# Kawasaki
# Shop Manual
## Z Series

KAWASAKI HEAVY INDUSTRIES, LTD.
Motorcycle Division

## Decimal Equivalents

| INCH | | | | | MM INCH |
|---|---|---|---|---|---|
| 1/64 | | | | .015625 | |
| | 1/32 | | | .03125 | 1mm= .03937 inch |
| 3/64 | | | | .046875 | |
| | | 1/16 | | .0625 | |
| 5/64 | | | | .078125 | 2mm= .07874 inch |
| | 3/32 | | | .09375 | |
| 7/64 | | | | .109375 | 3mm= .11811 inch |
| | | | 1/8 | .125 | |
| 9/64 | | | | .140625 | |
| | 5/32 | | | .15625 | 4mm= .15748 inch |
| 11/64 | | | | .171875 | |
| | | 3/16 | | .1875 | 5mm= .19685 inch |
| 13/64 | | | | .203125 | |
| | 7/32 | | | .21875 | |
| 15/64 | | | | .234375 | 6mm= .23622 inch |
| | | | 1/4 | .25 | |
| 17/64 | | | | .265625 | 7mm= .27559 inch |
| | 9/32 | | | .28125 | |
| 19/64 | | | | .296875 | |
| | | 5/16 | | .3125 | 8mm= .31496 inch |
| 21/64 | | | | .328125 | |
| | 11/32 | | | .34375 | 9mm= .35433 inch |
| 23/64 | | | | .359375 | |
| | | | 3/8 | .375 | |
| 25/64 | | | | .390625 | 10mm= .39370 inch |
| | 13/32 | | | .40625 | |
| 27/64 | | | | .421875 | 11mm= .43307 inch |
| | | 7/16 | | .4375 | |
| 29/64 | | | | .453125 | |
| | 15/32 | | | .46875 | 12mm= .47244 inch |
| 31/64 | | | | .484375 | |
| | | | 1/2 | .5 | 13mm= .51181 inch |

| INCH | | | | | MM INCH |
|---|---|---|---|---|---|
| 33/64 | | | | .515625 | |
| | 17/32 | | | .53125 | |
| 35/64 | | | | .546875 | 14mm= .55118 inch |
| | | 9/16 | | .5625 | |
| 37/64 | | | | .578125 | 15mm= .59055 inch |
| | 19/32 | | | .59375 | |
| 39/64 | | | | .609375 | |
| | | | 5/8 | .625 | 16mm= .62992 inch |
| 41/64 | | | | .640625 | |
| | 21/32 | | | .65625 | 17mm= .66929 inch |
| 43/64 | | | | .671875 | |
| | | 11/16 | | .6875 | |
| 45/64 | | | | .703125 | 18mm= .70866 inch |
| | 23/32 | | | .71875 | |
| 47/64 | | | | .734375 | 19mm= .74803 inch |
| | | | 3/4 | .75 | |
| 49/64 | | | | .765625 | |
| | 25/32 | | | .78125 | 20mm= .78740 inch |
| 51/64 | | | | .796875 | |
| | | 13/16 | | .8125 | 21mm= .82677 inch |
| 53/64 | | | | .828125 | |
| | 27/32 | | | .84375 | |
| 55/64 | | | | .859375 | 22mm= .86614 inch |
| | | | 7/8 | .875 | |
| 57/64 | | | | .890625 | 23mm= .90551 inch |
| | 29/32 | | | .90625 | |
| 59/64 | | | | .921875 | |
| | | 15/16 | | .9375 | 24mm= .94488 inch |
| 61/64 | | | | .953125 | |
| | 31/32 | | | .96875 | 25mm= .98425 inch |
| 63/64 | | | | .984375 | |
| | | | 1 | 1. | |

## Unit Conversion Table

| | | | | |
|---|---|---|---|---|
| cc | x | .0610 | = | cu. in. |
| cc | x | .02816 | = | oz. (imp.) |
| cc | x | .03381 | = | oz. (U.S.) |
| cu. in. | x | 16.39 | = | cc |
| ft-lbs | x | 12 | = | in. lbs. |
| ft-lbs | x | .1383 | = | kg-M |
| gal. (imp.) | x | 4.546 | = | litres |
| gal. (imp.) | x | 1.201 | = | gal. (U.S.) |
| gal. (U.S.) | x | 3.7853 | = | litres |
| gal. (U.S.) | x | .8326 | = | gal. (imp.) |
| grams | x | .03527 | = | oz. |
| in. | x | 25.40 | = | mm |
| in. lbs. | x | .0833 | = | ft-lbs. |
| in. lbs. | x | .0115 | = | kg-M |
| kg | x | 2.2046 | = | lbs. |
| kg | x | 35.274 | = | oz. |
| kg-M | x | 7.233 | = | ft-lbs |
| kg-M | x | 86.796 | = | in-lbs |
| $kg/cm^2$ | x | 14.22 | = | lbs/sq. in. |
| km | x | .6214 | = | mile |
| lb. | x | .4536 | = | kg |
| lb/sq. in. | x | .0703 | = | $kg/cm^2$ |
| litre | x | 28.16 | = | oz. (imp.) |
| litre | x | 33.81 | = | oz. (U.S.) |
| litre | x | .8799 | = | qt. (imp.) |
| litre | x | 1.0567 | = | qt. (U.S.) |
| metre | x | 3.281 | = | ft. |
| mile | x | 1.6093 | = | km |
| mm | x | .03937 | = | in. |
| oz.(imp.) | x | 35.51 | = | cc |
| oz. (U.S.) | x | 29.57 | = | cc |
| oz. (weight) | x | 28.35 | = | grams |
| qt. (imp.) | x | 1.1365 | = | litre |
| qt. (imp.) | x | 1.201 | = | qt. (U.S.) |
| qt. (U.S.) | x | .9463 | = | litre |
| qt. (U.S.) | x | .8326 | = | qt. (imp.) |

$°C \rightarrow °F: \quad \frac{9(°C + 40)}{5} - 40 = °F$

$°F \rightarrow °C: \quad \frac{5(°F + 40)}{9} - 40 = °C$

## List of Abbreviations

ABDC..... after bottom dead center
ATDC..... after top dead center
BBDC..... before bottom dead center
BDC ..... bottom dead center
BTDC ..... before top dead center
cc ..... cubic centimeters
cu. in..... cubic inches
ft. ..... foot, feet
ft-lbs ..... foot-pounds
gal. ..... gallon, gallons
hp..... horsepower
in. ..... inch, inches
in-lb..... inch-pounds
kg..... kilogram, kilograms
$kg/cm^2$ ..... kilograms per square centimeter
kg-M..... kilogram meters
km..... kilometer
kph..... kilometers per hour
lb., lbs. ..... pound, pounds
lbs/sq.in. ..... pounds per square inch
ltr..... liter
M ..... meter, meters
mi. ..... mile, miles
mm..... millimeters
mph..... miles per hour
oz ..... ounce, ounces
psi ..... pounds per square inch
qt. ..... quart, quarts
r.p.m. ..... revolutions per minute
sec. ..... second, seconds
SS ..... standing start
TDC ..... top dead center
" ..... inch, inches

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# Shop Manual
## Z Series

KAWASAKI HEAVY INDUSTRIES, LTD.
Motorcycle Division

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# FOREWORD

This manual is designed primarily for use in the shop, although it contains enough basic information to make it useful to the motorcycle owner who wishes to do his own maintenance. It should be noted, however, that where special tools or equipment are necessary to perform maintenance correctly and safely, only the repair procedure using that equipment is explained.

In order to perform work most efficiently and avoid costly mistakes, it is recommended that the mechanic read the applicable text and thoroughly familiarize himself with the maintenance procedures before starting work.

For maximum utility, this manual is divided into the following four main sections:

(1) Adjustment

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

(2) Disassembly

This section shows the best method for removal and installation of parts and assemblied, and covers disassembly of some assemblies such as the carburetor, starter, etc. Adjustments such as valve timing, which are a part of the assembly procedure, are also included in this section.

Since installation is usually the reverse of removal, installation of parts is not explained in detail in most cases. "Installation notes", however, are added wherever they may prove necessary or helpful.

In cases where the removal procedure is readily apparent, such as for the seat, kick stand, etc., no information is given in this section.

(3) Maintenance and Theory of Operation

Wear measurements and maintenance procedures are described in detail in this section, and enough theory of operation is given to enable the mechanic to understand the work.

(4) Appendix

The appendix contains all the miscellaneous information which is not found in other sections, and includes a list of special tools, torque tables, periodic maintenance, wiring diagrams, etc.

The information contained in this Shop Manual is intended to be as accurate as possible on the date of printing. When corrections become necessary, the changes will be passed on via correction sheets or Service News.



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**U.S. Model**






**European Model**





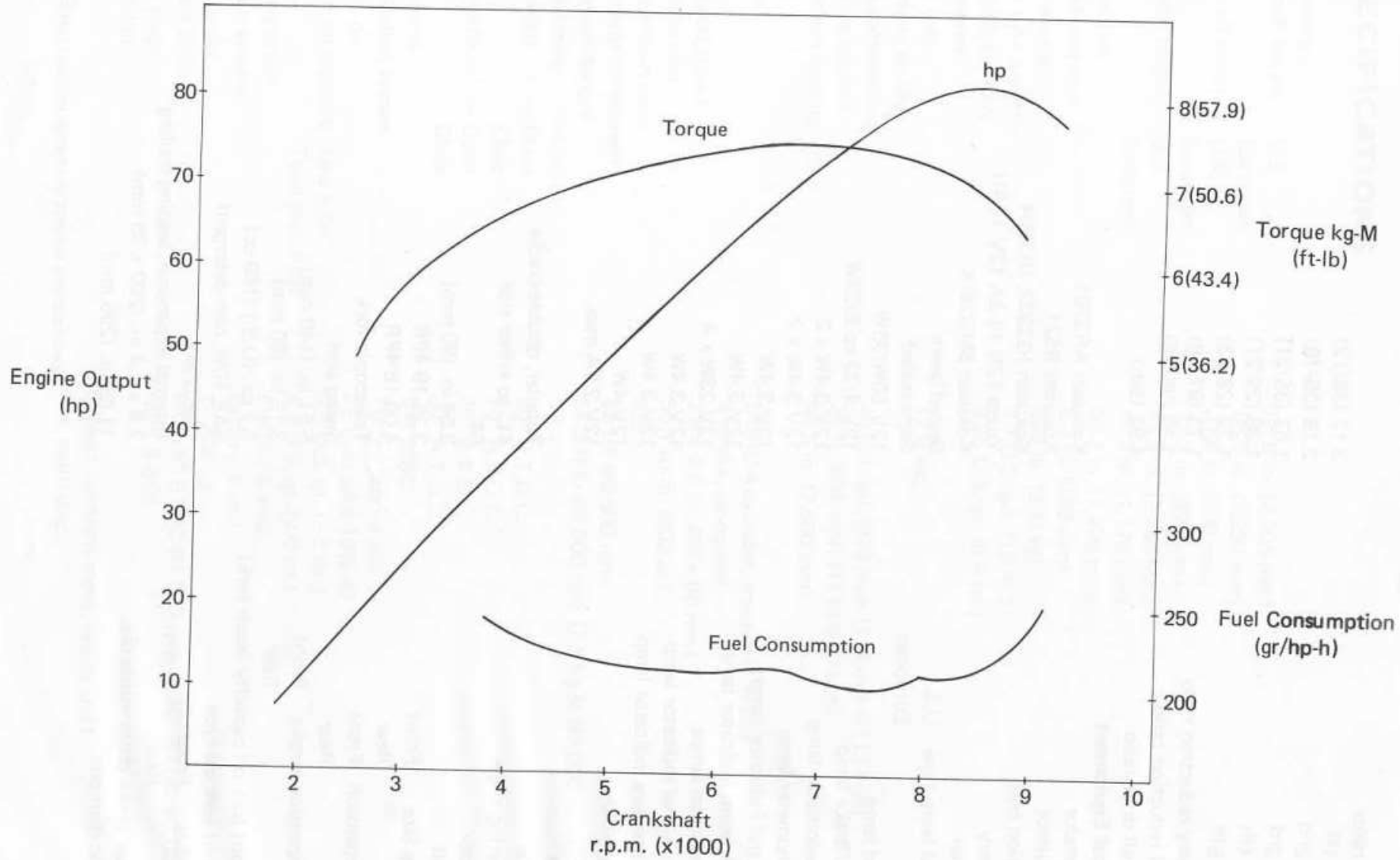

# SPECIFICATIONS

| | | |
|---|---|---|
| **Dimensions** | | |
| Overall length | U.S. | 86.8 in. (2,205 mm) |
| | European | 88.5 in. (2,250 mm) |
| Overall width | U.S. | 31.5 in. (800 mm) |
| | European | 32.3 in. (820 mm) |
| Overall height | U.S. | 45.3 in. (1,150 mm) |
| | European | 46.3 in. (1,175 mm) |
| Wheelbase | | 58.7 in. (1,490 mm) |
| Road clearance | | 6.3 in. (160 mm) |
| Dry weight | | 506 lb. (230 kg) |
| Fuel tank capacity | | 4.7 U.S. gal. (18 ltr.) |
| Oil tank capacity | | 0.95 U.S. qt. (0.9 ltr.) |
| **Performance** | | |
| SS¼ mile | | 12.0 sec. |
| Climbing ability | | 30° |
| Fuel consumption | | 40 mil./gal. @70 mph (17 km/ℓ @113 kph) |
| Braking distance | | 36 ft. @31 mph (11 M @50 kph) |
| Minimum turning radius | | 98.5 in. (2,500 mm) |
| **Engine** | | |
| Type | | DOHC 4 cylinder, transverse in-line<br>4 stroke, air-cooled |
| Bore and stroke | | 2.6 x 2.6 in. (66 x 66 mm) |
| Displacement | | 55.1 cu.in. (903 cc) |
| Compression ratio | | 8.5:1 |
| Maximum horsepower | | 82 HP @8,500 rpm |
| Maximum torque | | 54.3 ft-lb @7,000 rpm (7.5 kg-M @7,000 rpm) |
| Valve timing: | Clearance | 0,05 ~ 0,1 |
| Inlet | — Open | 30° B.T.D.C. |
| | Close | 70° A.B.D.C. |
| Exhaust | — Open | 70° B.B.D.C. |
| | Close | 30° A.T.D.C. |
| Carburetor | | VM 28SC |
| Lubrication system | | Forced lubrication |
| Engine oil | | SE class SAE 10W-40 |
| Engine oil capacity: | Less filter | 3.5 U.S. qt. (3.3 ltr.) |
| | Total incl. filter | 4.2 U.S. qt. (4.0 ltr.) |
| Starting sytem | | Electric & kick |
| Ignition system | | Battery & coil |
| Firing order | | 1–2–4–3 |
| Ignition timing | | From 5° BTDC @1 500 rpm to 40° BTDC @3,000 rpm |
| Spark plugs | | NGK B-8ES |
| **Transmission** | | |
| Type | | 5-speed, constant-mesh, return-shift |
| Clutch | | Wet, multi-disc. |

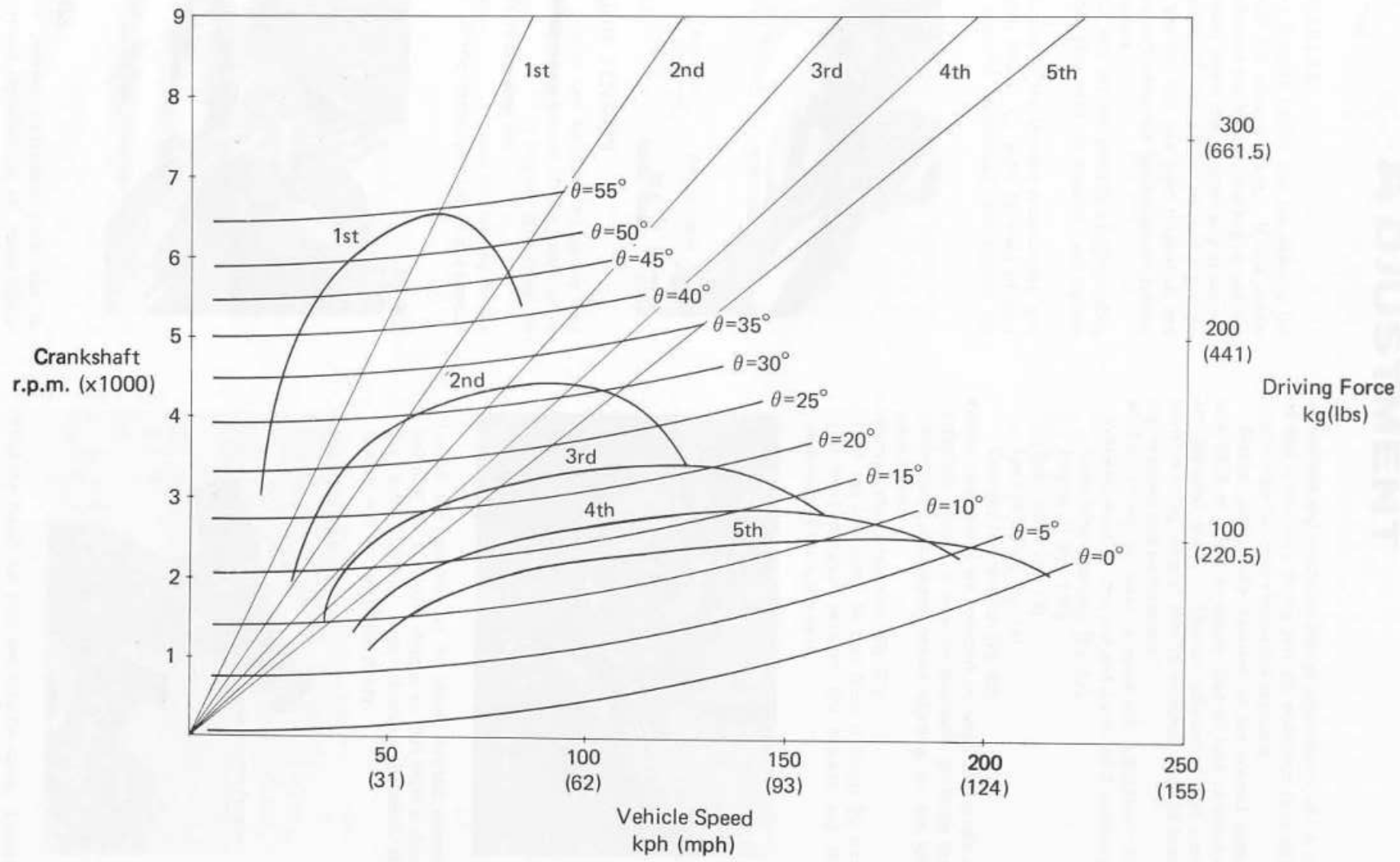
| | |
|---|---|
| Gear ratio: | |
| 1st | 3.17 (38/12) |
| 2nd | 2.19 (35/16) |
| 3rd | 1.67 (35/21) |
| 4th | 1.38 (29/21) |
| 5th | 1.22 (28/23) |
| Primary reduction ratio | 1.73 (97/56) |
| Final reduction ratio | 2.33 (35/15) |
| Overall drive ratio | 4.92 (5th) |
| **Electrical Equipment** | |
| Generator | Kokusan AR3701 |
| Regulator | Kokusan RS21 |
| Ignition coil | Kokusan IG3303, IG3304 |
| Battery | Yuasa 12N 14-3A 12V 14AH |
| Starter | Kokusan SM-226-K |
| Head lamp type U.S. | Sealed beam |
| European | Semi-sealed |
| Head lamp | 12V 50W/35W |
| Tail/Brake lamp | 12V 4/32 cp 8/23W |
| Speedometer lamp | 12V 3.4W x 2 |
| Tachometer lamp | 12V 3.4W x 2 |
| Neutral indicator lamp | 12V 3.4W |
| High beam indicator lamp | 12V 3.4W |
| Turn signal lamps | 12V 23W x 4 |
| Turn signal indicator lamp | 12V 3.4W |
| Oil pressure indicator lamp | 12V 3.4W |
| City lamp | 12V 4W |
| Horn | 12V 2.5A max. |
| **Frame** | |
| Type | Tubular, double-cradle |
| Steering angle | 41° to either side |
| Castor | 64° |
| Trail | 3.54 in. (90 mm) |
| Tire Size Front | 3.25-19 4PR |
| Rear | 4.00-18 4PR |
| Suspension Front | Telescopic fork |
| Rear | Swing arm |
| Suspension stroke Front | 5.51 in. (140 mm) |
| Rear | 3.15 in. (80 mm) |
| Front fork oil capacity (each fork) | 5.7 oz. (U.S.) (169 cc) |
| Front fork oil type | SAE 10W, non-detergent |
| Brakes: Front | Disc brake |
| Rear | Internal expansion, leading-trailing |
| Rear brake drum inside dia. | 7.9 x 1.4 in. (200 x 35 mm) |
| Disc diameter | 11.65 in. (296 mm) |

Specifications subject to change without notice.

## ENGINE PERFORMANCE CURVES



## RUNNING PERFORMANCE CURVES





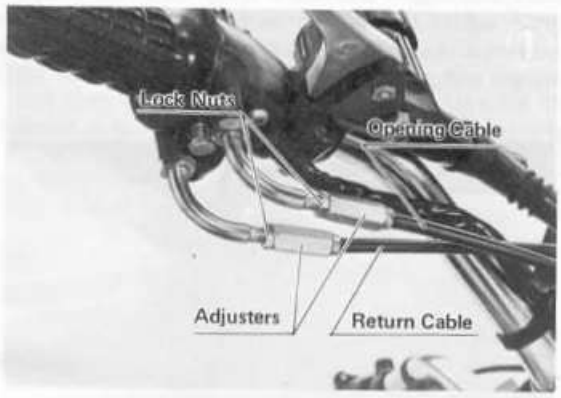
# ADJUSTMENT

## THROTTLE CABLES

There are two throttle cables, one for opening the throttles and one for closing them. If the cables stretch or are adjusted too loosely, the engine will not respond immediately when the throttle grip is turned. On the other hand, if the cables are too tight the throttle will be too sensitive and hard to control, and engine speed may vary when the handlebars are turned.

**Adjustment Procedure:**

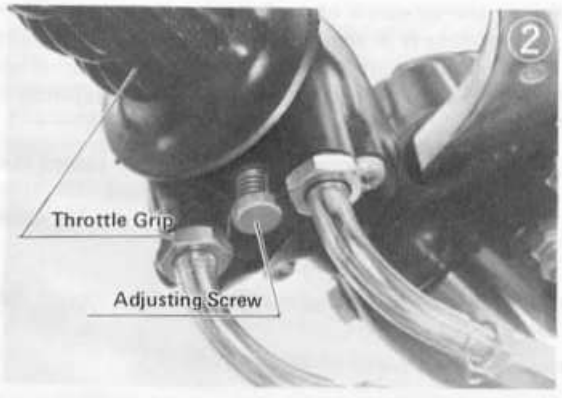
- Loosen the lock nut on the throttle opening cable, take up all cable play with the adjuster, and tighten the lock nut.
- Loosen the lock nut on the throttle return cable, give the throttle grip about $^{1}/_{16}$ inch (2 mm) of play (according to personal preference), and tighten the lock nut.




## THROTTLE GRIP TENSION

Throttle grip tension can be increased during long rides to take throttle return tension off the rider's wrist. It is also convenient for holding engine r.p.m. steady to check timing, battery charging, etc.

- Throttle grip tension is increased by turning in the adjusting screw on the underside of the right handlebar assembly.

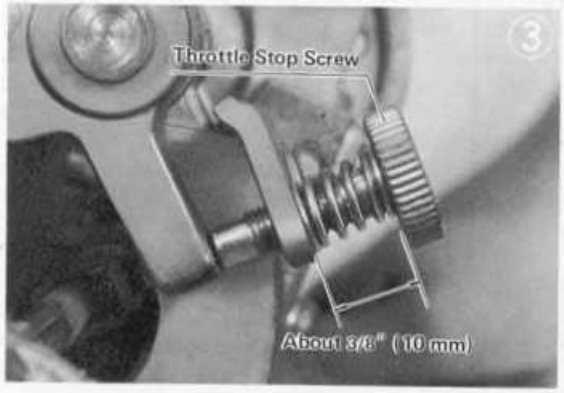



## CARBURETORS

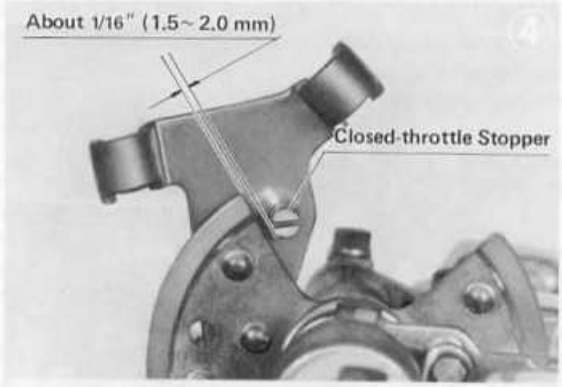
Although some internal carburetor parts can be adjusted by replacement, repositioning, etc., these adjustments are covered in the Maintenance section of this manual. The following procedure covers only the idle adjustment and associated linkage adjustments, which are all that is necessary during periodic maintenance or after a carburetor has been removed or replaced.

Besides setting idle rotation at the correct speed, care must be taken to ensure that all four carburetors are adjusted evenly. Uneven adjustment will cause unstable idling, sluggish throttle response, and will lower engine power and performance.

- Before trying to make a good idle adjustment the following must be checked and corrected if necessary.
  - Valve lifter clearance (Pg. 15)
  - Engine oil (Pg. 140)
  - Spark plugs (Pg. 14)
  - Ignition timing (Pg. 14)
  - Cylinder compression (Pg. 82)
- When carburetors are replaced, or when engine idle is especially rough, it may be necessary to make this preliminary adjustment before starting on the idle adjustment:
  - Remove the carburetors. (Pg. 27)
  - Turn the idle screw so that there is about $^{3}/_{8}$ inch (10 mm) distance between the bracket and the underside of the screw head.

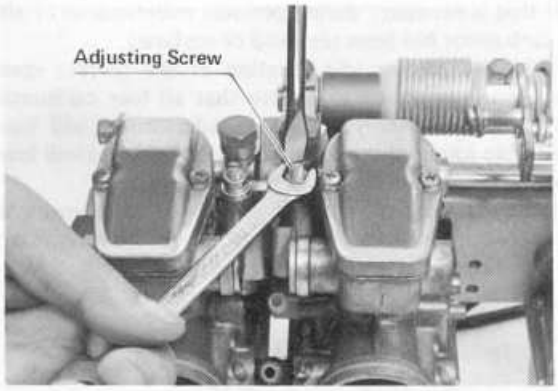



  - Loosen the lock nut on the closed-throttle stopper, and turn the eccentric stopper so that there is about $^{1}/_{16}$ inch (1.5~2.0 mm) clearance between the stopper and the top of the pulley.

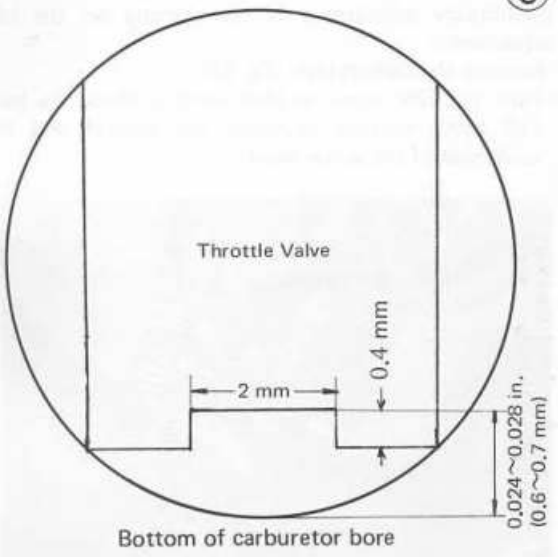



  - Find the notch cut into the throttle valve. Loosen the lock nut and turn the adjusting screw so that there is .024~.028 inch (.6~.7 mm) clearance

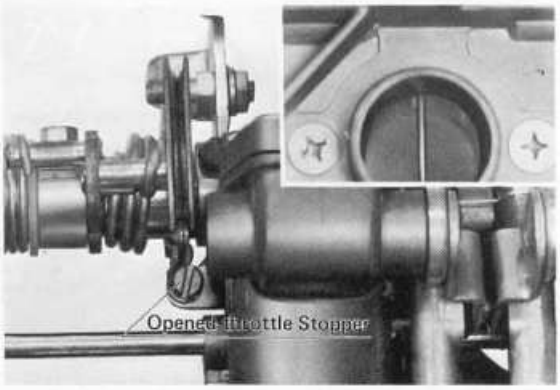
between the notch and the bottom of the carburetor throat. **This is a very fine adjustment, so make it carefully for each of the four carburetors.** Then tighten the lock nuts.



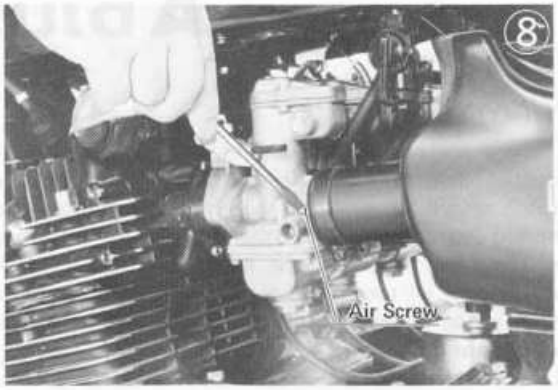

**Throttle Valve Clearance** ⑥




○Open the throttle (turn the pulley) so that the bottom edge of the lowest of the four carburetor throttle valves is even with the top of the carburetor throat. Turn the open-throttle stopper screw so the pulley is stopped at that point.




○Turn in the air screw of each carburetor fully – but not tightly – and then back it out 1½ turns.




○Mount the carburetors onto the engine, and adjust throttle grip (cable) play. (Pg. 11)

●Start the engine and warm it up for 5 minutes, and then adjust engine idle with the main idle adjust screw so that idle r.p.m. is about 800~1,000 r.p.m. by the tachometer.




●Adjust the air screw of each carburetor, one at a time, first turning it in one direction and then in the other until the point of highest idle is determined. If idle r.p.m. rises too much during air screw adjustment, lower it with the main idle adjust screw.

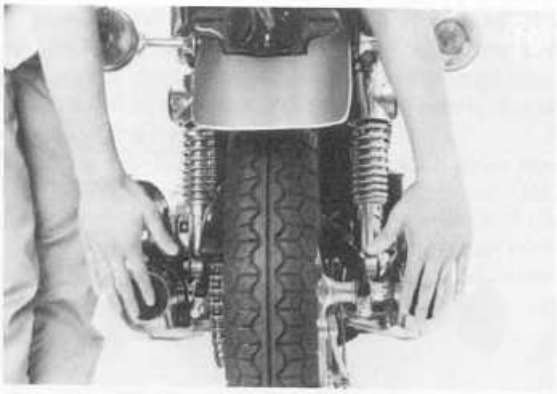
**NOTE:** If any carburetor air screw can be turned in to less than ½ turn from full in, without idle speed changing, there is probably trouble within that carburetor.

●From the point of highest idle speed, turn all four air screws in a small, equal amount.

●Re-adjust idle speed to 800~1,000 r.p.m.

●Use vacuum gauges as explained in the following steps to make fine adjustment of carburetor balance. If a vacuum gauge set is not available, perform only the following steps preceded by circles. If vacuum gauges are available, skip to the next step marked with a black dot.

○Listen to the exhaust noise, and place your hands behind the mufflers to feel exhaust pressure.



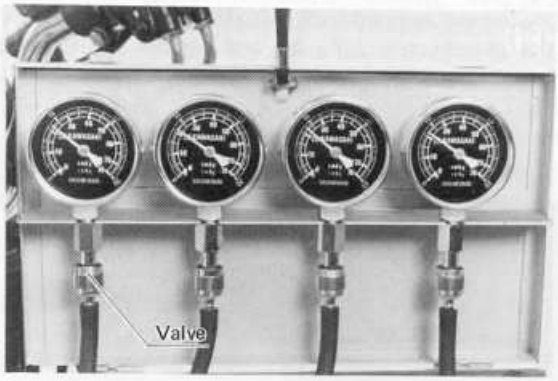
○If there is a variation in noise or exhaust pressure among the cylinders, re-adjust the individual throttle stop screws to make combustion uniform. Use a special purpose tool to loosen the lock nut and turn the screw. Backing the screw out increases pressure and turning it in decreases it, but try to keep the idle speed as low as possible. Tighten the lock nut after adjustment.




○For any carburetors that were re-adjusted, re-adjust the air screw as explained in a previous step.
○Adjust idle speed to 800~1,000 with the main idle adjust screw.
●Remove the rubber caps from the vacuum gauge attachments on the cylinder head, and attach the vacuum gauges.




●With the engine running at idle speed, close down the vacuum gauge intake valve until the gauge needle flutters less than 2 cm Hg (.8 in. Hg).




●Normal vacuum gauge reading is 20~23 cm Hg (8~9 in. Hg). If any gauge reads less than 15 cm Hg (6 in. Hg), recheck the points listed in the first step of these carburetor adjustments, and check that the carburetor hose clamps and spark plugs are tight.
●If there is a variation in vacuum readings among the different cylinders, re-adjust the individual throttle stop screws to make combustion uniform. Using a special purpose tool to loosen the lock nut and turn the screw, set all the carburetors to within 2 cm Hg (.8 in. Hg) of each other. Backing the screw out decreases vacuum and turning it in increases it, but try to keep the idle speed as low as possible. Tighten the lock nuts after adjustment.
●Open the throttle grip and let it snap shut a few times. Make sure the vacuum readings stay the same after this is done, making further adjustment if necessary.
●Detach the vacuum gauge and replace the rubber caps on the vacuum fittings.
●For any carburetors re-adjusted, re-adjust the air screw as explained in a previous step.
●Adjust idle speed to 800~1,000 r.p.m. with the main idle adjusting screw.

## CLUTCH

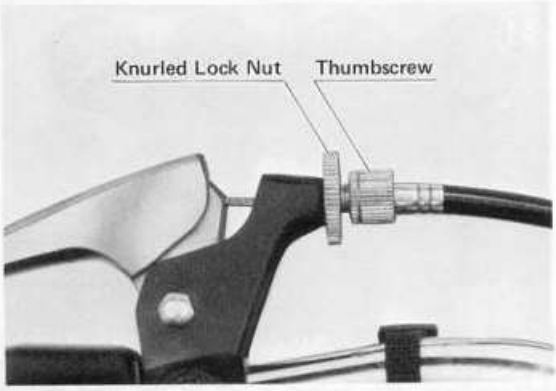
Stretching of the clutch cable causes the clutch lever to develop excessive play. Too much play will prevent the lever from fully disengaging the clutch, and will result in shifting difficulty and possible clutch or transmission damage. Most of the play must be adjusted out, but a small amount has to be left to ensure that the clutch will engage fully without slipping.

Besides cable stretch, clutch plate wear also causes the clutch to go out of adjustment, with a decrease in push rod play. Due to this wear, the push rod gradually moves closer to the clutch release lever (at the lower end of the clutch cable) until it touches the adjusting screw. When the rod is touching the screw and therefore has no play, the clutch will not engage fully and clutch slippage will occur. Note that the clutch push rod does not necessarily have play just because the clutch hand lever has play, and so hand lever play alone cannot be used to determine whether or not the clutch requires adjustment.

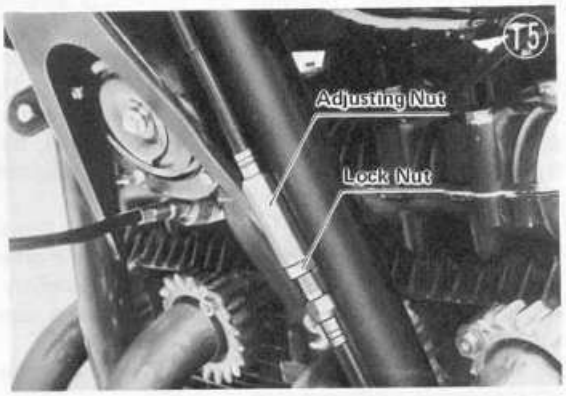
The adjustment procedure below includes adjustment both for cable stretch and plate wear.

### Adjustment procedure:

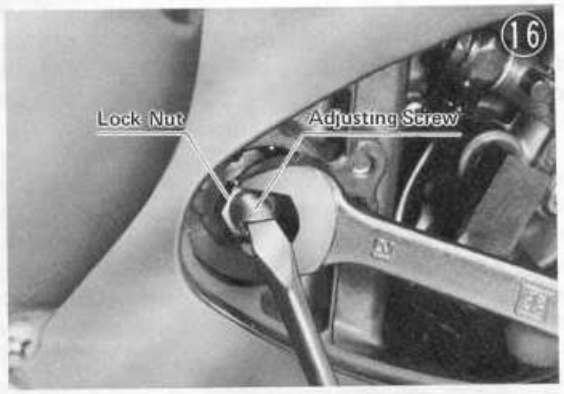
- Loosen the knurled lock nut at the clutch lever, screw the thumbscrew fully in, and tighten the lock nut.



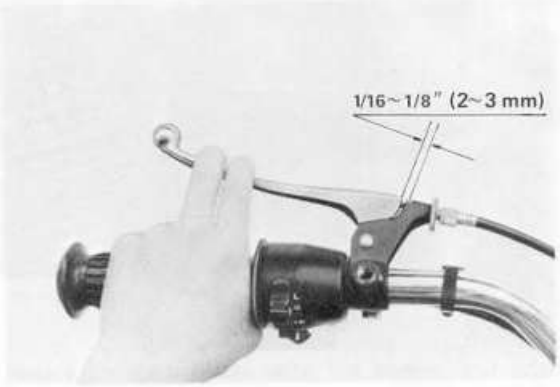

- Loosen the lock nut at the center of the clutch cable and screw in the adjusting nut to give the cable plenty of play.




- Remove the chain oil pump cover to get at the clutch adjusting screw.
- Loosen the lock nut and if the clutch adjusting screw does not turn loosely already, back it out until it does.
- Turn the clutch adjusting screw in to where it suddenly becomes hard to turn, back it out ½ turn from that point, and tighten the lock nut.




- Making sure that the ends of the clutch cable sleeve do not catch on the edge of the cable seat, now take up cable play with the adjuster at the cable center, until the clutch lever has $\frac{1}{16}$~$\frac{1}{8}$ inch (2~3 mm) play at the point indicated. Then tighten the lock nut.

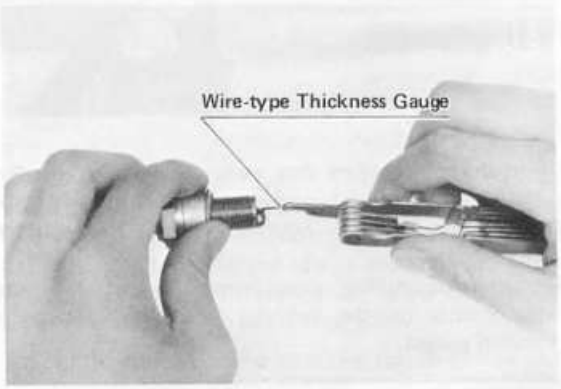



- If enough play could not be taken up with the adjuster in the center of the cable, make further adjustment with the thumbscrew at the clutch lever, and tighten the lock nut.
- Replace the chain oil pump cover.

## SPARK PLUG GAP

Spark plug electrode wear will widen the gap and cause missing and difficulty in starting. Too narrow a gap as a result of maladjustment will also result in poor performance since the small gap will produce only a weak spark.

- Clean the electrodes off and measure the gap with a wire-type thickness gauge. It should be .028~.031 inch (.7~.8 mm); if it is not, bend the outer electrode with a spark plug gap adjusting tool.



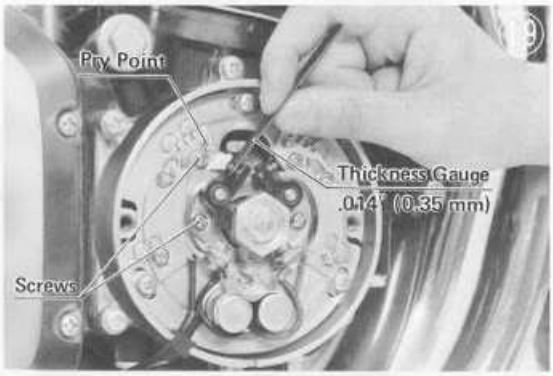

## IGNITION TIMING

Incorrect ignition timing can cause poor performance, knocking, and overheating. Periodic adjustment will be necessary to compensate for wear of parts, and must also be checked any time ignition-related parts are disassembled or replaced.

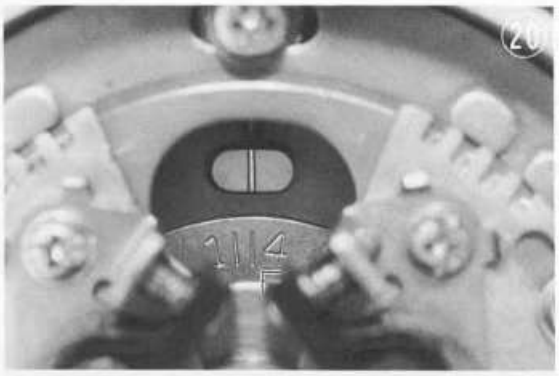
The Z1 has two sets of contact breaker points, the left set fires spark plugs 1 and 4 simultaneously, and the right set fires plugs 2 and 3 180° later. The gap for each set of points must be adjusted separately.

There are also two sets of double timing marks, which can be viewed through the inspection window by turning the crankshaft. One set is marked "1 4" and the other set 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.

- Turn the crankshaft so that the contact breaker points are at their widest opening. If the gap is not .012~.016 inch (.3~.4 mm), loosen the screws and use a screwdriver in the pry points to set the gap to .014 inch (.35 mm). Tighten the screws after adjustment.



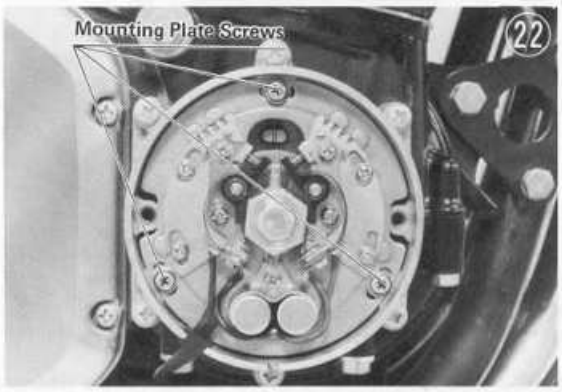

- Repeat the step above for the other set of points.
- Turn the crankshaft so that the **F** mark on the timing advancer is aligned with the timing mark seen above the advancer.




- Connect an ohmmeter 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 positively connected.




- Loosening its mounting screws, 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 three mounting plate screws and turn the plate to provide more room for adjustment.




- Repeat the last four steps using the other **F** mark.
- Disconnect the ohmmeter, and verify correct timing adjustment using a strobe light. At idle speed the timing mark and the **F** mark should coincide. By about 2,900~3,100 r.p.m., the timing advancer changes timing enough so that above this speed, the timing mark and the pin on the timing advancer should be aligned.




## VALVE LIFTER CLEARANCE

Wear of the valve and valve seat causes a decrease in valve lifter clearance. Besides upsetting valve timing, failure to adjust the clearance will eventually cause the valves to remain partly open, lowering performance and inviting engine damage.

Valve lifter clearances should be checked and adjusted as necessary at least every 4,000 miles (6,000 km), or any time repair or replacement of parts is done in the camshaft or valve areas. Do not adjust the clearance to a larger value than specified; too large a clearance will cause valve lifter noise and retard valve timing.

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

- Remove the fuel tank (Pg. 27).

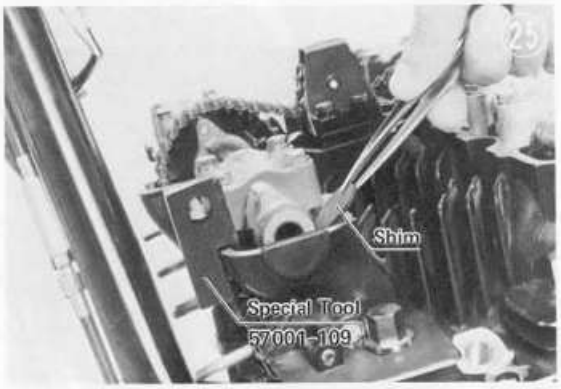
- Remove the valve cover, and checking one valve at a time, turn the crankshaft so that the cam lobe (highest part of the cam) is pointing directly away from the valve lifter.
- Measure the clearance between the cam, and the shim in the top of the valve lifter. The correct clearance is .002~.004 inch (.05~.10 mm).




- If the clearance is too small or if there is no clearance at all, use a special purpose tool to push down the valve lifter, and then remove the shim.

To use the tool:

- Turn the crankshaft so that the cam is pushing the lifter down.
- Fit the tool in place.

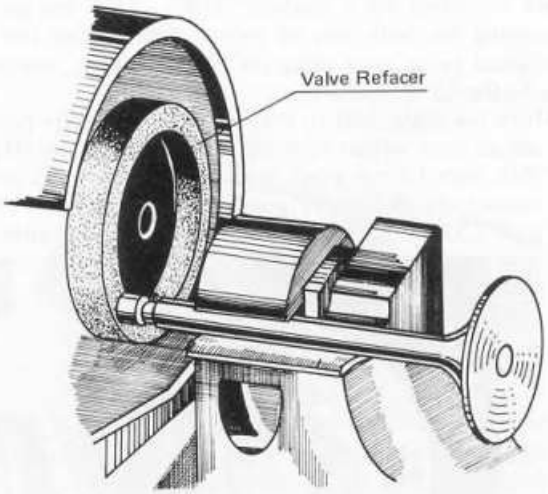



- Turn the crankshaft so that the cam points away from the lifter, and remove the shim. There is a notch in the lifter so that the shim can be grasped.

**CAUTION: If the camshafts are unbolted instead of using a special tool to remove the shims, see information on valve timing and camshaft installation before tightening the shafts back into place.**

- Insert a new shim to bring valve lifter clearance within the specified limits. Shims are available in sizes from 2.00 to 3.00 mm, in increments of .05 mm.
- When the valve seat is worn so much that not even the smallest shim will sufficiently increase clearance, remove the valve and grind down the stem slightly. Hold the valve in a V block to keep it at right angles to the side of the grinder.

**Valve Stem Grinding** (26)




## CAMSHAFT CHAIN

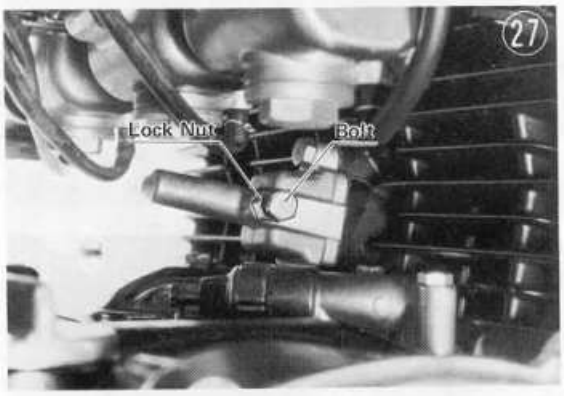
Chain and guide roller wear causes the chain to develop slack, and it should be re-tensioned periodically so that it does not come loose or break.

The cam chain should be adjusted at intervals of under 1,000 miles (1,500 km), at least often enough to keep it from making noise. The chain cannot be adjusted too often, and it cannot be maladjusted.

When the slack adjustment fails to stop the chain from making noise, the chain guide rollers are probably worn out and need to be replaced.

### To adjust the cam chain:

- Loosen the lock nut and bolt. (With the bolt loose, a spring inside takes up slack automatically.)
- Turn the engine over a couple of times so that slack is taken up evenly on all parts of the chain.
- Tighten the bolt and then its lock nut.

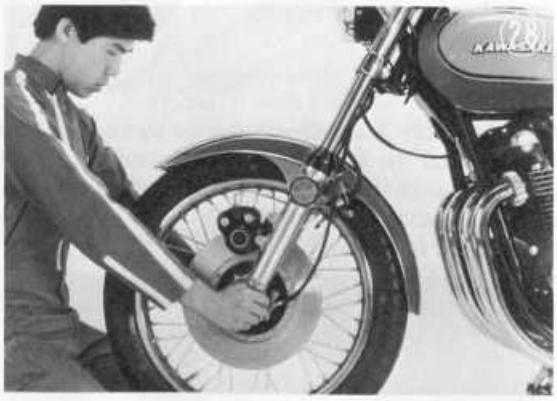



## STEERING PLAY

For safety, the steering should always be kept adjusted so that the handlebars will turn freely, but do not have excessive play.

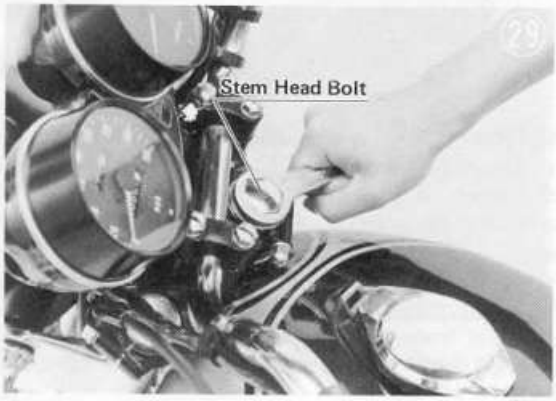
If the steering is too tight it will be hard to turn the handlebars quickly, the motorcycle may pull to one side, and the steering stem bearings may become damaged. If the steering is too loose the handlebars will vibrate, the motorcycle will be unstable, and it will be hard to steer in a straight line.

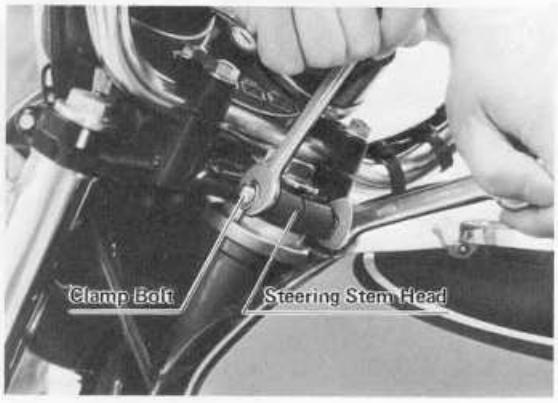
To check the steering adjustment, first place a stand or block under the engine so that the front wheel is raised off the ground. Push the handlebars lightly to either side; if they will continue moving under their own momentum, the steering is not too tight. Squatting in front of the motorcycle, grasp the lower ends of the front fork at the axle, and shake it back and forth; if no play is felt, the steering is not too loose.



### To adjust the steering:

- Loosen the steering stem head bolt and the one clamp bolt.




- Using a hook spanner, turn the steering stem lock nut down to tighten the steering, or up to loosen it.




- Tighten down the head bolt and clamp bolt.

- Loosen the two lower clamp bolts on the fork tubes to let the tubes reseat themselves, and tighten the bolts.




- Check that the three upper clamp bolts are tightened with 12~13 ft-lbs (1.6~1.8 kg-M) torque, and that the two lower bolts are tightened with 40~43 ft-lbs (5.4~6.0 kg-M) torque.

## 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 as follows:

- Make sure all spokes are tightened evenly.

- Raise the wheel off the ground and see that it will spin easily with no brake drag. In the case of the rear wheel, take the chain off the sprocket.

- Spin the wheel lightly several times and see if it stops of its own accord in various positions, indicating that it is correctly balanced.

●If one side of the wheel always stops at the bottom, attach a balance weight loosely to a spoke opposite that side.




●Repeat the previous two steps as many times as is necessary to correctly balance the wheel, and then clamp the weights on firmly using pliers.

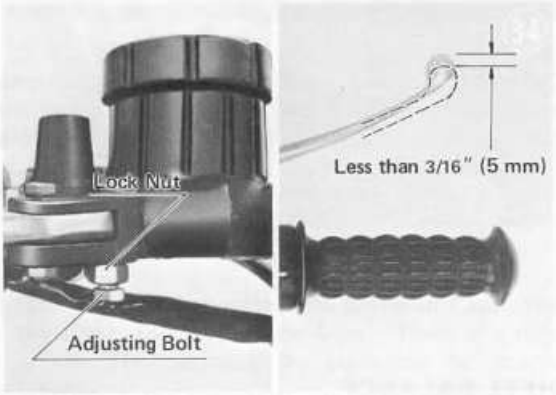
Balance weights are available from Kawasaki Dealers in 10, 20 and 30 gram ($\frac{1}{3}$, $\frac{2}{3}$ and 1 ounce) sizes. An imbalance of less than 10 grams will not usually affect running stability.

## FRONT BRAKE LEVER

The front brake itself is adjusted automatically during use, and if it needs additional adjustment, parts are probably excessively worn or defective.

Play in the brake lever can be adjusted out to keep the lever from vibrating, but a small amount of play must be left in to ensure a full braking stroke.

To adjust lever play, loosen the lock nut, turn the adjusting bolt **a fraction of a turn** so that the lever has less than $\frac{3}{16}$ inch (5 mm) play, and tighten the lock nut.

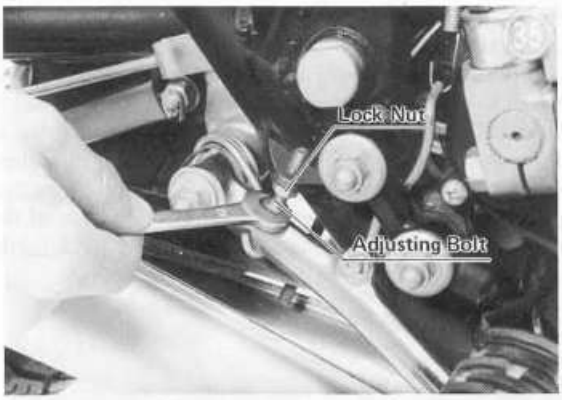



## REAR BRAKE

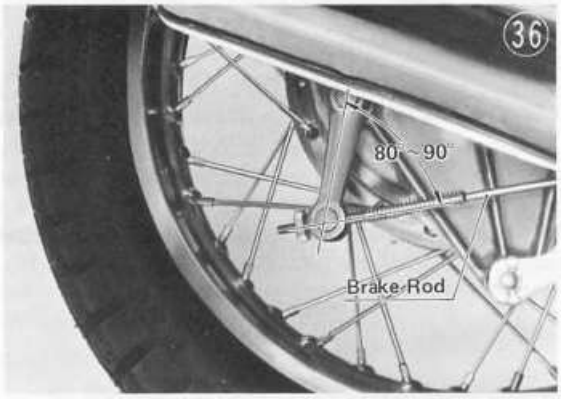
Brake lining and drum wear causes the rear brake to go out of adjustment, increasing pedal play and decreasing braking effectiveness. Rear brake adjustment to compensate for this actually consists of three separate adjustments: brake pedal position, cam lever angle, and brake pedal travel.

### Adjustment procedure:

●Check that the top of the brake pedal in its rest position is slightly (about $\frac{1}{16}$" or 2 mm) lower than the right front foot rest. To adjust pedal position, loosen the lock nut, turn the adjusting bolt, and tighten the lock nut.

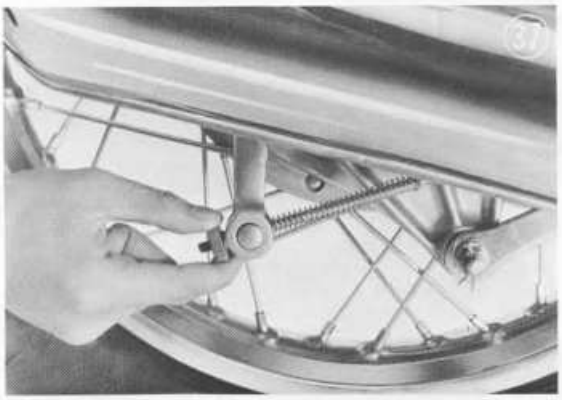


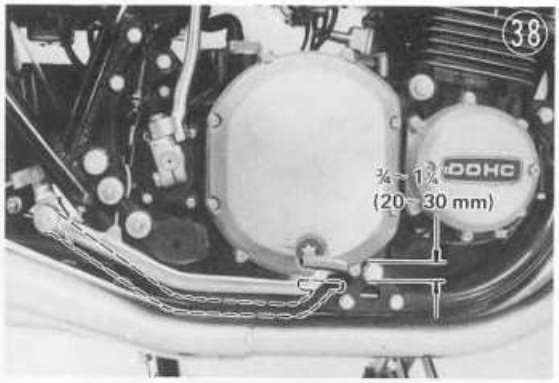

●Push the brake pedal down lightly by hand. When fully applied the brake cam lever should come to an 80°~90° angle with the brake rod; if it does not, remove the cam lever and mount it at a new position on the shaft to correct the angle.




**CAUTION: Before remounting the cam lever, check brake lining, drum, and brake cam wear (see pg. 108, 109). Worn parts could cause the brake to lock or fail, and must be replaced before making further brake adjustment.**

●Screw in the nut on the end of the brake rod so that the brake pedal has about ¾~1¼ inch (20~30 mm) of travel from the rest position to the fully applied position when the pedal is pushed down lightly by hand.






- Spin the rear wheel and check that the brake shoes are not dragging on the drum. If there is excessive drag (the wheel will not spin freely), disassemble and inspect the internal brake parts.
- Stand the motorcycle on both tires (use the side stand). Re-check the brake, making fine adjustment if necessary.
- Check the brake lamp switch adjustment.

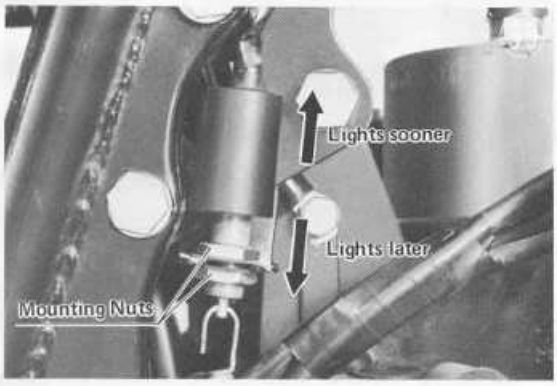
## BRAKE LAMP SWITCH

A hydraulic pressure switch turns on the brake lamp when the front brake is applied, and so adjustment of this switch is neither necessary nor possible.

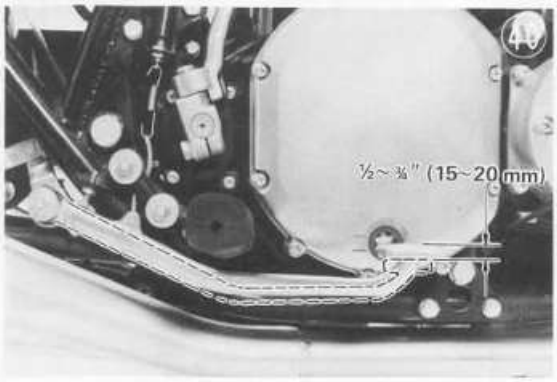
The rear brake switch, however, may require periodic adjustment as the activating spring stretches, or if the spring or brake pedal gets bent.

### Adjustment procedure:

- Loosen the two switch mounting nuts.




- Move the switch up or down so that the brake lamp will light after ½~¾ inch (15~20 mm) of brake pedal movement.




- Tighten the two mounting nuts at that switch position.

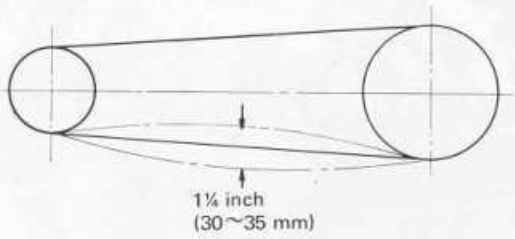
**CAUTION: Do not turn the switch body during adjustment to avoid damage to the electrical wiring.**

## DRIVE CHAIN

Chain and sprocket wear causes the chain to become loose and results in a power loss, increased wear, noise, and the chain could slip off the sprockets and/or snap. Adjusting the chain too tightly will also cause excessive wear and possible chain breakage.

With the motorcycle resting on the center stand, the chain should have about 1¼ inch (30~35 mm) slack measured midway between the sprockets. Spin the rear wheel around to find the place where the chain is tightest (because it wears unevenly), and if there is less than 1 inch (25 mm) or more than 1½ inch (40 mm) of slack, the chain should be re-adjusted.

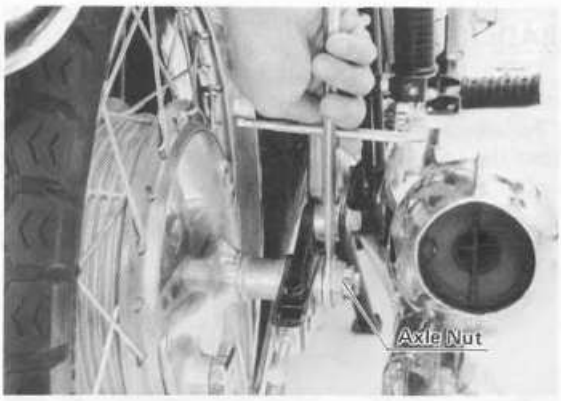
**Chain Slack** (41)



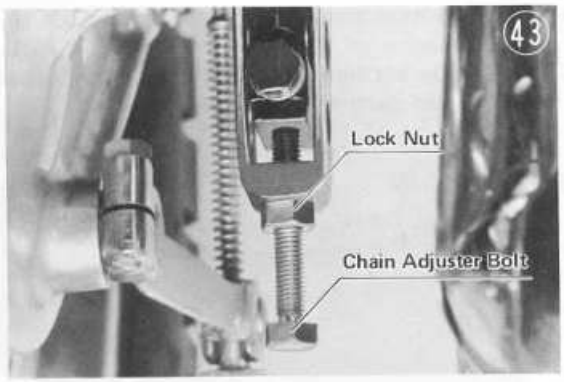

**CAUTION: If the chain is worn past the service limit, replace it; don't try adjusting it.** (See pg. 100)

### Adjustment procedure:

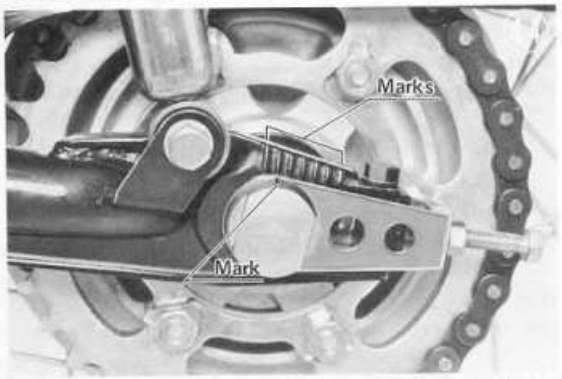
- Loosen the nut at the rear end of the torque link, and loose the right muffler mountings.
- Remove the cotter pin and loosen the axle nut.




- Loosen the lock nuts on the right and left chain adjusters. If the chain is too tight, first back out the chain adjuster bolts and kick the wheel forward until the chain is too loose.




•Now turn in the adjuster bolts, right and left sides evenly, until the chain has the correct amount of slack. To keep the chain and wheel aligned, the notch in the left chain adjuster must come to the same swing arm mark that the right hand chain adjuster notch comes to.

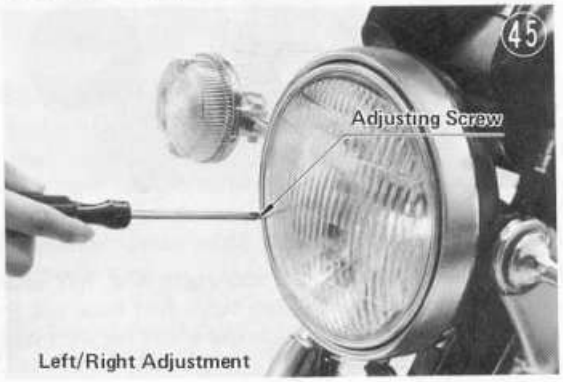



•Tighten both adjuster lock nuts and the axle nut, and spin the wheel and check adjustment, re-doing it if necessary.
•Tighten the axle nut with 95~115 ft-lbs (13~16 kg-M) torque, and insert a new cotter pin.
•Tighten the muffler mountings.
•Tighten the torque link nut with 22~25 ft-lbs (3~3.5 kg-M) torque.
•Check rear brake and brake lamp switch adjustments.

## HEADLIGHT

The headlight beam is adjustable in both the horizontal and vertical directions.

To adjust the horizontal aim of the beam, i.e. to adjust the beam right or left, turn the small screw in the front of the headlight rim.




Vertical beam adjustment is as follows:
•Remove the two screws from the lower side of the headlight housing, and drop out the headlight unit.




•Loosen the turn signal mounting nuts.
•Hold the headlight unit in place, loosen the mounting bolt underneath the headlight, move the headlight up and down to where the vertical aim is correct, and tighten the bolt to hold it there.

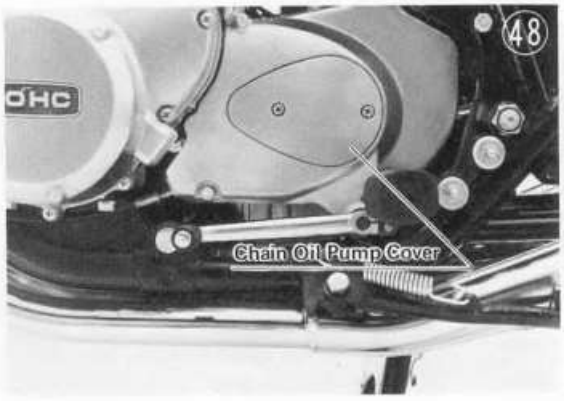


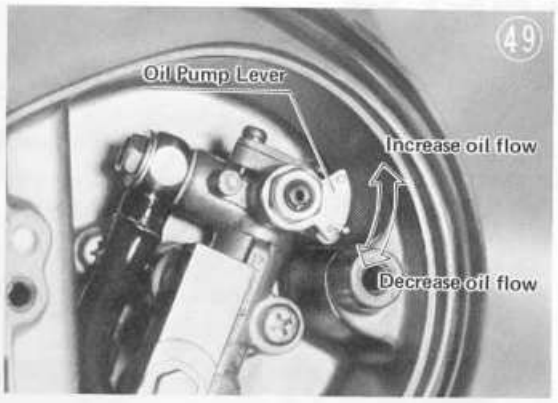

•Tighten the turn signal mountings and remount the headlight unit.

## CHAIN OIL PUMP

Since the drive chain will wear very quickly if it is allowed to dry out, keep the oil pump adjusted so that the chain is wet but not dripping.

If the pump requires adjustment, remove the cover and turn the lever to a different notch. "O" supplies the least oil, and notch "5" is for maximum pump output.



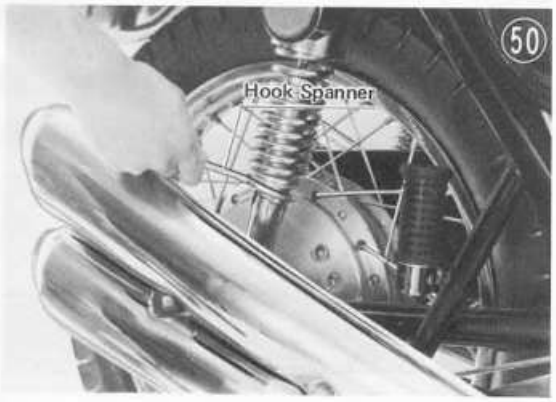



**NOTE:** Regardless of oil pump adjustment, the drive chain should still be hand oiled at least every 200 miles (300 km). Oil with SAE 90 weight oil between the end plates of the links, and at the sides of each roller. (See pg. 101.)

## SHOCK ABSORBERS

The rear shock absorbers can be adjusted to one of 5 positions to suit riding conditions. They can be left soft for average riding, but should be adjusted slightly harder for high speed riding or for riding on bad roads.

Adjustment is made by turning the adjusting sleeve with a hook spanner. Be sure to turn both left and right shock absorbers to the same position in order to maintain stability.



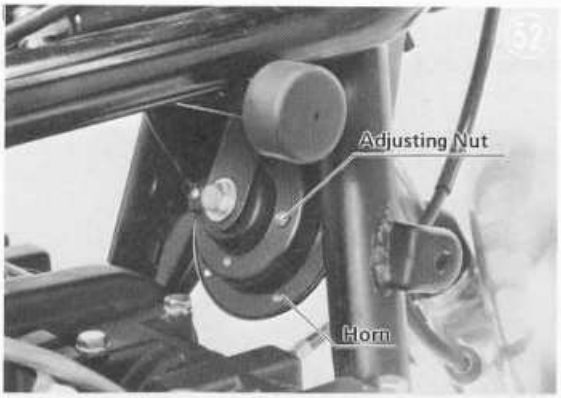

## HORN

The horn may need to be re-adjusted as the contacts inside wear down over a long period. Turning the adjusting nut to the right compensates for contact wear.

**CAUTION: Do not turn the adjusting nut too far in, as this will cause damage to the spring inside the horn, as well as increasing horn current and possibly burning out the horn coil.**

### Adjustment procedure:

- Remove the fuel tank to gain access to the horn wires.
- Disconnect the black horn wire, and connect an ammeter into the circuits, + ammeter lead to the black wire on the horn side, and - meter lead to the other black wire.
- Turn the ignition key on and keep the horn button pushed while turning the horn adjusting nut. Adjust for the best horn sound while keeping the horn current between 1.8 and 2.5 amperes

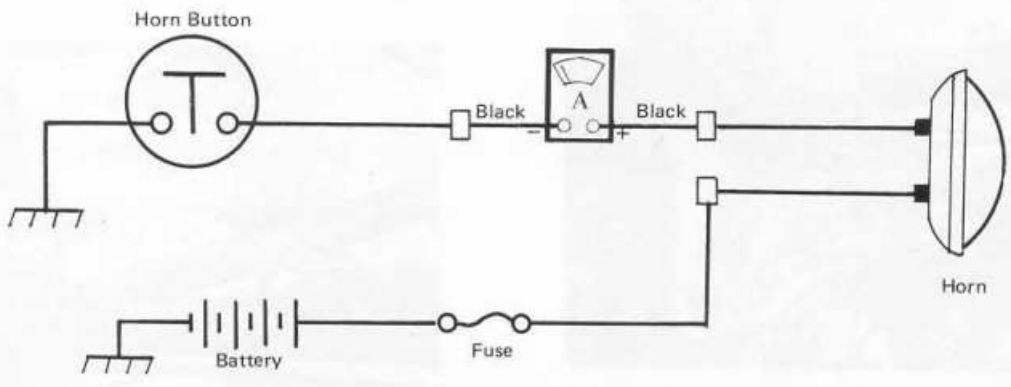



**NOTE:** The horn will not sound properly if it is mounted incorrectly or if any cables or other parts are touching it.

- If the horn cannot be adjusted properly, open it and clean and burnish the contacts first.

**NOTE:** Do not disassemble the horn during the warranty period, as this will invalidate horn warranty.

**Horn Current Measurement**



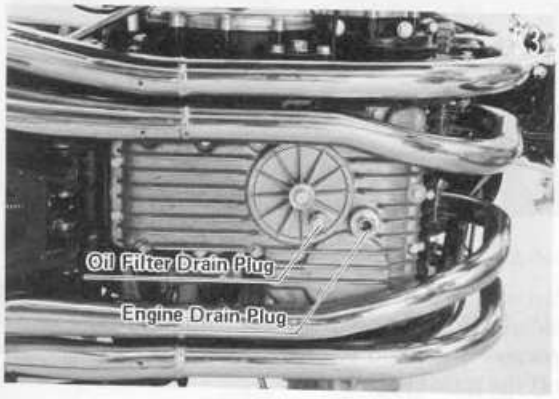


# DISASSEMBLY

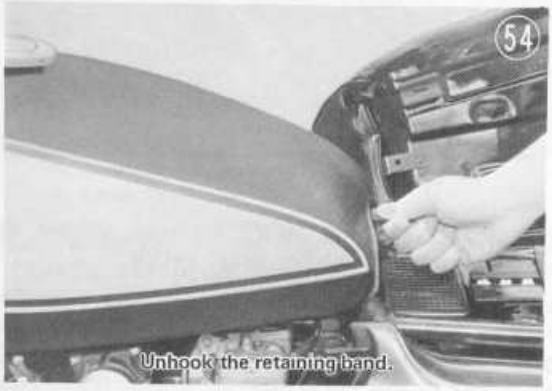
## ENGINE

### Removal:

•Remove the engine and oil filter drain plugs and drain the engine oil.



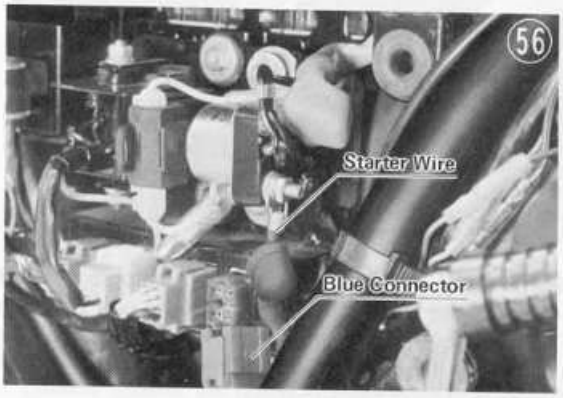

•Take off the motorcycle side covers. Turn the fuel tap to the **S** position, slide back the hose clamps and pull the two fuel hoses off the tap.
•Open the seat, unhooking it so that it will open completely and not scratch the fuel tank during tank removal.
•Unhook the rubber retaining band and pull the fuel tank off toward the rear.




•Disconnect the one black wire and one green wire that join the ignition coils to the contact breaker points.




•Take the wires off all the spark plugs.
•Unscrew the tachometer cable and pull it from the cylinder head.
•Unplug the blue connector from the electrical panel.
•Take the starter wire off the starter relay terminal.




•Remove the right front foot rest.
•Unbolt the negative (−) battery lead from its ground on the engine.




•Loosen all eight clamps and pull the carburetor assembly off to the rear.
•Loosen the nuts and unhook the two throttle cables from the pulley.

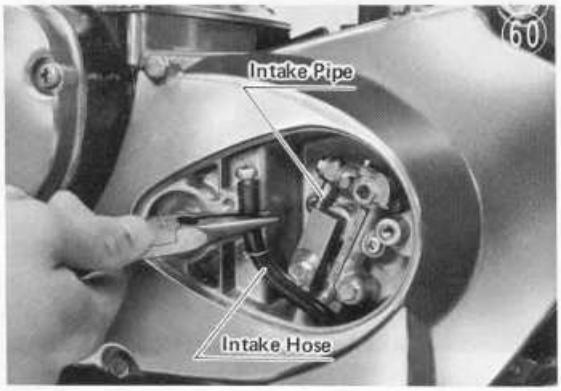



•Take the screen off the top of the air cleaner.

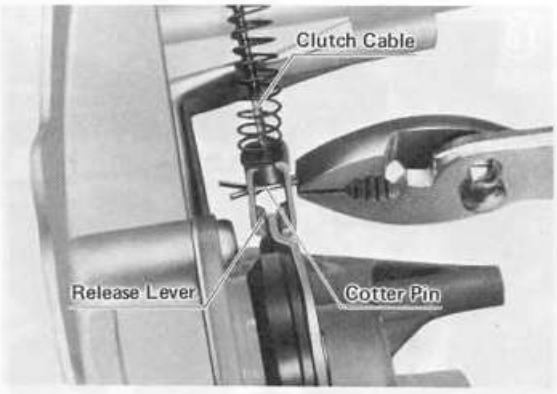
•Slide up the clamp to pull the hose off the oil breather, and remove the air cleaner assembly.




•Remove the nuts and pull each exhaust pipe collar off the cylinder head studs. Take out the rear mounting bolt and push the two mufflers on each side forward to remove them.
•Take off the left front foot rest.
•Remove the bolt completely and pull off the gear shift pedal.
•Take off the starter cover and gasket.
•Remove the chain oil pump cover, pull the inlet hose off the pump and plug the hose with a screw.

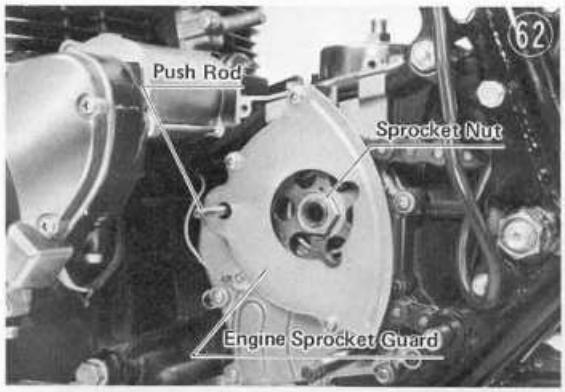



•Remove the chain cover, pull the cotter pin out of the clutch release lever, and unhook the clutch cable.

