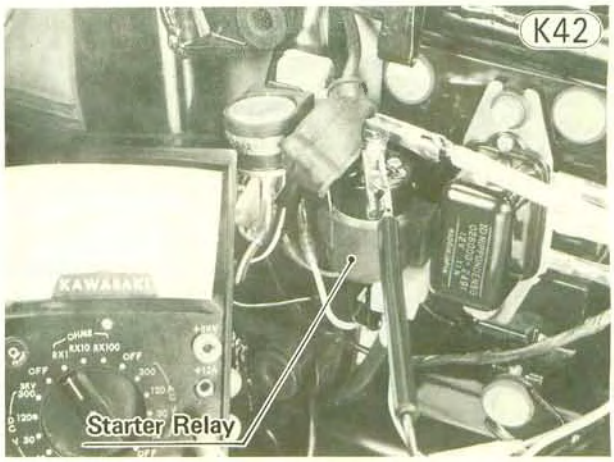


Starter relay test

Disconnect the starter motor lead from the starter relay, and connect an ohmmeter set to the R x 1 range across the relay terminals. Pulling the clutch lever, 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.

Starter Relay Contact Test K41

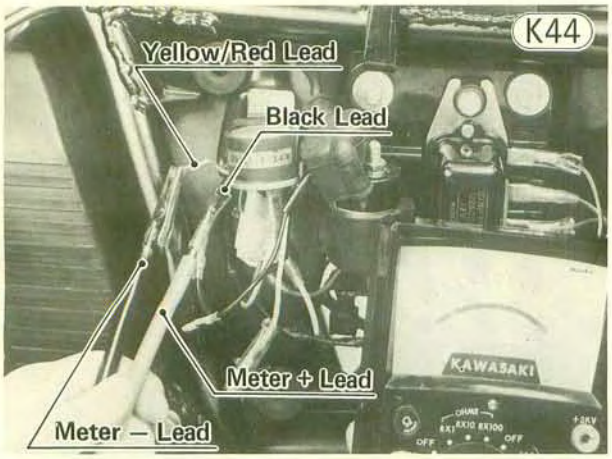




If the relay does not click at all, disconnect the other two leads (black and yellow/red), and measure the resistance across them. If the resistance is not close to zero ohms, the relay is defective.

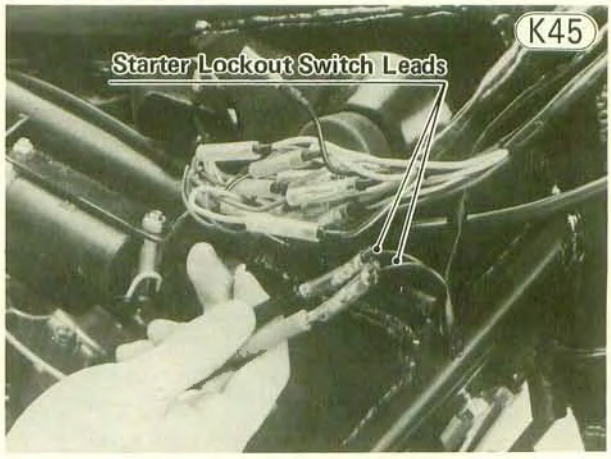
However, if there is about zero ohms resistance, the relay may be good; check that there is actually voltage to the relay before deciding that the relay is defective. To check for the voltage, first turn the meter to 30V DC,

connect the – meter lead to the yellow/red lead which was disconnected from the relay, and connect the + meter lead to the black lead. Pulling the clutch lever, push the starter button, and see if the meter reads battery voltage. If the meter does not, there is wiring or starter lockout switch trouble. If the meter reads battery voltage but the relay does not click, the relay is defective.



Starter lockout switch test

Remove the fuel tank (Pg. 41), and disconnect the two starter lockout switch black leads. Connect an ohmmeter set to the R x 1 range across the two black leads. Pull the clutch lever, and see if the meter reads zero ohms. If the meter does not, the starter lockout switch is defective and must be replaced.

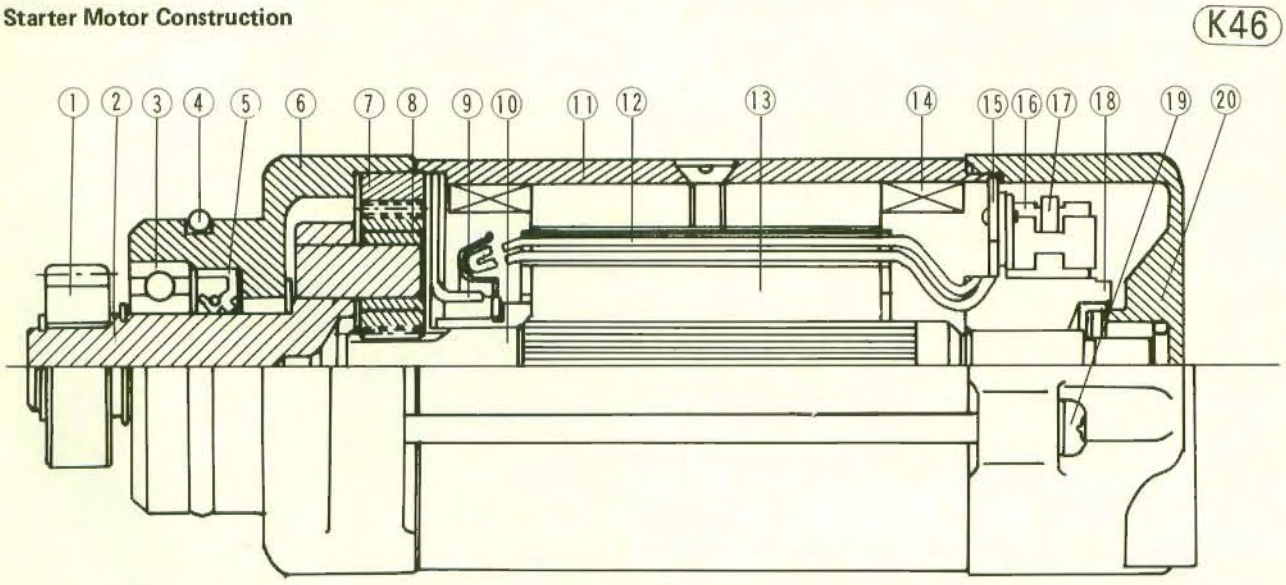


Starter Motor

The starter motor is installed with an idle gear to transmit starter motor rotation to the crankshaft. A starter clutch (Pg. 208) disengages the starter motor once the engine starts.

Fig. K46 shows starter motor construction. The field coils ⑭ are wound around four cores, forming the yoke ⑪ and the armature windings ⑫ are connected to the commutator ⑱ and receive their current through the brushes ⑯. If the brushes are not making good contact, no starter motor current will flow 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 into the bearing at the rear of the motor, causing heat seizure.

Starter Motor Construction



1. Starter Motor Pinion
2. Output Shaft
3. Ball Bearing
4. O Ring
5. Grease Seal
6. End Cover
7. Internal Gear
8. Planet Gear
9. End Plate
10. Sun Gear
11. Yoke Assembly
12. Armature Winding
13. Armature
14. Field Coil
15. Brush Plate
16. Carbon Brush
17. Spring
18. Commutator
19. Screw
20. End Cover

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 ⑧, and a sun gear ⑩. 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.

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.

