NOTE:

This manual contains basic service information for the Yamaha shaft drive mechanism. Information for complete overhaul is contained in the Yamaha Shaft Drive Service Manual.

NOTICE

This manual has been written by Yamaha Motor Company for use by Authorized Yamaha Dealers and their qualified mechanics. It has been assumed that certain basic mechanical procedures inherent to our product are already known and understood by the reader. Without such basic knowledge, repairs or service to this model may render the machine unsafe. For this reason, we advise that all repairs and/or service be performed by an Authorized Yamaha Dealer representative in possession of the requisite basic product knowledge.

The Research, Engineering, and Service Departments of Yamaha are continually striving to further improve all models manufactured by the company. Modifications are therefore inevitable and significant changes in specifications or procedures will be forwarded to all Authorized Yamaha Dealers and will, where applicable, appear in future editions of this manual.

This Service Manual is intended to acquaint the mechanic with the disassembly, reassembly, maintenance, and troubleshooting procedures required to provide optimum performance and longevity of the unit. The information enclosed should be closely studied to avoid unnecessary repairs and to provide the owner with a sound, safe, dependable machine.

YAMAHA XS1100E
SERVICE MANUAL
1st Edition, November 1977
2nd Printing January 1978
Copyright 1978, Yamaha Motor Company Limited, Japan
Printed in Japan
LIT-11616-00-81

Particularly important information is distinguished in this manual by the following notations:

NOTE: A NOTE provides key information to make procedures easier or clearer.

CAUTION: A CAUTION indicates special procedures that must be followed to avoid damage to the machine.

WARNING: A WARNING indicates special procedures that must be followed to avoid injury to a machine operator or person inspecting or repairing the machine.

INDEX

GENERAL INFORMATION	1
PERIODIC INSPECTIONS AND ADJSTMENTS	2
ENGINE OVERHAULING	3
CARBURETION	4
CHASSIS	5
ELECTRICAL	6
APPENDICES	7

CHAPTER 1.
GENERAL INFORMATION

Machine Identification..... 1-1
A. For Tune-up..... 1-1
B. For Engine Service..... 1-1
C. For Shaft Drive Service..... 1-4
D. For Electrical Components..... 1-5

CHAPTER 1. GENERAL INFORMATION

MACHINE IDENTIFICATION

A. Frame Serial Number

The frame serial number is stamaped on the right side of the steering head pipe.

B. Engine Serial Number

The engine serial number is stamped on the elevated part of the right rear section of the engine.

NOTE:

The first three digits of these numbers are for model identifications; the remaining digits are the unit production number. The frame and engine numbers are usually identical.

Starting engine serial number:
2H7-000101

SPECIAL TOOLS

The proper special tools are necessary for complete and accurate tune-up and assembly. Using the correct special tool will help prevent damage from improper tools or improvised techniques.

* Tools noted with an asterisk (*) are new special tools for the XS1100E only. Others are tools common to other models.

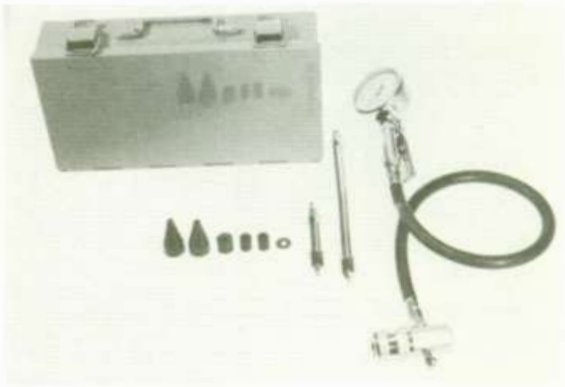
A. For Tune-up

Tappet adjusting tool*
P/N 90890-01245



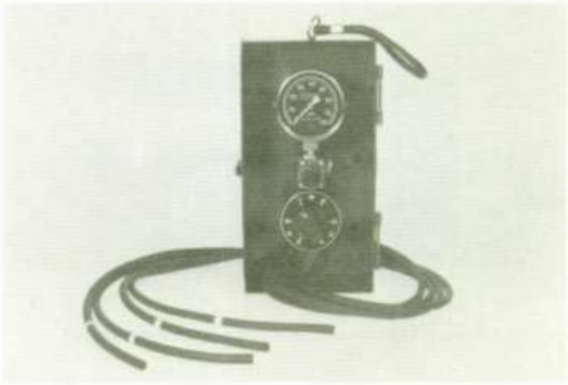
This tool is necessary to replace valve adjusting pads. This can also be used for the XS750.

Compression gauge
P/N 90890-03081



This tool is used to check cylinder compression.

Vacuum gauge
P/N 90890-03094



This gauge is needed for carburetor synchronization.

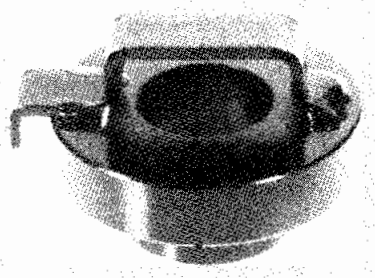
B. For Engine Service

Clutch holder*
P/N 90890-04007



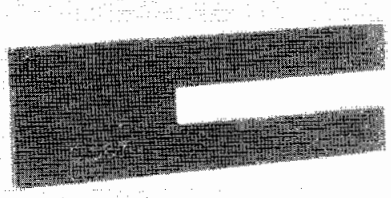
This tool is used to hold the clutch when removing or installing the clutch nut.

Drive axle holder*
P/N 90890-04009



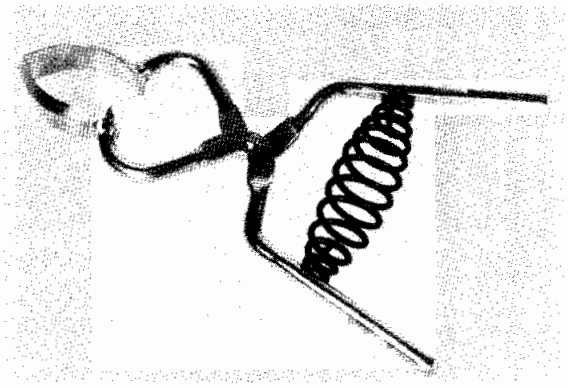
This tool must be used to remove and install the transmission drive axle.

Piston base
P/N 90890-01067



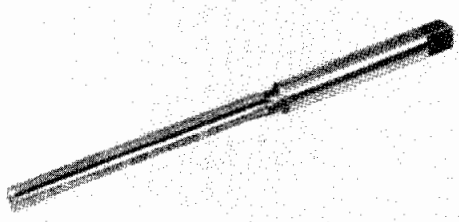
Use 4 of these to hold the piston during cylinder installation.

Piston ring compressor*
P/N 90890-04008



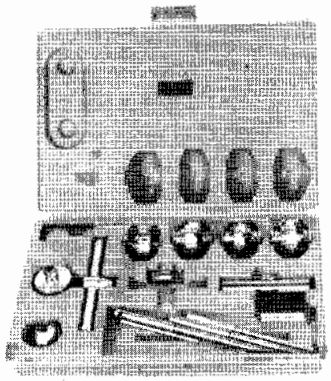
This is used to compress piston rings when installing the cylinder.

Valve guide reamer
P/N 90890-01227



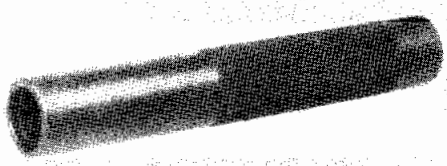
This must be used when replacing the valve guide.

Valve seat cutter
P/N 90890-91043



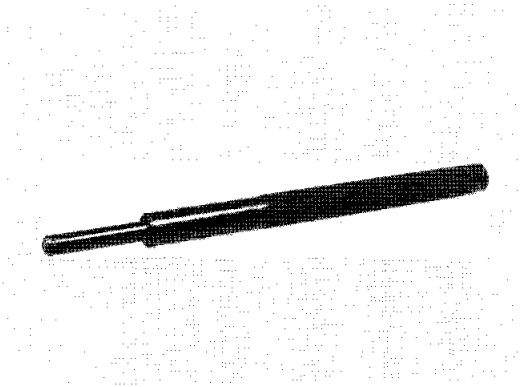
This tool is needed to re-surface the valve seat.

Valve guide installer
P/N 90890-01226



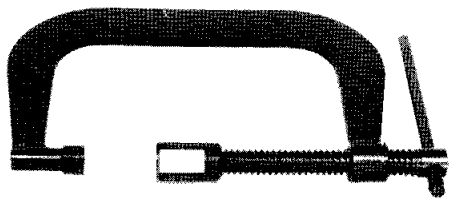
This tool is needed for proper installation of valve guides.

Valve guide remover
P/N 90890-01225



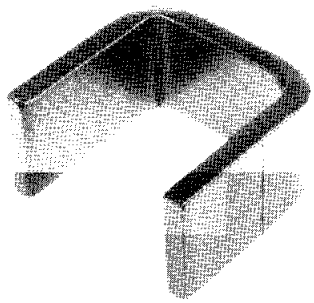
This must be used to remove valve guides.

Valve spring compressor
P/N 90890-01253



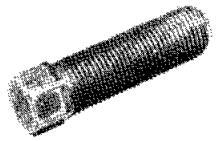
This tool must be used for removing and installing valve assemblies.

Damper compressor*
P/N 90890-04011



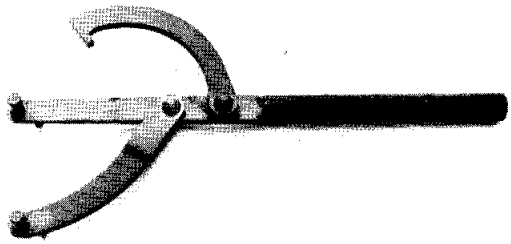
This tools is needed to disassemble and reassemble the primary shaft damper.

Rotor puller
P/N 90890-01080



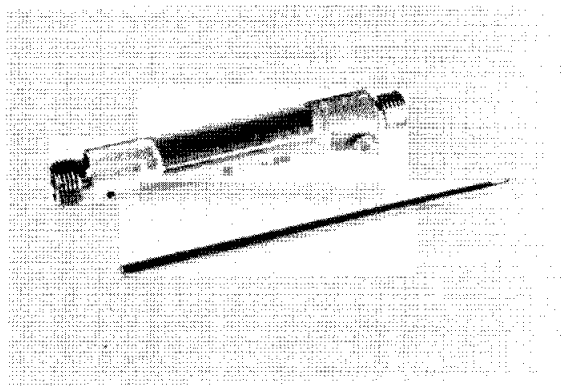
This tool is needed to remove the alternator rotor.

Rotor holding tool
P/N 90890-01235



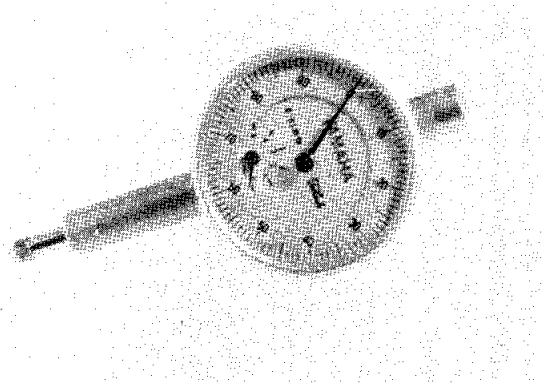
This is used to hold the alternator rotor during removal and installation.

Dial gauge stand
P/N 90890-01258



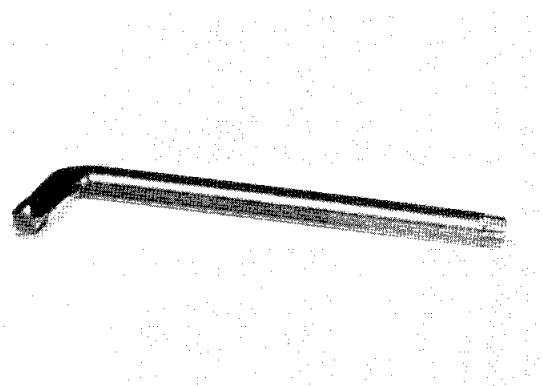
This tool is needed to hold the dial gauge.

Dial gauge
P/N 90890-03097



This dial gauge is used to determine piston position for correct timing.

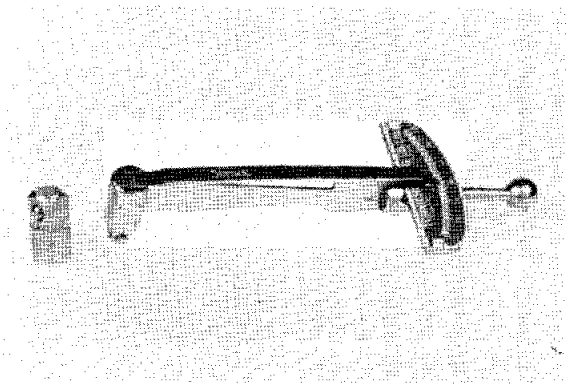
Drive axle wrench*
P/N 90890-05245



This wrench is used to remove the drive shaft bearing housing, special oil nozzle etc.

C. For Shaft Drive Service (See the Shaft Drive Service Manual for use of these tools)

Torque wrench (0 ~ 15 cm-kg)
P/N 90890-05244



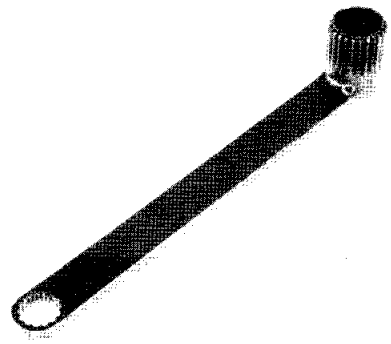
A sensitive torque wrench must be used for measuring bearing preload.

Final drive gear holding tool
P/N 90890-01254



This tool is needed when measuring gear lash.

Middle and final gear holding tool
P/N 90890-01229



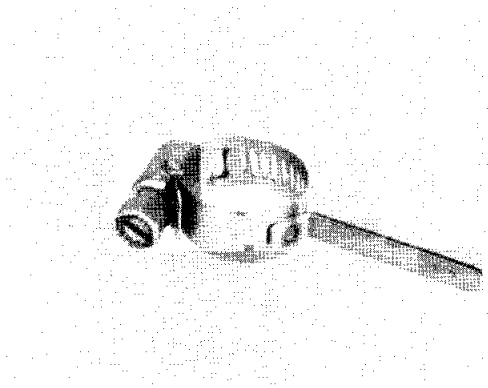
This tool is used when measuring gear lash and tooth contact.

Slide hammer
P/N 90890-01083, 01084



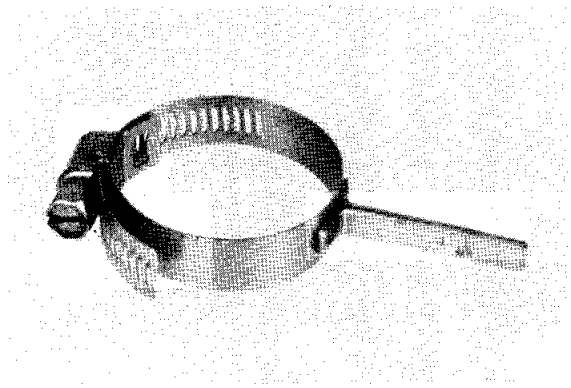
This tool is used to remove the final gear bearing housing and the drive shaft.

Gear lash measurement tool (Middle gear)
P/N 90890-01231



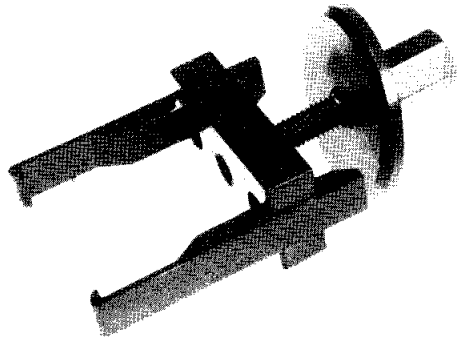
This tool is needed when measuring gear lash for middle gear.

Gear lash measurement tool (Final gear)
P/N 90890-01230



This tool is needed when measuring gear lash for final gear.

Drive shaft puller*
P/N 0890-04012

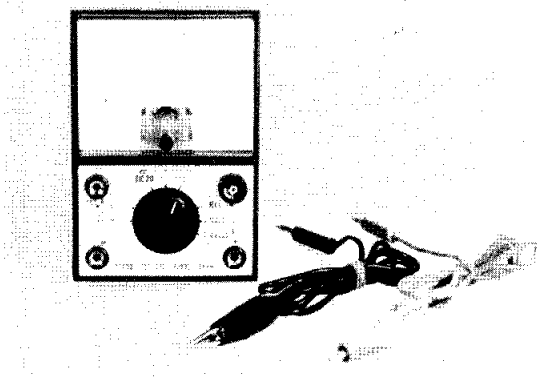


This tool is used to remove the drive shaft.

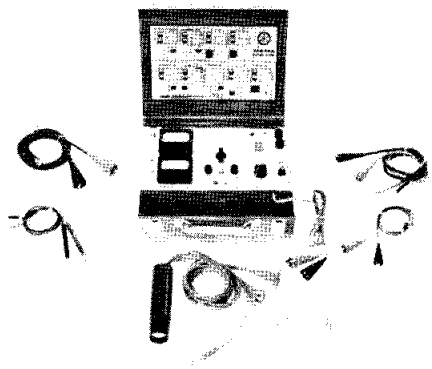
D. For Electrical Components

The uses of these tools are described in Chapter 6.