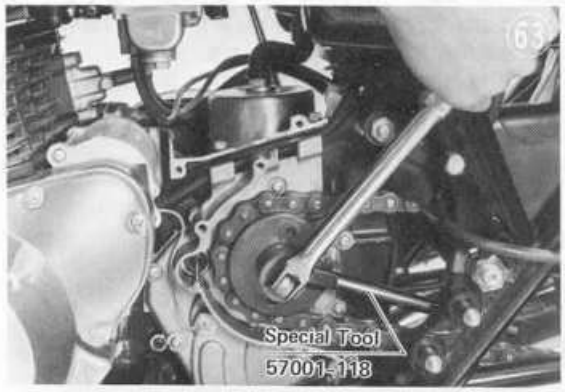



•Remove the engine sprocket guard.

•Take the clutch push rod out of the drive shaft.

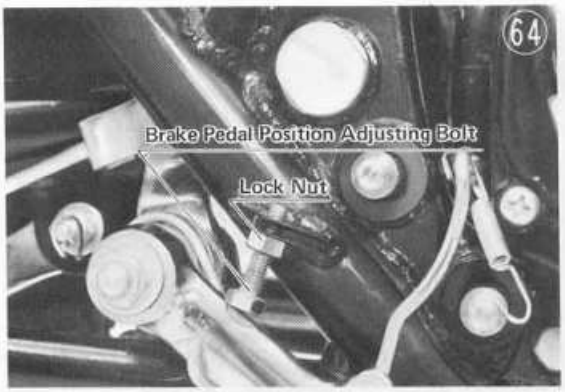



•Flatten the bent-up ear of the lock washer with a cold chisel. Hold the sprocket from turning using a special purpose tool, and remove the sprocket nut and take off the sprocket.

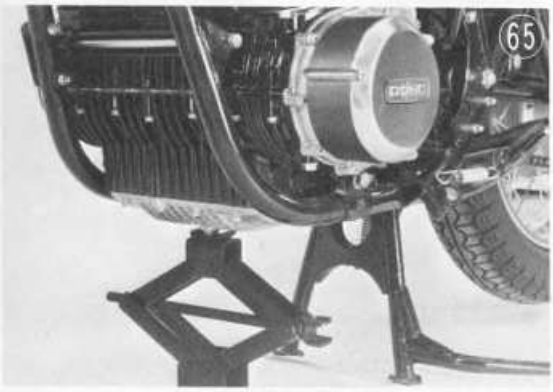



•With the brake lamp switch removed, unhook the spring from the brake lamp switch.

•Back the rear brake adjusting nut off to the end of the brake rod to give the pedal play. Loosen the lock nut and back out the brake pedal position adjusting bolt until the pedal is held down out of the way.

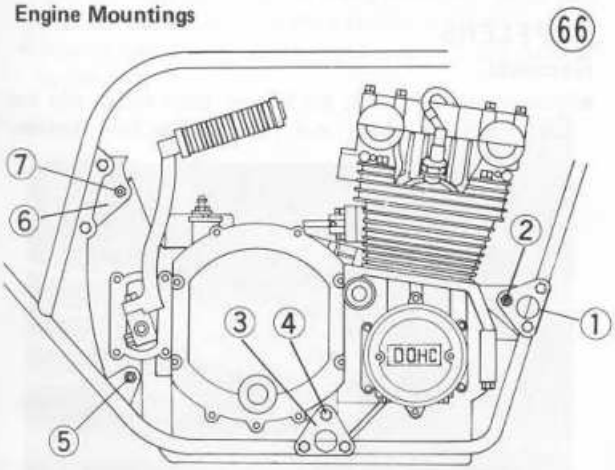


•Jack or lever the engine up to take the weight off the mounting bolts.



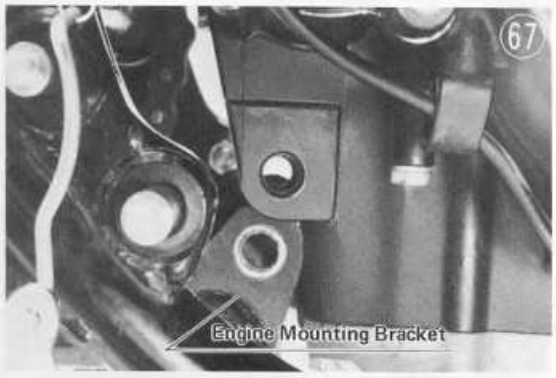

•Take the nuts off the three long engine mounting bolts.

**Engine Mountings**

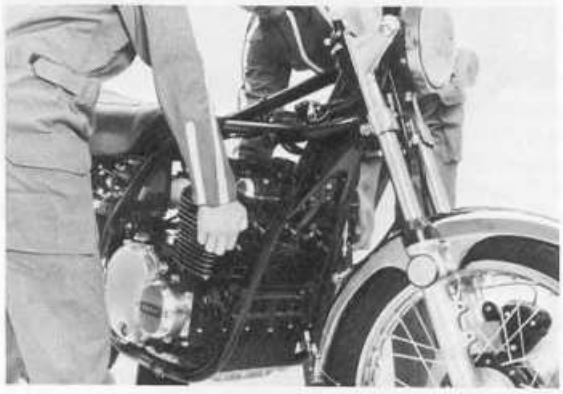



1. Front Bracket
2. Front Bolt
3. Lower Center Bracket
4. Lower Center Bolt
5. Rear Lower Bolt
6. Rear Upper Bracket
7. Rear Upper Bolt

•Completely remove the short engine mounting bolt from the lower center mounting on each side.
•Remove the right rear engine mounting bracket bolts.
•Remove the center and front right side mounting brackets.
•Remove the three long bolts.
•Level the engine and slowly lift it straight up about 1 inch (25 mm), then move it to the right slightly so the rear of the engine slips over the lower right rear mounting.




•Raise the front of the engine a little so that it will clear the frame, drop down the left side, and pull the engine out diagonally upward to the right.



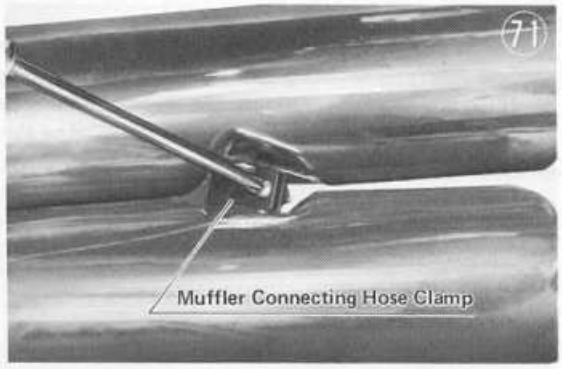
## Installation Notes:

1. Loosely mount the three engine mounting brackets before the engine bolts are inserted. After engine bolt insertion, first tighten the bracket mounting bolts, and then the engine mounting bolts. The three long engine mounting bolts are inserted from the left side of the motorcycle. Two spacers go on the rear upper bolt; a long one on the left side of the engine, and a short one on the right side.
2. Tighten the bracket mounting bolts with 14.5~16.5 ft-lbs (2.0~2.3 kg-M) torque.
3. Engine mounting bolt torque is 47~50 ft-lbs (6.5~7.0 kg-M) for the three long (12 mm) bolts, and 26~29 ft-lbs (3.5~4.0 kg-M) for the two short (10 mm) bolts.
4. Slip the chain over the engine sprocket first, and then mount the sprocket on the shaft.
   If the sprocket will not go on, loosen the rear wheel as for chain adjustment, and adjust the chain afterwards. (See Drive Chain Adjustment, page 19.) Sprocket nut tightening torque is 87~108 ft-lbs (12~15 kg-M).
5. When replacing the chain cover, use an oil seal guide to protect the rubber seal. Turn the rear wheel so that the pin in the output shaft is aligned with the groove in the chain oil pump shaft before trying to push the cover fully on.

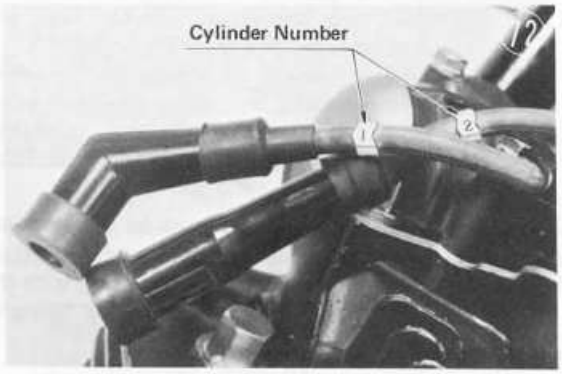





6. Be sure all the carburetor and air duct clamps are tight enough to stop any air leakage.
7. Put the mufflers on one at a time with the inside muffler of each side going on first. After installation tighten the muffler connecting hose clamp on each side so there is no exhaust leakage.




8. The numbers on the spark plug wires correspond to the cylinder numbers, counting from the left.

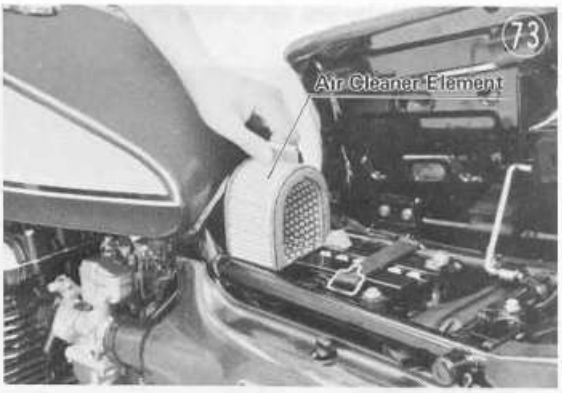



9. Fill the engine with a little over 4 quarts (about 4 litres) of SE or SD class SAE 10W-40, 10W-50 or 20W-50 weight motor oil. After the engine is run and then stopped for several minutes, the oil should come up above the low mark on the gauge.
10. After engine installation, adjust the rear brake (Pg. 18), and check the brake lamp (Pg. 19), chain (Pg. 19), clutch (Pg. 13), and throttle cable (Pg. 11) adjustments.

## AIR CLEANER ELEMENT

### Removal:

- Open the seat, take the screen off the air cleaner, and pull the element out.



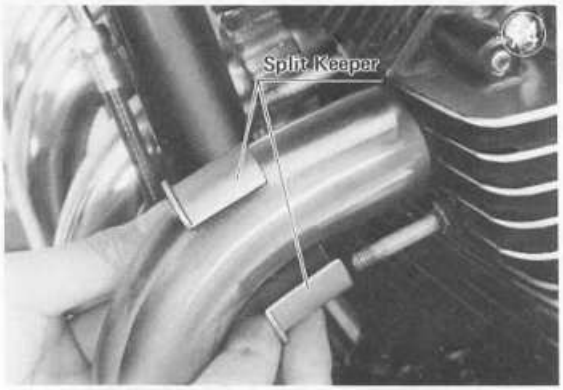

### Installation Note:

- Take care not to push the sponge gaskets out of place during installation.

## MUFFLERS

### Removal:

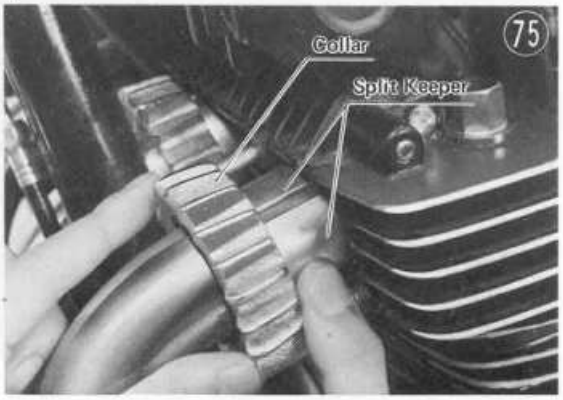
- Remove the two nuts holding on each collar, slip the collar off the studs and remove the split keeper.




- Take out the mounting bolt at the rear, and push the two mufflers for either side forward, removing them as a pair.
- Take the two mufflers apart after loosening the connecting hose clamp.

### Installation:

- Starting with the inside muffler of either side, put the gasket into the exhaust port of the cylinder head.
- Put the split keeper onto the exhaust pipe, holding it in place with the collar, and push the muffler into the cylinder head.

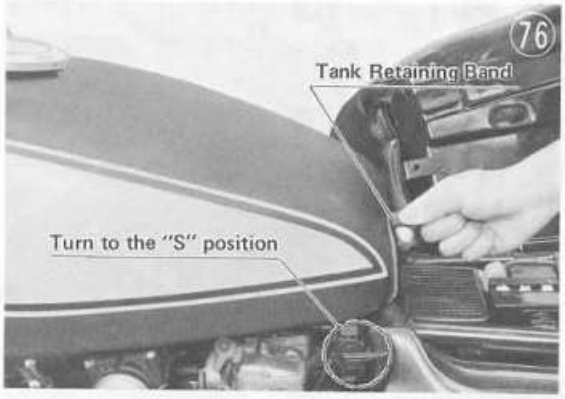


- Put the nuts on loosely to hold it in place, and then mount the outside muffler in this same manner.
- With both mufflers in place, put the rubber connecting hose on, and loosely screw in the muffler mounting bolt.
- Make sure the connecting hose is fitted securely onto both mufflers, and tighten the hose clamp securely so there is no exhaust gas leakage.
- Tighten the nuts at the cylinder head, and the tighten the rear mounting bolt. Check that the connecting hose clamp is tight.

## FUEL TANK

### Removal:

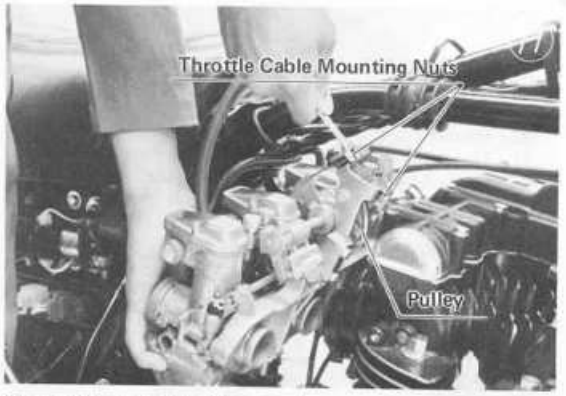
- Open the seat, unhooking it so that it will open completely and not scratch the fuel tank during removal.
- Take off the left side cover.
- Turn the fuel tap lever to the **S** position. Slide back the hose clamps and pull the two hoses off the fuel tap.
- Unhook the tank retaining band and pull the tank off to the rear.




## CARBURETORS AND CARBURETOR PARTS

### Removal as a complete assembly:

- Remove the fuel tank. (See above)
- Loosen the four intake manifold clamps and the four air cleaner hose clamps, and pull the carburetors off to the rear.
- Loosen the throttle cable mounting nuts, and unhook the cables from the pulley.

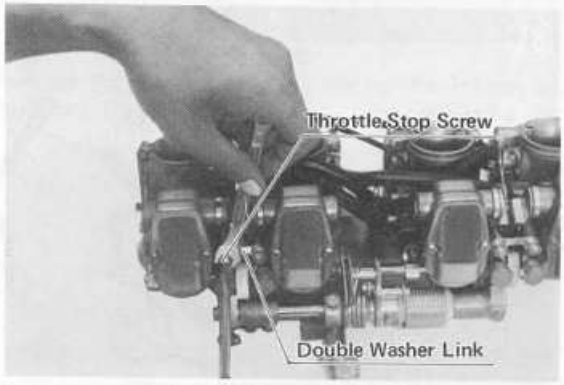



### Assembly installation notes:

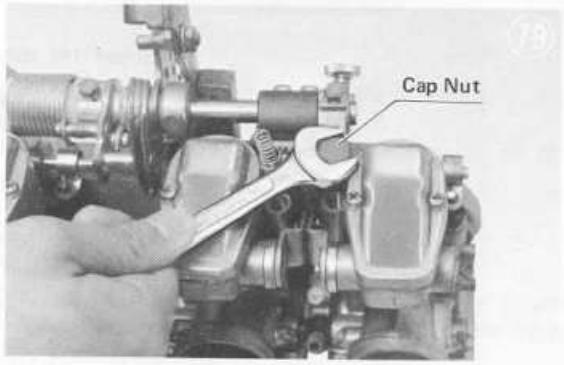
1. Be sure all air duct and intake manifold clamps are tight enough to prevent air leakage.
2. After the carburetors are installed, adjust throttle grip play (Pg. 11) and check general carburetor adjustment (Pg. 11).

### Removal of a single carburetor:

- Working with the right or left pair of carburetors, whichever pair contains the carburetor to be removed, remove the throttle stop screw lock nut ① from both carburetors and take off the double washer link ② . Then unscrew the throttle stop screw ⑬ to remove it and the spring ⑭ and spring seat ④ underneath it.

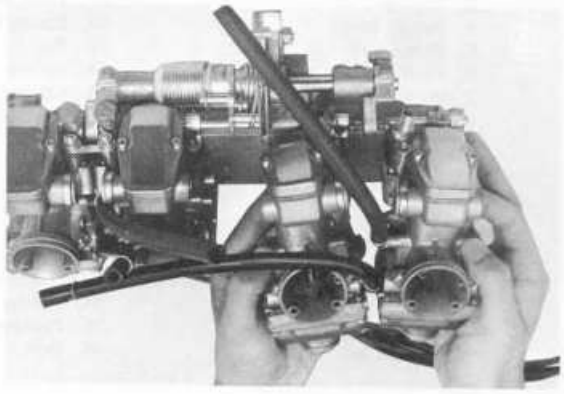



- Take the cap nut ⑫ off the linkage of the carburetor to be removed, taking care that the spring ③ under the nut doesn't fly out. The spring seat ④ will come out after the spring is removed.



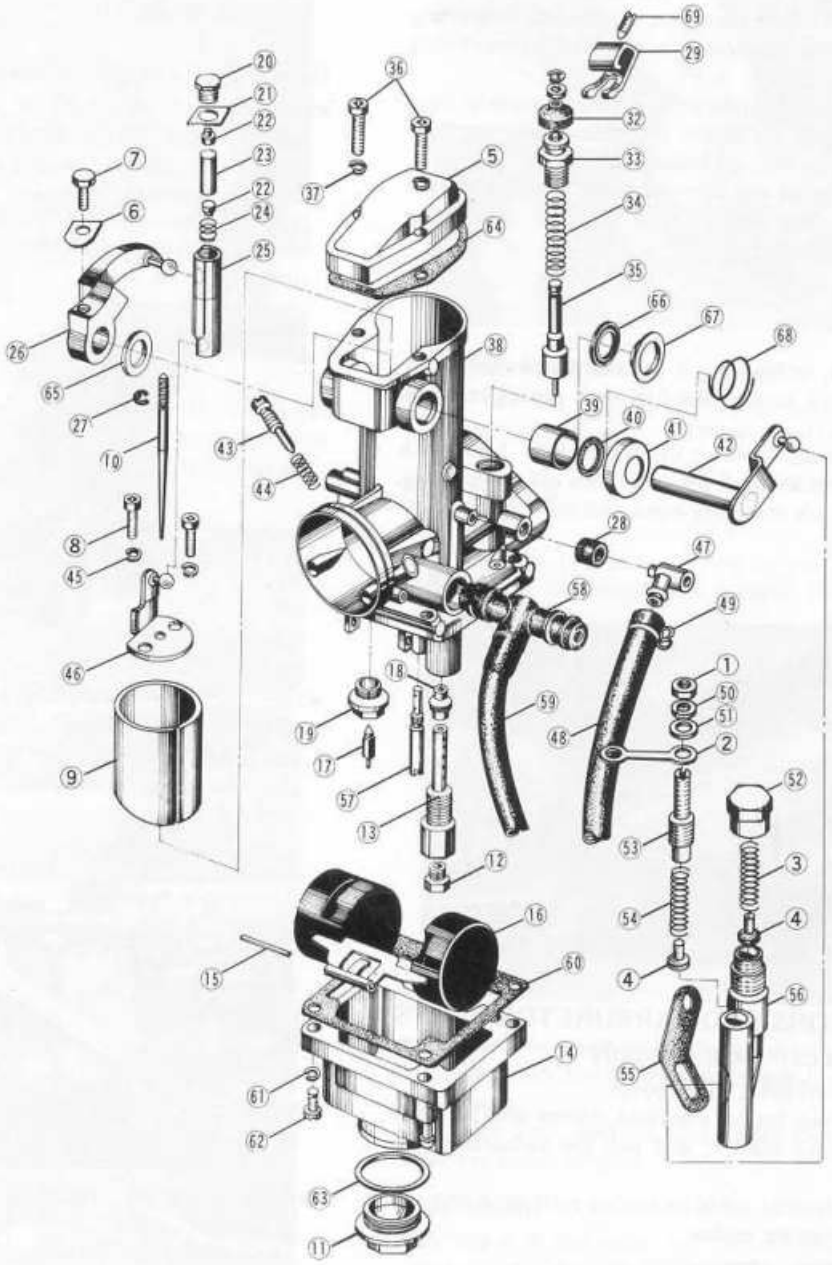

- Remove the four mounting screws and swing the two carburetors away from the plate. Pull the applicable carburetor off to the side.

**NOTE: Apply Loctite to the mounting screws during assembly.**



## Carburetor Assembly

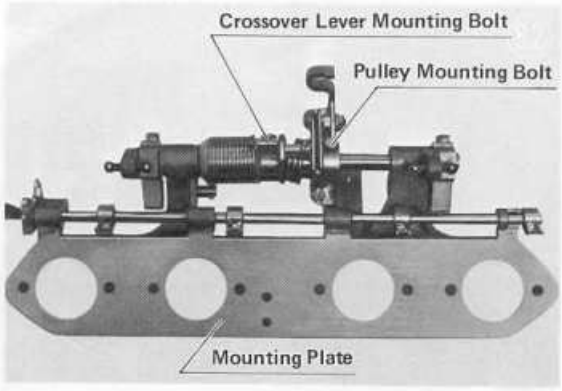
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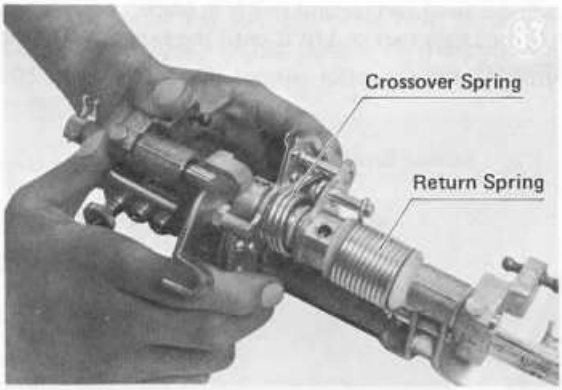
1. Throttle Stop Screw Lock Nut
2. Double Washer Link
3. Spring
4. Spring Seat
5. Top Cover
6. Lock Washer
7. Bolt
8. Screw
9. Throttle Valve
10. Jet Needle
11. Drain Plug
12. Main Jet
13. Air Bleed Pipe
14. Float Bowl
15. Pin
16. Float
17. Float Valve Needle
18. Needle Jet
19. Valve Seat
20. Guide Screw
21. Lock Washer
22. Spring Seat
23. Pin
24. Spring
25. Connector
26. Lever Assembly
27. Circlip
28. Hose
29. Lever
30. Circlip
31. Ring
32. Cap
33. Guide Screw
34. Spring
35. Plunger Assembly
36. Bolt
37. Lock Washer
38. Mixing Chamber
39. Hose
40. Washer
41. Cup
42. Lever Assembly
43. Air Screw
44. Spring
45. Lock Washer
46. Bracket Assembly
47. Air Vent Pipe Fitting
48. Air Vent Pipe
49. Clamp
50. Lock Washer
51. Washer
52. Cap Nut
53. Throttle Stop Screw
54. Spring
55. Rubber Washer
56. Connector
57. Pilot Jet
58. Fuel Pipe Fitting
59. Fuel Pipe
60. Gasket
61. Lock Washer
62. Bolt
63. O Ring
64. Gasket
65. Spacer
66. Oil Seal
67. Collar
68. Spring
69. Screw

## Link mechanism disassembly:

- Remove all the carburetors from the mounting plate.
- Remove the crossover lever mounting bolt.
- Take out the pulley mounting bolt.

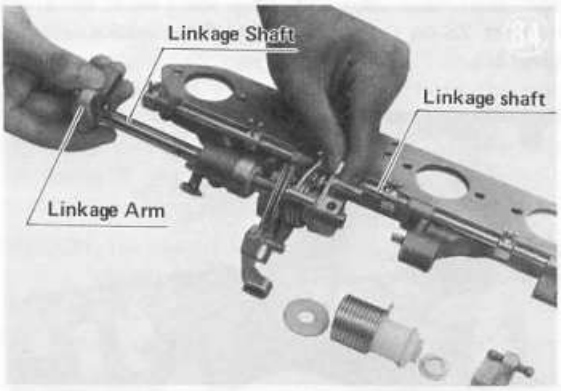



- Unhook the crossover spring from the pin on the pulley.



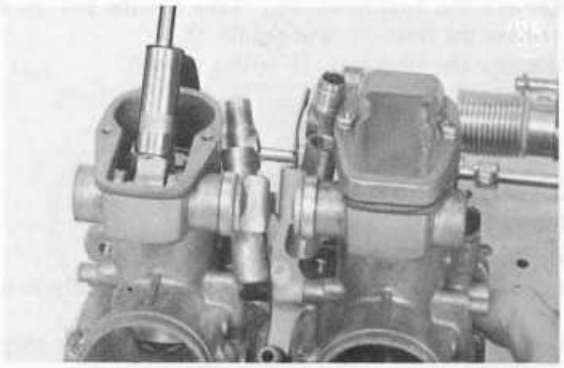

- Unhook the throttle return spring from the crossover lever pin.
- Take the bolt out of either linkage arm and pull the linkage shaft out the opposite end (with the other arm still attached).

**NOTE:** Do not remove the starter linkage except for repairs.

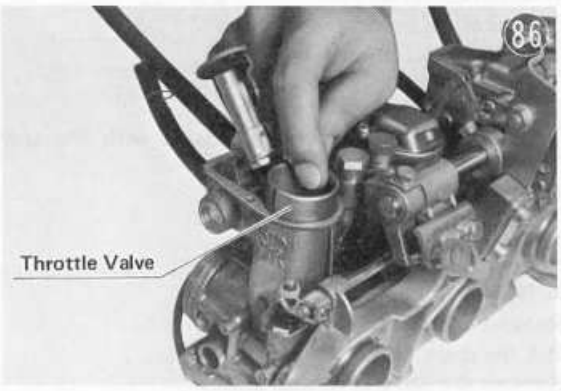



## Throttle valve, jet needle removal:

- Unscrew the top cover ⑤
- Flatten the bent-up ear of the lock washer ⑥ of the smaller bolt ⑦ , and remove the bolt.




- Remove the two screws ⑧ , lift up the linkage, and pull out the throttle valve ⑨ and jet needle ⑩ .



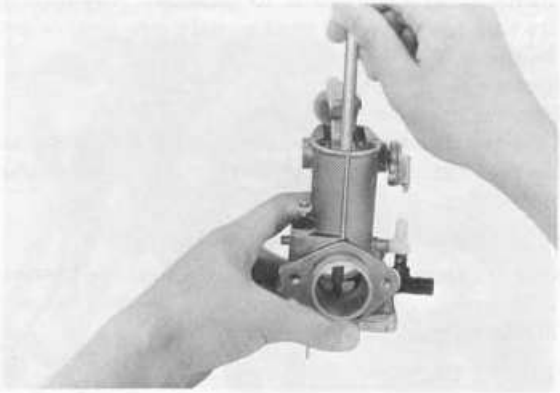

## Main jet removal:

- Remove the plug ⑪ and unscrew the main jet ⑫ and air bleed pipe ⑬ with a screwdriver.

**NOTE:** The main jet can be removed with all the carburetors still installed.

## Needle jet removal:

- Remove the throttle valve.
- Remove the float bowl ⑭ . Pull out the pin ⑮ and remove the float ⑯ , and the float valve needle ⑰ so they don't get damaged.
- Unscrew and remove the main jet ⑫ and air bleed pipe ⑬ .
- Push on the top of the needle jet ⑱ with a wooden or other soft rod, and it will fall out the bottom of the carburetor.



### Needle and seat removal:

- Remove the float bowl ⑭ . Take out the pin ⑮ to remove the float ⑯ and needle ⑰ .
- Unscrew the valve seat ⑲ with a wrench.

## IGNITION COIL

### Removal:

- Remove the fuel tank (Pg. 27).
- Unplug the black or green wire (depending on the coil), and the brown wire.
- Unplug the high tension wires from the spark plugs. They cannot be unplugged from the coil itself.
- Unbolt the ignition coil from the frame.

### Installation note:

- Coil wires are connected as follows:
  Black→contact breaker black wire
  Green→contact breaker green wire
  Brown→battery yellow/red wire
  The high tension wires are labeled with the spark plug numbers.

## CAMSHAFT

### Removal:

- Remove the fuel tank (Pg. 27).
- Pull the spark plug wires off the plugs.
- Remove the valve cover and gasket.
- Remove the chain guide sprocket.

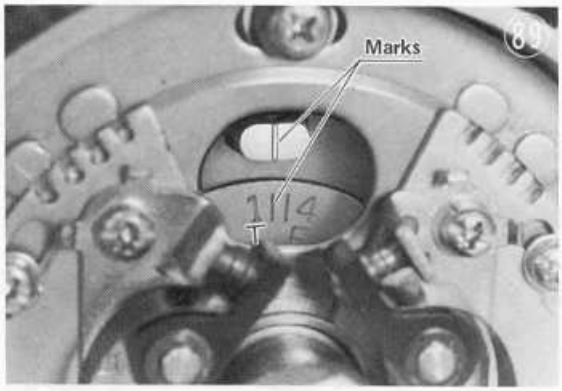



- Unbolt the camshaft caps, and mark the split bushing halves under each cap as to location. Any bushings that are to be re-used must go back into their original locations.
- Remove the camshaft.
- Unscrew the tachometer cable.
- Take out the tachometer pinion so it does not cause damage to the camshaft worm during camshaft installation.

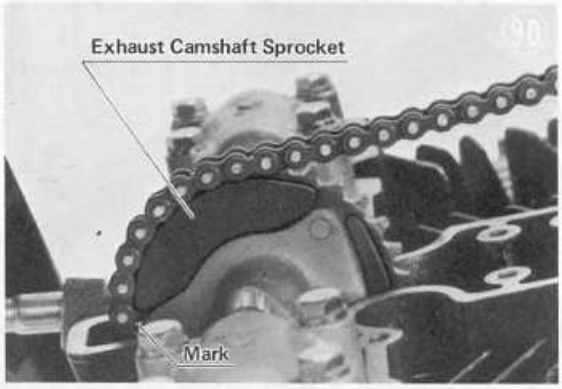
### Installation:

**NOTE:** Camshaft timing must be set during camshaft installation. Timing is included in the following installation procedure.

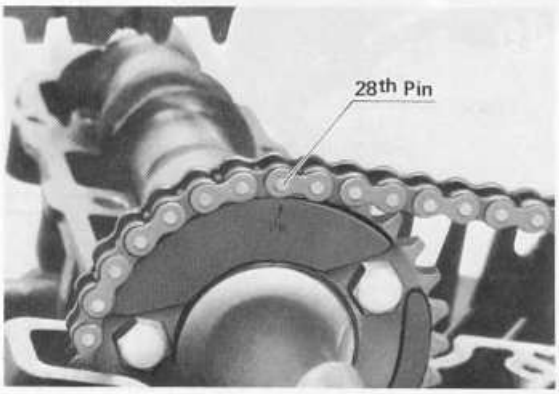
- Take off the breaker point cover.
- Holding the cam chain up so it doesn't get caught, turn the crankshaft until the **T** mark on the 1, 4 side of the timing advancer is aligned with the timing mark. At this time pistons 1 and 4 are at top dead center.



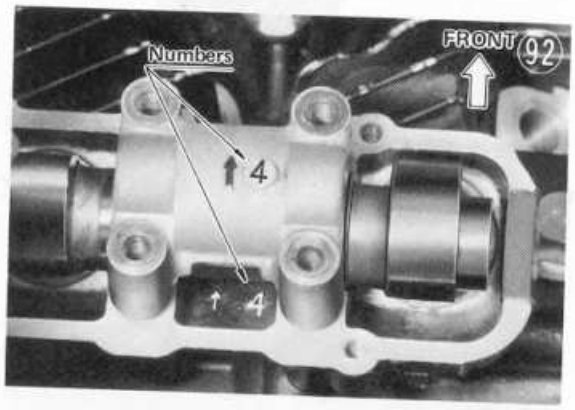

- Feed the exhaust camshaft through the chain, turn it so that the mark on the sprocket is aligned with the cylinder head surface and rest it in place.
- Pull the chain **taut** and fit it onto the exhaust camshaft sprocket.




- Starting with the next chain link pin above the one that coincides with the sprocket mark, count to the 28th pin. Feed the intake camshaft through the chain and align that 28th pin with the raised mark and number 28 on the rubber part of the intake camshaft sprocket.

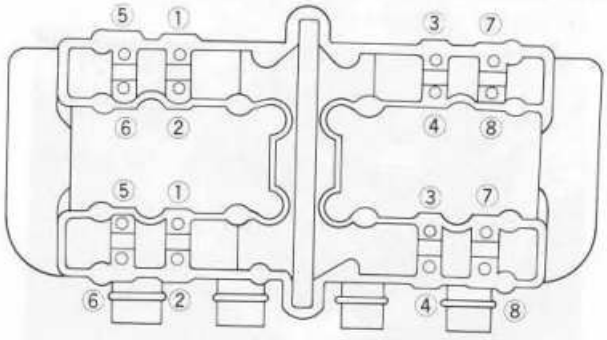


- Put all the split bushing halves back into their original positions.
- The camshaft caps are machined together with the cylinder head, so set the camshaft caps into place with the arrow on the cap pointing forward (toward the exhaust side), and with the number on the cap matching the number on the head.




- Partially tighten the left cap bolts first, to seat the camshaft in place. Fully tighten all the bolts with **105 in-lbs (1.2 kg-M) torque, following the tightening** order shown in the diagram.

**Camshaft Bolt Tightening Order** (93)

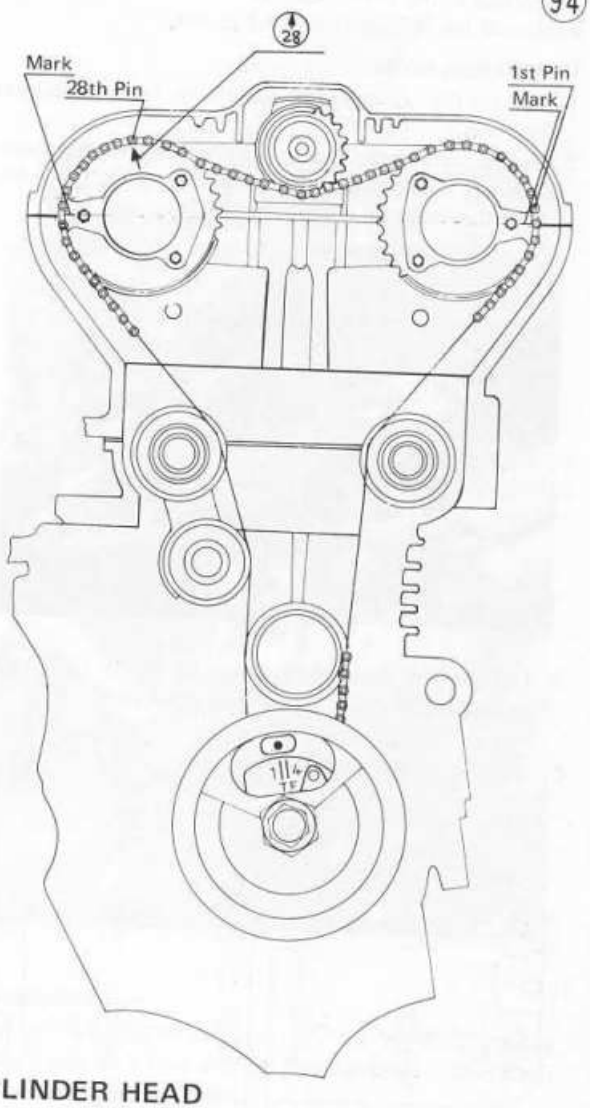



- Apply clean oil to all the cam parts.
- Install the chain guide sprocket assembly and adjust the cam chain tension (Pg. 16).
- Turn the crankshaft over until pistons 1 and 4 are at TDC (see Fig. 94 ), and check that both the mark on the exhaust camshaft sprocket and the mark on the metal part of the intake sprocket are aligned with the cylinder head surface, indicating that cam timing is correct.

**CAUTION: Do not try to turn the crank and camshafts with a wrench on the camshaft sprocket. Use the large nut on the end of the crankshaft.**

- Install the tachometer pinion, and screw in the tachometer cable.
- Put on the valve cover and gasket, tightening the bolts with 70 in-lbs (.8 kg-M) torque.
- Replace the plug wires, breaker point cover and fuel tank.

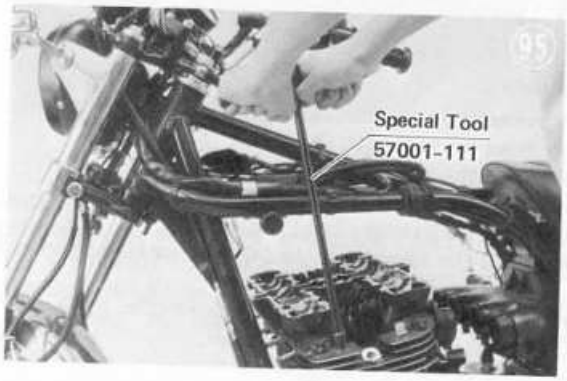
**Camshaft Timing** (94)




## CYLINDER HEAD

### Removal:

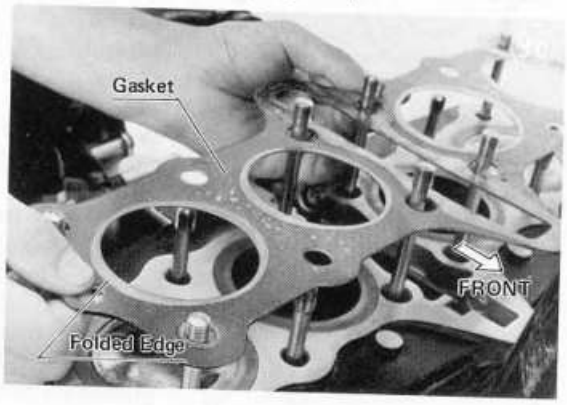
- Remove the mufflers (Pg. 26).
- Remove the fuel tank (Pg. 27).
- Remove the carburetors (Pg. 27).
- Remove the camshafts (Pg. 30).
- Take out the spark plugs using a plug wrench.
- Remove the bolt at either end of the head.
- Remove the 12 cylinder head nuts using a special purpose socket wrench.



- Mark all the valve lifters and shims, as they must be returned to the same location.
- Take off the cylinder head and gasket.

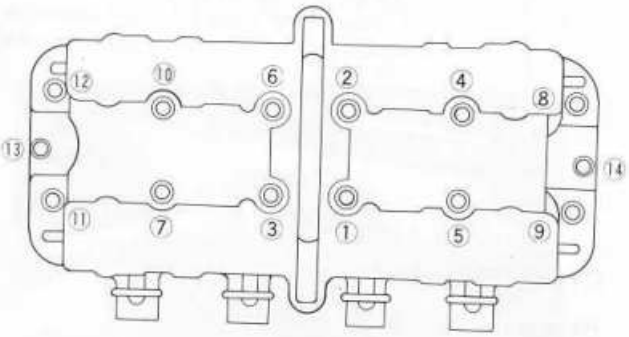
### Installation notes:

1. Return the valve lifters and shims to their original locations.
2. Use a new head gasket to prevent compression leakage. The side of the gasket with the wider folded-over metal edges goes up.




3. Tighten the head nuts with 25 ft-lbs (3.5 kg-M) torque, in the order shown in the diagram.

**Cylinder Head Nut Tightening Order** (97)




4. Tighten the two bolts with 105 in-lbs (1.2 kg-M) torque.
5. Tighten the spark plugs with 19~21 ft-lbs. (2.5~3.0 kg-M) torque.

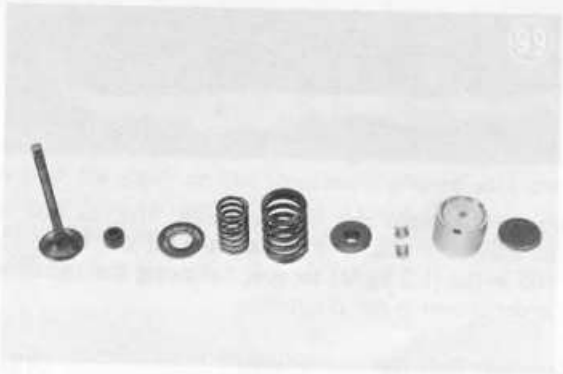
## VALVES, VALVE GUIDES

### Removal:

- Remove the mufflers (Pg. 26).
- Remove the fuel tank (Pg. 27).
- Remove the carburetors (Pg. 27).
- Remove the camshafts (Pg. 30).
- Remove the cylinder head (Pg. 31).
- Pull out the valve lifters and shims, marking them as to location.
- Using a special tool to press down the valve spring retainer, take out the split keeper.




- Release the tool and take out the spring retainer, spring, spring seat and valve.




- Pull the oil seal off the valve guide, taking care not to damage the seal or its spring.

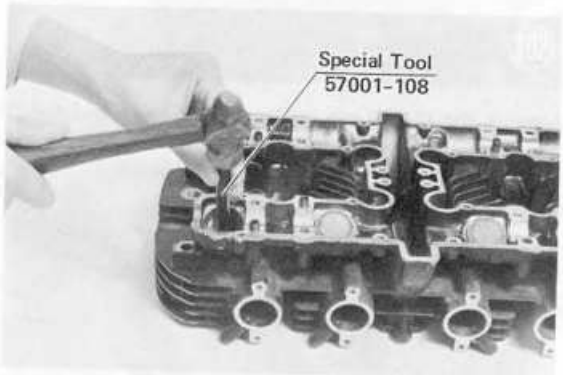



- Heat the area around the guide to about 250°~300°F (120°~150°C), and hammering lightly on the valve guide driver (special purpose tool), knock the guide out the top of the head.



### Installation:

- Snap the circlip into the groove on the valve guide, and apply oil to the guide.
- Heat the cylinder head area around the valve guide hole to about 250°~300°F (120°~150°C), and drive the valve guide in from the top of the head using the valve guide driver. The circlip stops the guide from going in too far.




- Ream the valve guide with a 7 mm reamer, even if the old guide is re-used.

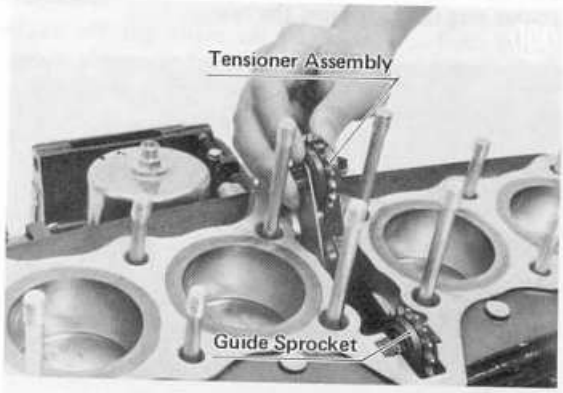



- Lap the valve so that it is properly seated (Pg. 80).
- The rest of the assembly procedure is the reverse of disassembly, except that before the valve cover is replaced, check valve lifter clearance and adjust it if necessary (Pg. 15).

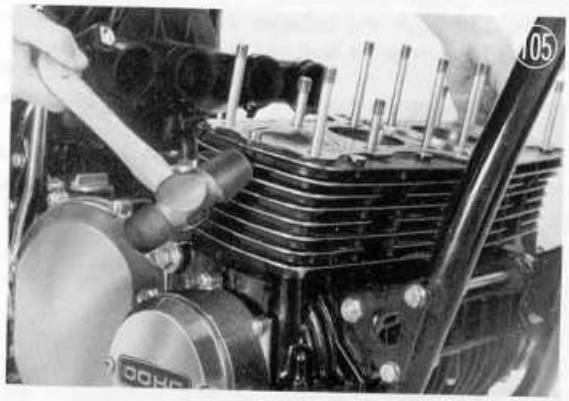
## CYLINDER BLOCK

### Removal:

- Remove the mufflers (Pg. 26).
- Remove the fuel tank (Pg. 27).
- Remove the carburetors (Pg. 27).
- Remove the camshafts (Pg. 30).
- Remove the cylinder head (Pg. 31).
- Remove the tensioner assembly and guide sprocket.




- Lightly tap up alternate ends of the cylinder with a plastic mallet, taking care not to bend the cooling fins, and lift off the cylinder and gasket.



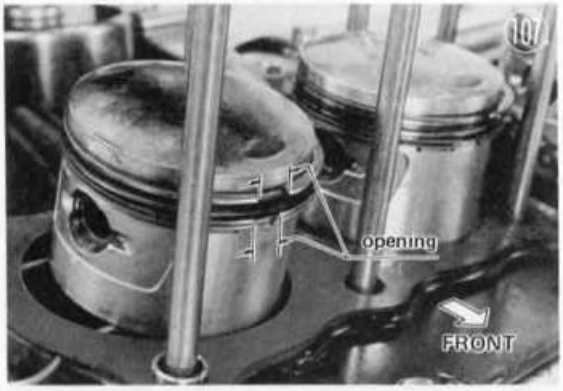
### Installation:

- Put the two alignment pins into the forward tension stud hole on either side of the crankcase. **Don't put them into the rear holes.**




- Install a new cylinder base gasket.
- Lifting up the cam chain so it doesn't get caught, turn the crankshaft so that all the pistons are at about the same height, and slip the positioning rods (special tool) under the pistons to hold them level. (See Fig. 108)

•Turn all the rings so that the opening in the top and bottom ring of each piston is facing forward, and the center ring opening faces the rear.




•Apply oil to the rings and to the cylinder walls.
•Use the special purpose tool to compress the piston rings, and push the cylinder down onto the pistons until all the rings are well inside the cylinder.




•Remove the ring compressor and take the rods out from under the pistons, and then push the cylinder fully down.
•Assemble the remaining parts in the reverse order of disassembly.

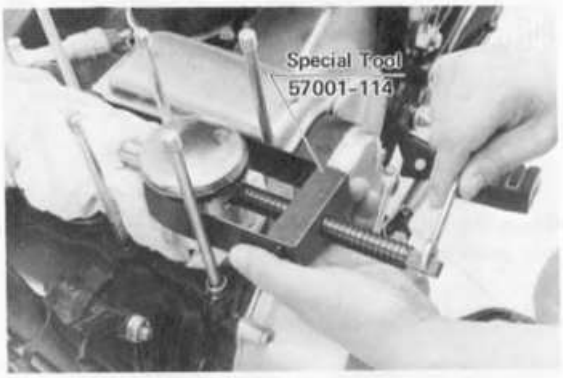
## PISTON, PISTON RINGS

### Removal:

•Remove the mufflers (Pg. 26).
•Remove the fuel tank (Pg. 27).
•Remove the carburetors (Pg. 27).
•Remove the camshafts (Pg. 30).
•Remove the cylinder head (Pg. 31).
•Remove the cylinder (Pg. 33).
•Stuff rags underneath the piston so that no parts fall into the crankcase, and remove the piston pin circlip.




•Remove the piston pin with a special tool, and put the pin back inside the piston as it must not be mixed up with the other pins. Mark the pistons as to cylinder number.




•Remove the rings from the piston with a special tool.

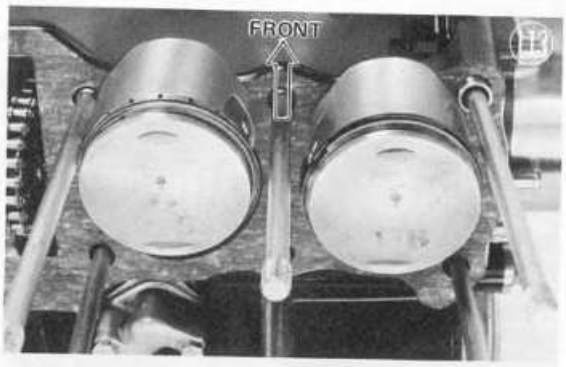



If no tool is available, spread the ring opening with the thumbs, and push up on the opposite side of the ring to remove it.



### Installation notes:

1. If the piston is replaced, piston to cylinder clearance (Pg. 83) changes. When a new piston or pin is used, also check that piston to pin clearance is .00026~.00057 in. (.0066~.0145 mm), and that pin to small end clearance is within .00012~.00079 in. (.003~.020 mm).
   **To the Dealer:** When possible, match parts from stock so that a marked pin is assembled with an **A** piston, and an unmarked pin with a **B** piston.
2. Apply oil to the piston pin before inserting it.
3. The arrow on the piston top must point forward.

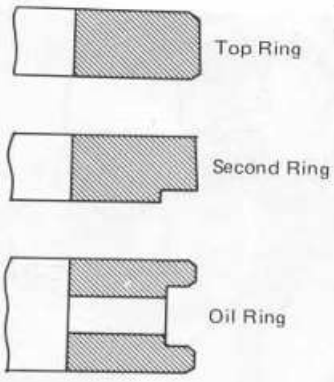



4. Use a new piston pin circlip in place of every one that is removed, as removal weakens and deforms the circlip. After installation, turn the circlip so that its opening does not coincide with either groove in the piston.




5. Install all the piston rings so that the lettering faces up. Don't mix up the first and second rings: the outer edges of the top ring are chamfered; the lower outer edge of the second ring is notched.

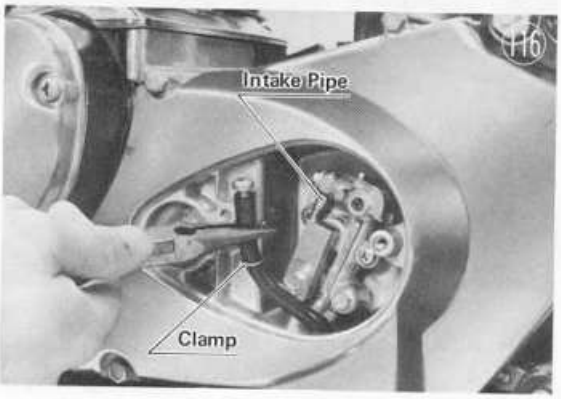
**Piston Rings** (115)



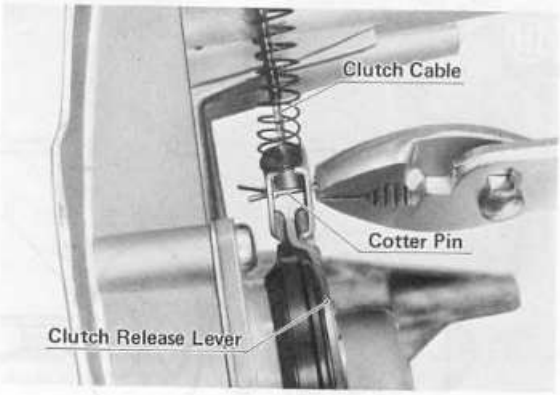

## CHAIN COVER

### Removal:

- Take off the chain oil pump cover. Push back the hose clamp and pull the inlet hose off the pump, plugging the hose with a screw to stop chain oil leakage.




- Unbolt the left front foot rest.
- Remove the clamp bolts completely and pull off the shift pedal.
- Take off the starter cover and gasket.
- Remove the chain cover. Take the cotter pin out of the clutch release lever and unhook the clutch cable.

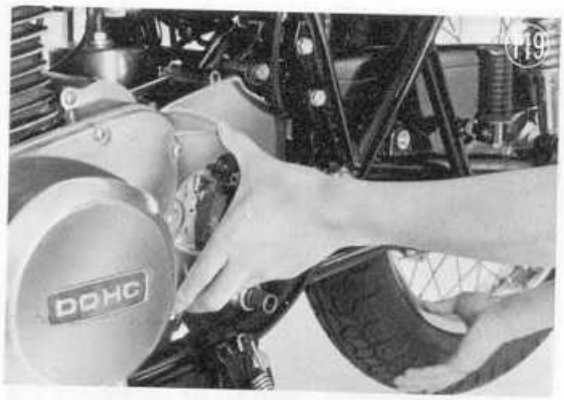



### Installation notes:

1. Use an oil seal guide (special tool) to prevent damage to the seal when the cover is put on.



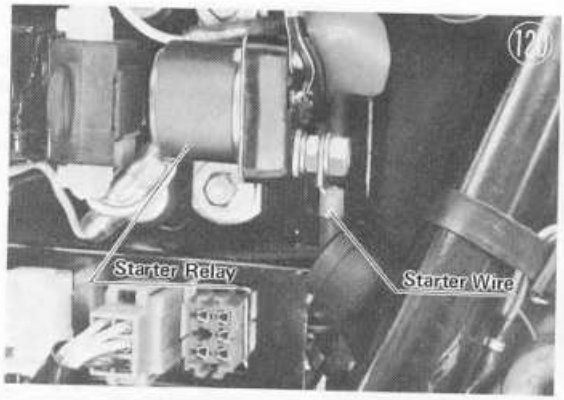
2. Turn the rear wheel to align the pin inside the output shaft with the groove in the chain oil pump shaft before the cover can be pushed fully on.



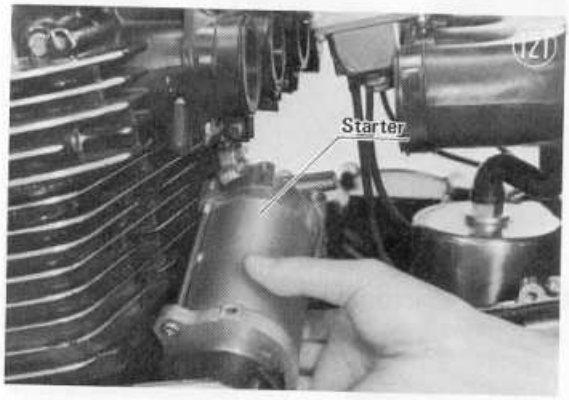

## STARTER

### Removal:

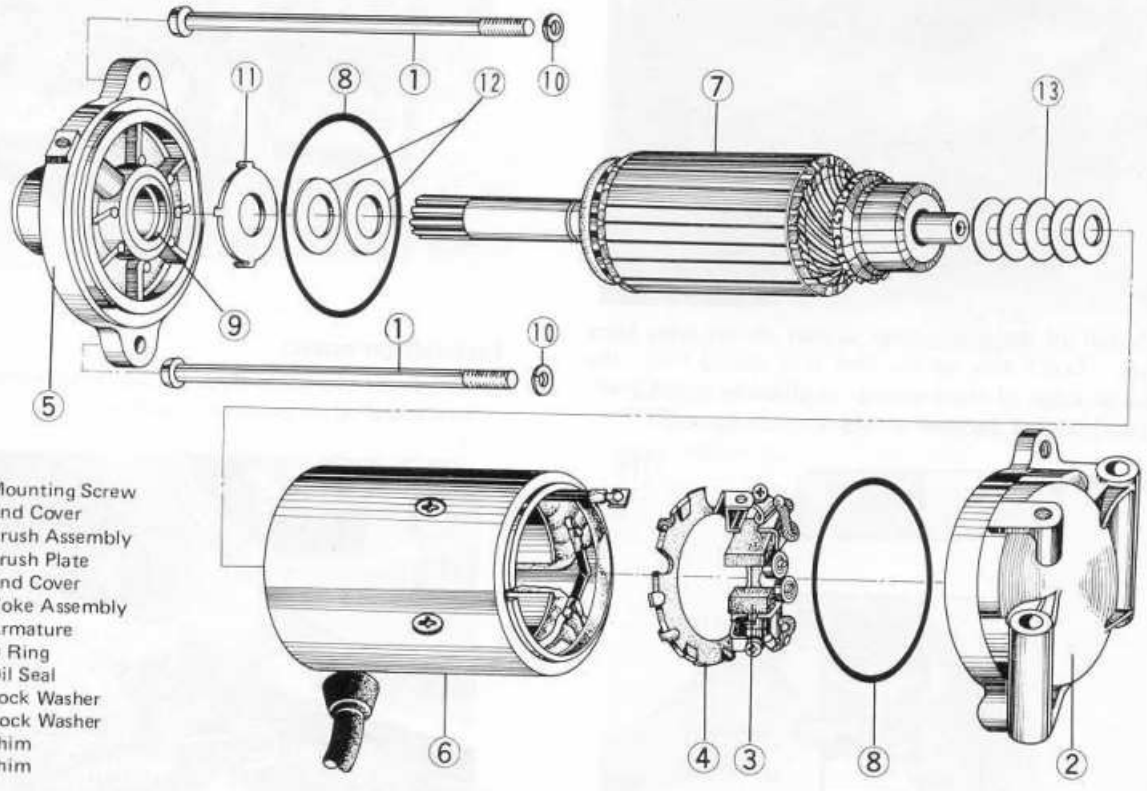
- Remove the fuel tank (Pg. 27).
- Remove the carburetors (Pg. 27).
- Remove the chain cover (Pg. 35).
- Take off the right side cover, unscrew the starter wire from the starter relay terminal, and release the wire from the cable clamp.




- Take out the two mounting bolts and remove the starter.




**Starter**



### Installation notes:

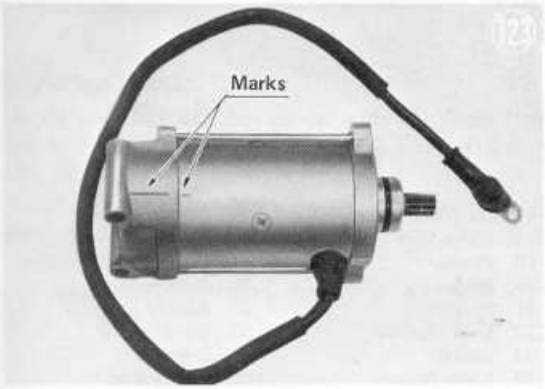
1. Apply a small amount of oil to the **O** ring before slipping the starter into place.
2. Apply Loctite to the starter mounting bolts before installing them.

### Disassembly:

- Take out the two mounting screws ① and pull off one end cover ② .
- Disconnect the brush assembly ③ from the field coil wire.
- Remove the brush plates ④ and take out the brushes.
- Take off the other end cover ⑤ , and remove the yoke assembly ⑥ and armature ⑦ .

### Assembly notes:

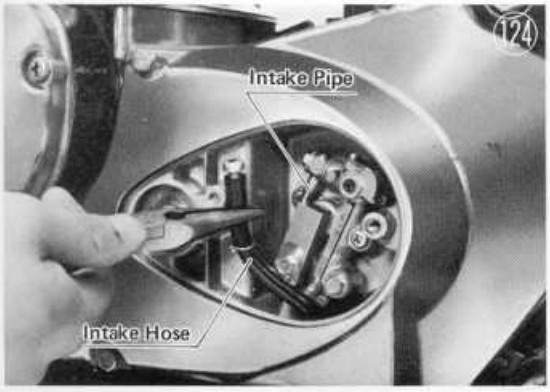
1. Clean off any dust that may be sticking to the shaft, as this would increase wear. Dampen the shaft felts with oil.
2. Be careful not to damage the **O** rings ⑧ and oil seals ⑨ when replacing the end covers, and align the mark on each cover with the mark on the housing.



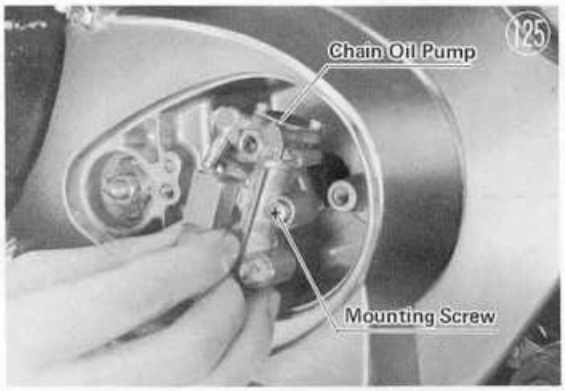

## CHAIN OIL PUMP

### Removal:

- Take off the oil pump cover.
- Slide back the hose clamp, pull the intake hose off the pump and plug the hose with a screw to keep oil from leaking out.

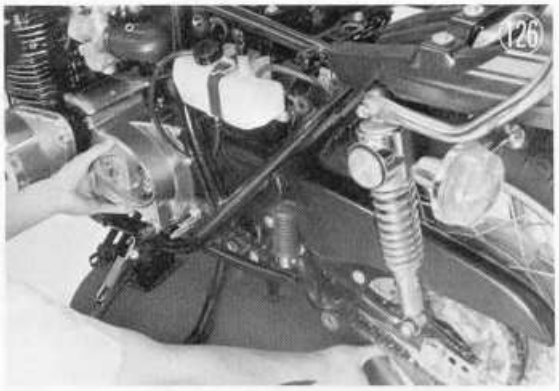



- Take out the two mounting screws and remove the pump.

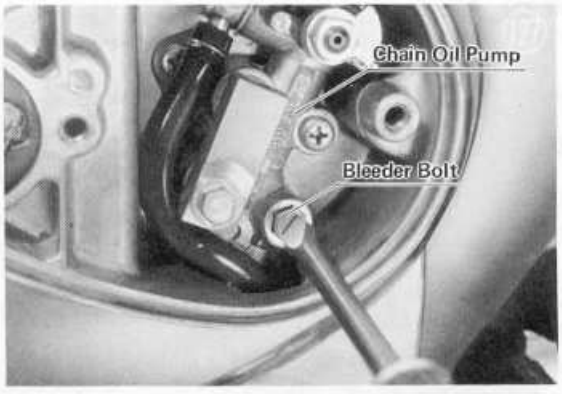



### Installation notes:

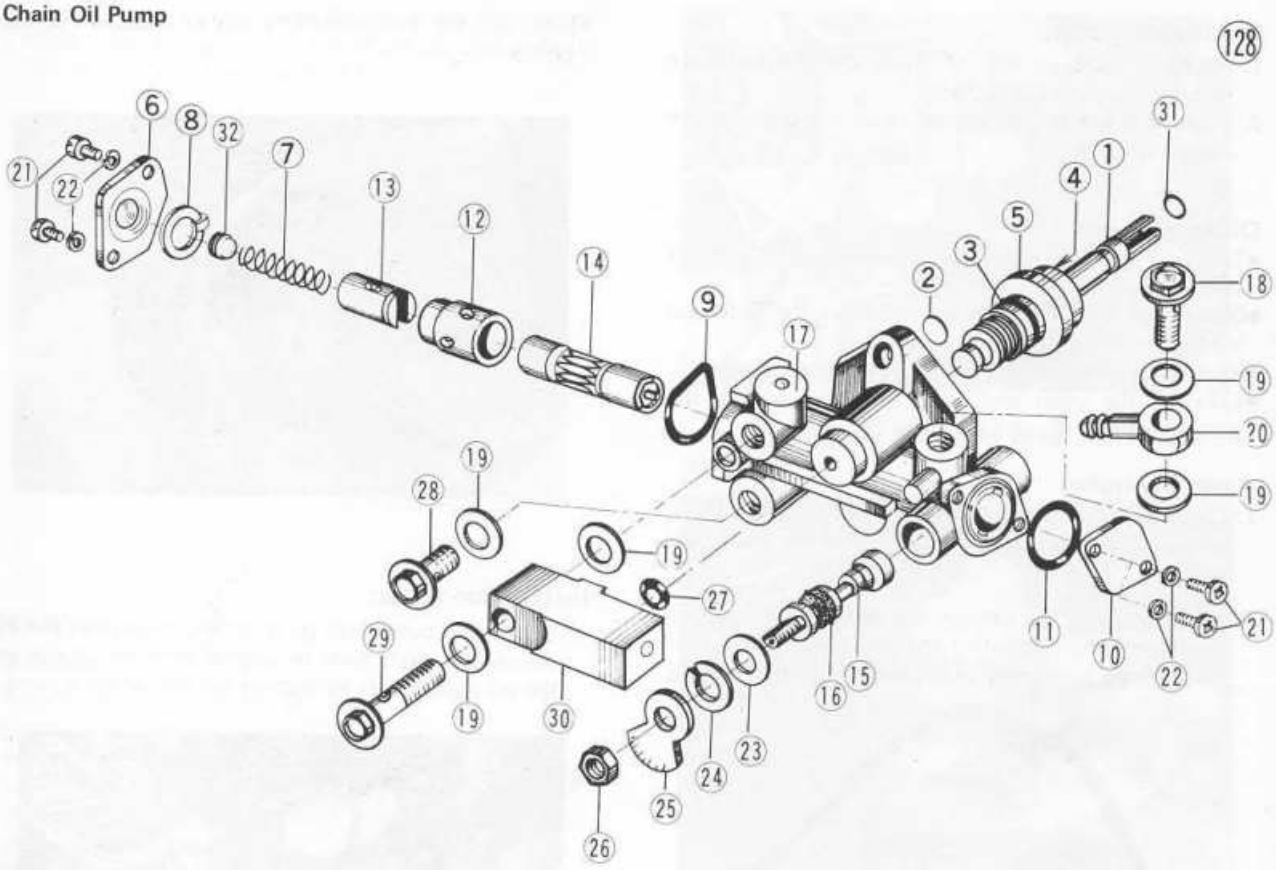
1. Before the pump will go fully into place, the pin in the output shaft must be aligned with the groove in the oil pump shaft by turning the rear wheel around.




2. Apply Loctite to the pump mounting screws before installing them.
3. Before putting the oil pump cover back on, air should be bled from the pump by removing the bleeder bolt until oil starts coming out of the bleeder hole, and then screwing the bolt back in.



Chain Oil Pump




1. Pump Shaft
2. Spacer
3. O Ring
4. Oil Seal
5. Bushing
6. Cap
7. Plunger Spring
8. Plunger Guide Stopper
9. O Ring
10. Cap
11. O Ring
12. Plunger Guide
13. Plunger
14. Plunger
15. Control Cam
16. V Ring
17. Oil Pump Body
18. Banjo Bolt
19. Washer
20. Banjo
21. Bolt
22. Lock Washer
23. Washer
24. Lock Washer
25. Control Lever
26. Nut
27. O Ring
28. Bleeder Bolt
29. Bolt
30. Check Valve
31. O Ring
32. Spring Seat

### Disassembly:

- Wrap cloth around the pump shaft ① to protect it and pull it out with pliers. A spacer ② comes out with the shaft.
- The **O** ring ③ and oil seal ④ can be taken off the shaft after the bushing ⑤ is removed.
- Take the cap ⑥ off the top and remove the plunger spring ⑦, plunger guide stopper ⑧ and **O** ring ⑨.
- Take off the lower cap ⑩ and remove the **O** ring ⑪.
- If the plunger ⑭ is pushed from the bottom with a thin rod, the plunger guide ⑫ and two plungers ⑬ ⑭ will come out.
- Remove the control cam ⑮ and **V** ring ⑯.

### Assembly notes:

1. Apply oil to the oil seal and press it on.
2. Apply oil to the **O** and **V** rings, plungers and plunger guide before assembly.

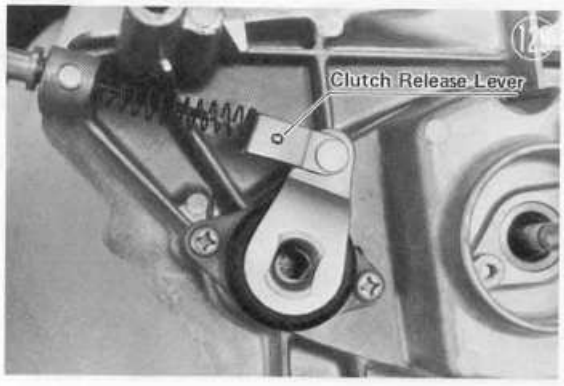
## CLUTCH RELEASE

### Removal:

- Remove the chain cover (Pg. 35).
- Twist out the inner release gear.
- Remove the outer release gear.

### Installation notes:

1. Lubricate the worm teeth of the two release gears with regular cup grease.
2. Use Loctite on the outer gear mounting screws.
3. After the inner release gear is installed, the clutch release lever should be in the position shown.



## ENGINE SPROCKET

### Removal:

- Remove the chain cover (Pg. 35).
- Pull out the clutch push rod and take off the sprocket guard.
- Flatten the bent up ear of the lock washer.
- Using a special purpose tool to hold the sprocket from turning, take off the sprocket nut and pull the sprocket off with the chain still on it.



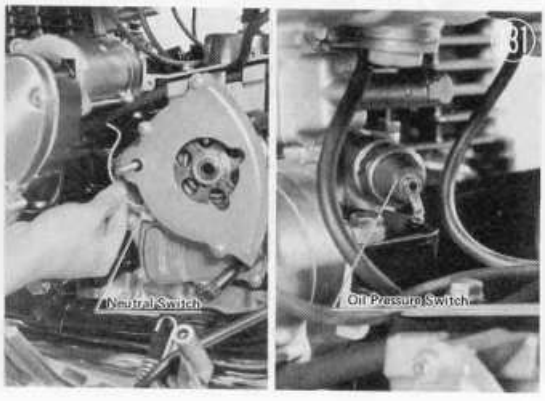

### Installation notes:

1. If the sprocket will not go on with the chain fitted on it, loosen the chain and re-adjust it afterwards (Pg. 19).
2. Make sure the tang on the lock washer goes into the hole in the sprocket, and bend up one side of the washer after tightening the nut.
3. Sprocket nut tightening torque is 87~108 ft-lbs (12~15 kg-M).

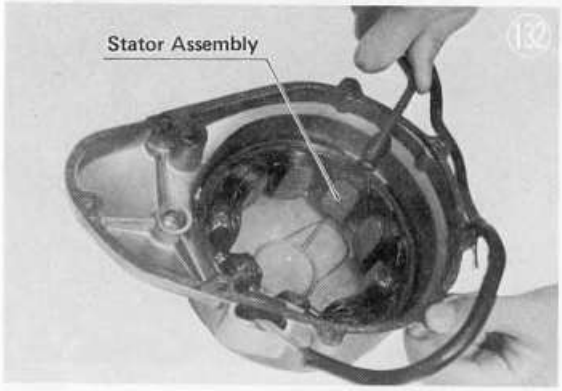
## DYNAMO STATOR

### Removal:

- Remove the chain cover (Pg. 35 ).
- Take off the right side cover, pull out the blue dynamo plug, disconnect the wires from the oil pressure and neutral switches, and release the wires from the cable clamps.




- Take off the left engine cover.
- Unscrew the Allen bolts and remove the stator from the cover.



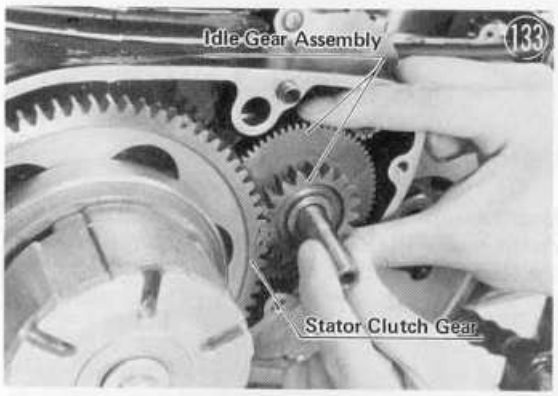

### Installation note:

Apply Loctite to the Allen bolts before installation.

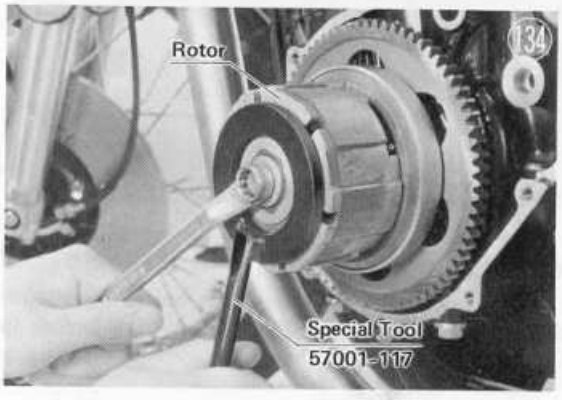
## DYNAMO ROTOR, STARTER CLUTCH

### Removal:

- Remove the chain cover (Pg. 35).
- Take off the left engine cover, leaving the wiring attached.
- Remove the starter idle gear.




- Use a special purpose tool to hold the rotor from turning and remove the rotor mounting bolt.



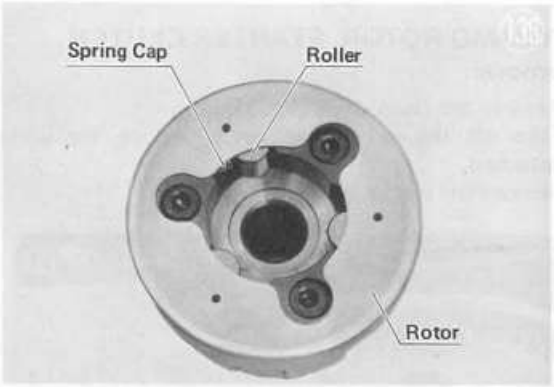
•Holding the rotor with the same tool, use another special tool to remove rotor/starter clutch assembly from the crankshaft.



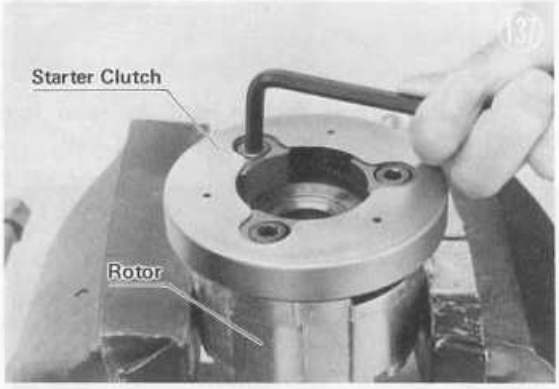

**CAUTION: Don't hammer on the rotor.**

•Remove the Woodruff key, thin shim, starter clutch gear, needle bearing, gear damper, and thick shim from the crankshaft.

•Remove the rollers, springs and spring caps from the starter clutch.

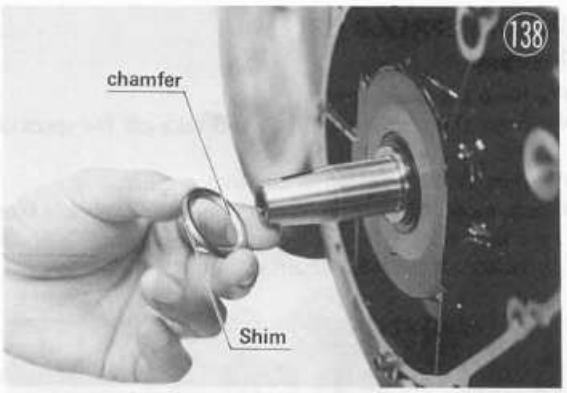



•Wrap the rotor or otherwise protect it from damage and clamp it in a vise. Remove the Allen bolts to separate the starter clutch from the rotor.




### Installation notes:

1. Apply Loctite to the Allen bolts before installation.
2. The thick shim goes onto the crankshaft before the starter clutch, with the chamfered side facing in.



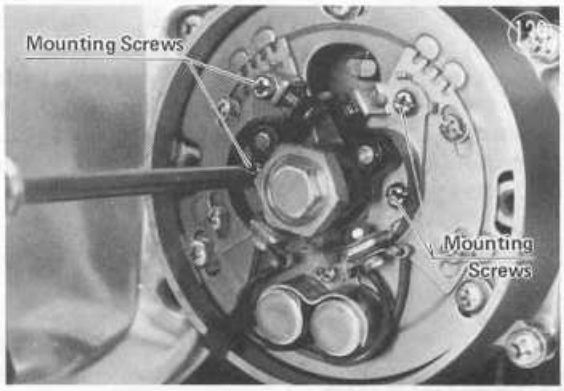

3. When installing the starter clutch, spin the clutch gear so that the rollers will move enough for it to go on.
4. Apply Loctite to the rotor mounting bolt before installation, and tighten the bolt with 18 ft-lbs (2.5 kg-M) torque.

## CONTACT BREAKER POINTS

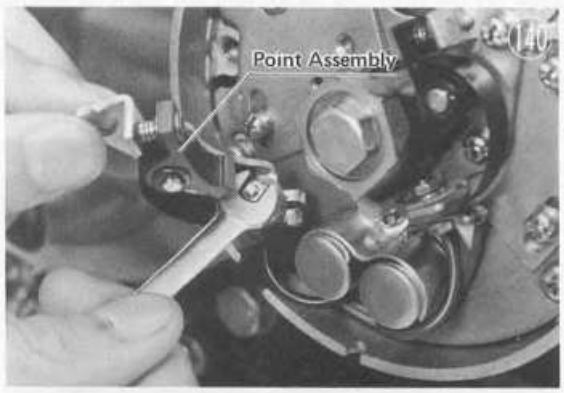
### Removal:

•Take off the breaker point cover and gasket.

•Take out the two mounting screws and remove the points.




•Loosen the nut and disconnect the condenser and ignition coil wires from the points.