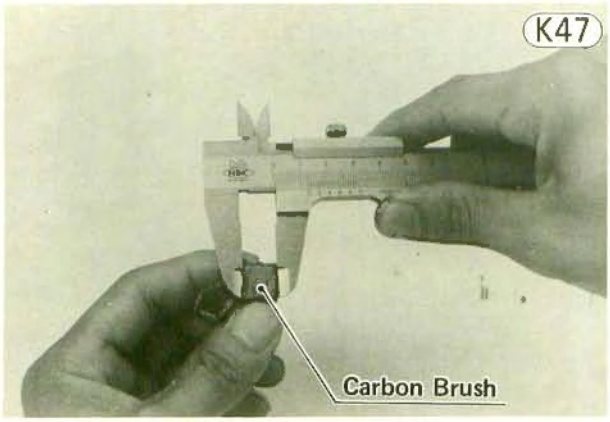


Table K8 Carbon Brush Length

Standard	Service Limit
12.0~13.0 mm	6 mm

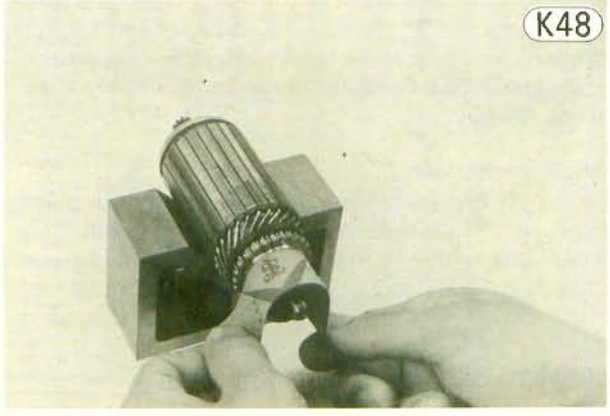
Brush spring

Spring tension should be 560~680 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.

Smooth 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

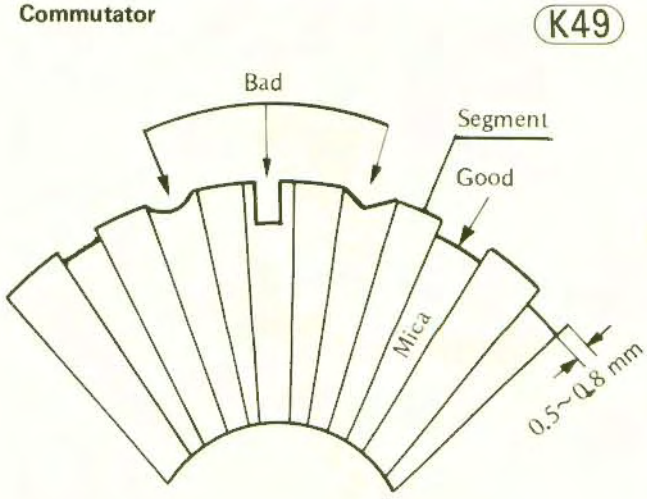
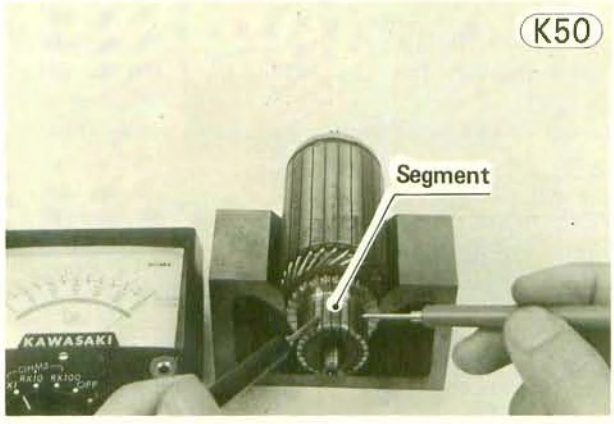


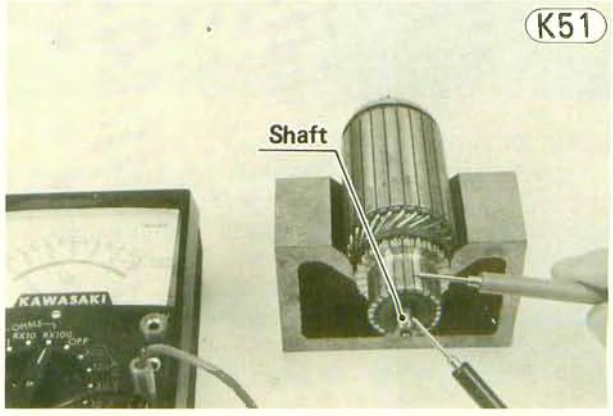
Table K9 Commutator Groove Depth

Standard	Service Limit
0.5~0.8 mm	0.2 mm

Using the R x 1 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.



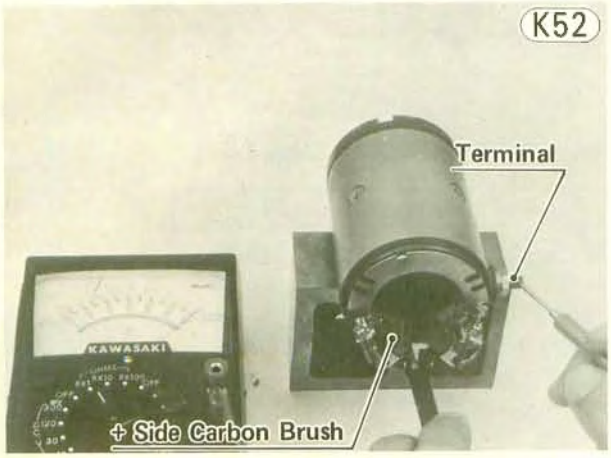
Using the highest ohmmeter range, measure the resistance between the commutator and the shafts. If there is any reading at all, the armature has a short and must be repalced.



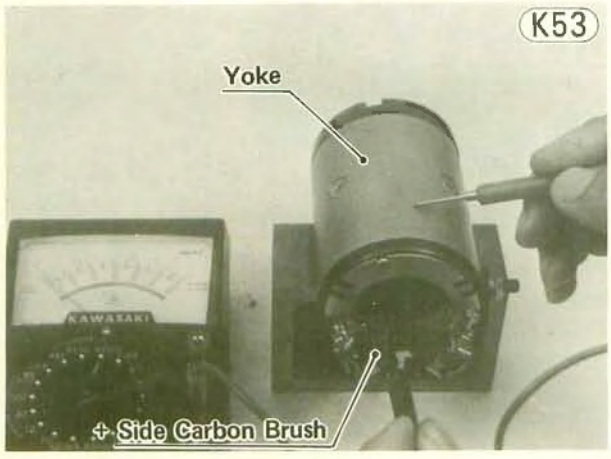
Even if the foregoing checks shows the armature to be good, it may be defective in some manner not readily detectable with an ohmmeter. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the armature with a new one.

Field coils

Using the R x 1 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.

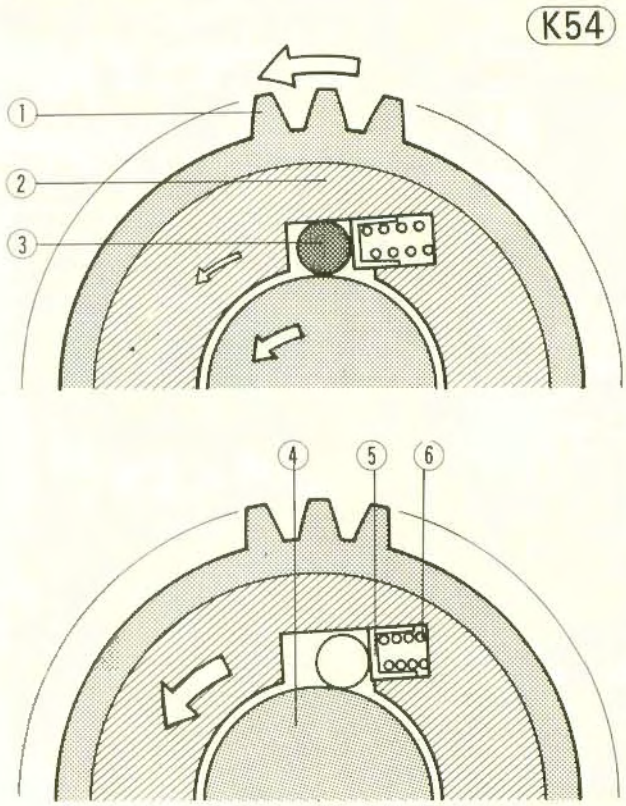


Using the highest ohmmeter range, measure the resistance between the + side carbon brush and the yoke (housing). If there is any meter reading, the coils are shorted to ground and the yoke assembly must be replaced.