Pocket tester
P/N 90890-03104



Electro tester
P/N 90890-03021



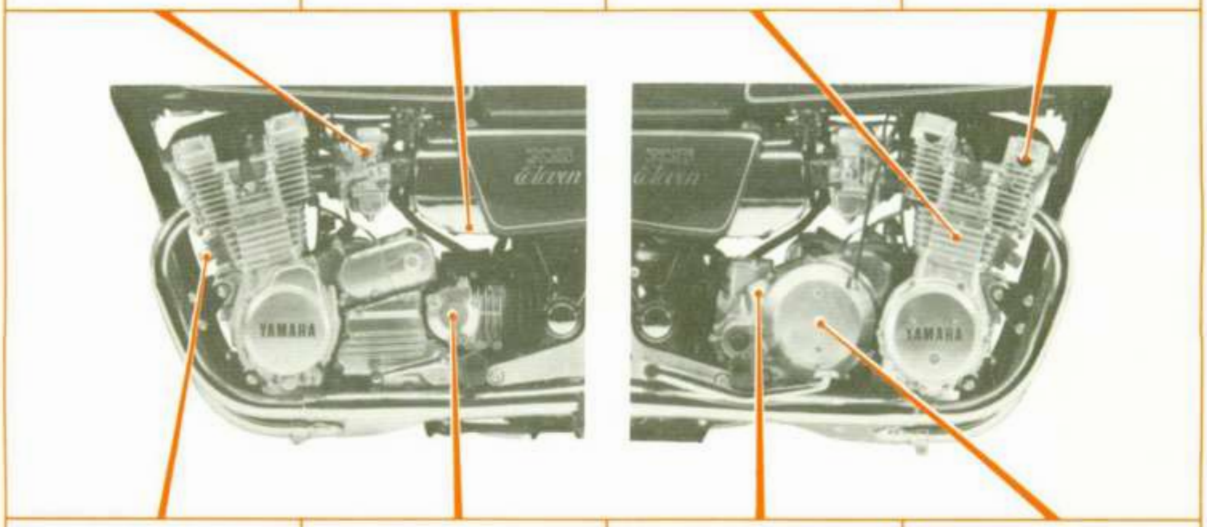
CHAPTER 2.
PERIODIC INSPECTION AND ADJUSTMENT

Introduction 2-2
Maintenance Intervals Charts 2-2
Engine 2-4
A. Valve Clearance Adjustment 2-4
B. Cam Chain Adjustment 2-7
C. Ignition Timing 2-7
D. Air Filter 2-9
E. Carburetor 2-9
F. Engine Oil 2-11
G. Middle Gear/Final Gear Oil 2-12
H. Compression Pressure Measurement 2-13
I. Clutch Adjustment 2-14
Chassis 2-14
A. Fuel Petcock Cleaning 2-15
B. Fuel Petcock Disassembly 2-15
C. Front and Rear Brake 2-15
D. Wheels and Tires 2-17
E. Front Fork Oil Change 2-17
F. Steering Head Adjustment 2-18
G. Throttle Cable and Grip Lubrication 2-19
H. Drive Shaft Joint Lubrication 2-19
I. Lubrication of Levers, Pedals, etc 2-19
Electrical 2-19
A. Battery 2-19
B. Spark Plug 2-20
C. Headlight 2-20

CHAPTER 2.
PERIODIC INSPECTION AND ADJUSTMENT

ENGINE

Carburetor page 2-9	Air Filter page 2-9	Compression Pressure page 2-13	Valve Clearance page 2-4



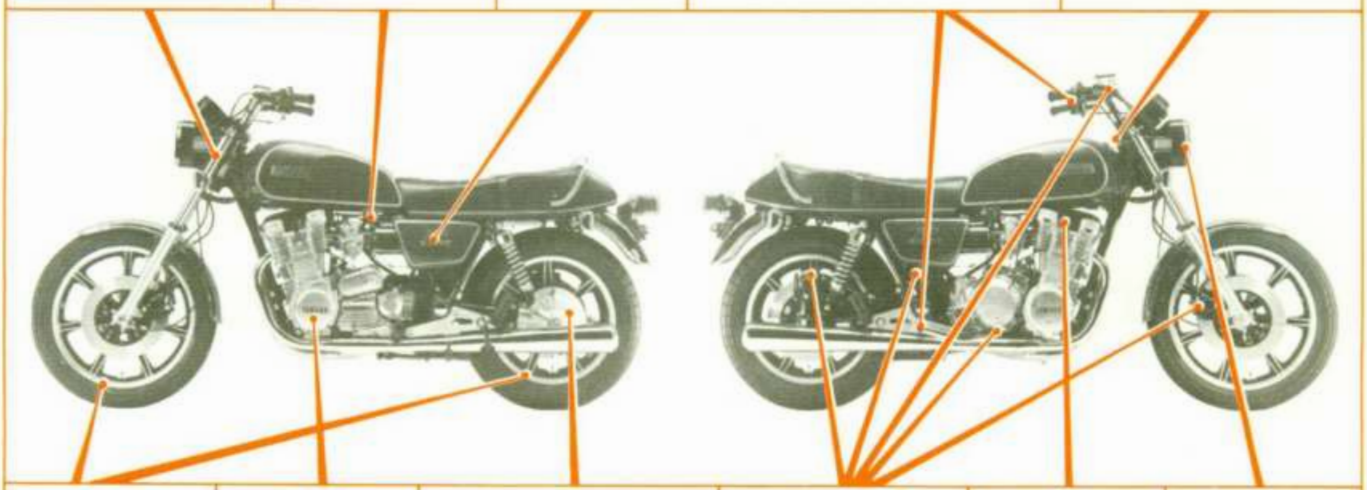
Cam Chain Adjustment page 2-7	Middle Gear Oil page 2-12	Engine Oil and Oil Filter page 2-11	Clutch Adjustment page 2-14

Special Tools

1. Tappet adjusting tool P/No. 90890-01223
2. Vacuum gauge P/No. 90890-03094
3. Compression gauge P/No. 90890-03081

CHASSIS/ELECTRICAL

Front Fork Oil Change page 2-17	Fuel Petcock Cleaning page 2-15	Battery page 2-19	Levers, Pedals, Cables, etc. Lubrications page 2-19	Steering Head Adjustment page 2-18



Wheels and Tires page 2-17	Ignition Timing page 2-7	Final Gear Oil, Drive Shaft Joint and Rear Wheel Splines Lubrications page 2-12, 2-19	Front and Rear Brake page 2-15	Spark Plug page 2-20	Headlight page 2-20

INTRODUCTION

This chapter includes all information necessary to perform recommended inspection and adjustments. These preventative maintenance procedures, if followed, will insure more reliable vehicle operation and a longer service life. the need for costly overhaul work will be greatly reduced. This information applies not only to vehicles already in service, but also to new vehicles that are being prepared for sale. Any service technician performing preparation work should be familiar with this entire chapter.

MAINTENANCE INTERVALS CHARTS

The following charts should be considered strictly as a guide to general maintenance and lubrication intervals. You must take into consideration that weather, terrain, geographical location, and a variety of individual uses all tend to alter this time schedule. For example, if the motorcycle is continually operated in an area of high humidity, then all parts must be lubricated much more frequently than shown on the chart to avoid damage caused by water to metal parts.

PERIODIC MAINTENANCE

Unit: km (mi)

Item	Remarks	Initial				Thereafter every		
		400 (250)	800 (500)	1.600 (1.000)	3.200 (2.000)	1.600 (1.000)	3.200 (2.000)	6.400 (4.000)
Cylinder	Check compression				○			○
Valves	Check/Adjust valve clearance				check			9.600 (6.000)
Cam chain	Check/Adjust chain tension	○			4.800 (3.000)			4.800 (3.000)
Spark plug	Inspect/Clean or replace as required	○			○		○	
Air filter	Dry type—Clean/Replace as required			○	○	○		
Carburetor	Check operation/Adjust as required		○		○		○	
Brake system (complete)	Check/Adjust as required—Repair as required	○	○	○	○	○		
Clutch	Check/Adjust as required				○		○	
Wheels and tires	Check pressure/Wear/Balance/Damage	○	○	○	○	○		
Fuel petcock	Clean/Flush tank as required	○		○			○	
Battery	Top-up/Check specific gravity and breather pipe	○	○	○	○	○		
Ignition timing	Adjust as required				check			check
Lights/Signals	Check operation/Replace as required	○	○	○	○	○		
Fittings/Fasteners	Tighten before each trip and/or	○	○	○	○	○		

LUBRICATION INTERVALS

Unit: km (mi)

Item	Remarks	Type	Initial				Thereafter every		
			400 (250)	800 (500	1,600 (1,000)	3,200 (2,000)	1,600 (1,000)	3,200 (2,000)	6,400 (4,000)
Engine oil	Replace/Warm engine before draining	See page 2-11	○			2,400 (1,500)			4,800 (3,000)
Oil filter	Replace/After installing start engine check for oil leaks	—	○			4,800 (3,000)			9,600 (6,000)
Middle/Final gear oil	Replace	See page 2-12	○						9,600 (6,000)
Control/Meter cables	Apply thoroughly	Yamaha chain and cable lube or SAE 10W/30 motor oil			○	○		○	
Throttle grip/ Housing	Apply lightly	Lithium base	○		○			○	
Hydraulic brake fluid reserve (Front and rear)	Use new fluid only— See note (page 42)	DOT No. 3 Brake fluid	check	check	check	check	check		
Front forks	Drain completely— Check specifications	Yamaha fork oil 10Wt.							12,800 (8,000)
Steering bearings	Inspect thoroughly/ Pack moderately yearly or	Medium-weight wheel bearing grease				check			12,800 (8,000)
Speedometer gear housing	Inspect thoroughly/ Pack moderately	Lithium base grease							12,800 (8,000)
Rear arm pivot shafts	Apply grease fully yearly or	Medium-weight wheel bearing grease							12,800 (8,000)
Wheel bearings	Do not over-pack yearly or	Medium-weight wheel bearing grease							12,800 (8,000)
Drive shaft joint	Apply grease approx.d 25 cc (0.85 oz)	Molybdenum disulfide grease NLGI-2M				○			○

NOTE:

Brake fluid replacement:

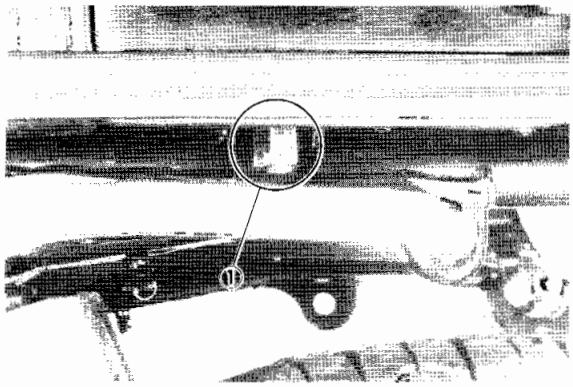
1. When disassembling the master cylinder or caliper cylinder, replace the brake fluid. Normally check the brake fluid level and add the fluid as required.
2. On the inner parts of the master cylinder and caliper cylinder, replace the oil seals every two years.
3. Replace the brake hoses every four years, or if cracked or damaged.

ENGINE

A. Valve Clearance Adjustment

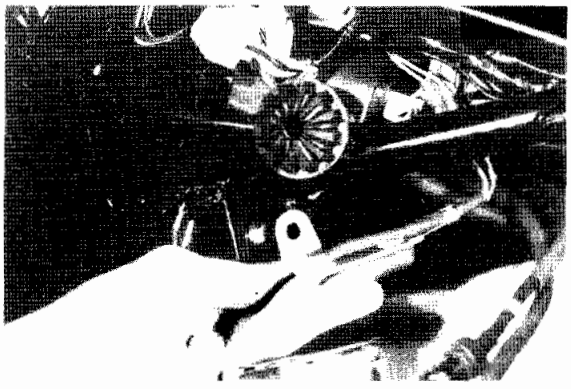
NOTE:
Valve clearance must be measured with the engine at room temperature.

1. Remove the seat and fuel tank.
   a. Loosen the 2 nuts that hold the seat to the frame. Slide the bolts in the seat to the front (out of the slots in the frame) and remove the seat.



1. Seat holding nut

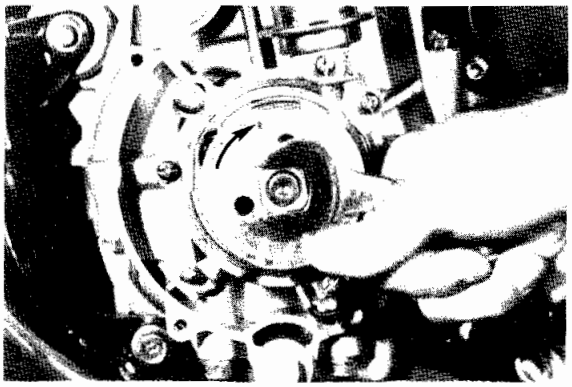
   b. Remove the bolt that holds the fuel tank to the frame and remove the fuel, vacuum and drain pipes. Disconnect the fuel gauge unit lead wires and remove the fuel tank.
   c. Remove the ignition ballast resistor.



2. Remove the cylinder head cover and the timing plate cover. Care should be taken to not scratch or damage gasket sealing surfaces.

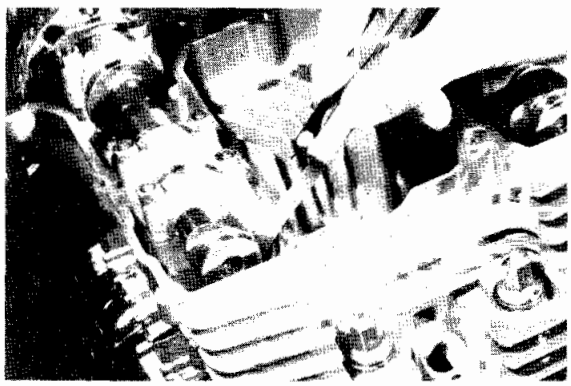


3. The proper cam position when measuring valve clearance is with the cam lobe directly opposite the valve lifter. To position the cams, turn the crankshaft. This will turn the cam chain and the cams.



4. Insert a feeler gauge between the valve lifter and the cam heel.

Exhaust valve clearance (cold): 0.21~0.25 mm (0.008~0.010in.) Intake valve clearance (cold): 0.16~0.20 mm (0.006~0.008 in.)



Adjustment

Valve clearance is adjusted by replacing the adjusting pad on the top of the valve lifter. Adjusting pads are available in 25 thicknesses ranging from No. 200 (2.00 mm) to No. 320 (3.20 mm) in steps of 0.05 mm. the thickness of each pad is marked on the pad face that contacts the valve lifter (not the cam). Adjustment of valve clearance is accomplished as follows:

1. Determine valve clearance (feeler gauge measurement.)
2. Remove adjusting pad and note number.
3. Select proper pad from appropriate chart (intake or exhaust chart).
4. Install new pad and check installed clearance.

Procedure

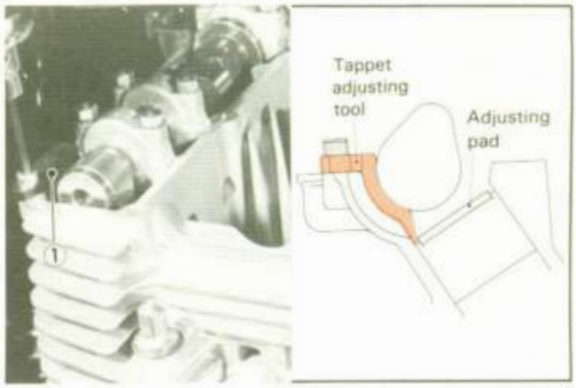
1. Measure valve clearance. If clearance is incorrect, record the measured amount of clearance. This must be measured carefully.
2. There is a slot in the valve lifter. This slot must be positioned opposite the blade of the tappet adjusting tool before the tool is installed.
3. Turn the cam until the lobe fully depresses the valve lifter and opens the valve. Install the tappet adjusting tool as shown to hold the lifter in this depressed position.

NOTE:

The tappet adjusting tool is fastened to the cylinder head using one allen screw such as one used to install the cylinder head cover. Make sure that the tool contacts the lifter only, and not the pad.

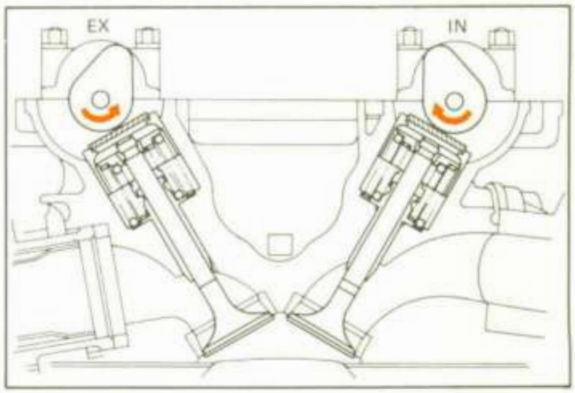
CAUTION:

If the cam lobe touches the tappet adjusting tool, the stress may fracture the cylinder head. DO NOT ALLOW THE CAM LOBE TO CONTACT THE TAPPET ADJUSTING TOOL.



1. Tappet adjusting tool

4. Carefully rotate the cam so that the pad can be removed. To avoid cam touching adjusting tool, turn cams as follows: (view from left side of machine)
   Intake: Carefully rotate **CLOCKWISE.**
   Exhaust: Carefully rotate **COUNTER-CLOCKWISE.**



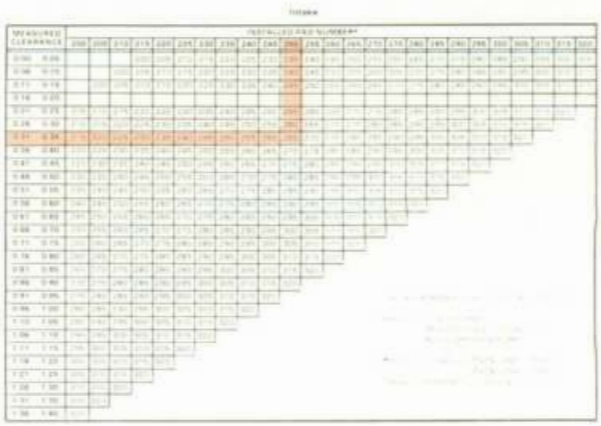
5. Remove the pad from the lifter. There is a slot in the lifter. Use a small screwdriver or other blade and a magnetic rod to remove the pad. Note the number on the pad.
6. Proper pad selection is made as follows: (Use appropriate chart for exhaust or intake valves.)

a. Find number of original (installed) pad number on chart. Read down on chart.
b. Find measured valve clearance (from step 1) on chart. Read across.
c. At the intersection of installed pad number (down) and measured clearance (across) is a new pad number.

EXAMPLE:
Intake valve, installed pad:
No. 250 (read down)
Measured clearance: 0.32 mm
(read across)
New pad number: No. 265
(intersection of down & across)

NOTE:
The new pad number is to be used as a guide only. Verify the correctness of this choice in the following step(s).

7. Install the new pad in the lifter. Install the pad with the number down.
8. Remove tappet adjusting tool.
9. Turn crankshaft to rotate cam several rotations. This will set the pad in the lifter.
10. Check valve clearance (step 3). If clearance is incorrect, repeat preceding steps until proper clearance is obtained.
11. Inspect head cover gasket. If bent or torn, replace gasket.
12. Reinstall removed parts in reverse order.



Intake

MEASURED CLEARANCE	INSTALLED PAD NUMBER*																								
	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320
0.00 ~ 0.05				200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305
0.06 ~ 0.10			200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310
0.11 ~ 0.15		200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315
0.16 ~ 0.20																									
0.21 ~ 0.25	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	
0.26 ~ 0.30	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320		
0.31 ~ 0.35	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320			
0.36 ~ 0.40	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320				
0.41 ~ 0.45	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320					
0.46 ~ 0.50	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320						
0.51 ~ 0.55	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320							
0.56 ~ 0.60	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320								
0.61 ~ 0.65	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320									
0.66 ~ 0.70	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320										
0.71 ~ 0.75	255	260	265	270	275	280	285	290	295	300	305	310	315	320											
0.76 ~ 0.80	260	265	270	275	280	285	290	295	300	305	310	315	320												
0.81 ~ 0.85	265	270	275	280	285	290	295	300	305	310	315	320													
0.86 ~ 0.90	270	275	280	285	290	295	300	305	310	315	320														
0.91 ~ 0.95	275	280	285	290	295	300	305	310	315	320															
0.96 ~ 1.00	280	285	290	295	300	305	310	315	320																
1.10 ~ 1.05	285	290	295	300	305	310	315	320																	
1.06 ~ 1.10	290	295	300	305	310	315	320																		
1.11 ~ 1.15	295	300	305	310	315	320																			
1.16 ~ 1.20	300	305	310	315	320																				
1.21 ~ 1.25	305	310	315	320																					
1.26 ~ 1.30	310	315	320																						
1.31 ~ 1.35	315	320																							
1.36 ~ 1.40	320																								

VALVE CLEARANCE (engine cold) 0.16 ~ 0.20 mm

Example: Installed is 250
Measured clearance is 0.32 mm
Replace 250 pad with 265

*Pad number (example) Pad No. 250 = 2.50 mm
Pad No. 255 = 2.55 mm
Always install pad with number down.

Exhaust

MEASURED CLEARANCE	INSTALLED PAD NUMBER*																								
	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320
0.00 ~ 0.05					200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300
0.06 ~ 0.10				200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305
0.11 ~ 0.15			200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310
0.16 ~ 0.20		200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315
0.21 ~ 0.25																									
0.26 ~ 0.30	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	
0.31 ~ 0.35	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320		
0.36 ~ 0.40	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320			
0.41 ~ 0.45	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320				
0.46 ~ 0.50	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320					
0.51 ~ 0.55	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320						
0.56 ~ 0.60	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320							
0.61 ~ 0.65	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320								
0.66 ~ 0.70	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320									
0.71 ~ 0.75	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320										
0.76 ~ 0.80	255	260	265	270	275	280	285	290	295	300	305	310	315	320											
0.81 ~ 0.85	260	265	270	275	280	285	290	295	300	305	310	315	320												
0.86 ~ 0.90	265	270	275	280	285	290	295	300	305	310	315	320													
0.91 ~ 0.95	270	275	280	285	290	295	300	305	310	35	320														
0.96 ~ 1.00	275	280	285	290	295	300	305	310	315	320															
1.01 ~ 1.05	280	285	290	295	300	305	310	315	320																
1.06 ~ 1.10	285	290	295	300	305	310	315	320																	
1.11 ~ 1.15	290	295	300	305	310	315	320																		
1.16 ~ 1.20	295	300	305	310	315	320																			
1.21 ~ 1.25	300	305	310	315	320																				
1.26 ~ 1.30	305	310	315	320																					
1.31 ~ 1.35	310	315	320																						
1.36 ~ 1.40	315	320																							
1.41 ~ 1.45	320																								

VALVE CLEARANCE (engine cold) 0.21 ~ 0.25 mm

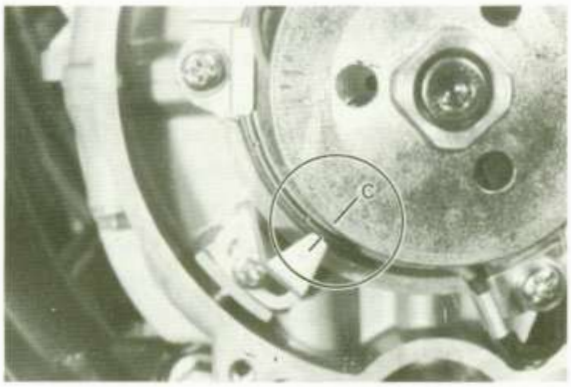
Example: Installed is 250
Measured clearance is 0.32 mm
Replace 250 pad with 260

*Pad number: (example) Pad No. 250 = 2.50 mm
Pad No. 255 = 2.55 mm
Always install pad with number down.