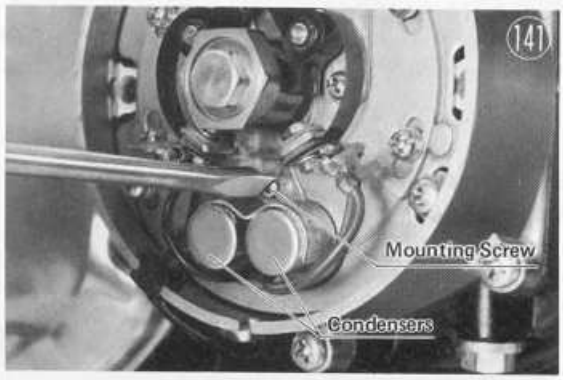

### Installation note:

Make sure the ends of the wire are kept on the outer part of the insulating washer when reconnecting them.

## CONDENSERS

### Removal:

- Take off the breaker point cover and gasket.
- Loosen the nuts and disconnect the condenser wires from both sets of points.
- Take out the mounting screw and remove the two condensers as a pair.




### Installation note:

When connecting the wires, make sure the ends of each wire go on the outside part of the insulating washer.

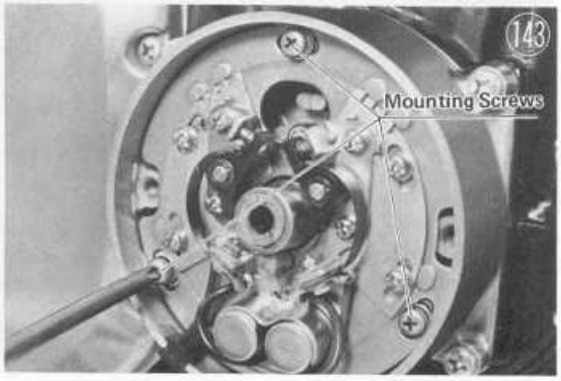
## AUTOMATIC TIMING ADVANCER

### Removal:

- Remove the breaker point cover and gasket.
- With one wrench on the crankshaft rotation nut to keep the shaft from turning, remove the bolt from the end of the shaft and take off the nut.

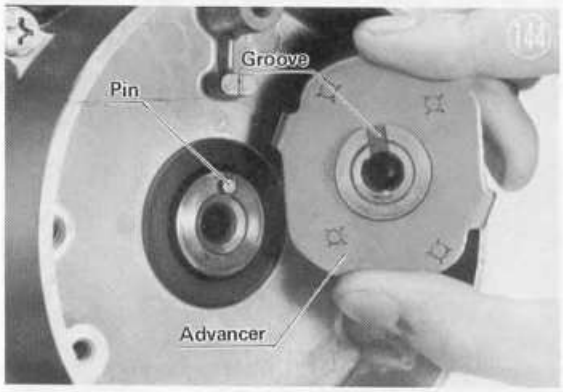



- Take out the contact breaker assembly mounting screws and remove the breaker assembly and advancer mechanism.



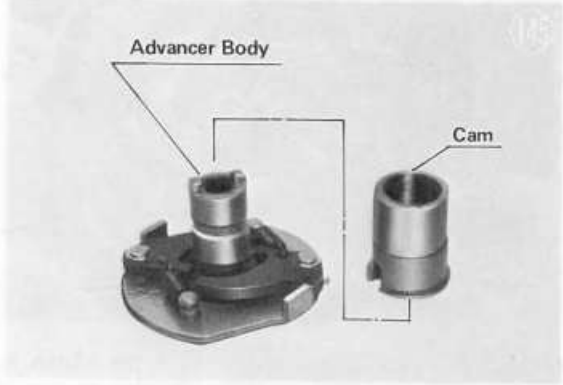

### Installation note:

Make sure that the pin on the crankshaft fits into the groove in the back of the advancer, and that the crankshaft rotation nut is properly seated.




### Disassembly:

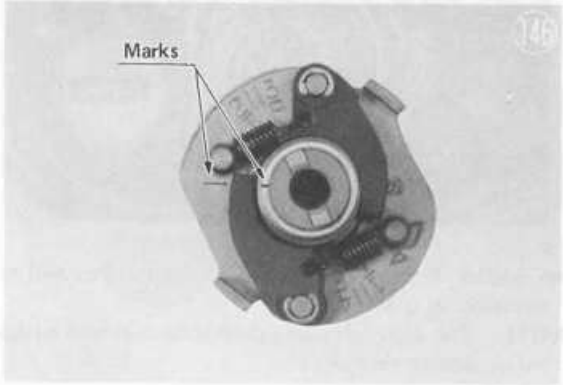
- Take the cam off the advancer.




- Unhook the two springs.
- Remove the two **C** rings, washers and weights.
- Remove the thrust washer from the advancer shaft.

### Assembly note:

- When reassembling the cam, align the mark on the cam with the mark on the advancer body.

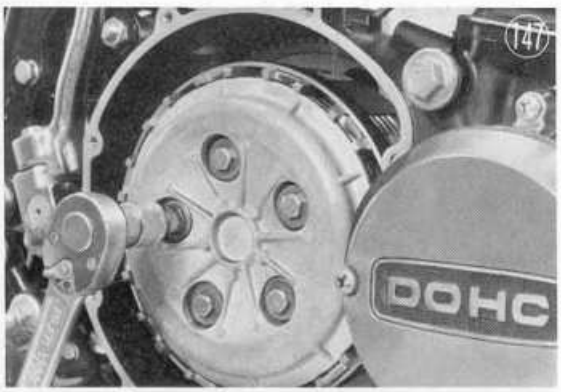



## CLUTCH HUB

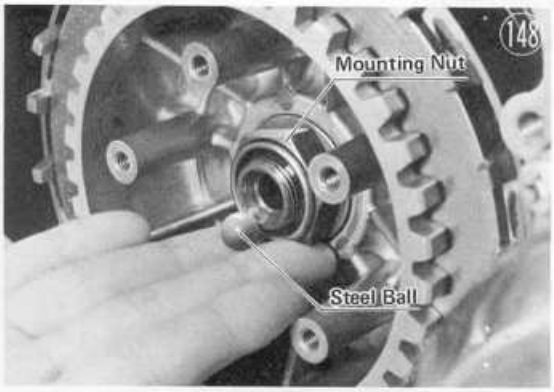
### Removal:

- Drain the engine oil. (See Fig. 53.) The oil inside the filter can be left in.

•Take off the clutch cover and gasket.
•Remove the bolts, clutch springs and spring plate.




•Take out the pusher and tilt the motorcycle so that the steel ball will fall out.




•Take out a few clutch plates, hold the clutch hub from turning using a special tool, and remove the mounting nut.




•A washer, the clutch hub and another washer will now come off in that order.

**NOTE:** The clutch housing cannot be removed without major disassembly work.

### Installation:

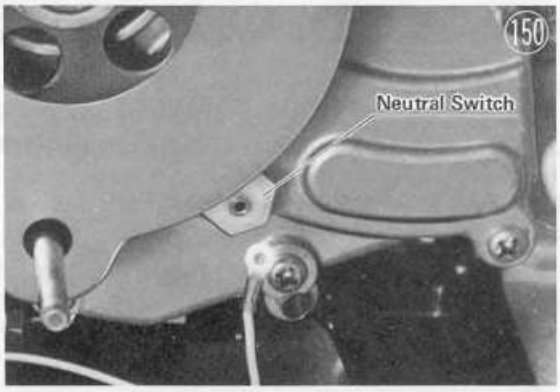
•Install the washer, clutch hub, and the other washer. Screw on the mounting nut and tighten it with 87~108 ft-lbs (12~15 kg-M) torque, holding the hub stationary with the special tool.

•Install all the friction and steel plates, starting with a friction plate and alternating them.
•Put the steel ball into the drive shaft, and follow it with the plate pusher.
•Install the spring plate, springs, and spring mounting bolts. Cross-tighten the bolts evenly.
•Mount the gasket and clutch cover.
•Fill the engine with SE or SD class SAE 10W-40, 10W-50 or 20W-50 weight motor oil, until the level at the window is between the upper and lower marks. (It will take about 3.5 quarts, or 3.3 litres.)

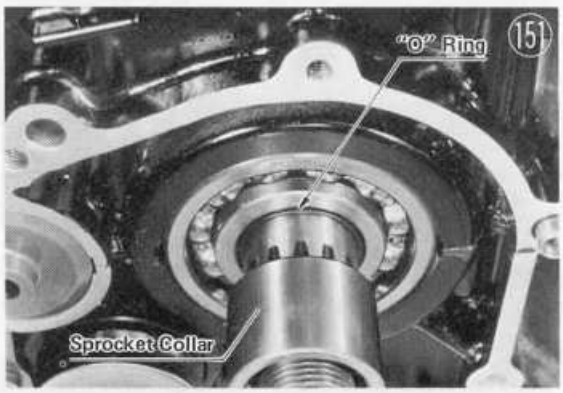
## EXTERNAL SHIFT MECHANISM

### Removal:

•Remove the chain cover (Pg. 35).
•Remove the engine sprocket (Pg. 39).
•Disconnect the wire from the neutral switch.



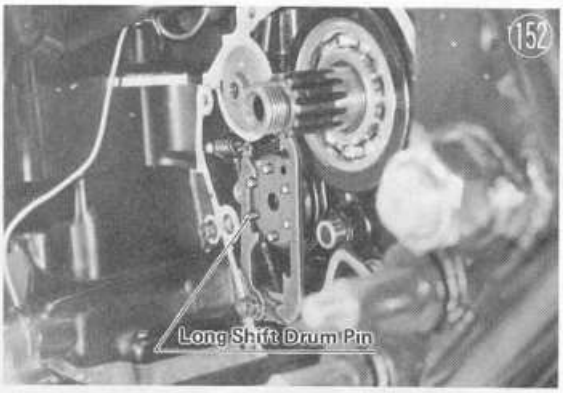

•Take off the transmission cover and gasket.
•Remove the sprocket distance collar, using a bearing puller if it is hard to get off, and take off the **O** ring.



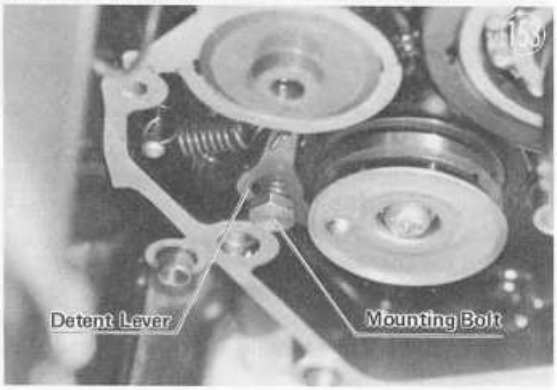

•Remove the shift lever assembly.
•Take out the detent lever mounting bolt, unhook the spring and remove the lever.

### Installation notes:

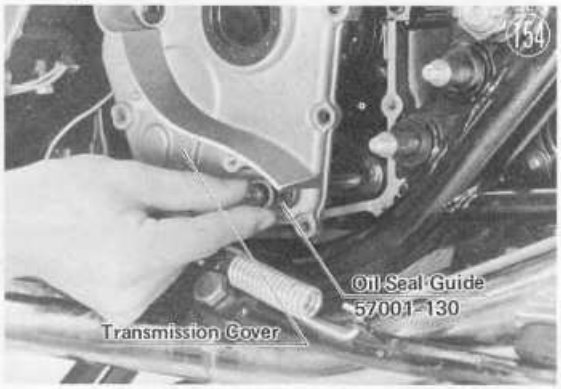
1. If the shift drum pins were removed, make sure the one long pin is assembled in the position shown. If this pin is assembled in the wrong position, the neutral indicator lamp will not light when the gears are in neutral.



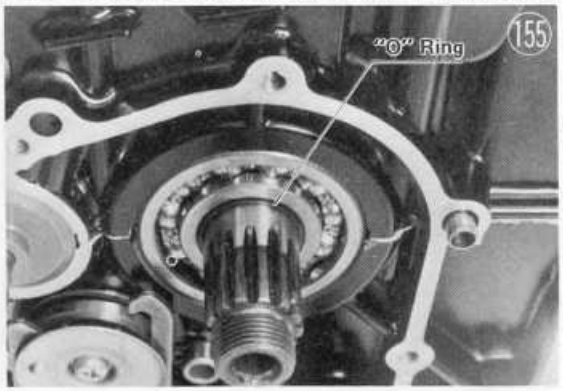

2. The detent lever must ride on the shoulder of its mounting bolt; take care it is not caught between the bolt and crankcase during installation.




3. Use an oil seal guide during transmission cover installation so that the shift shaft oil seal is not damaged.




4. Don't neglect installation of the **O** ring behind the sprocket, as oil leakage will occur if it is left out.

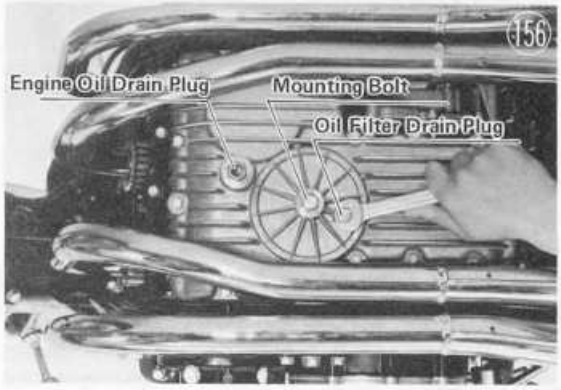



5. To avoid damage to the output shaft oil seal, the transmission cover must be put on before the sprocket collar is installed.
6. Apply grease to the push rod before installation.

## OIL FILTER

### Removal:

- Remove the filter drain plug and drain the oil from the filter.



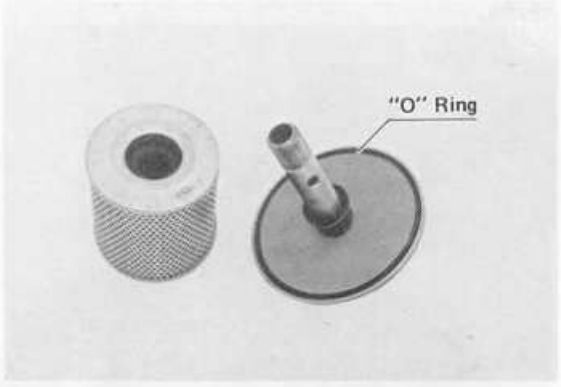

- Remove the mounting bolt and drop out the filter.




- Take off the rubber gaskets and remove the filter element.

### Installation note:

Make sure the **O** ring is properly in place.

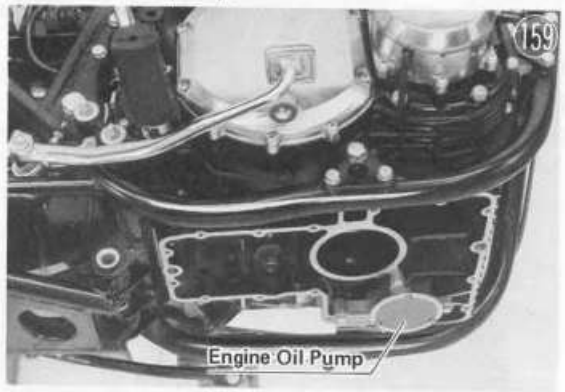



## ENGINE OIL PUMP

### Removal:

- Drain the engine oil and remove the oil filter (see Fig. 53).

- Remove the mufflers (Pg. 26).
- Take off the oil pan and gasket.
- Remove the oil pump.

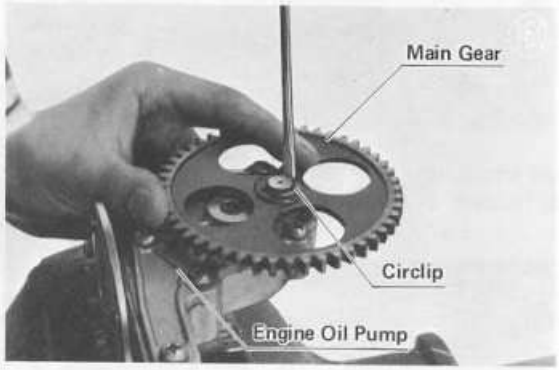



### Installation notes:

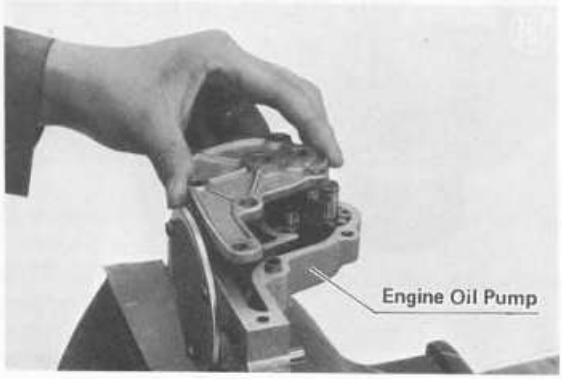
1. Be sure the pump and crankshaft gears mesh properly.
2. Apply Loctite to the pump mounting bolts and tighten them with 70 in-lbs (.8 kg-M) torque.

### Disassembly:

- Clamp the pump body in a vise, taking care not to deform or crack the pump body.
- Remove the circlip, main gear, alignment pin and shim.




- Remove the screws, and tap the two shafts alternately so as to split the pump halves without damaging the shafts.




### Assembly notes:

1. Clean both halves of the pump body mating surfaces and use a new gasket in assembly.
2. Use Loctite on the screws.

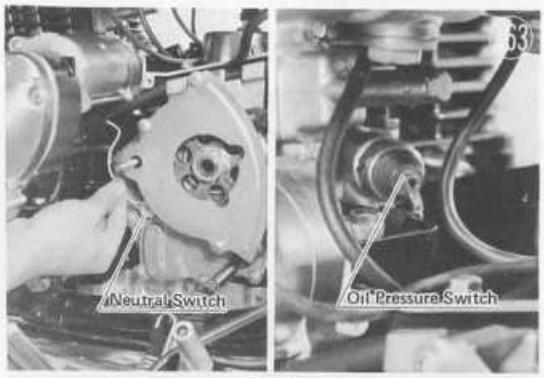
## TRANSMISSION

### Removal:

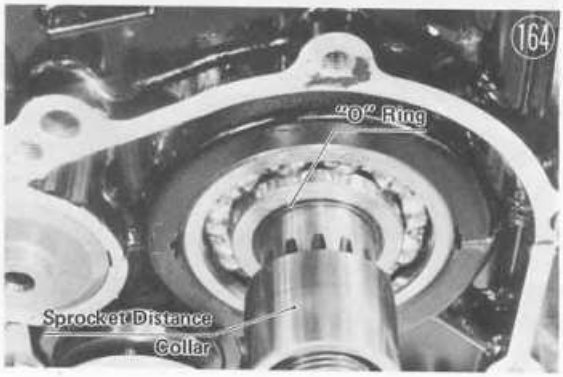
- Remove the complete engine from the frame (Pg. 23).
- Remove the kick pedal.
- Remove the kick spring cover and gasket.
- Pull out the spring guide, and unhook the spring and remove it.



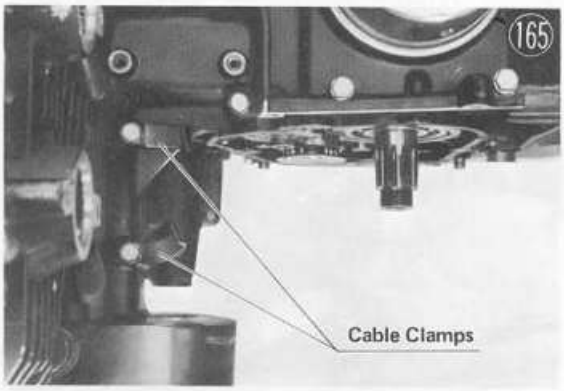

- Remove the clutch hub (Pg. 41) only if the clutch housing or the ball bearing is to be removed from the drive shaft.
- Remove the contact breaker cover, the complete breaker assembly and the automatic timing advancer assembly (Pg. 41). Then remove the right engine cover.
- Take the wires off the neutral lamp switch and the oil pressure switch.



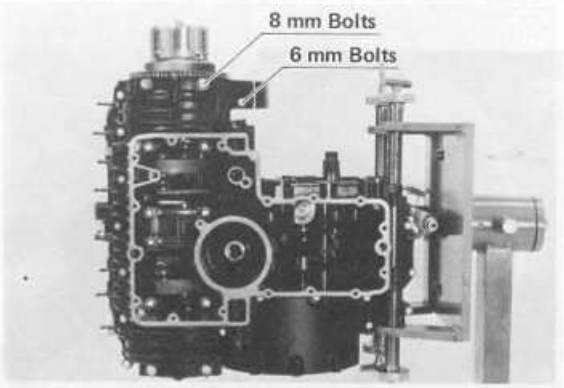

- Release the dynamo wires from the clamps and take off the dynamo cover and gasket.
- Take off the transmission cover and gasket.
- Take off the sprocket distance collar, using a bearing puller if it is hard to get off, and remove the O ring.



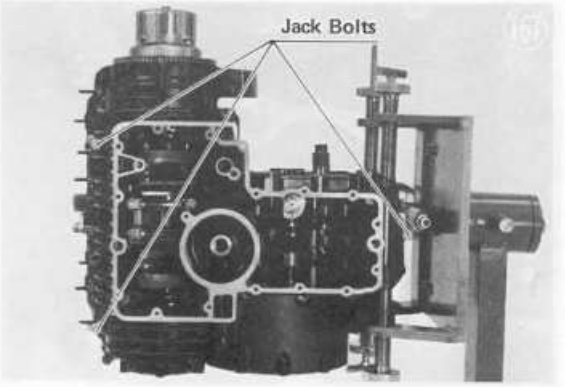
- Remove the shift lever assembly.
- Remove the starter (Pg. 36).
- Take out the 5 crankcase bolts from the top side of the engine, noting that cable clamps must be installed under two of them.



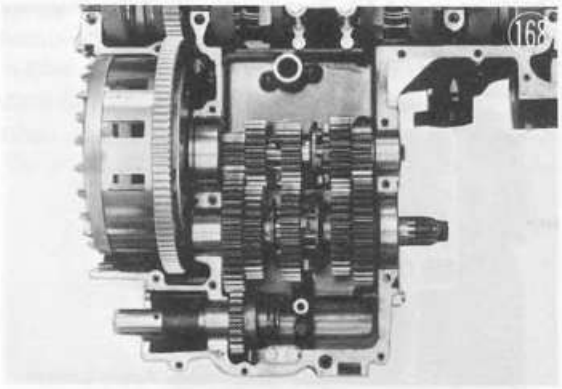

- Turn the engine upside down and remove the oil strainer, oil pan and pan gasket.
- Remove the oil pump.
- Remove the 17 6-mm crankcase bolts (cable clamps on two of them) and the 8 8-mm bolts. Be careful not to take out the 4 bolts that hold down the crankshaft.




- Screw three 8 mm bolts into the holes provided in the lower crankcase, and screw them in evenly to split the two crankcase halves apart.

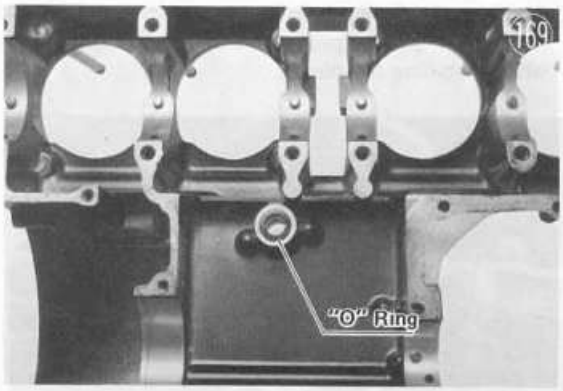



- The drive shaft, clutch housing, output shaft, and kick starter shaft can now be removed.

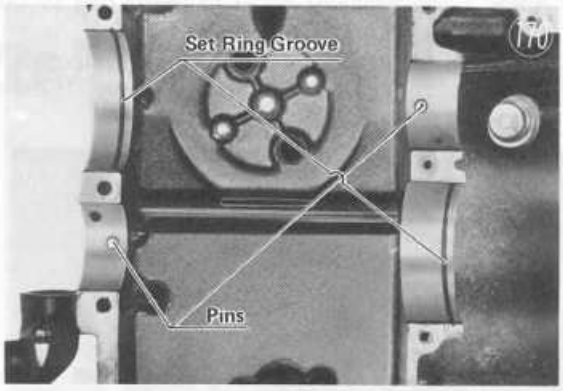



## Installation notes:

1. Make sure that the **O** ring for the main engine oil passage is in place before putting the crankcase halves back together.

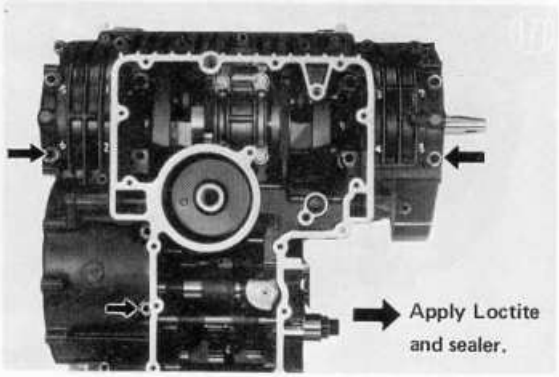



2. When installing the output, drive and kick shafts, the crankcase set pins must go into the holes in the respective bushings on the shafts. In addition, the set ring must fit into the groove in each ball bearing.

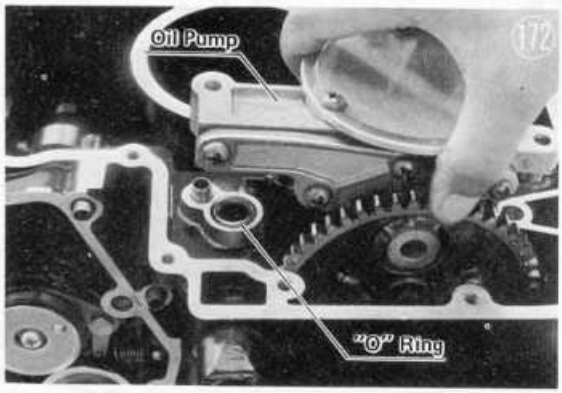



3. Before assembling the crankcase halves, clean the mating surfaces and apply liquid gasket to the surface of the lower half.

4. Tighten the 8 8-mm bolts with 18 ft-lbs (2.5 kg-M) torque, following the tightening order numbers on the lower crankcase. Apply Loctite to the threads of bolts No. 6 and No. 8, and apply #1 sealer (hardening type) to the underside of the bolt head.

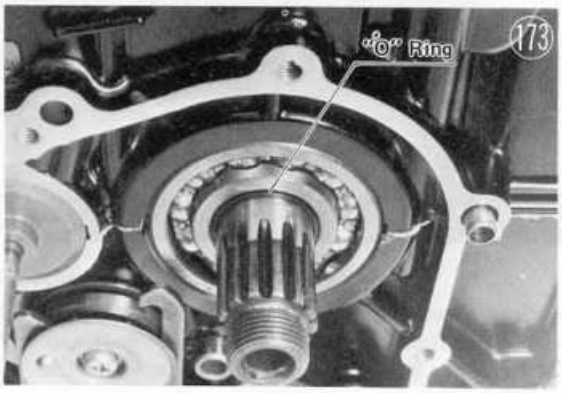



5. Tightening torque for the 22 6-mm bolts is 70 in-lbs (.8 kg-M). Apply Loctite to the threads of the bolt designated in Fig. 171, and apply #1 sealer (hardening type) to the underside of the bolt head.
6. See that the O ring is in place, and make sure the oil pump gear meshes properly with the crankshaft gear when installing the pump.




Use Loctite on the pump mounting bolts, tightening them with 70 in-lbs (.8 kg-M) torque.

7. Apply a small amount of oil to the O ring so that the starter will slip easily into place.
8. Don't fail to install the O ring on the output shaft before putting on the transmission cover. If the O ring is not in place, oil will leak.

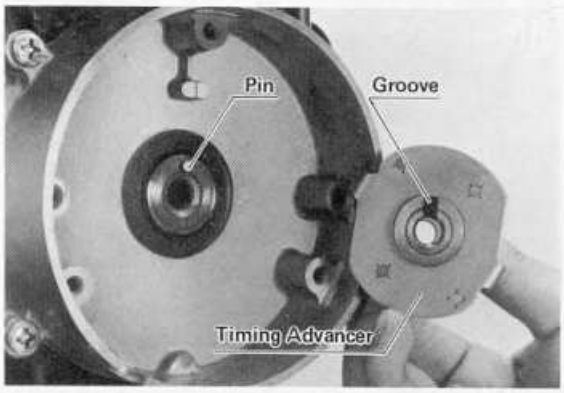



9. Use an oil seal guide to protect the oil seal when putting on the transmission cover, and install the sprocket distance collar after the cover is in place. If the collar is installed before the cover, the oil seal will be damaged.

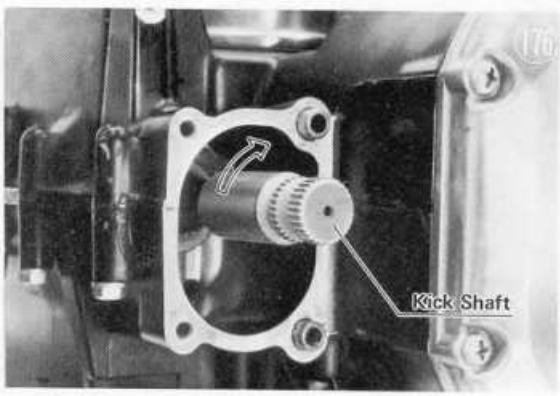



10. Use Loctite on the three upper right engine cover mounting screws.

11. When the timing advancer is installed, the pin on the crankshaft must fit into the groove in the advancer, and the crankshaft rotation nut must be properly seated before the mounting bolt is tightened.




12. The kick shaft should be turned fully clockwise before the spring is hooked into the hole in the shaft.



13. Use an oil seal guide to protect the oil seal when mounting the kick mechanism cover.




14. Adjust ignition timing (Pg. 14) when assembly is complete.

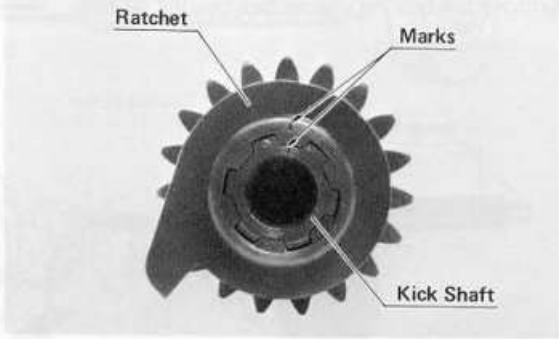
## KICK STARTER

### Disassembly:

- Remove the circlip ① and take the cap ② , coil spring ③ and ratchet ④ off the kick shaft ⑩ .
- Remove circlip ① , the washer ⑤ , kick gear ⑥ , washer ⑦ and bushing ⑧ from the shaft.

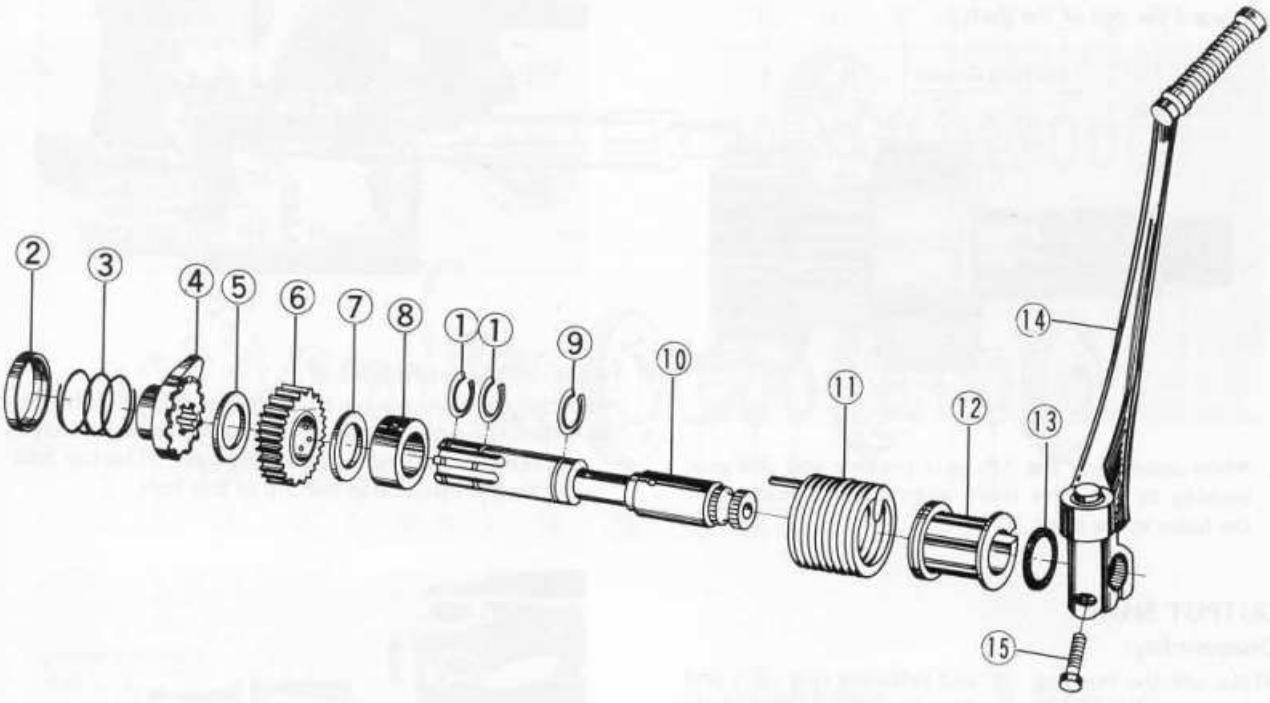
### Assembly note:

- When assembling the ratchet with the kick shaft, align the mark on the ratchet with the mark on the shaft.




Kick Starter

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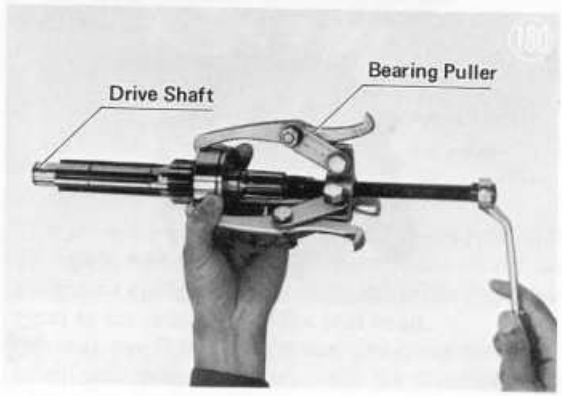



1. Retaining Ring
2. Cap
3. Coil Spring
4. Ratchet
5. Washer
6. Kick Gear
7. Washer
8. Bushing
9. Retaining Ring
10. Kick Shaft
11. Kick Spring
12. Spring Guide
13. Oil Seal
14. Kick Pedal
15. Clamp Bolt

## DRIVE SHAFT

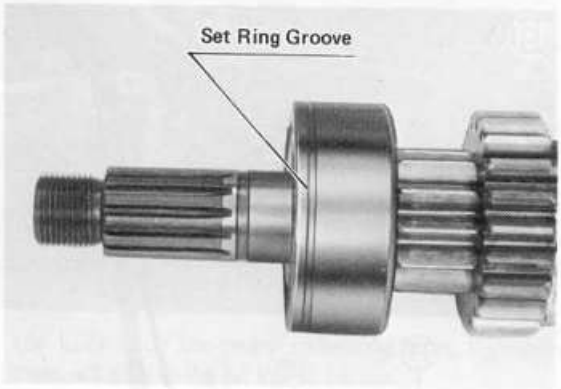
### Disassembly:

- When the bushing ① and retaining ring (circlip) ② are taken off, the shim ③, needle bearing ④, two washers ⑤ ⑥, 2nd gear ⑦, 5th gear ⑧, 5th gear bushing ⑨ and toothed washer ⑩ can be removed.
- Next remove retaining ring ⑪ and take 3rd gear ⑫ off the shaft.
- Remove another retaining ring ⑪, toothed washer ⑩ and 4th gear ⑬.
- Remove the bearing ⑭ with a bearing puller.




### Assembly notes:

1. Press on the ball bearing with the set ring groove toward the end of the shaft.




2. When assembling the 5th gear bushing and 3rd gear bushing to the drive shaft, align their oil holes with the holes in the shaft.

## OUTPUT SHAFT

### Disassembly:

- Take off the bushing ⑮ and retaining ring ②, and the shim ③, needle bearing ④, two washers ⑤ ⑥ 1st gear ⑯, and shim ⑰ will come off.
- 4th gear ㉙ has three steel balls ㉚ assembled into it for neutral positioning, so turn the shaft to move the balls while pulling off this gear.
- Remove the bearing ⑱ with a bearing puller and take the washer ⑲, 2nd gear ⑳, 2nd gear bushing ㉑ and toothed washer ㉒ off the shaft.
- Remove the retaining ring ㉓ and 5th gear ㉔.
- Remove the retaining ring ㉓, the toothed washer ㉒, 3rd gear ㉕ and washer ㉖

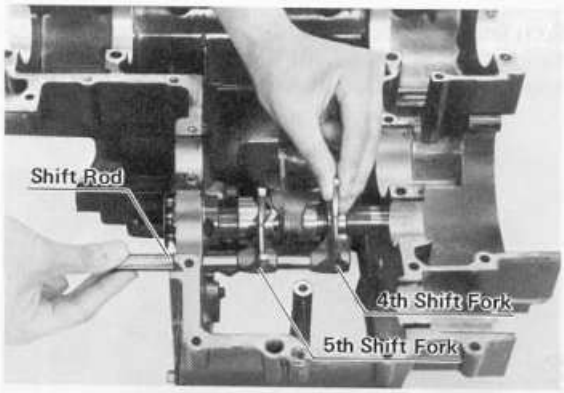
### Assembly notes:

1. When assembling 5th gear and 2nd gear to the shaft, align their oil holes with the holes in the shaft.
2. The ball bearing must be pressed on with the set ring groove toward the end of the shaft. (See Fig. 181.)
3. Don't use grease on the three steel balls during assembly; these balls must be able to move freely.

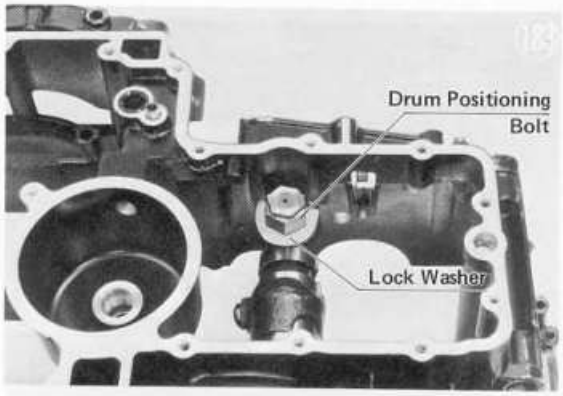
## SHIFT DRUM

### Removal:

- Remove the engine from the frame (Pg. 23).
- Split the crankcase as for transmission removal (Pg. 44).
- Tap the shift rod from the clutch end and pull it out, and take out the two (4th and 5th gear) shift forks.

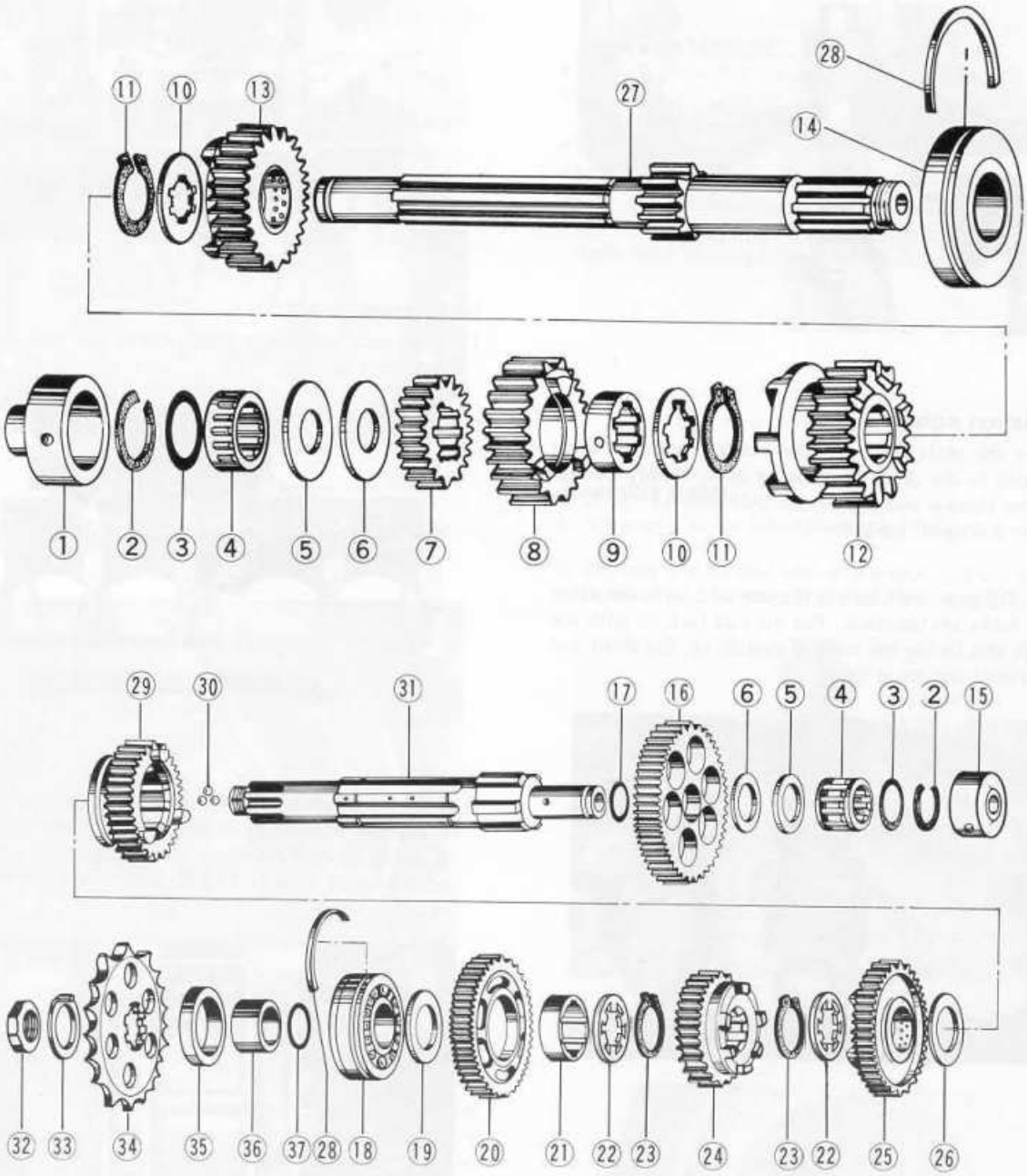



- Remove the detent arm.
- Flatten the lock washer and remove the shift fork pin.
- Flatten the bent-up ear of the lock washer, unscrew and remove the drum positioning bolt. The cap bolt may be left installed in the top of this bolt.



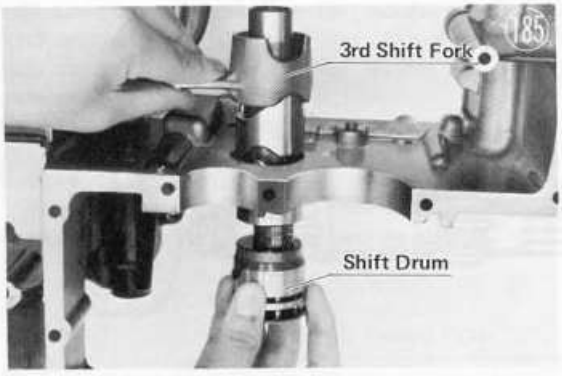
## Drive Shaft, Output Shaft

(184)




1. Bushing
2. Retaining Ring
3. Shim
4. Needle Bearing
5. Washer
6. Washer
7. 2nd Gear (D)
8. 5th Gear (D)
9. 5th Gear Bushing
10. Toothed Washer
11. Retaining Ring
12. 3rd Gear (D)
13. 4th Gear (D)
14. Bearing
15. Bushing
16. 1st Gear (O)
17. Shim
18. Bearing
19. Washer
20. 2nd Gear (O)
21. 2nd Gear Bushing
22. Toothed Washer
23. Retaining Ring
24. 5th Gear (O)
25. 3rd Gear (O)
26. Washer
27. Drive Shaft
28. Set Ring
29. 4th Gear (O)
30. Steel Balls
31. Output Shaft
32. Nut
33. Lock Washer
34. Engine Sprocket
35. Oil Seal
36. Engine Sprocket Collar
37. O Ring

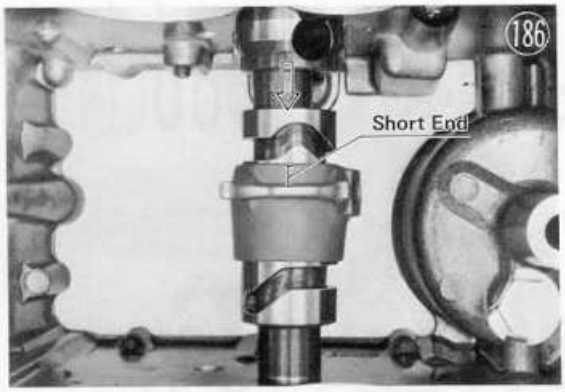
•Pull the shift drum out of the crankcase and the third (3rd gear) shift fork will come out.




**Installation notes:**

1. Turn the shift drum to the neutral position when putting in the drum positioning bolt. Apply Loctite to the threads and tighten the bolt with 44~57 ft lbs (6.0~8.0 kg-M) torque.

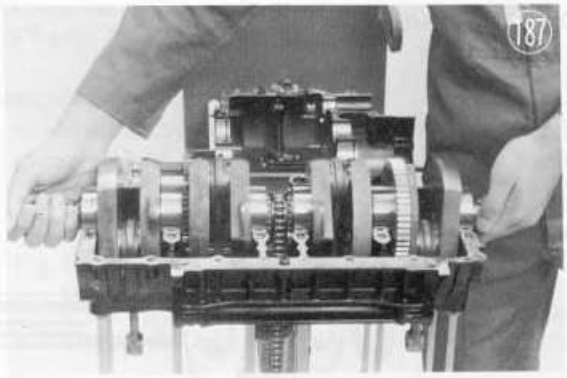
2. The 3rd gear shift fork is the one odd fork; the other two forks are identical. Put the odd fork on with the short end facing the neutral switch, i.e. the short end goes onto the drum first.




## CRANKSHAFT, CAM CHAIN

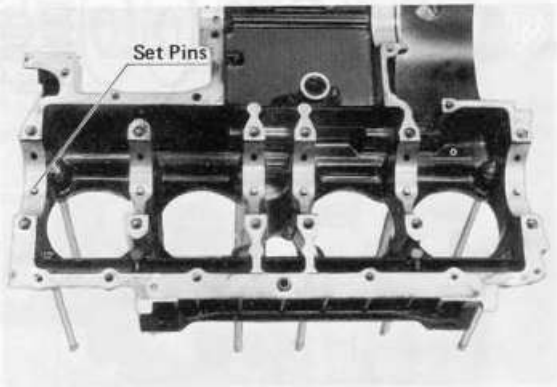
**Removal:**

- •Remove the complete engine from the frame (Pg. 23).
- •Remove the camshafts (Pg. 30).
- •Remove the cylinder head (Pg. 31).
- •Remove the cylinder block (Pg. 33).
- •Remove the pistons (Pg. 34).
- •Take out the chain guide wheel.
- •Split the crankcase (Pg. 44).
- •Remove the crankshaft bearing cap.
- •Take the crankshaft out of the upper crankcase half and slip the cam chain off it.

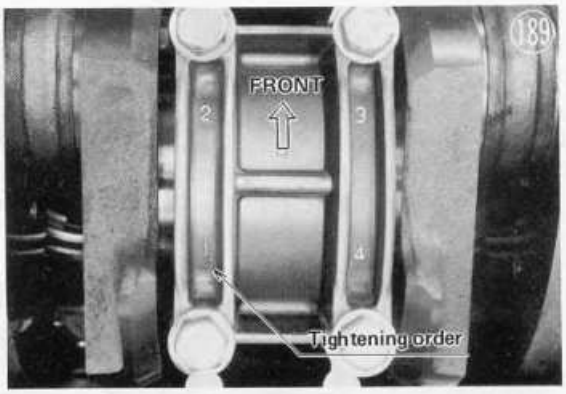



**Installation notes:**

1. Align each pin in the upper crankcase with the hole in the bearing.




2. The crankshaft bearing cap is bored together with the crankcase and so must be installed with the arrow pointing toward the front of the engine. Tighten the bolts with 18 ft-lbs (2.5 kg-M) torque, in the numbered order.



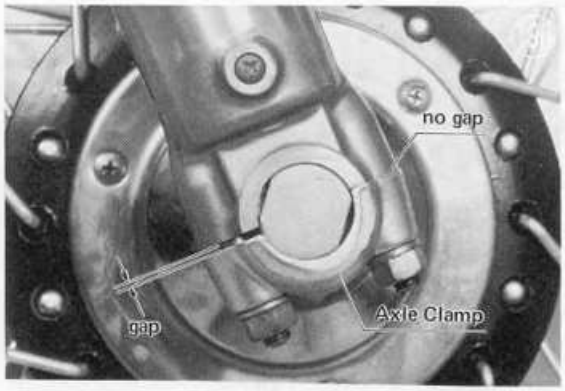

## FRONT WHEEL

**Removal:**

- •Disconnect the lower end of the speedometer cable with pliers.
- •Remove the axle clamps and use a jack under the engine so the wheel can be dropped out.

### Installation notes:

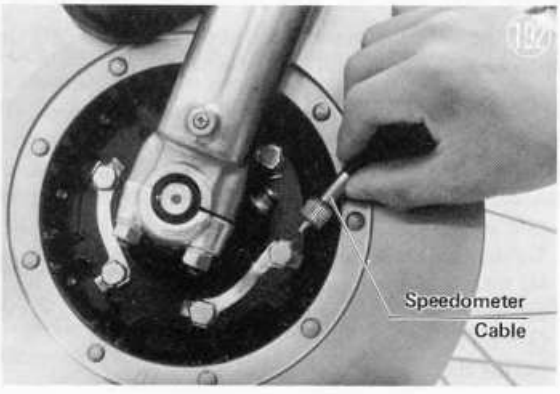
1. Using 13~14.5 ft-lbs (1.8~2.0 kg-M) torque, first tighten the front axle clamp bolt and then the rear bolt for each side, so that there will be a gap at the rear after tightening.




The axle clamp has a front and rear. If it is installed backward, the gap at the rear will be uneven.




2. Turn the front wheel while inserting the speedometer cable so that the tongue of the speedometer drive shaft will seat in the groove in the end of the cable.




## FRONT HUB

### Disassembly:

- Hold the gear box ⑨ stationary and unscrew the axle ⑰. If the axle is held stationary instead, the speedometer gear will be damaged.
- Take off the collar ⑱ and wheel cap ⑥.
- From the right side of the wheel, tap evenly around the inner race of the left bearing ④ and knock it out.
- Remove the distance collar ⑤.
- Remove the oil seal ②.
- Take out the retaining ring, ③ and from the left side of the wheel, tap evenly around the inner race of the right-hand bearing ④ and knock it out.

### Assembly notes:

1. See page 100 for lubrication information.
2. Replace the oil seal with a new one, and use a special purpose tool for oil seal and bearing installation.

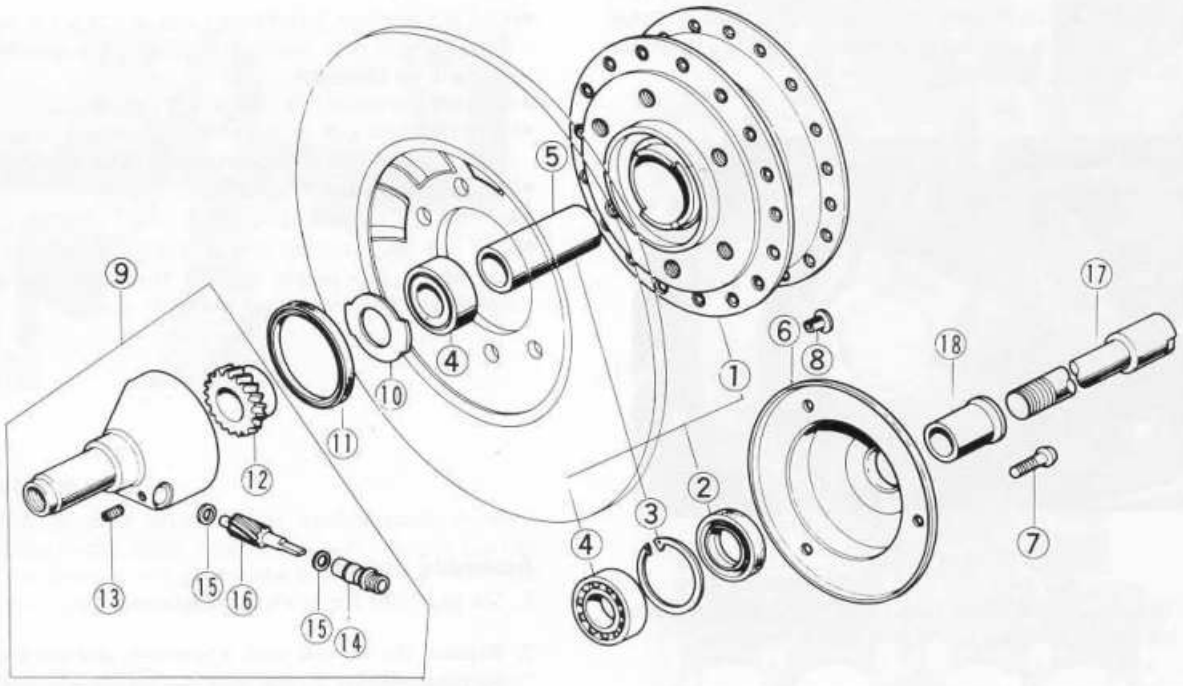



3. Align the parts as illustrated.




4. Hold the gear box stationary and screw in the axle. Don't hold the axle instead; otherwise, the speedometer gear drive will be damaged.

**Front Hub**



1. Drum Assembly
2. Oil Seal
3. Circlip
4. Bearing
5. Distance Collar
6. Wheel Cap
7. Screw
8. Cap
9. Gear Box
10. Speedometer Gear
11. Oil Seal
12. Speedometer Gear
13. Pin
14. Bushing
15. Washer
16. Speedometer Pinion
17. Axle
18. Collar

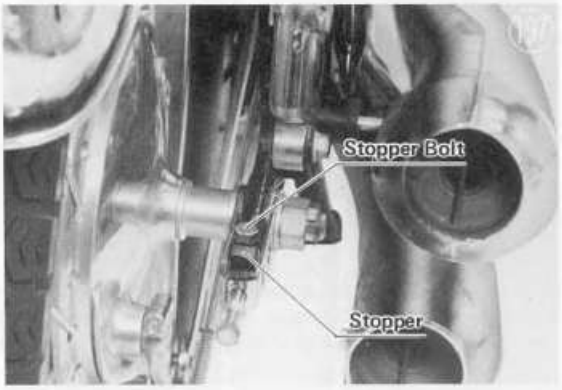
## REAR WHEEL

### Removal:

- Loosen the mountings for the right-hand mufflers.
- Remove the chain guard.
- Pull out the cotter pin and loosen the axle nut.




- Pull out the cotter pin and disconnect the torque link from its mounting.
- Disconnect the brake rod from the cam lever.
- Fully loosen both chain adjusters.
- Remove their bolts and take out the chain adjuster stoppers.



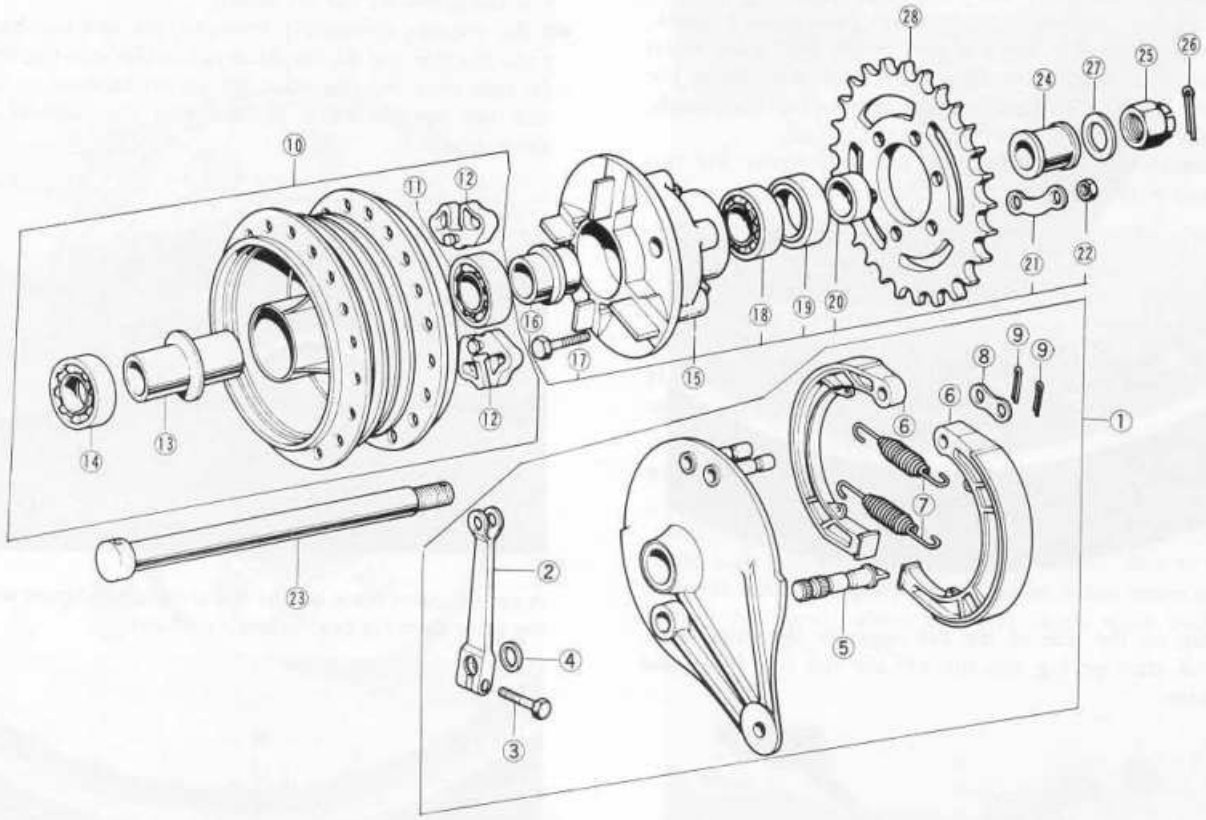

- Push the wheel forward to slip the chain off the sprocket, and then pull off the wheel.

### Installation notes:

1. Adjust the chain (Pg. 19) before tightening the axle and torque link nuts.
2. Tighten the axle nut with 95~115 ft-lbs (13~16 kg-M) torque and use a new cotter pin.
3. Tighten the torque link mounting with 22~25 ft lbs (3~3.5 kg-M) torque.
4. Adjust the rear brake (Pg. 18).

Rear Hub

(198)



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

### Brake shoe, brake cam disassembly:

- Remove the axle (23) and take out the panel assembly (1).
- Pull out the two cotter pins (9) and take off the double washer (8).
- Mark the position of the brake cam lever (2) on the camshaft, and remove the lever.
- Remove the dust seal (4), and prying the two brake shoes (6) up evenly, lift them off together with the brake cam (5).
- Separate the shoes from the cam and remove the springs (7).

### Coupling disassembly:

- Take the coupling assembly (15) from the hub and remove the shock damper rubbers (12).
- Remove the distance collar (16).
- Remove the axle sleeve collar (20) and oil seal (19).
- Tapping evenly around the inner race from the inside side of the coupling, knock out the bearing (18).

### Rear hub disassembly:

- Tapping evenly around the inner race from the sprocket side, knock out the panel side bearing (14).
- Remove the distance collar (13).
- Tapping on the inner race from the panel side, knock out the other ball bearing (11).

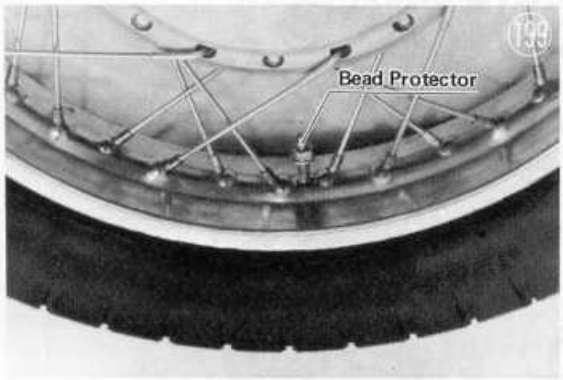
### Assembly notes:

1. See page 100, 109 for lubrication information.
2. Use new oil seals in place of any that were removed.
3. Use a special purpose tool for bearing and oil seal installation. (See Fig. 193.)

## TUBE, TIRE

### Removal:

- Remove the wheel from the motorcycle (Pg. 50, 52).
- Mark the valve stem position on the tire with chalk, so that the tire will not get turned and upset wheel balance. Also mark the direction of rotation on the tire so that it does not get remounted backwards.
- Take out the valve core and let out the air.
- Remove the valve stem nut, and fully loosen the two bead protector nuts.




- Step on the side of the tire opposite the valve stem, and start prying the tire off the rim near the valve stem.

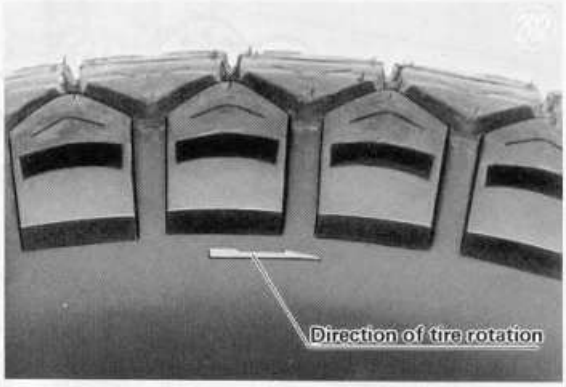



- Remove the tube when one side of the tire is pried off.
- Pry the tire off one of the bead protectors and then pry the other side of the tire off the rim.

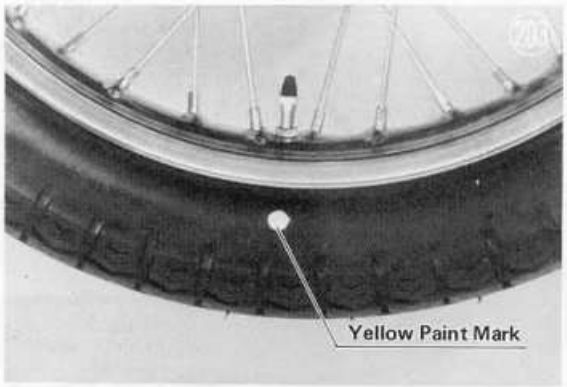



### Installation:

- Put just enough air in the tube to keep it from getting caught between the tire and rim, and insert it into the tire at this point, even if the tire was completely removed from the rim. Insert the valve stem into the rim and screw the nut on loosely.
- 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 direction.




A yellow paint mark on the tire should be aligned with the valve stem for best balancing results.

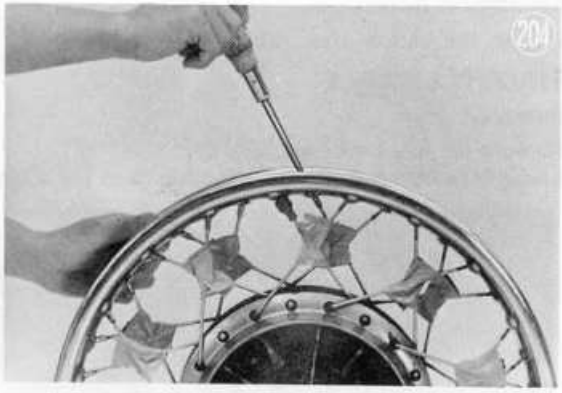


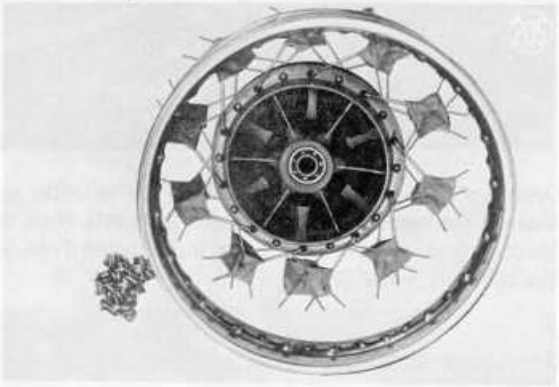

- Pry the other side of the tire onto the rim, starting at the side opposite the valve. Take care not to insert the tire irons so deeply that the tube is damaged.
- Check that the tube is not pinched between the tire and rim, and fill it with air to the specified pressure (Pg. 96).
- Tighten the bead protector and valve stem nuts, and put on the valve cap.
- Mount the wheel on the motorcycle (Pg. 50 52), and balance the wheel (Pg. 17). In the case of the rear wheel, leave the chain off the sprocket until balancing is completed.

## RIM

### Removal:

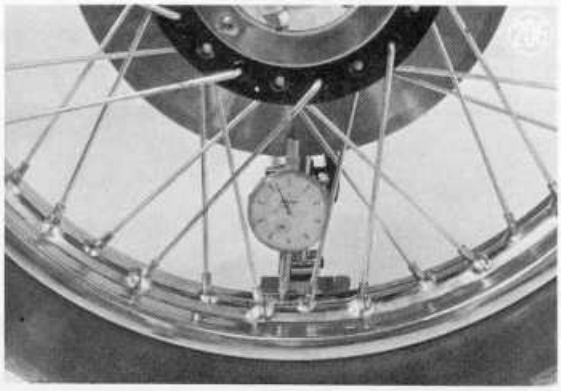
- Remove the wheel from the motorcycle (Pg. 50, 52).
- Take the tire and tube off the rim (Pg. 54).
- Tape or wire all the spoke intersections so that the spokes don't get mixed up, and unscrew the nipples from all the spokes with a screwdriver.





### Installation:

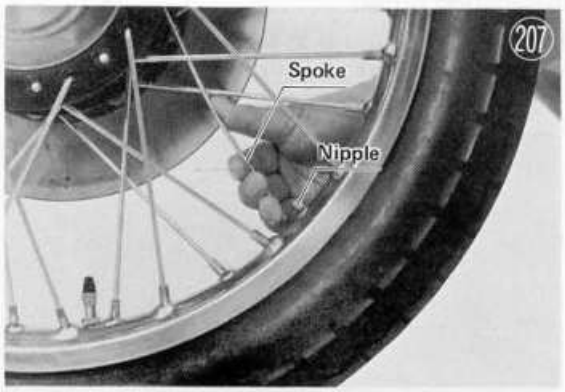
- Fit all the spokes through the holes and screw all the nipples onto the spokes, tightening them partially.
- Suspend the wheel on the axle and set up dial gauges to measure rim runout.



- Tighten the spokes evenly so that both axial (side to side) runout and radial (out from the axle) runout are less than .04 inch (1 mm). (See page 98).
- Make sure the spokes are tightened evenly. (Standard torque is 22~26 in-lbs or 25~30 kg-cm).
- Mount the tube, tire (Pg. 54) and mount the wheel on the motorcycle (Pg. 50, 52).
- Balance the wheel (Pg. 17).

### SPOKE (breakage replacement)

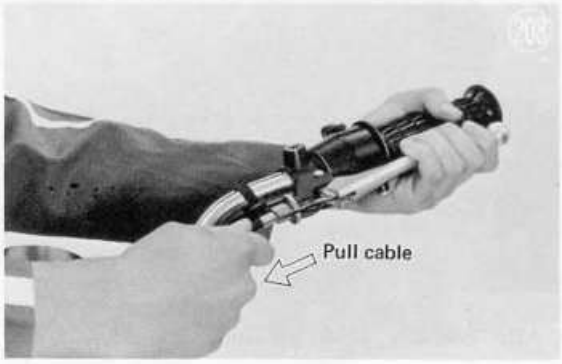
- Reduce tire air pressure by a small amount.
- Insert the new spoke through the hub, and bend it to meet the nipple. Tighten it with a spoke wrench.



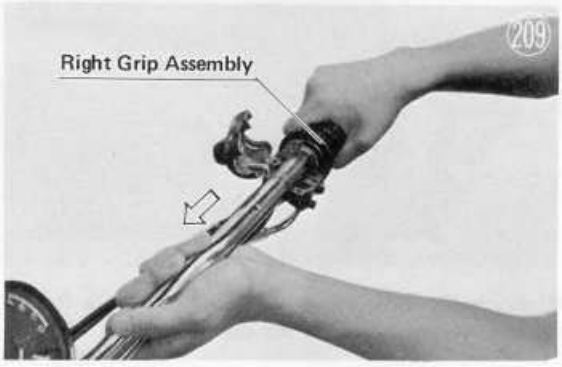

## HANDLEBAR

### Removal:

- Take off the rear-view mirrors.
- Unhook the clutch cable from the clutch lever as follows: Loosen the knurled lock nut and turn the adjusting screw in fully, lining up the slots in the screw and lock nut with the slot in the lever. Pull in the clutch lever, and grasping the clutch cable sleeve with the other hand, release the lever slowly while pulling on the cable to free it.




- Remove the left switch assembly.
- The left handlegrip is bonded to the handlebar so cut the rubber off.
- Loosen the mounting bolts and slide the clutch lever assembly off the handlebar.
- Unbolt the disc brake master cylinder assembly and take it off the handlebar.
- Loosen the right switch assembly mounting.
- Remove the handlebar clamp and slide the handlebar out of the right handlegrip assembly.

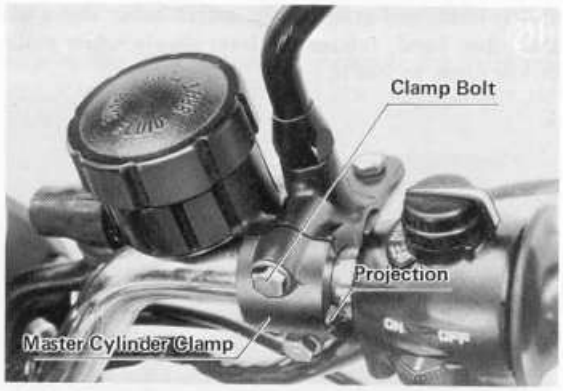


**Installation notes:**

1. Mount the handlebar at an angle conforming to that of the front fork, and tighten the clamp bolts with 18 ft-lbs (2.5 kg-M) torque.




2. The master cylinder clamp is installed with the small projection toward the throttle grip. First fully tighten the lower clamp bolt and then tighten the upper bolt with 55~75 in-lbs (63~88 kg-cm) torque.

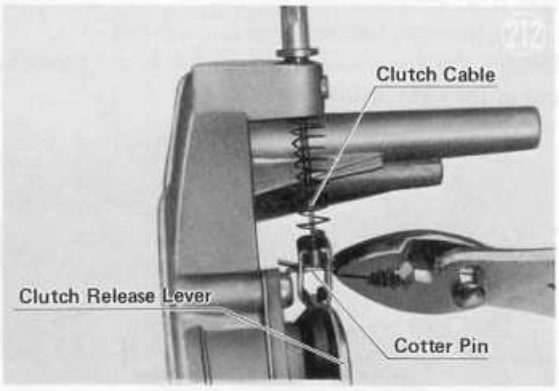



3. After assembly, adjust the clutch (Pg. 13 ).

## CLUTCH CABLE

**Removal:**

- Remove the left foot rest and take off the chain cover (Pg. 35 ).
- Pull the cotter pin out of the clutch release lever and unhook the clutch cable.




- Unhook the other end of the clutch cable from the clutch lever and remove the cable.

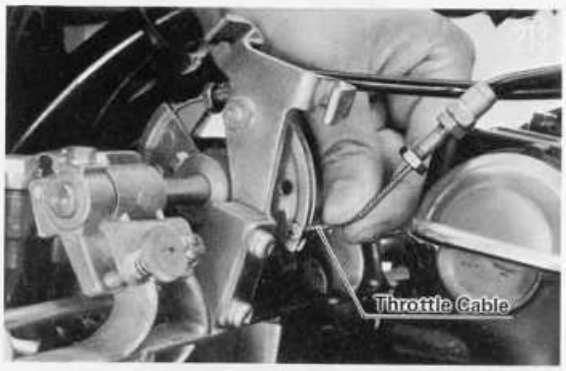
**Installation note:**

- Adjust the clutch after cable installation (Pg. 13 ).

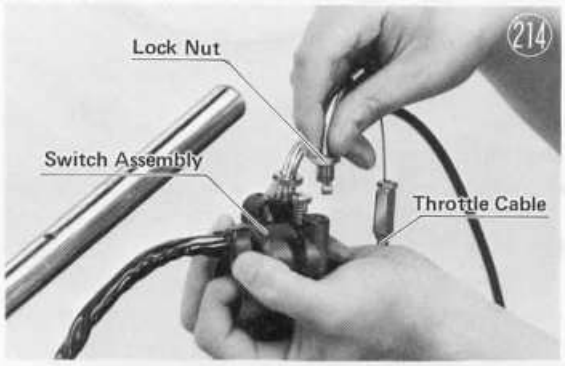
## THROTTLE CABLE

**Removal:**

- Remove the fuel tank (Pg. 27 ).
- Loosen the nuts and unhook the cable from the pulley.




- Open up the swtich assembly on the throttle grip side of the handlebar and unhook the cable from the throttle grip. Then loosen the lock nut and remove the cable.




**Installation note:**

- Adjust throttle grip play after cable installation (Pg.11).

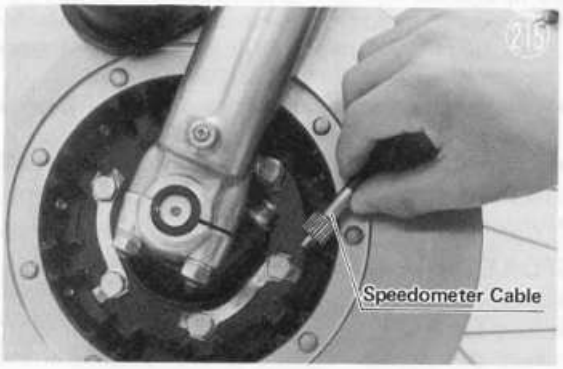
## SPEEDOMETER CABLE

**Removal:**

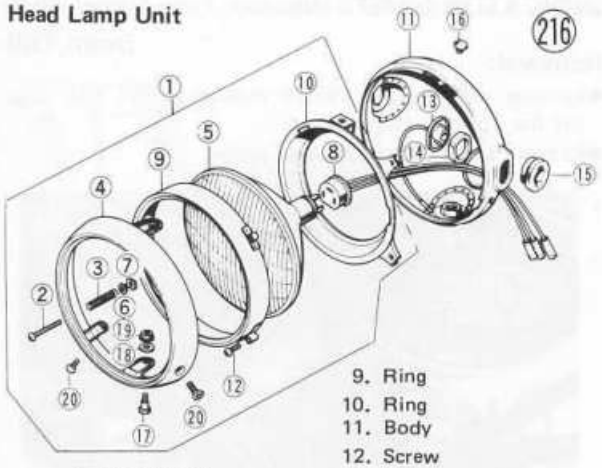
- Unscrew the cable at either end using pliers.

**Installation note:**

- Turn the front wheel while pushing the cable into the hub, so that the projection on the speedometer drive shaft seats in the groove in the end of the cable.



**Head Lamp Unit**



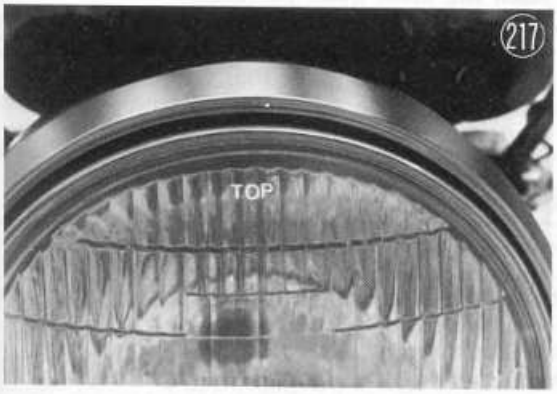
1. Head Lamp
2. Adjusting Screw
3. Spring
4. Rim
5. Sealed Beam Unit
6. Washer
7. Nut
8. Socket
9. Ring
10. Ring
11. Body
12. Screw
13. Collar
14. Damper Rubber
15. Damper Rubber
16. Plug
17. Screw
18. Washer
19. Nut
20. Screw

### Removal:

- Take out the two mounting screws and swing out the headlight. For semi-sealed beam units, the bulb can now be removed.
- Unplug the headlight wires.
- Remove the beam adjust screw and the rim holder screws, and the rim will come off.
- Take out the mounting screws, remove the mounting ring and retaining ring, and the sealed-beam unit (or lens unit for semi-sealed headlights) will be free.