Starter Motor Clutch

Fig. K54 shows starter motor clutch construction. The clutch body ② is connected to the secondary shaft ④ through the secondary sprocket and the primary chain. When the starter clutch gear 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 gear hub (the portion jutting out from the gear), thereby locking the clutch body and starter clutch gear together. With these two locked, starter motor rotation is transmitted to the crankshaft through the starter idle gear, starter clutch gear, rollers, clutch body, secondary sprocket, and primary chain.



1. Clutch Gear
2. Clutch Body
3. Roller
4. Secondary Shaft
5. Spring Cap
6. Spring

When the engine starts, friction with the starter clutch gear (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 lcutch body and starter clutch gear together. In this manner, the engine rotates freely without forcing the starter motor to turn with it.

If the rollers or the starter clutch gear hub becomes 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

Remove the starter motor (Pg. 62), and turn the starter motor idle gear by hand. When viewed from the left side of the engine, the starter motor idle gear should turn counterclockwise freely, but should not turn clockwise. If the clutch does not operate as it should or if it makes noise, disassemble the starter clutch (Pg. 73), examine each part visually, and replace any worn or damaged parts.

IGNITION SWITCH

The ignition switch has three positions: off, on, 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 park position the tail light is on, but all other circuits are cut off and the key can be removed from the switch. This provides added visibility when the motorcycle is parked.

Testing the switch

Table K10 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 connections 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.

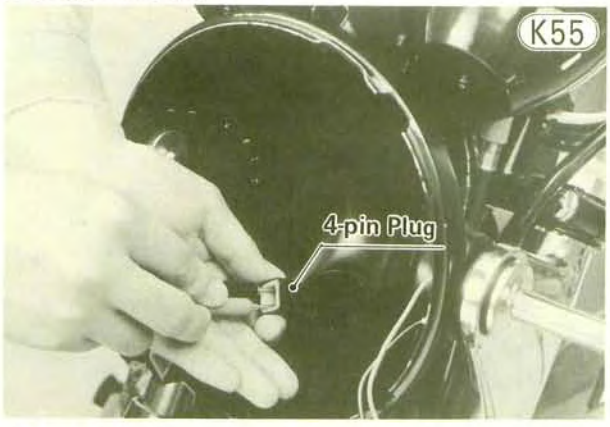


Table K10 Ignition Switch Connection

Color	White	Brown	Blue	Red
OFF				
ON	●	●	●	●
PK	●			●
Lead	BAT	IG	TL1	TL2

LIGHTING SYSTEM

Headlight Circuit

Fig. K57 and Fig. K58 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 K11, K12, and K13 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 leads (Blue, Red/Yellow, Red/Black) to the dimmer switch or the leads (Brown, Blue/White, Brown/White) to the headlight switch (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. 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.

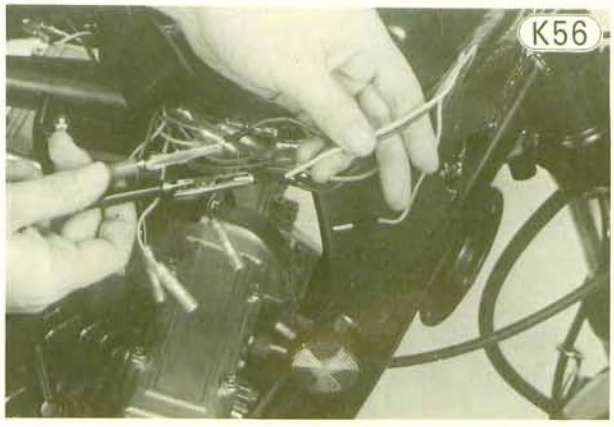


Table K11 Dimmer Switch Connection

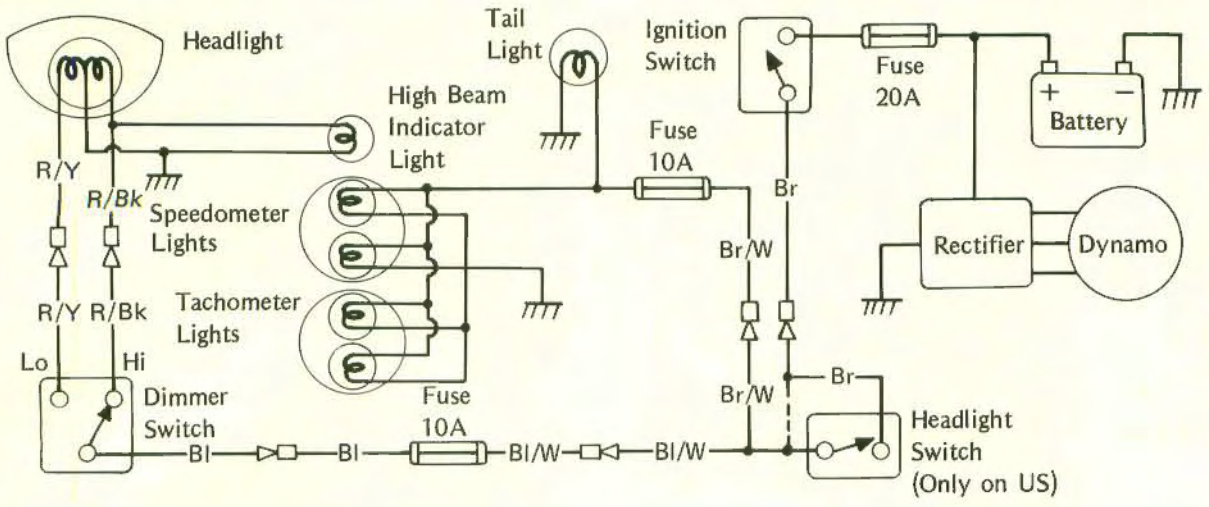
	Red/Black	Blue	Red/Yellow
Hi	●	●	
Lo		●	●

Table K12 Headlight Switch Connections

Color	Brown	Blue/White	Brown/White
OFF			
ON	●	●	●

Headlight Circuit (US, Canadian model)

K57



Headlight Circuit (European model)

K58

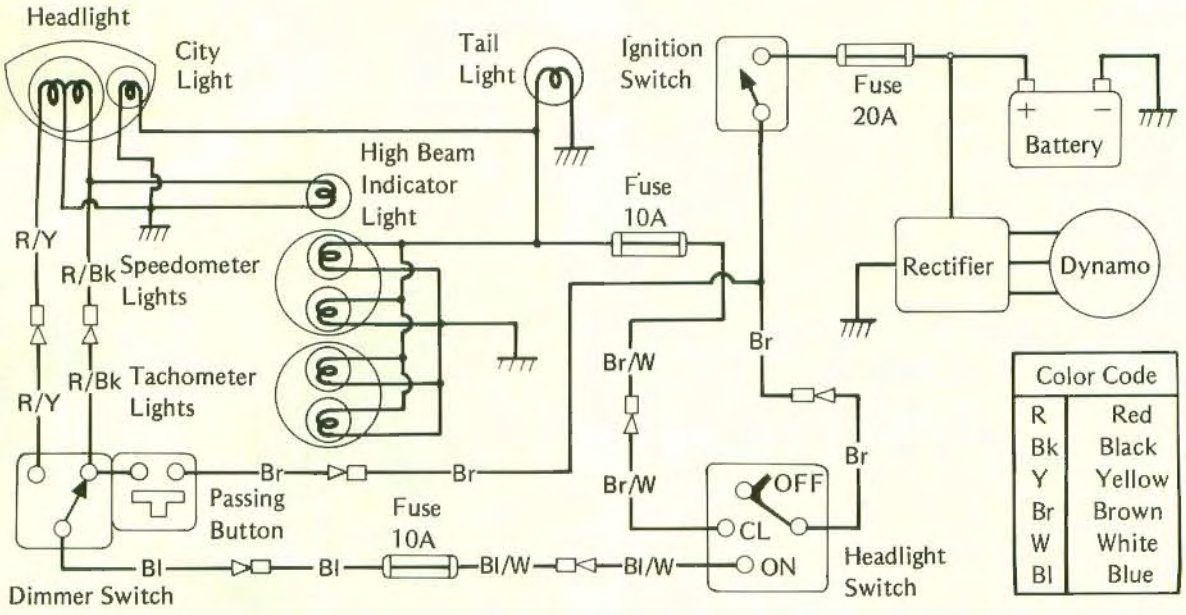


Table K13 Headlight Switch Connection (European Model)

Color	Brown	Brown/White	Blue/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.