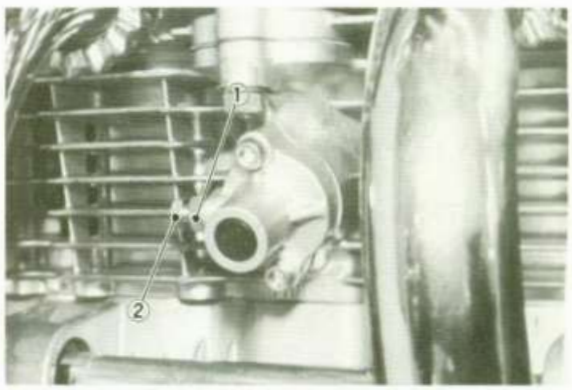
B. Cam Chain Adjustment

The cam chain becomes stretched with use, resulting in improper valve timing and engine noise. To prevent this, the cam chain tensioner must be adjusted regularly.

1. Remove the timing plate cover.
2. Slowly rotate the crankshaft clockwise until the "C" mark on the timing plate aligns with the stationary pointer.



3. Loosen the tensioner lock nut and then loosen the stopper bolt. This releases the cam chain tensioner with the proper tension.



1. Lock nut 2. Stopper bolt

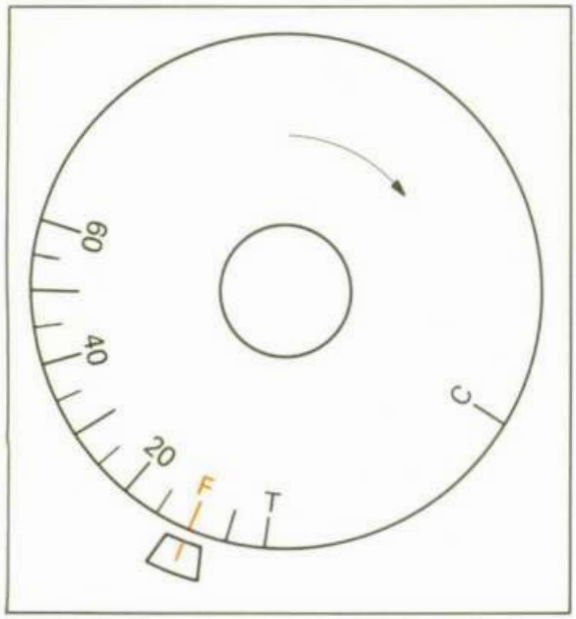
4. Tighten the stopper bolt and lock nut.

Stopper bolt torque: 0.6 m-kg (4.3 ft-lb) Lock nut torque: 0.9 m-kg (6.5 ft-lb)

5. Reinstall the timing plate cover.

C. Ignition Timing

1. Ignition timing is checked with a timing light (strobe light) by observing the position of the stationary pointer and the marks stamped on the timing plate. The timing plate is marked as shown.

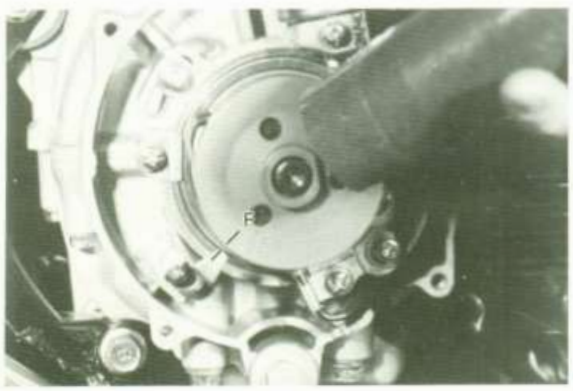


2. Connect the timing light to No. 1 (L.H.) spark plug lead wire.
3. Start the engine and keep the engine speed as specified.

Specified speed: 950~1,050 r/min

4. The statioonary pointer should line up with the "F" timing mark on the timing plate. If it does not align, loosen two pick-up base plate screws and move the complete pick-up base plate until "F" and the pointer marks align.

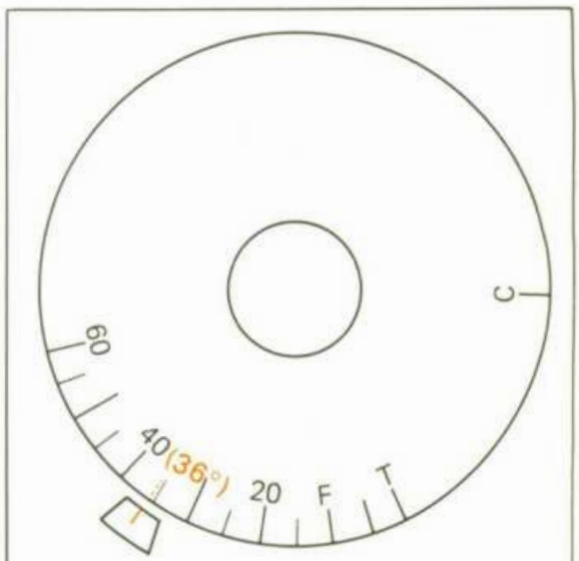
CAUTION:
Never bend the stationary pointer.



5. Retighten screws. Check timing again for the No. 1 cylinder.

NOTE:
No. 1 and No. 4 cylinders fire together. Therefore, when No. 1 cylinder is timed, No. 4 cylinder is also timed. No. 2 and No. 3 cylinders fire together exactly 180° from No. 1 and No. 4 cylinders. No ignition timing adjustment is required for No. 2 and No. 3 cylinders.

6. Disconnect and plug the hose to the vacuum advance unit and rev the engine to 5,200 r/min. The timing should be 36° before top dead center. If the timing does not meet this specification, the governor assembly should be removed and inspected.



CENTRIFUGAL ADVANCE
(36° BTDC)

7. Connect the hand operated vacuum pump to the vacuum advance line. Operate the pump until the vacuum pressure reaches 150 mmHg (5.91 inHg). At this pressure the pick-up base plate should have rotated counterclockwise just to the end of its travel.
If the base plate reaches the end of its travel before the vacuum pressure reaches 150 mmHg (5.91 inHg) or if the pick-up base plate has not yet reached maximum advance at 150 mmHg (5.91 inHg), the advance unit is faulty and must be replaced.

D. Air Filter

1. Removal

a. Remove the air filter case cover by loosening the wing bolts.



b. Pull out the element.



2. Cleaning method

a. Tap the element lightly to remove most of the dust and dirt; then blow out the remaining dirt with compressed air from the inner surface of the element outward. If element is damaged, replace.



b. The air filter element should be cleaned at the specified intervals.

CAUTION:

The engine should never be run without the air cleaner element installed; excessive piston and/or cylinder wear may result.

3. Reassembly

Reassemble by reversing the removal procedure. Check whether the element is seated completely against the case.

E. Carburetor

NOTE:

The carburetors are numbered 1, 2, 3, and 4 from the left when viewed from astride the motorcycle.

1. Idle mixture

The idle mixture is set at the factory by the use of special equipment. No attempt should be made by the dealer to change this adjustment.



1. Idle mixture screw "Do not adjust"

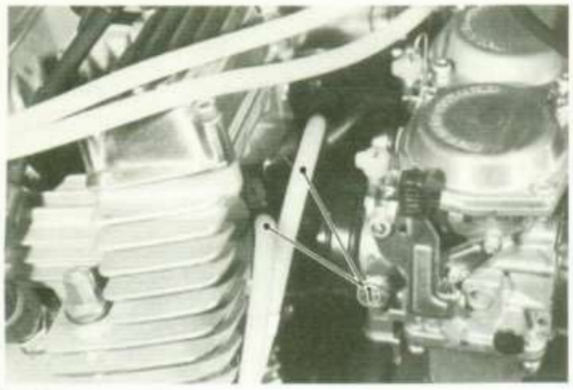
2. Synchronization

The seat must be removed and the rear of the tank elevated to gain access to the vacuum connections and throttle adjustment screws of the inner carburetors.

a. Turn fuel petcock to "PRI". Remove vacuum pipes from carburetor manifolds (No. 2 and No. 3 cylinders).

b. Remove caps from No. 1 and No. 4 carburetor manifolds.

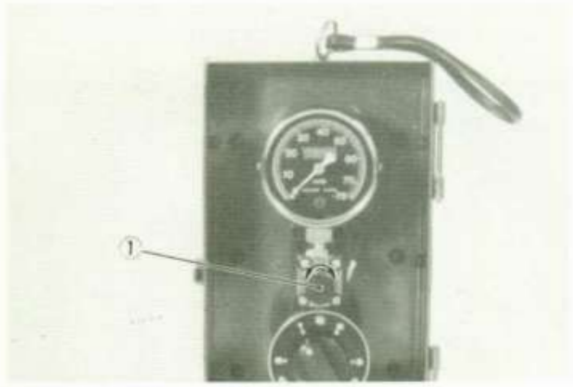
c. Connect each vacuum gauge hose to its proper carburetor.



1. Vacuum gauge hoses

d. Start engine and allow it to warm-up for a few minutes. The warm-up is complete when engine responds normally to throttle opening.

e. Adjust the damping valve on the vacuum gauge until the needle flutters only slightly. The gauge needle must respond quickly to rapid opening of throttle.



1. Damping valve

f. Set the engine idle at approximately 1,000 r/min.

g. Each gauge reading will indicate the same if the carburetors are synchronized. The No. 3 carburetor has no synchronizing screw and the other carburetors are to be synchronized to it in order, one at a time. First, synchronize carburetor No. 1 to carburetor No. 2 by turning the No. 1 synchronizing screw until both gauges read the same. Second, in the same way synchronize carburetor No. 4 to carburetor No. 3. Third, by adjusting No. 2 screw to match No. 3 carburetor reading, No. 1 and No. 2 carburetors will both change to match No. 3 carburetor.





1. No. 4 carburetor synchronizing screw
2. No. 2 carburetor synchronizing screw
3. No. 1 carburetor synchronizing screw

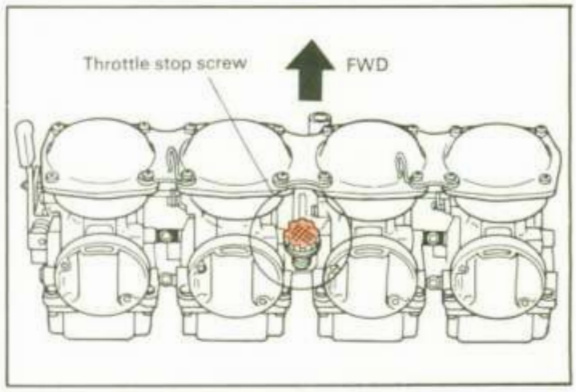
h. Set engine idle to 1,000 r/min.

i. Now each gauge reading should indicate the same vacuum. If not, repeat the process starting at step g.

3. Idle speed adjustment.

NOTE:

Carburetors must be synchronized before setting final idle speed. The idle speed adjustment is made by turning only one throttle stop screw.



a. The engine must be warmed up before setting idle speed.

b. Set engine idle speed by turning the throttle stop screw in (to increase engine speed) or out (to decrease speed).

Standard Idle Speed:
950 ~ 1,050 r/min

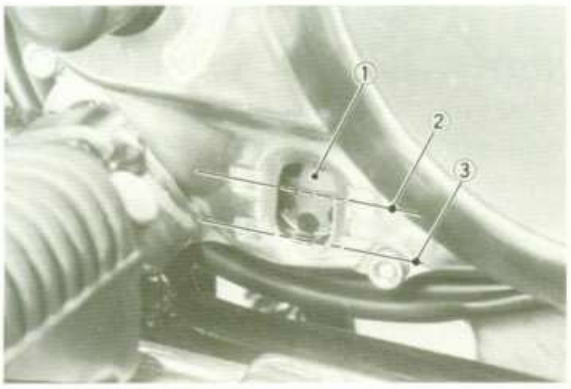
F. Engine Oil

1. Oil level measurement

a. Place the machine on the center stand. Warm up the engine for several minutes.

b. With the engine stopped, check the oil level through the level window located at the lower part of the right side crankcase cover.

NOTE:
Wait a few minutes until the oil level settles before checking.



1. Level window
2. Maximum
3. Minimum

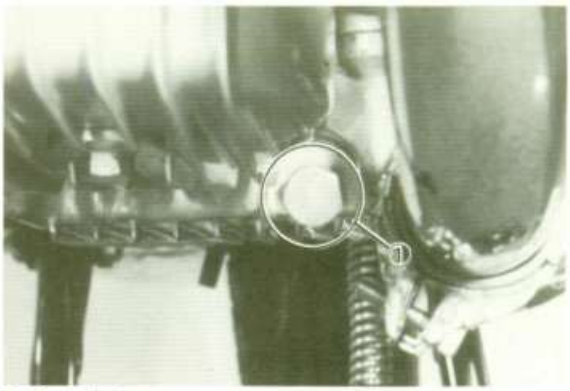
c. The oil level should be between maximum and minimum marks. If the level is lower, add sufficient oil to raise it to the proper level.

2. Engine oil and oil filter replacement

a. Start the engine and stop it after a few minutes of warm-up.

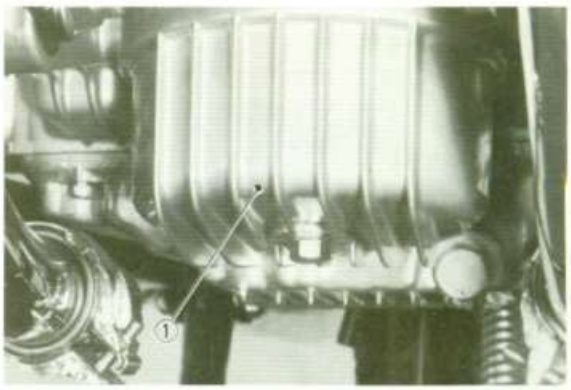
b. Place an oil pan under the engine and remove the oil filter cap.

c. Remove the drain plug and drain the oil.



1. Drain plug

d. Remove the oil filter bolt and filter element.



1. Oil filter

e. Re-install the drain plug and tighten to specification.

Drain plug torque:
4.3 m-kg (31 ft-lb)

f. Install the new oil filter element, new "O-ring" and filter cover. Tighten the oil filter bolt.

NOTE:
Make sure the "O-ring" is positioned properly.



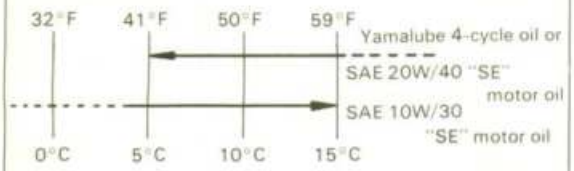
1. "O"-ring

Oil filter bolt torque:
3.2 m-kg (23 ft-lb)

g. Add oil through the oil filter hole.

Periodic oil change: 3.0 lit (3.17 U.S.qt)
(with oil filter replacement:)
3.5 lit (3.70 U.S. qt)

Recommended oil:



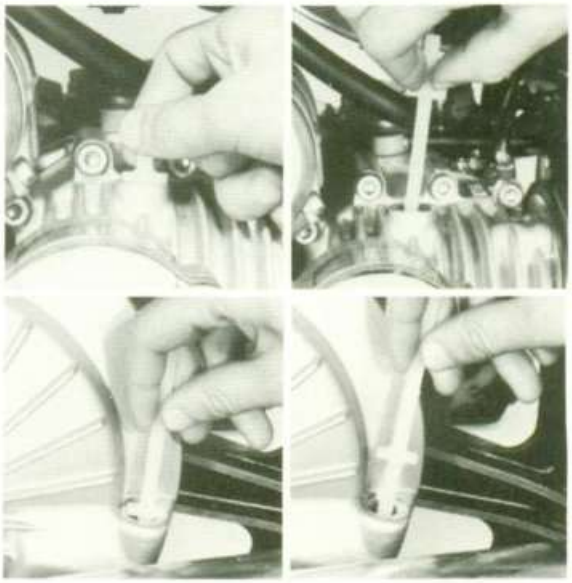


h. After replacement of the engine oil, and/or oil filter, be sure to check the oil pressure and for oil leakage. The oil pressure indicator light should go off after the engine is started.

CAUTION:
If the indicator light flickers or remains on, immediately stop the engine. Refer to lubrication information in Section ** for corrective action.

G. Middle Gear/Final Gear Oil

1. Oil level measurement.
a. Place the machine on the center stand on a level surface. The engine should be cool (at atmospheric temperature). Allow 2 minutes for oil to drain to bottom of cases.
b. Remove the oil filler cap. Check the oil level with level gauge (from tool kit) as shown. The correct oil level is between the two marks on each end of the level gauge. Use end of gauge marked "REAR" for measuring the rear (final) gear case. Use the end marked "MIDDLE" for measuring the middle gear case.



NOTE:
Middle gear and final gear oil can be checked with same level gauge, which is in the owners tool kit.

CAUTION:
Take care not to allow foreign material to enter the middle and/or final gear case.

2. Gear oil replacement
a. Place an oil pan under the transmission for the middle gear and under the final gear case.

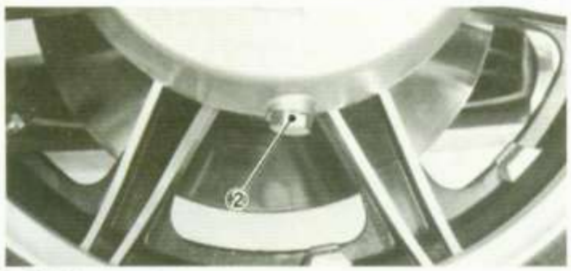


b. Remove the middle and/or final gear oil filler cap(s) and the drain plug(s), and drain the oil.

WARNING:

When draining or filling, take care not to allow foreign material to enter the middle and/or final gear case. Do not allow the gear oil to contact the tire and wheel.





1. Middle drain plug
2. Final drain plug

c. Reinstall the middle and/or final drain plug(s).

d. Fill te gear case(s) up to specified level.

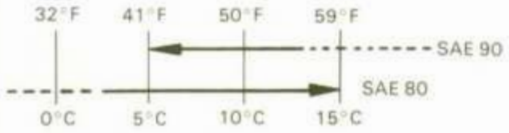
Oil Capacity:

Middle gear case: approx. 0.36 lit (0.38 U.S. qt)

Final gear case: approx. 0.30 lit (0.32 U.S. qt)

Recommended oil:

SAE 80 or 90 API "GL-4" Hypoid Gear oil



If desired, an SAE 80W/90 hypoid gear oil may be used for all conditions.

NOTE:

"GL-4" is a quality and additive rating. "GL-5" or "GL-6" rated hypoid gear oils may also be used.

e. Reinstall the filler cap(s) securely.

NOTE:

After initial 250 mile oil change, it is normally not necessary to change middle and final gear oil more frequently than the indicated service interval of 6,000 miles.

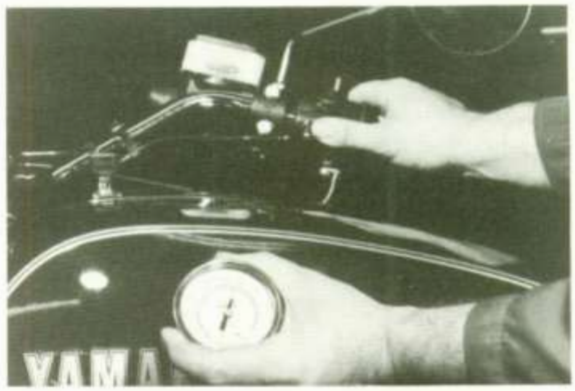
H. Compression Pressure Measurement

Insufficient compression pressure will result in performance loss and may indicate leaking valves or worn or damaged piston rings.

Procedure:

1. Make sure the valve clearance is correct.
2. Warm up the engine 2-3 minutes. Stop the engine.
3. Remove the spark plugs.
4. Install a compression check gauge.
5. Turn over the engine with the kick or the electric starter (make sure the battery is fully charged) with the throttle wide open until the pressure indicated on the gauge does not increase further.