### Installation notes:

1. The top of the sealed-beam unit is marked **TOP**.

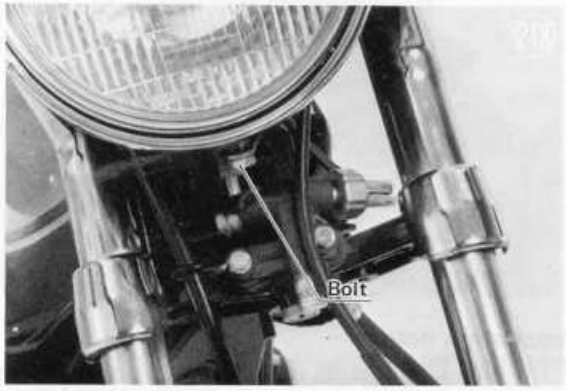



2. Make horizontal beam adjustment after installation (Pg. 20 ).

## SPEEDOMETER, TACHOMETER

### Removal:

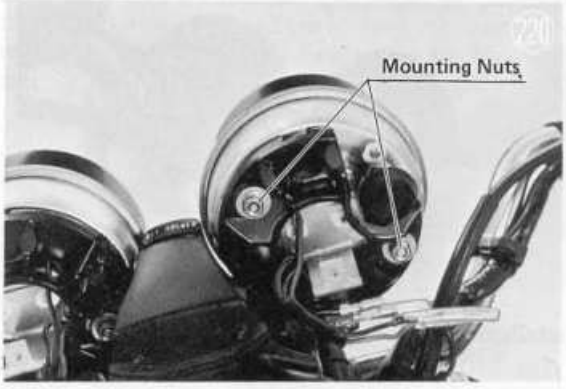
- Remove the two head lamp unit mounting screws from the sides of the headlight to drop the lamp unit out the front, and unplug the headlight wires.
- Remove the bolt from the underside of the headlight housing.




- Disconnect the turn signal wires and the two main wiring harness connectors.
- Take off the nuts and remove the turn signals, and pull off the headlight housing.



- Remove the meter cover, and disconnect the meter cables.
- Unplug the meter wires, remove the meter mounting nuts, and take off the meters separately.




- The meter illumination lamps can be taken out with the meters removed.




### Installation notes:

1. Use only 12 volt bulbs of the correct wattage (see the wiring diagram) for meter illumination lamp replacement.
2. The left turn signal wire goes to the green wire, and the right turn signal wire is connected to the gray wire.
3. Adjust the vertical head lamp aim before tightening the turn signal lamp nuts and the bolt at the bottom of the headlight (Pg. 20).

## IGNITION SWITCH

### Removal:

- Take out the two screws from the sides of the headlight housing, drop the head lamp unit out the front and unplug it.
- Remove the bolt from the underside of the headlight housing. (See Fig. 218.)
- Disconnect the turn signal wires and unplug the two main wiring harness connectors.
- Unscrew the nuts to remove the turn signals, and take off the headlight housing. (See Fig. 219.)
- Remove the three cover mounting screws and take off the lower switch cover.
- Remove the switch lower cover, mounting nut, and remove the ignition switch.



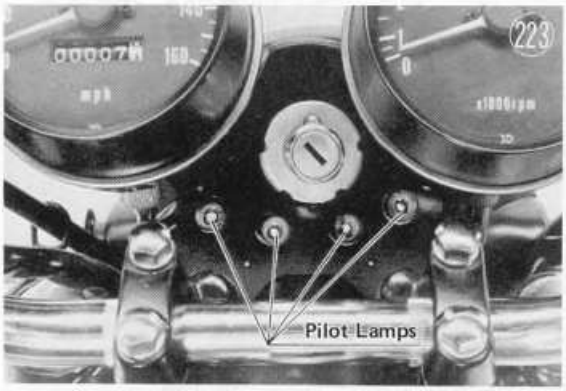

### Installation notes:

1. The left turn signal wire goes to the green wire, and the right turn signal wire is plugged into the gray wire.
2. Adjust the vertical aim of the headlight before tightening the turn signal mounting nuts and the bolt at the bottom (Pg. 20 ).

## INDICATOR LAMPS (Neutral, Turn Signal, High Beam, Oil)

### Removal:

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




### Installation note:

- Use 12 volt bulbs of the correct wattage (see the wiring diagram) for indicator lamp replacement.

## DISC BRAKE

CAUTION:

1. **Use only disc brake fluid, isopropyl alcohol or ethyl alcohol for cleaning brake parts, but do not allow rubber parts to remain in contact with these fluids for a long period of time.**
2. **Brake fluid will damage painted surfaces; any spilled fluid should be wiped off immediately.**
3. **Do not use gasoline, motor oil, or any other mineral oils near disc brake parts; these oils cause deterioration of rubber brake parts. If oil spills on any brake parts it is very difficult to wash off and will eventually reach and break down the rubber.**
4. **If any of the brake line fittings or the bleeder valve is loosened at any time, the AIR MUST BE BLED FROM THE BRAKE (Pg. 105).**
5. **Prescribed torque values for tightening disc brake parts mountings are as follows:**

**Table 1 Disc Brake Torque**

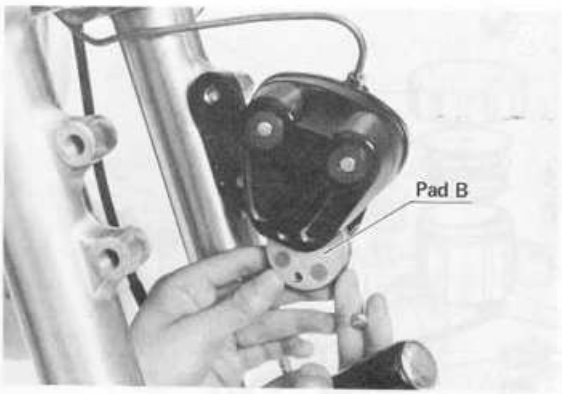
| | | |
|---|---|---|
| Brake lever | 45~60 in-lbs | 0.5~0.7 kg-M |
| Brake lever adjuster | 70~100 in-lbs | 0.8~1.2 kg-M |
| Master cylinder clamp | 55~75 in-lbs | 0.63~0.88 kg-M |
| Fitting (banjo) bolts | 19~23 ft-lbs | 2.5~3.3 kg-M |
| Brake pipe nipple | 150~155 in-lbs | 1.7~1.8 kg-M |
| 3-way fitting mounting | 45~50 in-lbs | 0.5~0.6 kg-M |
| Pressure switch | 135~170 in-lbs | 1.5~2.0 kg-M |
| Caliper shafts | 22~26 ft-lbs | 3.0~3.6 kg-M |
| Caliper mounting | 19~23 ft-lbs | 2.5~3.3 kg-M |
| Bleeder valve | 70~85 in-lbs | 0.8~1.0 kg-M |
| Disc mounting bolts | 140~190 in-lbs | 1.6~2.2 kg-M |

## BRAKE PADS (See CAUTION above)

### Removal:

- Remove the front wheel (Pg. 50 ).

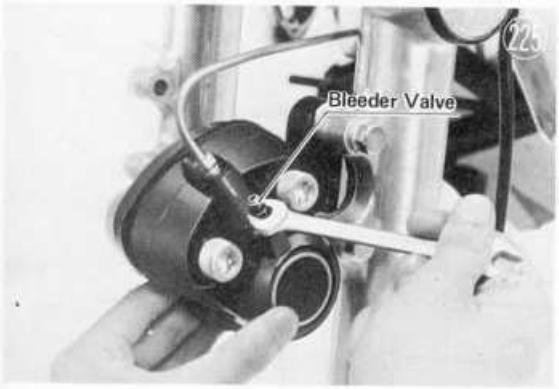
•Take out the mounting screw for pad B and remove the pad.




•With pad B removed, squeeze the brake lever several times until the piston pushes pad A out.

### Installation:

•Loosen the bleeder valve slightly, push the piston in by hand as far as it will go, and close the valve.




•Align the groove of pad A with the ridge in the caliper and insert the pad.

•Install pad B, using Loctite on the mounting screw.

•Since fluid was spilled when the bleeder valve was opened, check the fluid level in the master cylinder reservoir.

## MASTER CYLINDER (See CAUTION pg. 58)

### Removal:

•Take off the right rear view mirror.

•Remove the banjo bolt to disconnect the brake hose.

•Remove the clamp bolts and take off the master cylinder assembly.

### Installation notes:

1. The master cylinder clamp is installed with the small projection toward the throttle grip. Tighten the lower clamp bolts first, then tighten the upper bolts, all with the specified torque (Table 1).




2. Bleed the brake line after master cylinder installation (Pg. 105).

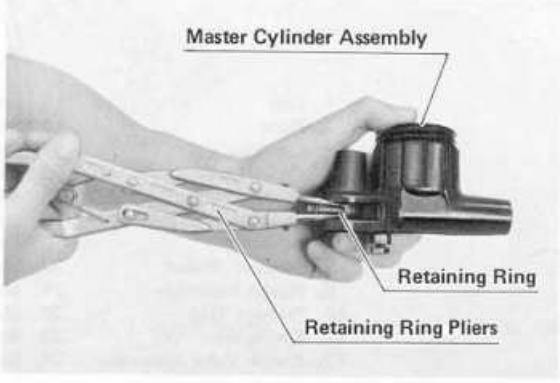
### Master cylinder disassembly:

•Take off the reservoir cap ① , and after removing the diaphragm plate ② and diaphragm ③ , empty out the brake fluid.

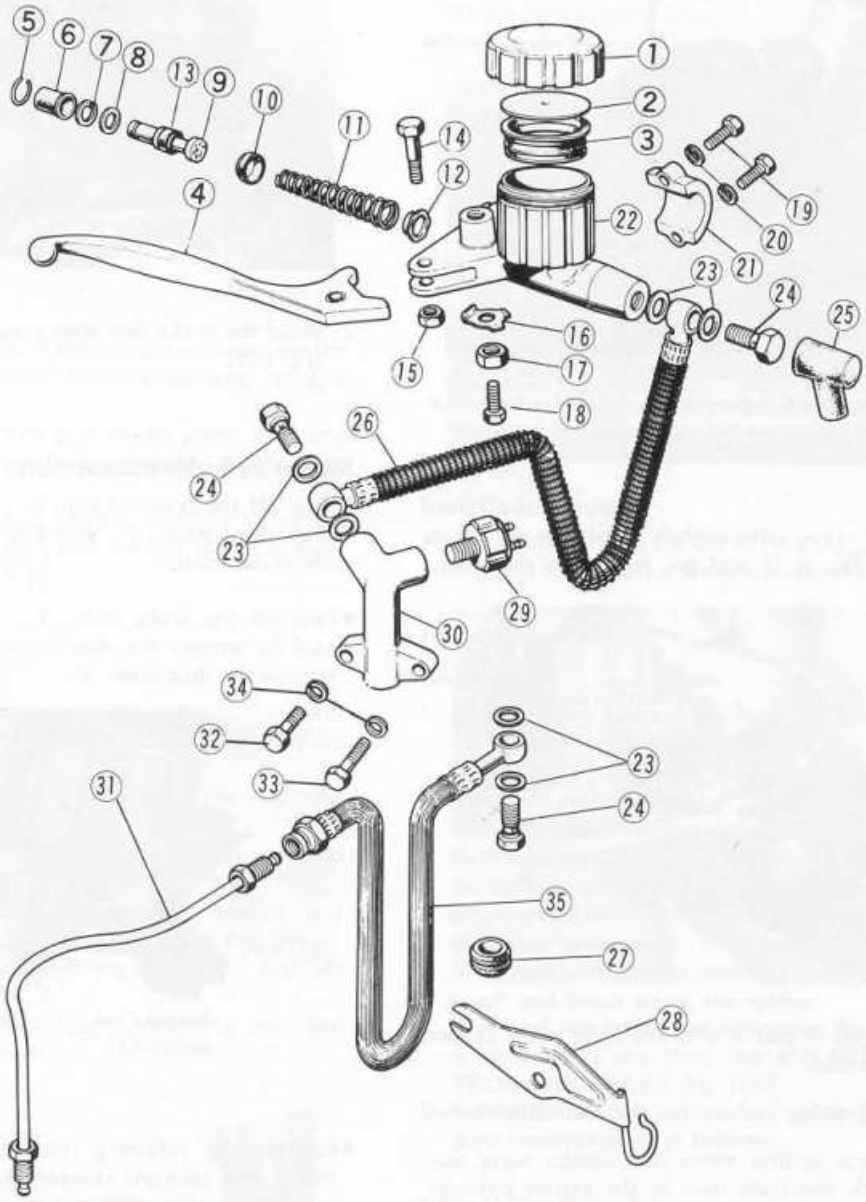
•Take off the brake lever ④ . Use a special purpose tool to remove the dust cover stopper ⑤ , and then remove the dust cover ⑥ .




•Remove the retaining ring ⑦ with retaining ring pliers, and take the stopper ⑧ , piston ⑨ , primary cup ⑩ , spring ⑪ , and check valve ⑫ out of the master cylinder body. Do not remove the secondary cup ⑬ from the piston as removal damages the cup.



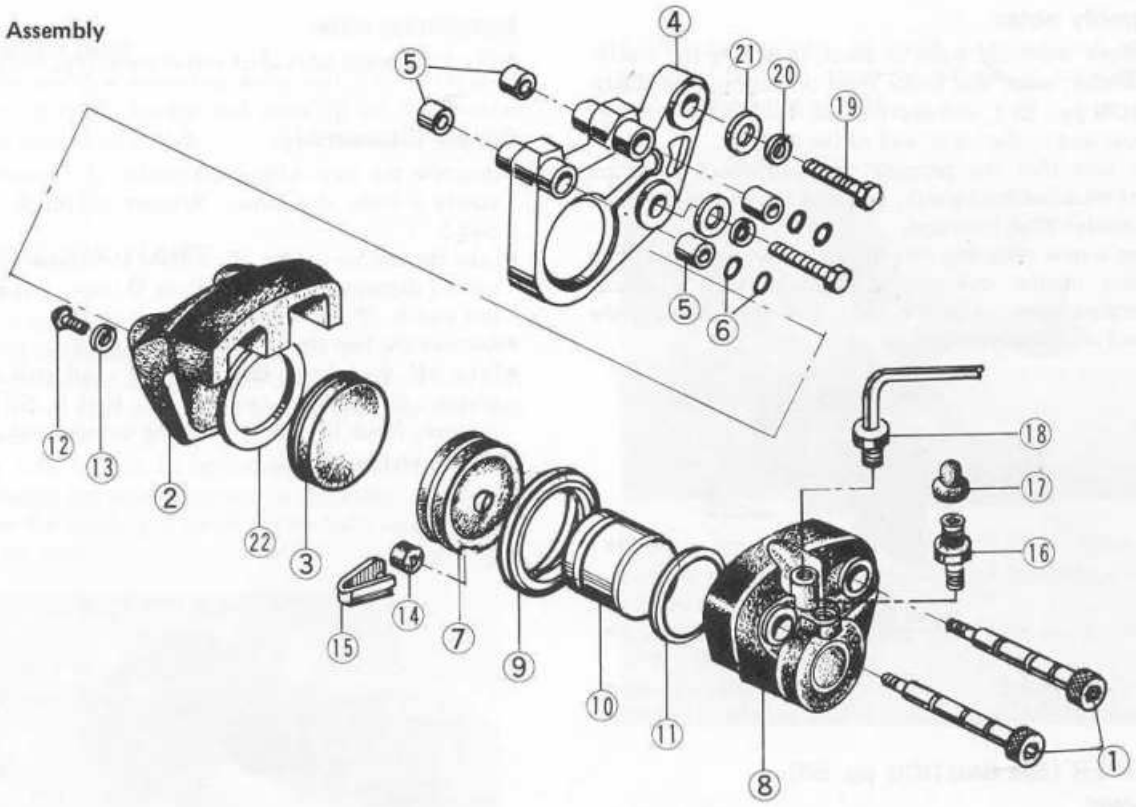
229



1. Cap
2. Plate
3. Cap Seal
4. Brake Lever
5. Stopper, Dust Seal
6. Dust Seal
7. Circlip
8. Stopper, Piston
9. Piston Assembly
10. Primary Cup
11. Spring Assembly
12. Check Valve Assembly
13. Secondary Cup
14. Bolt
15. Nut
16. Lock Washer
17. Nut
18. Bolt
19. Bolt
20. Washer
21. Master Cylinder Mounting
22. Master Cylinder Body
23. Washer
24. Banjo Bolt
25. Dust Cover
26. Hose
27. Grommet
28. Bracket
29. Pressure Switch
30. 3-Way Fitting
31. Pipe
32. Bolt
33. Bolt
34. Washer
35. Hose

## Caliper Assembly

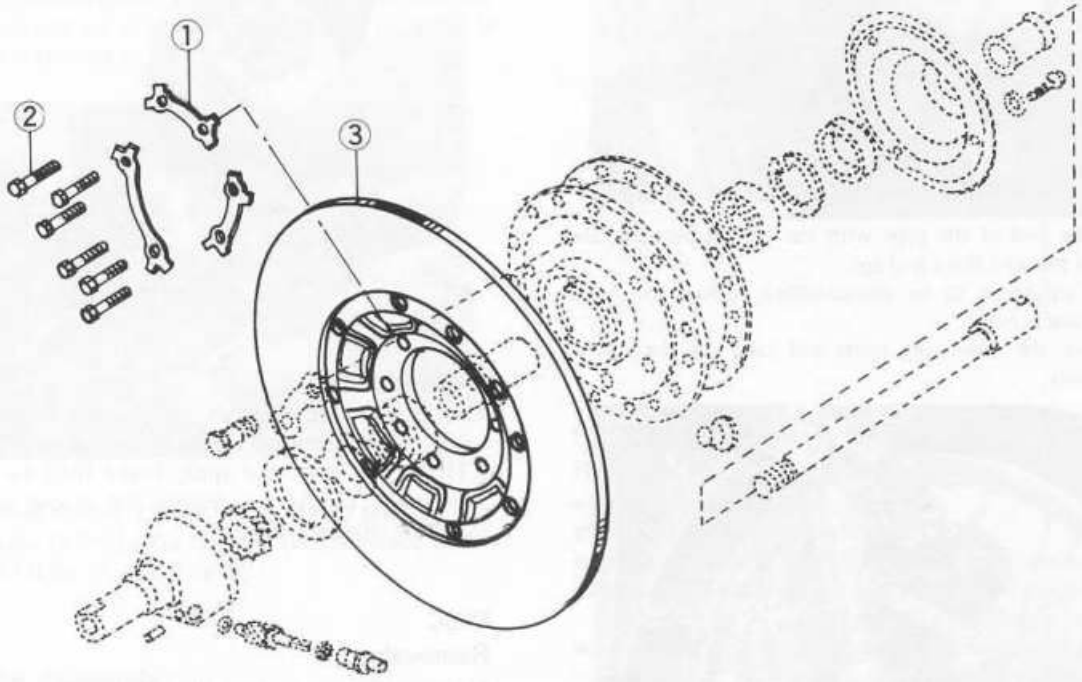
(230)




1. Allen-head Shaft
2. Caliper B
3. Pad B
4. Caliper Holder
5. Boots
6. O Ring
7. Pad A
8. Caliper A
9. Piston Dust Seal
10. Piston
11. Seal
12. Screw
13. Lock Washer
14. Bushing
15. Stopper
16. Bleeder Valve
17. Bleeder Valve Cap
18. Nipple
19. Mounting Bolt
20. Lock Washer
21. Washer
22. Ring

## Disc

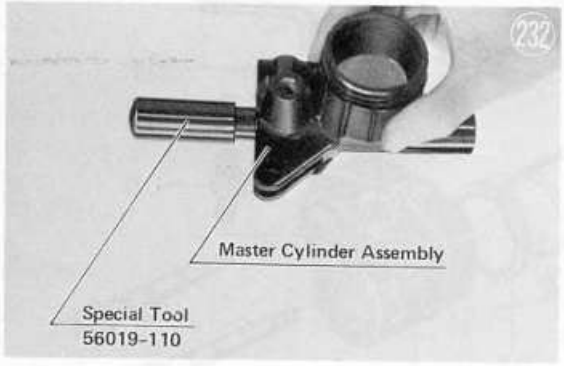
(231)




1. Lock Washer
2. Bolt
3. Disc

### Assembly notes:

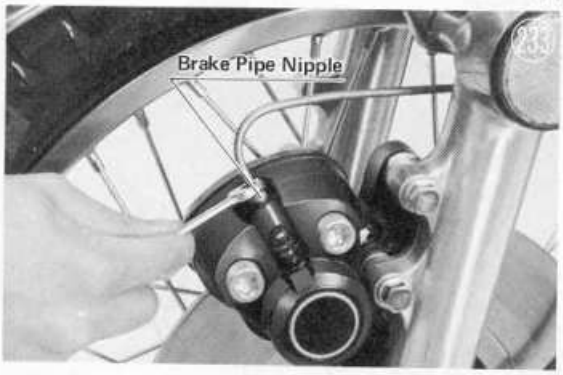
1. Before assembly wash all parts, including the master cylinder, with disc brake fluid or alcohol (See **CAUTION** pg. 58 ), and apply brake fluid to the removed parts and to the inner wall of the cylinder.
2. Be sure that the primary cup and check valve are not installed backwards, and that they are not turned sideways after insertion.
3. Use a new retaining ring for assembly, pushing it into place in the cylinder wall groove with a special purpose tool. Use the same tool for installing the boot and boot stopper.




## CALIPER (See CAUTION pg. 58)

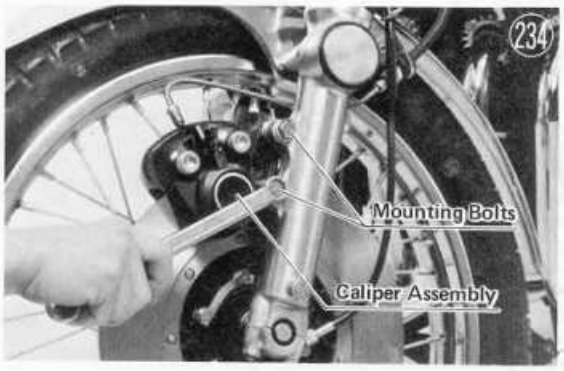
### Removal:

- Remove the front wheel (Pg. 50).
- Unscrew the brake pipe nipple and disconnect the pipe.




Cap the end of the pipe with the rubber bleeder valve cap to prevent fluid leakage.

- If the caliper is to be disassembled, loosen the Allen-head shafts now.
- Remove the mounting bolts and take off the caliper assembly.




### Installation note:

- Bleed the brake lines after installation (Pg. 105).

### Caliper disassembly:

- Unscrew the two Allen-head shafts ① evenly, alternately a little at a time. Remove caliper B ② and pad B ③ .
- Take the caliper holder ④ off the shafts, being careful not to damage the boots ⑤ or **O** rings ⑥ , and take out pad A ⑦ .
- Remove the two shafts from caliper A ⑧ .
- Take off the piston dust seal ⑨ and pull out the piston ⑩ without twisting it. If it is difficult to remove, force it out by blowing compressed air into the brake line outlet.




- Remove the seal ⑪ without damaging the cylinder wall.




### Assembly note:

- Before reassembly, wash the calipers, shafts, holder, seal and piston with brake fluid or alcohol (see **CAUTION**, pg. 58 ), and apply brake fluid to them. Be especially careful in cleaning the groove in the seal, and the shaft guide holes.

## DISC

### Removal:

- Remove the front wheel (Pg. 50).
- Flatten the bent up ears of the lock washers ① and remove the disc mounting bolts ② to take off the disc ③.

### Installation note:

- Tighten the disc mounting bolts with 140~190 in-lbs (1.6~2.2 kg-M) torque and bend up the lock washer firmly against each bolt.

## FRONT FORK TUBES

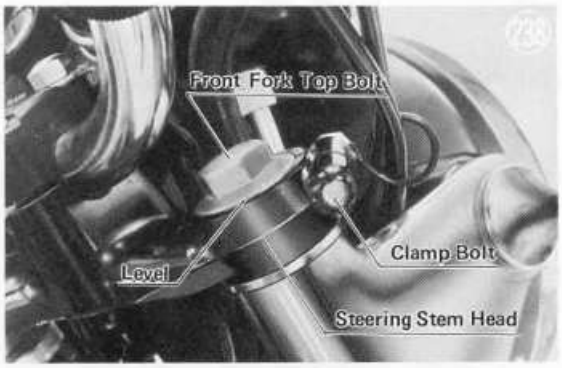
### Removal:

- Remove the front wheel (Pg. 50).
- Take off the fender.
- Take the caliper assembly off the front fork and rest it on some kind of a stand so that the pipe does not get bent.
- If the fork tube is to be disassembled after removal, first loosen the bolt in the top of the tube.
- Loosen the upper and lower clamp bolts and drop out the fork tube.




### Installation notes:

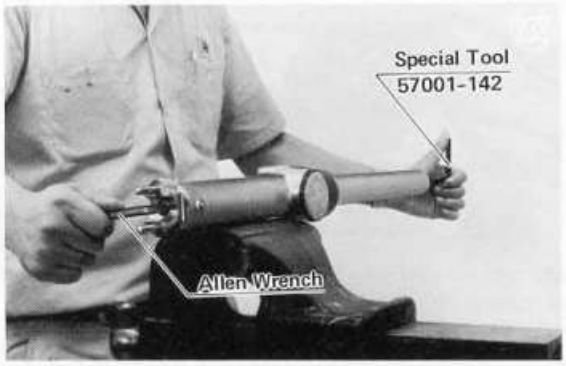
1. Before tightening the top clamp, make sure that the flange surface of the bolt in the top of the tube, is level with the top of the stem head.




2. Tightening torque for the upper clamp bolt is 140~155 in-lbs (1.6~1.8 kg-M), and for the lower bolt it is 40~43 ft-lbs (5.4~6.0 kg-M).

### Fork tube disassembly

- Remove the top bolt ② and dump out the spring ⑱ and the fork oil.
- Take the dust seal ㉑ off the outer tube ㉕
- Holding the cylinder ⑳ with a special tool, remove the Allen bolt ㉚ from the bottom of the tube, and pull out the inner tube ⑲.




- Remove the retaining ring ㊱ inside the inner tube, using retaining ring pliers, and the cylinder assembly ⑳ will come out of the tube.
- Remove the retaining ring ㉒ from the outer tube with a sharp hook.
- Also pull the oil seal ㉔ out with a hook.

**NOTE:** If the oil seal is removed, it must be replaced.

### Assembly note:

- Use a special purpose tool for installing the oil seal.



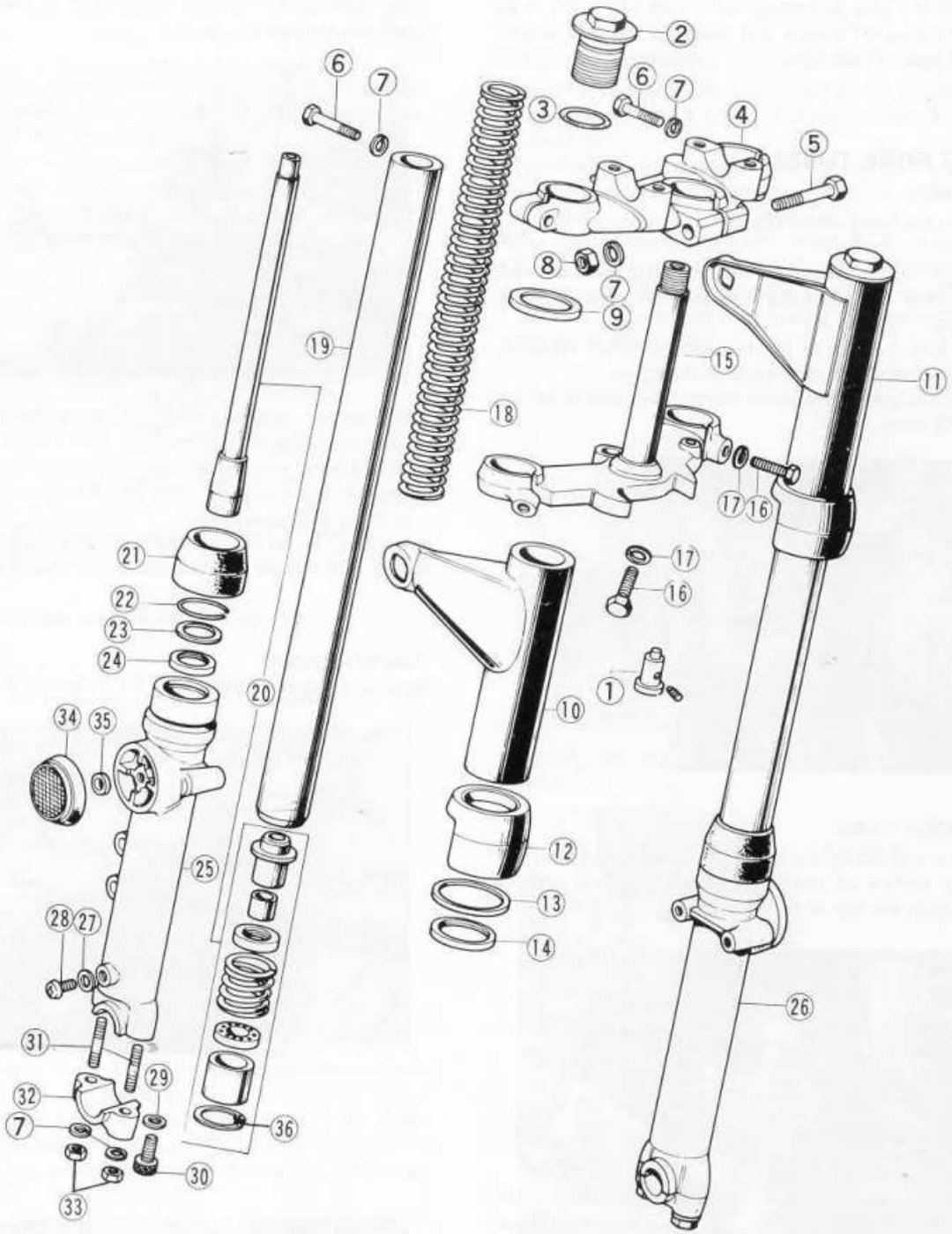

## STEERING STEM

### Removal:

- Remove the front wheel (Pg. 50).
- Take off the front fender.
- Remove the bolt from the underside of the headlight.
- Remove the two screws from the sides of the headlight, drop out the head lamp unit and unplug the wires.
- Unplug the turn signal wires and the main wiring harness connectors.
- Remove the mounting nuts and take off the turn signals and headlight housing.
- Unscrew the tachometer cable from the cylinder head.

## Front Fork

241



1. Lock Ass'y
2. Top Bolt
3. O Ring
4. Stem Head
5. Clamp Bolt
6. Clamp Bolt
7. Lock Washer
8. Nut
9. Washer
10. Headlight Stay
11. Headlight Stay
12. Stay Guide
13. Washer
14. Gasket
15. Steering Stem
16. Bolt
17. Lock Washer
18. Spring
19. Inner Tube
20. Cylinder
21. Dust Seal
22. Circlip
23. Washer
24. Oil Seal
25. Outer Tube
26. Outer Tube
27. Gasket
28. Drain Plug
29. Gasket
30. Allen Bolt
31. Stud
32. Axle
33. Nut
34. Reflector
35. Rubber Washer
36. Circlip

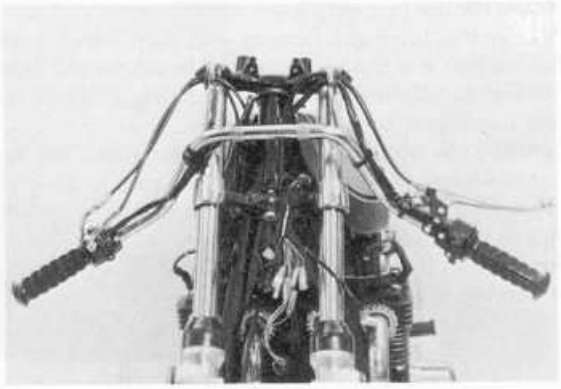
•Remove the mounting bolts and take off the ignition switch, tachometer and speedometer as an assembly.



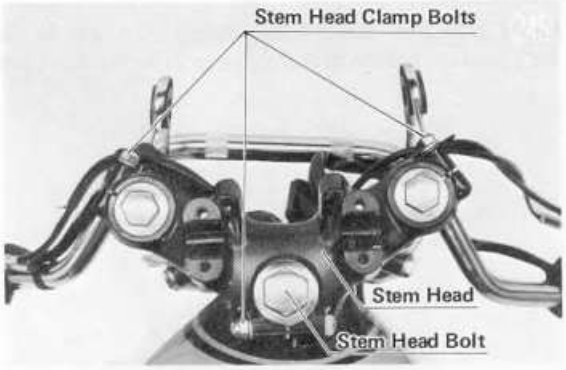

•Take off the rear-view mirror.
•Disconnect the pressure switch wire and remove the mounting bolts for the 3-way fitting, disc brake master cylinder, and for the caliper. Remove the whole brake assembly as a unit, taking care not to bend the pipe.



•Unbolt the handlebar and set it to the front with all the wiring and cables still attached.



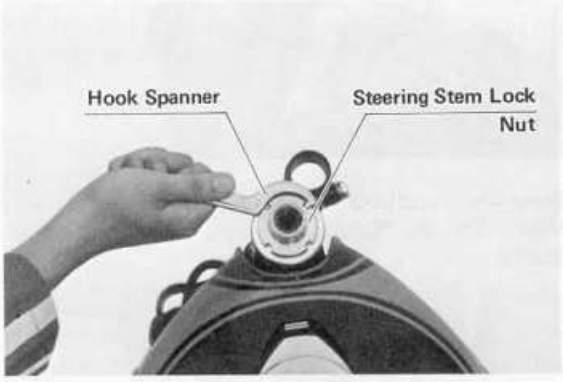
•Loosen the three stem head clamp bolts, take out the stem head bolt, and remove the stem head.

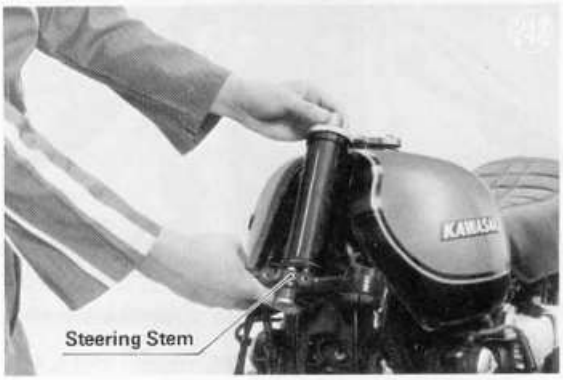



•Now shift the handlebar out of the way to the rear, loosen the two lower clamp bolts, and remove the fork tubes and the headlight stays.



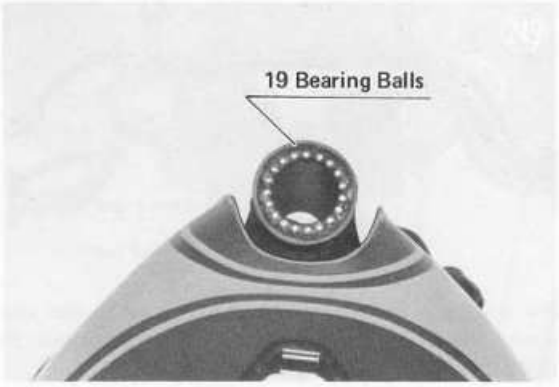

•Remove the steering stem lock nut with a hook spanner and drop out the stem. The balls from the lower race will fall out when the stem is removed. The stem cap and upper inner race and balls can also be taken out now.



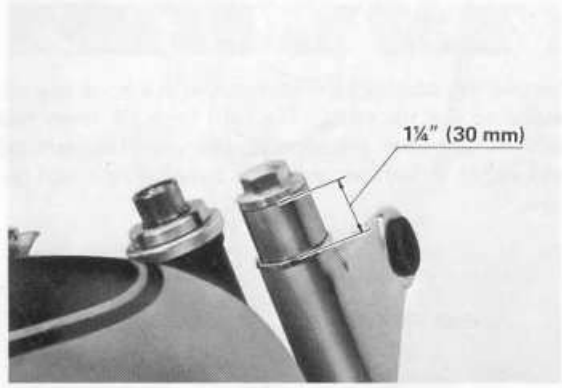



### Installation:

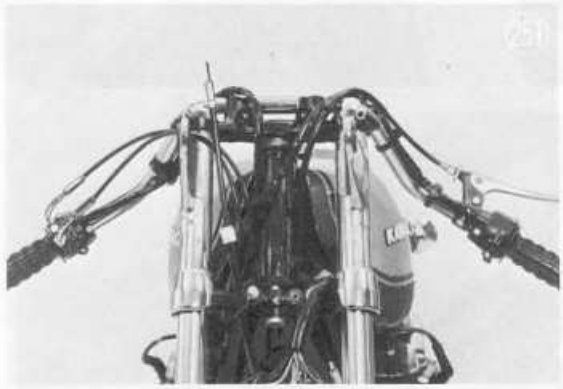
•Apply grease to the 19 upper and 20 lower bearing balls, and stick them to the outer races in the head pipe.




•Insert the steering stem up into the head pipe, put on the upper inner race and the cap and lock nut.
•Tighten the lock nut with a hook spanner so that the stem moves freely to either side with a slight push, but so that it has no play.
•Put each headlight stay and the stay guides into place, and push the fork tube up through them so that it protrudes about 1¼ inch (30 mm) at the top.
Temporarily tighten the lower clamp bolt to hold the tube in place.

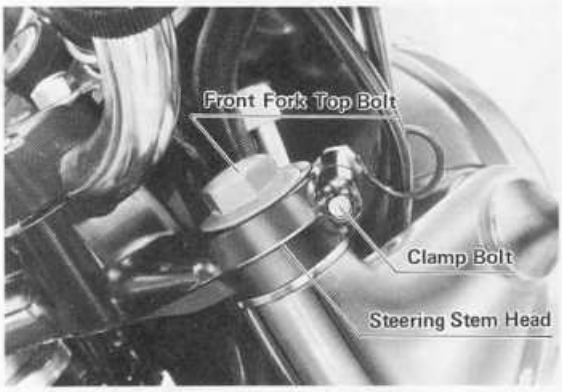



•Bring the handlebar to the front and rest it there.
•Make sure the handlebar wiring is routed as illustrated.



•Put on the stem head and tighten down the stem head bolt and the rear clamp bolt.

•Loosen the lower clamp bolt and align the flange surface of the bolt in the top of the fork tube, with the upper surface of the steering stem head. Tighten the clamp bolts at that point.




•Tighten the three upper clamp bolts with 140~155 in-lbs (1.6~1.8 kg-M) torque, and tighten the two lower clamps with 40~43 ft-lbs (5.4~6.0 kg-M) torque.
•Align the angle of handlebar mounting with that of the front fork, and tighten down the mounting bolts with 18 ft-lbs (2.5 kg-M) torque.
•Mount the disc brake assembly. (See pg. 58 for correct mounting torque.) When mounting the master cylinder, the projection on the clamp must point toward the throttle grip. Tighten the lower clamp bolts first, and then the upper bolts.




•Mount the ignition switch and meter assembly.
•Put on the headlight housing and turn signal lamps.
•Put the bolt into the bottom of the headlight and adjust vertical headlight aim before tightening this bolt and the turn signal nuts. (Pg. 20)
•Connect the main wiring harness wiring and the turn signal wiring. The left turn signal wire goes to the green wire, and the right is plugged into the gray wire.
•Plug in the head lamp unit and mount it.
•Mount the front fender and the brake hose clamp.
•Mount the front wheel (Pg. 50)

## STEERING STEM BEARINGS

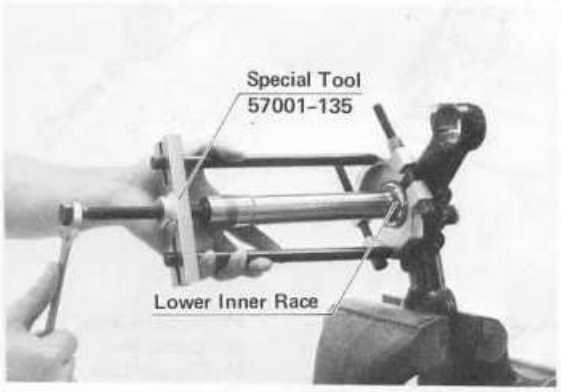
### Removal:

•Remove the steering stem (Pg. 63).

•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 race to drive it out.




•The lower inner race, which is pressed onto the steering stem, should be removed with a special bearing puller. Be careful not to damage the grease seal under the race.




### Installation:

•Apply oil to the outer races and drive them into the head pipe using special purpose tools.




•Replace the steering stem grease seal if it is damaged.
•Apply oil to the lower inner race and drive it onto the steering stem with a special tool.




•Install the steering stem (Pg. 63).

## SWING ARM

### Removal:

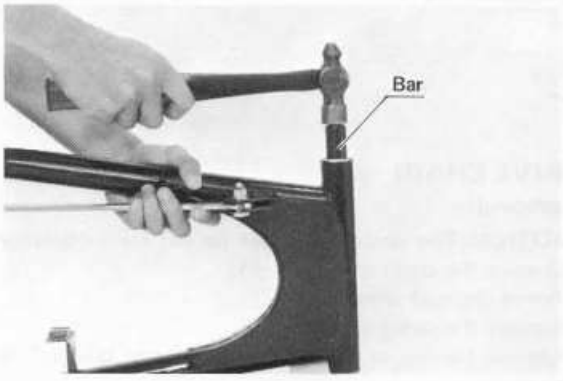
•Remove the rear wheel (Pg. 52).
•Take out the lower mounting bolts for the rear shock absorbers.
•Unscrew the nut, pull out the swing arm pivot shaft, and drop out the swing arm.

### Installation note:

•Pivot shaft torque is 87~108 ft-lbs (12~15 kg-M).

### Disassembly

•Pull the sleeve ⑤ out of each side of the swing arm.
•Make sure the distance collar ⑨ is as off-centered as possible, and insert a bar into one side, hammering on it lightly to knock out the bushing ⑥ on the opposite side.

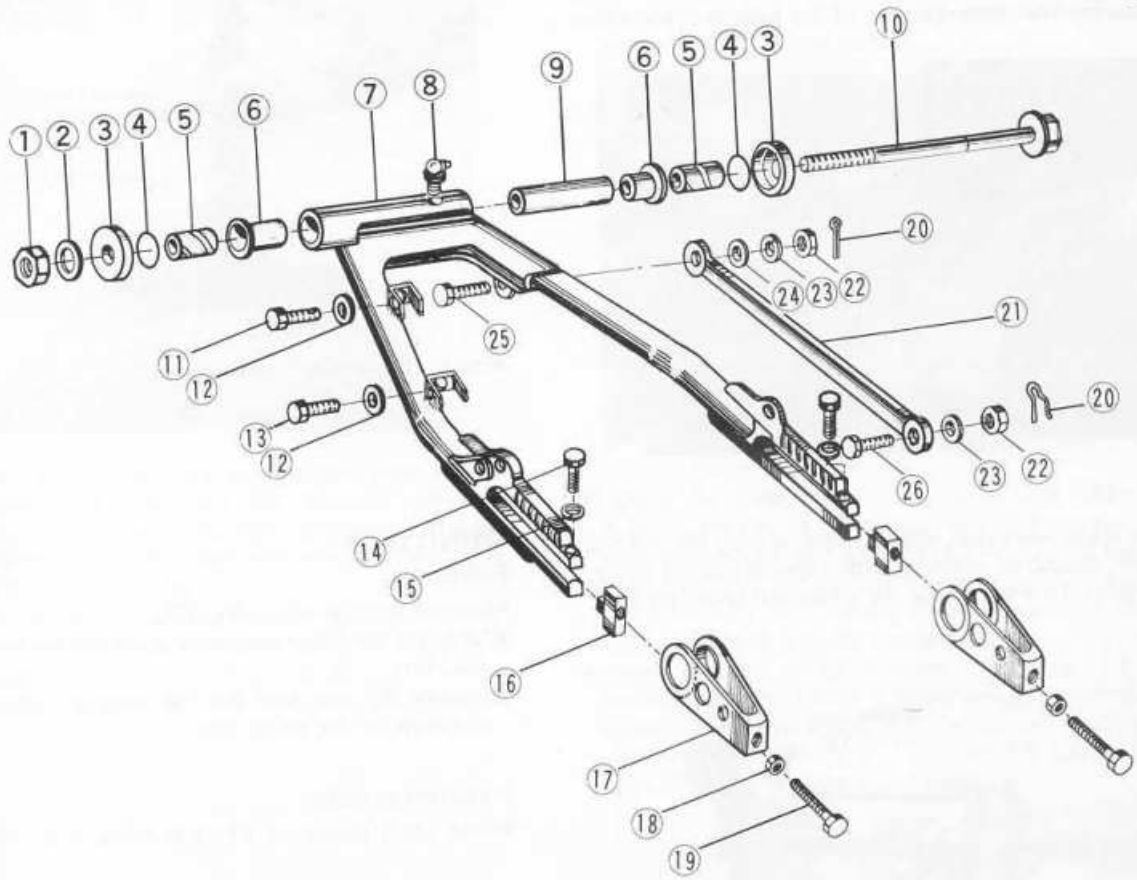



•Use the bar again to knock out the other bushing ⑥.

### Installation notes:

1. Replace the bushings with new ones. Apply oil to the new bushings before installation.
2. Put grease into the swing arm (Pg. 115).

Swing Arm




1. Self-locking Nut
2. Washer
3. Cap
4. O Ring
5. Sleeve
6. Bushing
7. Swing Arm
8. Grease Nipple
9. Distance Collar
10. Pivot Shaft
11. Chain Guard Mounting Bolt 1
12. Washer
13. Chain Guard Mounting Bolt 2
14. Chain Adjuster Stopper Mounting Bolt
15. Washer
16. Chain Adjuster Stopper Mounting
17. Chain Adjuster
18. Lock Nut
19. Adjuster Bolt
20. Cotter Pin
21. Torque Link
22. Nut
23. Lock Washer
24. Washer
25. Bolt
26. Bolt

## DRIVE CHAIN

### Removal:

**CAUTION: The chain must not be cut for installation.**

- Remove the chain cover (Pg. 35).
- Remve the rear wheel (Pg. 52).
- Remove the swing arm (Pg. 67).
- Remove the engine sprocket (Pg. 39) and take off the chain.

## REAR SPROCKET

### Removal:

- Remove the left mufflers (Pg. 39).
- Flatten the bent-up ears of the lock washers, and remove the mounting nuts.
- Remove the rear wheel (Pg. 52).
- Pull off the sprocket.

### Installation note:

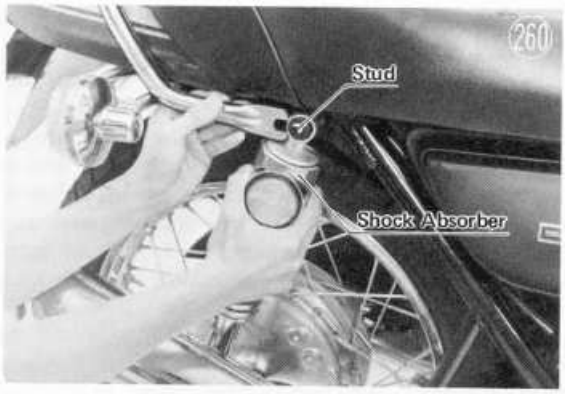
- After tightening the sprocket mounting nuts with 23~30 ft-lbs (3.1~4.2 kg M) torque, bend up one side of the lock washer against each nut.

## REAR SHOCK ABSORBERS

### Removal:

- Remove the mounting nut at the upper end of each shock absorber, and the bolt at the lower end. If the bolt is hard to unscrew, loosen the front and rear muffler mountings, or remove the mufflers altogether (Pg. 26).
- Take out the mounting bolts for the chrome bar, and move it out of place.

•Pull the top of the shock absorber off the stud and remove it.




**Installation note:**

•Shock absorber mounting torque is 44~47 ft-lbs (6.0~6.5 kg-M) for the mounting nut at the upper end, and 22~25 ft-lbs (3.0~3.5 kg-M) for the bolt at the lower end.

# MAINTENANCE

## AIR CLEANER

The air cleaner ensures that only clean, filtered air is fed through the carburetor into the engine. If air is used directly without filtering, not only will dust and dirt from the air plug up the carburetor air passages and jets and cause the engine to run poorly, but the dust that enters the cylinder acts like grinding compound and wears down the cylinder, piston and rings. If the air cleaner element is damaged or if too coarse a filter is used, the results will be the same as if no filtering is used.

When the air cleaner element becomes clogged with dirt, it chokes the air supply to the engine, resulting a richer fuel/air mixture and poor combustion efficiency. This in turn causes overheating from carbon build-up, and causes a loss of engine power.

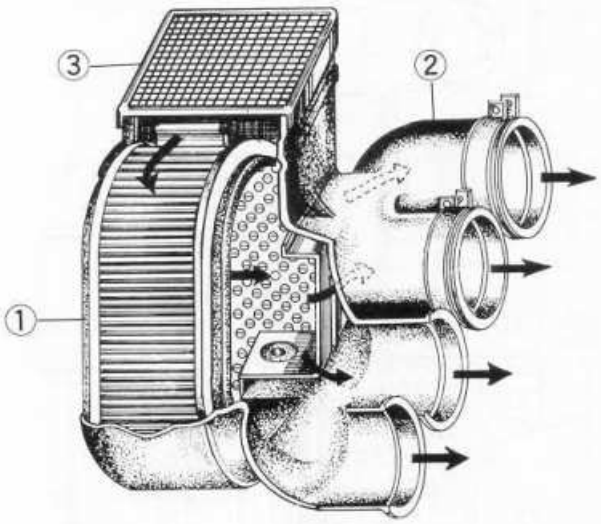
*Cleaning and replacement*

Every 2,000 miles (3,000 km) or less, remove the air cleaner element (Pg. 26) wash it with gasoline or some other volatile solvent, and blow it dry from the inside with compressed air. Since this is a dry-type element, do not use Diesel oil, kerosene, or other cleaners which will not evaporate completely.

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

Since repeated washing coarsens the element, replace it every 8,000 miles (12,000 km), or sooner if it has been washed 3 or 4 times.

**Air Cleaner** (261)

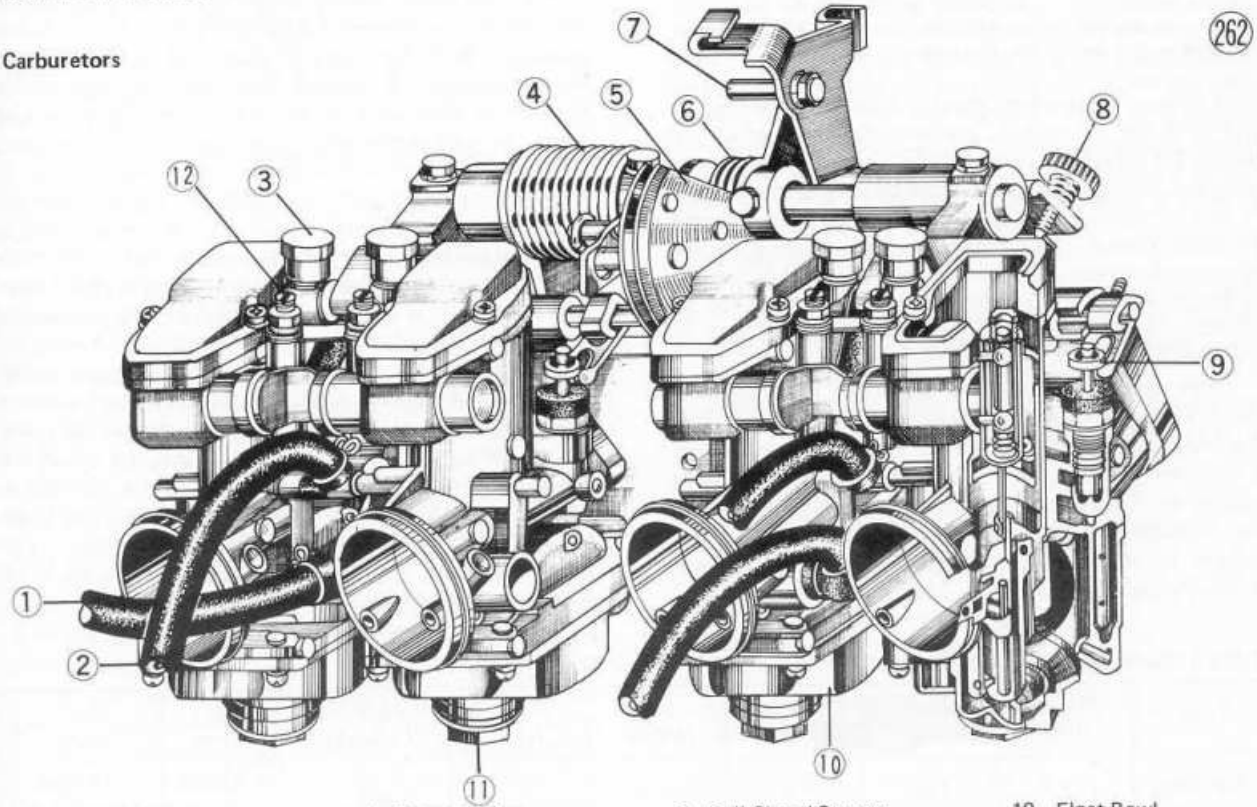



1. Air Cleaner Element
2. Air Cleaner Housing
3. Air Cleaner Cover

## CARBURETORS

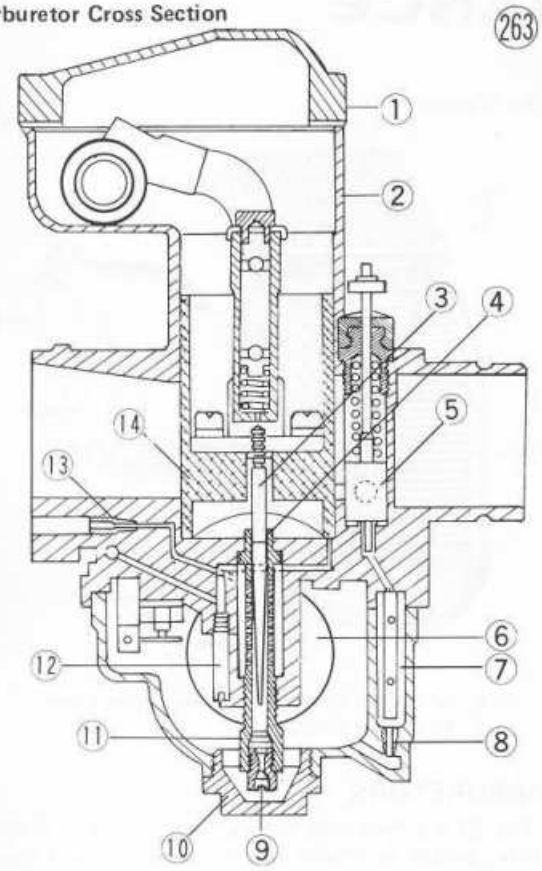
The Z1 has four carburetors, (one for each cylinder) which operate in unison and must be adjusted evenly before the engine will run smoothly. (See pg. 11 for carburetor adjustment.)

**Carburetors** (262)




1. Fuel Pipe
2. Air Vent Pipe
3. Guide Screw
4. Return Spring
5. Pulley
6. Crossover Spring
7. Full Closed Stopper
8. Throttle Stop Screw
9. Starter Plunger
10. Float Bowl
11. Drain Plug
12. Throttle Adjuster

**Carburetor Cross Section**




1. Top Cover
2. Mixing Chamber
3. Jet Needle
4. Needle Jet
5. Starter Plunger
6. Float
7. Starter Pipe
8. Starter Jet
9. Main Jet
10. Drain Plug
11. Air Bleed Pipe
12. Pilot Jet
13. Air Jet
14. Throttle Valve

A linkage mechanism, which is moved by the throttle grip with the two cables, connects the carburetors and causes the throttle valves of all four carburetors to open and close simultaneously when the throttle grip is turned. A heavy return spring on the linkage acts to pull the throttles closed. A crossover spring pulling in the opposite direction of the return spring, counteracts some of the return spring tension so that the two springs are balanced and the throttle grip can be turned with an even pressure.

Carburetor construction is shown in Figs. 262 and 263. Each carburetor has four main systems for fuel regulation and supply: a starter system which supplies a rich mixture to aid in starting the engine; a pilot system for fuel supply at low speeds; a main system for medium and high speed fuel supply; and a float system to maintain the gasoline at a constant level inside the carburetor.

Since the carburetor regulates and mixes the gasoline and air going to the engine, there are two general types of carburetor maladjustment or trouble that can occur: the fuel/air mixture can be too rich (too much gasoline), or too lean (too much air). This can be caused by wear, dirt, maladjustment, or a change in the gasoline level in the float bowl. (It can also be caused by a dirty or damaged air cleaner element.) Table 2 shows the symptoms for each of these two types of trouble.

**Table 2 Mixture Trouble Symptoms**

| Mixture too rich | Mixture too lean |
|---|---|
| Engine is sluggish | Engine overheats |
| Smoky exhaust | Runs better with starter lever on |
| Runs worse when warm | Spark plugs burned white |
| Spark plugs fouled black | Running is unstable |
| Runs better without air cleaner | No power |

Some parts of the carburetor are replaceable or adjustable to adapt the engine to special operating conditions. These parts and their standard values are shown in Table 3.

## Starter System

The carburetor starter is a device used to provide the engine with the exceptionally rich 1:1 fuel/air mixture that is necessary to enable easy starting when the engine is cold.

Fig. 264 shows the starter jet ①, starter pipe, starter plunger ② and other functional parts of the starter system. With the throttle valve left closed and the starter plunger ③ pulled fully open, a high intake vacuum is developed at the jet opening to draw fuel from the carburetor when the engine is turned over. Fuel is measured by the starter jet, mixed with air in the starter pipe, drawn into the starter plunger chamber and mixed with starter primary air. At this point it is the most suitable mixture for starting and it has been well atomized, so the fuel is now sprayed into the main bore. There it is mixed with a small amount of fuel/air spray from the pilot system and supplied to the engine.

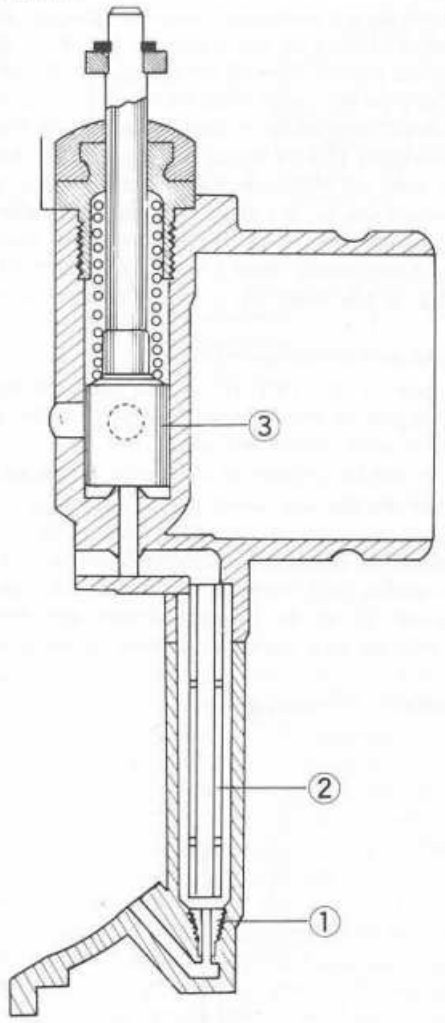
In order for the starter system to work properly, the throttle must be kept closed so that sufficient vacuum can be built up at the starter outlet. In addition, the starter lever must be raised fully so that the tip of the starter will unplug the fuel passage. If the throttle is opened or if the starter lever is not fully raised, the starter system will fail to operate efficiently. The starter will also not operate correctly if the air bleed hole clogs and causes insufficient atomization.

**Table 3 Carburetor Specifications**

| Type | Main Jet | Air Jet | Needle Jet | Jet Needle | Pilot Jet | Throttle Valve Cutaway | Air Screw | Fuel Level |
|---|---|---|---|---|---|---|---|---|
| VM28SC | 112.5 | 1.0 | P-8 | 5J9-3* | 20 | 2.5 | 1½ turns out | 32±1mm (1.26±.04 in.) |

*The 9 of 5J9-3 shows lot no., and may vary. The 3 is the groove no. for the C ring, counting from the top.

Starter System




1. Starter Jet 2. Starter Pipe 3. Starter Plunger

*Cleaning*

Remove the float bowl and blow the starter pipe clean with compressed air. **Do not clean it with wire or other hard objects which may damage it.**

Remove the starter plunger and clean it with gasoline.

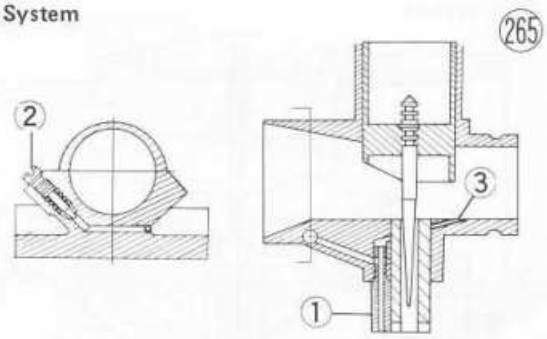
## Pilot System

Fig. 265 shows the pilot system, which includes the pilot jet ① , pilot air screw ② and pilot outlet ③ .

The pilot system operates from zero to about one-fourth throttle opening. At small throttle openings the opening near the needle jet of the main system is comparatively wide, so there is little vacuum and almost no fuel is drawn from this jet. Near the pilot outlet, however, the air passage is narrow and a high vacuum develops, drawing a rich fuel mixture up through the pilot outlet.

The pilot jet mixture is produced by combining the gasoline measured out by the pilot jet, with the air let in past the pilot air screw. Since the pilot jet opening is fixed, the mixture must be controlled instead by turning the pilot air screw. As the screw is backed out, the pilot air passage is opened wider and the mixture is made leaner. Turning the screw in makes the mixture richer.

Pilot System




1. Pilot Jet 2. Pilot Air Screw 3. Pilot Outlet

Flow Characteristic

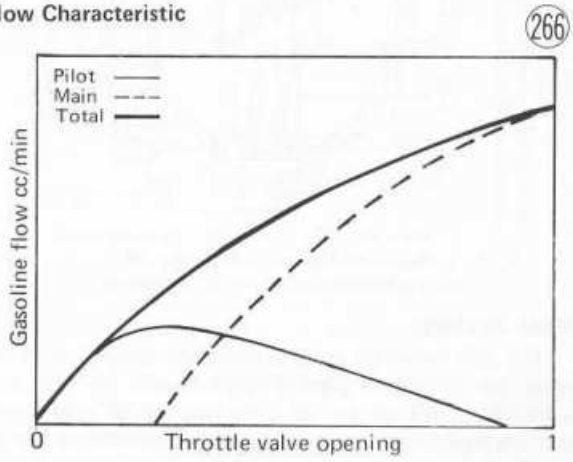
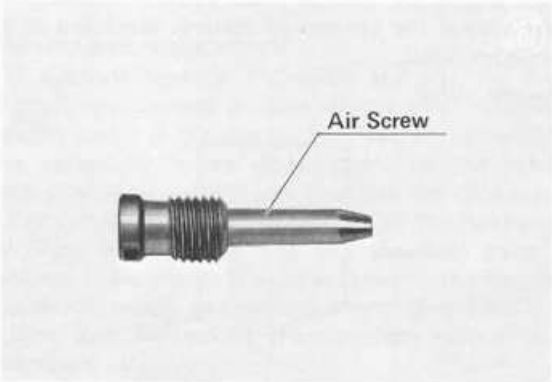



Fig. 266 shows throttle valve opening versus gasoline flow for the main and pilot systems. If trouble occurs in the pilot system, not only are starting and low speed running affected, but the transition from pilot to main system is not smooth as the throttle is opened, causing a drop in acceleration efficiency. Pilot system trouble might be due to maladjustment, a dirty or loose pilot jet, or clogging of the pilot outlet.

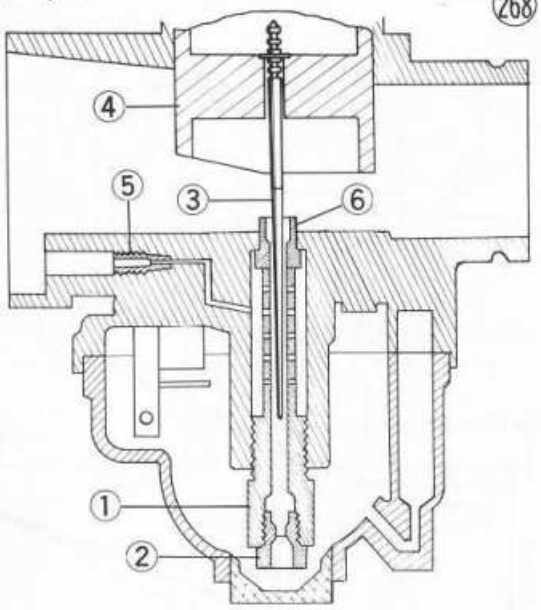
*Cleaning and replacement*

Wash the pilot jet with gasoline and blow it clean with compressed air. Also use compressed air to clean the pilot outlet. **Do not use wire for cleaning as this could damage the jet.**

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



**Main System**




1. Main Jet
2. Air Bleed Pipe
3. Jet Needle
4. Throttle Valve
5. Air Jet
6. Needle Jet

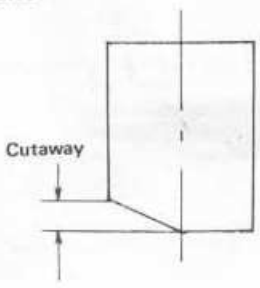
## Main System

Fig. 268 shows the main system, which consists of the main jet ② , bleed pipe ① , jet needle ③ , throttle valve ④ , and air jet ⑤ . At one-fourth and larger throttle openings, the vacuum in the vicinity of the jet needle rises enough to cause most of the engine's fuel supply to be delivered by the main system. Gasoline passes through the main jet, bleed pipe, through the opening between the needle jet and needle, and into the main bore to be mixed with the air flowing there.

In one side of the bleed pipe, there is an air bleed hole to admit air measured by the air jet. This air mixes with the gasoline and begins atomization before it ever reaches the main bore.

The jet needle is connected to the throttle valve, and the tapered tip of the needle extends down into the needle jet. As the throttle is raised open, the needle is lifted with it out of the jet. At one-fourth throttle opening, the tapered portion of the needle starts coming out of the jet, increasing the needle/jet clearance and thereby increasing the rate of gasoline flow above this throttle opening. Flow regulation by the needle jet is also affected by the throttle valve cutaway, a part of the lower end of the throttle valve which is shaved off to help control the amount of vacuum developed at the needle jet outlet.

**Throttle Valve**




At near full-throttle openings, the cross-sectional area of the needle/jet clearance becomes greater than the cross-sectional area of the main jet. At these openings the gasoline flow is limited by the size of the main jet, rather than the jet needle clearance.

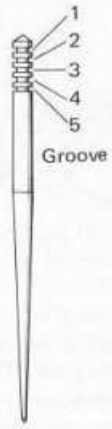
Trouble in the main system is usually indicated by poor running or lack of power at high speeds. A dirty or clogged main jet will cause the mixture to be leaner. A rich mixture could be caused by clogging of the air jet, its air passages or the air bleed hole in the bleed pipe; needle jet and needle wear (increasing clearance); or by loosening of the main jet, air bleed pipe, or the needle jet.

### *Cleaning and adjustment*

Disassemble the carburetor and wash the main jet, bleed pipe, air jet and air passages with gasoline, blowing them clean with compressed air.

If the needle jet/needle clearance has worn larger, it is best to replace these parts, 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, and changing the position of the **C** ring to a groove closer to the top, lowers the needle and makes the mixture leaner at a given throttle opening.

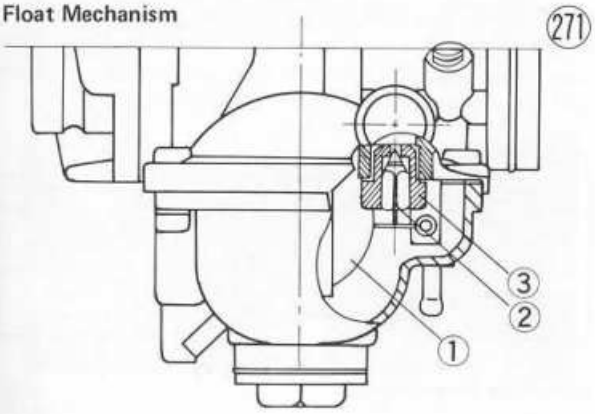
**Jet Needle**




**NOTE:** The last number of the jet needle number ("3" of 5J9-3) is not stamped on the needle, but is the number of the standard groove in which the **C** ring is clipped. The groove numbers are counted from the top of the needle, 1 being the topmost groove, and 5 being the lowest groove.

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.

Float Mechanism




1. Float 2. Float Valve 3. Seal

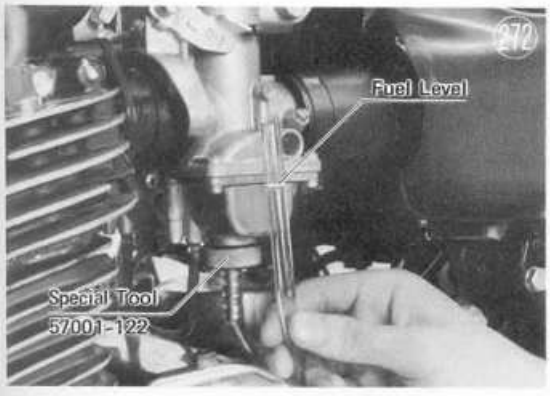
## Float System

Fig. 271 shows the float system, comprising the float ① , and float valve-needle ② and seat ③ . The float system serves to keep a more or less fixed level of gasoline in the carburetor at all times, so that the fuel mixture to the engine is stable. If the level is too low, it will be harder for gasoline to be drawn into the intake and the mixture will turn out lean; if the fuel level in the bowl is too high, gasoline can be drawn up too easily and the mixture will be too rich.

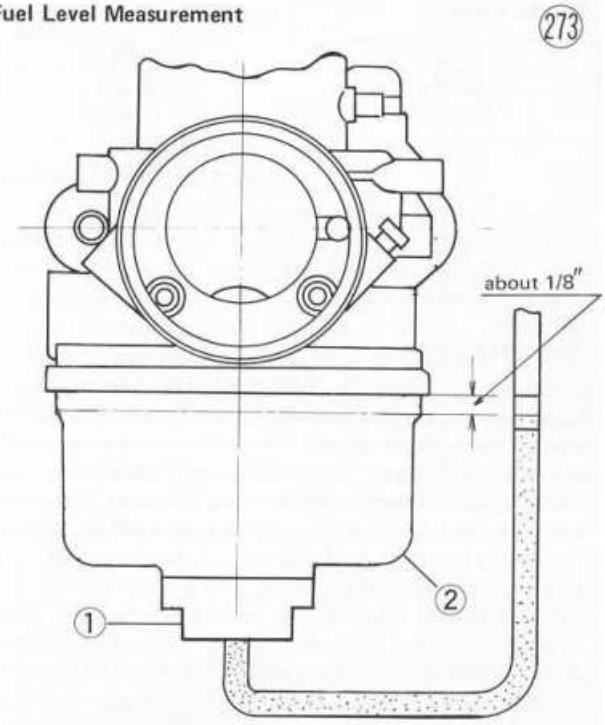
The fuel level is defined as the vertical distance from the center of the carburetor main bore to the surface of the gasoline in the float bowl. It is maintained at a constant valve by the opening and closing of the float valve. As gasoline flows through the float valve and causes the level in the bowl to rise, the float riding on the gasoline rises, too, pushing up the needle as it moves. When the gasoline reaches a predetermined level, the float rises high enough to push the needle completely into the seat, closing the valve and stopping gasoline flow into the carburetor. When the engine uses some of the gasoline and the level drops, the float (and needle) drop with it, opening the valve to let in more gasoline.

### *Fuel level measurement and adjustment*

Turn the fuel tap to **O**ff, and remove the plug from the underside of the float chamber. In its place, screw in the fuel level measuring device (special tool). Hold the plastic tube against the carburetor body and turn on the fuel tap to read the level. The gasoline level in the hose should come up to .10~.18 inch (about 1/8 inch, or 2.5~4.5 mm) below the edge of the carburetor body.

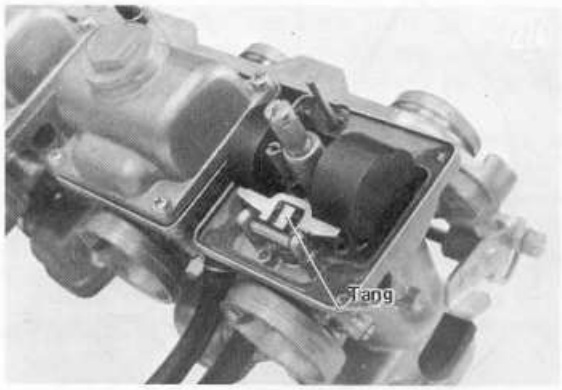



Fuel Level Measurement




1. Special Tool 2. Float Bowl

If the fuel level is incorrect, remove the float bowl and float (pull the pivot pin out to drop out the float, and catch the needle as it falls). Bend the tang on the float a very slight amount to change the fuel level. Bending it up closes the valve sooner and lowers the fuel level; bending it down raises the level.



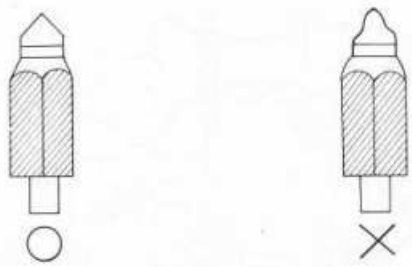

### *Cleaning and replacement*

If dirt gets between the needle and seat, the float valve will not close and gasoline will overflow. Overflow can also occur if the needle and seat are allowed to wear excessively before replacement. If the needle sticks closed, no gasoline will flow into the carburetor.

Remove the carburetors and take off the float bowl and float, washing the bowl and the float parts in gasoline. If the needle is worn as shown in the diagram, replace the needle and seat as a set. (See Fig. 275.)

Blow out the mixing chamber fuel passage with compressed air.

Needle Valve (275)

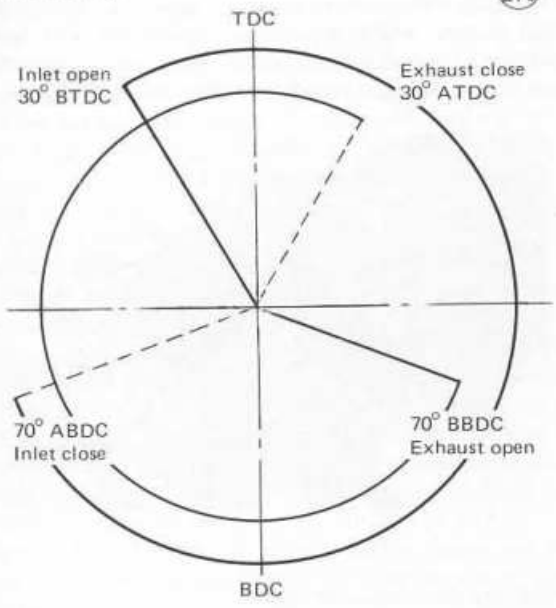


## CAMSHAFTS

Since this engine is the DOHC (Double OverHead Camshaft) type, there are two camshafts mounted in the top of the cylinder head. One is the intake camshaft, and is manufactured with four cams, one to open the intake valve for each cylinder. The other is the exhaust camshaft, and has four cams to open the exhaust valves. There is a sprocket at the center of the crankshaft and at the center of each camshaft, and 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 a mark so that valve timing (the time that each valve is opened) can be reset correctly any time the camshaft is removed for inspection or repairs (See pg. 30 for valve timing adjustment.)

Valve Timing (276)




Since the time, amount, and duration that each valve is opened (valve timing) changes with cam surface wear, camshaft bushing wear, and camshaft runout (bending), these parts should be inspected periodically or when timing trouble is suspected. If the valves do not open at the right times or if they do not open the correct amount, there will be a decrease in combustion efficiency (and engine power), and engine trouble may develop. Cam wear will also cause "tappet" noise as the cam hits the valve lifter.