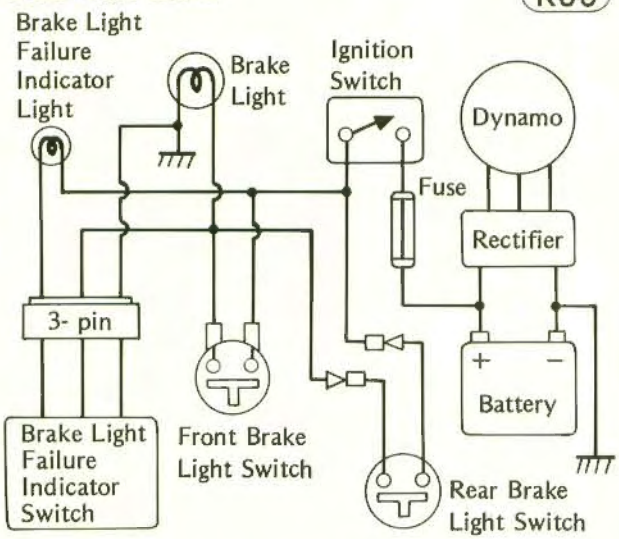
Tail light trouble

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. K59. 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.

Brake Light Circuit (K59)



The front brake light switch is a pressure switch installed in the brake fluid line, and is operated by fluid pressure when the brake lever is pulled. 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.

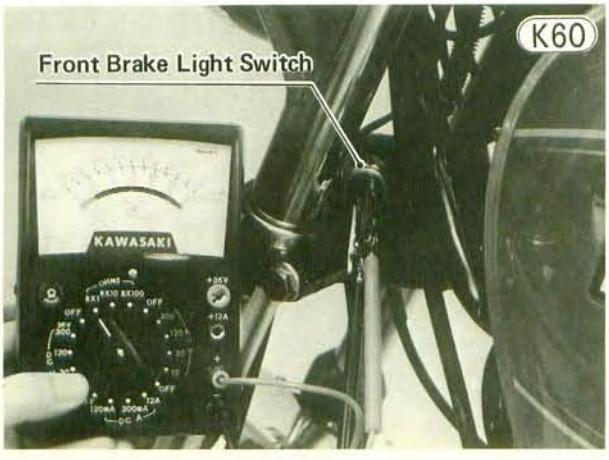
The rear brake light switch is a plunger type switch actuated by a spring attached to the rear brake pedal. It can be adjusted by changing its position higher or lower in the mounting bracket (See Pg. 26).

The brake light failure indicator switch is in the brake light circuit as a warning device to indicate whether or not the brake light is functioning properly during vehicle operation. Brake light failure may be due to a burned out bulb or some other failure in the brake light circuit.

Brake light circuit inspection involves the front brake light switch, rear brake light switch, brake light, brake light failure indicator switch, brake light failure indicator light, and wiring.

Front brake light switch inspection

- Disconnect the front brake light switch leads from the switch.
- Set an ohmmeter to the R x 1 range, connect the meter to the switch terminals, and determine whether or not there is continuity whenever the front brake lever is squeezed.



- If there is no continuity, replace the switch with new one according to following Notes.

NOTES: 1. If brake fluid spills when the switch is replaced, painted or chromed surfaces may become damaged. If any fluid spills on the fender or elsewhere, wipe it up immediately.
2. Apply a small amount of a non-permanent locking agent to the switch threads before mounting the switch. However, so that no locking agent will mix with the brake fluid, do not apply any on the lower fourth of the threads.
3. After the switch has been installed, bleed the front brake lines.

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 failure indicator switch inspection

Turn on the ignition switch. Watching the indicator light, apply and then release either brake. Next, with the tail/brake light bulb removed, do the same above. If the indicator light operates as shown in Table K14, the brake light failure indicator switch and brake light circuit are functioning properly.

Table K14 Brake Light Failure Indicator Switch Test

		Brake Lever or Pedal	
		Applied	Released
Tail/Brake Light Bulb	In place	Goes on	Goes off
	Out of place	Goes on	Flashes

If the brake light failure indicator does not function properly, find out whether the brake light wiring is defective or the failure indicator switch is defective. The easiest way to test the failure indicator switch is to install and check the suspect switch on a motorcycle with a known good brake light circuit. When this method is impossible, check the circuit as follows (the battery must be charged).

(1) Brake light wiring inspection:
- Check brake light operation and replace any defective parts. The brake light must go on only when the brake is applied.
- Remove the left side cover, and disconnect the indicator switch 3-pin plug.
- Set an ohmmeter to the R x 1 range and voltmeter to the 30V DC range. Check the wiring as shown in Table K15.

CAUTION **To prevent a meter burning, turn off the ignition switch while using an ohmmeter.**

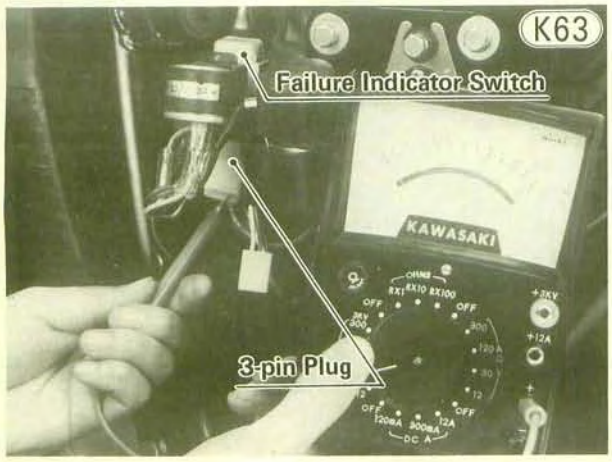


Table K15 Brake Light Wiring Inspection

Meter	Connections†	Brake	Standard
Voltmeter 30V DC	Meter (+) ⟷ Blue	Apply	Battery Voltage
		Release	0V
	Meter (+) ⟷ Green/White	—	Battery Voltage
Ohmmeter R x 1	Meter (+) ⟷ Black/Yellow	—	0 Ω

†1. Negative (–) meter lead connected to the ground.
2. Positive (+) meter lead at 3-pin socket with indicator switch disconnected.

If the meter does not read according to this table, there may be an open or short. In case the voltage of the green/white lead shows 0 volts, the indicator bulb may be burned out.

(2) Brake light failure indicator switch inspection:
- Make sure that the brake light operates properly, and that the brake light wiring is not damaged.
- Connect the indicator switch 3-pin plug.
- Measure the voltage at the 3-pin plug as shown in Table K16.