Compression pressure: (at sea level)	
Standard	10 kg/cm² (142 psi)
Minimum	9 kg/cm² (128 psi)
Maximum	11 kg/cm² (156 psi)

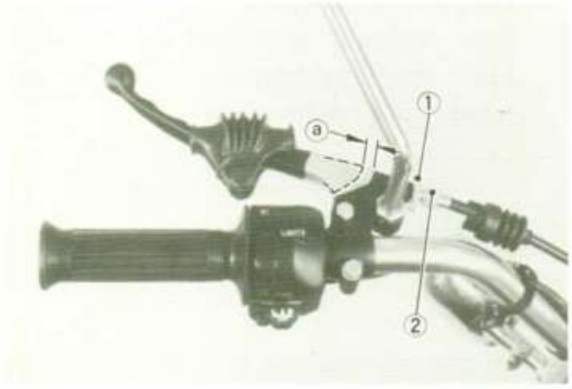


6. If the pressure is too low, squirt a few drops of oil into the cylinder being measures. Measure compression again. If there is a higher reading than before (without oil), the piston rings may be worn or damaged. If the pressure remains the same after measurig with the oil, either or both the rings and valves may be the cause.
7. Check each cylinder. Compression pressure should not vary more than 1 kg/cm² (14 psi) from one cylinder to any other cylinder.

I. Clutch Adjustment

This model has a clutch cable length adjuster and a clutch mechanism adjuster. The cable length adjuster is used to take up slack from cable stretch and to provide sufficient free play for proper clutch operation under various operating conditions. The clutch mechanism adjuster is used to provide proper disengagement. Normally, once the mechanism is properly adjusted, the only adjustment required is maintenance of free play at the clutch handle lever.

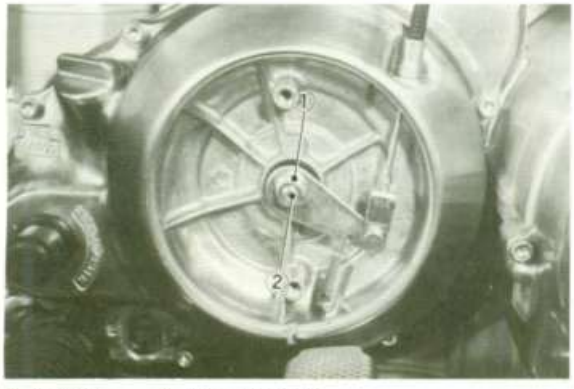
1. Free play adjustment
   a. Loosen the handle lever adjuster lock nut.
   b. Turn the length adjuster either in or out until proper lever free play is achieved.



1. Lock nut 2. Adjuster a. 2 ~ 3 mm (0.08 ~ 0.12 in)

2. Mechanism adjustment
   a. Loosen the adjusting screw lock nut and turn the adjusting screw in (clockwise) until the screw positively but lightly contacts the pressure plate.

NOTE:
There is an "O-ring" on the screw shaft which will cause some resistance. Make sure the screw positively but lightly contacts the pressure plate.



1. Lock nut 2. Adjusting screw

   b. Back the screw off (counterclockwise) 1/4 turn, and retighten the lock nut.

CAUTION:
Do not operate the clutch lever until clutch mechanism adjustment is complete. This could cause dislocation of the steel balls in the adjuster housing. If the balls are out of position in the housing, the clutch will not disengage. To reposition the steel balls in this housing, remove the right side case cover.

CHASSIS

A. Fuel Petcock Cleaning

1. Turn the petcock lever to the "ON" or "RES" position. Remove the fuel pipe.



2. Remove the drain cover and clean the bottom of the cover with solvent.

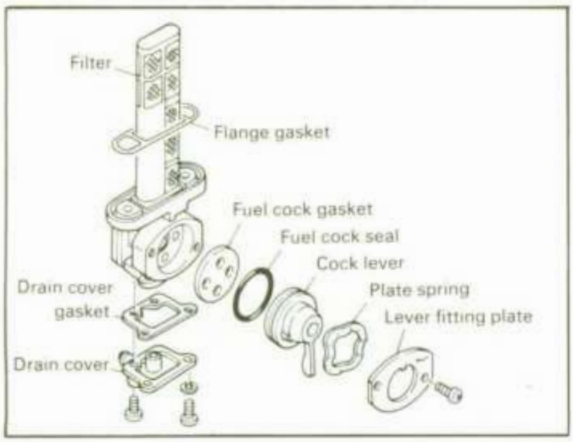


1. Drain cover

3. Check the condition of the drain gasket. Replace if damaged. Reinstall the drain cover and fuel pipe.

B. Fuel Petcock Disassembly

If the fuel petcock is leaking or excessively contaminated, it should be removed from the fuel tank and inspected.



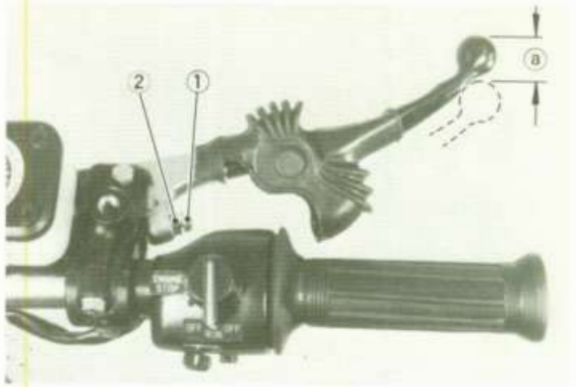
1. Remove fuel tank and position it so that fuel will not spill when the petcock is removed.
2. Remove petcock and inspect filter screw. Replace filter if seriously contaminated.
3. Remove 4 screws on front and rear of petcock and remove plate, gaskets, lever and diaphragm.
4. Inspect all components and replace any that are damaged. If the diaphragm is in any way damaged, or the petcock body gasket surfaces scratched or corroded, the petcock assembly must be replaced. If there is abrasive damage to any component, the fuel tank must be drained and flushed.
5. Reassemble the petcock and install it on the fuel tank.

C. Front and Rear Brake

1. Brake adjustment
   The brakes can be adjusted by simply adjusting the free play of the brake lver and pedal. (The piston in the caliper moves forward as the brake pad wears out, automatically adjusting the clearance between the brake pad and the brake disc.)

a. Front brake lever free play.

CAUTION:
Proper lever free play is essential to avoid excessive brake drag.

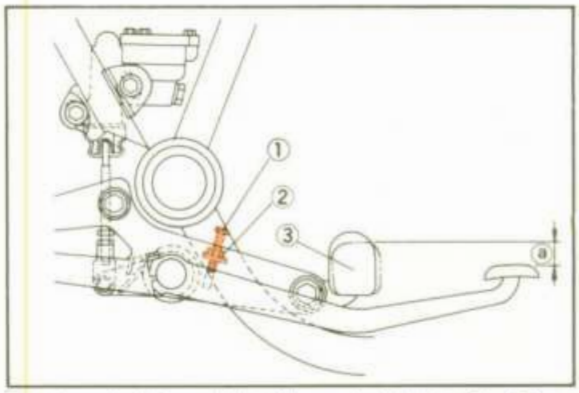


1. Adjuster
2. Lock nut

a. 5 ~ 8 mm (0.2 ~ 0.3 in)

1) Loosen the adjuster lock nut on the brake lever.
2) Turn the adjuster so that the brake lever movement athe lever end is 5~8 mm (0.2~0.3 in) before the adjuster contacts the master cylinder piston.
3) After adjusting, tighten the lock nut.

b. Rear brake pedal height

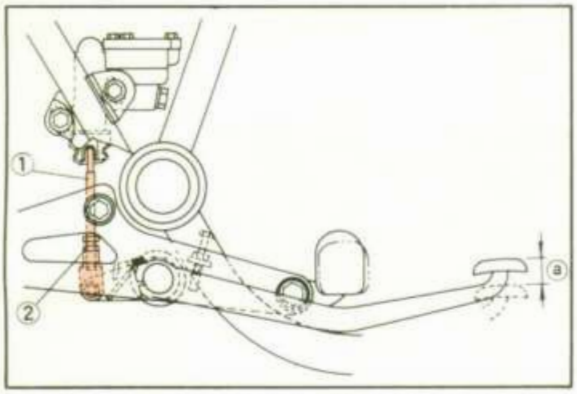


1. Adjuster bolt (for pedal height)
2. Lock nut
3. Footrest

a. Pedal height 17 ~ 23 mm (0.67 ~ 0.91 in)

1) Loosen the adjuster lock nut (for pedal height).
2) By turning the adjuster bolt clockwise or counterclockwise, adjust the brake pedal position so that its top end is approximately 17~23 mm (0.67~0.91 in) below the footrest top end.
3) Secure the adjuster lock nut.

c. Rear brake pedal free play



1. Brake rod
2. Lock nut

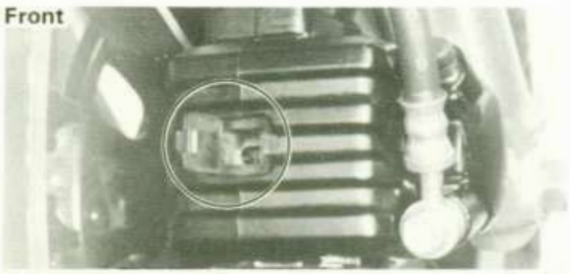
a. Free play 13 ~ 15 mm (0.51 ~ 0.59 in)

1) Loosen the brake rod lock nut and screw brake rod downward until there is noticeable free play between rod and master cylinder piston.
2) Turn in the brake rod until it lightly touches the master cylinder piston, then turn it out so that the brake pedal has a free play of 13~15 mm (0.51~0.59 in) from when the brake pedal is touched to when the brake begins to take effect.
3) Tighten the brake rod lock nut.

CAUTION:
Set that the pin hole on the brake rod is not above the top surface of the brake rod lock nut in securing the brake rod lock nut.

2. Brake pad check
To check pad wear, open the wear indicator cap. If any pad is worn to the red line, replace both pads in the caliper.

Front

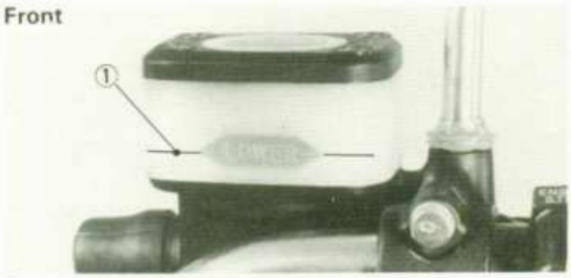


Rear



3. Check the brake fluid level
Insufficient brake fluid may allow air to enter the brake system, possibly causing the brake to become ineffective. Check the brake fluid level and replenish when necessary observing these precautions:

Front



Rear



1. Lower level

a. Use only the designated quality brake fluid; otherwise, the rubber seals may deteriorate, causing leakage and poor brake performance.

Recommended brake fluids: DOT No. 3

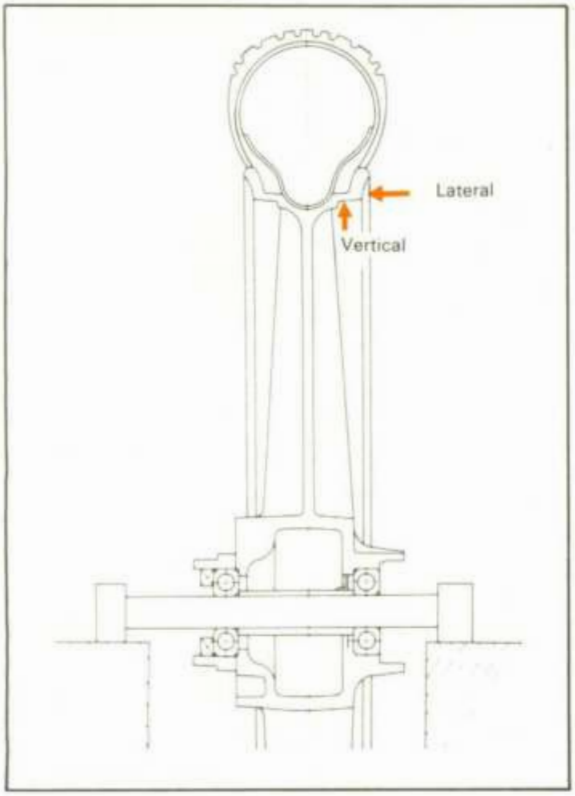
b. Refil with the same type and brand of brake fluid; mixing fluids may result in a harmful chemical reaction and lead to poor performance.
c. Be careful that water or other contamination does not enter the master cylinder when refilling. Water will significantly lower the boiling point and may result in vapor lock.

D. Wheels and Tires

1. Checking the aluminum wheels.
a. Check for cracks, bends or warpage of the wheels. If a wheel is deformed or cracked, it must be replaced.

CAUTION:
These aluminum wheels are NOT designed for use with tubeless tires.

b. Raise the wheel off the ground. Spin.



1. Vertical
2. Lateral

Rim runout limits:
Vertical - 2 mm (0.08 in)
Lateral - 2 mm (0.08 in)

2. Front and rear axles
a. Check axle nuts.

Front axle nut torque:
10.7 m-kg (77.5 ft-lb)
Rear axle nut torque:
15 m-kg (108 ft-lb)

b. Check axle holder nuts and axle pinch bolts.

Front axle holder nuts:
2.0 m-kg (14.5 ft-lb)
(See page 5-4 for tightening procedure.)
Rear axle pinch bolt:
0.6 m-kg (4.3 ft-ib)

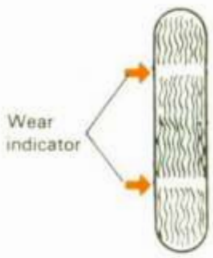
3. Tires
a. Tire pressure

WARNING:
Never overload the motorcycle beyond specified tire limits. Operation of an overloaded tire could cause tire damage, an accident and injury.

	FRONT	REAR
XS1100E BASIC WEIGHT with oil and full fuel tank	126 kg (278 lb)	151 kg (333 lb)
Standard tire	Bridgestone 3.50H19—4PR	Bridgestone 4.50H17—4PR
Tire load limit	190 kg (420 lb)	304 kg (670 lb)
Cold tire pressure		
Up to 90 kg (198 lb) load	1.8 kg/cm² (26 psi)	2.0 kg/cm² (28 psi)
90 kg (198 lb) load ~ 153 kg (337 lb) load	2.0 kg/cm² (28 psi)	2.5 kg/cm² (36 psi)
153 kg (337 lb) load ~ 217 kg (478 lb) load (Maximum load)	2.0 kg/cm² (28 psi)	2.8 kg/cm² (40 psi)
High speed riding	2.6 kg/cm² (36 psi)	2.8 kg/cm² (40 psi)
Minimum tire tread depth	0.8 mm (0.03 in)	0.8 mm (0.03 in)

Make sure the total weight of the motorcycle with accessories, rider(s) etc., does not exceed the tire limits.

b. If a tire tread shows crosswise lines, it means that the tire is worn to its limit. Replace the tire.



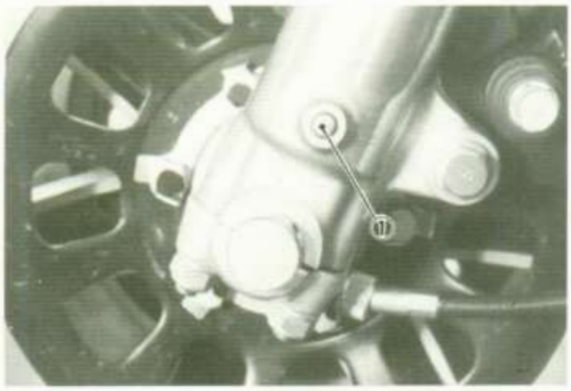
E. Front Fork Oil Change

1. Raise the machine or remove the front wheel so that there is no weight on the front end of the machine.
Remove the handlebar.
2. Remove the rubber cap and the cap bolt from the top of each fork.



3. Place open container under each drain hole. Remove drain screw from each outer tube.

CAUTION:
Do not allow oil to contact disc brake components.



1. Drain screw

4. When most of the oil has drained, slowly raise and lower the outer tubes to pump out the remaining oil.
5. Inspect drain screw gasket. Replace if damaged. Reinstall drain screw.
6. Pour specified amount of oil into the fork inner tube.

Front fork oil (each fork):
212 cc (7.12 oz)
Yamaha Fork Oil 10Wt or equivalent



7. After filling, slowly pump the forks up and down to distribute the oil.
8. Inspect the "O-ring" on the cap bolt. Replace "O-ring" if damaged.



1. "O"-ring

9. Reinstall the cap bolt and rubber cap.

Cap bolt torque: 2.3 m-kg (16.5 ft-lb)

F. Steering Head Adjustment

The steering head is fitted with tapered roller bearings. The steering assembly should be checked periodically for looseness.

Procedure:

1. Raise front end of machine so that there is no weight on the front wheel.
2. Grasp bottom of forks and gently rock fork assembly backward and forward, checking for looseness in the steering assembly bearings.



3. If there is looseness in the steering head, loosen the crown pinch bolts and steering fitting bolt.
4. Use steering nut wrench to loosen top steering fitting nut. The top nut serves as a lock nut.
5. Tighten the lower steering fitting nut until the steering head is tight, but does not bind when forks are turned.
6. Retighten the top steering fitting nut, steering fitting bolt and crown pinch bolts, in that order.
7. Recheck steering adjustment to make sure there is no binding when the forks are moved from lock to lock. If necessary, repeat adjustment procedure.

G. Throttle Cable and Grip Lubrication

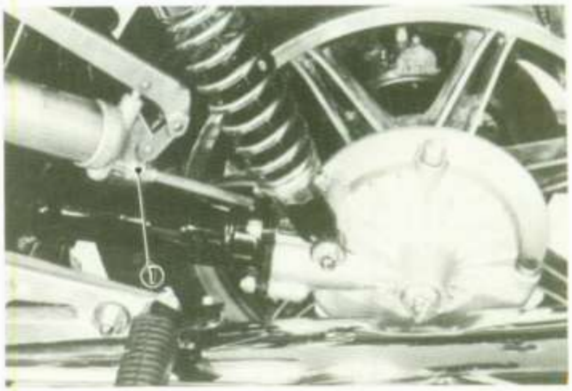
The throttle twist grip assembly should be greased at the time that the cable is lubricated since the grip must be removed to get at the end of the throttle cable. Two screws clamp the throttle housing to the handlebar. Once these two are removed, the end of the cable can be held high to pour in several drops of lubricant. With the throttle grip disassembled, coat the inside surface of the throttle grip guide tube with a suitable all-purpose grease to cut down friction.

Upon reassembly, make sure the throttle snaps closed automatically when released.

H. Drive Shaft Joint Lubrication

Use a hand-operated grease gun to apply the specified amount of grease to the final drive grease fitting at the specified intervals. (see page 2-3).

Recommended grease:
Molybdenum disulfide grease
(type NLG1-2M)
Quantity: Approx. 30 cc (1.01 oz)



1. Hand-operated grease gun

I. Lubrication of Levers, Pedals, etc.

1. Lubricate the pivoting parts of the brake and clutch levers.

Recommended lubricants:
Yamaha Chain and Cable Lube or
10W/30W Motor Oil

2. Lubricate the brake pedal shaft with lithium soap grease.

ELECTRICAL

A. Battery

1. This model has been equipped with a long life type battery; however, the battery fluid should be checked at least once a month. The fluid level should be between the upper and the lower level marks.

CAUTION:
Normal tap water contains minerals which are harmful to a battery; therefore, refill only with distilled water.

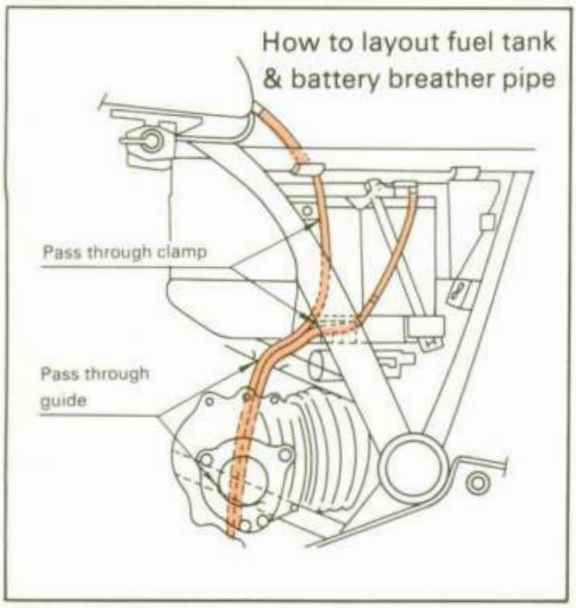
2. Refill the battery as follows:
   a. Remove the seat and left side cover.
   b. Remove the filling plug and slowly put in distilled water. Each individual cell automatically permits no filling above the UPPER LEVEL mark.