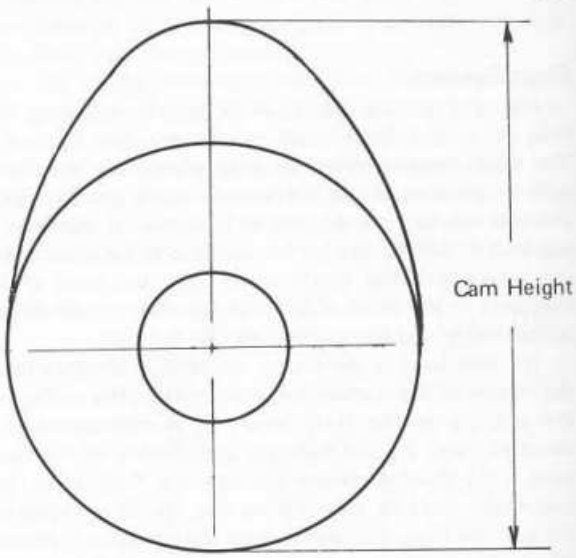
### *Cam Wear*

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

**Table 4 Cam Height**

| | Standard | Service Limit |
|---|---|---|
| Intake | 1.4276~1.4307 in. (36.26~36.34 mm) | 1.4236 in. (36.16 mm) |
| Exhaust | 1.4079~1.4110 in. (35.76~35.84 mm) | 1.4039 in. (35.66 mm) |

Cam Wear Measurement (277)




### *Bushing and Shaft Wear*

Bushing wear is measured using a plastigauge, or press gauge, which is inserted into the clearance to be measured, and indicates wear by the amount it is compressed and widened when the parts are assembled.

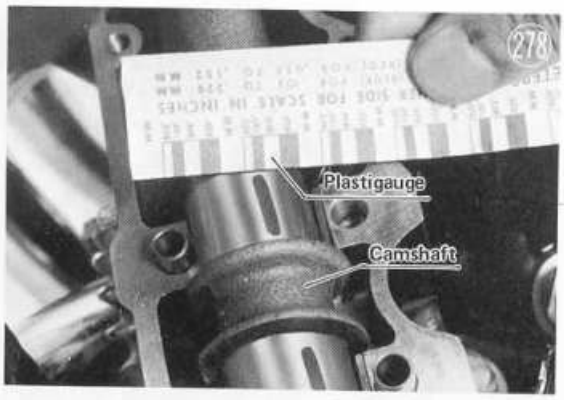
Remove the camshaft, cut strips of plastigauge to the width of the bushing, and place a strip on the lower half of each bushing, parallel to the camshaft and so the plastigauge will be between the bushing and the shaft.

Now fit the chain over the camshaft sprocket so the shaft won't turn, and install the camshaft, tightening the bolts in the correct order with the specified torque (Pg. 31).

Next, remove the camshaft again and measure the new width of the plastigauge to compute the bushing/camshaft clearance. If any clearance exceeds the limit, replace all four bushing halves for that camshaft.

**Table 5 Camshaft/Bushing Clearance**

| Standard | Limit |
|---|---|
| .0008~.0025 in. (.020~.064 mm) | .0063 in. (.16 mm) |




Next measure the part of the camshaft that wears on the bushing. If the micrometer reading shows less than the service limit, replace the camshaft.

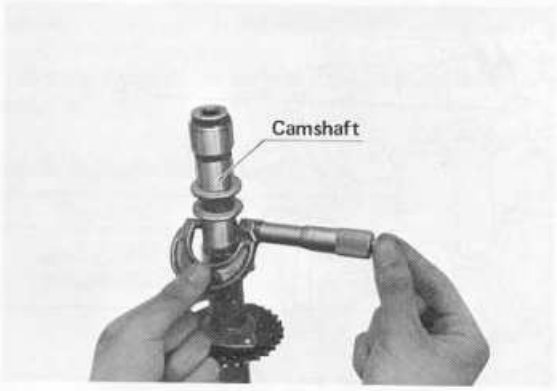



**Table 6 Camshaft Diameter**

| Standard | Limit |
|---|---|
| .9633~.9638 in.<br>(24.467~24.480 mm) | .9614 in.<br>(24.420 mm) |

### *Camshaft Runout*

Remove the camshaft and take the sprocket off the shaft.

**NOTE:** When remounting the sprocket, use Loctite on the mounting bolts, and make sure that the exhaust and intake sprockets go on the right shaft.

Suspend the shaft in V blocks at the points on the shaft where the bushings seat. Measure runout with a dial gauge set to the sprocket mounting location, and replace the shaft if runout exceeds the service limit.

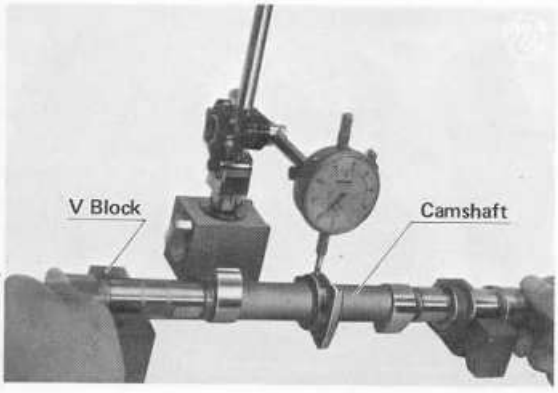


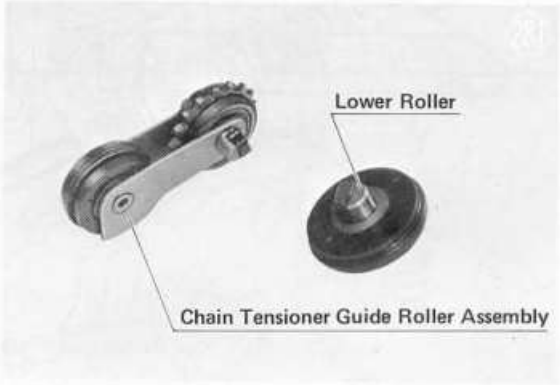

**Table 7 Camshaft Runout**

| Standard | Limit |
|---|---|
| under .0008 in.<br>(under .02 mm) | .004 in.<br>(.10 mm) |

## CAMSHAFT CHAIN

The camshaft chain, which is driven by the crankshaft sprocket, drives the two camshafts at one-half of the crankshaft r.p.m. For maximum durability, it is an endless-type chain with no master link. Because of ample lubrication and little load on the chain, the camshaft chain and sprockets wear very little.

The guide rollers, however, are made of rubber and will slowly wear down. When the chain can no longer be adjusted enough to stop it from making noise, remove the guide rollers for inspection. If the lower roller or the chain tensioner guide roller assembly shows wear or damage, replace the parts.

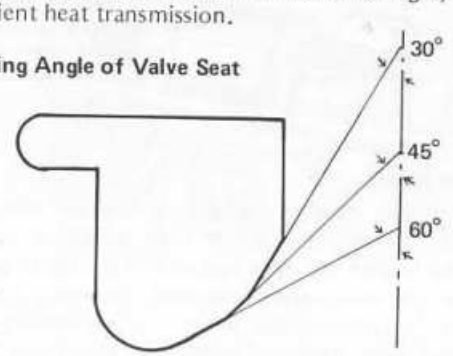



## CYLINDER HEAD, VALVES

The cylinder head and valve parts are shown in Fig. 283. The valves are mounted in the head, and are pushed open by the cams, and closed by the valve springs.

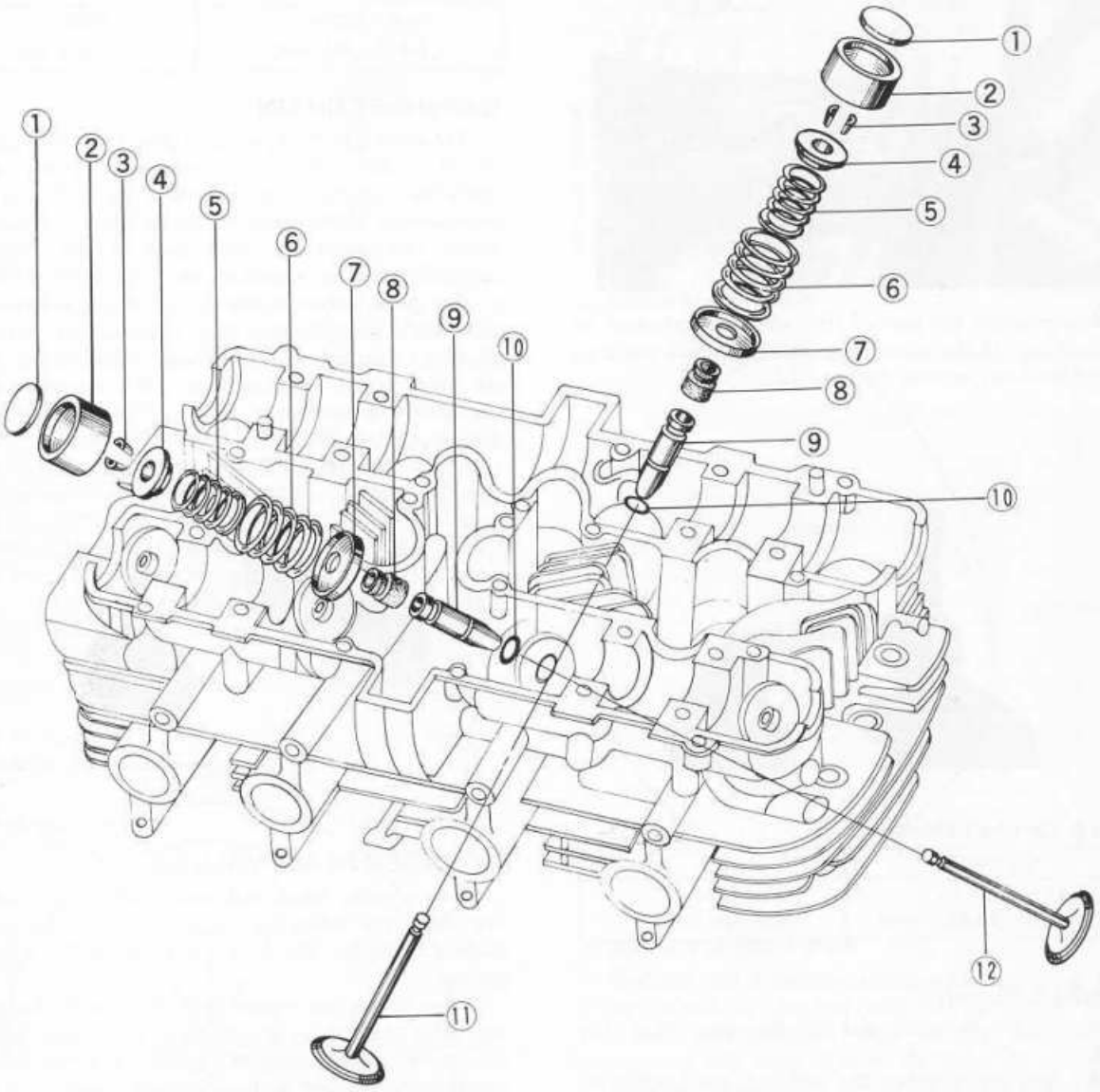
Valve guides are pressed into the cylinder head, and the valve seats are cast in. The valve seat, which is cut to the angles shown in Fig. 282, not only prevents compression leakage by fitting snugly against the valve, but also prevents the valve from overheating by allowing efficient heat transmission.

**Cutting Angle of Valve Seat**




The clearance between the valve lifter and cam is adjustable up to .04 in. (1 mm), but when valve and seat wear and valve seat grinding make this clearance unadjustable, the valve stem end can be ground down to increase clearance. If the adjustment limit is again exceeded, the cylinder head will have to be replaced.

Valve Assemblies



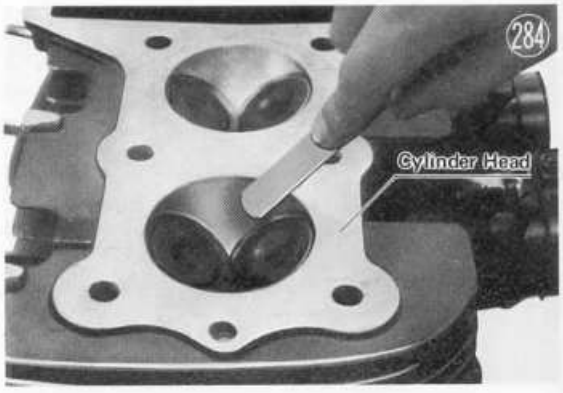
1. Shim
2. Valve Lifter
3. Split Keeper
4. Valve Spring Retainer
5. Inner Valve Spring
6. Outer Valve Spring
7. Valve Spring Seat
8. Oil Seal
9. Valve Guide
10. Circlip
11. Exhaust Valve
12. Inlet Valve

## Cylinder Head

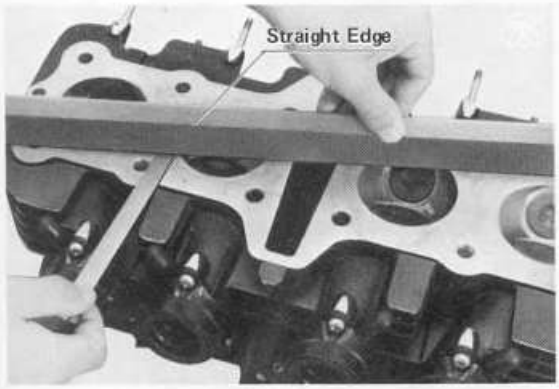
The cylinder head is made of aluminum alloy for good heat conduction, and fins are provided on the outside to further aid heat radiation. If carbon builds up inside the combustion chamber, however, cooling efficiency is reduced and preignition, knocking, and overheating may result. Trouble can also come from improper head mounting or mounting torque, causing compression leakage.

### *Cleaning and inspection*

Remove the cylinder head (Pg. 31). Scrape out any carbon and wash the head with gasoline.



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 8 Cylinder Head Warp**

| Standard | Limit |
|---|---|
| under .002 in. (under .05 mm) | .010 in. (.25 mm) |

## Valve, Valve Guide, Valve Seat

Valve face deformation or wear, stem bending or wear, and valve guide wear are all causes of poor valve seating. Poor seating can also be caused by the valve seat itself, through heat damage or carbon build-up. The result of poor seating is compression leakage and a loss of engine power.

In addition, valve and valve seat wear cause deeper valve seating and a decrease in valve lifter clearance. Insufficient clearance upsets valve timing and may eventually prevent the valve from seating fully. Before this happens, valve lifter clearance should be adjusted (Pg. 15).

### *Valve inspection*

Visually inspect the valve face, replacing the valve if it shows deformation or uneven wear.

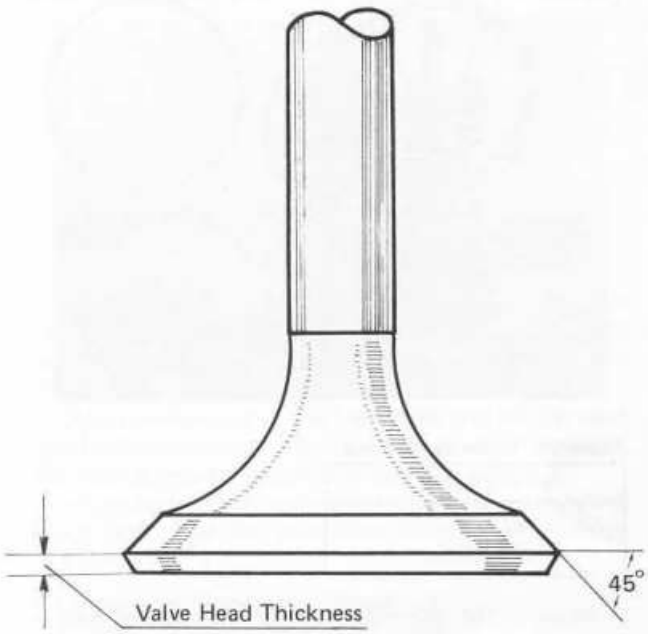
Measure the thickness of the valve head using vernier calipers, and replace the valve is the thickness is under the service limit.

**Table 9 Valve Head Thickness**

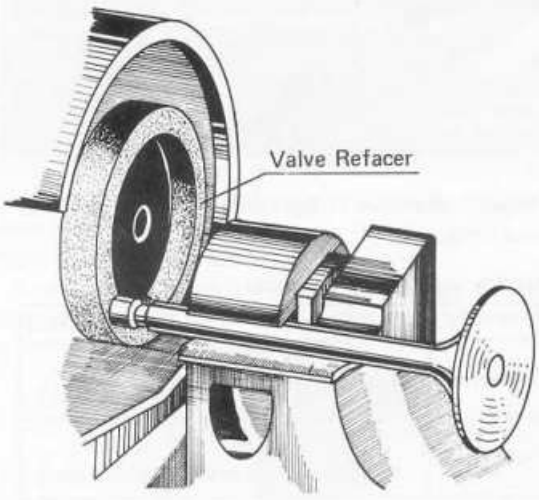
| Standard | Limit |
|---|---|
| .034~.045 in. (.85~1.15 mm) | .020 in. (.5 mm) |

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

**Valve Shape** (286)




**Valve Stem Grinding** (287)




**CAUTION: If the valve stem is ground down, be sure to leave at least .16 inch (4.1 mm) of stem end above the wide groove portion.**

Turn the valve in a V block, and use a dial gauge as shown to measure the amount the stem is bent. Replace the valve if it is bent over the service limit.

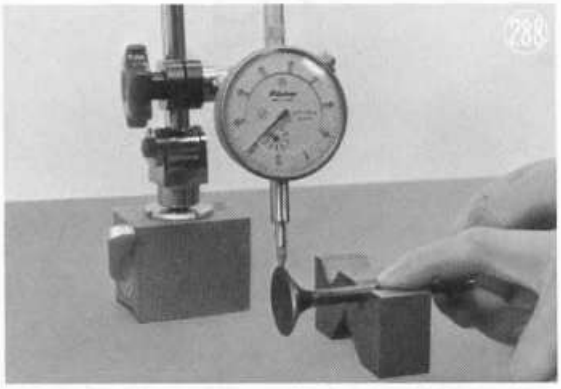
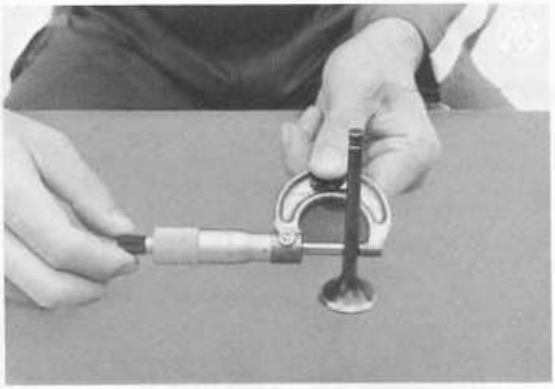


**Table 10 Valve Stem Bend**

| Service Limit |
|---|
| .002 in.<br>(.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 11 Valve Stem Diameter**

| | Standard | Service Limit |
|---|---|---|
| Intake | .2742~.2748 in.<br>(6.965~6.980 mm) | .270 in.<br>(6.86 mm) |
| Exhaust | .2738~.2744 in.<br>(6.955~6.970 mm) | .270 in.<br>(6.85 mm) |

### *Valve guide inspection*

Remove the valve and measure the inside diameter of the valve guide using a small bore gauge and micrometer.

Since the guide wears unevenly, measure the diameter at four places up and down the guide. If any measurement exceeds the service limit, replace the guide.

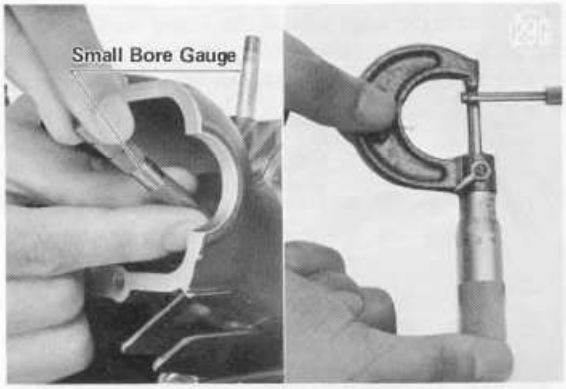
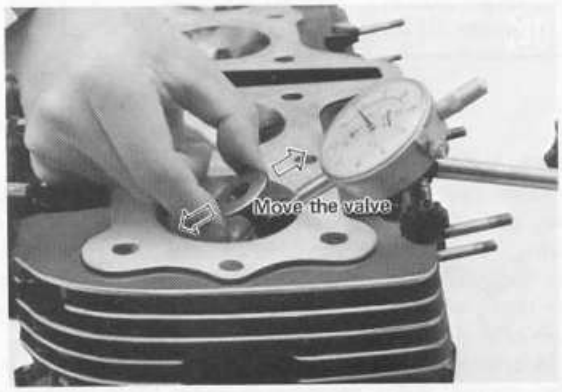



**Table 12 Valve Guide Inside Diameter**

| Standard | Limit |
|---|---|
| .2756~.2762 in.<br>(7.000~7.015 mm) | .280 in.<br>(7.10 mm) |

If a small bore gauge is not available, insert a new valve into the guide, set a dial gauge against the stem and move the stem back and forth to measure valve/guide clearance. Repeat the measurement in a direction at right angles to the first.




If valve guide clearance exceeds the service limit, replace the guide.

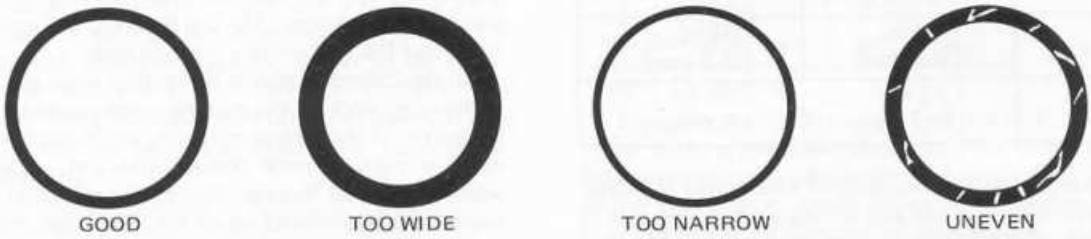
**Table 13 Valve/Guide Clearance**

| | Standard | Service Limit |
|---|---|---|
| Intake | .0008~.0020 in.<br>(.02~.05 mm) | .004 in.<br>(.10 mm) |
| Exhaust | .0012~.0024 in.<br>(.03~.06 mm) | .004 in.<br>(.10 mm) |

### *Valve seat repair*

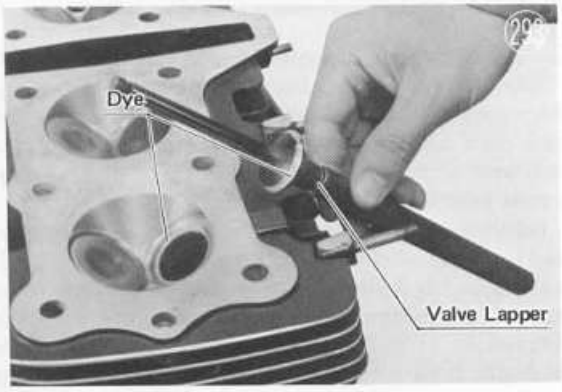
The valve must seat in the valve seat evenly around the circumference, over a .04~.06 inch (1.0~1.5 mm) wide area. If the seat is too wide the seating pressure per square unit of area is reduced, inviting compression leakage and carbon accumulation on the seating surface. If the seating area is too narrow, heat conduction from the valve is reduced, and the valve will overheat and warp. Uneven seating or seat damage will cause compression leakage.

**Valve/Valve Seat Contact Area**



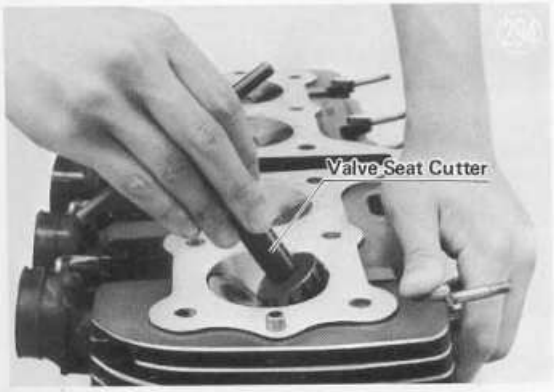

If the seating surface requires repair, this is done with valve cutters. Four cutters are required for complete repairs: one 30°, one 45°, and two 60° cutters, one for the intake, and the other for the exhaust valve seat.

With the valve removed, apply machinist's dye to the valve seat, and use a lapper to tap the valve lightly into place. The distribution of the dye that adheres to the valve, gives an indication of the condition of the seat.




**NOTE:** The valve and valve guide must be in good condition before the above action will give an accurate picture of valve seat condition.

Cut the seating surface of the valve seat with a 45° cutter. Cut only the amount necessary to make a good surface, as over-cutting will reduce valve lifter clearance and could make it unadjustable.




Next use the 30° cutter to cut the surface inside the seating surface, and use the 60° cutter to prepare the outermost surface. Cut these two surfaces so that the seating surface is .04~.06 inch (1.0~1.5 mm) wide.

After cutting, lap the valve to properly match the valve and valve seat surfaces so that the valve will seat well. 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 lapper, repeating this until a smooth, matched surface is obtained.

When lapping is completed and the valves are installed, check and adjust the valve lifter clearance as necessary (Pg. 15).




## Valve Springs

The valve springs hold the valve to the seat and prevent compression leakage. A double coil spring is used for each valve to prevent spring bounce at high speeds. If the springs weaken or break, compression leakage, valve chatter and noise will result, and engine power will drop.

### *Inspection and replacement*

Remove the springs and check the free length of each spring with vernier calipers. If any spring is shorter than the service limit, replace that spring.

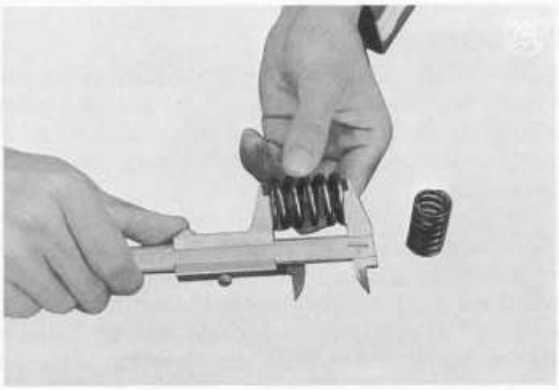


**Table 14 Valve Spring Free Length**

| | Standard | Limit |
|---|---|---|
| Inner | 1.42 in. (36.0 mm) | 1.38 in. (35.0 mm) |
| Outer | 1.55 in. (39.3 mm) | 1.50 in. (38.0 mm) |

Measure the perpendicularity of each spring by standing it on a surface plate and setting a square against it. If the top of the spring is more than the service limit distance away from the square, replace the spring.

**Valve Spring Perpendicularity** (297)

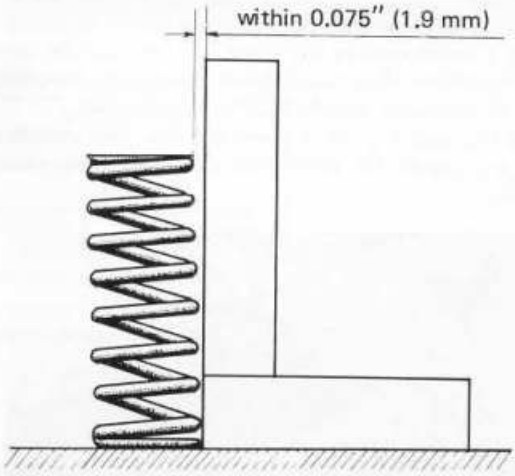



**Table 15 Valve Spring Perpendicularity**

| Standard | Service Limit |
|---|---|
| Zero variation | .075 in. (1.9 mm) |

## Oil Seals

The oil seal around each valve stem prevents oil from leaking down into the combustion chamber. When the oil seal goes bad, there will be an increase in oil consumption, carbon may build up in the combustion chamber area, and the engine will exhaust white smoke.

If the oil seal appears damaged or is suspected, remove the valve, take the oil seal off the valve guide and replace it.

## CYLINDER, PISTON

The cylinder is manufactured from aluminum alloy for good heat conduction, and fins are provided around its outer circumference to aid in heat radiation. A heat and wear-resistant cylinder sleeve is cold pressed into the cylinder.

The piston shape is designed so that it will become cylindrical after heat expansion takes place when the engine is running. To this end, the piston is tapered in toward the head, and is elliptical rather than perfectly round. The piston is made with enough clearance between 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 chamber. The top two rings are compression rings, and the bottom ring is an oil ring.

If the cylinder, piston and piston rings get worn, or if the rings stick to the piston, compression leakage and excessive oil consumption occur, accompanied by difficulty in starting, poor performance and white exhaust smoke. The oil leakage into the combustion chamber causes carbon to build up on the piston top, resulting in preignition, overheating and knocking. In addition, blowby gases leak into the crankcase and reduce the lubricating ability of the engine oil.

A piston pin is installed into the center of each piston, and the middle part of the pin passes through the small end of the connecting rod. A circlip in each end of the piston pin hole prevents the pin from coming out. Pin installation is the complete floating type, so that there is a certain amount of clearance between each end of the pin and the piston, and between the middle of the pin and the connecting rod. Slapping noise will result if this clearance becomes too large.

### *Compression measurement*

Compression greatly affects engine performance, and differences in compression among the cylinders will cause poor running. A drop in compression can stem from wear of the cylinder, piston or rings, sticking rings, or poor valve seating.

Before measuring compression, check that the cylinder head is tightened down with the correct torque (Pg. 32) and thoroughly warm up the engine so that engine oil between the piston and cylinder wall will help seal compression as it does during normal running. While the engine is running, check that there is no gas leakage from around the cylinder head gasket.

Stop the engine, remove all the spark plugs, and screw the compression gauge firmly into a spark plug hole so that there is no leakage. Turn the engine over with the throttle fully open until the compression gauge stops rising; compression is the highest reading obtainable.

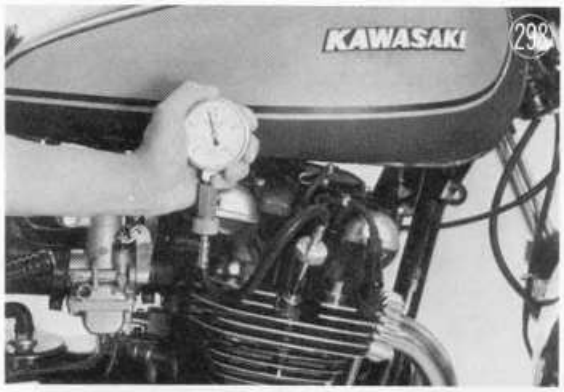
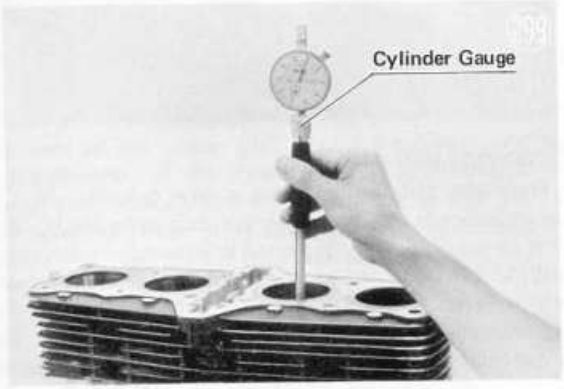



**Table 16 Cylinder Compression**

| Standard | Service Limit |
|---|---|
| 121 lbs/sq in (8.5 kg/cm$^2$) | 85 lbs/sq in (6 kg/cm$^2$) and less than 14 lbs/sq in (1 kg/cm$^2$) difference between any two cylinders. |

### *Cylinder and 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 three locations (total of 6 measurements) shown in Fig. 300. If any of the measurements exceeds the service limit, or if there is a difference of more than .002 inch (.05 mm) between any two measurements, all the cylinders will have to be bored and honed.




**Cylinder Diameter Measurement** (300)

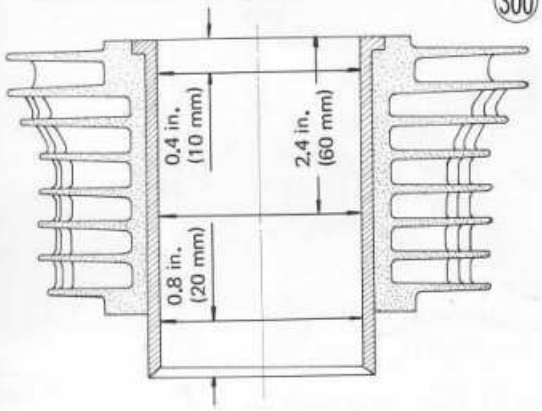



**Table 17 Cylinder Inside Diameter**

| Standard | Service Limit |
|---|---|
| 2.5984~2.5992 in. (66.000~66.019 mm) | 2.602 in. (66.10 mm) |

Measure the diameter of the piston .2 inch (5 mm) up from the bottom of the piston, at right angles to the direction of the piston pin. If the measurement is under the service limit, replace the piston.

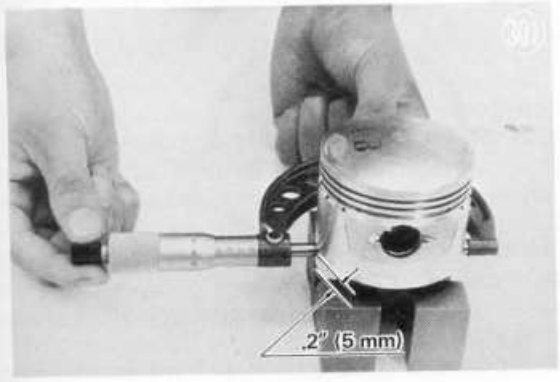



**Table 18 Piston Diameter**

| Standard | Service Limit |
|---|---|
| 2.5956~2.5965 in. (65.93~65.95 mm) | 2.590 in. (65.80 mm) |

### *Piston Clearance*

The most accurate way to find the piston clearance is by making separate piston and cylinder diameter measurements and subtracting the two values. Measure piston diameter as shown above, and measure cylinder diameter at the very bottom of the cylinder.

**Table 19 Piston/Cylinder Clearance**

| Standard |
|---|
| .0025~.003 in. (.060~.079 mm) |

The standard clearance must be adhered to whenever the cylinder is replaced, or when the cylinder is bored. However, if only the piston is replaced, clearance may exceed the limit but must not be less than the minimum clearance given in the table.

### *Boring, honing*

When boring and honing the cylinder, note the following:

1. Cylinder inside diameter must not vary more than .0004 inch (.01 mm) at any point.
2. There are two sizes of oversize pistons available: 0.5 mm (.020 inch) and 1.0 mm (.040 inch). If boring more than 1 mm becomes necessary, the cylinder will have to be replaced.
3. To avoid cylinder distortion due to unbalanced metal temperatures, bore the cylinders in 2-4-1-3 or 3-1-4-2 order.
4. Be wary of taking measurements directly after boring, as the cylinder diameter may be changed due to the temperature.
5. Piston/cylinder clearance should be set at the standard value given in Table 19.

### *Piston/cylinder seizure*

Remove the cylinder and piston and check the damage. If it is light, smooth the piston and cylinder with #400 emery cloth. If damage is heavy, the cylinder will have to be bored and honed and the piston replaced.

### *Piston cleaning*

As carbon on the piston top reduces piston cooling efficiency, scrape off any accumulated carbon.



Clean carbon and dirt out of the piston ring grooves using a piece of broken piston ring or other suitable tool.



*Piston ring, ring groove wear*

Visually inspect the piston rings and the piston ring grooves in the piston. If the rings are damaged or worn unevenly, they must be replaced. If the ring grooves in the piston are worn unevenly or damaged, replace the piston. When the piston is replaced because of uneven ring groove wear, the rings should be replaced at the same time.

Measure the width of the ring grooves, and measure the thickness of the rings. If the width of the grooves exceeds the service limit, replace the piston; replace any rings that are worn down to less than the service limit.

**Table 20 Piston Ring Thickness**

| | Standard | Service Limit |
|---|---|---|
| Top ring | .0567~.0573 in.<br>(1.440~1.455 mm) | .0535 in.<br>(1.36 mm) |
| Second ring | .0579~.0587 in.<br>(1.470~1.490 mm) | .055 in.<br>(1.40 mm) |
| Oil ring | .0973~.0980 in.<br>(2.470~2.490 mm) | .0945 in.<br>(2.40 mm) |

**Table 21 Piston Ring Groove Width**

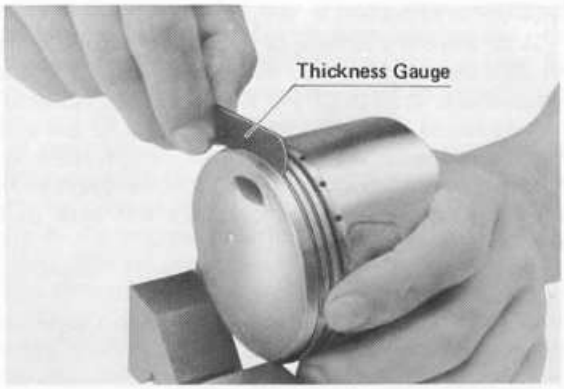
| | Standard | Service Limit |
|---|---|---|
| Top groove | .059~.060 in.<br>(1.50~1.52 mm) | .063 in.<br>(1.60 mm) |
| Second groove | .059~.060 in.<br>(1.50~1.52 mm) | .063 in.<br>(1.60 mm) |
| Bottom groove | .098~.099 in.<br>(2.50~2.52 mm) | .102 in.<br>(2.60 mm) |

Even though both the piston ring grooves and the piston rings may be in tolerance, if the ring/groove clearance exceeds the service limit, parts will have to be replaced.

With the piston rings fitted into place on the piston, make several clearance measurements around the groove using thickness gauges.

**Table 22 Piston Ring/Groove Clearance**

| | Standard | Service Limit |
|---|---|---|
| Top ring | .0018~.0031 in.<br>(.045~.080 mm) | .007 in.<br>(.18 mm) |
| Second ring<br>oil ring | .0004~.0020 in.<br>(.010~.050 mm) | .006 in.<br>(.15 mm) |




*Piston ring end gap*

Place the piston ring inside a new cylinder, or if a new cylinder is not available, inside a cylinder as little worn as possible. If it is placed in a used cylinder, set it close to the bottom of the cylinder, where cylinder wear is low. Measure the gap between the ends of the ring with thickness gauges. If the gap is wider than the service limit, the ring is overworn and should be replaced.

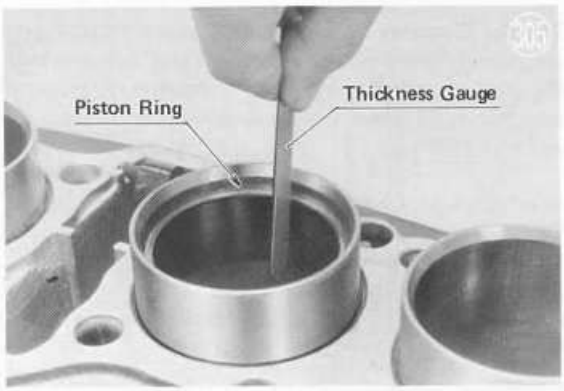



**Table 23 Piston Ring End Gap**

| Standard | Service Limit |
|---|---|
| .008~.016 in.<br>(.2~.4 mm) | .028 in.<br>(.7 mm) |

*Piston ring tension*

Piston ring tension can be evaluated by measuring the gap between the ends of the ring, with the ring sitting free of any restraint. If the measured gap is less than the service limit, the ring is weak and should be replaced.



**Table 24 Piston Ring (Free) End Gap**

| | Standard | Service Limit |
|---|---|---|
| Top ring | .354 in. (9 mm) | .236 in. (6 mm) |
| Second Ring | .354 in. (9 mm) | .236 in. (6 mm) |
| Oil ring | .315 in. (8 mm) | .197 in. (5 mm) |

*Piston, piston pin, connecting rod wear*

To determine wear, measure the diameter of the piston pin with a micrometer, and measure the inside diameter of the piston pin hole of the piston, and the inside diameter of the connecting rod small end. If the piston pin measurement is less than the service limit at any point, or if the other two measurements exceed the service limit, replace the defective part(s).

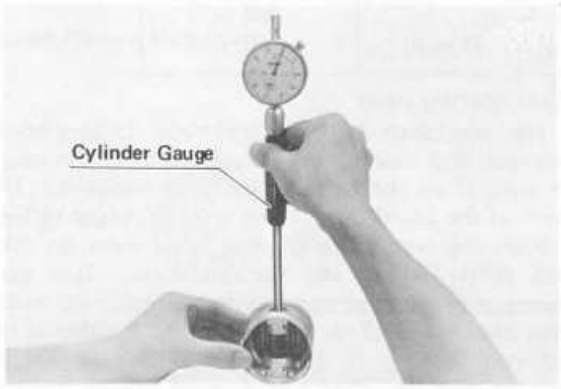



**Table 25 Piston Pin, Piston Pin Hole, Small End Dia.**

| | Standard | Service Limit |
|---|---|---|
| Piston pin | .6691~.6693 in. (16.994~17.000 mm) | .6677 in. (16.96 mm) |
| Piston pin hole | .6694~.6701 in. (17.0035~17.0115 mm) | .6724 in. (17.08 mm) |
| Small end I.D. | .6694~.6698 in. (17.003~17.014 mm) | .6713 in. (17.05 mm) |

**NOTE:** When a new piston or pin is used, also check that piston to pin clearance is .00026~.00057 in. (.0066~.0145 mm), and that pin to small end clearance is within .00012~.00079 in. (.003~.020 mm).

**To the Dealer:** When possible, match parts from stock so that a marked pin is assembled with an **A** piston, and an unmarked pin with a **B** piston.

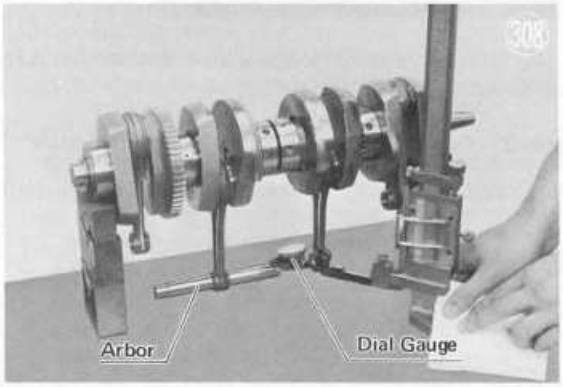
## CRANKSHAFT

The crankshaft is the part that takes the intermittent force of the pistons, and changes their reciprocating motion into usable rotating motion. If crankshaft trouble develops – excessive play, runout, etc. – not only are the bearings and crankcase parts adversely affected, but it causes noise, power loss, vibration, and in general tends to shorten overall engine life. For these reasons, crankcase trouble should be detected and repaired at an early stage.

This manual lists some of the more common crankshaft troubles and the method for detecting them; it does not explain crankshaft disassembly. Crankshaft disassembly requires exacting tolerances and highly specialized equipment; when the crankshaft becomes defective for one or more reasons, it should be replaced as an assembly, or rebuilt by a properly equipped Kawasaki rebuilding station. Note that the crankshaft bearing caps are machined assembled with the crankcase, and if the caps are damaged during repairs or otherwise, the caps and crankcase must be replaced as a machine-matched set.

*Connecting rod bending or twisting*

Remove the bearing from each end of the crankshaft and set the crankshaft in **V** blocks on a surface plate. Select an arbor of the same diameter as the piston pin and of optional length, and insert it into the small end of the connecting rod. Use a height gauge or dial gauge and measure the difference in height over a 100 mm (4 inch) length to determine the amount the connecting rod is bent.




Using the arrangement and arbor shown below, measure the amount that the arbor varies from being parallel with the crankshaft, over a 100 mm length of the arbor.

If either of the above measurements exceeds the service limit, the crankshaft assembly should be replaced.

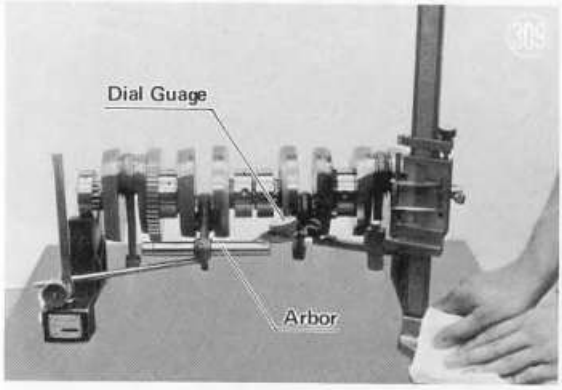
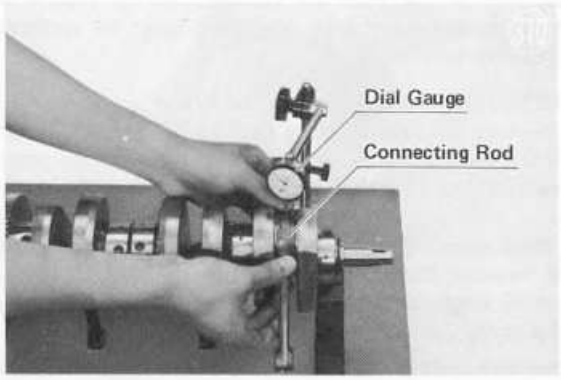



**Table 26 Connecting Rod Bend, Twist**

| | Standard | Service Limit |
|---|---|---|
| Bend | under .002 in./100 mm (under .05 mm/100 mm) | .008 in. (.20 mm) |
| Twist | under .002 in./100 mm (under .05 mm/100 mm) | .008 in. (.20 mm) |

*Connecting rod big end radial clearance*

Remove the bearing from either end of the crankshaft and suspend it in V blocks. Set a dial gauge against the big end of the connecting rod, and first push the connecting rod toward the gauge and then in the opposite direction. The difference between the two gauge readings is the radial clearance.




If radial clearance exceeds the service limit, the crankshaft should be replaced.

**Table 27 Connecting Rod Big End Radial Clearance**

| Standard | Service Limit |
|---|---|
| .0006~.0012 in.<br>(.016~.030 mm) | .0031 in.<br>(.08 mm) |

*Connecting rod side clearance*

Measure the side clearance of the connecting rod with a thickness gauge as shown, replacing the crankshaft if the measured value exceeds the service limit.

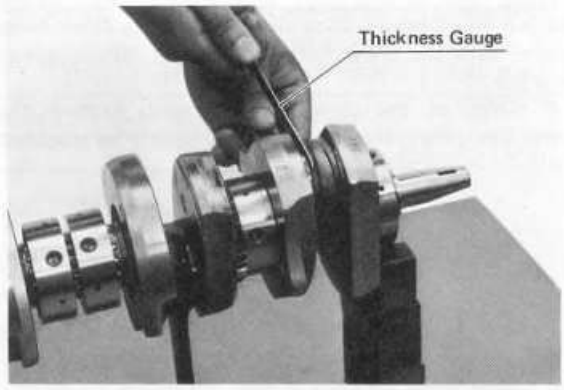
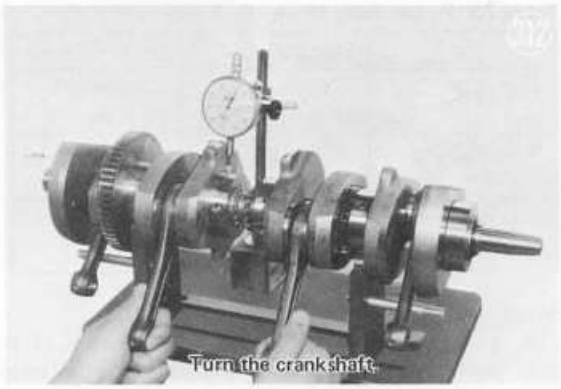



**Table 28 Connecting Rod Big End Side Clearance**

| Standard | Service Limit |
|---|---|
| .012~.016 in.<br>(.3~.4 mm) | .024 in.<br>(.6 mm) |

*Crankshaft runout*

Remove the bearing from either end of the crankshaft and suspend it in V blocks. Set a dial gauge against each of the other bearings and turn the crankshaft slowly. The difference between the highest and lowest dial gauge reading for the bearing is the runout.




If runout measured at any bearing exceeds the the service limit, the crankshaft should be replaced.

**Table 29 Crankshaft Runout**

| Standard | Service Limit |
|---|---|
| under .0012 in.<br>(under .03 mm) | .004 in.<br>(.10 mm) |

*Main bearing wear*

The crankshaft bearings are made to very close tolerance, and bearing play would be difficult to measure even if all the bearings could be removed. The worth of the bearing, therefore, must be judged by feel.

Wash the bearings in gasoline, blow them dry (**DO NOT SPIN THEM**), and lubricate them. Turn each bearing over by hand and see that it makes no noise, turns smoothly, and has no rough spots. If either of the two end bearings is defective, that bearing can be replaced, but the other four bearings can be replaced only as an assembly with the crankshaft.

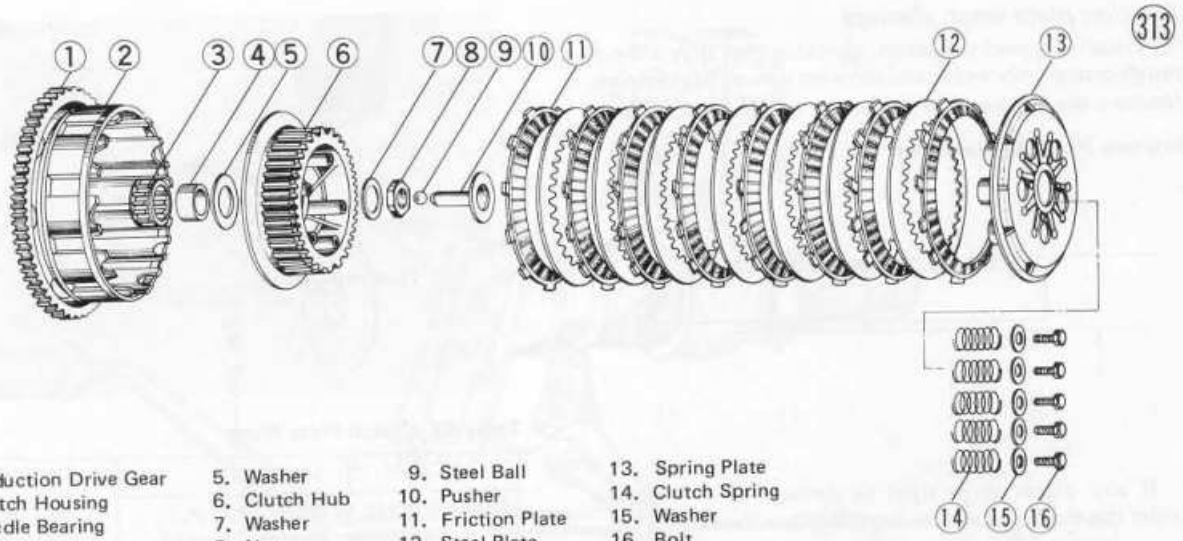
## CLUTCH

Fig. 313 is a breakdown diagram of the Z1 clutch. It is a wet-type, multiple-plate clutch with 8 friction plates and 7 steel plates. The friction plates are made of steel with a bonded cork covering. The clutch housing has a reduction drive gear riveted to one side of it, and contains damper rubbers and springs to reduce clutch vibration.

The clutch release mechanism is shown in Fig. 314. The outer clutch release worm gear is made of nylon, and the inner one of steel. Assembled into the center of the inner release gear is a clutch adjusting screw, which pushes on the push rod and steel ball inside the drive shaft, to release the clutch.

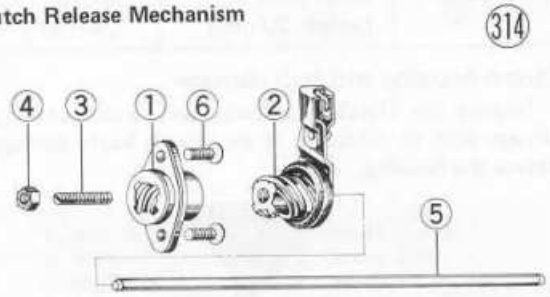
The clutch friction plates are connected to the clutch housing by tangs on the outer circumference of each plate, and since the clutch housing is gear-driven directly by the crankshaft, these plates are always turning any time the engine is running. The steel plates have a toothed inner circumference which meshes with the splines in the clutch hub on the drive shaft, and so the drive shaft and steel clutch plates always turn together. The friction plates and clutch plates are pushed together by the clutch springs, so that the friction plates drive the steel plates by virtue of their mutual friction, and thereby turn the transmission drive shaft.

**Clutch**




1. Reduction Drive Gear
2. Clutch Housing
3. Needle Bearing
4. Bushing
5. Washer
6. Clutch Hub
7. Washer
8. Nut
9. Steel Ball
10. Pusher
11. Friction Plate
12. Steel Plate
13. Spring Plate
14. Clutch Spring
15. Washer
16. Bolt

**Clutch Release Mechanism**




1. Outer Release Gear
2. Inner Release Gear
3. Adjusting Screw
4. Lock Nut
5. Push Rod
6. Screw

When the clutch lever at the handlebar is squeezed to release the clutch, the clutch cable is pulled, and this turns the inner release gear. The release gear worm causes it to move toward the clutch, and the adjusting screw in the gear pushes on the push rod inside the drive gear. The push rod in turn pushes on the steel ball which pushes the spring plate pusher. When the spring plate pusher pushes on the spring plate, the clutch springs are compressed and no longer force the friction plates and the steel plates together, and power transmission from the crankshaft to the transmission drive shaft is interrupted.

If the clutch does not release properly, it will be hard to shift gears, and you will run the danger of damaging the transmission. If the clutch slips, power transmission efficiency is reduced, and the clutch may overheat. Possible reasons for clutch release trouble include:

1. Too much clutch lever play
2. Clutch plates are warped or too rough
3. Clutch spring tension is uneven among the springs
4. Transmission oil is old, or viscosity too high
5. Clutch bearing is frozen
6. Clutch release mechanism is defective
7. Clutch hub or housing unevenly worn

Some possible reasons for clutch slippage:

1. No clutch lever play
2. Friction plates worn
3. Clutch springs weak
4. Clutch cable not sliding smoothly
5. Clutch release mechanism is defective

Clutch noise could be the result of:

1. Too much backlash between the primary gear and the clutch gear
2. Gear teeth damaged
3. Too much clearance between the friction plate tangs and the clutch housing
4. Needle bearing worn or damaged
5. Damper rubber or springs bad

### *Clutch spring tension*

If the springs are weak, they will not expand to their full length when removed, so the condition of the springs can be judged by measuring the free length of the springs with vernier calipers.

If any spring is shorter than the service limit, replace all the springs as a matched set to ensure even tension on the clutch plates.

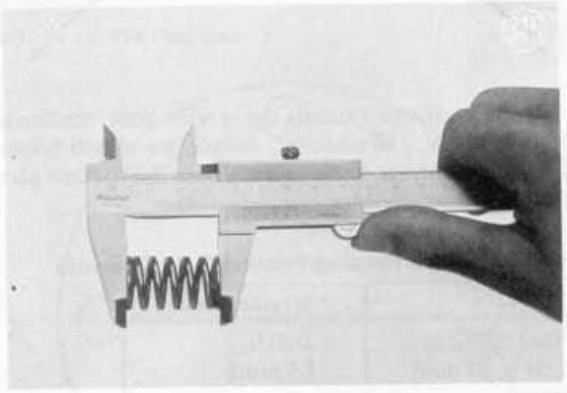


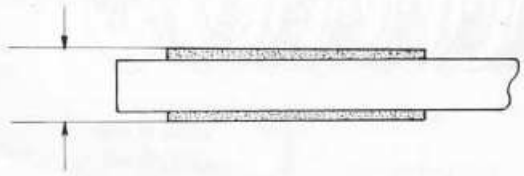
**Table 30 Clutch Spring Free Length**

| Standard | Service Limit |
|---|---|
| 1.33 in. (33.8 mm) | 1.27 in. (32.3 mm) |

*Friction plate wear, damage*

Visually inspect the plates, checking that they are not rough or unevenly worn, and show no sign of heat seizure. Measure the thickness of the plates with vernier calipers.

**Friction Plate Measurement** (316)



If any plates show signs of damage, or if they are under the thickness service limit, replace them.

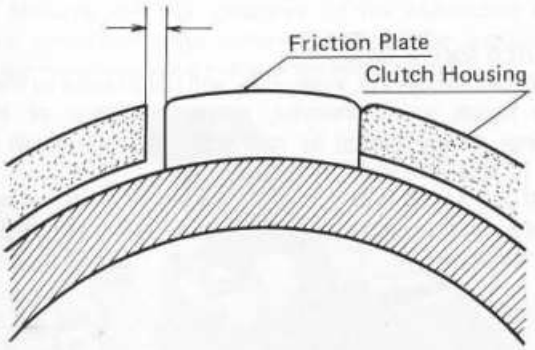
**Table 31 Friction Plate Thickness**

| Standard | Service Limit |
|---|---|
| .146~.154 in.<br>(3.7~3.9 mm) | .134 in.<br>(3.4 mm) |

*Clutch housing/friction plate clearance*

Measure the clearance between the fingers of the clutch housing, and the tangs on the friction plates. If this clearance is excessive, the clutch will be noisy.

**Friction Plate/Clutch Housing Clearance** (317)




If the clearance exceeds the service limit, replace the friction plates. In addition, replace the clutch housing if it is unevenly or badly worn where the friction plates hit it.

**Table 32 Clutch Housing/Friction Plate Clearance**

| Standard | Service Limit |
|---|---|
| .002~.012 in.<br>(.04~.30 mm) | .020 in.<br>(.5 mm) |

*Clutch plate warp*

Place each friction plate and each steel plate on a surface plate, and measure the gap between the clutch plate and the surface plate. This gap is the amount the clutch plate is warped.

Replace any plates warped over the service limit.

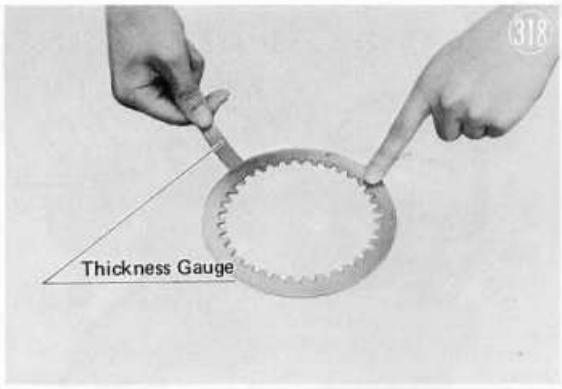



**Table 33 Clutch Plate Warp**

| | Standard | Service Limit |
|---|---|---|
| Friction plate | under .006 in.<br>(under .15 mm) | .012 in.<br>(.30 mm) |
| Steel plate | under .008 in.<br>(under .20 mm) | .016 in.<br>(.40 mm) |

*Clutch housing and hub damage*

Inspect the clutch gear teeth and repair any light damage with an oilstone. If the gear is badly damaged, replace the housing.




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.

Inspect the splines of the hub where the steel plates hit. If there are notches worn, replace the hub.

*Clutch release gear wear*

Fit the two gears together and pull them back and forth in the direction of the shaft, without turning them. If there is excessive play, replace the two gears as a set. Also replace them if there is any visible damage to the worm.

*Lubrication*

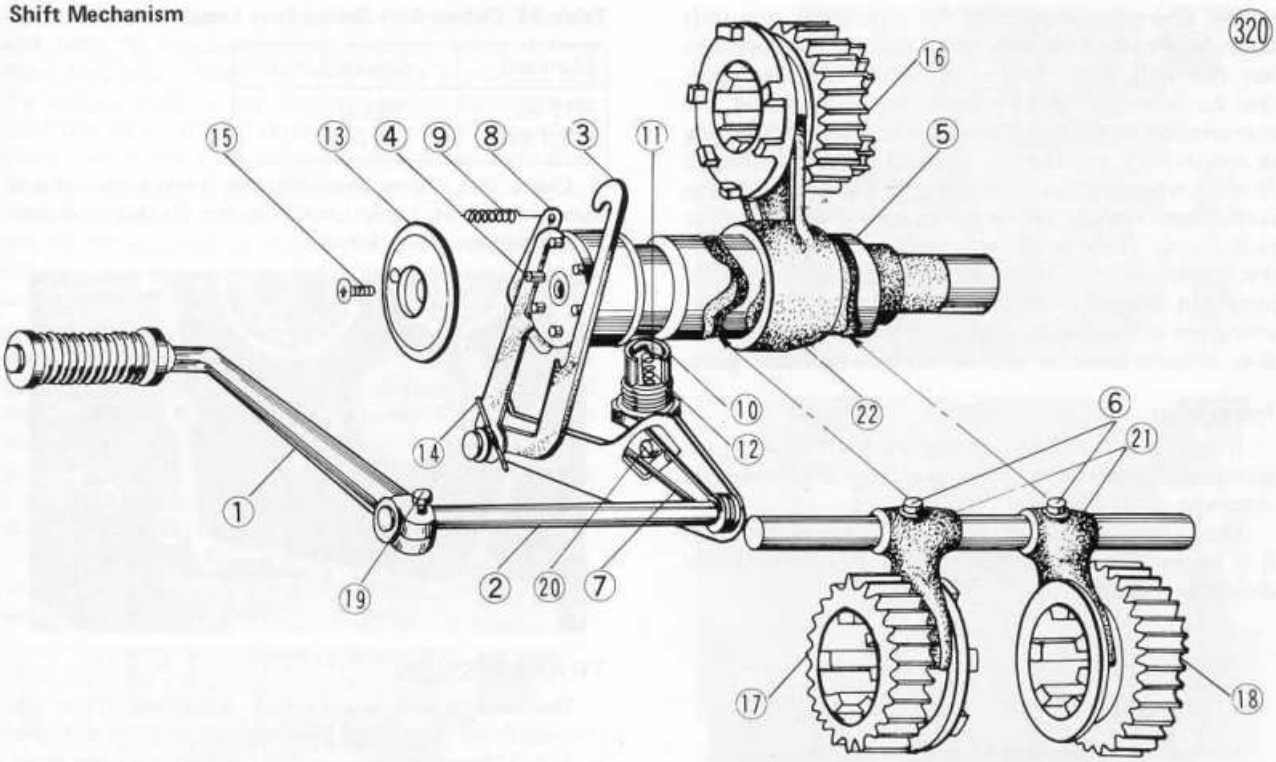
Lubricate the worm teeth of the two release gears with regular cup grease.

## EXTERNAL SHIFT MECHANISM

The external shift mechanism comprises the parts which turn the shift drum in the transmission. The shift mechanism is shown in Fig. 320. When the shift pedal ① is raised or lowered, the shaft ② is turned,

**Shift Mechanism**

320




1. Shift Pedal
2. Shaft
3. Shift Pawl
4. Shift Drum Pin
5. Shift Drum
6. Shift Fork Pin
7. Return Spring
8. Detent Arm
9. Detent Arm Spring
10. Shift Drum Positioning Pin
11. Neutral Detent Pin
12. Spring
13. Shift Drum Pin Holder
14. Pawl Spring
15. Screw
16. Drive 3rd Gear
17. Output 5th Gear
18. Output 4th Gear
19. Bolt
20. Return Spring Pin
21. Shift Fork
22. Shift Fork

one shift pawl ③ catches on the shift drum pins ④ and turns the shift drum ⑤ . The pin ⑥ of each shift fork rides in a groove in the shift drum, so that as the drum turns, the shift fork ㉑ ㉒ is forced to move right or left to follow the groove. The prongs of each fork move the transmission gears back and forth as the forks move, so that different gears are put into mesh.

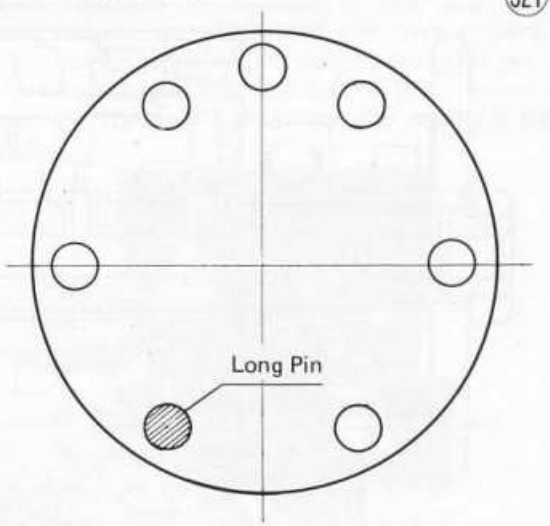
When the shift pedal is released after shifting gears, the return spring ⑦ returns the pedal to its original position. To keep the shift drum in its new position, a detent arm ⑧ is held against the shift drum pins by the detent arm spring ⑨ .

The transmission neutral position is located halfway between 1st and 2nd gears, and shifting into neutral is done by moving the shift pedal a half-stroke from either 1st or 2nd gear. When the transmission is shifted into a gear other than neutral, the detent arm keeps the shift drum in place; but since neutral is between gears, the same detent arm will not help position the drum or keep it in place when neutral is selected. Instead, there is a neutral detent pin ⑪ inside the shift drum positioning pin ⑩ for this purpose. The detent pin is pushed down into the drum positioning groove by a spring ⑫ , and drops down into a depression in the groove when the drum is turned to the neutral position.

In addition to the neutral detent, a neutral indicator lamp helps in detecting the neutral position. The switch terminal for the lamp is installed in the transmission cover, and a boss on the shift drum pin holder ⑬ provides the switch ground (i.e. it lights the lamp) when the drum is turned to the neutral position. To position the pin holder so that it cannot be misassembled to where the neutral lamp will be lighted at the wrong time, the one long shift drum pin seats into the inner side of the pin holder boss. The long pin must be assembled into the position shown; if it is not, the neutral lamp will light at some position other than neutral.

**Shift Drum Pin Position**

321



For a single operation of the shift pedal, the shift drum is supposed to turn only the distance between any two shift pins. If the shift drum turns randomly due to worn or broken parts, not only could the transmission be damaged from the resultant misshifting or overshifting, but the engine could be badly damaged from overrunning (over-revving). Failure to shift can come from breaking of the return spring, shift pawls or pawl spring. If the detent arm spring weakens or breaks, the transmission will not be held firmly in gear, and may jump out of gear under power. Note that the return spring pin is fixed with a lock nut and Loctite, but if it does become loose it will be difficult to shift gears.

### *Inspection*

Inspect the shift lever spring, the shift pawls, pawl spring and detent arm spring, replacing any broken or otherwise damaged parts.

Measure the free length of the detent arm spring. If it is longer than the service limit value, it is weak and should be replaced.

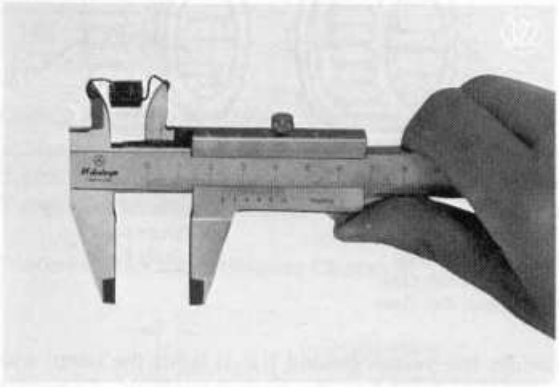
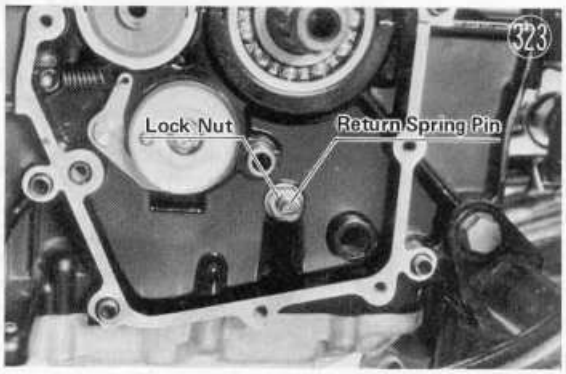


**Table 34 Detent Arm Spring Free Length**

| Standard | Service Limit |
|---|---|
| .917 in. (23.3 mm) | .984 in. (25 mm) |

Check that the return spring pin is not loose. **If it is loose,** remove it, apply Loctite to the threads, re-install it, and tighten the lock nut.

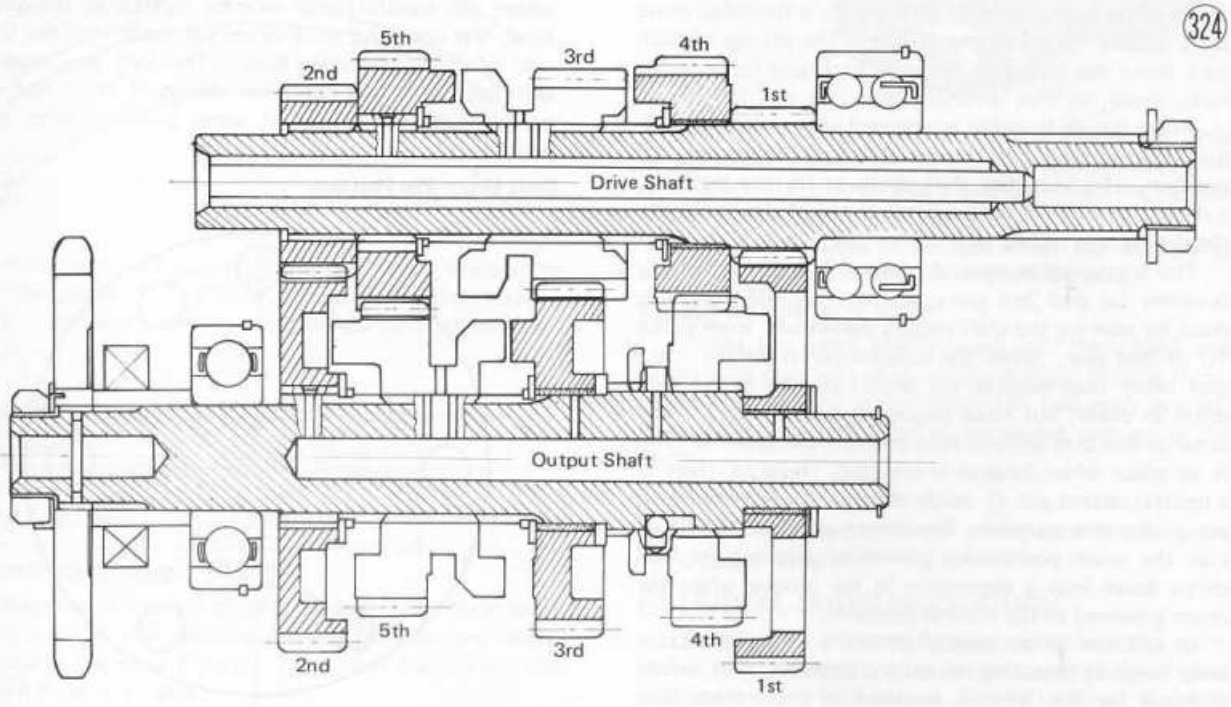



## TRANSMISSION

The transmission is a 5-speed, return-shift type. A cross-sectional diagram of the transmission gears is shown in Fig. 324. For purposes of explanation, the drive shaft gears are labeled "D" (D1=Drive shaft 1st gear, etc.) and the output shaft gears are marked "O".

The three shift forks ride on gears D3, O4, and O5, and can move them back and forth along the shaft, although these gears must rotate with their respective shafts. Gears D1 and D2 are fixed to the drive shaft; gears D4, D5, O1, O2 and O3 are free to rotate on the shaft but cannot move along the shaft.

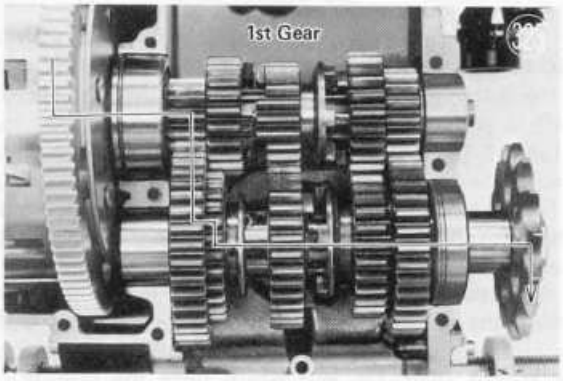
**Transmission Gears**

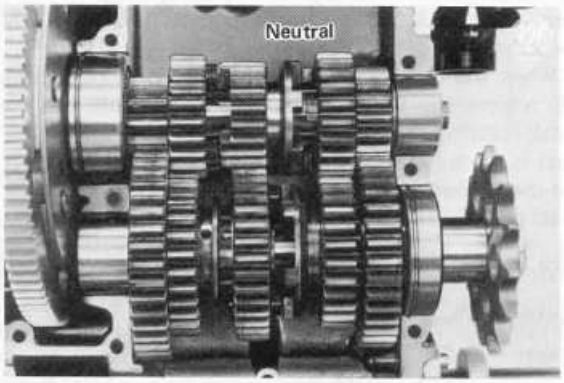


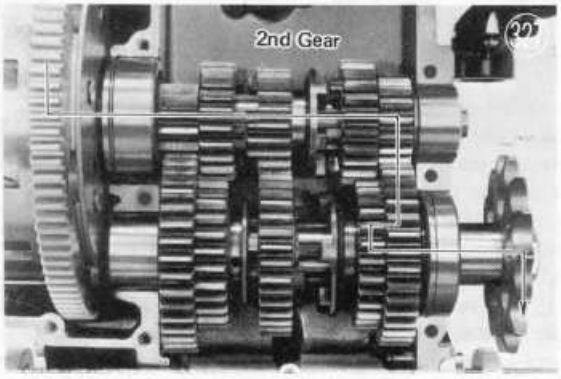
Inside gear O4 three steel balls are located 120° apart, and serve to facilitate neutral location when shifting from first gear. When the motorcycle is stopped and the output shaft is not turning, one or two of these balls falls down into its respective groove in the output shaft. When the shift pedal is operated to shift from first toward second, gear O4 starts moving, but halfway toward its second gear position, the steel ball(s) hits the end of the groove(s) in the output shaft, stopping gear O4 from moving, stopping the shift drum from turning, and leaving the transmission gears in the neutral position.

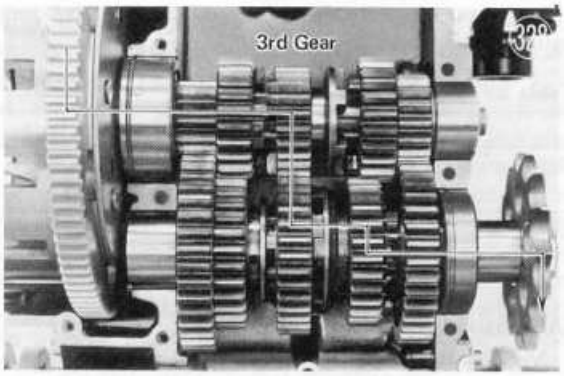
Trouble in shifting could be caused by wear of the shift forks, the shift fork grooves in the gears, shift fork guide pins, or the grooves in the shift drum. It could also be the result of bent shift forks, or of damage to the tongues on the side of the gears or the holes that they go into. If there is trouble in the external shift mechanism or with the clutch release, this could also cause difficulty in shifting.

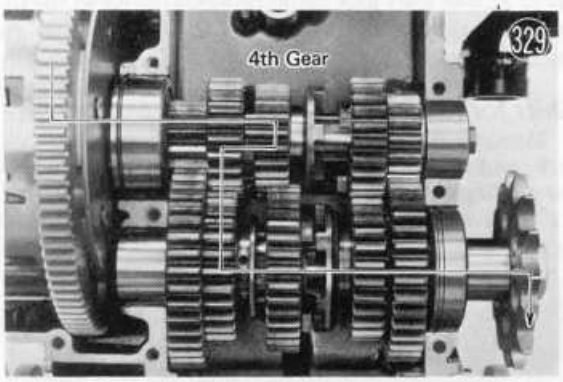
Transmission noise will result from gear teeth damage, or damage or wear of the gear bushings, shaft, bearings, etc.

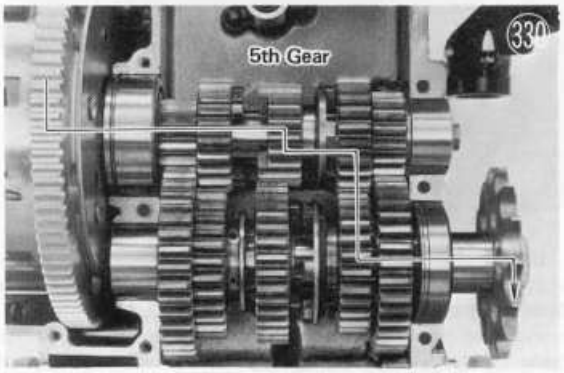


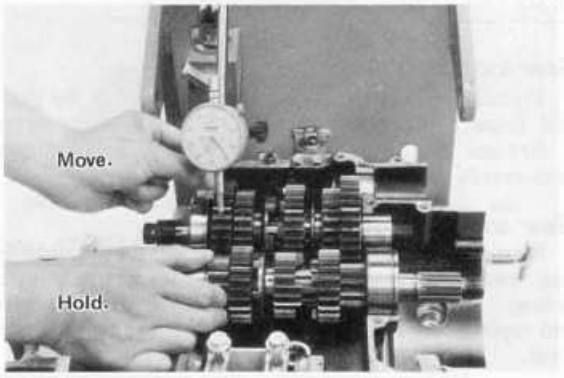




*Gear backlash*

Split the crankcase, leaving the transmission shafts in place. Measure the backlash between gears one through five, by preventing one gear from rotating, setting a dial gauge against the teeth of the other gear, and rotating the gear back and forth. The difference between the highest and the lowest dial reading is the backlash.