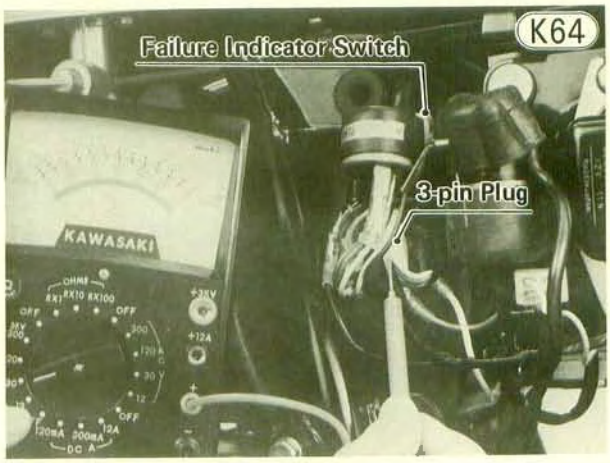


Table K16 Indicator Switch Inspection

Meter	Connections†	Brake	Standard
30V DC	Meter (+) ⟷ Yellow	Apply	Battery Voltage
		Release	0V
	Meter (+) ⟷ Green/White	Apply	0V
		Release	Battery Voltage

†1. Negative (–) meter lead connected to the ground.
2. Positive (+) meter lead at 3-pin plug with indicator switch connected.

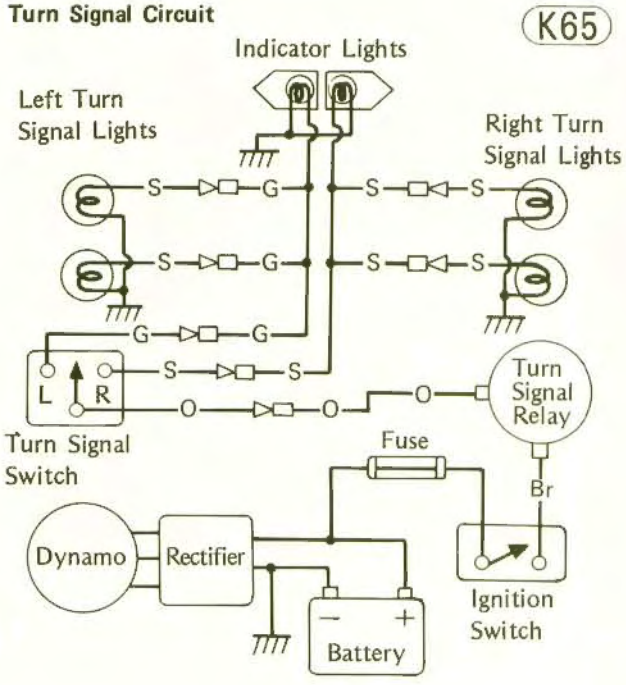
If any one of the meter readings shows an improper value, the brake light failure indicator switch is defective.

Turn Signal Circuit

A wiring diagram of the turn signal circuit is shown in Fig. K65. 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 through 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 contracts, closing the contacts so that the cycle can begin again. The indicator light in the turn signal circuit flashes on and off with the turn signals to indicate that they are working properly.

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.

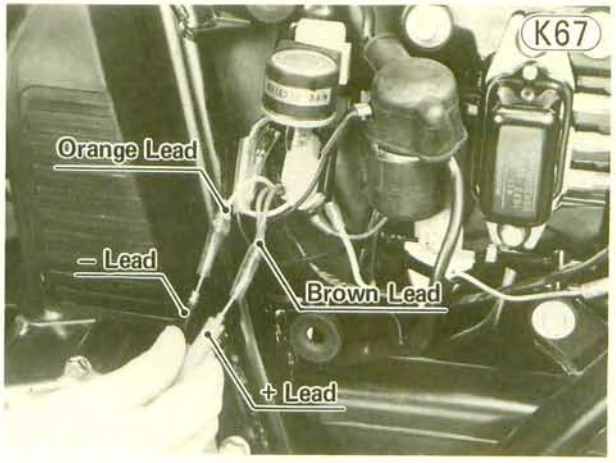
Turn Signal Circuit



Turn signal trouble

(1) Neither right nor left turn signals come on at all:
- Check that battery voltage is normal.
- Unplug 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 30V 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 or of the incorrect wattage, or the wiring is broken or improperly connected.

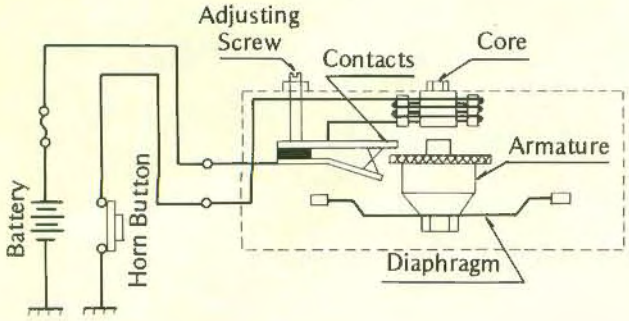
(4) Neither light on one side comes on:
- Unless both lights for that side are burned out, the trouble is with the turn signal switch.

(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). 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. K68. 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.

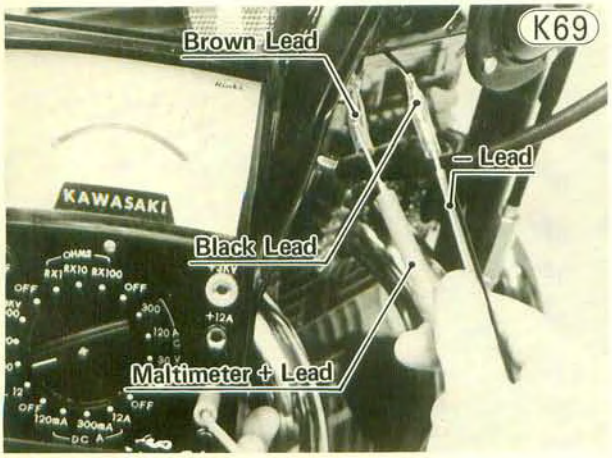
Horn Construction (K68)



The contacts wear down after long use, requiring adjustment from time to time (Pg. 29). 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 to the horn terminals a multimeter set to the R x 1 range 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 30V 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 the wiring is at fault.



- If the meter does snow 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
- Clutch lever not pulled
- 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 lockout switch defective

Starter motor rotating but engine doesn't turn over
- Starter motor clutch defective

Engine won't turn over
- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure
- Secondary shaft bearing seizure
- Kick ratchet gear not engaging
- Primary chain broken

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 wear
- Battery voltage low
- Spark plug dirty, defective, or maladjusted
- Spark plug cap or high tension wiring defective
- Spark plug cap 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 screw(s) maladjusted
- Pilot jet, or air passage clogged
- Air bleed pipe bleed holes clogged
- Air cleaner clogged, poorly sealed, or missing
- Air cleaner poorly sealed
- Starter plunger stuck open
- Fuel level too high or too low
- Fuel tank air vent obstructed
- Carburetor holders 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)
- Carburetors not synchronizing
- Throttle valves don'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 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
- Starter plunger stuck open
- Water or foreign matter in fuel
- Carburetor holders 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 valves don'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 holders loose
- Air cleaner poorly sealed, or missing
- Air cleaner duct poorly sealed

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 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 of too high a viscosity
- Engine oil level too high
- Clutch housing frozen on drive shaft
- Clutch release mechanism defective
- Loose clutch hub nut

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 drum positioning pin binding
- Shift pedal return spring weak or broken
- Shift lever broken
- External shift mechanism pawl broken
- Shift return spring pin loose
- Pawl 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
- Drive shaft, output shaft, and/or gear splines worn

Overshifts
- Shift drum positioning pin spring weak or broken
- Pawl 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

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
- Camshaft bearings worn
- Valve lifter worn

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
Primary chain worn
Camshaft chain tensioner defective
Camshaft chain, sprocket, guides worn
Camshaft chain requires adjustment
Loose dynamo rotor

Abnormal Drive Train Noise

Clutch noise
Clutch housing/friction plate clearance excessive
Weak or damaged shock damper spring (s)

Transmission noise
Bearings worn
Transmission gears worn or chipped
Metal chips jammed in gear teeth
Engine oil insufficient
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