1. Upper level
2. Lower level

c. Stop filling when the excessive distilled water flows out through the breather pipe.
d. Securely tighten the filling plug.
e. Install the seat and side cover.

3. Always make sure the connections are correct when installing the battery. Make sure the breather pipe is properly connected, properly routed, and is not damaged or obstructed.

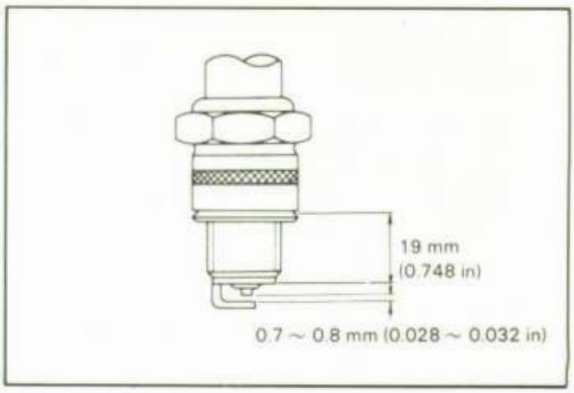


CAUTION:
The battery must be charged before using to insure maximum performance. Failure to properly change the battery before first use, or a low electrolyte level will cause premature failure of the battery.

Charging current:	2.0 amps/10 hrs.

B. Spark Plug

1. Check the electrode condition and wear, insulator color and electrode gap.



2. Use a wire gauge for measuring the plug gap.
3. If the electrodes become too worn, replace the spark plug.
4. When installing the plug, always clean the gasket surface. Wipe off any grime that might be present on the surface of the spark plug, and torque the spark plug properly.

Standard Spark Plug:	
	BP6ES (NGK) or N-7Y (CHAMPION)
Spark Plug Gap:	
	0.7 ~ 0.8 mm (0.028 ~ 0.032 in)
Spark Plug Tightening Torque:	
	2.0 m-kg (14.5 ft-lb)

C. Headlight

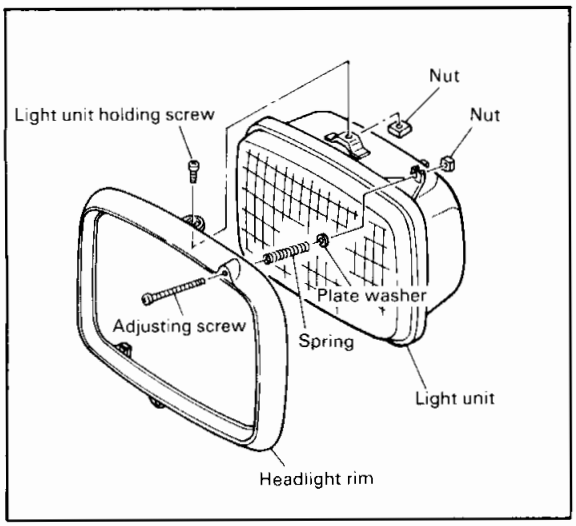
1. Head light adjustment
   There are 3 adjustments for the headlight: horizontal, coarse vertical, and fine vertical.



1. Horizontal adjusting screw
2. Fine verticals adjusting screw
3. Coarse vertical adjusting bolt

a. To shift the headlight beam to the left, screw in the horizontal adjust screw (clockwise). To adjust the beam to the right, turn the screw counterclockwise.
b. Coarse vertical adjustment is done at the screw beneath the headlight shell. The vertical fine adjustment screw is on the headlight rim. Turn the screw clockwise to lower the beam or counterclockwise to raise it.

2. Replacing the headlight bulb



a. Remove the screws holding the light unit in the rim. Remove the reflector unit from the rim.
b. Slip a new unit into position and install the screws.
c. Adjust the headlight beam.

CHAPTER 3. ENGINE OVERHAUL

Engine Removal 3-2
A. Preparation for Removal 3-2
B. Seat and Fuel Tank Removal 3-2
C. Ignition Ballast Resister, Horn, Muffler, Footrest, Brake Pedal 3-2
D. Air Cleaner Case 3-3
E. Wiring and Cables 3-4
F. Drive Shaft Joint 3-5
G. Removal 3-5
Engine Disassembly 3-6
A. Cylinder Head and Cylinder Removal 3-6
B. Cylinder Head Disassembly 3-8
C. Piston and Cam Chain Dampers Removal 3-9
D. Generator 3-9
E. Kick Shaft, Clutch and Primary Driven Gear 3-9
F. Pick-up Coil Assembly Removal 3-11
G. Starter Motor Removal 3-12
H. Shifter 3-12
I. Oil Pump Removal and Disassembly 3-13
J. Crankcase Disassembly 3-13
K. Primary Shaft Disassembly 3-18
Inspection and Repair 3-19
A. Cylinder Head Cover 3-19
B. Cylinder Head 3-19
C. Valve, Valve Guide and Valve Seat 3-19
D. Valve Spring and Lifters 3-22
E. Camshafts, Cam Chain and Cam Sprockets 3-23
F. Cylinder 3-24
G. Piston and Piston Rings 3-24
H. Piston Pin 3-25
I. Crankshaft 3-26
J. Connecting Rod 3-27
K. Oil Pump 3-28
L. Primary Shaft Damper Hi-Vo Chain 3-29
M. Primary Drive 3-29
N. Transmission 3-30
O. Starter Drives 3-31
P. Crankcases and Strainer Cover 3-32
Q. Bearings and Oil Seals 3-32
Engine Assembly and Adjustment 3-33
A. Crankcase 3-33
B. Oil Pump and Strainer Cover 3-38
C. Shifter 3-39
D. Starter Motor/Breather Cover 3-39
E. Clutch/Kick Gear 3-40
F. Generator (A.C.G.) 3-42
G. Pick-up Coil Assembly 3-43
H. Pistons and Cylinder 3-44

I. Cylinder Head and Cam Shafts 3-45
J. Cam Chain, Cam Sprockets and Chain Tensioner 3-46
K. Oil Delivery Pipe and Cylinder Head Cover 3-48
Remounting Engine 3-48
A. Remounting Engine 3-48

CHAPTER 3.
ENGINE OVERHAUL

Clutch
Disassembly page 3-9
Inspection page 3-30
Reassembly page 3-41

Kick Gear
Disassembly page 3-9, 3-18
Inspection page 3-32
Reassembly page 3-33, 3-42

Cylinder/Piston
Disassembly page 3-8, 3-9
Inspection page 3-24
Reassembly page 3-44

Starter Motor
Removal page 3-12
Reinstallation page 3-39

Top End
Disassembly page 3-6, 3-8
Inspection page 3-19
Reassembly page 3-45

Middle Gear
Removal page 3-5
Inspection page 3-32
Reinstallation page 3-48

Generator
Removal page 3-9
Reinstallation page 3-42

Shifter
Disassembly page 3-12,3-17
Inspection page 3-30
Reassembly page 3-34, 3-39

Primary Shaft/HY-Vo Chain
Disassembly page 3-14, 3-18
Inspection page 3-29
Reassembly page 3-35

Pick-Up Coil Ass'y
Removal page 3-11
Reinstallation page 3-43

Crankcase
Disassembly page 3-13
Inspection page 3-32
Reassembly page 3-37

Crankshaft/Connecting Rod
Disassembly page 3-16
Inspection page 3-26
Reassembly page 3-35

Oil Pump
Disassembly page 3-13
Inspection page 3-28
Reassembly page 3-38

Transmission
Disassembly page 3-14, 3-17
Inspection page 3-30
Reassembly page 3-33, 3-36



SPECIAL TOOLS

1. Clutch holder P/N 90890-04007
2. Piston ring compressor P/N 90890-04008
3. Drive axle holder P/N 90890-04009
4. Damper compressor P/N 90890-04011
5. Piston base P/N 90890-01067
6. Valve guide remover P/N 90890-01225
7. Valve guide installer P/N 90890-01226
8. Valve spring compressor P/N 90890-01253
9. Rotor puller P/N 90890-01080
10. Rotor holding tool P/N 90890-01235
11. Dial gauge stand P/N 90890-01258
12. Valve seat cutter P/N 90890-91043
13. Valve guide reamer P/N 90890-01227
14. Drive axle wrench P/N 90890-05245

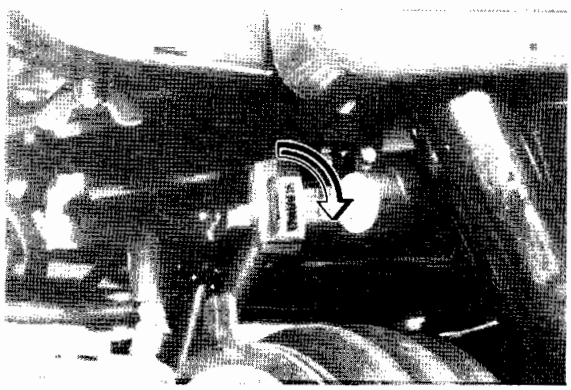
ENGINE OVERHAUL

NOTE:
It is not necessary to remove the engine in order to remove the cylinder head, cylinder, or pistons.

A. Preparation for Removal

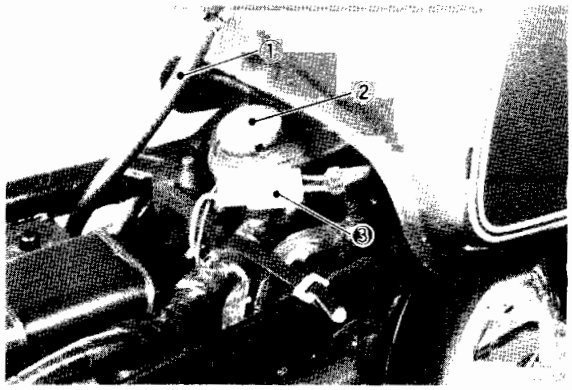
1. All dirt, mud, dust and foreign material should be thoroughly removed from the exterior of the engine before removal and disassembly. This will help prevent any harmful foreign material from engine oil.
2. Before engine removal and disassembly, be sure that you have the proper tools and cleaning equipment so that you can perform a clean and efficient job.
3. During disassembly of the engine, clean and place all of the parts in trays in order of disassembly. This will speed up assembly time and help insure correct reinstall-action of all the engine parts.
4. Place the machine on its center stand. Start the engine and allow it to warm up. Stop the engine and drain the engine oil.
5. Remove the oil filter element to drain the oil filter.
6. If the middle gear case is to be removed, drain the middle gear oil.
7. Remove the wing bolt with the cover and then take out the kick crank.
8. Remove the left and right side covers.

NOTE:
The left side cover is normally locked. To open the side cover, use the ignition key.



B. Seat and Fuel Tank Removal

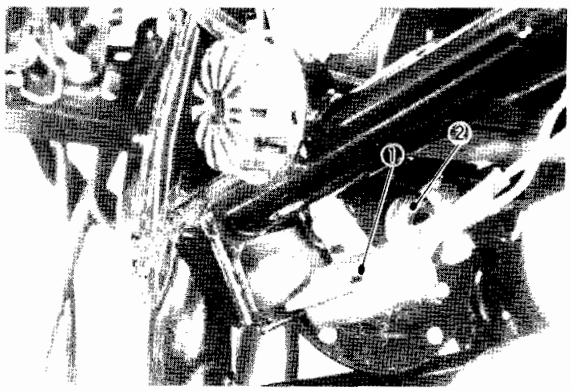
1. Loosen the 2 nuts that hold the seat to the frame. Slide the bolts in the seat to the front and remove the seat.
2. Remove the bolt that holds the fuel tank to the frame and remove the pipes. Disconnect the fuel gauge unit lead wires and remove the fuel tank.



1. Drain hose 2. Fuel tank holding bolt
3. Fuel gauge unit lead wires

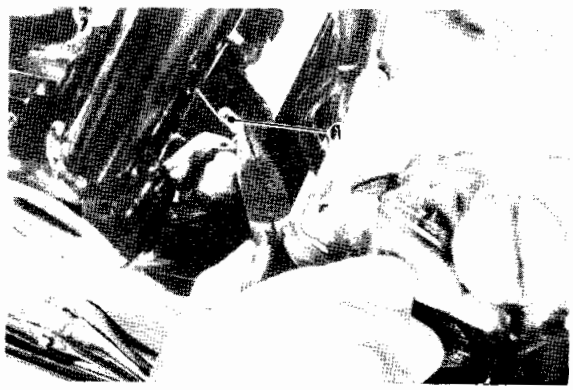
C. Ignition Ballast Resistor, Horn, Muffler, Footrest, Brake Pedal

1. Remove the resistor and the horn.



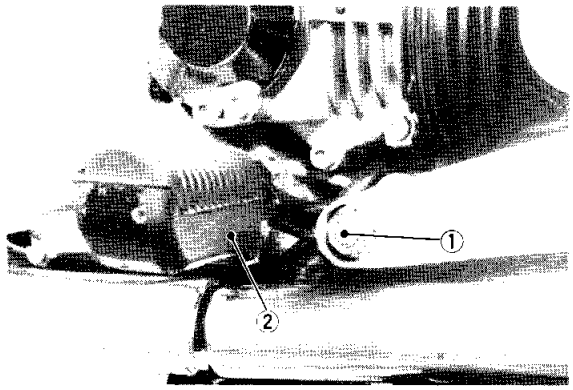
1. Resister 2. Horn

2. The right and left muffler and the footrests.
   a. Remove the brake switch spring at the brake lever.



1. Brake switch spring

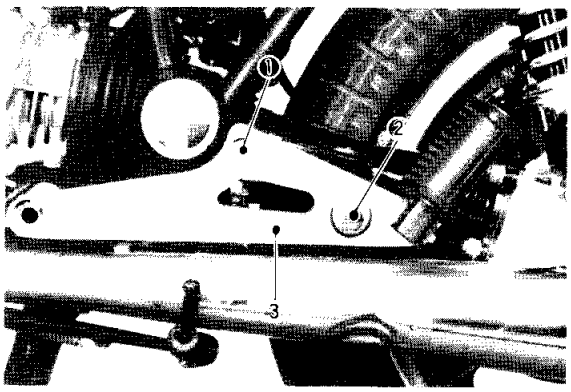
b. Remove the rear engine mounting through bolt and the footrests.
muffler brackets to the frame.



1. Engine mounting bolt
2. Footrest

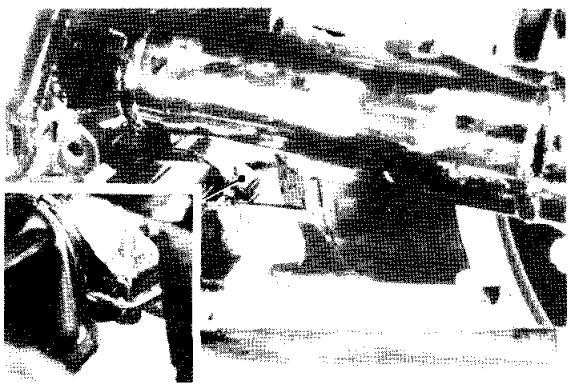
c. Remove the bolts holding the muffler brackets to the frame and remove the muffler brackets.

NOTE:
The brake pedal assembly and the right side muffler bracket can be removed as a single unit.

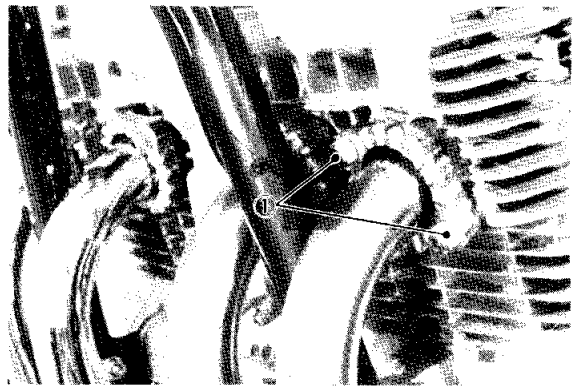


1. Bracket holding bolt
2. Muffler mounting bolt
3. Muffler bracket

d. Loosen the clamp securing the cross over pipe.



e. Remove exhaust pipe holding nuts from cylinder head.

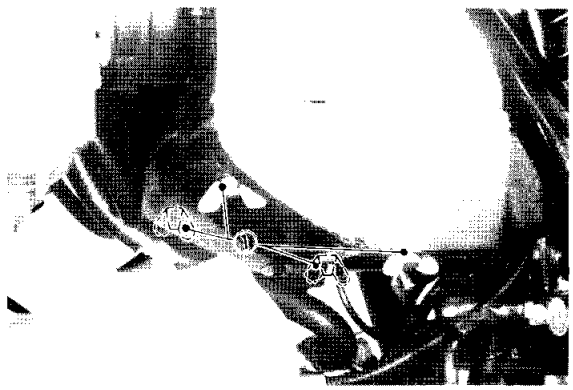


1. Exhaust pipe holding nuts

f. Remove the left and right exhaust pipes and mufflers as an assembly.

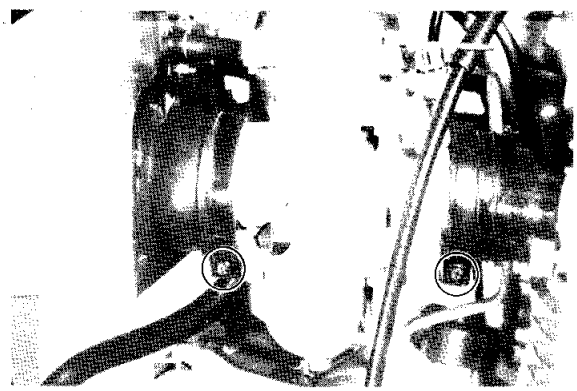
D. Air Cleaner Case

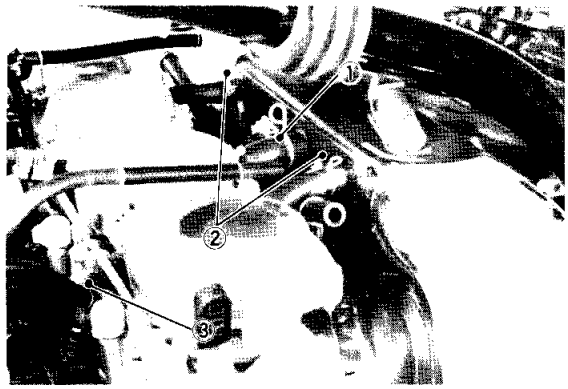
1. Remove the air filter cover and the filter by loosening the wing bolts.



1. Wing bolts

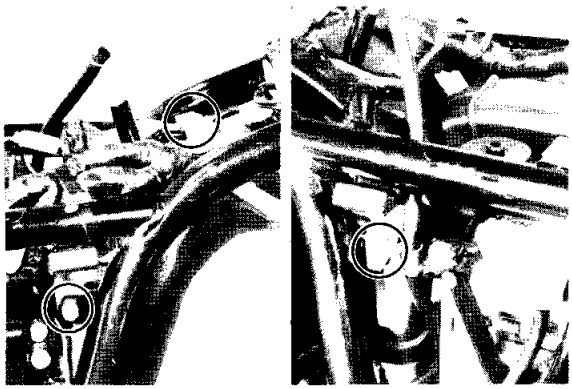
2. Loosen the clamp holding the carburetors to the air cleaner case and the carburetor joints.
3. Remove the crankcase breather hose and the carburetor ventilation hoses at the air cleaner case. Remove the vacuum advancer hose from No. 2 carburetor joint.



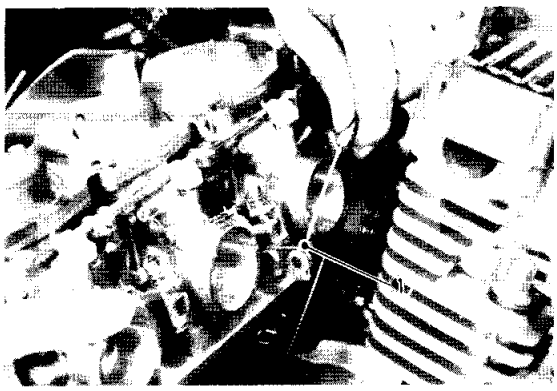


1. Breather hose 2. Ventilation hoses 3. Vacuum advance hose

4. Remove the bolts holding the air cleaner case to the frame.



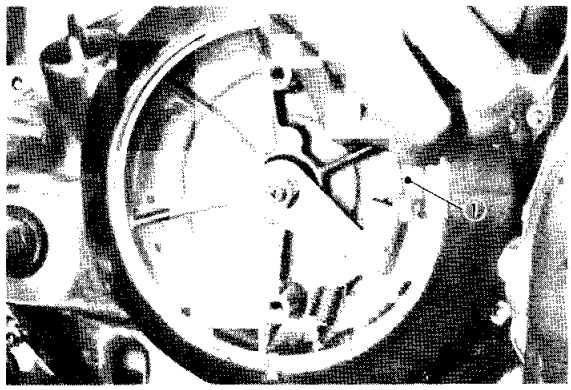
5. Pull the air cleaner case to the rear. Remove the clutch cable from the holder attached to the right carburetor. Lift the carburetors back and to the left. Remove the throttle cable from the carburetors.