In cases where backlash exceeds the service limit, replace both gears.

**Table 35 Transmission Gear Backlash**

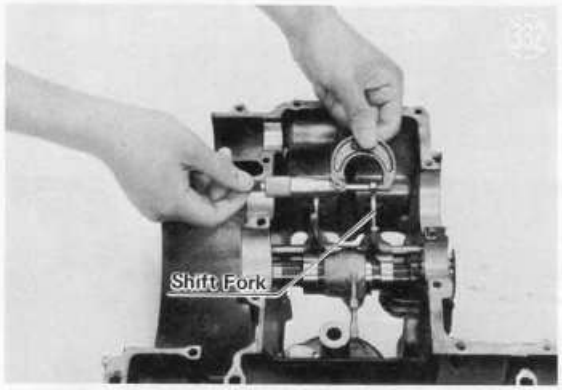
| | Standard | Service Limit |
|---|---|---|
| 1st gear | .0008~.0075 in. (.02~.19 mm) | .0098 in. (.25 mm) |
| 2nd-5th gears | .0024~.0091 in. (.06~.23 mm) | .0118 in. (.30 mm) |

### *Shift fork bending*

Visually inspect the shift forks and replace any bent ones. A bent shift fork could cause difficulty in shifting, or could allow the transmission to jump out of gear under power.

### *Shift fork or gear groove wear*

Measure the thickness of the prongs of each shift fork, and measure the width of the shift fork groove in the applicable gears.




If the shift fork prongs are thinner than the service limit, or if the gear groove is worn over the limit, replace the worn part.

**Table 36 Shift Fork Thickness**

| Standard | Service Limit |
|---|---|
| .228~.236 in. (5.80~6.00 mm) | .224 in. (5.70 mm) |

**Table 37 Gear Groove for Shift Fork**

| Standard | Service Limit |
|---|---|
| .238~.242 in. (6.05~6.15 mm) | .246 in. (6.25 mm) |

### *Gear tongue, hole damage*

Visually inspect the tongues on the sides of the gears, and inspect the holes into which these tongues go.

Replace any gears where these parts are damaged or unevenly worn.

### *Gear and shaft wear*

Measure the diameter of the shaft with a micrometer, and measure the inside diameter of each gear listed below. Subtract the two readings to figure clearance, and replace any gear where clearance exceeds the service limit.

**Table 38 Gear/Shaft Clearance**

| Gear | Standard | Service Limit |
|---|---|---|
| Drive 4th, output 3rd | .0008~.0024 in. (.020~.062 mm) | .0064 in. (.162 mm) |
| Drive 5th | .0063~.0096 in. (.160~.245 mm) | .0136 in. (.345 mm) |
| Output 1st | .0011~.0024 in. (.027~.061 mm) | .0063 in. (.161 mm) |
| Output 2nd | .0118~.0182 in. (.300~.463 mm) | .0222 in. (.563 mm) |

### *Bearing damage*

Since the bearings are manufactured to very close tolerances, clearance measurement is very difficult, and not recommended. Wash each bearing with gasoline, blow it dry **(DO NOT SPIN IT)**, and lubricate it. Spin it by hand, replacing it if it makes noise, does not turn smoothly, or has any rough spots.

## KICK STARTER

Kick starter construction is shown in Fig. 333.

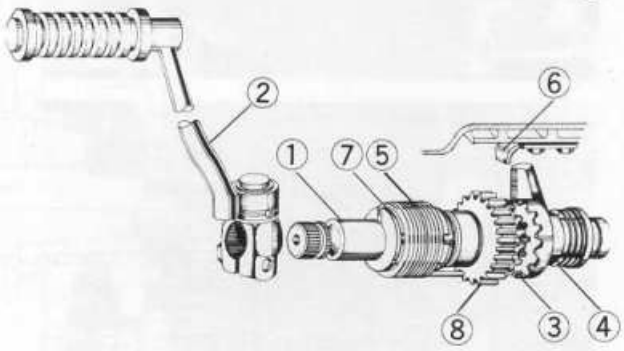
The kick gear ⑧, which is constructed with a ratchet on one side, is always meshed with first gear of the output shaft, and turns freely any time the output shaft is turning. The kick shaft ① is splined, and a ratchet gear ③ mounted on this shaft is pushed toward the kick gear by a spring ④. When no kicking is being done, however, the lever on the ratchet gear hits a stopper ⑥, and the ratchet gear is prevented from meshing with the kick gear ratchet.

When the pedal ② is kicked, the lever moves out from behind the stopper and the ratchet gear meshes with the kick gear ratchet. The kick gear then turns, turning the output shaft 1st. gear which turns the crankshaft over via drive shaft 1st gear and the clutch gear, and starts the engine.

When the kick pedal ② is released, the kick spring ⑤ returns the pedal to its original position. As the pedal returns, the ratchet gear lever (and the ratchet gear) is guided away from the kick gear by the stopper, and the ratchet gear returns to its rest position.

If the kick pedal return spring weakens or breaks,

**Kick Starter** (333)




1. Kick Shaft
2. Kick Pedal
3. Ratchet Gear
4. Spring
5. Kick Spring
6. Stopper
7. Spring Guide
8. Kick Gear

the kick pedal will not return completely or at all, and the ratchets will stay partially meshed and make noise while the engine is running. Kick mechanism noise may also occur when the kick gear bushing or kick shaft becomes worn.

If the teeth of either ratchet are worn or damaged, the ratchet will slip and it will be impossible to kick-start 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.

Measure the outside diameter of the kick shaft and replace it if it is under the service limit.

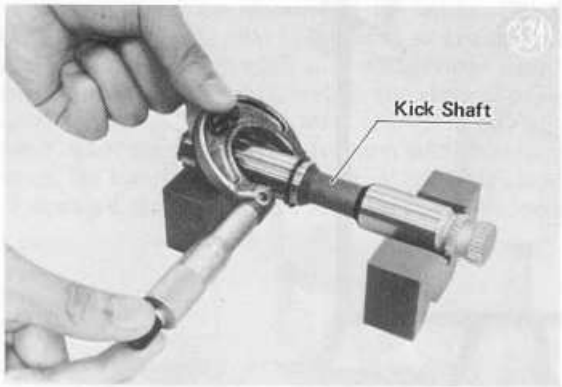



**Table 39 Kick Gear Inside Diameter**

| Standard | Service Limit |
|---|---|
| .8653~.8661 in.<br>(21.979~22.000 mm) | .8681 in.<br>(22.05 mm) |

**Table 40 Kick Shaft Outside Diameter**

| Standard | Service Limit |
|---|---|
| .8637~.8646 in.<br>(21.939~21.960 mm) | .8626 in.<br>(21.91 mm) |

## ENGINE OIL PUMP

The oil pump is a gear pump installed in the lower part of the crankcase. It is driven by a gear on the crankshaft, and used to pump oil for engine and transmission lubrication. The Z1 has a wet-sump lubrication system in which there is always a supply of oil in the sump, or oil pan at the bottom of the engine. The oil pump intake extends into this oil to pump it up into the engine. A screen at the pump inlet filters out large metal filings and other foreign matter before they can enter to damage the pump.

The oil passages into which the oil pump forces oil are shown in Fig. 337. From the pump, oil first goes through the oil filter to be cleaned. If the filter becomes clogged, a safety bypass valve routes the oil around the filter. It next goes through a pipe in which an oil pressure switch is mounted, and through an oil hole in the crankcase, from which point it is sent in three different directions.

One of these directions is to the crankshaft main bearings and crank pins. After lubricating the crank parts, the oil is thrown out by the force of crankshaft rotation and the spray lands on the cylinder walls and the piston and piston pin to lubricate these parts. The oil eventually drips down from all these points and collects in the bottom of the crankcase to be recirculated.

The second path for oil from the pump is through the oil passage at each end of the cylinder block and up into the head. After passing through holes into the camshaft bushings, the oil flows out over the cams and down around the lifters to lubricate these areas also. This oil return to the sump via the oil return holes at the base of the cam lifters, and the cam chain opening in the center of the head and cylinder.

The third path for oil flow is to the transmission, where it exits from the oil passages at the bearings of the drive and output shafts, and drops down into the crankcase after completing bearing lubrication.

### *Oil pump wear, damage*

Remove the oil passage plug from the right side of the crankcase, and connect and oil pressure gauge in its place to measure oil pressure. Standard pressure is 2.8 lbs/sq.in. (.2 kg/cm$^2$) with the engine at 3,000 r.p.m. and engine oil temperature approximately 140°F (60°C).

**NOTE:** Apply Loctite to the plug before installation.




If pressure is low, remove and disassemble the oil pump, and re-assemble the internal gears in one side of the pump body. With thickness gauges, measure the minimum clearance between the each gear and the body. If the clearance is over the service limit or if the gears are damaged, replace the pump as an assembly.

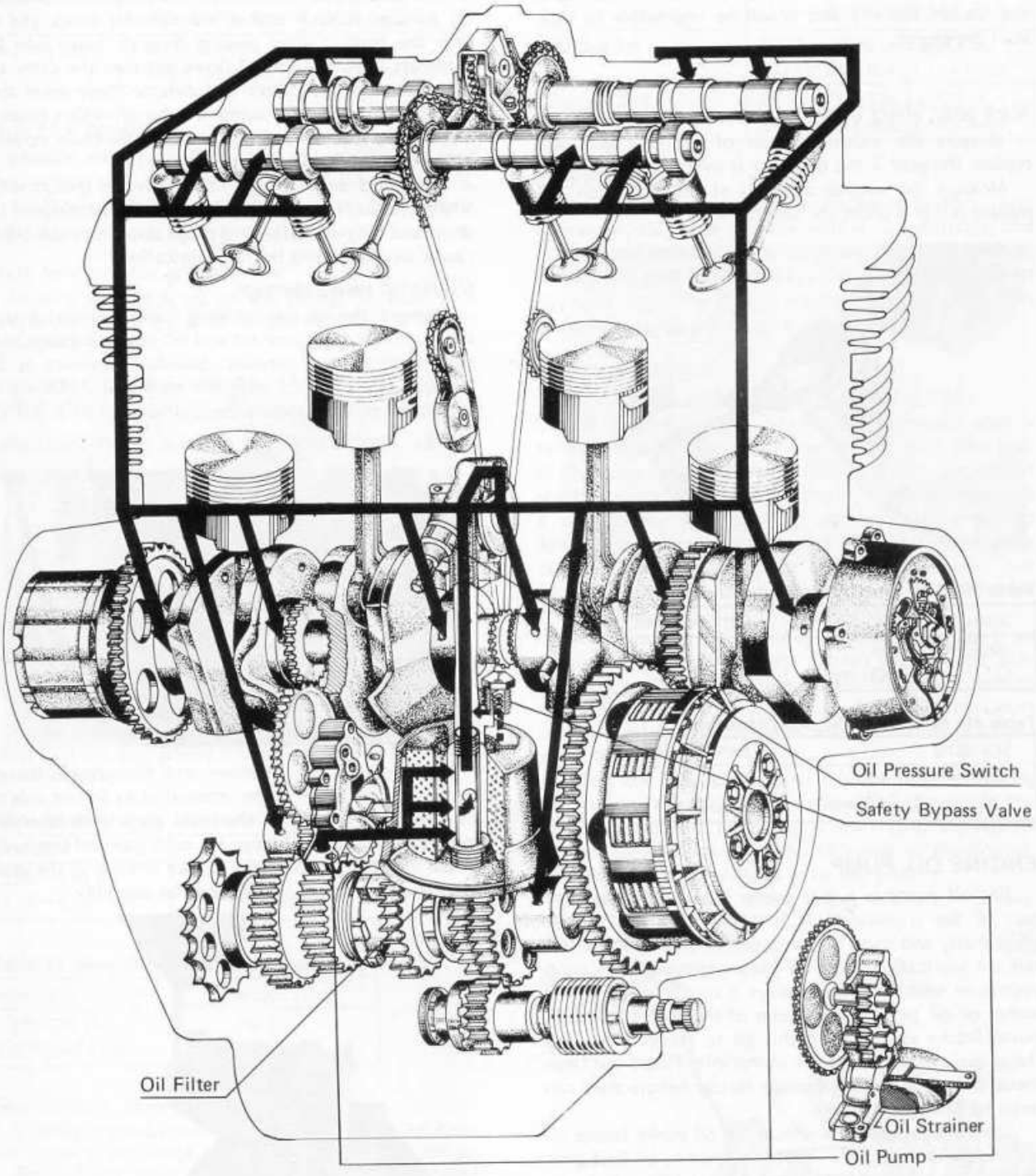



**Table 41 Oil Pump Gear Clearance**

| Standard | Service Limit |
|---|---|
| .0001~.0014 in.<br>(.003~.036 mm) | .004 in.<br>(.100 mm) |

## Engine Lubrication System

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Pry out the **O** ring and inspect it. If it appears worn or damaged, replace it.

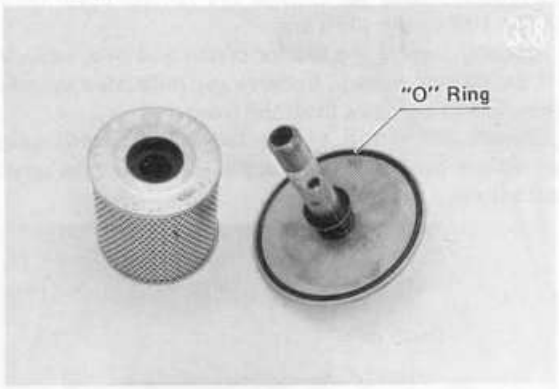
Check the screen filter at the oil pump inlet, and replace it if it is worn or damaged.

## OIL FILTER

The oil filter in the lower part of the engine filters the oil from the oil pump before it is used for lubrication.

As the oil filter becomes dirty and clogged, its filtering efficiency is reduced. If it becomes so clogged that it seriously impedes oil flow, a bypass valve opens and routes oil around the filter, so the oil is not filtered at all. In either case, a certain amount of dirt and metal filings reach the engine and transmission to accelerate wear and engine breakdown, so the filter should not be neglected to that point.

Replace the filter element at the initial 500 mile (800 km) and 2,000 mile (3,000 km) oil changes, since it quickly becomes clogged with metal filings from the initial wear-in. After that, replace the element at every other oil change. When the filter is removed for replacement, wash the rest of the filter parts with gasoline, and check the condition of the **O** ring. If the **O** ring is worn or damaged, replace it before it causes engine oil leakage.




## OIL PRESSURE SWITCH

The oil pressure switch is designed to light the oil pressure warning lamp when the oil pump malfunctions or when there is too little oil to pump. It does not indicate whether or not the engine oil level is correct.

The switch normally turns the oil lamp on when the ignition key is on but the engine is not running. If the light does not come on when the engine is not running, disconnect the wire from the switch and use an ohmmeter to check for continuity between the switch terminal and switch body. A dead short indicates the switch is not at fault, and the trouble is either defective wiring or a burned-out indicator bulb. If the ohmmeter does not read zero ohms, the switch is defective.




The switch normally turns the oil lamp off whenever the engine is running, even at idle speed. If the lamp stays on when the engine is running, stop the engine immediately and investigate the cause. Start by removing the oil lamp wire from the switch and connecting an ohmmeter between the switch terminal and the engine (chassis ground). The meter should read zero ohms when the engine is off, and should read an open (∞) when the engine is running. If the meter still reads a short when the engine is running, shut the engine off immediately and measure engine oil pressure (Pg. 93). If the pressure is normal, the switch is defective and must be replaced.

**NOTE:** When installing a new pressure switch, be sure to use Loctite on the switch threads.

## OIL BREATHER

The oil breather on top of the crankcase is open to the crankcase at the underside and is connected to the air cleaner by a hose extending from its upper side. Its function is to minimize crankcase pressure variations due to piston and crank movement, and oil heating, by venting the crankcase to the atmosphere via the air cleaner.

If the breather hose or the ports 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.

## FUEL TANK

The fuel tank holds 18 litres (4.75 U.S. gal.), 4 litres (4.2 qts.) of which forms the reserve supply. The tank cap and the fuel tap are mounted on the fuel tank.

Besides closing the tank, the tank cap serves as an air vent to let air into the tank so that gasoline will flow.

Fuel tap construction is shown in Fig. 340. The fuel tap has three positions: off, on and reserve. With the tap in the off position, no gasoline will flow through the tap; with the tap lever on, gasoline flows into the tap through the main pipe until only the reserve supply is left in the tank; with the tap lever in the reserve position, fuel flows into the tap from the bottom of the tank. The fuel tap contains a strainer and a sediment cup to filter out dirt and water from the gasoline.

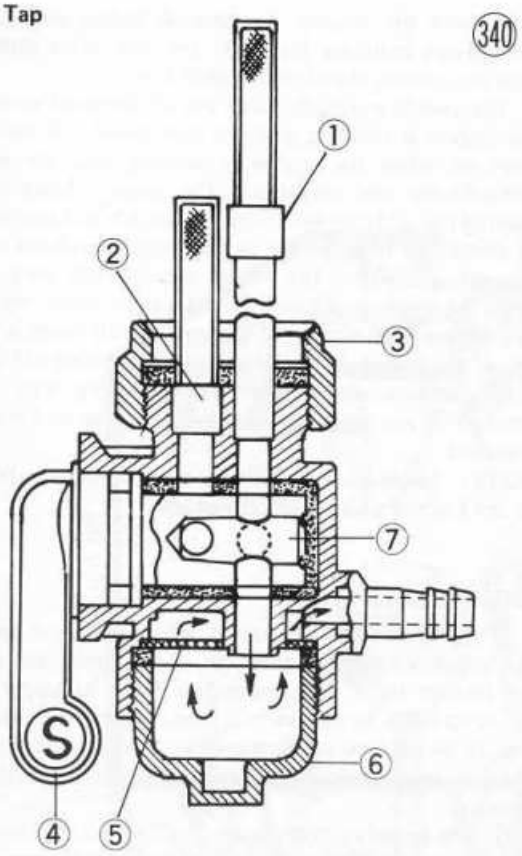
### *Inspection and cleaning*

If fuel leaks from the cap or from around the fuel tap, the cap or tap gasket may be damaged. Visually inspect these parts and replace them as necessary.

If the air vent in the tank cap is obstructed, gasoline will not flow to the carburetors. Blow the vent free with compressed air.

Periodically inspect and clean the fuel tap strainer and sediment cup, using gasoline and a fine brush on the strainer. If the strainer is damaged, replace it. If the sediment cup contains a lot of water or foreign material,

**Fuel Tap**




1. Main Pipe
2. Reserve Inlet
3. Nut
4. Tap Lever
5. Filter
6. Filter Cap
7. Valve

the fuel tank and the carburetors may need to be cleaned, too. Open the fuel tap and flush out the gasoline tank, and remove the plug at the bottom of each carburetor to drain the water and sediment from the carburetor float bowl.

## WHEELS

Wheel construction is shown in Fig. 342 and Fig. 343. For brake information, see pages 103, 108. Wheel balance is explained on page 17.

**Table 42 Wheel Bearings, Oil Seals**

| | Front Wheel | | Rear Wheel | | |
|---|---|---|---|---|---|
| | Left | Right | Coupling | Drum | |
| | | | | Left | Right |
| Bearing | 6203 | 6203 | 6206 | 6304 | 6304Z |
| Oil seal | 54656 | 92050-003 | AJ39627 | | |

**NOTE:** 92050-003 is a Kawasaki part number.

## TIRES

The tires are designed to give a smooth ride without slipping when they inflated to the correct pressure and not overloaded. The maximum recommended load, in addition to vehicle weight, is 330 lbs. (150 kg).

If the tires are inflated to too high a pressure, 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 heavy, 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, and inflate them to the specified pressure. To minimize heat build-up, increase tire pressure from 3 to 6 psi (.2~.4 kg/cm$^2$) for continuous high-speed travel.

**Table 43 Tires, Air Pressure**

| | Brand/ Type | Size | Air Pressure | |
|---|---|---|---|---|
| | | | ONE RIDER | TWO RIDER |
| Front | Dunlop F6 | 3.25-19 4PR | 26 psi (1.8kg/cm$^2$) | 26 psi (1.8kg/cm$^2$) |
| Rear | Dunlop K-87 | 4.00-18 4PR | 31 psi (2.2kg/cm$^2$) | 36 psi (2.5kg/cm$^2$) |

### *Tire wear and damage*

Tires must not be used until they are bald, or if they are cut or otherwise damaged. As the tire tread wears down, the tire becomes more susceptible to puncture and failure; ninety per cent of tire failures occur during the last 10% of the tire's life.

Visually inspect the tire for cracks and cuts, replacing it if the damage is bad. Remove any imbedded stones or other foreign particles from the tread.

Measure the depth of the tread with depth gauge and replace the tire if tread depth is less than the service limit value.

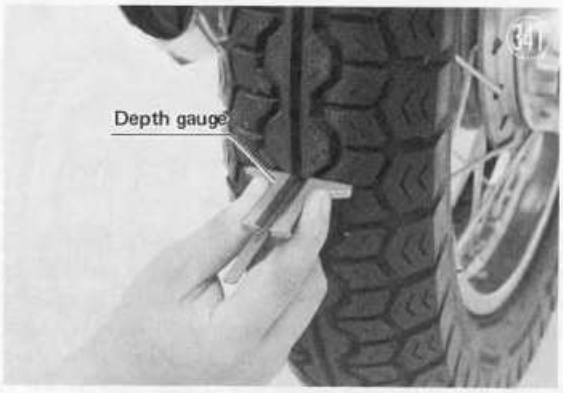
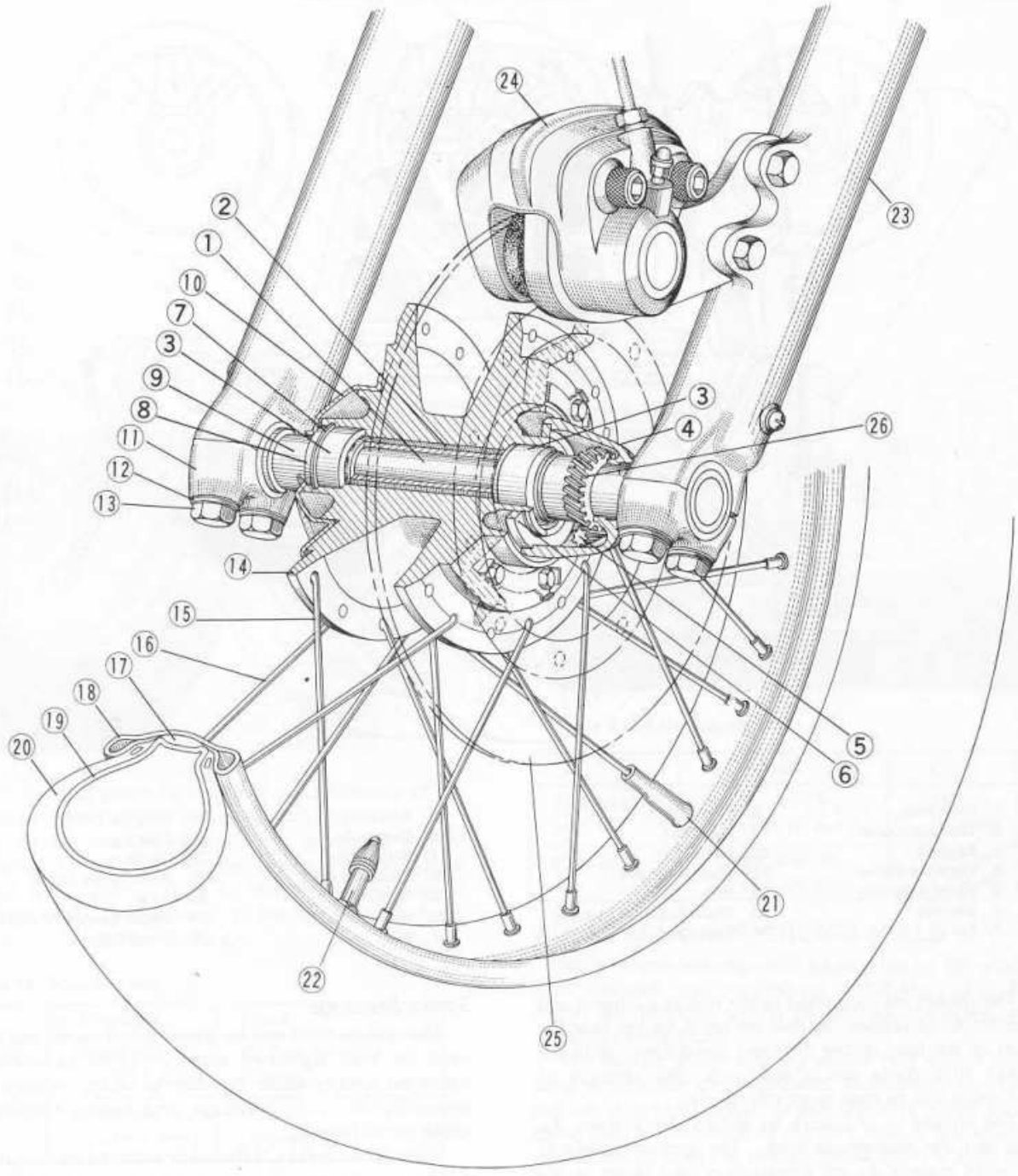



**Table 44 Tire Tread Depth**

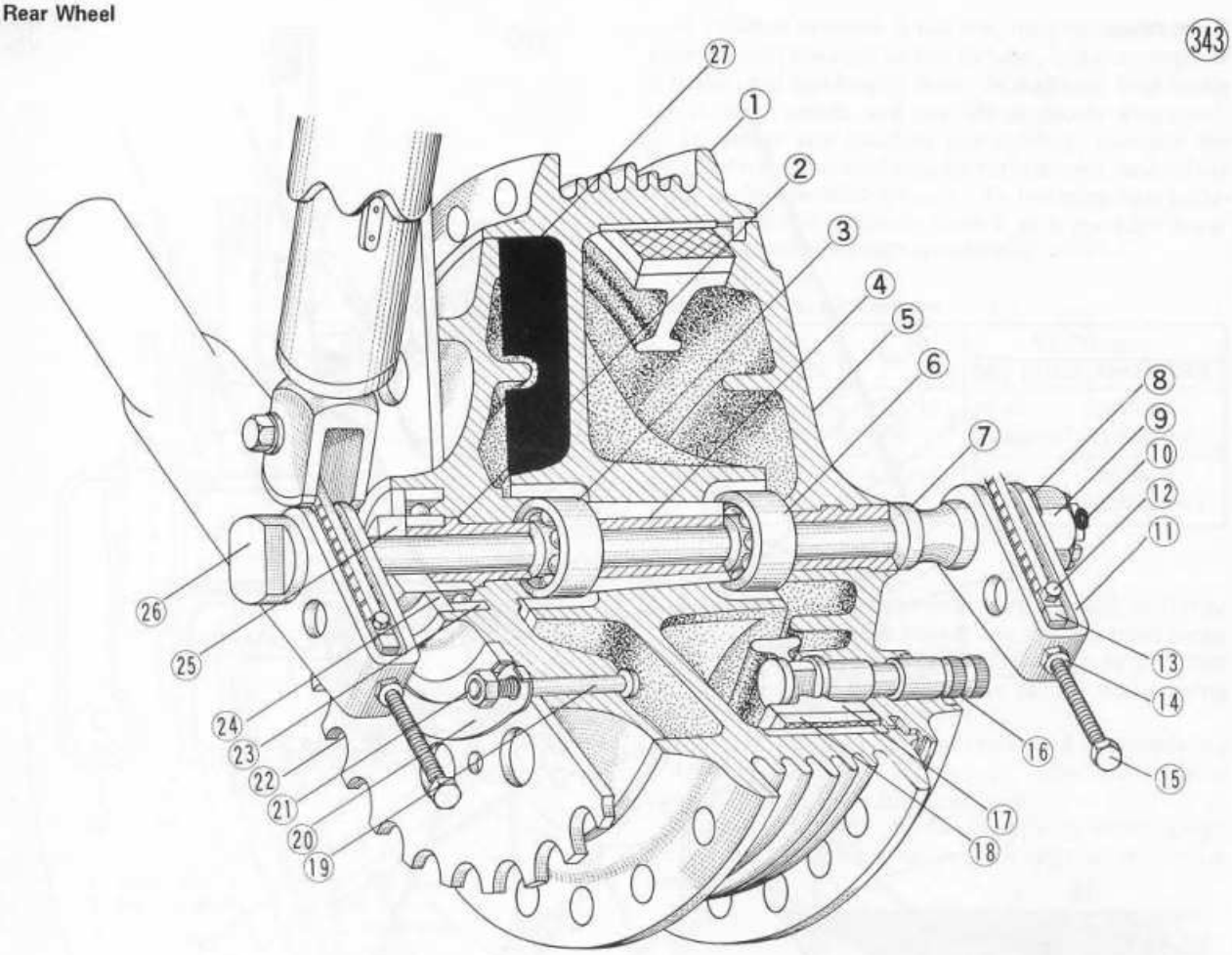
| | Standard | Service Limit | |
|---|---|---|---|
| | | normal speed | over 80 mph |
| Front | .157 in. (4.0 mm) | .04 in. (1 mm) | .04 in. (1 mm) |
| Rear | .276 in. (7.0 mm) | .08 in. (2 mm) | .12 in. (3 mm) |

## RIM, SPOKES

The rim of the Z1 is made of steel and is held 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 mounting nipples.




1. Front Axle
2. Distance Collar
3. Bearing
4. Gear Box
5. Speedometer Pinion
6. Oil Seal
7. Snap Ring
8. Oil Seal
9. Collar
10. Wheel Cap
11. Axle Clamp
12. Washer
13. Bolt
14. Front Hub
15. Inner Spoke
16. Outer Spoke
17. Rim Band
18. Rim
19. Tube
20. Tire
21. Wheel Balancer
22. Valve
23. Front Fork
24. Caliper
25. Disc
26. Speedometer Gear




1. Rear Hub
2. Distance Collar
3. Bearing
4. Distance Collar
5. Panel Assembly
6. Bearing
7. Collar
8. Washer
9. Axle Nut
10. Cotter Pin
11. Chain Adjuster
12. Bolt
13. Chain Adjuster Stopper
14. Lock Nut
15. Bolt
16. Camshaft
17. Brake Shoe
18. Brake Lining
19. Bolt
20. Lock Washer
21. Nut
22. Rear Sprocket
23. Bearing
24. Oil Seal
25. Axle Sleeve Collar
26. Axle
27. Shock Damper Rubber
28. Coupling

The spokes are connected to the hub at a tangent and in different directions, so that different spokes bear the brunt of the load during different conditions. With the spokes thus doing specialized work, the strength of each spoke can be used more effectively.

The spokes in (A) work to absorb shock from the road and the motorcycle load. The spokes marked in (B) work mainly during acceleration, and those in (C) during braking. The spokes not marked with arrows in each case, are more or less free of tension and are used to absorb shock.

**Table 45 Rim, Spoke Size**

| | Rim | Spokes | |
|---|---|---|---|
| | | Inner | Outer |
| Front | 1.85Bx19W | #8-#9x177.0mm | #8-#9x176.5mm |
| Rear | 2.15Bx18W | #7-#9x142.5mm | #7-#9x140.0mm |

### *Spoke breakage*

The spokes must not be allowed to loosen, and they must be kept 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.

If any spoke breaks, it should be replaced immediately, since a missing spoke places an additional load on the other spokes and will eventually cause other spokes to break.

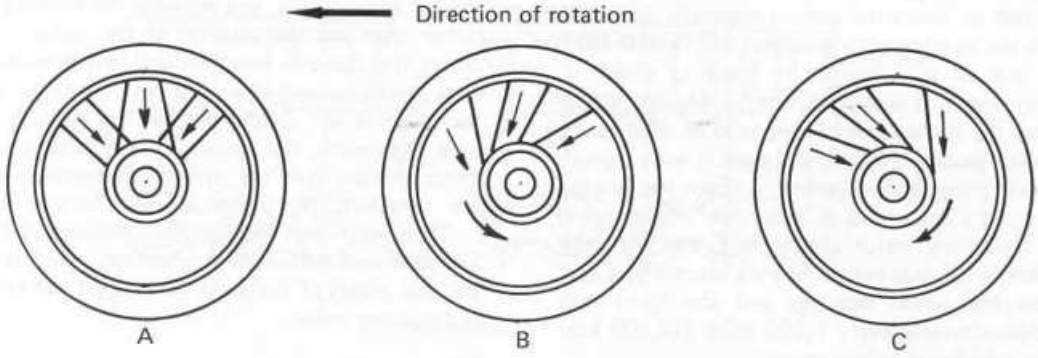
Periodically check that all the spokes are tightened evenly, since they stretch a certain amount during usage.
**NOTE:** Standard spoke tightening torque is 22~26 in-lbs (25~30 kg-cm). Over or under tightening may cause breakage.

### *Wheel runout*

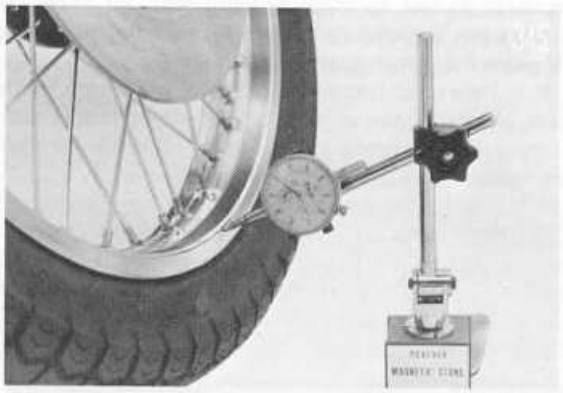
Set a dial gauge to the side of the rim and spin the wheel to measure axial runout. The difference between

Spoke Force

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the highest and the lowest dial reading is the amount of runout.



Set the dial gauge to the inner circumference of the rim and spin the wheel to measure radial runout.

A certain amount of rim warp or runout can be corrected by re-centering the rim, i.e. 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.

**Table 46 Rim Runout**

| | Standard | Limit |
|---|---|---|
| Axial | under .04 in. (under 1 mm) | .012 in. (3 mm) |
| Radial | under .04 in. (under 1 mm) | .008 in. ( 2 mm) |

## AXLE

A bent axle causes vibration, and poor handling and stability.

To measure axle runout, remove the axle, place it in V blocks that are 100 mm (4.0 inch) apart and set a dial gauge to the axle at a point halfway between the blocks. Turn the axle to measure runout, which 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 .028 in. (.7 mm), replace the axle.

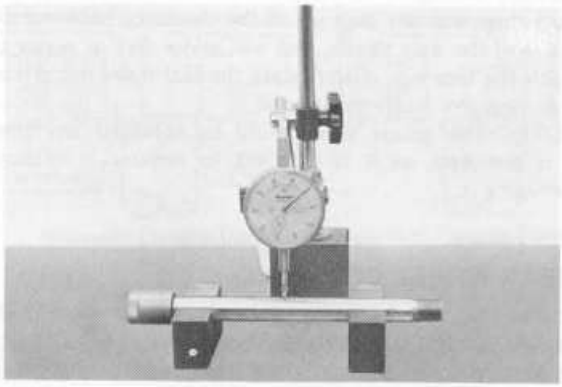


**Table 47 Axle Runout/100 mm**

| | Standard | Limit |
|---|---|---|
| Front axle | under .004 in. (under .10 mm) | .008 in. (.2 mm) |
| Rear axle | under .002 in. (under .05 mm) | .008 in. (.2 mm) |

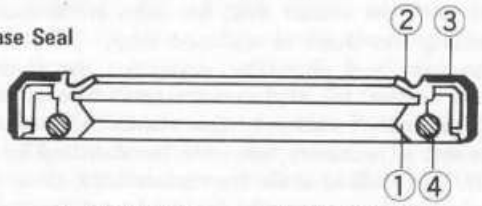
## WHEEL BEARINGS, GREASE SEALS

Worn wheel bearings will cause play in the wheel, with vibration and motorcycle instability. For this reason the bearings should be cleaned, inspected, and re-greased periodically.

The bearing grease seal is a rubber ring with a metal band on its outer circumference. The primary lip of the seal which is held against the axle sleeve by a wire spring band, goes to the inside of the hub toward the bearing, and serves to keep the bearing grease from leaking out. The secondary lip of the seal prevents water and dirt from entering the hub from the outside. Grease seal construction is shown in Fig. 347.

Grease Seal

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1. Primary Lip
2. Secondary Lip
3. Metal Band
4. Wire Spring Band

*Inspection and lubrication*

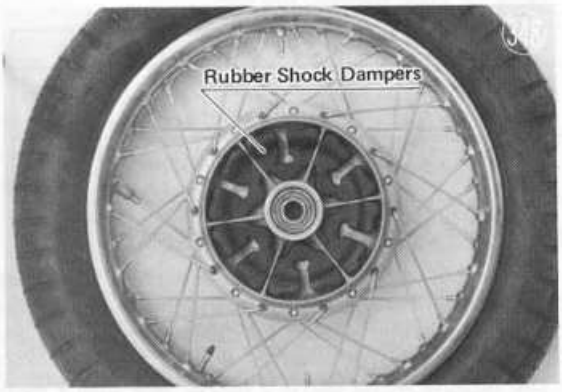
The wheel bearings are made to extremely close tolerances, and so clearance cannot normally be measured. Wash the bearing with gasoline, dry it (**DO NOT SPIN IT**), and oil it. Spin it by hand to check it. If it is noisy, does not spin smoothly, or has any rough spots, replace it. If the same bearing is to be used again, re-wash it with gasoline, dry it, and pack it with a good-quality bearing grease before assembly. Turn the bearing around 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 assembly. Clean and regrease the wheel bearings and the front hub gear box approximately every 1,200 miles (20,000 km) or two years, whichever comes sooner.

Inspect the grease seal and replace it if the lips are misshapen, discolored (indicating the rubber has deteriorated), damaged, or have hardened. If the lips are hard they will not take up all the clearance between the seal and the axle sleeve, and will allow dirt or water to reach the bearing. Also replace the seal if the metal part is damaged or badly misshapen.

**NOTE:** The grease seal should be replaced any time it is removed, as it is difficult to remove it without damaging it.

## REAR WHEEL COUPLING

The rear wheel coupling connects the sprocket to the wheel. Motion is transmitted via rubber shock dampers to absorb some of the force from sudden changes in torque due to acceleration or braking.




If the dampers have weakened or appear damaged, the should be replaced.

## 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 Enuma EK630S-TG (92-link) chain for replacement, since only this chain has been especially designed to withstand the extremely high torque developed by the Z1 engine.

Chain construction is shown in the cross-sectional diagram of Fig. 350. 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 sprockets if the chain is left unadjusted. If the chain is allowed to wear too much, the distance from roller to roller is so much greater than the distance between each tooth of the sprocket, that wear is even further accelerated.

This wear can be greatly reduced, however, by frequent and sufficient lubrication, especially between the side plates of the links so that oil can reach the pin and bushing inside.

*Wear*

When the chain has worn so much that it is more than 2% longer than when new, it is no longer safe enough to be used under all conditions, and it should be replaced. At this same time, the engine and rear sprockets should be inspected and replaced necessary. If overworn sprockets are used with a new chain, they will cause it to wear down quickly.

It is impractical to measure the entire length of the chain, but the degree of wear can be gauged just as easily by measuring a portion of the chain. Stretch the chain taut either by using the chain adjusters, or by hanging a 20-lb. (10 kg) weight on the chain. Measure the length of 20 links on 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 value, the chain should be replaced with a standard Enuma EK630S-TG, 92-link, endless-type chain.

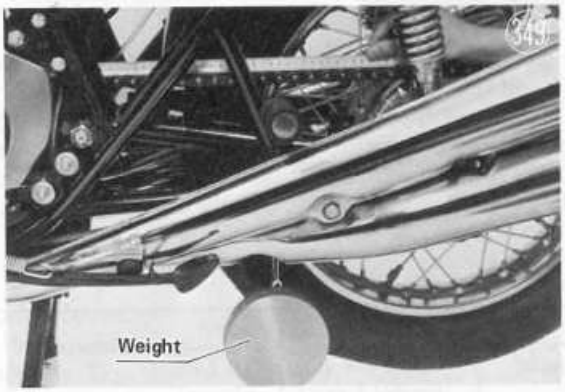


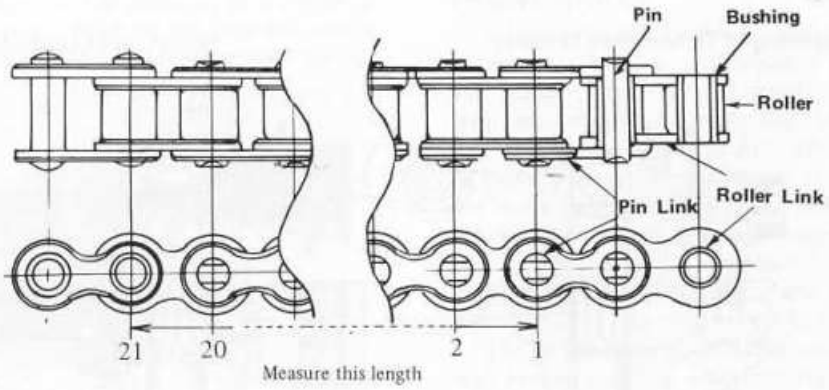

**Table 48 Drive Chain Length**

| | Standard | Service Limit |
|---|---|---|
| 20-link length | 15.0 in. (381 mm) | $15\frac{5}{16}$ in. (389 mm) |

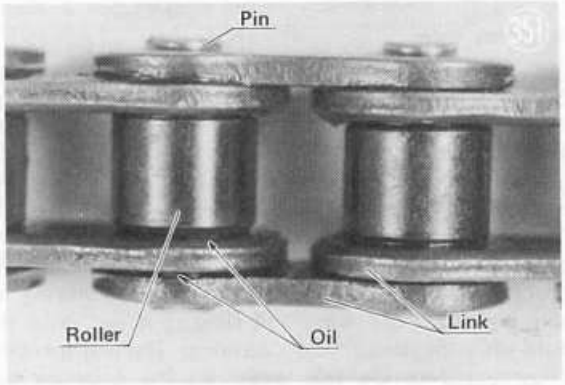
*Lubrication*

Although the chain oil pump helps keep the chain lubricated while riding, it cannot completely take the place of careful hand lubrication. The chain should be lubricated by hand at least once a week or once every 200 miles (300 km), whichever comes sooner. It should also be oiled after riding through rain or on wet roads, after washing the motorcycle, or any other time the chain appears dry.

**Drive Chain**




Use a heavy oil such as SAE 90 weight gear oil to lubricate the chain. A lighter oil is still better than no oil at all, but a heavier oil will stay on the chain longer and provide better lubrication. Apply oil to the sides of the rollers and between the side plates of the links so that it will penetrate to the pin and bushing where most wear takes place. Wipe off any excess oil.



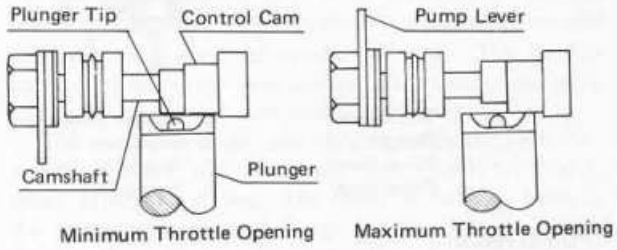

If the chain is especially dirty, it should be washed in Diesel oil or kerosene, and afterward soaked in a heavy oil. Shake the chain while it is in the oil so that oil will penetrate to the inside of each roller.

## DRIVE CHAIN OIL PUMP

The drive chain oil pump is a plunger-type pump driven by the output shaft to supply oil to lubricate the drive chain. The amount of oil pumped varies with the speed of the motorcycle (the output shaft drives the pump and motorcycle simultaneously), and with the length of the plunger stroke, which is controlled by a cam inside the pump. The camshaft has a graduated lever mounted on the end of it so that the cam can be turned to adjust chain oil flow. (At position **O** the least oil flows; at position **5**, the most.) Fig. 352 shows that when the cam is turned from maximum flow to minimum flow, the plunger tip will hit the cam after a shorter travel, thereby pumping less oil.

The oil input to the pump is supplied by a hose from the chain oil tank, and the oil output from the pump goes through a non-return check valve mounted on the side of the pump, back through the hollow pump shaft.

**Stroke Length Control**



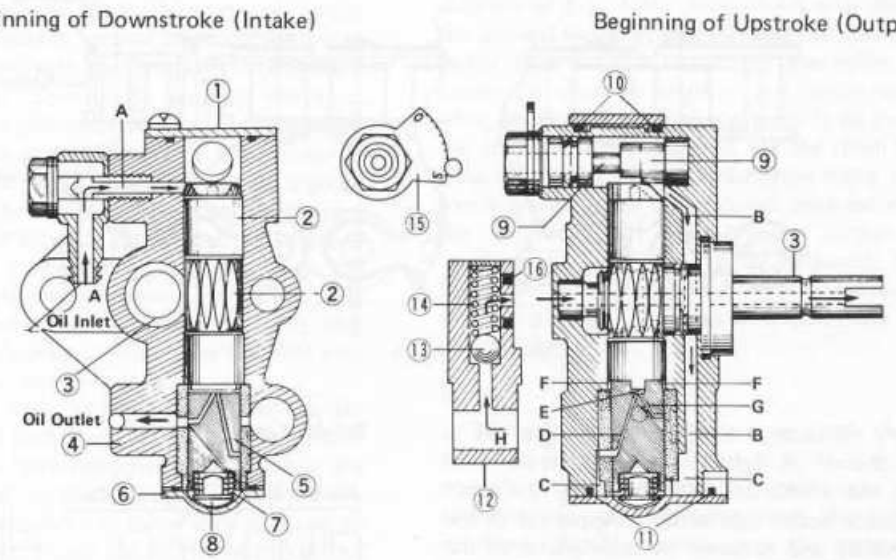

From the pump shaft the oil goes into the output shaft, out the holes in the output shaft to the sprocket and, as the sprocket turns, the oil is flung out to the chain.

**NOTE:** The drive chain oil pump does not eliminate the need for hand lubrication every 200 miles (300 km). See the preceding Drive Chain paragraph for chain lubrication information.

Pump operation and the path for oil flow through the pump are shown in Fig. 353. The pump shaft has a worm gear at the end which meshes with the teeth cut into the center of the plunger. A spring pushes the plunger follower and plunger so that the plunger cam face rests against the camshaft. As the plunger turns, the cam on its face causes it to moves back and forth according to the height of the cam.

Oil flows into the pump at point A and along passage B into chamber C. When the plunger moves toward the camshaft, a chamber F is formed between the follower plunger and the cylinder wall. Just at this time, the plunger follower is turned so that passage D in the follower is aligned with a hole in the valve sleeve, and oil flows from chamber C through passage D through space E into the vacuum in chamber F. When the plunger moves back in the other direction on the pumping stroke, chamber F becomes gradually smaller. At this time, however, the plunger rotates so that the inlet passage D is no longer aligned with the inlet hole in the valve sleeve. Instead, passage G is aligned with the outlet hole in the sleeve, and the oil forced from F can flow through G, through the hole in the valve sleeve, and into H, the check valve inlet. The oil pressure pushes against the spring tension on the ball that blocks the valve inlet, and flows into the valve and from there into the oil pump shaft to the chain.

**Drive Chain Oil Pump**




1. End Cover
2. Plunger
3. Pump Shaft
4. Pump Body
5. Plunger Follower
6. End Cover
7. Plunger Spring
8. Spring Seat
9. Control Cam
10. O Ring
11. O Ring
12. Check Valve
13. Steel Ball
14. Spring
15. Pump Lever
16. O Ring

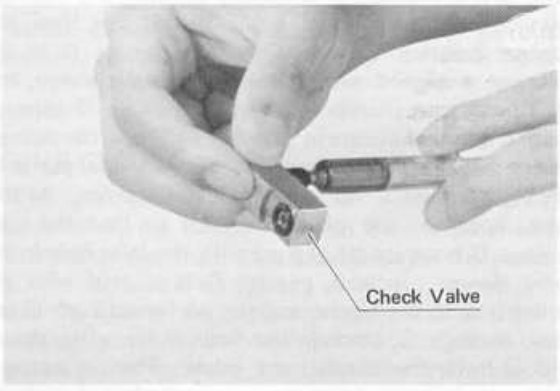
*Pump repair*

Pump repair is limited to replacement of the **O** rings, pump shaft oil seal and the check valve, since these are the only parts that may be expected to deteriorate. Other moving parts are well lubricated by the oil in the pump, and wear very little.

If the **O** rings deteriorate or are damaged, the pump will lose compression, pump output will drop, and oil may leak from the pump. When pump trouble is suspected, inspect the **O** rings and replace any defective ones. If the trouble is with parts other than the **O** rings, replace the pump assembly.

When the pump is disassembled or if the chain oil tank runs out of oil, air will enter the pump and must be bled out. To bleed the pump, remove the bleeder bolt until oil starts coming out of the hole, and then screw the bolt back in. (See Fig. 127)

If the check valve will not pass oil, clean it out using solvent or gasoline in a syringe. Do not blow it out with compressed air as this will damage the valve spring.




If the valve will pass oil in either direction even after being cleaned out, replace it.

## SPROCKETS

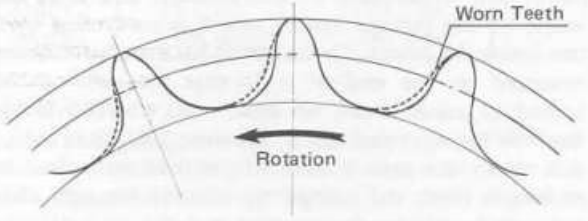
There are two sprockets for the drive chain, one to drive the chain, and one driven by the chain. The forward sprocket, or engine sprocket, is mounted on the end of the output shaft and is used to drive the chain. There are grooves cut into both faces of the engine sprocket, so that in addition to driving the chain, the sprocket can serve a second purpose of conveying oil from the chain oil pump and flinging it out onto the chain while the motorcycle is running. The rear sprocket is connected to the rear wheel via the coupling and shock dampers, and is driven by the chain to turn the rear wheel.

If the sprockets become excessively worn, they will cause the chain to make noise and wear down quickly. The sprockets should be checked for wear any time the chain is replaced.

*Sprocket wear*

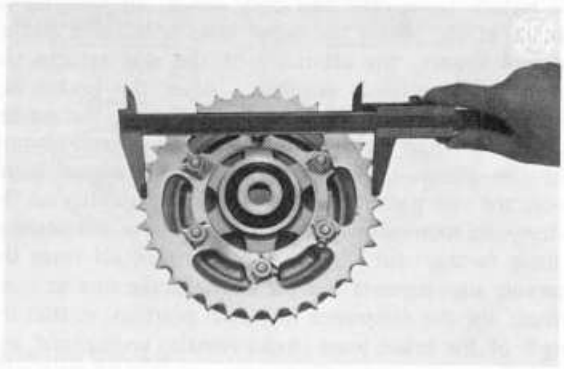
Visually inspect the sprocket teeth, and if they are worn as illustrated, replace the sprocket.

**Sprocket Teeth** 355




**NOTE:** If the sprocket requires replacement, the chain is probably worn, too, and should be inspected.

Measure the diameter of the sprocket at the base of the teeth and if it is worn down to less than the service limit, replace the sprocket. Measure rear sprocket runout



with a dial gauge set to the side of the sprocket near the teeth, replacing the sprocket if runout is over the service limit.

**Table 49 Engine Sprocket Diameter**

| Standard | Service Limit |
|---|---|
| 3.376~3.384 in. (85.76~85.96 mm) | 3.346 in. (85.0 mm) |

**Table 50 Rear Sprocket**

| DIAMETER | | RUNOUT | |
|---|---|---|---|
| Standard | Limit | Standard | Limit |
| 8.560 in. (217.4 mm) | 8.484 in. (215.5 mm) | under .012 in. (under .3 mm) | .020 in. (.5 mm) |

## FRONT BRAKE

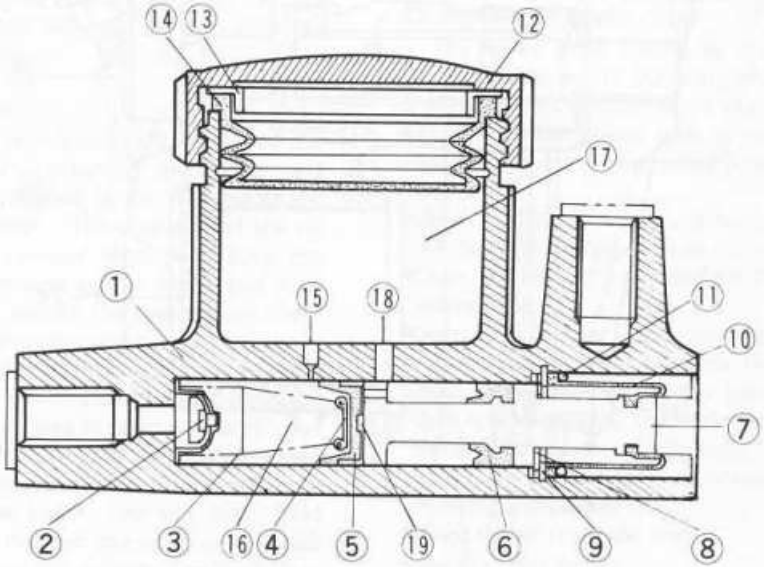
A hydraulic disc brake is used on the front wheel for its superior braking performance and high reliability. The major components of the disc brake are the brake lever, master cylinder, brake fluid pressure switch, brake line, caliper assembly and disc. The brake lever is pulled to move a piston in the master cylinder and pressurize the brake fluid. Fluid pressure operates the brake lamp pressure switch and is transmitted by the brake line to operate the calipers. The switch turns on the brake lamp, and the calipers grip the disc attached to the front wheel, thereby stopping wheel rotation.

The brake fluid is an extra heavy duty type with a high boiling point to withstand the heat produced from friction of the caliper pads on the disc. Since the fluid's performance and boiling point 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 cap seal also prevents fluid evaporation, and spillage should the motorcycle fall over. The fluid is further protected by dust covers 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, check 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 oil from leaking back around the piston while the piston is moving forward to pressurize the lines.

**Master Cylinder**

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1. Master Cylinder Body
2. Check Valve
3. Spring
4. Spring Seat
5. Primary Cup
6. Secondary Cup
7. Piston
8. Stopper, Piston
9. Circlip
10. Dust Seal
11. Stopper, Dust Seal
12. Cap
13. Plate
14. Cap Seal
15. Relief Port
16. Pressure Chamber
17. Reservoir
18. Supply Port
19. Non-return Valve

The check valve stops fluid from suddenly returning from the brake line when the lever is released, and thereby smooths brake operation. The non-return valve is in the head of the piston; it stops backward fluid flow when the brake is applied, but allows flow around the cup to fill the vacuum in front of the piston so that the piston can return easily when the brake lever is released.

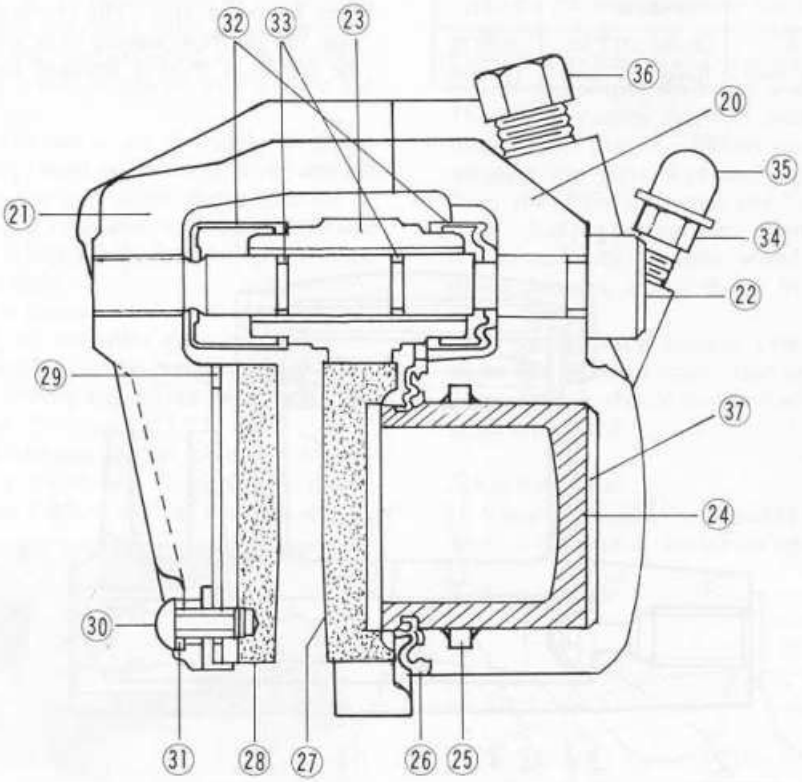
The caliper assembly comprises the piston, A and B pads, and A and B calipers. The calipers are held together by two shafts, which also pass through the caliper holder to mount the assembly on the front fork. When the calipers move, the shafts slide back and forth through the holder and keep the brake pads parallel with the disc.

Unlike drum-type brakes, the components of the disc brake which perform the actual braking action, i.e. the disc and pads, are open to direct contact with the air flow past the motorcycle. This provides for excellent dissipation of the heat from brake friction, and minimizes any possibility of brake fade common to drum brakes.

When oil pressure is developed inside caliper A's cylinder, the piston is pushed and exerts pressure against the brake pad which in turn presses against the brake disc. The pressurized oil is prevented from leaking by a rubber seal fitted into the cylinder wall. The seal presses against the piston, and instead of sliding when the piston moves, the seal only bends, allowing no oil leakage at all. When the brake lever is released and oil pressure lowers, the elasticity of the seal returns the piston to its original position. After the brakes are used for awhile and the pads wear slightly, the rubber seal will no longer be able to bend the additional amount that the piston travels. Instead, when piston travel forces the seal past Its limit, the seal slips slightly on the piston, and then returns the piston to a new rest position a little further out. A small amount of oil from the reservoir supplements the oil in the brake line to compensate for the difference in piston position, so that the length of the brake lever stroke remains unchanged, and the brake never needs adjustment.

The caliper A oil seal and the cup at the head of the master cylinder piston are made of an oil and heat resistant rubber composition for best performance and to prevent their contaminating the brake fluid by deterioration. For this reason only standard parts should be used.

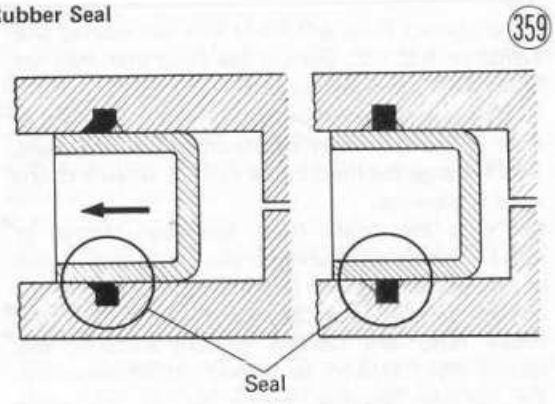
**Caliper Assembly**




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20. Caliper A
21. Caliper B
22. Allen-head Shaft
23. Caliper Mounting
24. Piston
25. Oil Seal
26. Dust Seal
27. Pad A
28. Pad B
29. Ring
30. Screw
31. Lock Washer
32. Dust Seal
33. O Ring
34. Bleeder Valve
35. Bleeder Valve Cap
36. Nipple
37. Cylinder

Rubber Seal




## Braking Stroke

When the brake lever is pulled, the piston ⑦ in the master cylinder ① is pushed and moves forward against the force of the return spring ③. At this time, the primary cup ⑤ at the head of the piston closes the small relief port ⑮ which connects the pressure chamber ⑯ and the reservoir ⑰. 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. Brake fluid being used as a pressure medium, the piston compresses the fluid and forces it through the check valve ② and out into the brake line. Pressure from the line is felt in the cylinder ㊲ of caliper A ⑳ and pushes the piston ㉔ toward the disc. Pad A ㉗ at the end of the piston is pushed against the disc, but since the disc is immovable, further pressure cannot move the pad any further. Instead, the cylinder and entire caliper assembly move in the reverse direction so that pad B ㉘ is pulled toward the disc. In this manner the disc is pinched between the two pads and braking action is performed.

## Braking Release Stroke

When the brake lever is released, the piston in the master cylinder is quickly returned toward its rest position and brake fluid pressure in the line and in the caliper master cylinder drops. The elasticity of the oil seal ㉕ in caliper A's cylinder then pulls back the piston. This leaves no pressure against either pad A or B so that slight friction against the disc pushes them both a hairbreadth away from the disc.

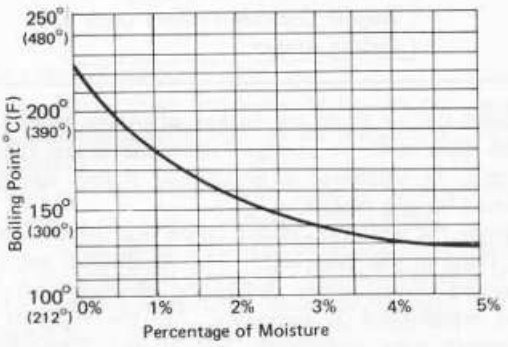
As the master cylinder piston moves back further, the brake fluid in the line (which still has some pressure) rushes to fill the low pressure area in front of the primary cup at the piston head. But the fluid is prevented from moving too fast by the check valve and the pressure in front of the piston drops lower. At this time, fluid from the reservoir flows through the large supply port ⑱ into the space between the primary and secondary cups ⑥, through the non-return valve ⑲, and escapes around the edges of the primary cup to fill the vacuum. When the piston finally returns to its rest position against the stopper ⑧, the small relief port is uncovered and the brake fluid still returning from the line pushes any excess fluid through the relief port back into the reservoir until pressure in the line is again normal.

## 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 dissipated, the rest is transmitted to the brake fluid and may raise fluid temperature to as high as 300°F (150°C) 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 the fluid is 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 the recommended brake fluids.

The graph of Fig. 360 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.

Brake Fluid Boiling Point




### *Changing the brake fluid*

The brake fluid should be changed once a year or every 6,000 miles (10,000 km), whichever comes sooner, or if it becomes contaminated with dirt or water.

- Attach a clear plastic hose to the bleeder valve at the caliper, and run the other end of the hose into a container.
- Open the bleeder valve and pump the brake lever until all the fluid is drained from the lines.
- Close the bleeder valve and fill the reservoir with new brake fluid.
- Open the bleeder valve (counterclockwise is open), squeeze the brake lever, close the valve with the lever held squeezed, then quickly release the lever. Repeat this operation until the brake 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.

### *Bleeding the brake*

The brake fluid has a 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 and 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.

## WARNING

**When working with the disc brake, observe the precautions listed below.**

1. Never re-use old brake fluid.
2. Do not use fluid from a container that has been left unsealed, or that has been open a long time.
3. Do not mix two types of fluid for use in the brakes. 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 shown 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 that one type thereafter.

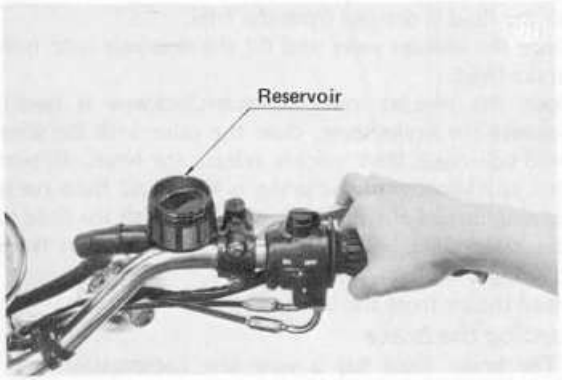
**Table 51 Recommended Disc Brake Fluid**

| |
|---|
| Atlas Extra Heavy Duty |
| Shell Super Heavy Duty |
| Texaco Super Heavy Duty |
| Wagner Lockheed Heavy Duty |
| Girling Amber |

   The correct fluid will come in a can labeled **SAE J-1703** or **D.O.T.3.** Do not use fluid that does not have one of these markings.
4. Don't leave the reservoir cap off for any length of time as moisture may be absorbed into the fluid.
5. Don't change the fluid in the rain, or when a strong wind is blowing.
6. Use only disc brake fluid, isopropyl alcohol or ethyl alcohol for cleaning brake parts, but do not allow rubber parts to remain in contact with the alcohol for more than 30 seconds.
7. Brake fluid will damage painted surfaces; any spilled fluid should be wiped off immediately.
8. Do not use gasoline, motor oil, or any other mineral oils near disc brake parts, these oils cause deterioration of rubber brake parts. If oil spills on any brake parts it is very difficult to wash off and will eventually reach and break down the rubber.
9. If any of the brake line fittings or the bleeder valve is loosened at any time the **AIR MUST BE BLED FROM THE BRAKE** (Pg. 105).
10. Prescribed torque valves for tightening disc brake parts mountings are listed on Pg. 58.

Bleed the air from the brakes 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 at 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.

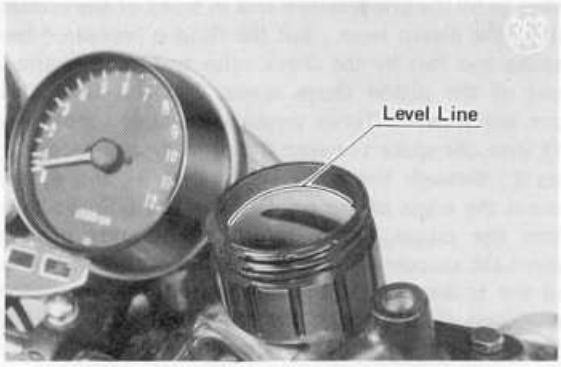



- Replace the reservoir cap, and connect a clear plastic hose to the bleeder valve at the caliper, running the other end of the hose into a container. Pump the brake lever a few times until it becomes hard and then, holding the lever squeezed, quickly open (turn counter-clockwise) and close the bleeder 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.



- If a double disc brake is used, repeat the previous step one more time for the other side.

When air bleeding is finished, replace the rubber can on the bleeder valve, and check that the brake fluid is filled to the line marked in the reservoir (handlebars turned so that the reservoir is level).



### *Master cylinder parts wear*

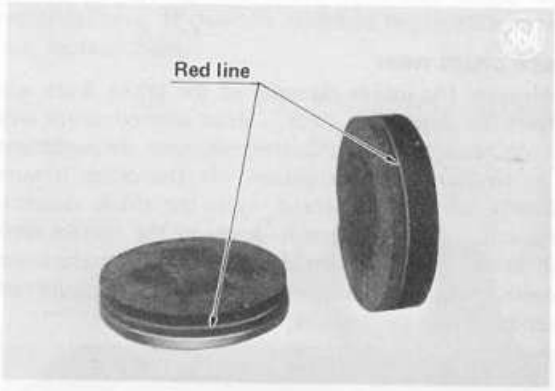
When master cylinder parts are worn or damaged, proper brake fluid pressure cannot be obtained in the lines, and the brake will not hold.

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 to outside the service limit.
- Check the piston for these same faults.
- 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 oil leakage is noted at the brake lever, the cups should be replaced. (The secondary cup is part of the piston assembly, so replace the piston if this cup is bad.)
- Check that the spring is not damaged and is not shorter than the service limit.
- Replace the rubber dust seal if it is damaged.

### *Caliper parts wear*

Inspect the pads for wear. If the surface of 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 trichlorethylene or gasoline. If the oil cannot be thoroughly cleaned off, replace the pads.




The oil seal around the piston maintains the proper pad/disc clearance. If this seal is bad 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 oil seal under any of the following conditions: (a) oil 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. Also replace the seal every other time the pads are changed.

Replace the cylinder and piston if they are worn out of tolerance, badly scored, or rusty.

Check the oil and dust seals and the **O** rings, replacing any that are cracked, worn, swollen or otherwise damaged.

**Table 53 Caliper Parts**

| | Standard | Service Limit |
|---|---|---|
| Cylinder inside diameter | 1.5031~1.5039 in. (38.180~38.200 mm) | 1.5045 in. (38.215 mm) |
| Piston outside diameter | 1.5006~1.5019 in. (38.180~38.200 mm) | 1.5002 in. (38.105 mm) |

### *Brake line damage*

The high pressure inside the brake line can cause oil 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 metal pipes are made of plated steel, and will rust if the plating is damaged. Replace the pipe if it is rusted, cracked (especially check the fittings), or if the plating is badly scratched.

### *Disc wear, warp*

Besides wearing thin, 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 trichlorethylene or gasoline.

**Table 52 Master Cylinder Parts**

| Measurement | Standard | | Service Limit | |
|---|---|---|---|---|
| | SINGLE DISC | DUAL DISC | SINGLE | DUAL |
| Cylinder inside diameter | .5512~.5529 in. (14.000~14.043 mm) | .6248~.6265 in. (15.870~15.913 mm) | .5543 in. (14.080 mm) | .6280 in. (15.950 mm) |
| Piston outside diameter | .5495~.5506 in. (13.957~13.984 mm) | .6231~.6242 in. (15.827~15.854 mm) | .5472 in. (13.900 mm) | .6209 in. (15.770 mm) |
| Primary, secondary cup diameter | .5768~.5965 in. (14.650~15.150 mm) | .6476~.6673 in. (16.450~16.950 mm) | .5709 in. (14.500 mm) | .6417 in. (16.300 mm) |
| Spring length (free) | 2.008 in. (51.0 mm) | 1.709 in. (43.4 mm) | 1.890 in. (48.0 mm) | 1.594 in. (40.5 mm) |

Jack up the motorcycle so that the front wheel is off the ground, and turn the handlebars fully to one side. Set up a dial gauge against the disc as illustrated, and measure disc runout. If runout exceeds the service limit, replace the disc.

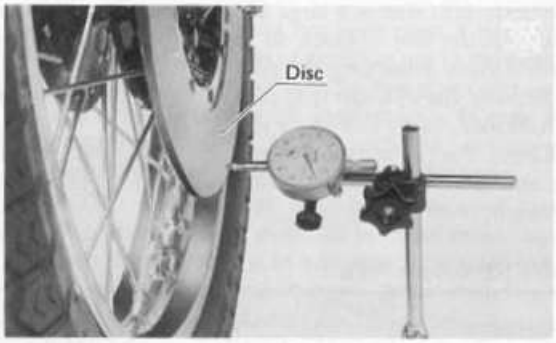



**Table 54 Disc Runout**

| Standard | Service Limit |
|---|---|
| under .004 in.<br>(under .1 mm) | .012 in.<br>(.3 mm) |

Measure the thickness of the disc at the point where it is most worn, and replace it if it is worn down to under the service limit.



**Table 55 Disc Thickness**

| Standard | Service Limit |
|---|---|
| .276 in.<br>(7.0 mm) | .217 in.<br>(5.5 mm) |

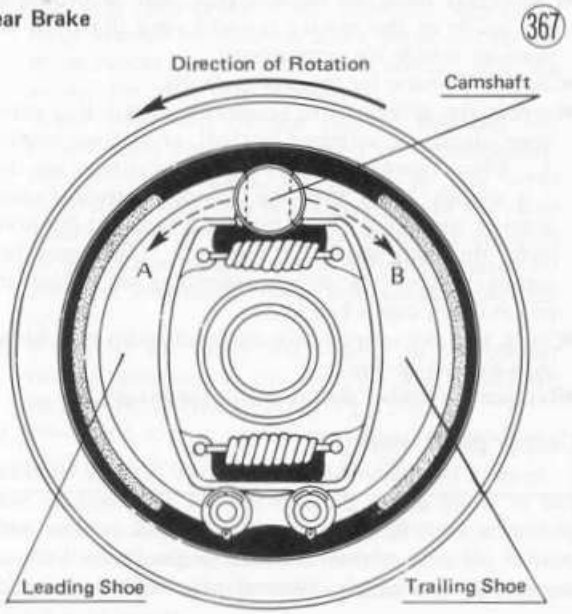
## REAR BRAKE

The rear wheel is equipped with a leading-trailing type drum brake. "Leading-trailing" means that one of the two brake shoes leads, or expands against the drum in the direction of drum rotation; and the other shoe trails, that is, it expands in the direction opposite drum rotation.

Stepping on the brake pedal pulls the brake cable which in turn pulls the rear brake cam lever. The lever is mounted on the camshaft so that the camshaft turns and forces the large part of the cam between the two brake shoes. Since the shoes are only held together away from the drum by springs, the cam overcomes spring tension and pushes the shoes outward against the drum. The leading shoe pivots in direction A, and the trailing shoe in direction B of the diagram.

Due to wear of the brake drum, shoes and cam, periodic brake adjustment is required. If the brake parts become too worn, however, adjustment will not be sufficient to ensure safe brake operation. Not only can overworn parts break, but if wear allows the cam to turn so far that it is nearly horizontal when the brake is fully applied, the brake may lock in the operated position, or brake pedal return may be very sluggish. All the brake parts should be checked for wear at least every 6,000 miles (10,000 km).

**Rear Brake**




### *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 or replace it. (Do not turn it down to the service limit, and do not turn it down if any diameter measurement exceeds the service limit.) If any diameter measurement exceeds the service limit, replace the drum.



**Table 56 Brake Drum Inside Diameter**

| Standard | Service Limit |
|---|---|
| 7.874~7.881 in.<br>(200.00~200.185 mm) | 7.904 in.<br>(200.75 mm) |

### *Brake shoe wear*

Check the brake lining on each shoe for uneven wear, and file or sand down any high spots. Check the

thickness of the lining, replacing both shoes as a set if the thickness at any point is less than the service limit.

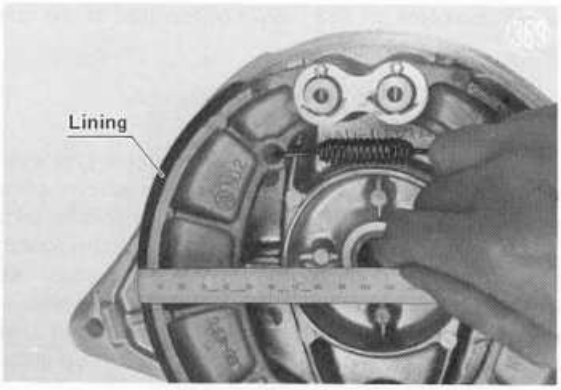



**Table 57 Brake Lining Thickness**

| Standard | Service Limit |
|---|---|
| .1909~.2146 in.<br>(4.85~5.45 mm) | .118 in.<br>(3.00 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 they are stretched beyond the service limit, replace them.

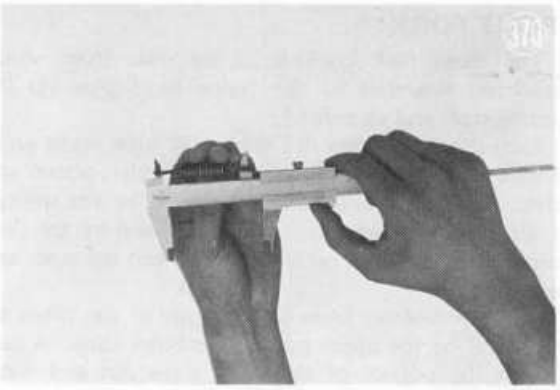


**Table 58 Brake Spring Free Length**

| Standard | Service Limit |
|---|---|
| 2.62 in.<br>(66.5 mm) | 2.72 in.<br>(69.0 mm) |

### *Camshaft, shaft hole wear*

Excessive shaft/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 out to over the service limit.