Disc brake noise
Pad B loose
Pad surface glazed
Disc warped

Other noise
Brackets, nuts, bolts, etc. nor properly mounted or tightened

Oil pressure Indicator Light Goes On

Engine oil pump defective
Engine oil screen clogged
Engine oil level too low
Engine oil viscosity too low
Camshaft bearings worn
Crankshaft bearings worn
Oil pressure indicator light switch defective
Wiring defective
Relief valve stuck open

Exhaust Smokes Excessively

White smoke
Piston oil ring worn
Cylinder worn
Valve oil seal damaged
Valve guide worn
O rings at the cylinder oil passage orifice are damaged
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
Carburetor intake ducts 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 sleeve worn
Rim(s) warped, or not balanced
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
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 brake
Air in the brake line
Pad or disc worn
Brake fluid leak
Disc warped
Contaminated pads
Brake fluid deteriorated
Primary or secondary cup defective
Master cylinder scratched inside

Drum brake
- Brake maladjusted
- Brake lining or drum worn
- Overheated
- Water in brake drum
- Brake cam, camshaft worn
- Oil on brake linings

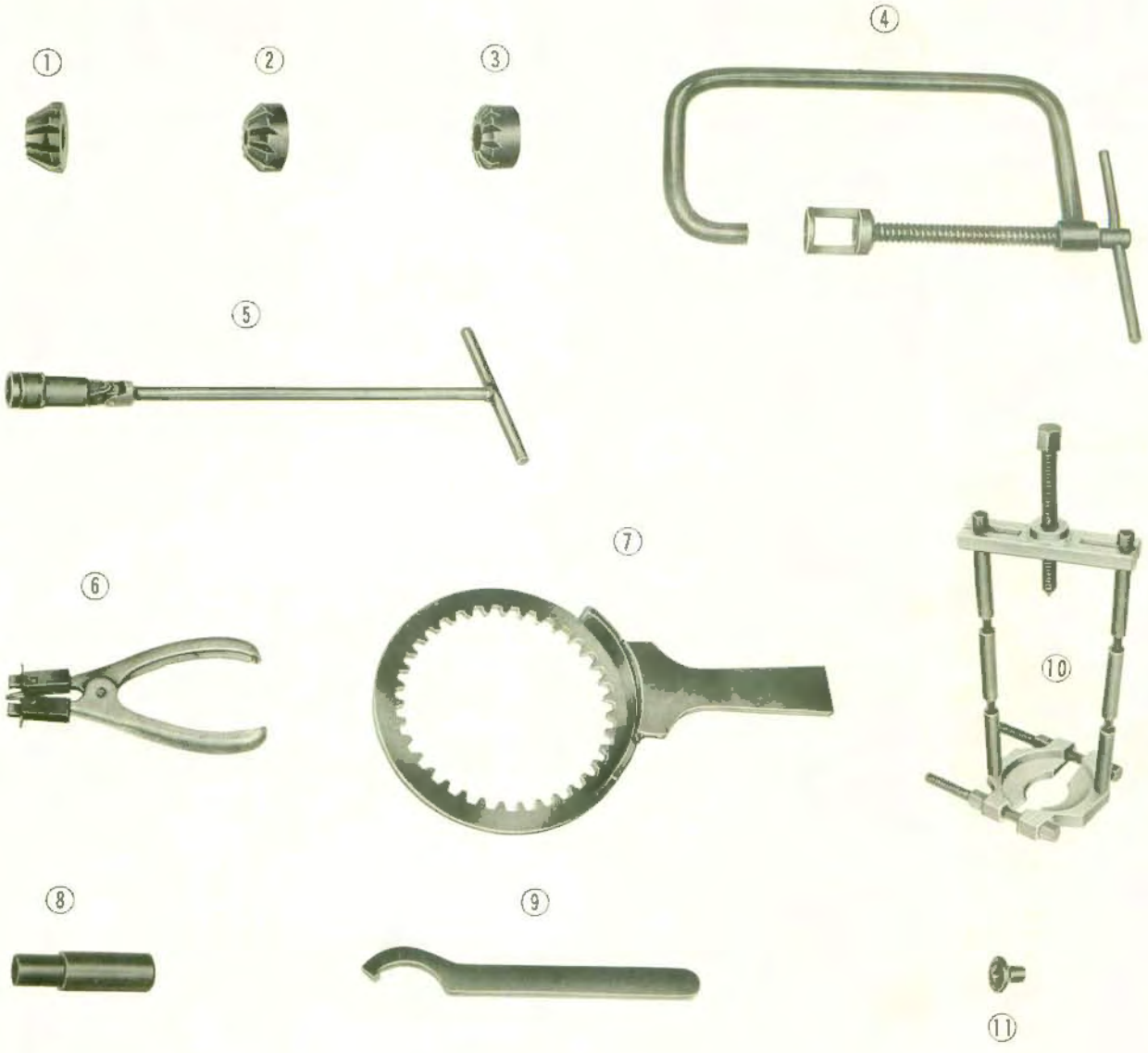
Battery Discharged
- Battery *faulty* (e.g., plates sulphated, shorted through sedimentation, electrolyte level too low)
- Battery leads making poor contact
- Load excessive (e.g., bulb of excessive wattage)
- Rectifier defective
- Ignition switch defective
- Regulator defective
- Armature coil open or short
- Wiring faulty

Battery Overcharged
- Regulator 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 (EX60°)
4	57001-107	VALVE SPRING COMPRESSOR ASSY
	(or P/No. 57001-241	+ 57001-243)
5	57001-110	SPARK PLUG WRENCH
6	57001-115	PISTON RING PLIERS
7	57001-119	CLUTCH HOLDER
8	57001-132	BOOTS STOPPER HOLDER
9	57001-134	STEM NUT WRENCH
10	57001-135	BEARING PULLER
11	57001-317	BEARING PULLER ADAPTER