1. Throttle cable

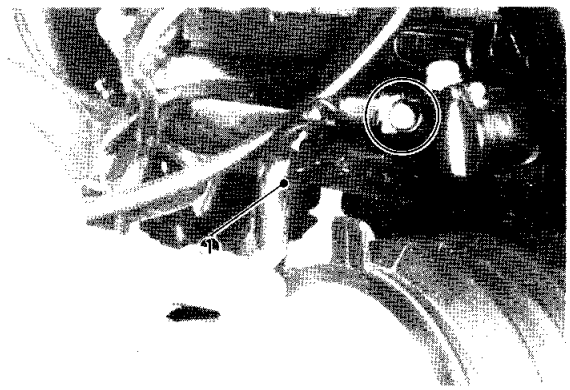
E. Wiring and Cables

1. Disconnect the battery ground wire at the battery terminal.
2. Remove the clutch cover and disconnect the clutch cable at the push lever.



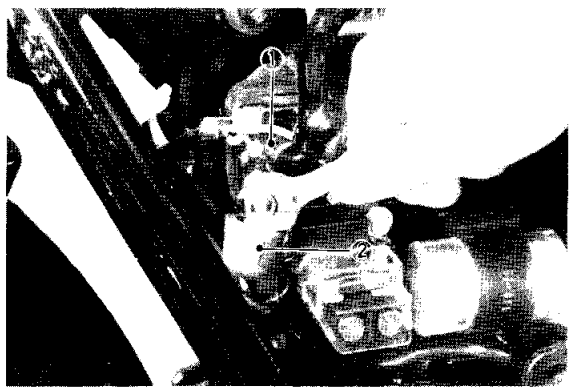
1. Clutch cable

3. Remove the spark plug wires.
4. Disconnect the engine ground wire at the frame side.



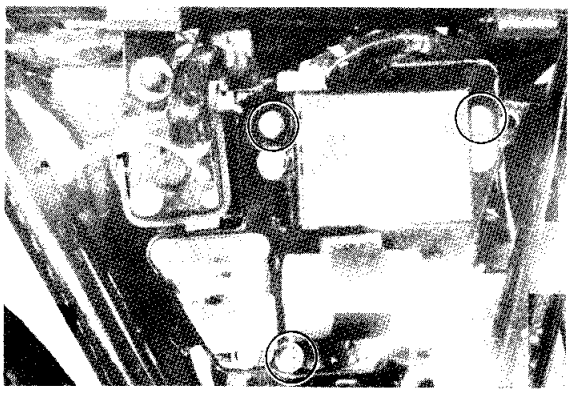
1. Ground wire

5. Disconnect the starter motor cable at the starter solenoid switch.

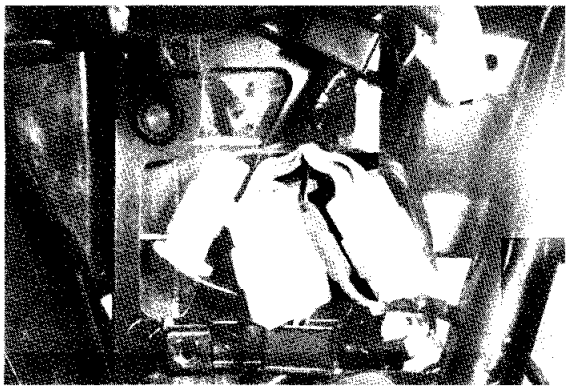


1. Starter solenoid switch
2. Starter motor cable

6. Remove the 3 screws holding the fuse box backing plate to the battery box.

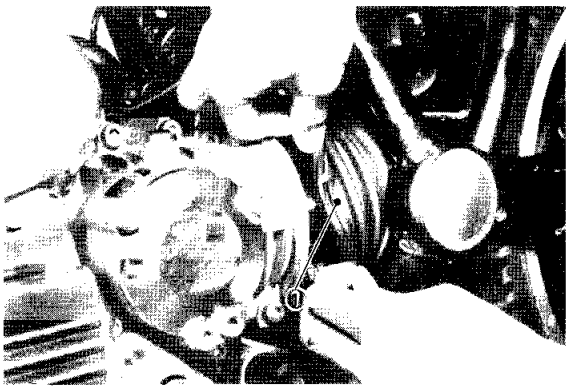


7. Disconnect the wiring harness couplers. Position the wires so that they can be safely removed.



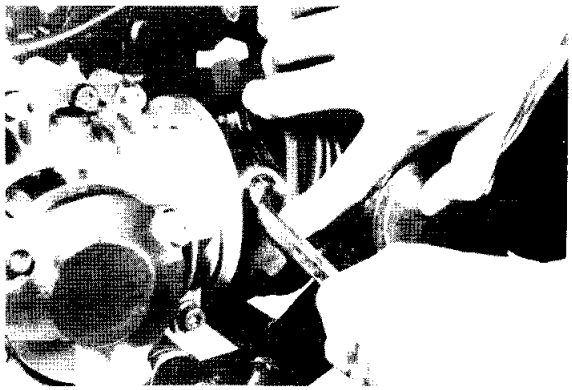
F. Drive Shaft Joint

1. Pull rubber boot from drive shaft coupling to expose 4 bolts.



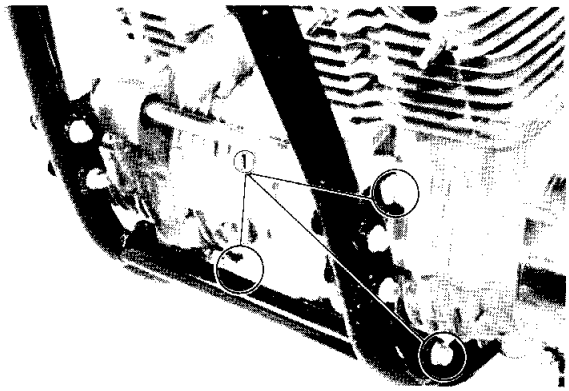
1. Rubber boot

2. Remove the 4 bolts on the drive shaft coupling.



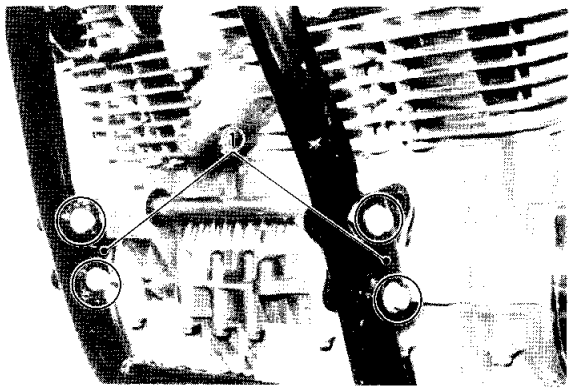
G. Removal

1. Remove the 3 engine mounting bolts from the frame.



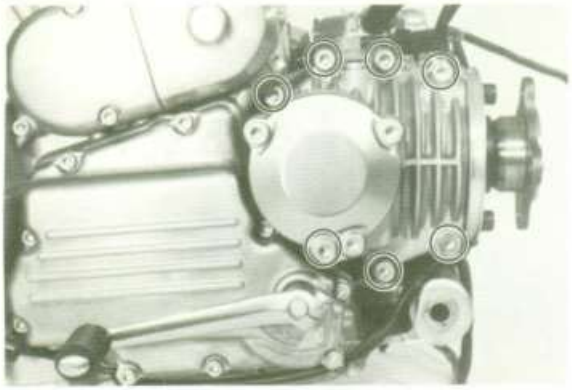
1. Engine mounting bolts

2. Remove the bolts securing the engine bracket to the frame.



1. Engine bracket

3. Slide the engine forward. Remove the engine to the right. Position a box or other support to the right of the machine for assistance when removing the engine.
4. Remove the 7 middle gear case securing bolts and remove the middle gear case.

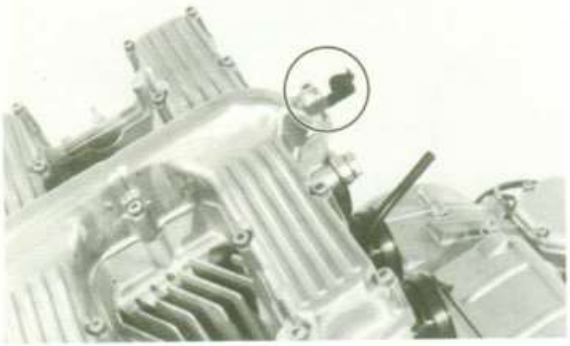


ENGINE DISASSEMBLY

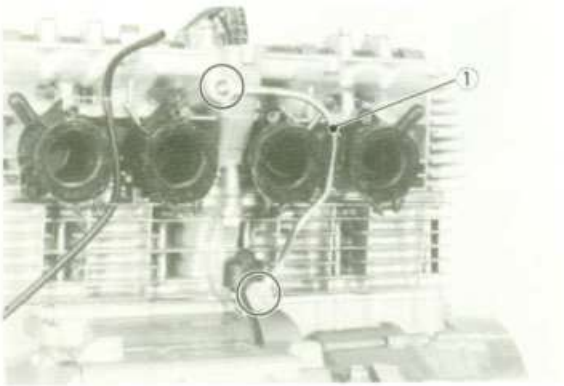
A. Cylinder Head and Cylinder Removal

NOTE:
Cylinder head and cylinder can be removed without removing engine.

1. Remove the cylinder head cover. Note the location of the throttle cable clip.

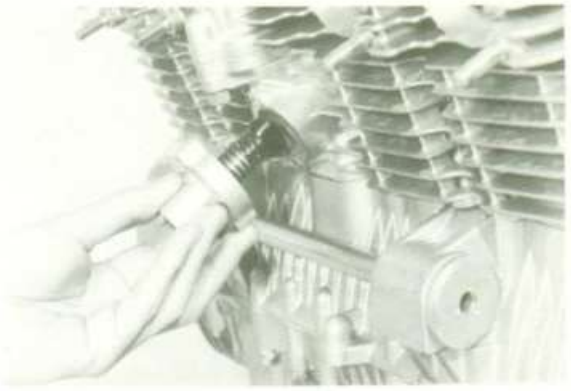


2. Remove the oil delivery pipe and copper washers.

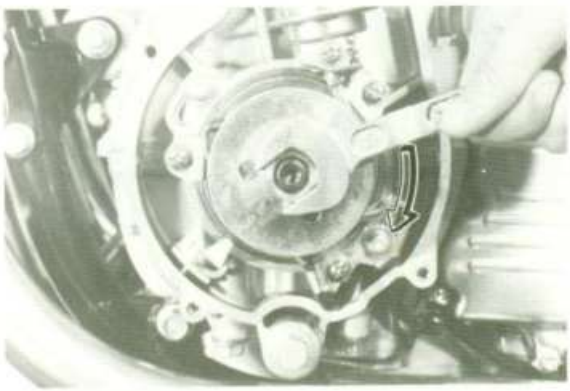


1. Oil delivery pipe

3. Remove the cam chain tensioners from the front of the engine.

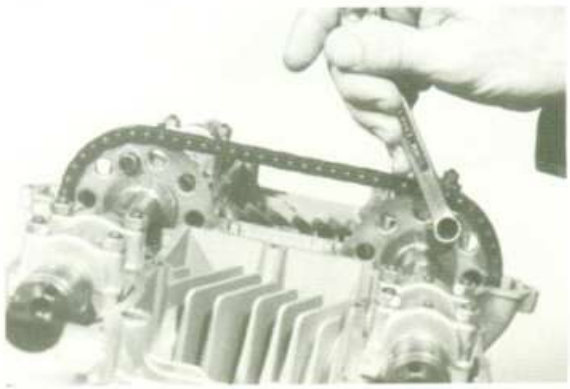


4. Remove the timing cover. Use a 19 mm wrench on the timing plate flats to rotate the crankshaft clockwise until the engine is at TDC. An important note: This engine rotates in a clockwise direction, contrary to Yamaha engines of the past.



CAUTION:
Never use an allen wrench to rotate the crankshaft. Always use the 19 mm flats provided on the timing plate to rotate this engine.

5. Remove the four cam sprocket bolts.



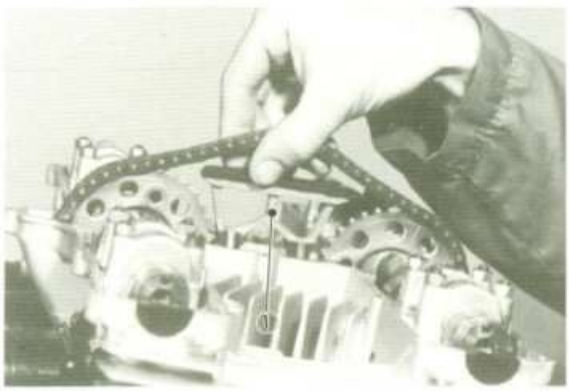
6. Slip each sprocket off its mounting boss on the cam.

CAUTION:

From this point on, do not rotate the cam shaft or valve damage may occur. On the XS1100E, it is not necessary to break the cam chain. However, it can be broken if so desired. It is easier to disassemble the engine without separating the chain.

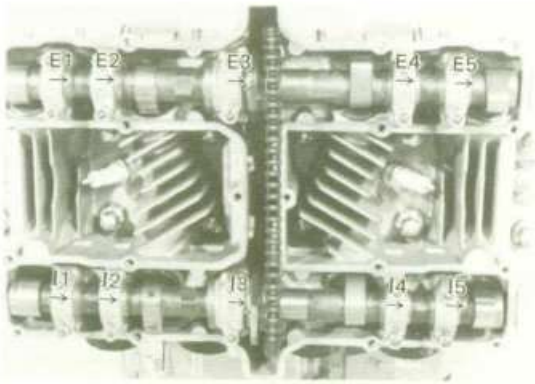


7. Remove the cam chain guide.

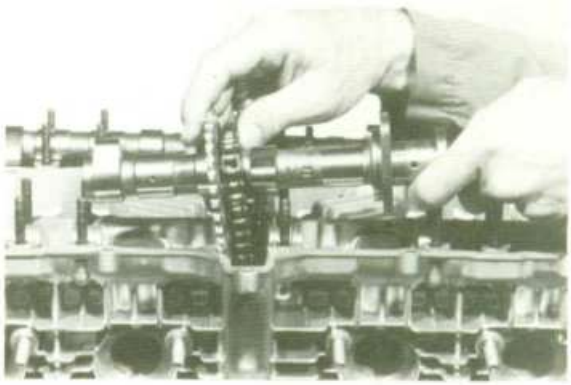


1. Cam chain guide

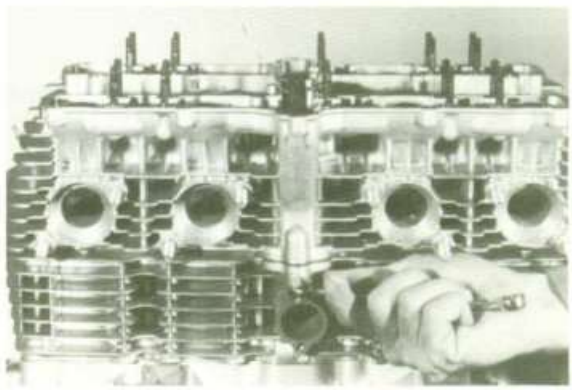
8. Note the location of the cam caps. The caps for the intake cams are identified I-1 through I-5. The exhaust cam caps are identified E-1 through E-5. The center cap for each cam is dowel pinned. Directional arrows are cast on each cap and point toward the alternator and the clutch side of the engine. Use the center caps as a reference.



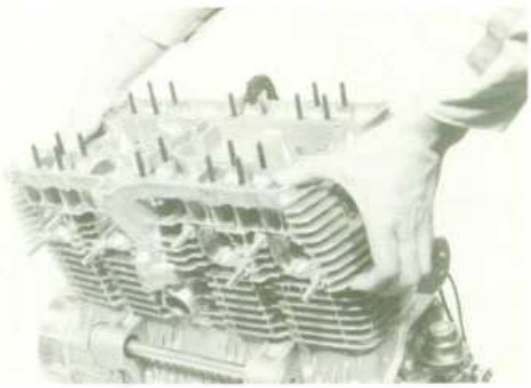
9. Fasten safety wire to the cam chain to prevent its falling into the crankcase cavity.
   Slide the cams and sprockets from under the chain and remove the cams and sprockets.

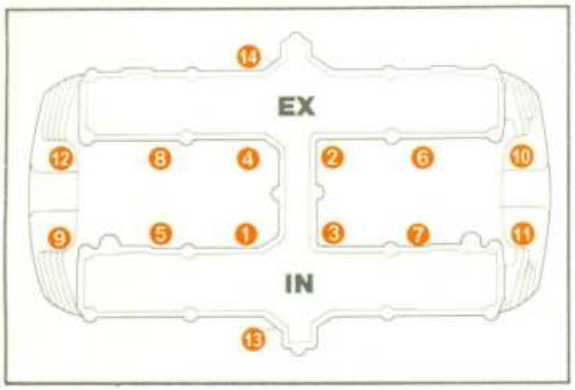


10. Remove the cylinder head nuts located in the front and the rear of the cylinder.

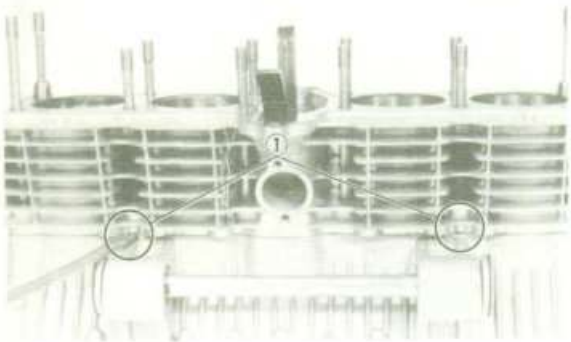


11. Remove the cylinder head nuts in the reverse order of the torque sequence. Start by loosening each nut 1/2 turn until all of the nuts are loose. Then remove the cylinder head.





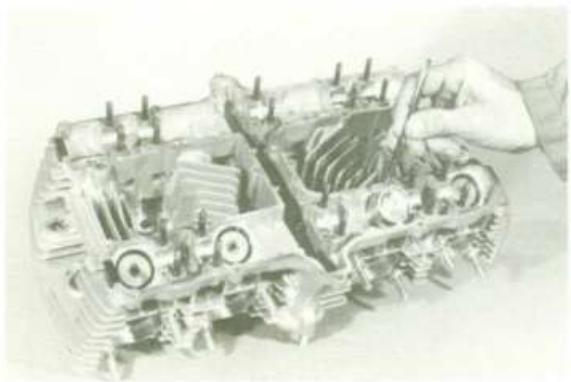
12. Remove the cylinder assembly. It may be necessary to tap the cylinder lightly to loosen it from the base gasket.
    If it is necessary to pry the cylinder loose from the base gasket, carefully use a broad, flat-bladed screw driver at the reinforced points shown.



1. Reinforcement points

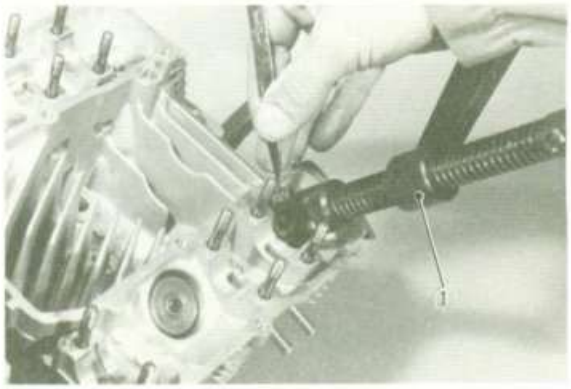
B. Cylinder Head Disassembly

1. Remove the valve lifters and pads. Be careful not to scratch the lifter bodies or lifter bores in the cylinder head.
   Be very careful to identify each lifters position so that it may be returned to its original place.