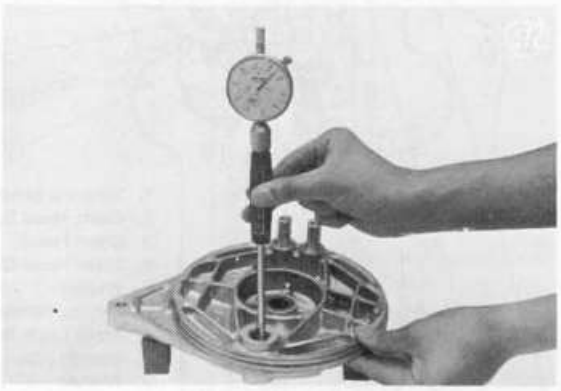
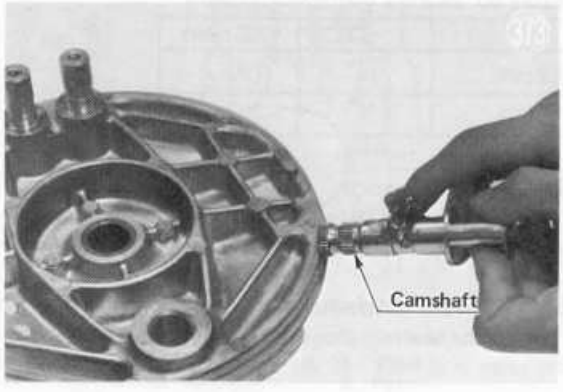



**Table 59 Brake Camshaft, Hole Diameter**

| | Standard | Service Limit |
|---|---|---|
| Camshaft | .6676~.6687 in.<br>(16.957~16.984 mm) | .6626 in.<br>(16.83 mm) |
| Shaft hole | .6693~.6704 in.<br>(17.000~17.027 mm) | .6764 in.<br>(17.18 mm) |

### *Lubrication*

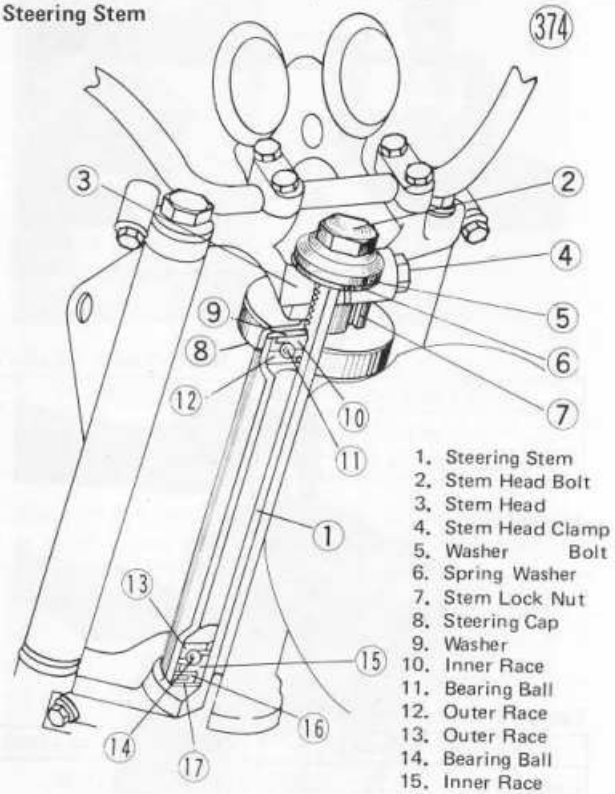
Every time the brakes are disassembled, but at least every two years or 12,000 miles (20,000 km), wipe out the old grease and re-grease the brake pivot points with cup grease. Apply grease to the brake shoe anchor pins, spring ends, to the cam surface of the camshaft, and fill the camshaft groove with grease. Do not get any grease on the brake shoe linings, and wipe off any excess grease so that it does not drop onto the linings or drum after brake assembly.



## STEERING STEM

The steering stem supports the handlebars and front fork, 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.

**Steering Stem**




The steering stem itself does not wear, but it may become bent. If it is bent, steering will be stiff and the bearings may be 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, such as a head-on collision, the bearing race surfaces may become dented. When this happens, the handlebars will turn jerkily and may always catch at one or more locations.

**Table 60 Bearing Ball Specifications**

| | Size | Number |
|---|---|---|
| Upper | ¼" | 19 |
| Lower | ¼" | 20 |

### *Steering stem warp*

Examine the steering stem visually and replace it if it is bent.

### *Bearing wear or 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. When the inner race for the lower bearing is taken off the steering stem, the grease seal will also come off and should be replaced at the same time.

### *Bearing lubrication*

Whenever the steering stem is disassembled, or every two years or 12,000 miles (20,000 km), whichever comes sooner, the steering stem bearings should be re-lubricated.

Wipe all the old grease off the races and balls, washing them in gasoline if necessary. Replace the grease seal, and 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 cup grease.



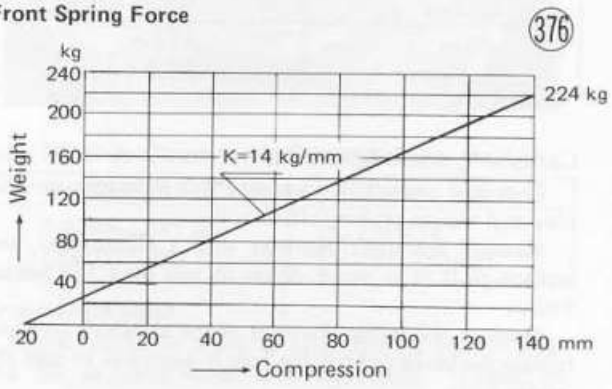
## FRONT FORK

The front fork consists of the two front shock absorbers, mounted to the frame head pipe via the steering stem and stem head.

Each shock absorber is a telescopic tube made up of an inner tube, outer tube, springs, cylinder, piston and valve. Shock damping is accomplished by the springs, by air being compressed in the tubes, and by the flow resistance of the fork oil flowing between the inner and outer tubes.

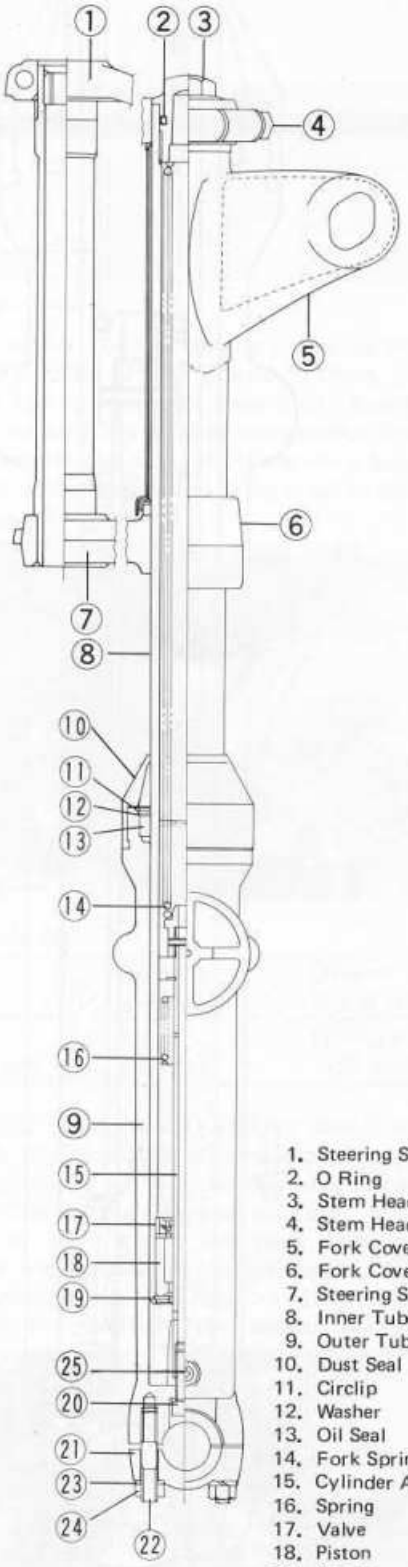
Oil is prevented from leaking out of the tubes by an oil seal on the upper part of the outer tube. A dust seal on the outside of the tubes stops dirt and water from entering and damaging the oil seal and the tube surfaces.

**Front Spring Force**



## Front Fork

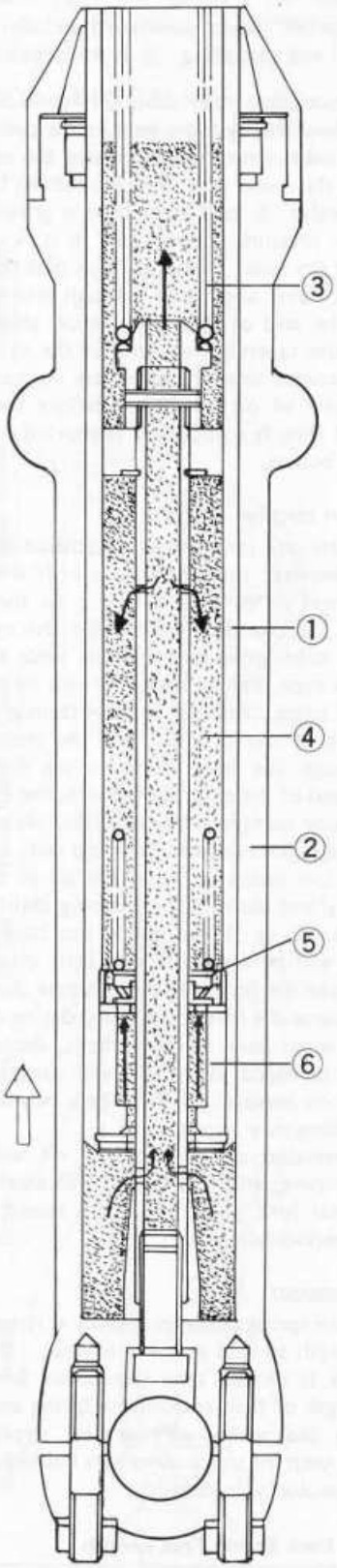
377




1. Steering Stem Head
2. O Ring
3. Stem Head Bolt
4. Stem Head Clamp Bolt
5. Fork Cover
6. Fork Cover Guide
7. Steering Stem
8. Inner Tube
9. Outer Tube
10. Dust Seal
11. Circlip
12. Washer
13. Oil Seal
14. Fork Spring
15. Cylinder Assembly
16. Spring
17. Valve
18. Piston
19. Circlip
20. Fork Cylinder Bolt
21. Axle Clamp
22. Stud Bolt
23. Lock Washer
24. Nut
25. Drain Screw

## Compression Stroke

378




1. Inner Tube
2. Outer Tube
3. Spring
4. Cylinder
5. Valve
6. Piston

### *Compression Stroke*

When a load is placed on the front fork, or when the front wheel hits a bump, the inner tube ① of the shock absorber moves downward (relative to the outer tube ② ) and the spring ③ is compressed.

The descending inner tube, forces the oil in the outer tube to flow through the hole in the cylinder ④ into the inner tube, thereby compressing the air in the inner tube. At this same time, the oil chamber formed by the cylinder, valve ⑤ and inner tube is growing larger and a negative pressure is developed in it, so oil from the bottom of the outer tube also flows past the piston ⑥ , opens the valve, and flows through into that chamber.

Near the end of the compression stroke, the space between the tapered lower end of the cylinder and the piston becomes smaller and offers increased resistance to the flow of oil until, just before the end of the stroke, oil flow is completely prevented and an oil lock condition occurs.

### *Extension stroke*

The outer and inner tubes are pushed apart by spring tension whenever the load is taken off the front wheel or the wheel drops into a hole. As the tubes move apart, the oil chamber formed by the cylinder, valve and inner tube grows smaller, but since the valve is a non-return type, the oil cannot return through the valve the way it came. Instead, it flows through a hole in the upper part of the cylinder, and the resistance to this flow through the hole dampens the fork extension. Near the end of the extension stroke, the cylinder spring ⑦ starts being compressed and further slows fork extension so that it does not suddenly top out.

Either too much or too little oil in the forks will adversely affect their shock damping ability. If there is too much oil or if the oil is too heavy, the shock absorbers will be too hard; too little oil or to light an oil will make the fork soft and decrease damping ability, and may cause the fork to be noisy during operation.

If the inner tube becomes bent, dented, scored or otherwise damaged, it in turn will damage the oil seal and allow oil leakage. If the tube is bent badly enough, poor handling may also result.

Contaminated or deteriorated oil will also affect shock damping, and in addition will accelerate wear of the internal fork parts. For this reason it should be changed periodically.

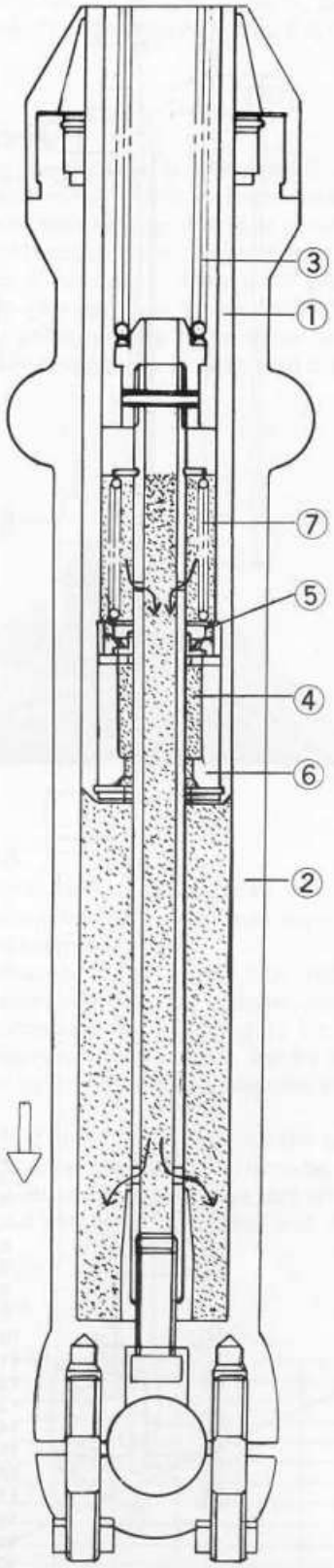
### *Spring tension*

Since the spring becomes shorter as it weakens, check its free length to find out if it is weak. If the spring of either fork is shorter than the service limit, replace it. If the length of the replacement spring and that of the remaining old spring vary greatly, replace both old springs to keep the shock absorbers balanced and thereby maintain motorcycle stability.

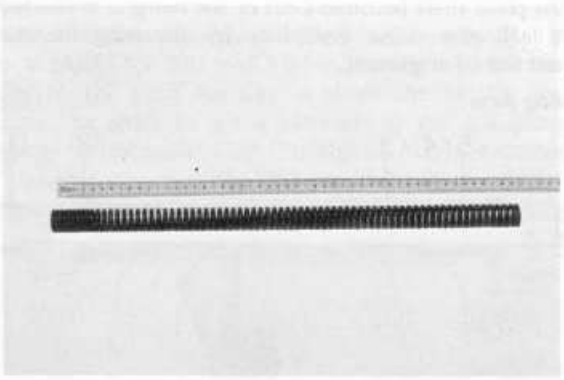
**Table 61 Fork Spring Free Length**

| Standard | Service Limit |
|---|---|
| 19½ in.<br>(495.5 mm) | $19^{1}/_{16}$ in.<br>(485 mm) |

**Extension Stroke** (379)




1. Inner Tube
2. Outer Tube
3. Spring
4. Cylinder
5. Valve
6. Piston
7. Spring



*Fork oil*

Place a jack or stand under the engine to that the front wheel is raised off the ground to check fork oil. Remove the top bolt from the inner tube. Insert a rod down into the tube and measure the distance from the top of the tube to the oil level. If the oil is below the correct level, add enough oil to bring it up to standard, but do not overfill the fork.

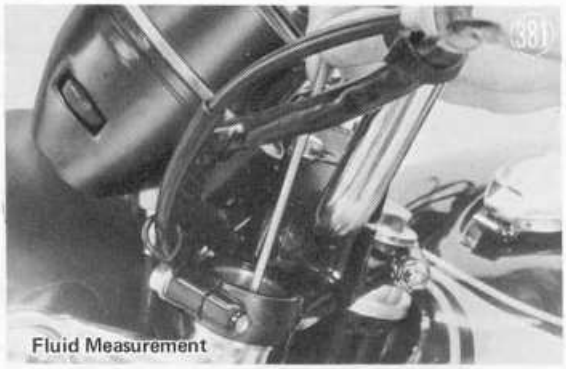
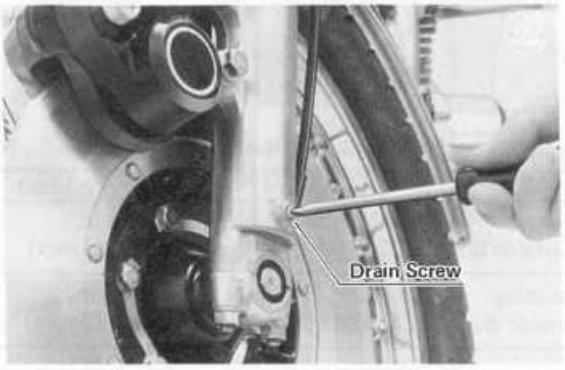



**Table 62 Fork Oil**

| Type | Amount per side | Oil level from top of tube |
|---|---|---|
| SAE 10W non-detergent | 5.7 oz. (169 cc) | $17^{15}/_{16}$ in. (455 mm) |

Every 6,000 miles (10,000 km), or less if the oil appears dirty, the front fork oil should be changed. To drain out the old oil, first remove the drain screw from the lower end of the outer tube on each side. Stand the motorcycle on both wheels and push down on the handlebars a few times to pump out the oil. Replace the drain screws, remove the top bolt from each side, and pour in the specified type and amount of oil.

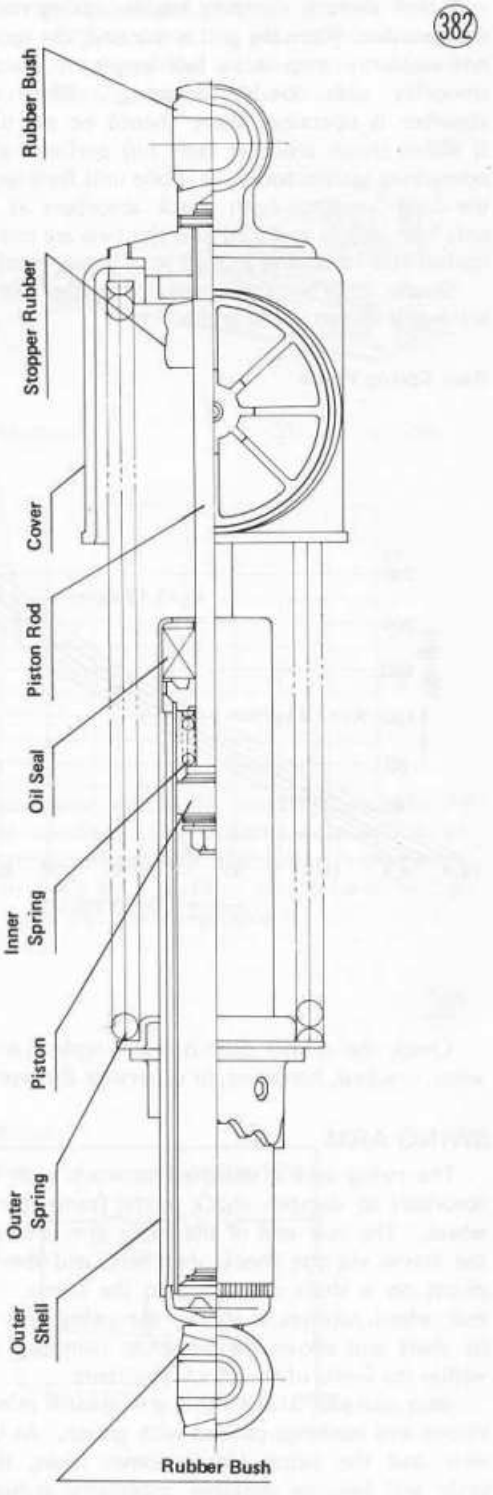



*Inner tube damage*

Visually inspect the inner tube and repair any damage, or replace the tube if the damage is not repairable. Since inner tube damage will also damage the oil seal, replace the seal, too.

## REAR SHOCK ABSORBERS

The rear shock absorbers serve to dampen shock transmitted to the frame and rider from the rear wheel,

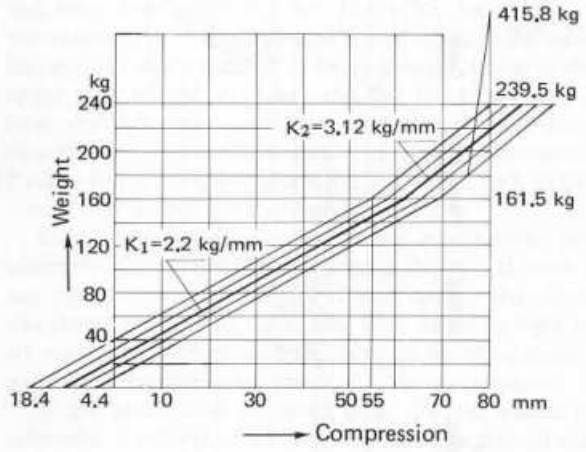


and for this purpose they are connected between the frame and the rear end of the swing arm. Shock absorbing is performed by the spring and by the flow resistance of the oil inside each unit. Shock absorbing is further aided by the use of rubber bushings in both the upper and lower shock absorber mountings.

Since the rear shock absorbers are sealed units and 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 besides 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 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 five different settings is shown in the graph.

**Rear Spring Force** (384)



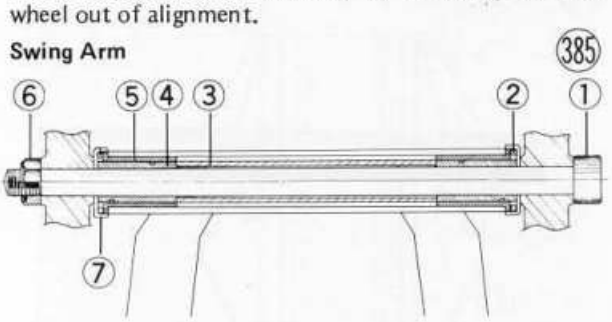

Check the rubber bushings and replace any that are worn, cracked, hardened, or otherwise damaged.

## SWING ARM

The swing arm is designed to work with the shock absorbers to dampen shock to the frame from the rear wheel. The rear end of the swing arm is connected to the frame via the shock absorbers, and the front end pivots on a shaft connected to the frame. When the rear wheel receives a shock, the swing arm pivots on its shaft and allows the wheel to swing up and down within the limits of the shock absorbers.

Wear and play at the swing arm pivot is minimized by sleeves and bushings packed with grease. As these parts wear and the swing arm becomes loose, the motorcycle will become unstable, especially at high speeds. If the pivot shaft becomes bent or the swing arm twisted, this will also cause instability by throwing the rear wheel out of alignment.

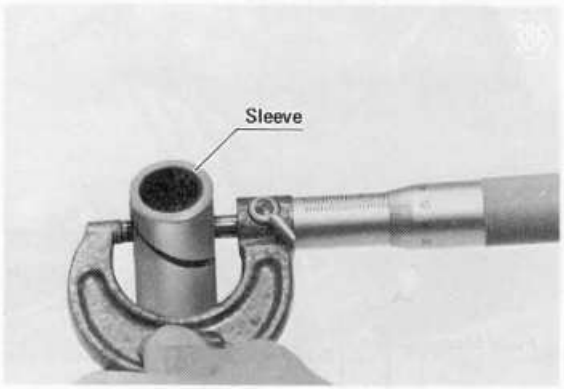
**Swing Arm** (385)




1. Pivot Shaft
2. O Ring
3. Collar
4. Sleeve
5. Bushing
6. Self Lock Nut
7. Cap

### *Sleeve, bushing wear*

Measure the outside sleeve diameter with a micrometer, and replace the two sleeves as a set if the diameter is less than the service limit, or if either sleeve is visibly damaged.




Measure the inside diameter of the bushings with a cylinder gauge or micrometer, and replace them as a set if the diameter exceeds the service limit, or if they are visibly damaged.

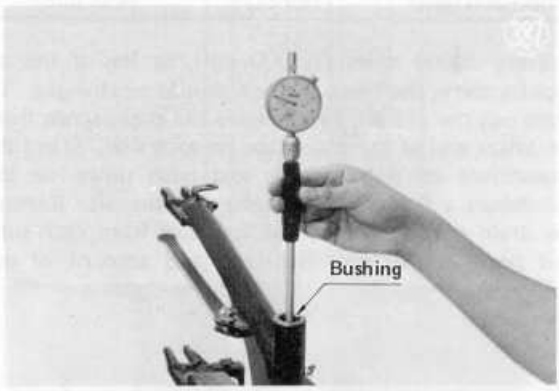



**Table 63 Swing Arm Sleeve, Bushing Diameter**

| | Standard | Service Limit |
|---|---|---|
| Sleeve outside dia. | .8653~.8661 in. (21.979~22.000 mm) | .864 in. (21.95 mm) |
| Bushing inside dia. | .8712~.8729 in. (22.128~22.171 mm) | .881 in. (22.37 mm) |

*Pivot shaft*

Check whether the pivot shaft is bent by placing it in two **V** blocks set 100 mm(3.94 in.) 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 is bent, straighten it. If it cannot be straightened, or if the dial gauge shows a variation of more than .028 in. (.7 mm), replace the shaft.

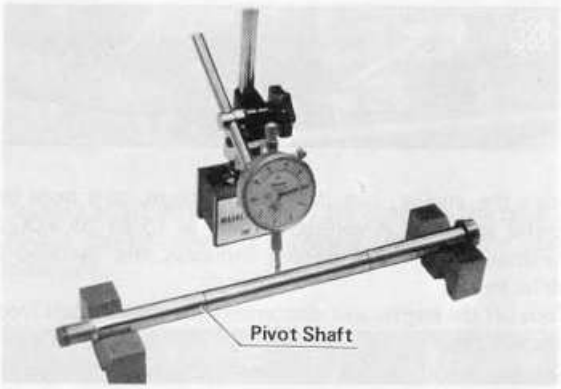



**Table 64 Pivot Shaft Runout**

| Standard | Service Limit |
|---|---|
| under .004 in. (under .1 mm) | .008 in. (.2 mm) |

*Swing arm lubrication*

There is a grease fitting on the swing arm for lubrication. At least every 2,000 miles (3,000 km) or six months, grease the swing arm with regular cup grease. Force the grease into the fitting until it comes out at both sides of the swing arm, and wipe off any excess. If the grease does not come out, first check that the fitting is not clogged with dirt or old grease. If the fitting is clear but will still not take grease, remove the swing arm pivot shaft, sleeve and bushings and clean out the old grease first.

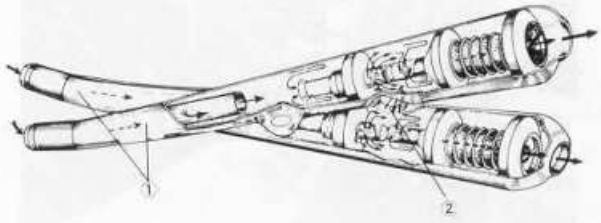
## MUFFLERS

The mufflers reduce exhaust noise and conduct exhaust gases back away from the rider, while keeping engine power loss to a minimum. The two mufflers of each side are connected by a rubber hose so that exhaust gases can expand freely into both mufflers, further reducing noise and back pressure.

If there is any exhaust leakage at the exhaust manifold, or if the gaskets appear damaged, replace the gaskets. Replace any muffler that is badly dented, cracked or otherwise damaged, or that is rusted through.

Replace the muffler connecting hose if it is damaged or has hardened. If either hose is damaged or if it is not clamped tightly in place, exhaust gas will leak.

**Muffler** (389)

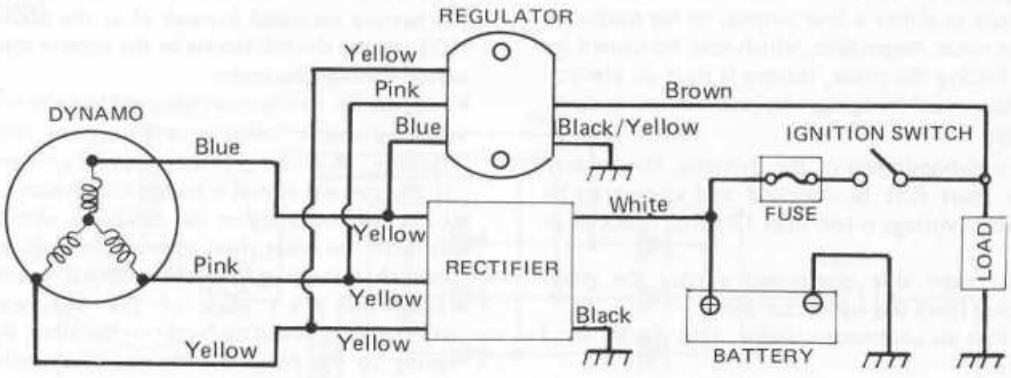



1. Muffler
2. Connecting Hose

## DYNAMO

The dynamo generates all the current required by the Z1 electrical circuits. The dynamo output is three-phase alternating current (AC). The output is changed to direct current (DC) by a rectifier, and dynamo voltage is regulated by an electronic regulator.

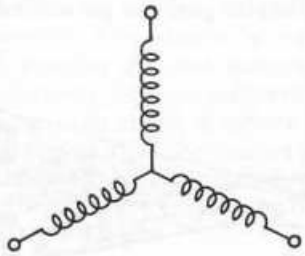
**Dynamo Circuit** (390)



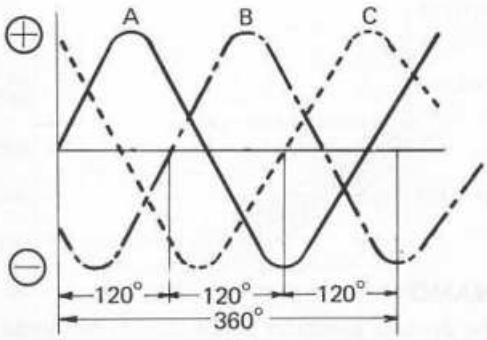
The dynamo is made of a rotor and armature. Permanent magnets supply the magnetic field of the rotor so that no slip rings or brushes are necessary, making the generator practically maintenance free. The armature consists of three sets of coils wound on laminated steel cores. The armature coils are connected in a wye pattern so that a smooth, 3-phase current of ample voltage can be supplied.

The wye connection of Fig. 391 produces the overlapping voltage shown in Fig. 392 so there is always a continuous supply of current.

**Wye Connection** (391)



**Dynamo Current** (392)




*Dynamo failure*

If the battery, rectifier and regulator are all good, but there is still low voltage or insufficient charging current, the dynamo may be defective. There are three types of dynamo failures: short, open (wire burned out), or loss in rotor magnetism. A short or open in one of the coil wires will result in either a low output, or no output at all. A loss in rotor magnetism, which may be caused by dropping or hitting the rotor, leaving it near an electromagnetic field, or just by aging, will result in low output.

*Dynamo test*

To make a dynamic test of the dynamo, the battery and rectifier must first be checked and known to be good. If battery voltage is less than 12 volts, first charge the battery.

- Remove the right side cover and unplug the green regulator plug from the connector panel.
- Make sure that all accessories (lights, turn signals, etc.) are turned off.
- Turn the hand tester switch to the 30 VDC range and connect it accross the battery, — meter lead to the battery — terminal, and + lead to the battery +.



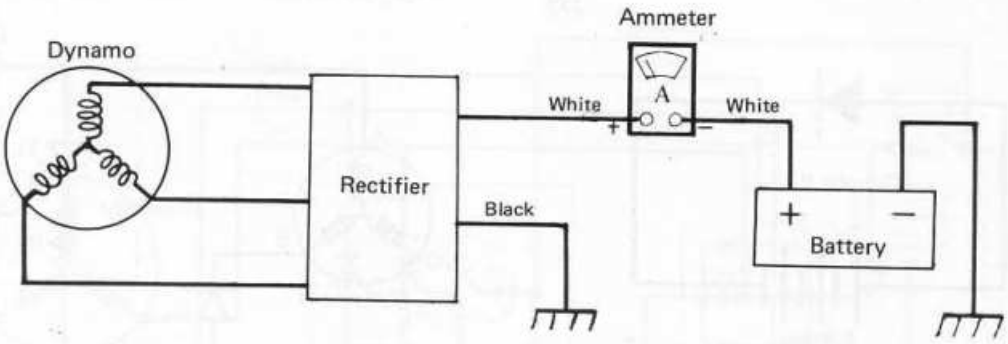

- Start the engine, run it at 4,000 r.p.m. and note the meter reading. A voltage reading of 15 to 20 VDC is normal. A lower reading indicates the dynamo is defective.
- Turn off the engine and disconnect the meter leads from the battery.
- Set the meter to the 12 Amp DC range and plug the meter leads into the appropriate meter sockets.
- Unplug the wire that goes between the fuse and the starter relay. Connect the + meter lead to the white wire on the fuse side, and connect the — meter lead to the white wire on the relay side. This puts the ammeter in series with the rectifier and battery so that battery charging current can be measured.




**CAUTION: If the meter is connected in series directly at the battery terminal instead of at the above point, DO NOT use the electric starter as the reverse starting current would damage the meter.**

- Turn on the ignition switch and start the engine.
- Holding engine speed at 4 000 r.p.m., note the meter reading. A reading of 9.5 amperes or more is normal; if the current is much lower, the dynamo is defective.
- To determine whether the trouble is with the windings or with the rotor, first turn off the engine and disconnect the blue plug from the connector panel.
- Using the R x 1 scale of the ohmmeter, measure resistance between each pair of the three dynamo wires going to the plug: blue↔pink, blue↔yellow, pink↔yellow. Resistance between any two of the wires should be .45~.6 ohms. Less than this resistance means the coils are shorted; a higher resistance or no

**Dynamo Test**

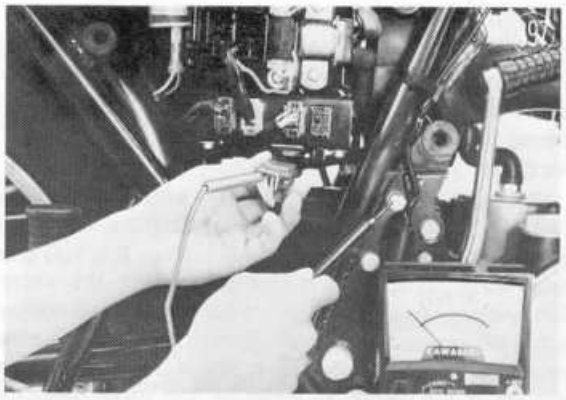



reading at all means the coils are open. If the coils are found to be open or shorted, replace the stator assembly.



•Using the highest resistance scale of the ohmmeter, measure the resistance between each dynamo wire and chassis ground (the engine or frame, etc.). No reading (∞) is normal; any meter reading indicates a short, and the stator assembly must be replaced.

If the windings have normal resistance, but voltage and current checks showed the dynamo to be defective, then the rotor magnets have probably weakened, and the rotor must be replaced.

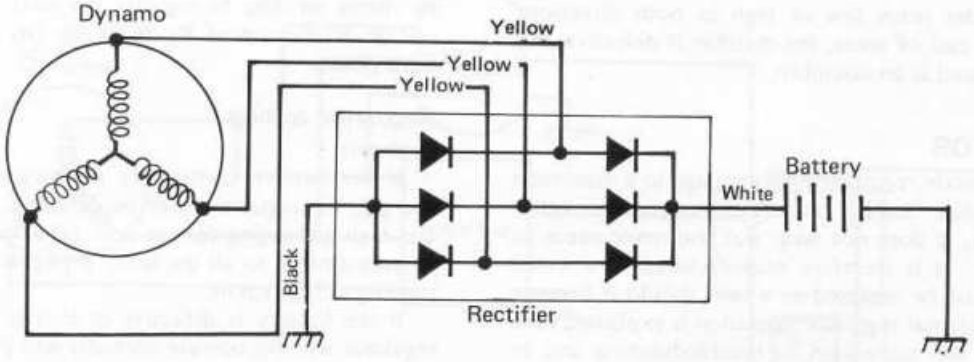


## RECTIFIER

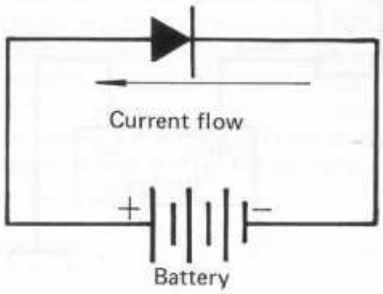
The rectifier is used to change the alternating current (AC) from the dynamo to direct current (DC) for the battery charging, ignition, lighting, and other circuits. It contains six diodes, two to rectify (change to DC) each of the three phases of the dynamo output, and the diodes are connected in a bridge circuit arrangement for efficient full-wave rectification.

The reason that the diodes can change alternating current to direct current is that they only conduct in one direction from the − to the + side. A bad rectifier, however, will conduct in both directions or stop conducting altogether and can be found easily with a resistance check.

**Rectifier Circuit**



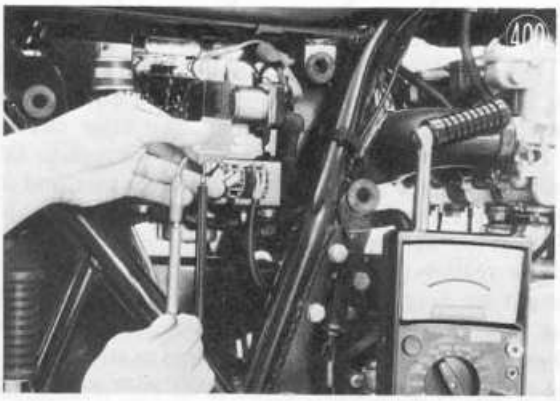
**Diode** (399)




If any one of the six diodes is open or shorted, voltage output from the rectifier will be well below normal, and the battery will discharge.

*Rectifier check*

With the engine off, unplug the white rectifier plug from the connector panel, and unplug the white lead going to the battery. Using the R x 10 or R x 100 ohmmeter range, check the resistance between the white↔each yellow, each yellow↔white, black↔each yellow, each yellow↔black rectifier wires, a total of 12 measurements. Resistance should be low in one direction and more than ten times as much in the other direction.



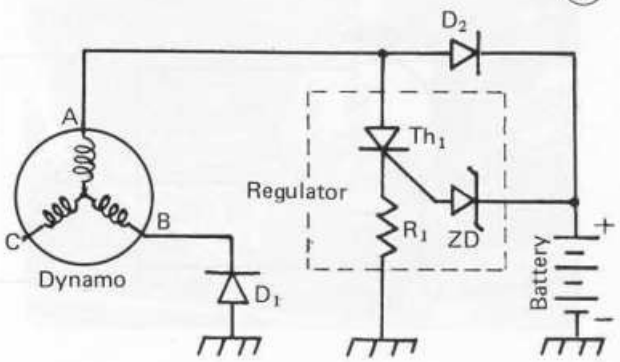
**NOTE:** The actual meter reading varies with the meter used and with the individual rectifier, but, generally speaking, the lower reading should be within $^1/_3$ scale of zero ohms.

If the meter reads low or high in both directions between any pair of wires, the rectifier is defective and must be replaced as an assembly.

## REGULATOR

The solid-state regulator limits voltage to a maximum of 15~16 volts. Since it contains no contacts or other moving parts, it does not wear out and never needs to be adjusted. It is therefore manufactured as a sealed unit, and must be replaced as a unit should it become defective. Internal regulator operation is explained here only to aid the technician in troubleshooting and in understanding test procedures.

**Regulator Circuit** (401)




There are three parts to the regulator, one to regulate each phase of the three-phase dynamo output voltage. Fig. 401 is a simplified diagram of the regulation circuit for one phase. The main components of the circuit are a thyristor ($Th_1$) and a zener diode (ZD). One side of the zener diode is connected to the + terminal of the battery to keep a check on charging voltage. The other side is connected to the gate lead (G) of the thyristor to signal the thyristor when charging voltage becomes too high. The thyristor, or Silicon Controlled Rectifier (SCR) as it is also called, is an electronic switch which is turned on by a voltage signal to its gate lead. When it conducts it, in effect, returns excess voltage to the dynamo. $D_1$ and $D_2$ in the diagram are two of the diodes in the rectifier.

Detailed circuit operation is as follows:

Normally current flows from B through $D_1$ to ground. From ground it goes up through the battery to charge it, and through $D_2$ back to the dynamo. When battery charging voltage gets too high, however, the zener diode conducts and signals the thyristor to start conducting. Then, instead of current going through the battery and overcharging it, it flows from ground up through $R_1$ and $Th_1$ and directly back to the dynamo. On the portion of the AC sine wave where the voltage is not too high, the thyristor does not conduct and battery current is allowed to flow. This ensures that the battery will still be charged at high engine r.p.m. when dynamo voltage is being regulated.

Fig. 402 shows the complete rectifier and regulator circuits for all three phases, although internal regulator circuitry is simplified. After $Th_1$ starts conducting to regulate one phase of voltage, the voltage at the top of $R_1$ turns on $Th_2$ to regulate the next phase, and the voltage at the top of $R_2$ turns on $Th_3$ to regulate the third phase.

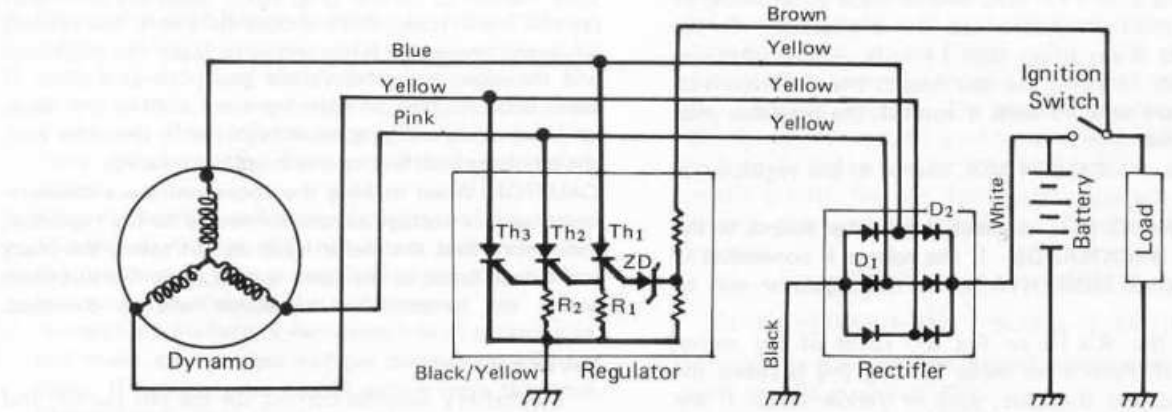
*Regulator testing*

**In circuit:**

If the battery continually discharges, or if it overcharges, the regulator may be defective. Symptoms of too high a charging voltage are: (a) battery water must be added often to all the cells; (b) lights burn out when running at high r.p.m.

If the battery is defective or if it is discharged, the regulator will not operate normally and the battery must first be charged before any regulator tests can be made.

**Rectifier and Regulator Circuit**

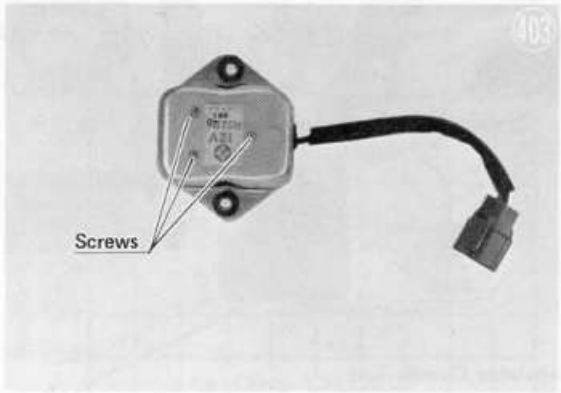



Check the battery voltage before starting the engine and charge it if it is less than 12 volts.

To check voltage, set the meter to the 30 VDC range and connect it across the battery, the − meter lead to the − battery terminal, and the + meter lead to the + battery terminal. With all lights and other accessories turned off, start the engine and run it at 4,000 r.p.m. If the meter reads between 15 and 16 volts at this time, the regulator is operating normally. If it reads more than 16 volts, either the regulator is defective, or it is not properly connected into the circuit due to a loose connection, broken wire, etc. Carefully check all connections before replacing the regulator. If the meter reading is less than 15 volts, either the dynamo or rectifier is defective, or the regulator is defective. This can be checked easily by leaving the meter connected to the battery as is, stopping the engine, unplugging the green regulator plug from the connection panel under the right side cover, and restarting the engine. With the engine again running at 4,000 r.p.m., if the meter now reads between 15 and 20 volts, the regulator is defective; if the meter reads less than that, either the dynamo or the rectifier is defective.

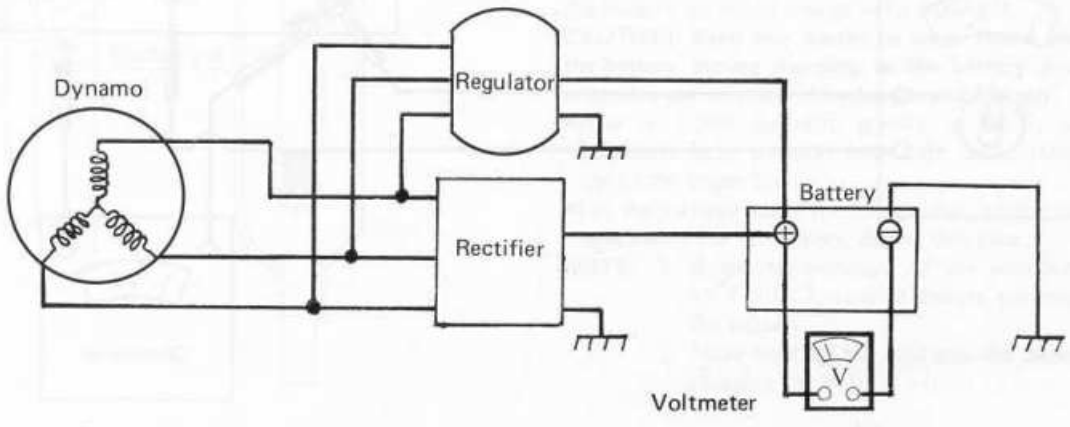
**Out of circuit:**

**NOTE:** When the regulator is removed, make sure that the screws in the regulator body are not removed or loosened. These screws aid in heat dissipation and the regulator will overheat if the screws are not properly installed.




To test the regulator out of circuit, first use an ohmmeter to check resistance between the various leads. With the meter on the R x 10 or R x 100 scale, there should be 1,000~1,100Ω resistance between the black and brown leads, and no reading at all (∞) between any other two leads or between the brown or black and any other lead. If the resistance reading results are any other than this, the regulator is defective.

**Dynamo Circuit Test**

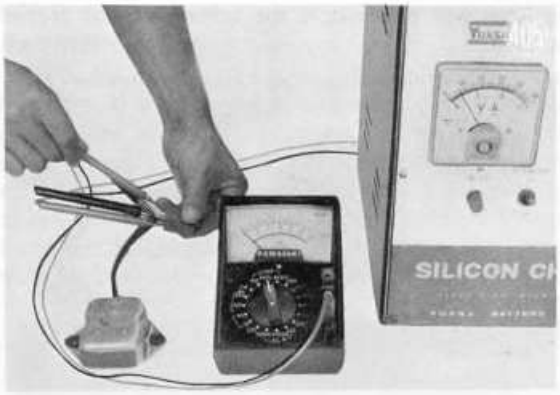


For the second out-of-circuit check, a 14 VDC voltage source and a 16~17 VDC source must be available so actual circuit conditions can be duplicated. If the one source is any lower than 14 volts, or the other any lower than 16 volts, the test results may be incorrect. **If any more than 18 volts is applied, the regulator may be damaged.**

First connect the 14 VDC source to the regulator as shown in Fig. 406.

**CAUTION: DO NOT connect the voltage source to the regulator BACKWARDS. If the voltage is connected in reverse even MOMENTARILY, the regulator will be damaged.**

Using the R x 10 or R x 100 range of the meter, check that there is no meter reading (∞) between the black lead and the blue, pink or yellow lead. If the meter gives any reading for any wire, the regulator is defective.




Then connect 16~17 VDC to the regulator in the same manner as before (Fig. 404). With the ohmmeter on the R x 1 scale, there should be a very low reading when the ohmmeter is connected between the black lead and the blue, pink and yellow leads, one at a time. If there is no reading between any one or all of the leads, or if any one reading is much higher than the other two, the regulator is defective and must be replaced.

**CAUTION: When making the above resistance measurements with a voltage source connected to the regulator, make sure that the meter leads do not touch the black and brown leads at the same time (i.e. do not put them across the battery) as the meter will be damaged.**

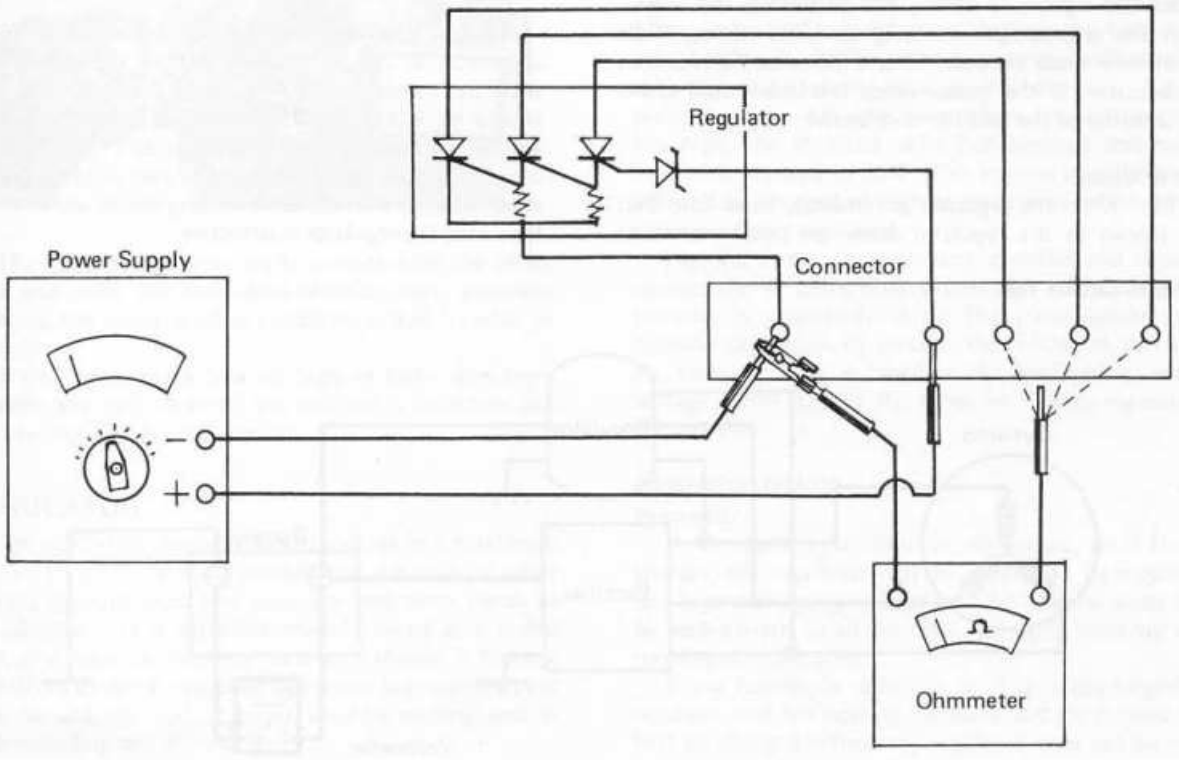
## BATTERY

The battery supplies current for the self starter, and is the back-up source of power to run the lights, ignition, etc. whenever the engine is turning too slowly for the dynamo to supply sufficient power.

With proper care, the battery can be expected to last a few 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 your 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. Distilled water comes in a sealed, non-metallic container; any other water is not distilled water.**
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.**

**Regulator Circuit Test** (406)



3. **Avoid quick-charging the battery, as this damages 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 or crimped shut. If battery gases cannot escape from this hose, they will explode the battery.**
7. **DON'T INSTALL THE BATTERY BACKWARDS. The negative side is grounded.**

### *Electrolyte*

The electrolyte is a mixture of distilled water and sulphuric acid. The standard specific gravity of the electrolyte in a fully charged battery is 1.260 at 68°F (20°C), although a 1.280 solution is also used. The water in this solution evaporates due to chemical action in the battery, but the acid always remains. For this reason only distilled water should be added when the electrolyte level is low. If acid is added, the solution will become too strong for proper chemical action, in addition to damaging the plates. Metal from the damaged plates collects in the bottom of the battery, and this sediment eventually causes an internal short circuit.

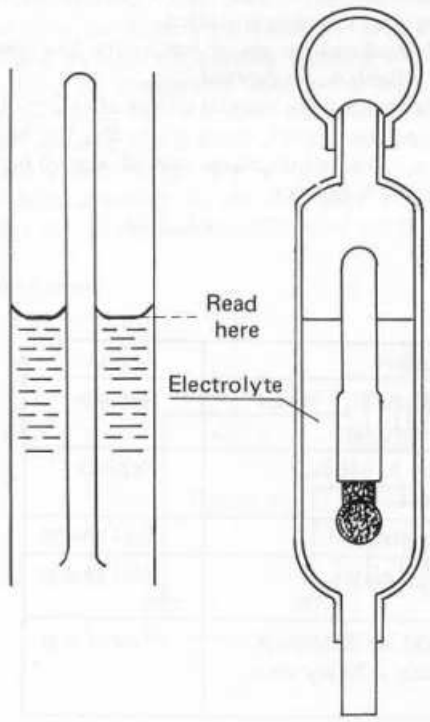
The specific gravity of the electrolyte, measured with a hydrometer, is the most accurate indication of the condition of the battery. When using the hydrometer, read the electrolyte level at the bottom of the meniscus (curved surface of the fluid). Fig. 408 shows the relationship between the specific gravity and the percentage of battery charge. The chart is accurate at 68°F (20°C), but since specific gravity varies with temperature, the formula below can be used to figure the equivalent specific gravity for any temperature. When the temperature goes up, the specific gravity goes down, and vice versa.

| Fahrenheit | Celsius |
|---|---|
| $St = S_{68} - [.0004(t-68)]$ | $St = S_{20} - [.0007(t-20)]$ |

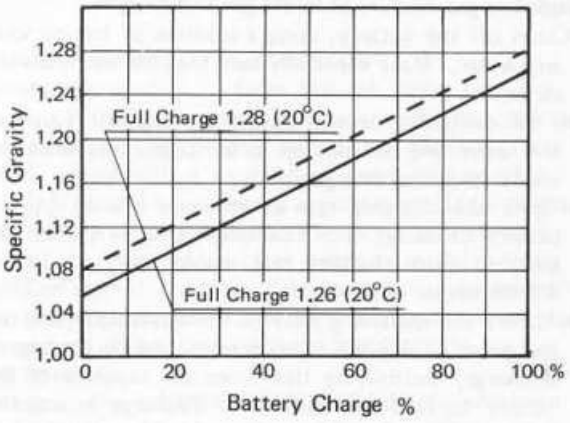
St = specific gravity at the present temperature
$S_{20}$ = specific gravity at 20°C
$S_{68}$ = specific gravity at 68°C
t = present temperature

Generally speaking, a battery should be charged if a specific gravity reading shows it to be discharged to 50% or less of full charge.

**Hydrometer** (407)




**Specific Gravity/Battery Charge Relationship** (408)




### *Initial charge*

New batteries for Kawasaki motorcycles are dry-charged and can be used directly after adding the sulphuric acid solution. However, the effect of the dry charge deteriorates somewhat during storage, especially if air has entered the battery due to imperfect sealing. So to ensure long battery life, it is best to give the battery an initial charge before using it.

**CAUTION: Keep any sparks or open flame away from the battery during charging, as the battery gives off an explosive gas mixture of hydrogen and oxygen.**

- Pour a 1.260 (specific gravity at 68°F, or 20°C) sulphuric acid solution into each cell of the battery up to the upper line.
- Let the battery stand for 30 minutes, adding more acid solution if the level drops during this time.

**NOTE:** 1. If the temperature of the solution is over 85°F(30°C), cool it 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 of the battery capacity, and charge it for 10 hours. For example, if the battery is rated at 14AH, the charging rate is 1.4 amperes. 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 115°F (45°C) 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 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*

**CAUTION: Keep any sparks or open flame away from the battery during charging, as the battery gives off an explosive gas mixture of hydrogen and oxygen.**

- Clean off the battery, using a solution of baking soda and water. Make especially sure that the terminals are clean.
- If the electrolyte level is low in any cell, fill it to over the lower line but not up to the upper line since the level rises during charging.
- Figure the charging rate as between 1/10 to 3/10 of battery capacity. For example, for a 14AH battery the maximum charging rate would be 3/10 x 14, or 4.2 amperes.
- Measure the specific gravity of the electrolyte, and use the graph of Fig. 408 to determine the percentage of discharge, multiplying this times the capacity of the battery to find the amount of discharge in ampere-hours. Use this figure in the formula below to compute charge time.

$$\text{Charging time (hours)} = \frac{\text{amount of discharge (AH)}}{\text{charging current (A)}} \times 1.2 \sim 1.5$$

- Removing the caps from all the cells, begin charging the battery at the rate calculated above. 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 115°F (45°C) 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 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 a battery is suspected of being defective, first inspect the points noted in the chart below. The battery can be tested by charging it by the ordinary method. 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 cases:

- ☆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 will gradually go up to 12.5 to 13 volts about 30 to 60 minutes after charging is started.
- ☆If one cell produces no gas or has a very low specific gravity, it is liable to be shorted.
- ☆If a fully-charged battery loses its charge after 2~7 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.

**Table 65 Battery Troubleshooting Guide**

| | Good Battery | Suspect Battery | Action |
|---|---|---|---|
| Plates | (+) chocolate color<br>(–) 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 | Test charge |
| Specific gravity | above 1.200 in all cells; no two cells more than .020 different | below 1.100, or difference of more than .020 between two cells | Test charge |

## IGNITION SYSTEM

The working electrical part of the ignition system consists of the battery, two sets of contact breaker points, two condensers, two ignition coils, and four 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.

In a four-cycle engine, the spark plug is normally fired only every other time the piston rises (i.e. after every 720° of crankshaft rotation), because between each compression stroke of the piston when gasoline is in the cylinder, there is an exhaust stroke in which the piston rises only to push out burned gases. If the spark plug does fire during the exhaust stroke, however, there is no compression and no gasoline to burn so that firing at that time has no effect, either harmful or otherwise. Keeping this in mind, each two spark plugs have been designed to fire when both of the applicable pistons are moving upward, but when one is on the compression stroke and the other is on the exhaust stroke. The advantage to this method is that only the two sets of points, coils, etc. are needed to fire four spark plugs.

Each set of points has one fixed and one movable contact. The movable contact is pivoted with the heel at one end held against the cam on the end of the crankshaft by a single-leaf spring. As the cam turns, the heel rides up and down along the cam surface and causes the contacts to open and close. This heel wears in time, changing the point gap and timing so that they will require periodic adjustment.

A wiring diagram of one half of the ignition system is shown in Fig. 409. The other half is identical, and works as follows. The points start out closed and current from the battery (or dynamo) flows through the points and through the primary winding of the ignition coil, setting up a magnetic field in the coil. When the points are opened by the cam, the current through the primary winding is suddenly cut off and the magnetic field starts collapsing. The collapsing field inside the coil induces a voltage in the secondary winding of the coil, but due to the sudden collapse of the field and also due to the large turns ratio between the primary and secondary windings, a much higher voltage is induced in the secondary winding than was originally present in the primary. This high voltage is applied to the two spark plugs connected in series with the winding, and causes a spark to jump across the electrodes of both plugs simultaneously.

Because the two spark plugs of each pair are connected in series, the current through one spark plug must go through the other. And, of course, it follows that if the current will not go through one plug (due to dirty electrodes, broken plug wire, etc.) then there will be no spark at the other plug either.

The condenser connected across each set of points serves to prevent a spark from jumping across the points, and thereby permitting a higher spark voltage to be developed at the spark plug. It does this by absorbing a small amount of current when the contacts first open, giving the contacts time to get far enough apart to where a spark will not jump across them. Because there is almost no spark to continue current flow, the electrical breaking of the contacts is that much faster, and this speed causes a higher voltage to be developed in the secondary winding.

### *Contact breaker points, condenser*

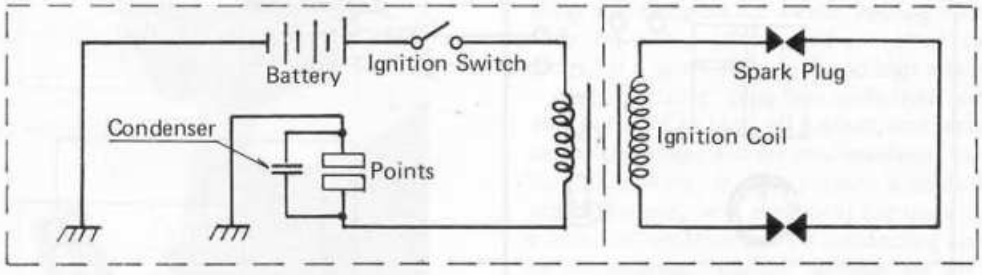
When the contact surfaces become dirty, pitted or burned, or spring weakens, the points will not make good contact. Since this will cause misfiring, and unstable idling with a weak or no spark to two plugs, the points should be inspected at least every 2,000 miles (3,000 km), and repaired or replaced as necessary.

Clean the points with clean paper or cloth, or using an oil-free solvent. To repair light damage, use sandpaper or an oilstone. If the points are badly worn down or damaged, or if the spring is weak, replace the breaker point assembly.

At least every 2,000 miles (3,000 km), or whenever the contacts are inspected or replaced, apply a small amount of grease to the felt to lubricate the cam and minimize wear of the breaker point heel. Be careful not to apply so much grease that it can drop off or be flung off onto the points, causing them to foul and burn.

**Ignition Circuit**

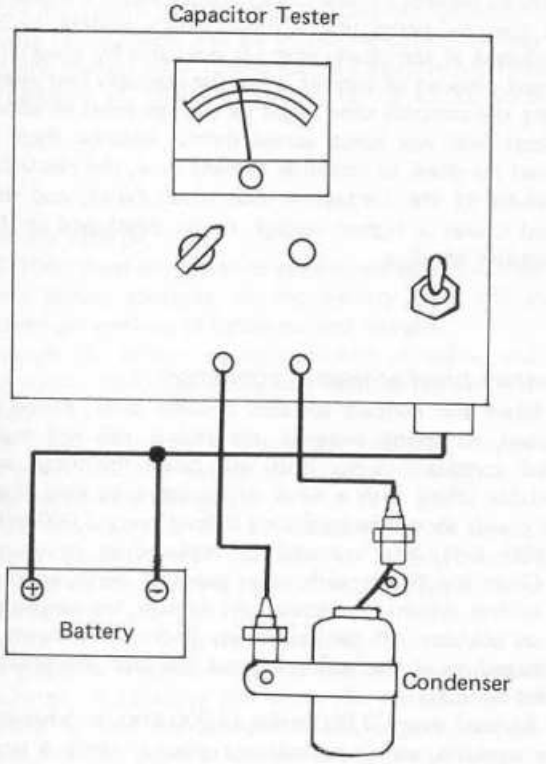
409



A bad condenser will also result in the same troubles that bad points cause. In addition, a bad condenser will not prevent sparking across the points, causing them to burn and pit. The condenser can usually be considered to be defective if a long spark is seen jumping across the points when they open, or if the points are burned or pitted for no apparent reason. Replace the condensers any time either one appears to be defective, or whenever the breaker points are replaced.

**NOTE:** For checking with a capacitor tester, condenser specifications are: .25±.03 μfd., 1,000 WVDC.

**Condenser Test** (410)

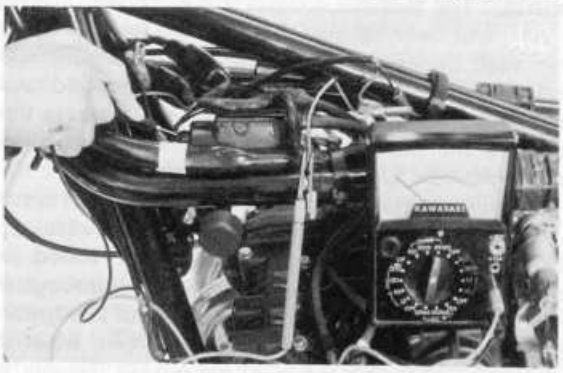



*Ignition coil*

The most accurate test of coil condition is made with a three-point tester (electrotester). Connect the coil to the tester according to the directions with the tester, and check that the coil will produce at least a 7 mm (.28 inch) spark.

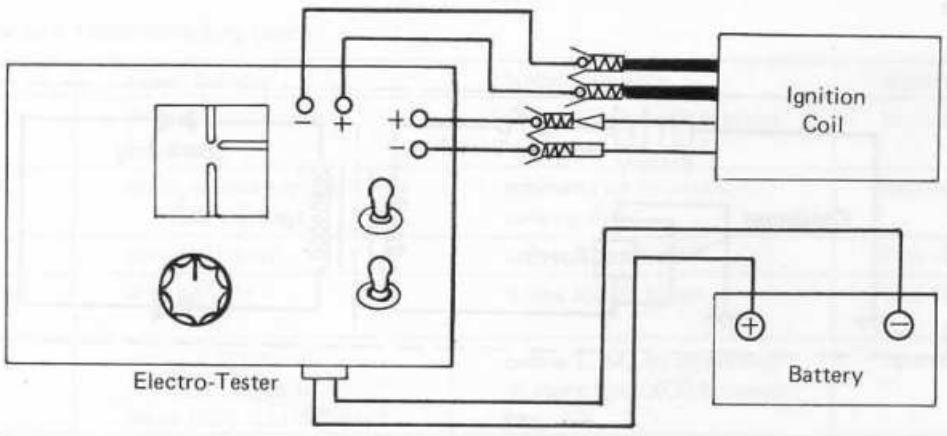
If an electrotester is not available, the coil can be checked for a shorted or open winding with an ohmmeter, but this method is not 100% accurate as it does not test for high voltage shorts (insulation breakdown). The (primary winding) resistance between the red/yellow wire and the green or the black lead, depending on the coil, is 3.2~3.8Ω. The (secondary winding) resistance between the two spark plug wires – connect one meter lead to each spark plug wire to measure this – is about 30KΩ. Checking with the highest ohmmeter scale, there should be no reading at all (∞) between the brown wire or the plug wires and the coil core.





If any of the above readings are incorrect, or if the coil or the spark plug wires show visible damage, replace the coil.

**Ignition Coil Test** (413)



## AUTOMATIC TIMING ADVANCER

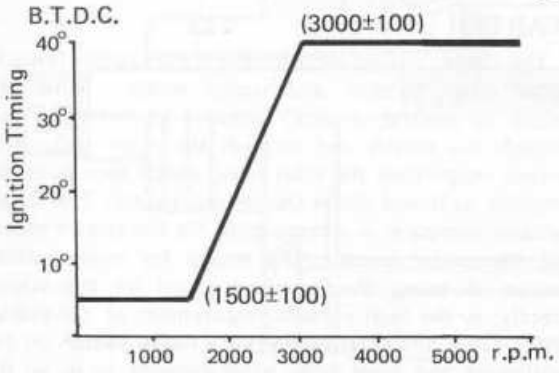
The automatic timing advancer is a device that advances the ignition timing (makes the spark plug fire sooner) as engine r.p.m. rises. It consists of two weights and two springs connected to the timing cam that opens the contact breaker points. The more engine speed rises, the more that the weights are thrown out against spring tension, turning the cam in the direction of crankshaft rotation and causing the points to open sooner.

If the cam and weight do not move smoothly, timing will not advance smoothly or it may stick in one position. If this happens, or if the springs weaken so that the advance is too rapid, the timing will be incorrect for that engine speed and cause poor performance. Failure to advance will cause bad high speed performance, and too much advance (weak or broken spring, etc.) will cause knocking and poor low speed performance.

### *Advancer inspection*

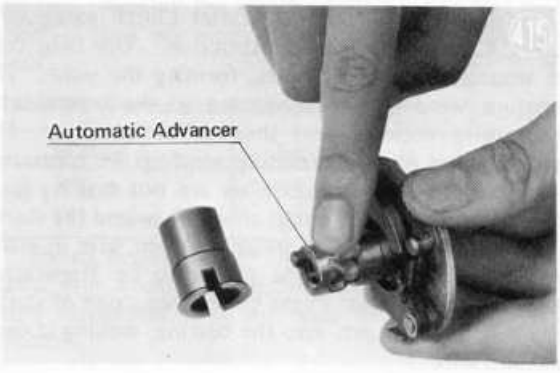
Fig. 414 shows the relationship between ignition timing and engine r.p.m., and if timing differs from the graph, the advancer should be replaced.

**Ignition Timing/Engine r.p.m. Relationship** (414)




The actual check is made with a strobe light, after first adjusting ignition timing. The timing marks should be aligned at 1,000 r.p.m. or below, and the mark should be aligned with the pin of the timing advancer at 3,000 r.p.m. or higher.

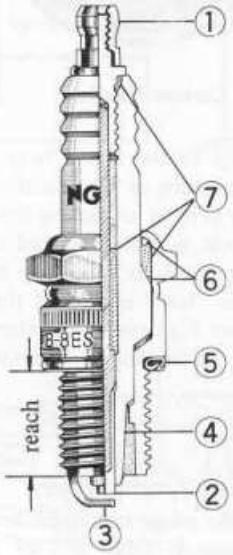
Also check that the advancer moves smoothly by hand, and that no parts are visually worn or damaged. Every 2,000 miles (3,000 km) or sooner, wipe the timing advancer clean, apply oil to the advancer, and fill the groove in the advancer body with grease.




## SPARK PLUGS

The spark plugs ignite the gasoline mixture in the cylinder. To do this effectively and at the proper time, the correct spark plugs must be used, and they must be kept clean and adjusted.

**Spark Plug** (416)



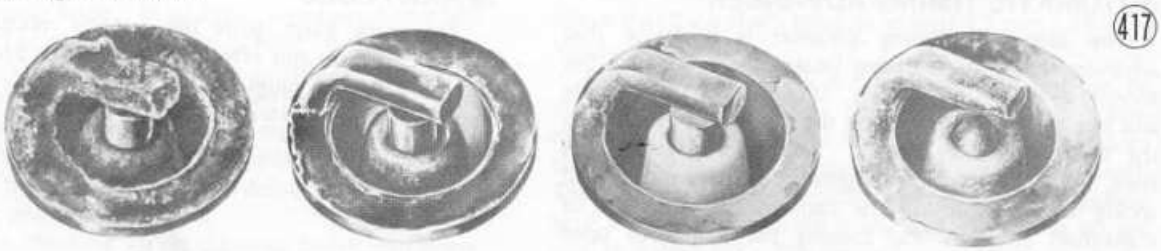

1. Terminal
2. Center Electrode
3. Side Electrode
4. Insulator
5. Gasket
6. Wire Packing
7. Cement

Tests have shown the NGK B-8ES spark plug set to a .028~.031 inch (.7~.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 may not necessarily be the best plug for a particular engine. Spark plug replacement is done if it appears necessary after removing and inspecting the plugs, and is usually limited to replacement with plugs of the next higher or lower heat range.

When plugs of the correct temperature range are used, the electrodes will stay hot enough to keep all the carbon burned off, but cool enough so keep from damaging the engine and the plug itself. This temperature is about 750°~1,450°F (400°~800°C), 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 burning at the right temperature.

Spark plugs for higher operating temperatures are used for racing and other high speed applications. These plugs are designed for better cooling efficiency so that they do not overheat, and are often called "colder" plugs. If a spark plug with too high a heat range is used – that is, a "cold" plug that cools itself too well – it will stay too cool to burn off carbon, and carbon will collect on the electrodes and ceramic insulator. If enough of this carbon collects, it may prevent a spark from jumping across the gap, or it may short the spark out by bridging across the electrodes or by conducting along the outside of the ceramic. Carbon build-up on the plug can also cause other troubles: it can heat up red-hot and cause preignition and knocking and may eventually burn a hole in the top of the piston.

**Spark Plug Condition**



(417)

**Carbon Fouling** **Oil Fouling** **Normal Operation** **Overheating**

Spark plugs in the lower heat ranges are used when engine temperature is comparatively low, such as for constant city driving or during the break-in period when the motorcycle is not operated at high speed. These plugs are designed to hold the heat and so are often referred to as "hot" plugs. If these plugs are used for racing or other high speed use, they will run too hot and cause engine overheating, preignition, etc.

*Inspection and replacement*

Remove the plugs and inspect the ceramic insulator. If the insulator is clean and of a light brown color, the correct plugs are being used. If they are all black, change to the "hotter" NGK B-7ES; if the ceramic is burned white and the electrodes are burned, replace the plugs with "colder" NGK B-9ES's.

If only one or two plugs are burning incorrectly, the cause of trouble may be other than the spark plugs, such as carburetion, ignition timing, etc. This should be checked out before deciding to replace the plugs.

**CAUTION: When the type of riding changes – for example, a change to faster riding after the break-in period is over – the spark plugs should be inspected and changed if necessary. The B-7ES plugs in particular can damage the engine if used for high speed riding.**

Clean the electrodes and the ceramic insulator around the center electrode by scraping off any deposits and washing the plug in gasoline. If the gap has widened, reset it to the standard .028~.031 inch (.7~.8 mm). If the electrodes are badly worn down or burned, replace the plug.

Also replace the spark plugs any time there is visible damage such as cracked ceramic, damaged threads, etc.

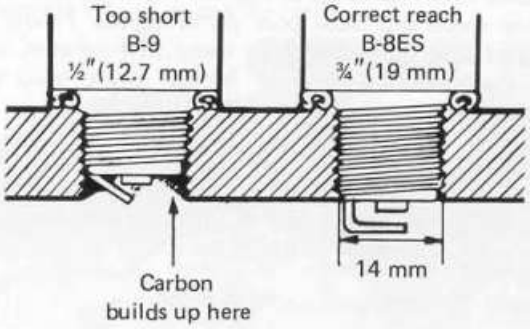
**NOTE:** If the spark plugs are replaced by any other than the recommended NGK B-7ES, B-8ES (standard), or B-9ES, make sure that the replacement plugs have the same:

(1) thread pitch
(2) reach (threaded portion must be ¾ inch or 19 mm long)
(3) diameter of threaded part (9/16 inch or 14 mm)

If a plug with the wrong thread pitch or thread diameter is used, the cylinder head will be damaged. If a plug with too long or short a reach is used, carbon will build up around the plug or plug hole threads possibly causing engine damage, and making the old plug difficult to remove or the new one difficult to install.

**Plug Reach**

(418)




## STARTER

The starter circuit includes the starter button/switch, starter relay, battery and starter motor. When the button is pushed, a small amount of current flows through the switch and through the relay coil. This current magnetizes the relay core, which then pulls the armature to it and closes the relay contacts. The closed contacts complete a current path for the starter motor and the motor turns. The reason for using a relay instead of using the switch to turn on the starter directly, is the high current requirement of the starter motor. It is not practical to put a heavy switch on the handlebars and have large wires running to it, so the starter switch is made only to carry the light relay coil current, and heavy contacts inside the relay carry the starter motor current.

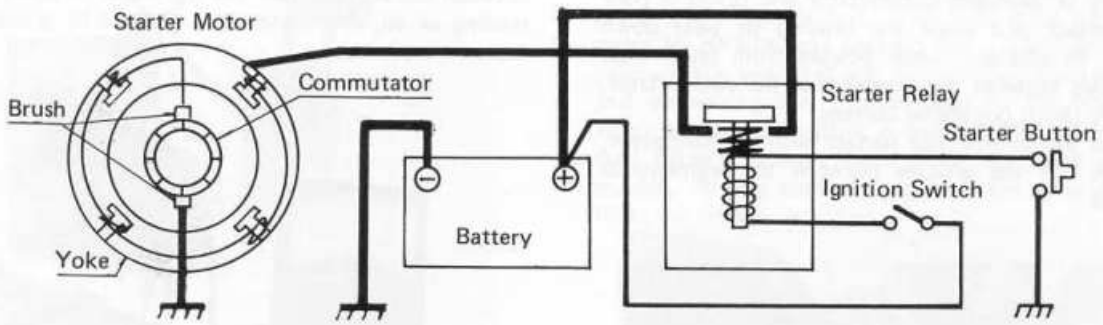
**NOTE:** Because of this high current, never keep the starter button pushed any time the starter will not turn over, as the current will burn out the starter windings.

The starter motor is installed in a constant-mesh arrangement without a solenoid to engage and disengage the starter from the engine. In place of the solenoid used in automobiles, a clutch disengages the starter once the engine starts. (See the Starter Clutch paragraph.)

Fig. 420 shows starter construction. The field coils are wound around four cores, forming the yoke. The armature windings are connected to the commutator and receive their current through the brushes. The field windings and the armature windings are connected in series, and so if the brushes are not making good contact, no starter current at all will flow and the starter will not turn over. A short or an open wire in either winding will also cause the starter to be inoperative. Dust from brush wear might be another cause of starter failure if the dust gets into the bearing, making it overheat and seize.