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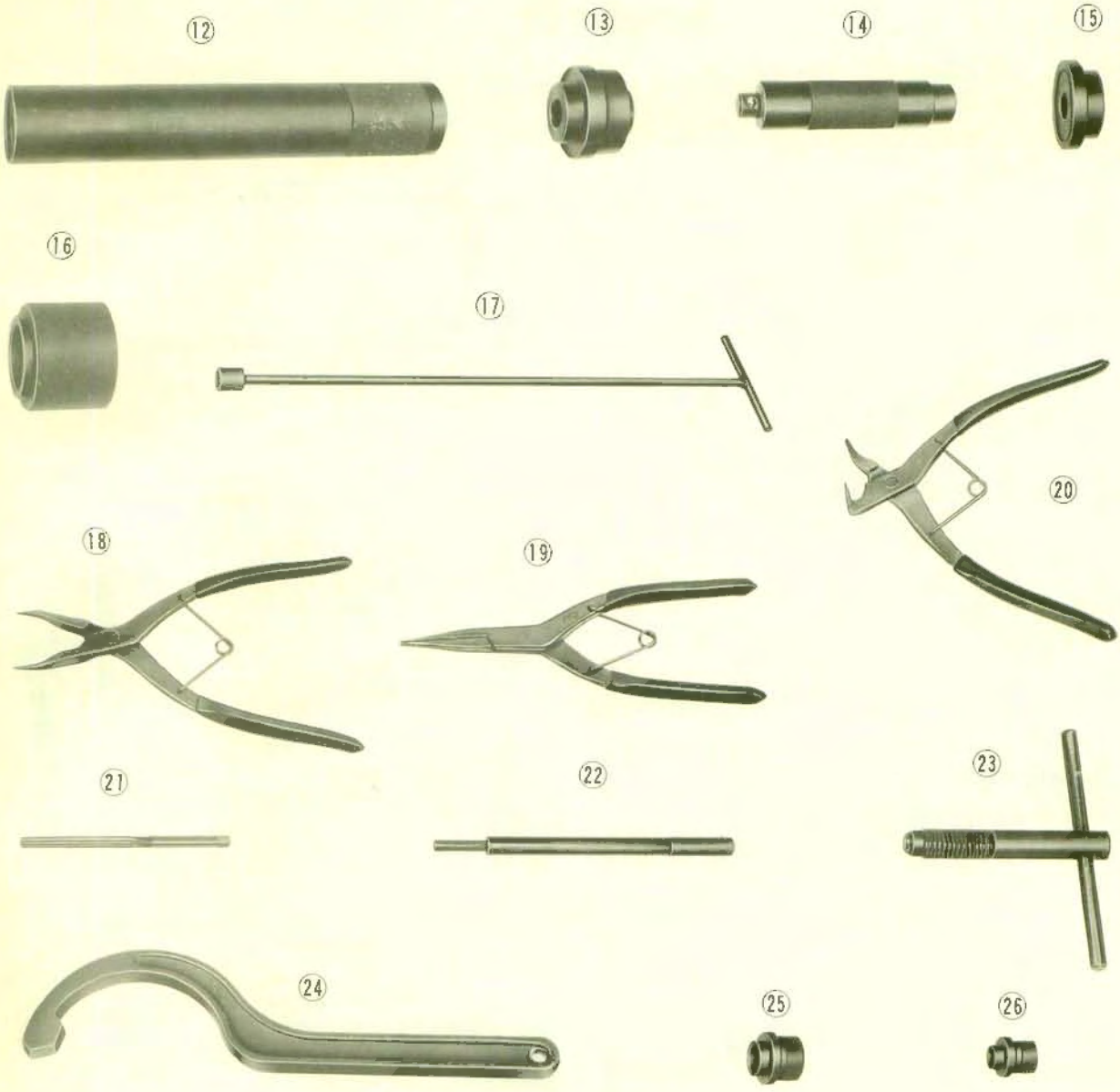
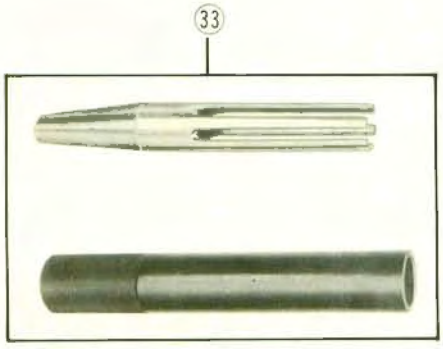
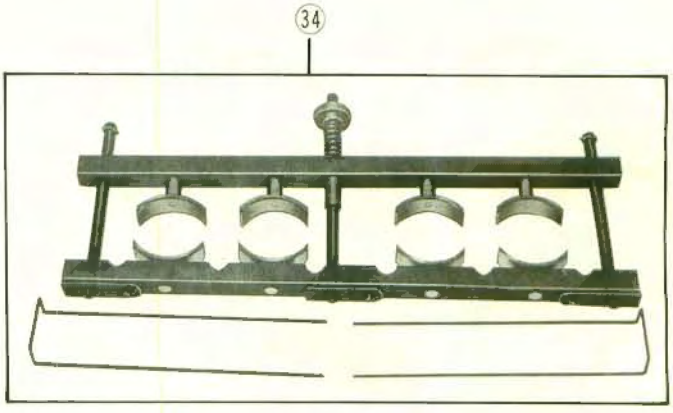
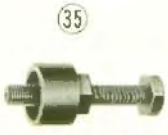
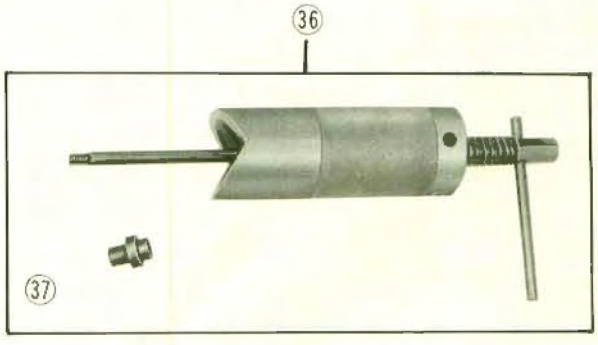


REF. NO.	PART NO.	DESCRIPTION
12	57001-137	STEM BEARING DRIVER
13	57001-138	STEM CUP DRIVER
14	57001-139	BEARING DRIVER HOLDER
15	57001-140	BEARING DRIVER
16	57001-141	FRONT FORK OIL SEAL DRIVER
17	57001-142	FRONT FORK CYLINDER HOLDER
	(or P/No. 57001-176 + 57001-183)	
18	57001-143	CIRCLIP INSIDE PLIERS
19	57001-144	CIRCLIP OUTSIDE PLIERS
20	57001-154	SPECIAL PLIERS
21	57001-162	VALVE GUIDE REAMER
22	57001-163	VALVE GUIDE ARBOR
23	57001-254	ROTOR PULLER
24	57001-255	ROTOR HOLDER
25	57001-265	KICK SHAFT OIL SEAL GUIDE
26	57001-266	SHIFT SHAFT OIL SEAL GUIDE









REF. NO.	PART NO.	DESCRIPTION
27	57001-286	SHIFT DRUM BEARING DRIVER
28	57001-290	BEARING DRIVER "C"
29	57001-296	BEARING DRIVER
30	57001-297	SECONDALY SHAFT BEARING DRIVER
31	57001-306	ENGINE SPROCKET FLYWHEEL HOLDER
32	57001-309	BOOTS REMOVER
33	57001-380	TRANSMISSION CIRCLIP DRIVER
34	57001-531	PISTON RING COMPRESSOR ASSY
35	57001-535	SECONDALY GEAR PUSHER
36	57001-910	PISTON PIN PULLER ASSY
37	57001-913	PISTON PIN PULLER ADAPTER

(38)

(39)

(40)

(41)

(42)

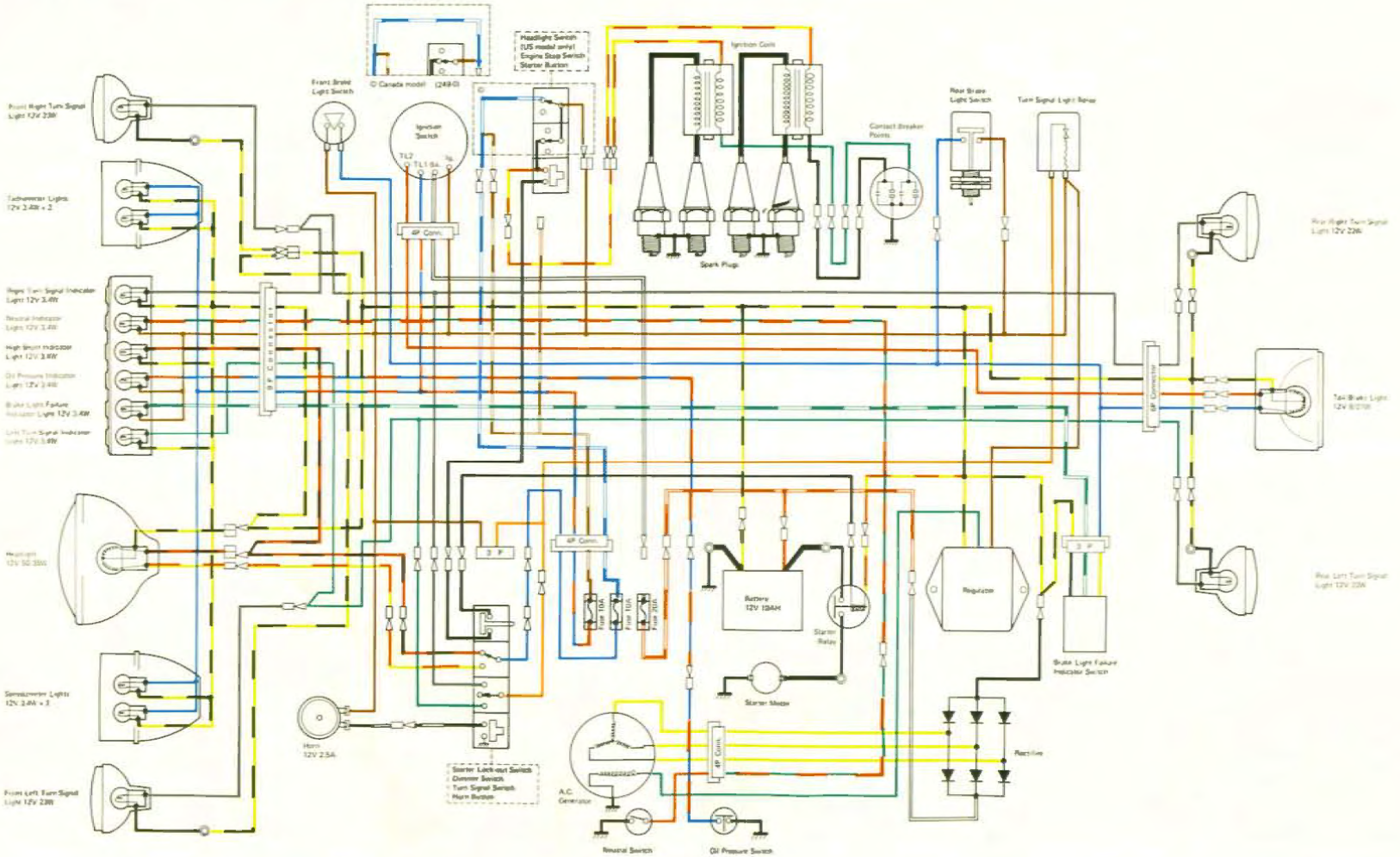
(43)