2. Mount the valve spring compressor on the head and depress each valve spring. Remove the keepers using a magnet and take out the retainer and valve springs with forceps.

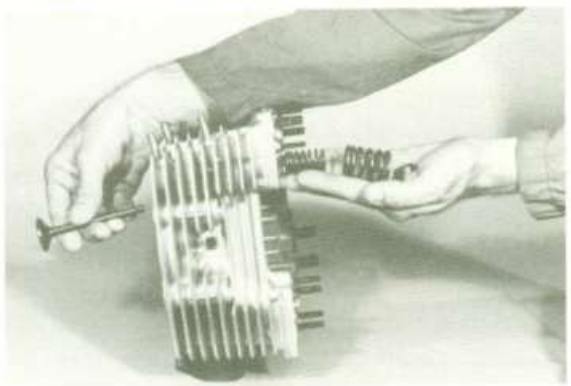
NOTE:
Note that the valve springs are progressively wound with the more tightly wound end facing the cylinder head.

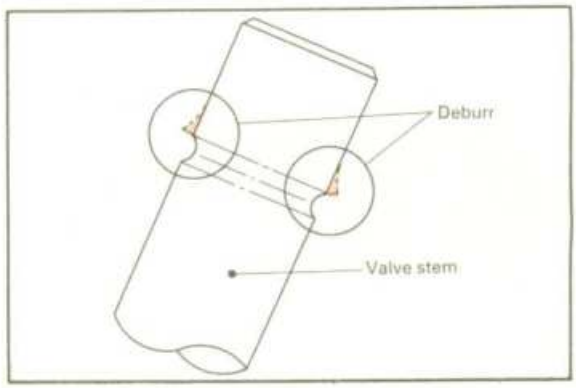


1. Valve spring compressor

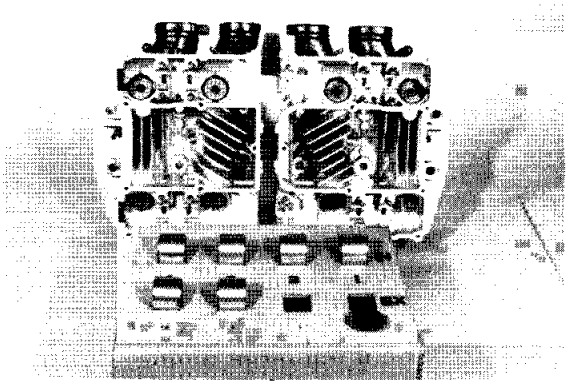
3. Remove valves.

NOTE:
Deburr any deformed valve stem end. Use an oil stone to smooth the stem end. This will help prevent damage to the valve guide during valve removal.



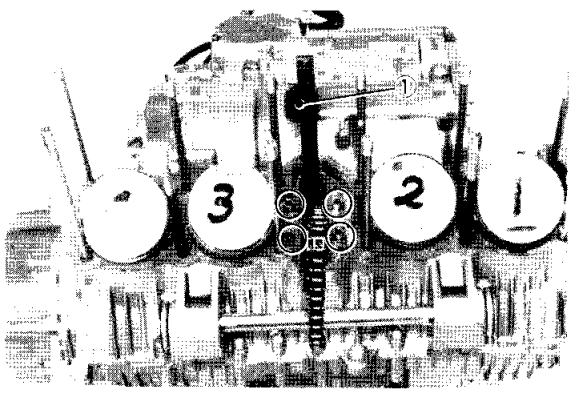


4. Use a small box to hold the parts and identify the original position of each lifter and valve. Be very careful not to mix the location of these components.



C. Piston and Cam Chain Dampers Removal

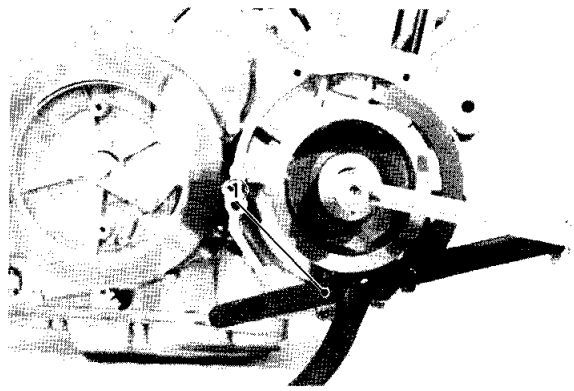
1. Mark each piston to aid in reassembly.
2. Place a clean towel or rag into the crankcase to keep circlips and material from falling into the engine.
3. Remove piston pin clips, piston pins, and pistons.
4. Remove the cam chain dampers.



1. Cam chain damper

D. Generator

1. Remove the bolts that hold the generator.
   After the wiring harness has been removed from the clips take off the stator assembly.
2. Remove the alternator rotor using the universal magneto and rotor holding tool (special tool) and the rotor puller bolt (special tool).



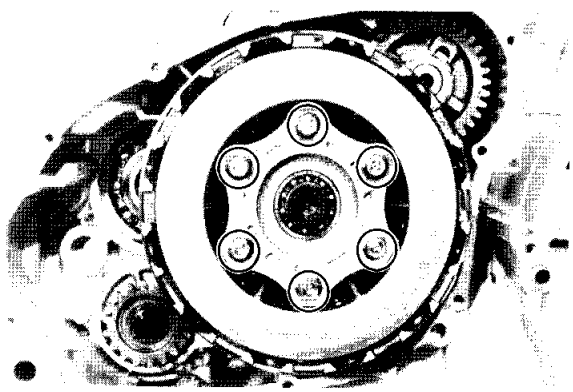
1. Universal magneto and rotor holding tool

E. Kick Shaft, Clutch and Primary Driven Gear

1. Remove the kick start shaft cap and then the right crankcase cover. Pull the kick crank spring off of the crankcase boss and remove the kick crank assembly.

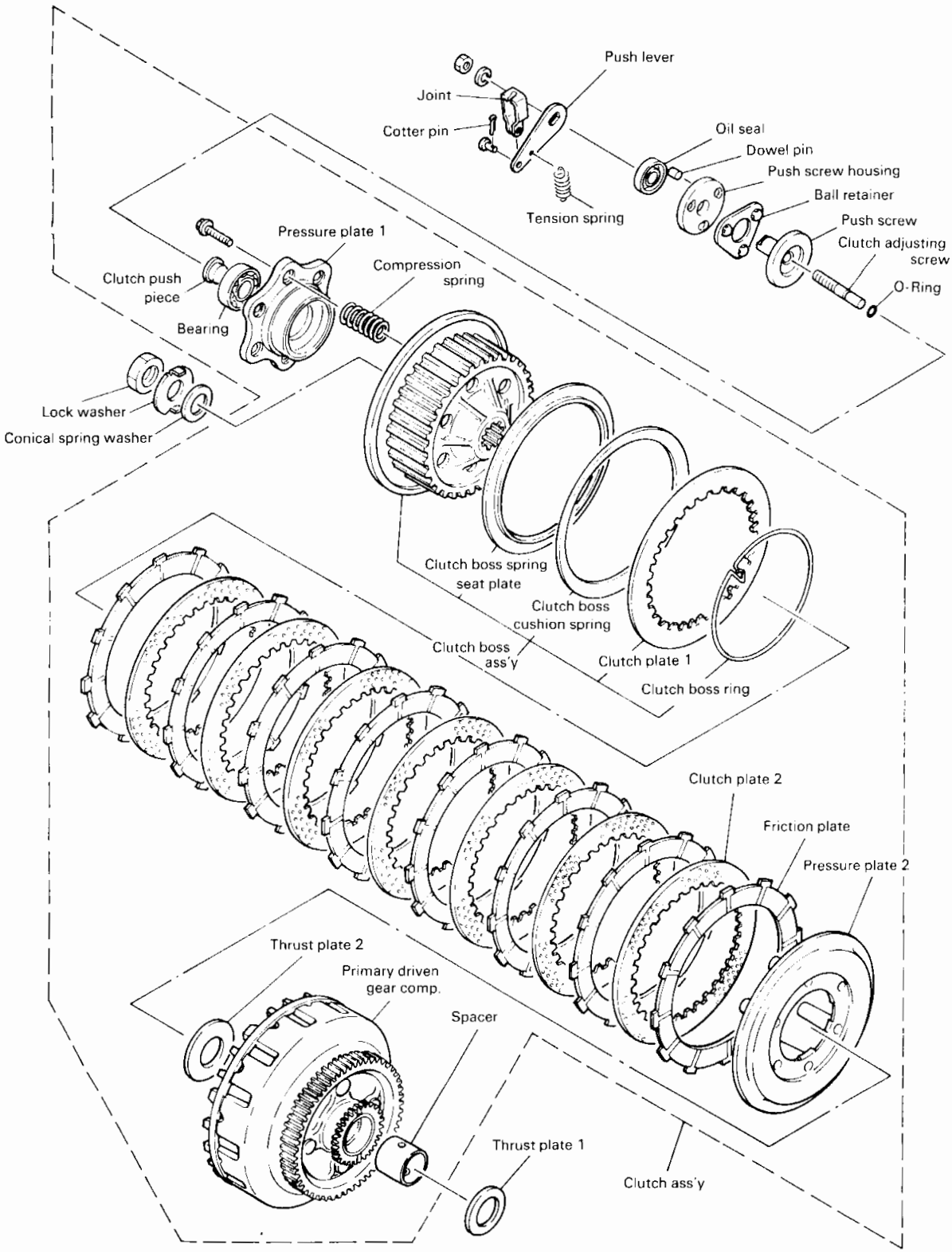


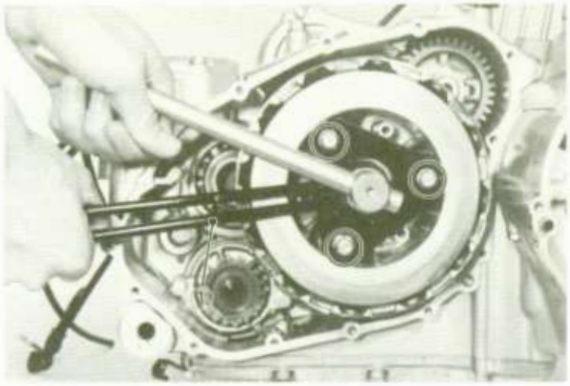
2. Release the tension evenly on the six 6 mm bolts and remove clutch pressure plate No. 1 and the six clutch springs.



3. After straightening the lock washer tab on the clutch unit, secure the clutch holding tool (special tool) to the clutch boss using three 6 mm clutch bolts.

CLUTCH


Push lever
Joint
Cotter pin
Oil seal
Dowel pin
Push screw housing
Ball retainer
Push screw
Clutch adjusting screw
O-Ring
Tension spring
Pressure plate 1
Clutch push piece
Bearing
Compression spring
Lock washer
Conical spring washer
Clutch boss spring seat plate
Clutch boss cushion spring
Clutch boss ass'y
Clutch plate 1
Clutch boss ring
Clutch plate 2
Friction plate
Pressure plate 2
Thrust plate 2
Primary driven gear comp.
Spacer
Thrust plate 1
Clutch ass'y



1. Clutch holding tool

CAUTION:

Use a new lock washer during reassembly.

CAUTION:

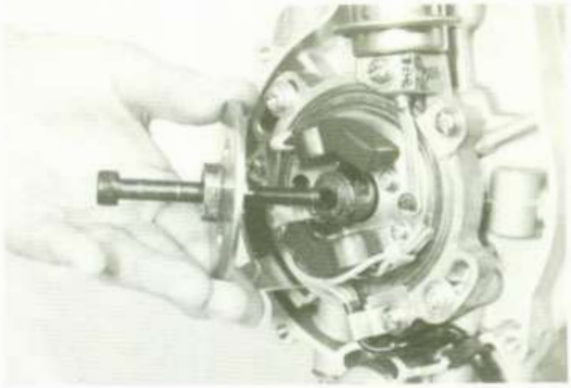
Failure to secure the clutch tool with the bolts could result in a broken clutch boss.

4. Remove the clutch nut.
5. Remove the clutch holding tool along with the clutch boss clutch plates and pressure plate and remove the three clutch bolts from the clutch holding tool.
6. Take off the thrust washer, clutch housing and primary driven gear.
   Remove the thrust washer from the main axle.



F. Pick-up Coil Assembly Removal

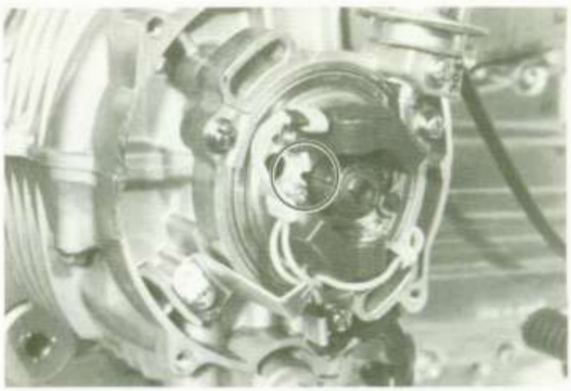
1. Remove the allen bolt that holds the timing plate.



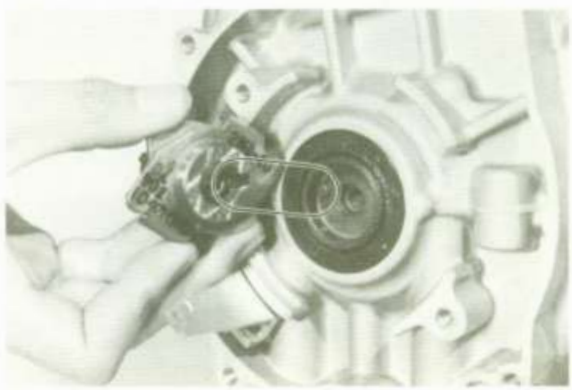
2. Remove the pick-up coil assembly by removing the two Phillips head screws which hold the assembly to the crankcase.

NOTE:

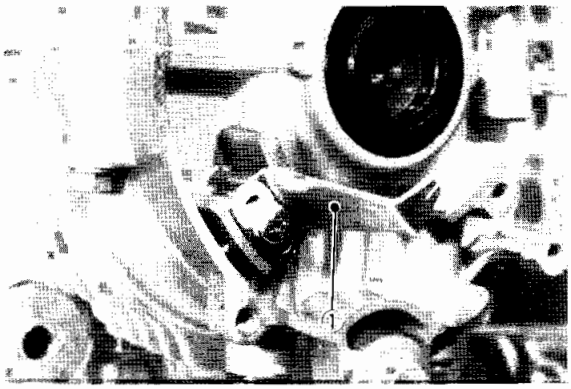
Note that there is a slot in the pick-up coil backing plate. This slot must align with the projection on the governor assembly so that the backing plate can be removed.



3. Remove the governor. Notice that the governor assembly is indexed by a pin on the end of the crankshaft.



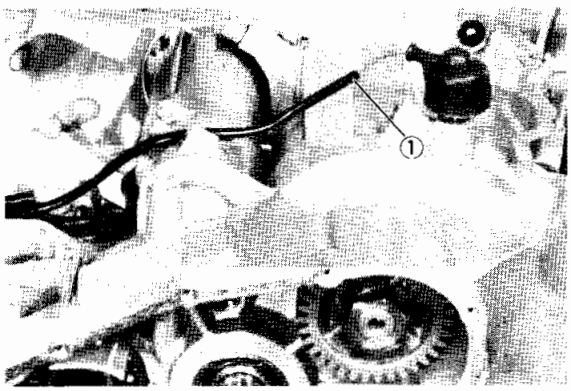
4. Remove the timing pointer from the crankcase. This will prevent it from being damaged when turning the crankcases over on the bench.



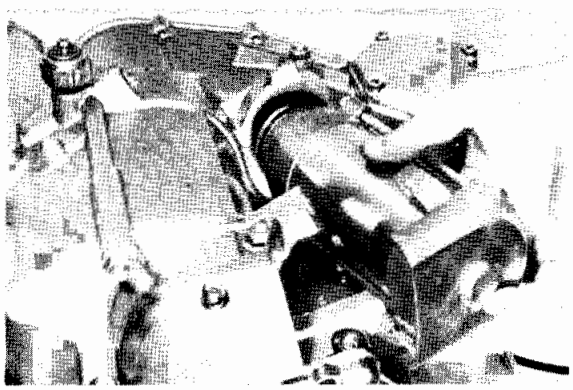
1. Timing pointer

G. Starter Motor Removal

1. Remove the 3 bolts holding the starter motor and cover.
2. Remove the oil pressure switch lead wire from the pressure switch.
3. Remove the cover and the starter motor.



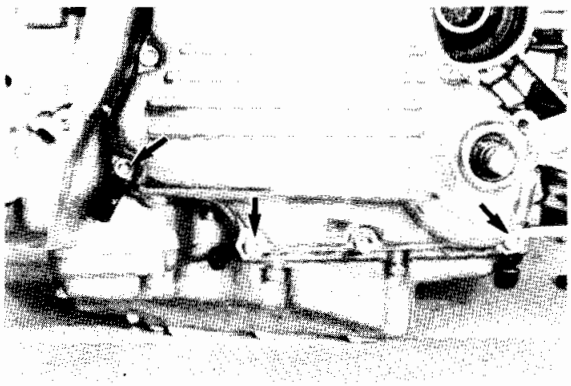
1. Oil pressure switch lead wire



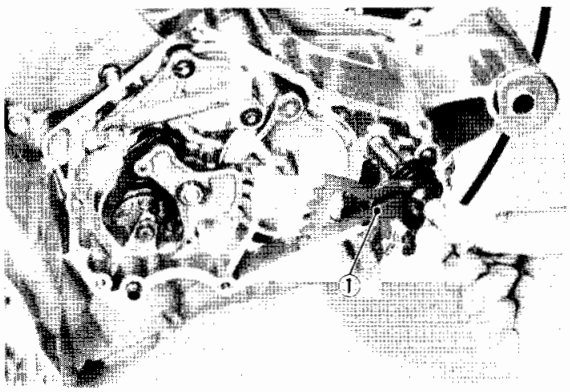
H. Shifter

1. Remove the change pedal and the left hand crankcase cover.

Note the positions of the wire harness clips.

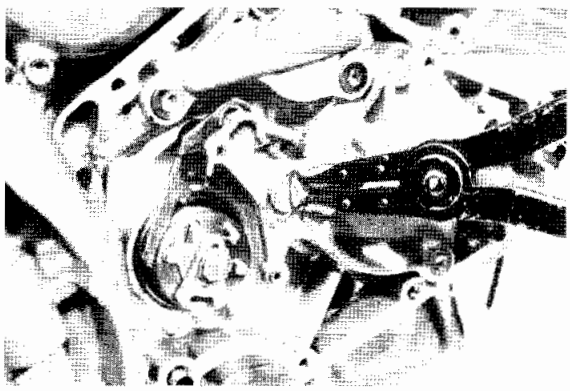


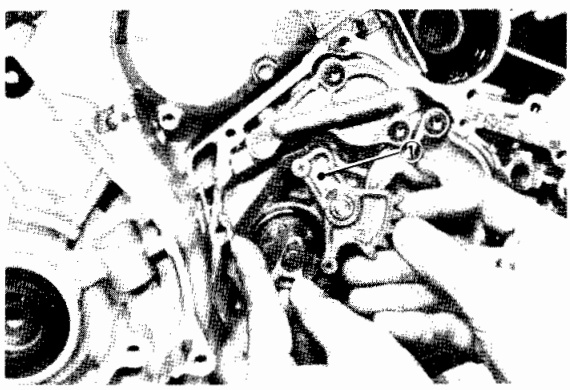
2. Remove the shift shaft assembly.



1. Shift shaft assembly

3. Remove the circlip and shift lever No. 2.

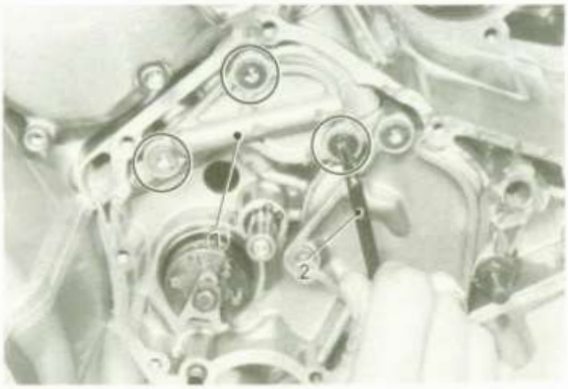




1. Shift lever No. 2

NOTE:
Use a new circlip during reassembly.