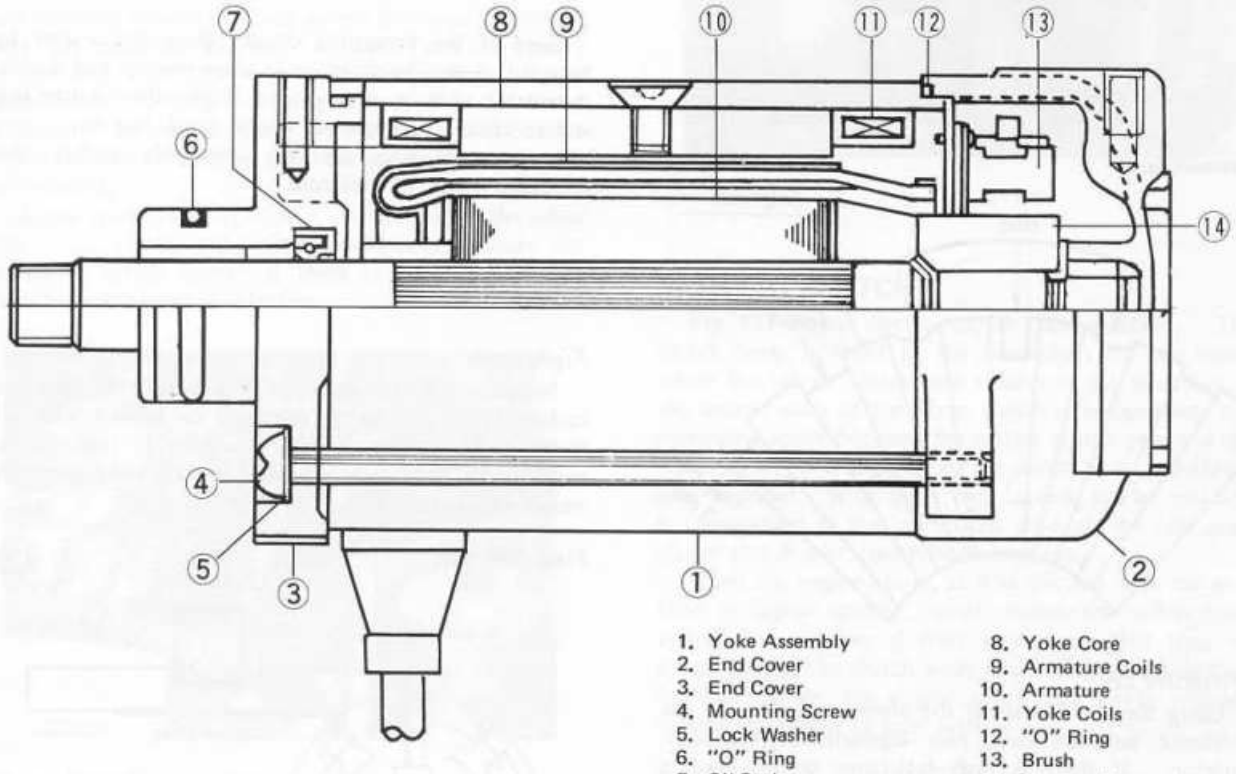
**Starter Circuit**

(419)




**Starter Construction**

(420)




1. Yoke Assembly
2. End Cover
3. End Cover
4. Mounting Screw
5. Lock Washer
6. "O" Ring
7. Oil Seal
8. Yoke Core
9. Armature Coils
10. Armature
11. Yoke Coils
12. "O" Ring
13. Brush
14. Commutator

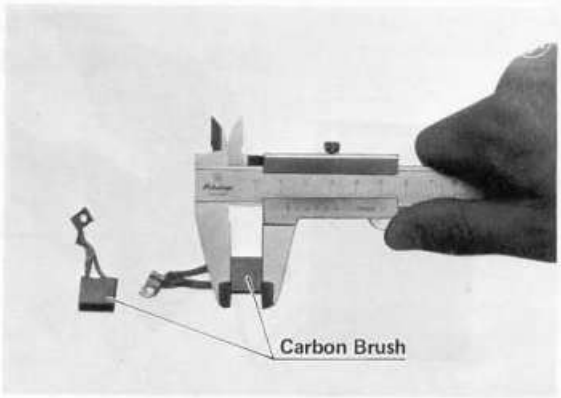
*Carbon brushes*

Worn brushes or weak springs will cause poor brush contact. Measure the length of the brushes and replace them if they are worn down to less than the service limit.

**Table 66 Starter Brush Length**

| Standard | Service Limit |
|---|---|
| ½ inch (12~13 mm) | ¼ inch (7 mm) |

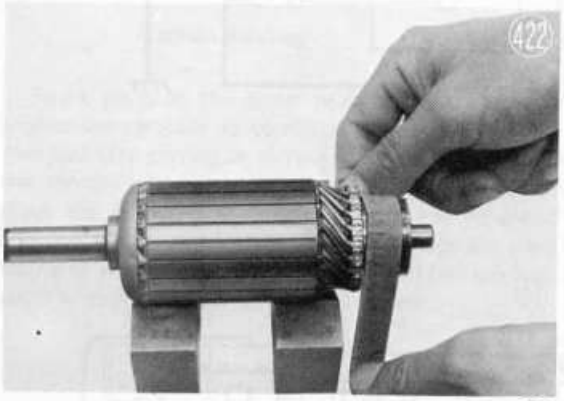
Spring tension is 20~24 oz. (560~680 grams) measured with a spring gauge, but the spring can be considered serviceable if it will snap the brush firmly into place.



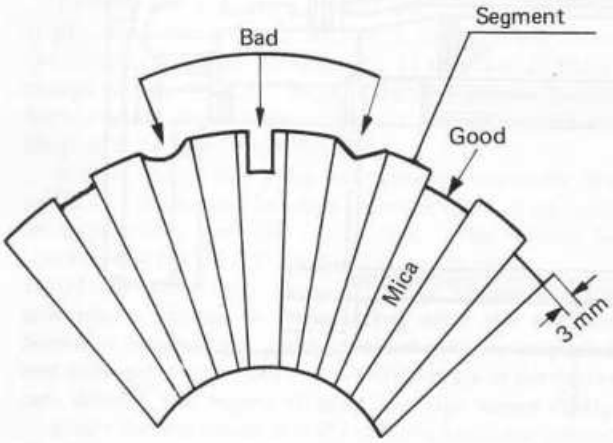
### *Commutator*

A dirty or damaged commutator will result in poor brush contact and cause the brushes to wear down quickly. In addition, when powder from brush wear accumulates between the segments of the commutator, it partially shorts out starter current.

Correct the commutator surface with fine sandpaper, and clean out the grooves between the segments as illustrated.

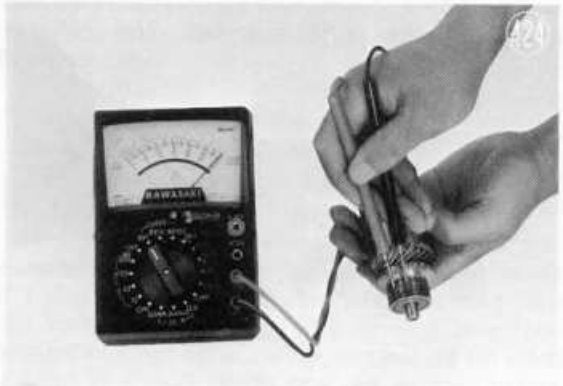


**Commutator** (423)

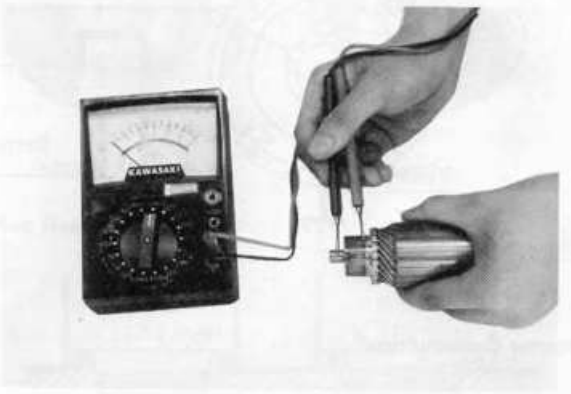



### *Armature coil*

Using the R x 1 scale of the ohmmeter, measure the resistance between each two segments of the commutator. If there is high resistance or no reading between any two, a wire is open and the armature must be replaced.



Using the highest scale of the ohmmeter, measure between the commutator and the shaft. If there is any reading at all, the armature is shorted to ground and must be replaced.

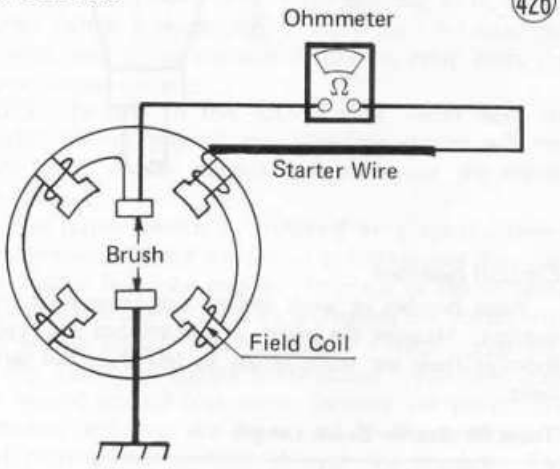


Even if the foregoing checks show the starter to be good, it may be defective in some manner not readily detectable with an ohmmeter. If all other starter and starter circuit components check good, but the motor still does not turn over or turns only weakly, the armature should be replaced.

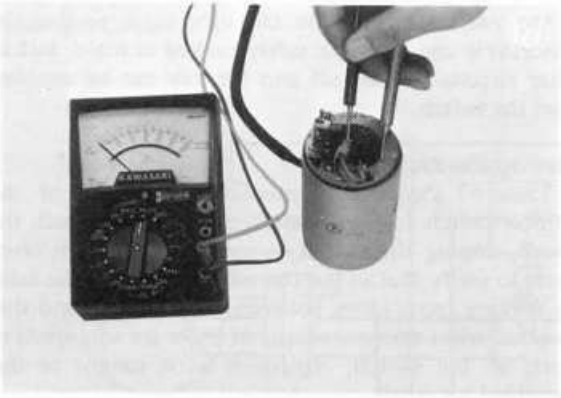
### *Field coils*

Measure the resistance (R x 1 scale) between the carbon brush on the + side, and the starter lead. If there is not close to zero ohms or if there is no reading, the field coils are open and the yoke assembly must be replaced.

**Field Coil Test** (426)




Using the highest ohmmeter scale, measure resistance between the + side brush and the yoke (housing). If there is any meter reading, the coils are shorted to ground and the yoke must be replaced.



*Starter relay*

Disconnect the starter wires from the starter relay and connect ohmmeter leads across the relay terminals, with the meter on the R x 1 scale. Push the starter button and see if the meter reads zero ohms. If the relays makes a single clicking sound and the meter reads zero, the relay is good. If the relay clicks but the meter does not read zero, the relay is defective and must be replaced.

If the relay does not click at all, disconnect the other two wires (black and yellow/black) and measure the resistance across them. If there is not close to zero resistance, the relay is defective.




**Starter Relay Contact Test**

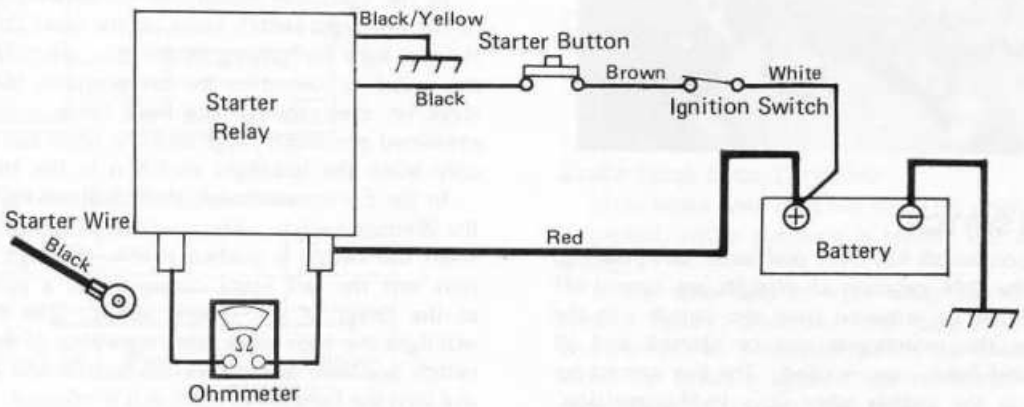
If there is zero resistance, the relay may be good, so check that there is actually voltage to the relay before deciding the relay is bad. This is done by turning the meter to 30 VDC and connect the – meter lead to the yellow/black wire that was disconnected from the relay, and connecting the + meter lead to the black wire. When the starter button is pushed, the meter should read battery voltage. If it does not, there is wiring trouble. If this check is good but the relay does not click, the relay is defective.



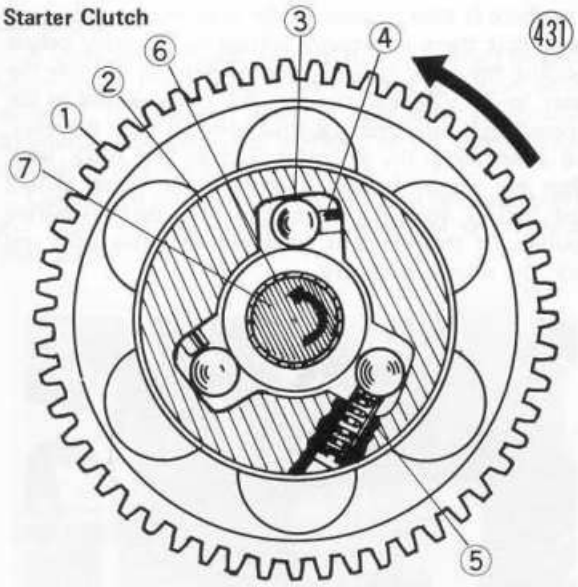

## STARTER CLUTCH

Fig. 431 shows starter clutch construction. The clutch body is fixed to the crankshaft via the rotor. When the starter clutch gear rotates in the direction of the arrow, each of the three rollers is wedged into the narrowing space between the starter clutch gear and the clutch body, thereby locking the clutch body and clutch gear together. With these two locked, starter rotation is transmitted to the crankshaft through the idle gear, starter clutch gear, clutch body, and rotor.

When the engine starts, at first friction with the gear (and at higher speeds, inertia) moves the rollers back against the tension of their springs, so that they no longer wedge the clutch body and clutch gear together. In this manner the engine can rotate freely without forcing the starter to turn with it.



Starter Clutch

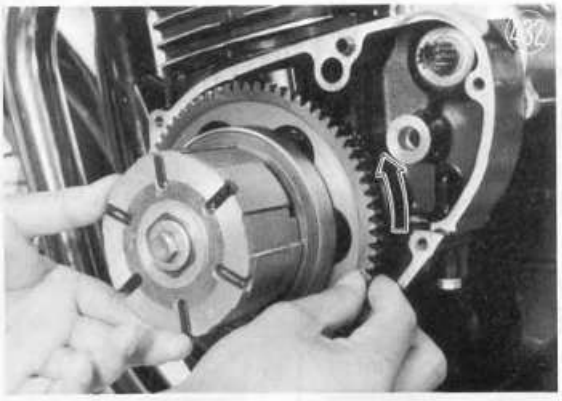



1. Gear
2. Clutch Body
3. Roller
4. Spring Cap
5. Spring
6. Needle Bearing
7. Crankshaft

If the rollers or clutch gear become damaged or worn, the rollers may lock in place so that the starter will not disengage when the engine starts. On the other hand, roller or gear damage could stop the clutch from engaging properly and cause the starter motor to run free and not turn the engine over at all, or to make noise while turning the engine over.

### *Clutch inspection*

Remove the left engine cover and idle gear, and turn the clutch gear by hand. It should not turn in the direction of the arrow, but should turn freely in the opposite direction. If the clutch will not operate like this or if it makes noise, examine each part visually and replace any that are worn or damaged.



## 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 accessories and lights can be used. The key cannot be removed from the switch when it is in this position. In the **PARK** position the tail light lights so that the motorcycle can be more safely parked at night, but all other circuits are cut off and the key can be removed from the switch.

### *Testing the switch*

Table 67 shows the internal connections of the ignition switch for each switch position. To check the switch, unplug the switch connector and use an ohmmeter to verify that all the connection listed in the table are making (zero ohms between those wires), and that no other wires are connected. If there are any opens or shorts in the switch, replace it as it cannot be disassembled for repair.

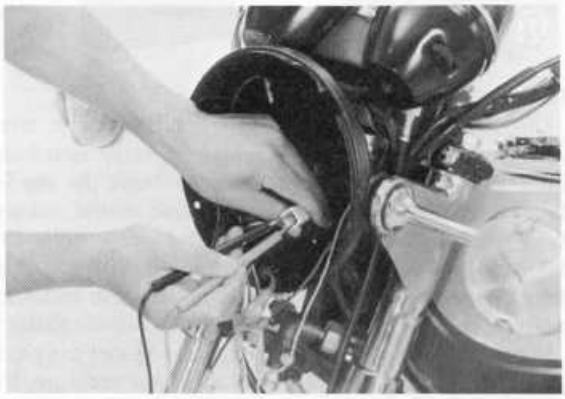


**Table 67 Ignition Switch Connections**

| LEAD | Batt | Ig | Tail 1 | Tail 2 |
|---|---|---|---|---|
| Off | | | | |
| On | ● | ● | ● | ● |
| Park | ● | | | ● |
| COLOR | White | Brown | Blue | Red |

## HEADLIGHT CIRCUIT

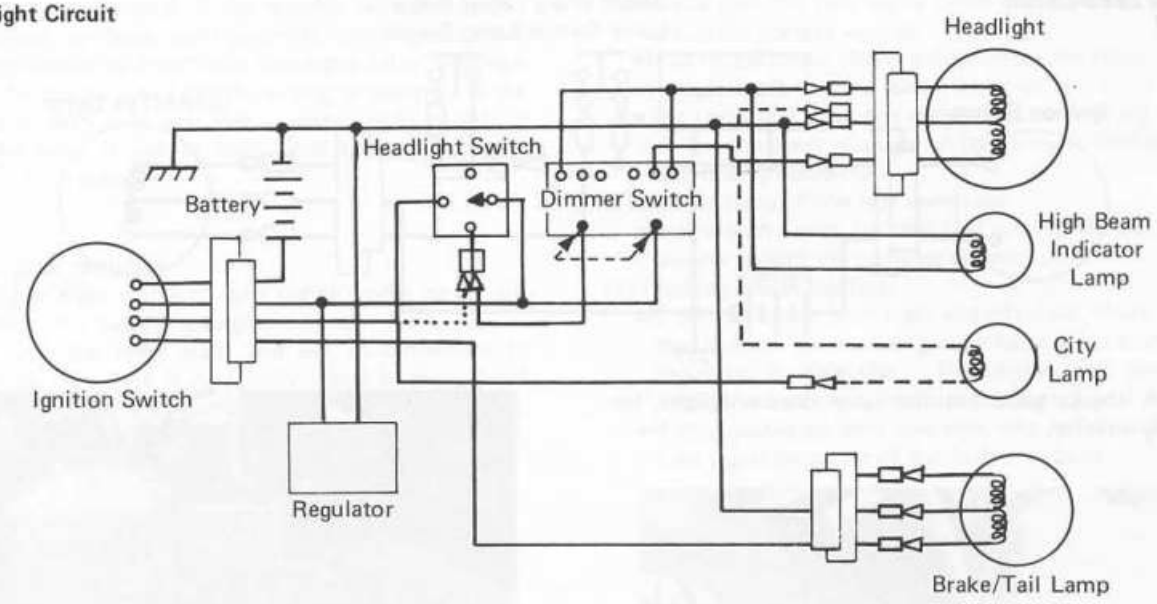
Fig. 434 is a wiring diagram of the head and tail light circuit. When the headlight switch is turned to **ON**, the head and tail lamps come on together, and the dimmer switch can be used to select high or low beam.

In the U.S. model, the center position of the headlight switch functions exactly the same as the **ON** position.

In the European model, the center **CL (PO)** position of the headlight switch turns on the small city light and the tial light for driving in the city after dark. When the switch is turned to the **ON** position, the city light stays on even though the head lamp is lit too. As explained previously, 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 **PA** position of the dimmer switch. This position is spring loaded and when the switch is pushed to **PA**, the high beam light (but not the tail light) comes on as a passing signal to the driver of the vehicle ahead. The **PA** position will light the high beam lamp regardless of the headlight switch position, and the switch button will spring back and turn the light off as soon as it is released.

**Headlight Circuit**




*Switch testing*

Tables 68, 69 show the internal headlight and dimmer switch connections for each position. Unplug the switch wires and use an ohmmeter to check that only the connections shown have continuity (zero ohms between those wires). If the switch is open or shorted, it can be disassembled for repairs or to clean the contact surfaces, but no internal parts are available for replacement. If the switch is not repairable, it must be replaced as an assembly.




**Table 68 Headlight Switch Connections**

| | | | |
|---|---|---|---|
| Off | | | |
| CL | ● | | ● |
| On | ● | ● | ● |
| **COLOR** | Brown | Blue | Red |

**Table 69 Dimmer Switch Connections**

| | | | | |
|---|---|---|---|---|
| High | ● | ● | | |
| Low | | ● | ● | |
| Pass | ● | | | ● |
| **COLOR** | R/Bk | Blue | R/Y | Brown |

*Lamps*

If the headlight on the U.S. model burns out, it must be replaced as an assembly since it is a sealed-beam unit. On the European model the headlight lamp or the city lamp can be replaced separately as the headlight is of semi-sealed construction.

The tail lamp on either model is replaceable, and is a double-filament bulb which serves as a combination tail/brake lamp.

## BRAKE LAMP CIRCUIT

The brake lamp is turned on by either the front or rear brake lamp switch, as shown in the wiring diagram of Fig. 436. The front brake lamp switch is an oil pressure switch installed in the front brake line. It turns on with 45~70 lb/sq. in. (3~5 kg/cm$^2$) of fluid pressure when the front brake is applied. Being a sealed unit, adjustment is neither necessary nor possible.

The rear brake lamp switch is a plunger-type switch which is pulled on by the rear brake pedal. It is a sealed unit, but is adjustable by changing its position higher or lower in the mounting bracket.

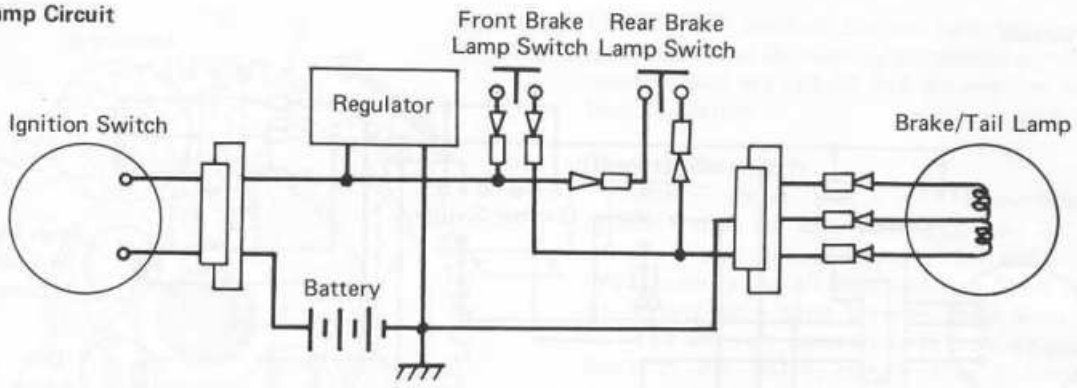
The brake lamp itself is one of the two filaments inside the tail lamp bulb, and so the bulb must be replaced if either the tail or the brake lamp filament burns out.

*Brake lamp circuit trouble*

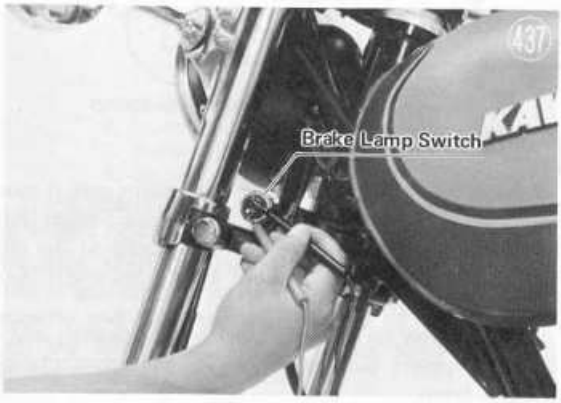
If the brake lamp does not come on when either brake is applied, either the bulb is burned out or the wiring is bad.

If the lamp fails to light when the front brake is applied lightly, disconnect the leads from the switch and connect an ohmmeter across the switch terminals. When the brake is applied the ohmmeter should read zero ohms; if it does not, replace the switch. If the

**Brake Lamp Circuit**




switch checks good but the lamp does not light, the wiring is faulty.




**NOTE:** When replacing the brake lamp switch:

1. The brake fluid that spills when the front brake lamp switch is removed will corrode most surfaces. Wipe it off immediately if any spills on the fender, etc.
2. Apply a small amount of Loctite to the switch threads before screwing the switch in, but do not apply any near the end where it might get into the brake fluid.
3. After switch installation, bleed the air from the switch and brake line.

To check the rear brake lamp switch, unplug the two switch wires and connect an ohmmeter across them. When the switch plunger is pulled down, the ohmmeter should read zero ohms; if it does not, replace the switch.

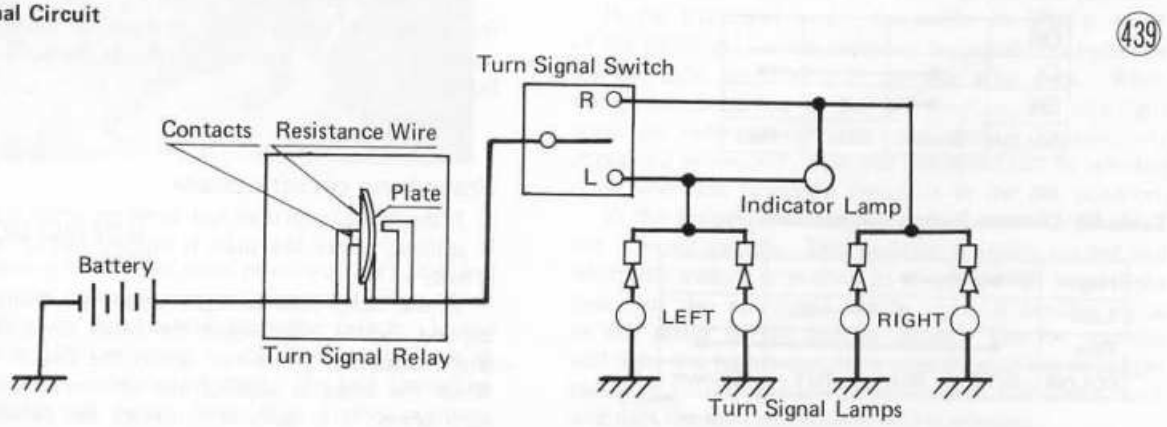



## TURN SIGNALS

A wiring diagram of the turn signal circuits is shown in Fig. 439. When the turn signal switch is turned to R or L, a ground is provided for the circuit so current can flow. Current to the turn signal lamps flows through the closed contacts and resistance wire inside the turn signal relay, and the lamps light. After a few moments, the resistance wire heats up, expands, and allows a spring to pull the contacts open. With the contacts open, the circuit is broken and the lamps go off, and the resistance wire cools and contracts, closing the contacts so the cycle can begin again. The indicator lamp in the turn signal sircuit, 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 signal lamps (one front and one rear) are properly connected into the circuit, trouble may result from a burned out bulb, a bulb of incorrect wattage, loose wiring, etc., as well as from a defect in the

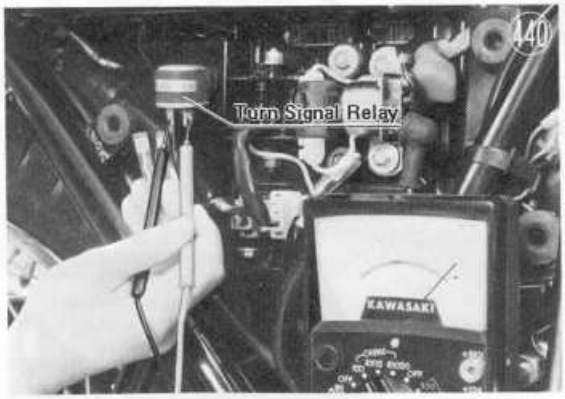
**Turn Signal Circuit**



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 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.




- If the relay checks good, turn the meter to the 30 VDC scale and connect the + meter lead to the brown wire that was unplugged from the relay, and connect the – meter lead to the orange wire. 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 switch or wiring is bad; if battery voltage is read on the meter but the turn signals will still not work when the relay is plugged back in, then re-check 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 lamps and indicator lamp are of the correct wattage.
- If all of the above check good, replace the relay.

(3) A single lamp on one side comes on and stays on:
- The lamp that does not come on is burned out, it is of the incorrect wattage, or its wiring is broken or improperly connected.

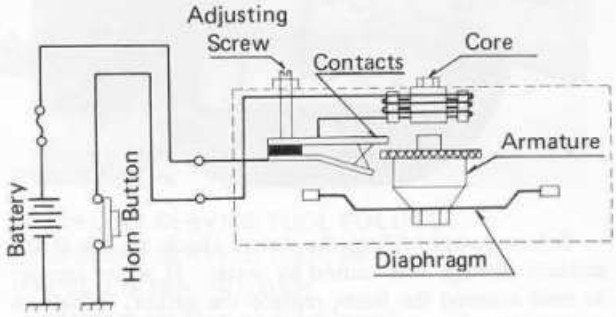
(4) Neither lamp of one side comes on:
- Unless both lamps for that side are burned out, the trouble is with the turn signal switch.

(5) Flashing rate is too fast:
- If this occurs on both right and left sides, check that the battery is not being overcharged because the regulator is defective. If dynamo and battery voltage are normal, replace the turn signal relay.
- If this occurs on only one side, one or both of the turn signal lamps are of too high a wattage.

## HORN

Horn construction is shown in Fig. 442. When the horn button is pushed, a ground is provided to complete the horn circuit. Battery current flows through the horn contacts, which are normally closed and through the horn coil, magnetizing the iron core. With the horn coil core magnetized, it pulls down the armature and diaphragm, which are an assembly. As the armature moves toward the core, it pushes the plate that opens the horn contacts and interrupts current flow. This causes the magnetic field to collapse, allowing the armature and diaphragm to spring back to their original positions, and the contacts to close again. With the contacts now closed, the cycle begins once more and repeats until the horn button is released. Since each cycle takes only a small fraction of a second, the diaphragm moves fast enough to produce audible sound.

**Horn Construction** (442)



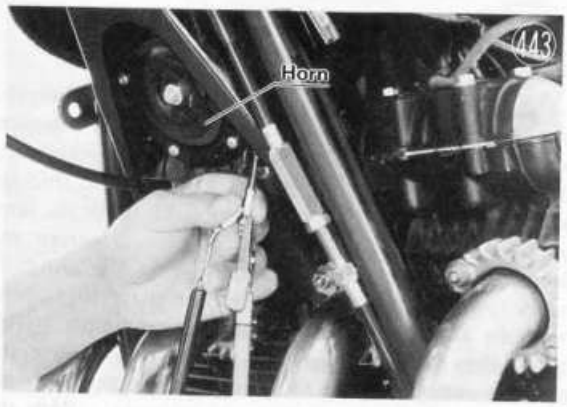

Unless the horn is damaged by maladjustment, almost all horn failures will be contact trouble. The contacts wear down after long use and will need to be re-adjusted from time to time, as explained in the adjustment section. When adjustment fails to correct the trouble, the contacts are probably dirty or pitted and need to be cleaned and smoothed.

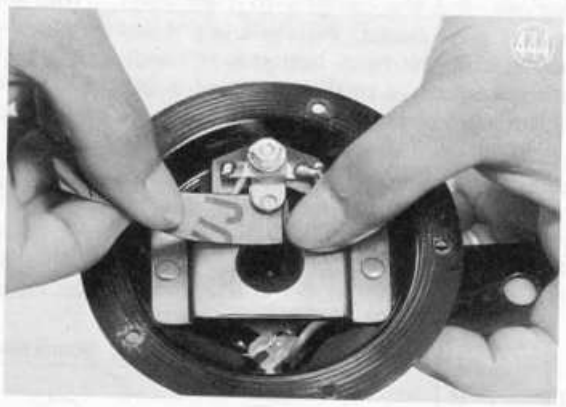
*Horn repair*

**NOTE:**

1. The horn should not be disassembled for repair during the warranty period as this will invalidate horn warranty.
2. If the horn is disassembled, do not loosen the core or the armature mounting as this serves no purpose and will necessitate fine adjustments not explained in this manual.

First check horn continuity by connecting the ohmmeter leads to the black and brown horn leads. If the reading is very close to zero, only adjustment should be required. If the reading is several ohms or there is no reading, or if adjustment will not cure the trouble, remove all the screws around the perimeter of the horn and disassemble it. Clean and smooth the contacts with sandpaper or emery cloth until there is zero ohms resistance across the contacts. Then measure the resistance across the horn wires again; if there is still high resistance or no reading even though the contacts are closed, the coil is burned out and the horn must be replaced.




Before re-assembling the horn, check to see if the contact damage was caused by water. If water appears to have entered the horn, replace the gasket. (The new gasket will have to be homemade.)

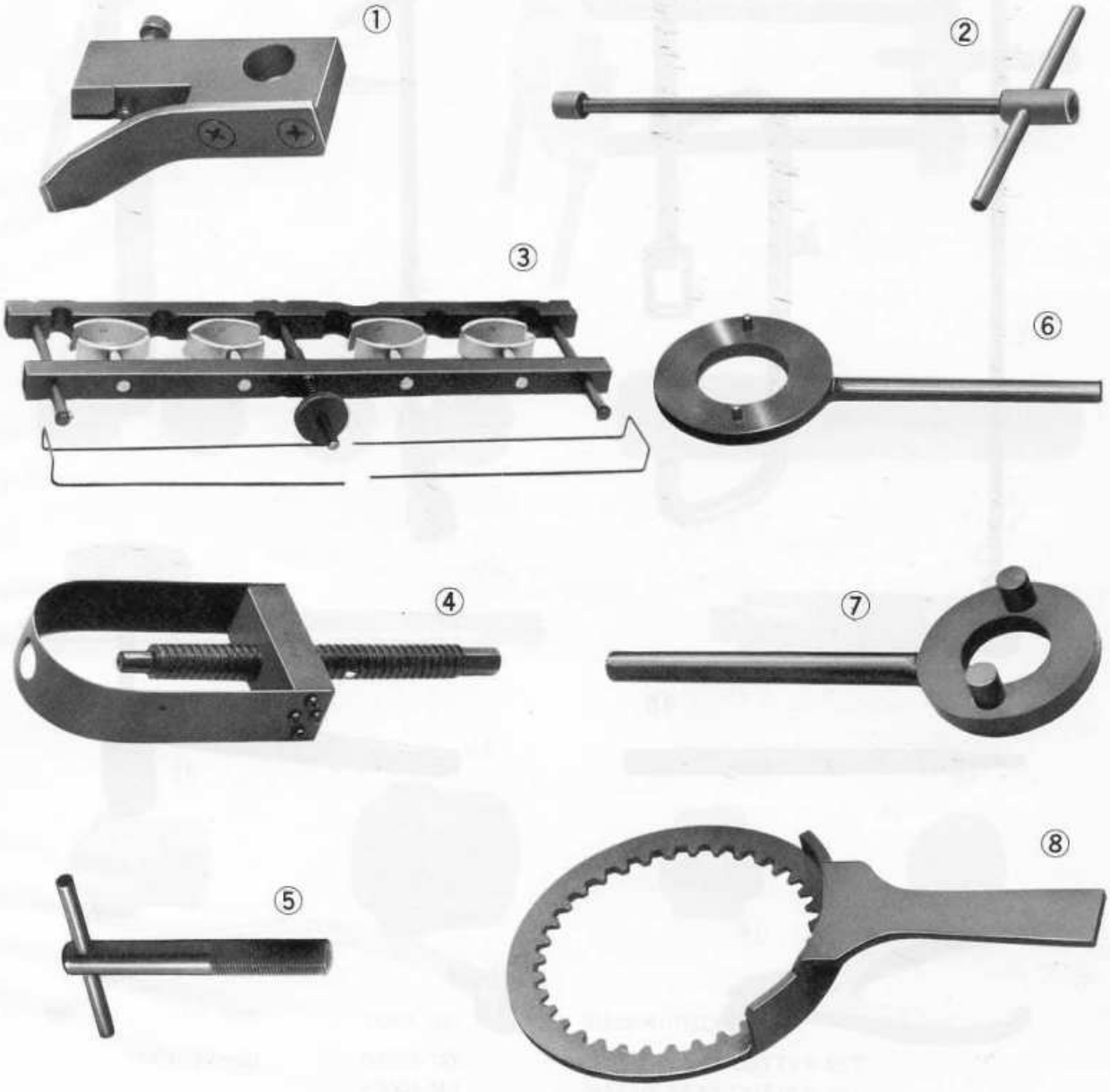
## SPEEDOMETER, TACHOMETER

The speedometer and tachometer are sealed units and cannot be disassembled. If either of the meters fails to operate, it must be replaced as an assembly.

The meter illumination lamps are not a part of the sealed unit, and are replaceable separately.

# APPENDIX

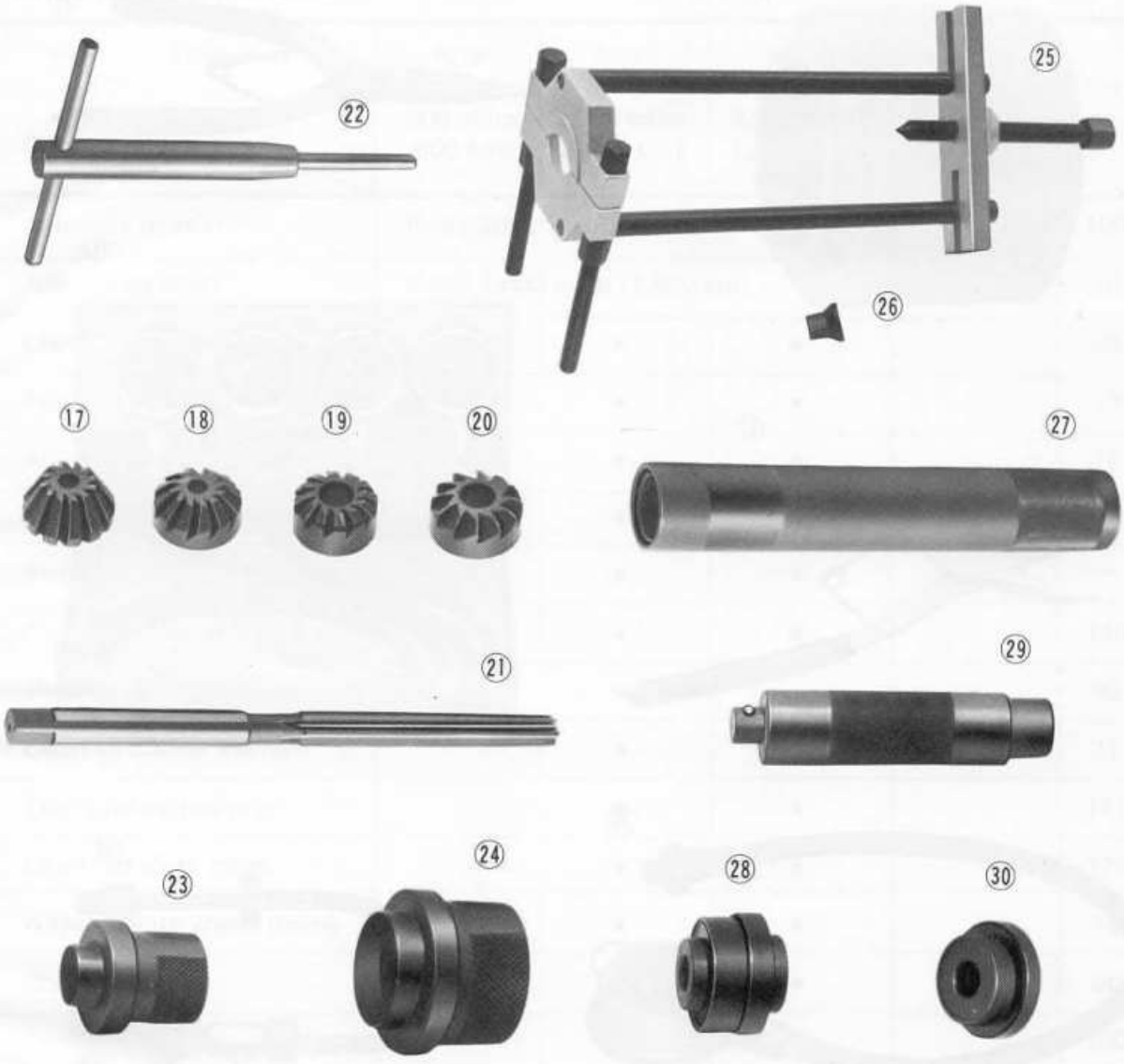
## SPECIAL SERVICE TOOLS




| REF. NO. | TOOL NO. | DESCRIPTION |
|---|---|---|
| INCL. 1~36 | 99990-521 | Z1 SPECIAL SERVICE TOOL FULL SET |
| INCL. 1~10 | 57001-001 | Z1 SPECIAL SERVICE TOOL SET |
| 1 | 57001-109 | VALVE LIFTER HOLDER |
| 2 | 57001-111 | CYLINDER HEAD BOLT WRENCH |
| 3 | 57001-112 | PISTON RING COMPRESSOR SET |
| 4 | 57001-114 | PISTON PIN PULLER |
| 5 | 57001-116 | DYNAMO ROTOR PULLER |
| 6 | 57001-117 | DYNAMO ROTOR HOLDER |
| 7 | 57001-118 | ENGINE SPROCKET HOLDER |
| 8 | 57001-119 | CLUTCH HUB HOLDER |




| REF. NO. | TOOL NO. | DESCRIPTION |
|---|---|---|
| 9 | 57001-134 | STEM NUT WRENCH |
| 10 | 57001-142 | FRONT FORK PISTON SOCKET |
| 11 | 57001-107 | VALVE SPRING COMPRESSOR |
| 12 | 57001-108 | VALVE GUIDE ARBOR |
| 13 | 57001-110 | SPARK PLUG WRENCH |
| 14 | 57001-115 | PISTON RING PLIERS |
| 15 | 57001-120 | THROTTLE VALVE ADJUSTER |
| 16 | 57001-122 | FUEL LEVEL GAUGE |

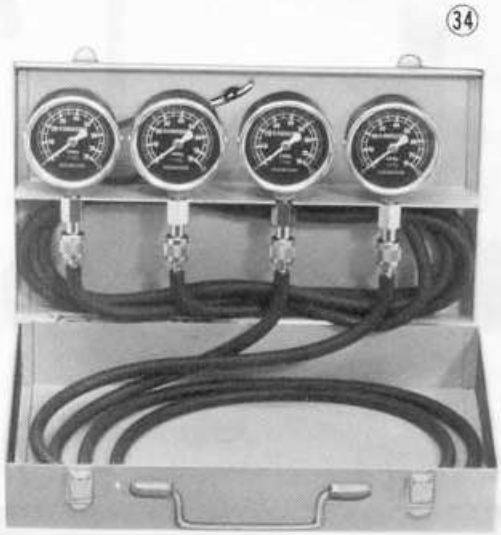


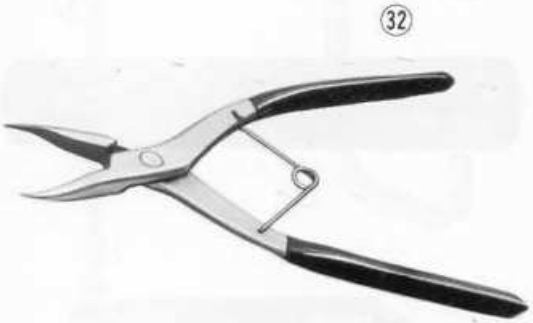

| REF. NO. | TOOL NO. | DESCRIPTION |
|---|---|---|
| INCL. 17~20 | 57001-128 | VALVE SEAT CUTTER SET |
| 17 | 57001-101 | VALVE SEAT CUTTER 30° |
| 18 | 57001-102 | VALVE SEAT CUTTER 45° |
| 19 | 57001-103 | EXHAUST VALVE SEAT CUTTER 60° |
| 20 | 57001-104 | INLET VALVE SEAT CUTTER 60° |
| 21 | 57001-105 | VALVE GUIDE REAMER |
| 22 | 57001-106 | VALVE SEAT CUTTER HOLDER |
| 23 | 57001-130 | SHIFT SHAFT OIL SEAL GUIDE |
| 24 | 57001-131 | KICK SHAFT OIL SEAL GUIDE |
| 25 | 57001-135 | STEM BEARING PULLER |
| 26 | 57001-136 | STEM BEARING ADAPTER |
| 27 | 57001-137 | STEM BEARING DRIVER |
| 28 | 57001-138 | STEM CUP DRIVER |
| 29 | 57001-139 | BEARING DRIVER HOLDER |
| 30 | 57001-140 | WHEEL BEARING DRIVER |
















| REF. NO. | TOOL NO. | DESCRIPTION |
|---|---|---|
| 31 | 57001-141 | FRONT FORK OIL SEAL DRIVER |
| 32 | 57001-143 | INSIDE CIRCLIP PLIERS |
| 33 | 57001-144 | OUTSIDE CIRCLIP PLIERS |
| 34 | 57001-127 | VACUUM GAUGE |
| INCL. 35, 36 | 57001-129 | OIL PRESSURE & COMPRESSION GAUGE SET |
| 35 | 57001-123 | COMPRESSION GAUGE |
| 36 | 57001-125 | OIL PRESSURE GAUGE |

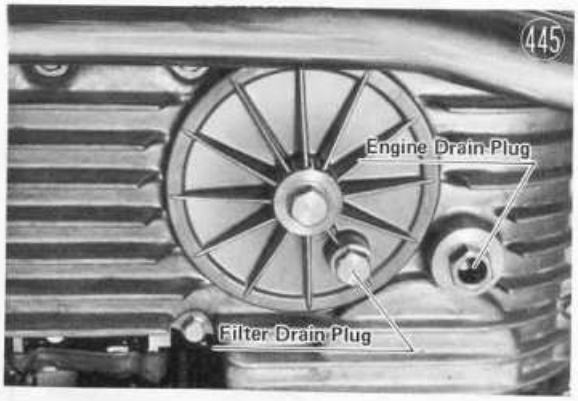
## PERIODIC MAINTENANCE

| Frequency / Operation | After initial 500 miles (800 km) | After initial 2,000 miles (3,000 km) | Every subsequent 2,000 miles (3,000 km) | Every 4,000 miles (6,000 km) | See pg. |
|---|---|---|---|---|---|
| Lubricate drive chain | Every 200 miles (300 km) | | | | 100 |
| Adjust cam chain | Every 1,000 miles (1,500 km) | | | | 16 |
| Check, tighten spokes | • | • | • | | 98 |
| Adjust drive chain | • | • | • | | 19 |
| Adjust brakes | • | • | • | | 18 |
| Adjust clutch | • | • | • | | 13 |
| Tighten nuts and bolts | • | • | • | | – |
| Change engine oil | • | • | • | | 140 |
| Replace oil filter element | • | • | | • | 95 |
| Clean air cleaner element | | • | • | | 71 |
| Lubricate motorcycle | | • | • | | 141 |
| Clean, set spark plugs | | • | • | | 125 |
| Adjust points, check timing | | • | • | | 14 |
| Check tire wear | | • | • | | 96 |
| Check chain wear | | | • | | 100 |
| Check brake shoes and drum | | | • | | 108 |
| Clean fuel lines | | | • | | 140 |
| Check valve lifter clearance | | | | • | 15 |
| Check steering play | | | | • | 16 |
| Change brake fluid | Every 1 year or 6,000 miles (10,000 km) | | | | 105 |
| Change front fork oil | Every 6,000 miles (10,000 km) | | | | 113 |
| Re-grease wheel bearings | Every 12,000 miles (20,000 km) | | | | 100 |

## Engine Oil Change

The engine oil and the oil filter are changed as follows:

- Warm the engine up thoroughly and set the motorcycle on the center stand.
- Remove the engine drain plug and the oil filter drain plug.




- If the oil filter is to be changed, remove the filter mounting bolt and drop out the oil filter.
- The engine drain plug is magnetic to catch steel filings so wipe it off first.
- Install the engine drain plug with 29 ft-lbs (4.0 kg-M) torque.
- Install the filter, making sure the gaskets and **O** ring are in place. Tighten the filter mounting bolt with 18 ft-lbs (2.5 kg-M) torque.
- Install the filter drain plug with 16 ft-lbs (2.2 kg-M) torque.
- Fill the engine with 4.2 quarts (4.0 litres) of SE or SD class SAE 10W-40, 10W-50 or 20W-50 motor oil.

## Fuel Line Cleaning

Water or dirt anywhere in the fuel system can cause starting difficulty, poor running and lack of power. Clean the lines out as follows:

1. Turn the fuel tap to **S**. 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 screen.



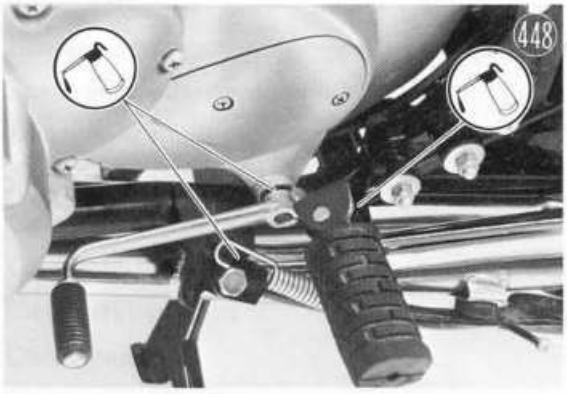

2. If there was water inside the sediment cup, there may also be some in the fuel tank. Holding a container under the fuel tap, turn the tap lever to **R** and drain the tank until only pure gasoline comes out, then close the tap again.
3. Remove the plug from the bottom of each carburetor float bowl and drain the bowls.

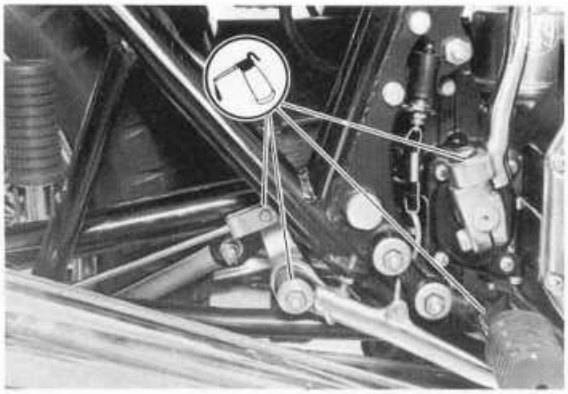


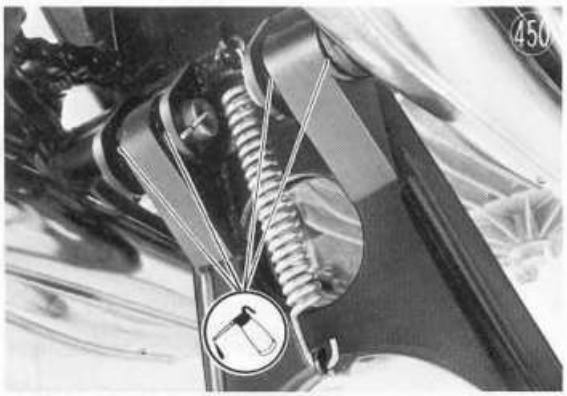

4. Replace all the plugs and the fuel tap sediment cup. Make sure the gasket is in the tap and that the screen is not damaged during installation.

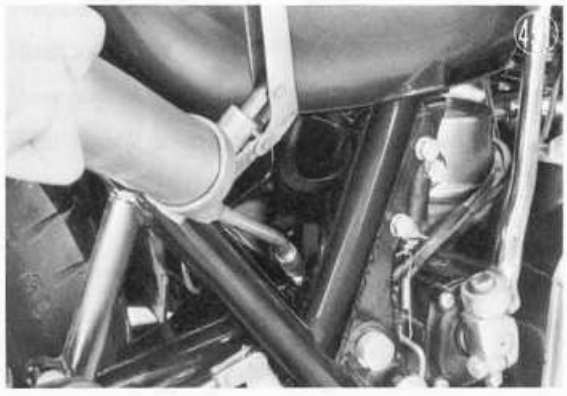
## General Lubrication

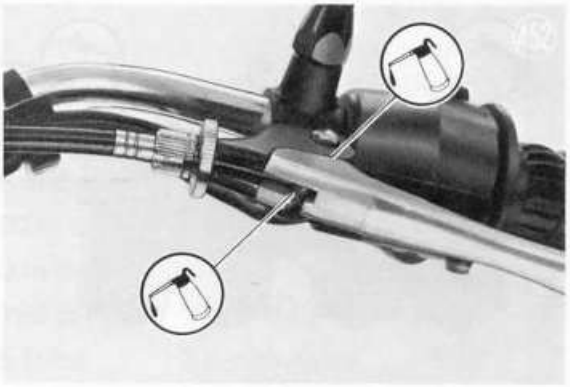
Lubricate the points indicated in the illustrations with the SAE 30 weight motor oil or cup grease, as specified.





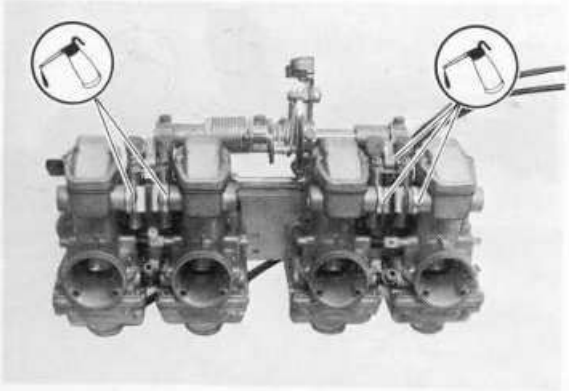



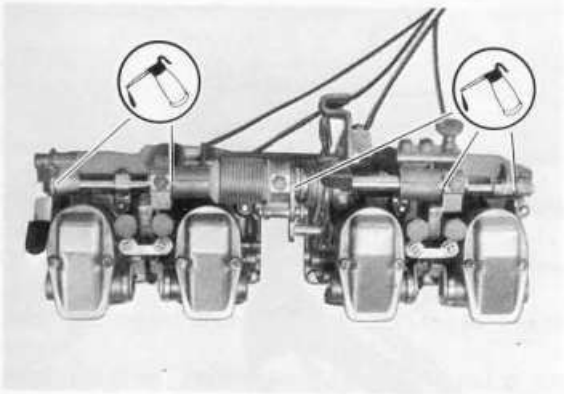


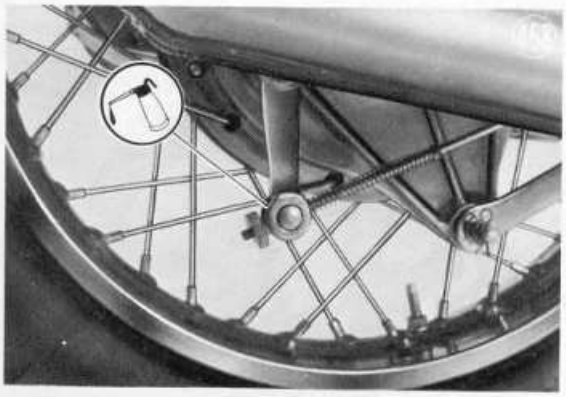










## TORQUE TABLE

| | English | Metric | See Pg. |
|---|---|---|---|
| Banjo bolt | 19~23 ft-lbs | 2.5~3.3 kg-m | 58 |
| Bleeder valve | 70~85 in-lbs | 0.8~1.0 kg-m | 58 |
| Brake lever adjuster lock nut | 70~100 in-lbs | 0.8~1.2 kg-m | 58 |
| Brake lever mounting nut | 45~60 in-lbs | 0.5~0.7 kg-m | 58 |
| Brake pipe nipple | 150~155 in-lbs | 1.7~1.8 kg-m | 58 |
| Caliper connecting shaft | 22~26 ft-lbs | 3.0~3.6 kg-m | 58 |
| Caliper to front fork bolts | 19~23 ft-lbs | 2.5~3.3 kg-m | 58 |
| Camshaft cap bolts | 105 in-lbs | 1.2 kg-m | 31 |
| Clutch hub nut | 87~108 ft-lbs | 12~15 kg-m | 42 |
| Crankcase nuts (6$\phi$) | 70 in-lbs | 0.8 kg-m | 46 |
| Crankcase nuts (8$\phi$) | 18 ft-lbs | 2.5 kg-m | 46 |
| Crank shaft cap bolts | 18 ft-lbs | 2.5 kg-m | 50 |
| Cylinder head bolts | 105 in-lbs | 1.2 kg-m | 32 |
| Cylinder head cap nuts | 25 ft-lbs | 3.5 kg-m | 32 |
| Cylinder head cover bolts | 70 in-lbs | 0.8 kg-m | 31 |
| Disc mounting bolts | 140~190 in-lbs | 1.6~2.2 kg-m | 58, 63 |
| Drum positioning bolt | 44~57 ft-lbs | 6.0~8.0 kg-m | 50 |
| Dynamo rotor to crankshaft | 18 ft-lbs | 2.5 kg-m | 40 |
| Engine bolt (10$\phi$) | 26~29 ft-lbs | 3.5~4.0 kg-m | 25 |
| Engine bolt (12$\phi$) | 47~50 ft-lbs | 6.5~7.0 kg-m | 25 |
| Engine bracket (8$\phi$) | 14.5~16.5 ft-lbs | 2.0~2.3 kg-m | 25 |
| Engine oil pump bolts | 70 in-lbs | 0.8 kg-m | 44, 46 |
| Engine sprocket nut | 87~108 ft-lbs | 12~15 kg-m | 25, 39 |
| Front axle clamp bolts | 13.0~14.5 ft-lbs | 1.8~2.0 kg-m | 51 |
| Front brake lamp switch | 135~170 in-lbs | 1.5~2.0 kg-m | 58 |
| Front fork pinch bolt (8$\phi$) | 12~13 ft-lbs | 1.6~1.8 kg-m | 17, 63, 66 |
| Front fork pinch bolt (12$\phi$) | 40~43 ft-lbs | 5.4~6.0 kg-m | 17, 63, 66 |
| Handlebar mounting bolts | 18 ft-lbs | 2.5 kg-m | 56, 66 |
| Master cylinder clamp bolts | 55~75 in-lbs | 0.63~0.88 kg-m | 56, 58 |
| Pivot shaft nut | 87~108 ft-lbs | 12~15 kg-m | 67 |
| Rear axle nut | 95~115 ft-lbs | 13~16 kg-m | 20, 52 |
| Rear shock absorber bolt (lower) | 22~25 ft-lbs | 3.0~3.5 kg-m | 69 |
| Rear shock absorber bolt (upper) | 44~47 ft-lbs | 6.0~6.5 kg-m | 69 |
| Rear sprocket bolts | 23~30 ft-lbs | 3.1~4.2 kg-m | 68 |
| Spoke | 22~26 in-lbs | 0.25~0.30 kg-m | 98 |
| Three-way fitting bolts | 45~50 in-lbs | 0.5~0.6 kg-m | 58 |
| Torque link nut | 22~25 ft-lbs | 3.0~3.5 kg-m | 20, 52 |

The torque values listed below should be used in tightening all nuts and bolts where no specific torque is otherwise indicated.

Coarse threads

| dia (mm) | Pitch (mm) | ft-lbs | kg-m |
|---|---|---|---|
| 5 | 0.90 | 2.53~3.47 | 0.35~0.48 |
| 6 | 1.00 | 4.56~6.37 | 0.63~0.88 |
| 8 | 1.25 | 11.6~15.9 | 1.6~2.2 |
| 10 | 1.50 | 22.4~30.4 | 3.1~4.2 |
| 12 | 1.75 | 39.1~54.2 | 5.4~7.5 |
| 14 | 2.00 | 60.0~83.2 | 8.3~11.5 |
| 16 | 2.00 | 94.0~130 | 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 | 2.53~3.47 | 0.35~0.48 |
| 6 | 0.75 | 3.98~5.57 | 0.55~0.77 |
| 8 | 1.00 | 9.76~13.4 | 1.35~1.85 |
| 10 | 1.25 | 18.4~25.3 | 2.55~3.5 |
| 12 | 1.50 | 32.5~44.8 | 4.5~6.2 |
| 14 | 1.50 | 53.5~73.8 | 7.4~10.2 |
| 16 | 1.50 | 83.2~116 | 11.5~16 |
| 18 | 1.50 | 123~166 | 17~23 |
| 20 | 1.50 | 166~239 | 23~33 |

## POINTS REQUIRING USE OF LOCTITE

| Item | Q'ty | See Pg. |
|---|---|---|
| Cylinder, cylinder head mounting studs (lower end) | 12 | – |
| Dynamo rotor mounting (rotor to crankshaft) | 1 | 40 |
| Allen bolts (rotor to starter clutch) | 3 | 40 |
| Dynamo stator installation Allen bolts | 3 | 39 |
| Oil pump driving gear mounting screw (crankshaft) | 1 | – |
| Shift drum positioning bolt | 1 | 50 |
| Oil passage plug | 1 | 93 |
| Carburetor installation screws | 8 | 27 |
| Shift pedal return spring pin | 1 | 90 |
| Oil pump housing assembly screws | 6 | 44 |
| Crankcase bolts #6 and #8 | 2 | 46 |
| Crankcase bolt (left side between drive/output shaft) | 1 | 46 |
| R.H. engine cover screws | 3 | 46 |
| Starter mounting bolts | 2 | 37 |
| Clutch release mounting screws | 2 | 38 |
| Drive chain oil pump mounting screws | 2 | 37 |
| Camshaft sprocket mounting bolts | 3 | 77 |
| Engine oil pump mounting bolts | 3 | 44, 46 |

## TROUBLESHOOTING GUIDE

### Engine doesn't start or starting difficulty

**Starter motor not rotating**
- Starter defective
- Battery voltage low
- Relay not contacting or operating
- Starter switch button not contacting
- Wiring open or short
- Main switch not contacting
- Fuse blown

**Starter motor rotating but engine doesn't start**
- Starter clutch defective

**Engine won't turn over**
- Valve seizure
- Piston, cylinder seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft bushing seizure
- Kickstarter return spring broken
- Kick gear not engaging

**Low compression**
- Cylinder wear
- Piston rings bad (worn, weak, broken or sticking), or all end gaps accidentally aligned
- Piston ring clearance too large
- Valve not seating evenly (valve bent, warped or worn)
- Valve sticking
- Valve not closing
- Valve spring broken or weak
- Cylinder head gasket damaged
- Cylinder head not sufficiently tightened down
- Cylinder head warped
- Spark plug loose

**No spark to two plugs or spark weak**
- Battery voltage low
- Spark plug bad
- Spark plug cap or high tension wiring bad
- Points bad
- Condenser bad
- Ignition coil bad
- Main switch defective
- Wiring open or short

**No gasoline flow**
- Fuel tap clogged
- Fuel pipe clogged
- Float valve clogged
- Starter jet clogged
- No gasoline in tank

**Flooded**
- Float level too high
- Float valve worn or stuck open
- If the engine is flooded, kick it over with the throttle fully open to let more air in

### Poor running at low speed

**Spark weak**
- Spark plug bad
- Ignition coil defective
- Condenser defective
- Points bad

**Mixture too rich or too lean**
- Air screw(s) maladjusted
- Pilot jet clogged
- Throttle stop screw(s) maladjusted
- Starter needle valve stuck open
- Float level too high or low
- Air cleaner clogged
- Carburetor intake manifold loose
- Individual carburetor link mechanism loose
- Tank cap air vent obstructed

**Low compression**
- Cylinder wear
- Piston rings bad (worn, weak, broken or sticking), or all end gaps accidentally aligned
- Piston ring clearance too large
- Valve not seating evenly (valve bent, warped or worn)
- Valve sticking
- Valve spring broken or weak
- Cylinder head gasket damaged
- Cylinder head not sufficiently tightened down
- Cylinder head warped
- Spark plug loose
- Valve not closing

**Other possible troubles**
- Ignition timing maladjusted
- Timing not advancing (spring broken or stretched)
- Engine oil viscosity too high

### Poor running or no power at high speed

**Mixture too rich or too lean**
- Main jet clogged, or wrong size
- Main jet holder bleed hole clogged
- Jet needle or needle jet wear
- Starter needle valve stuck open
- Float level too high or low
- Air cleaner clogged
- Carburetor intake manifold loose
- Tank cap air vent obstructed

**Low compression**
- Cylinder wear
- Piston rings bad (worn, weak, broken or sticking), or all end gaps accidentally aligned
- Piston ring clearance too large
- Valve not seating evenly (valve bent, warped or worn)
- Valve not closing
- Valve spring broken or weak
- Cylinder head gasket damaged
- Cylinder head not sufficiently tightened down
- Cylinder head warped
- Spark plug loose
- Valve sticking

**Incorrect firing**
- Spark plug bad
- Points bad

Point springs stretched
Condensers bad
Ignition coil defective
Plugs cap not contacting or leaking

**Knocking**
Ignition timing maladjusted
Gasoline bad
Carbon built up in combustion chamber

**Other possible troubles**
Ignition timing maladjusted
Timing not advancing
Brake dragging
Engine oil viscosity too high
Engine oil level too high

**Overheating**
Engine oil level too low
Ignition timing maladjusted
Carbon built up in combustion chamber
Brake dragging
Clutch slipping
Intake manifold broken or clamp loose
Main jet clogged
Float level too low

## Clutch not operating smoothly

**Clutch slipping**
No clutch lever play
Friction plates worn or smooth
Clutch springs weak
Clutch wire maladjusted

**Clutch doesn't disengage**
Too much clutch play
Clutch plates warped
Clutch springs not evenly tightened
Engine oil viscosity too high, or oil bad

## Shift operation not smooth

**Doesn't go into gear**
Clutch isn't disengaging
Clutch lever return spring broken
Clutch lever return spring stopper loose
Shift lever spring broken
Shift lever broken
Shift fork bent or seized
Shift drum broken

**Jumps out of gear**
Detent arm spring broken, or weak
Shift fork wear
Gear groove worn
Positioning spring broken or weak
Gear or pawl worn
Shift drum or shift fork pin worn
Drive output shaft or gear spline worn

## Abnormal engine sounds

**Cam chain sounds**
Cam chain sprocket worn
Cam chain stretched
Cam chain guide roller worn
Tensioner not adjusted

**Piston slap sounds**
Piston clearance too large
Piston or cylinder wear
Connecting rod bent

**Piston ring sounds**
Piston ring wear

**Transmission sounds**
Bearing worn
Gear backlash too large
Kick gear bushing wear

**Clutch sounds**
Buffer rubber shrunken
Gap between clutch housing and friction plate too large
Gear backlash too large or gear damage

**Connecting rod small end noise**
Piston pin or piston or connecting rod wear

**Connecting rod big end noise**
Big end radial clearance too large

**Main bearing noise**
Main bearing worn
Crankshaft runout

**Drive chain noise**
Rear or engine sprocket worn
Chain worn

**Valve lifter noise**
Valve lifter clearance bad
Camshaft bearing parts worn
Valve spring broken or weak

**Front fork noise**
Fork oil level low

**Rear suspension noise**
Rear shock absorbers bad

**Front brake noise**
Pad B loose
Pad surface glazed
Disk runout
Caliper seal bad
Master cylinder bad

## Oil indicator lamp lights

Pilot lamp burn out
Wiring bad
Pilot lamp switch bad
Engine oil pump defective
Engine oil pump filter clogged
Engine oil level too low
Camshaft bushings worn
Main bearings worn

## Exhaust smokes

**White smoke**
Piston oil ring wear
Cylinder wear
Valve guide wear
Engine oil level too high

**Black smoke**
Air cleaner clogged
Main jet too large or falling off
Starter needle stuck up
Float level too high

**Brown smoke**
- Main jet too small
- Intake manifold loose
- Float level too low

## Poor handling or stability

**Handlebars hard to turn**
- Steering stem nut too tight
- Steel bearing ball broken
- Bearing race dented or worn
- Tire air pressure too low
- Steering stem lubrication bad

**Handlebars shake**
- Tire worn
- Swing arm loose or worn
- Wheel runout or unbalance
- Front or rear axle runout
- Spoke loose
- Bearing worn
- Handlebars clamp(s) loose or broken

**Handlebars pull to one side**
- Swing arm bent
- Front fork bent
- Frame bent
- Alignment bad
- Swing arm pivot shaft runout
- Steering stem bent
- Right/left front fork oil level uneven

**Shock absorbing bad**
- Too hard
  - Front fork oil level too high
  - Front fork oil viscosity too high
  - Tire air pressure too high
  - Rear suspension maladjusted
- Too soft
  - Front fork oil level too low
  - Front fork oil viscosity too low
  - Front fork spring weak
  - Front or rear suspension oil leak

## Brakes don't hold

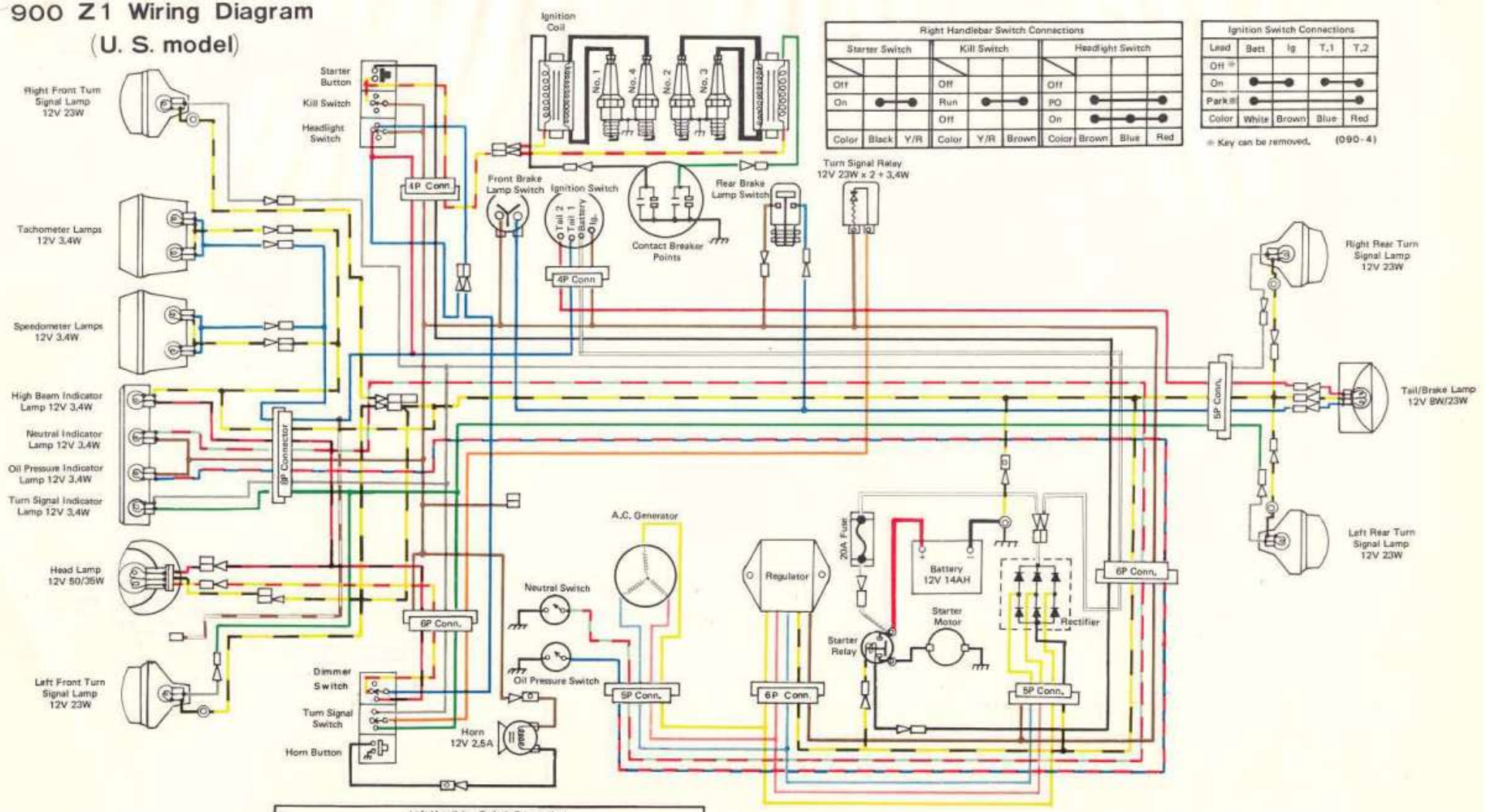
**Front wheel**
- Air in the brake line
- Pad or disc wear
- Brake oil leak
- Brake oil bad
- Primary cup or secondary cup defective
- Master cylinder inside scratched

**Rear wheel**
- Brake maladjusted
- Brake lining or drum wear
- Overheated
- Water brake drum
- Brake cam wear
- Oil in brake drum

## Battery discharged
- Wiring bad or connection loose
- Battery terminal corrosion
- Armature coil open or short
- Rectifier bad
- Regulator bad
- Battery bad (sulfation, sedimentation, or electrolyte level too low)

## Battery overcharged or charge current too high
- Regulator bad or wiring open

# 900 Z1 Wiring Diagram
## (U. S. model)




| Right Handlebar Switch Connections | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Starter Switch | | | Kill Switch | | | Headlight Switch | | | |
| | | | | | | | | | |
| Off | | | Off | | | Off | | | |
| On | ● | | Run | ● | | PO | ● | | |
| | | | Off | | | On | ● | ● | |
| Color | Black | Y/R | Color | Y/R | Brown | Color | Brown | Blue | Red |

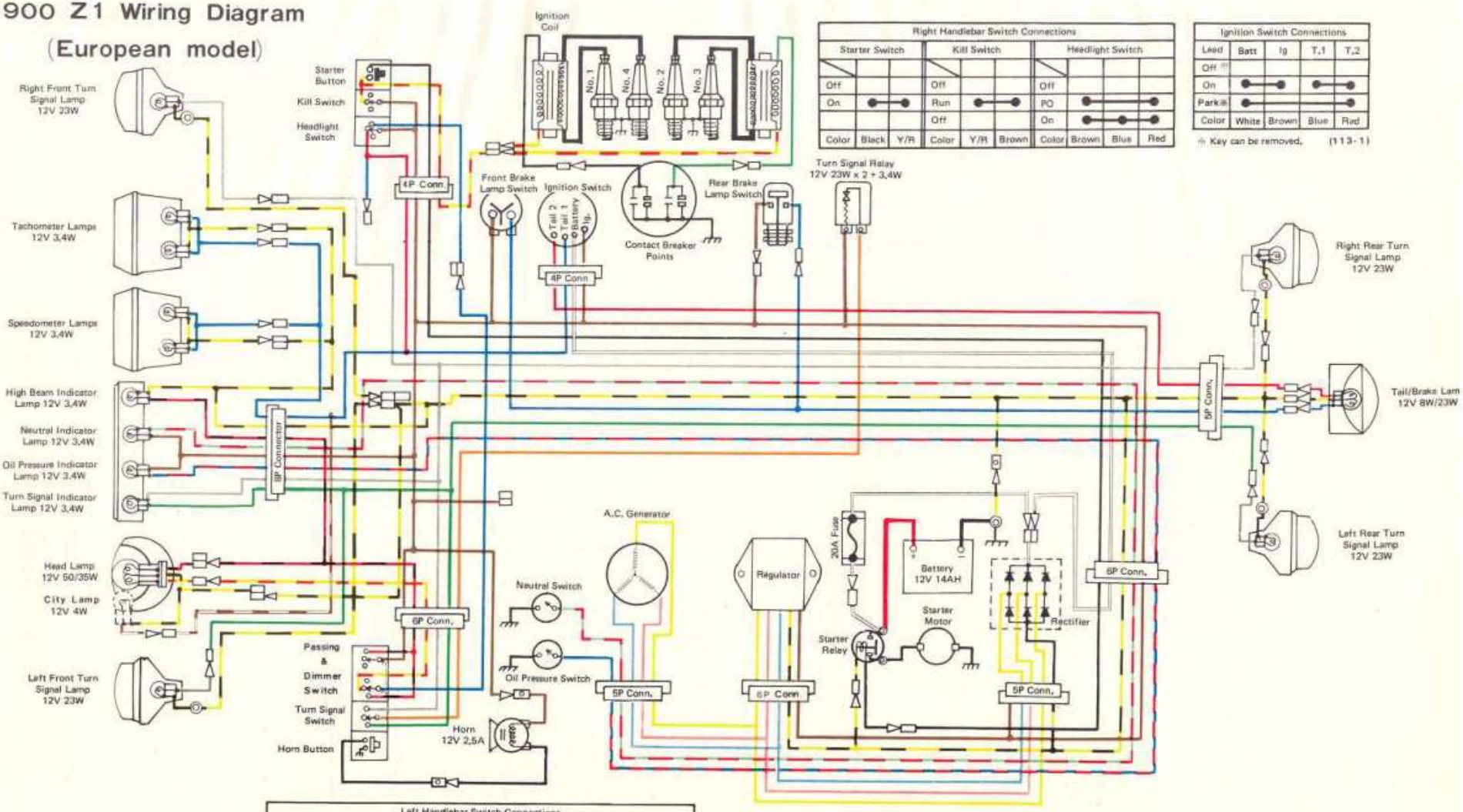
| Ignition Switch Connections | | | | |
|---|---|---|---|---|
| Lead | Batt | Ig | T.1 | T.2 |
| Off ※ | | | | |
| On | ● | | ● | |
| Park ※ | ● | | | ● |
| Color | White | Brown | Blue | Red |

※ Key can be removed. (090-4)

| Left Handlebar Switch Connections | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Horn Switch | | | Passing and Dimmer Switch | | | | Turn Signal Switch | | | |
| | | | | | | | | | | |
| Off | | | High | ● | | | L | ● | | |
| On | ● | | Low | | ● | | Off | | | |
| | | | | | | | R | | ● | ● |
| Color | Black | | Color | R/Bk | Blue | R/Y | Brown | Color | Green | Orange | Slate |

# 900 Z1 Wiring Diagram

## (European model)



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