(44)

(45)

REF. NO.	PART NO.	DESCRIPTION
38	57001-123	COMPRESSION GAUGE ASSY
39	57001-127	VACUUM GAUGE SET
40	57001-164	OIL PRESSURE GAUGE ASSY
41	57001-403	OIL PRESSURE GAUGE ADAPTER
42	57001-226	VACUUM GAUGE
43	57001-208	FUEL LEVEL GAUGE
44	57001-980	ELECTRO TESTER
45	57001-983	HAND TESTER

KZ650-B1 Wiring Diagram
(US, Canadian model)



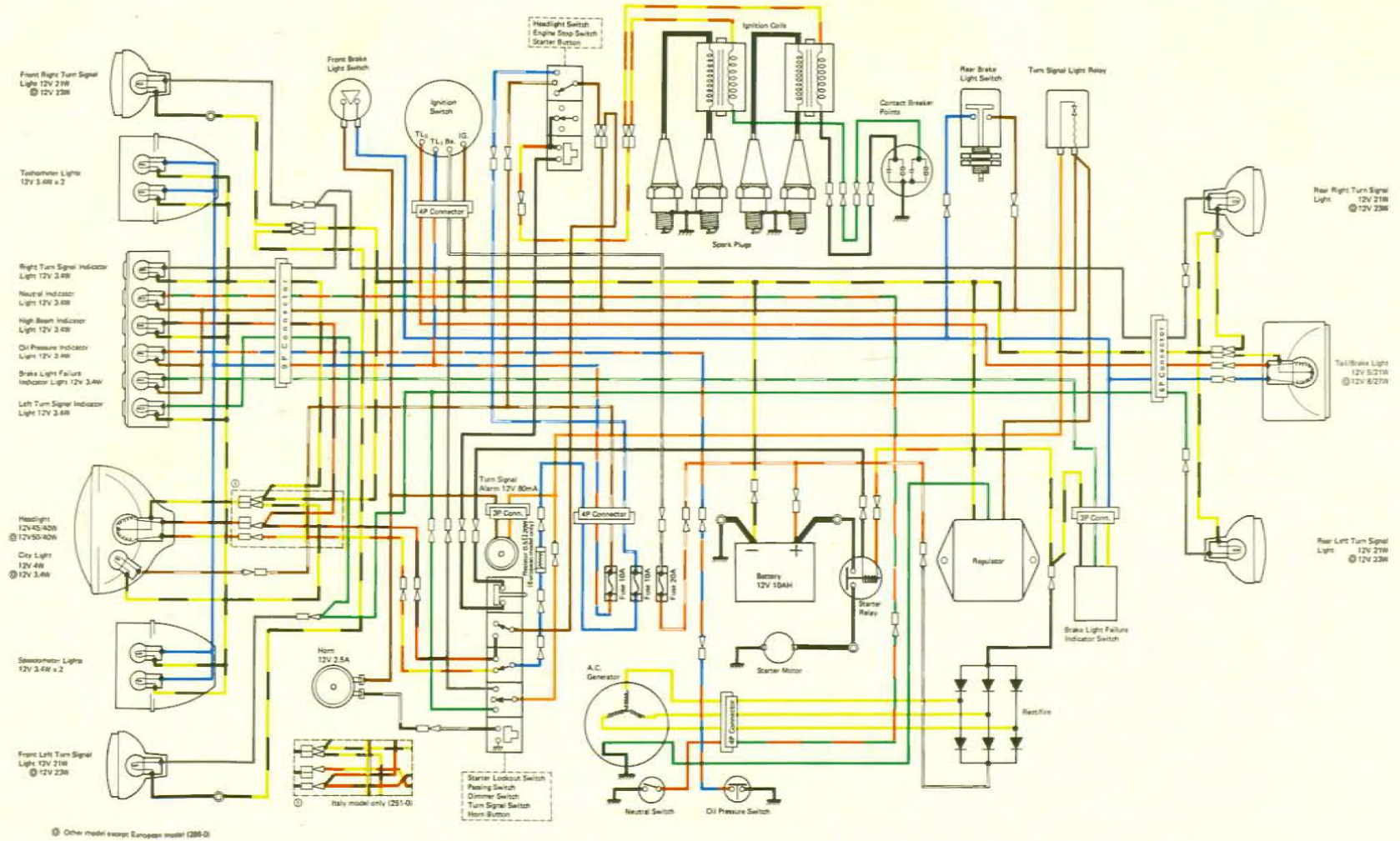
Left Handlebar Switch Connections												
Starter Lock-out Switch			Dimmer Switch			Turn Signal Switch				Horn Button		
Color	Bk	Bk	Color	Bk/R	Blue	R/Y	Color	Green	Orange	Slate	Color	Bk/W
ON			HI				Left				ON	
			LO				Right					

Ignition Switch Connections				
	Battery	Ignition	Tail 1	Tail 2
Color	White	Brown	Blue	Red
OFF				
ON				
PARK				

(2461)

Right Handlebar Switch Connections								
Headlight Switch			Starter Button		Engine Stop Switch			
Color	Brown	Bl/W	Bl/W	Color	Black	R/Y	Color	Brown	R/Y
OFF							OFF		
ON				ON			RUN		
							OFF		

KZ650-B1 Wiring Diagram (European model)



① Other model except European model (2B6-0)

Left Handlebar Switch Connections

Passing Switch			Starter Lockout Switch			Dimmer Switch				Turn Signal Switch				Horn Button		
Color	Brown	Bk/R	Color	Bk	Bk	Color	Bk/R	Blue	R/Y	Color	Green	Orange	Slate	Color	Bk/W	
ON	●	●	ON	●	●	HI		●		Left	●	●		ON	●	●
						LO		●	●	Right		●	●			

Ignition Switch Connections

	Battery	Ignition	Tail 1	Tail 2
Color	White	Brown	Blue	Red
OFF				
ON	●		●	
PARK	●			

(2S0-0)

Right Handlebar Switch Connection

Headlight Switch				Starter Button			Engine Stop Switch		
Color	Brown	Bl/W	Bl/W	Color	Black	R/Y	Color	Brown	R/Y
OFF							OFF		
PO	●		●	ON	●	●	RUN		
ON	●	●					OFF		

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