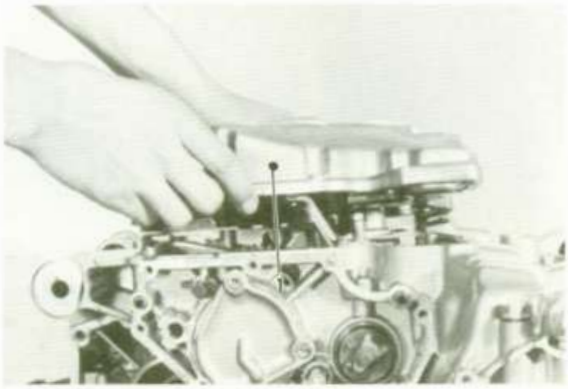
4. Using the drive axle wrench (special tool) remove the three countersunk screws securing the special oil nozzle. remove the nozzle.



1. Special oil nozzle
2. Drive axle wrench

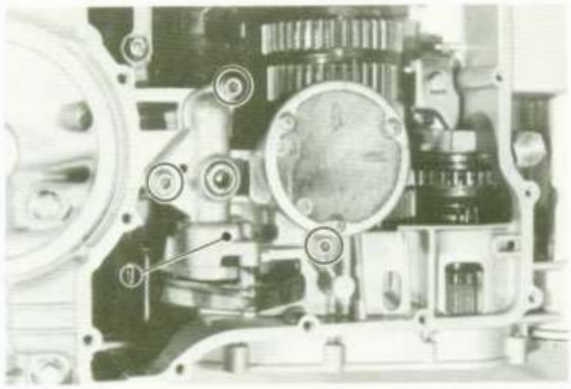
I. Oil Pump Removal and Disassembly

1. Remove the strainer cover.



1. Strainer cover

2. Remove the oil pump assembly.



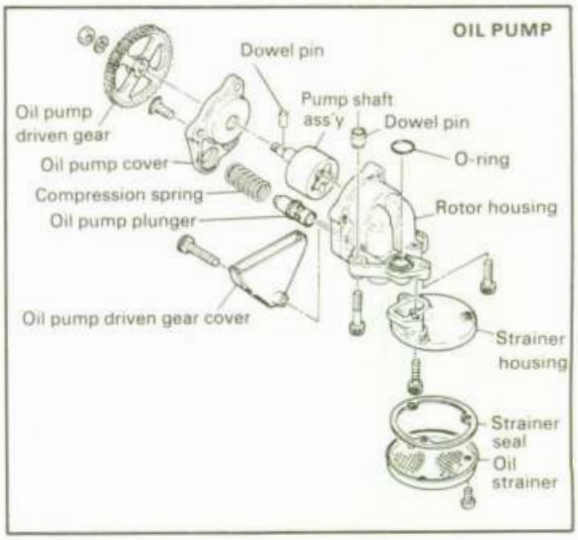
1. Oil pump

3. Remove the driven gear cover, driven gear, and retaining pin.



1. Gear cover 2. Driven gear 3. Retaining pin

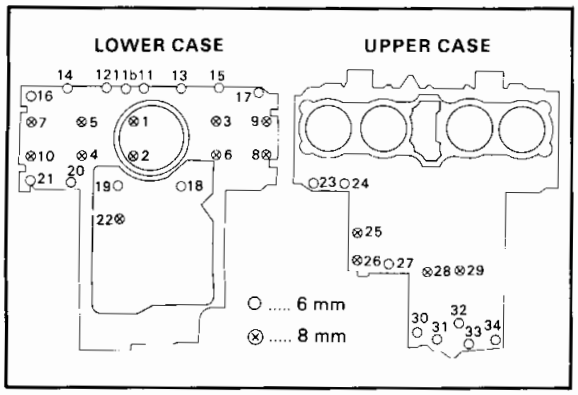
4. Remove the oil pump cover, the rotor assembly and the pressure relief valve.



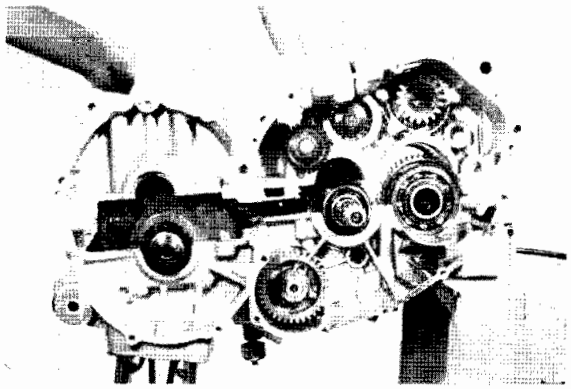
J. Crankcase Disassembly

1. Refer to the illustration for the crankcase bolt removal sequence. Start with the highest numbered bolt. Loosen all bolts 1/2 turn, then remove the bolts. The crankshaft area bolts should be loosened last. Notice that the bolts in the oil filter cavity have no washers, while the other crankshaft area bolts use washers.

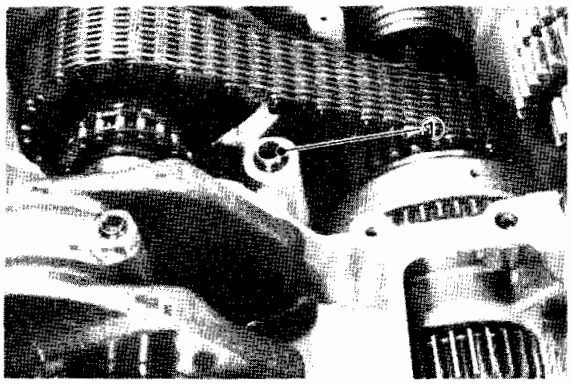
CAUTION:
Before trying to separate the crankcases, remove the crankcase breather cover and remove the hidden bolt located under the cover.



2. Turn the engine upside down and lift off the lower case half. The crankshaft will remain in the upper case half. Prop the engine up to prevent damage to the cylinder studs.

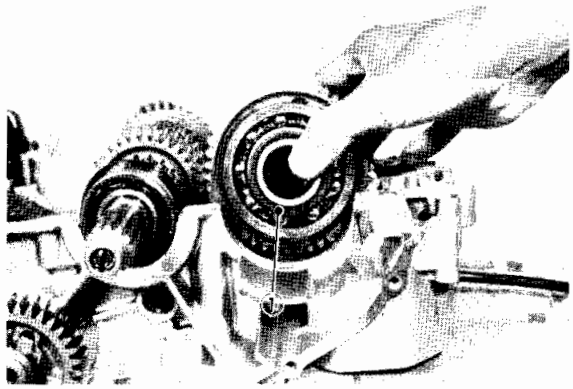


3. The arrow indicates an important "O-ring" and oil passage in the top case half. Take care not to allow any dirt or foreign matter to enter this passage.



1. "O"-ring

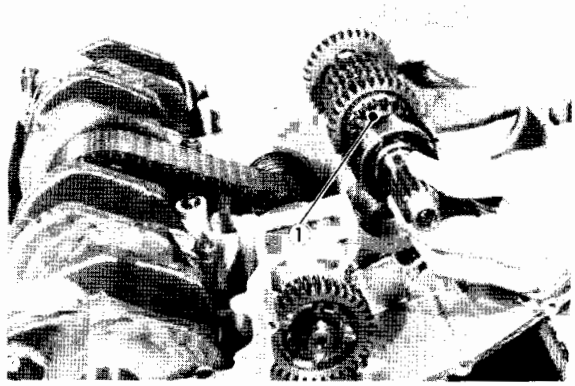
4. Remove the middle driven gear assembly from the upper case half.



1. Middle driven gear assembly

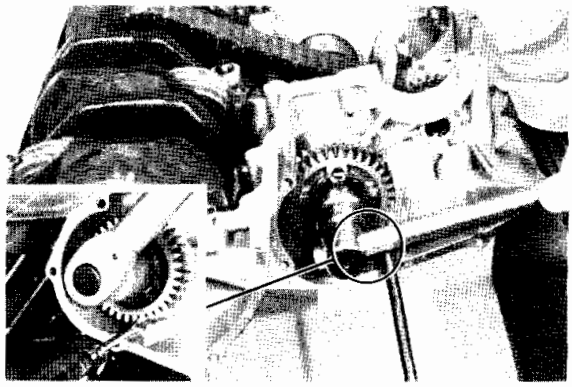
NOTE:
Always use a new oil seal when reassembly.

5. Remove the main axle assembly from the upper case half.

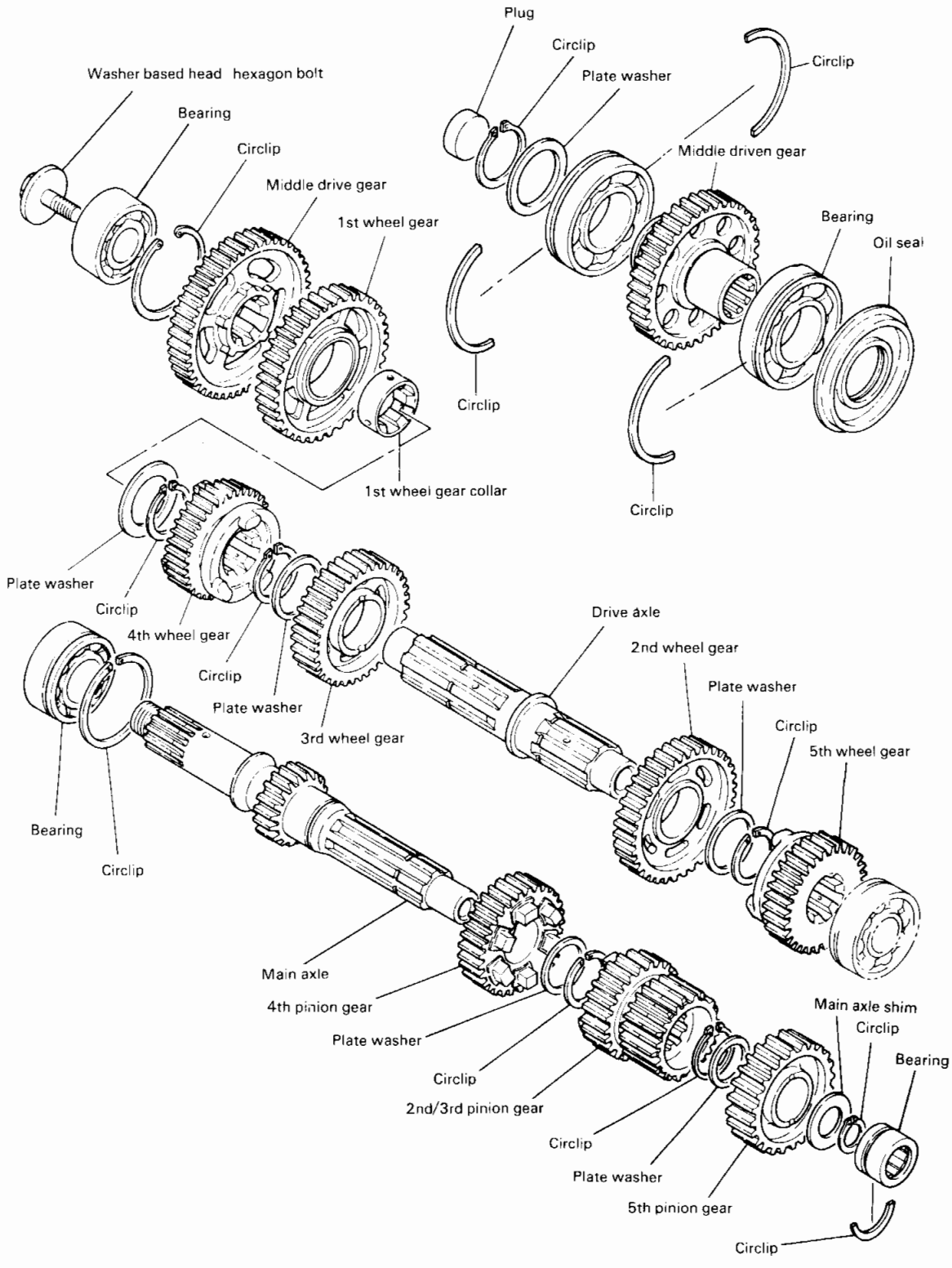


1. Main axle assembly

6. Straighten the lockwasher tab and loosen the holding nut. Place a large flat bladed screwdriver into the slot provided in the crankcase to prevent the primary drive gear from turning when loosening the nut. Next, take off conical spring washer located under the lock tab and remove the gear.

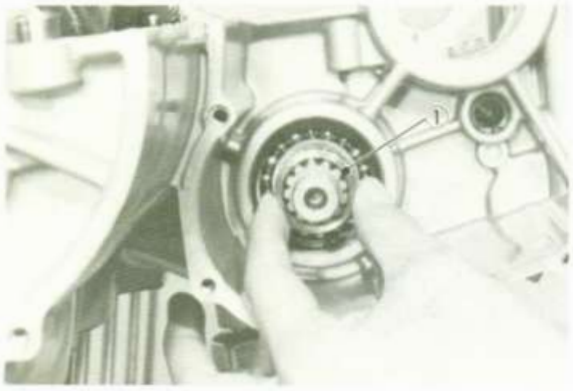


TRANSMISSION



CAUTION:
Replace lockwasher during reassembly.

7. Remove the spacer from the primary shaft.



1. Spacer

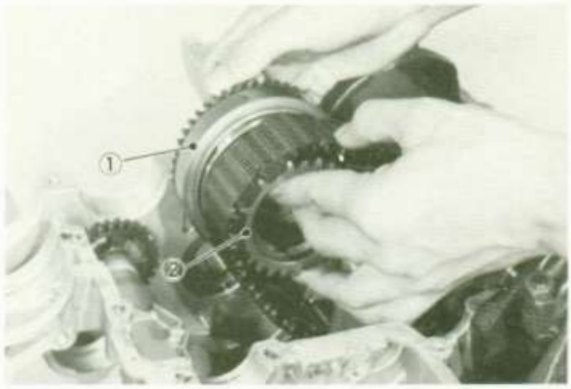
8. Remove the 3 allen screws and lightly tap the right end of primary shaft with a soft faced hammer and then pull out the primary shaft bearing housing. Remove the primary shaft.





1. Primary shaft

9. With the primary shaft removed, the starter clutch assembly and primary chain gear can be removed.

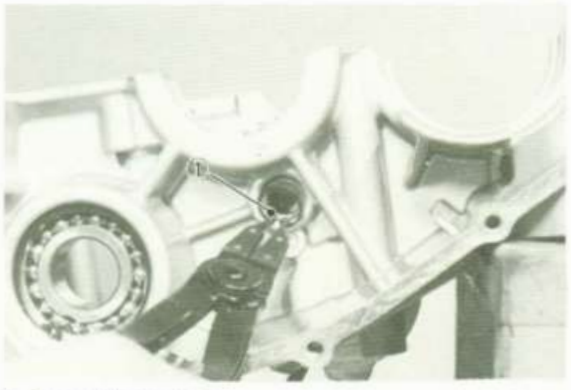


1. Starter clutch assembly
2. Primary chain gear

10. Lift the crankshaft with connecting rods from the case.

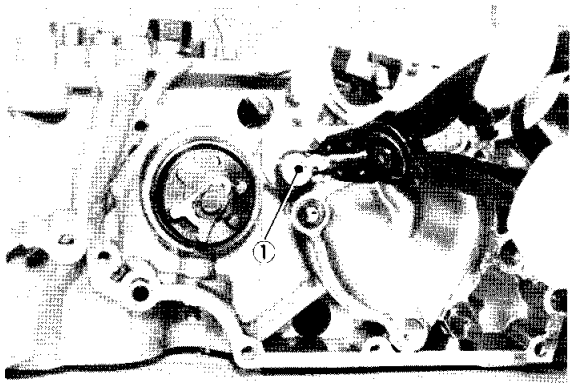


11. Mark the original location of each connecting rod and cap and then remove the rods.
12. Slip the primary chain and cam chain over the crank webs and remove the chains.
13. Remove the starter idle gear from the upper case half.



1. Starter idle gear shaft

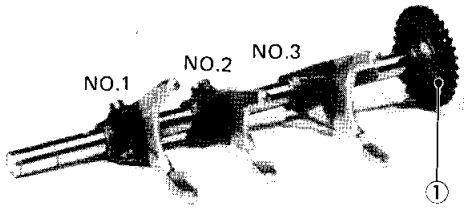
14. Remove the circlip securing the shift fork guide bar and pull out the bar and shift forks. The shift forks are identified by numbers cast on their sides.



1. Shift fork guide bar

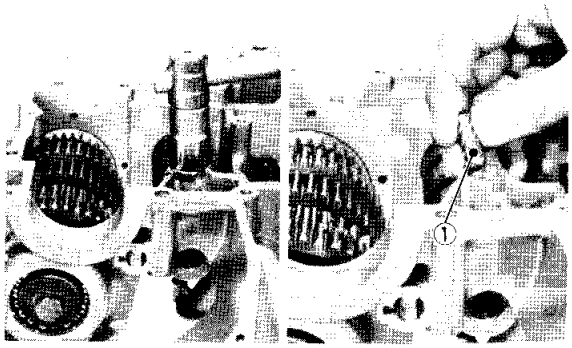
NOTE:

The gear on the end of this shaft is the oil pump idle gear.



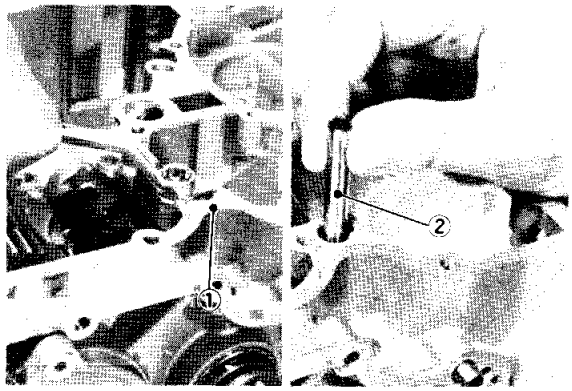
1. Oil pump idle gear

15. Remove the shift cam detent.



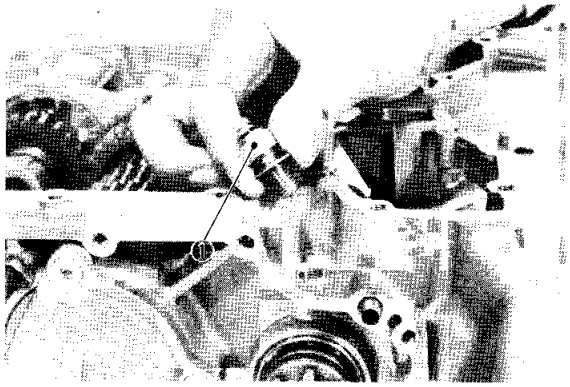
1. Shift cam detent

16. Remove the bolt, retainer and guide pin.



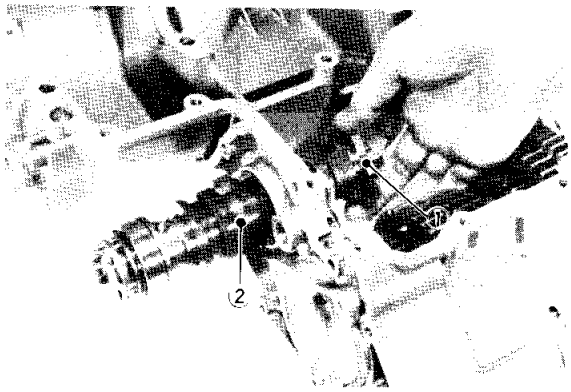
1. Retainer 2. Guide pin

17. Remove the neutral indicator switch.



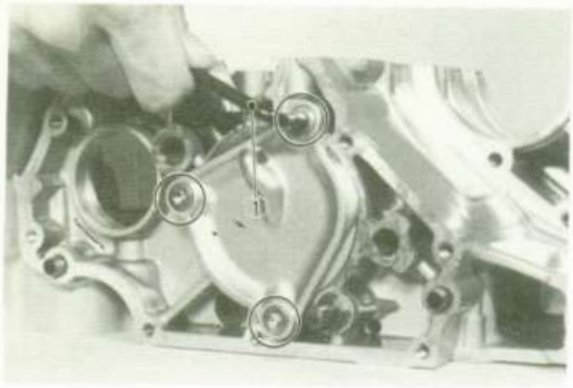
1. Neutral indicator switch

18. Remove the circlip holding the stopper plate to the shift cam and remove the shift cam.



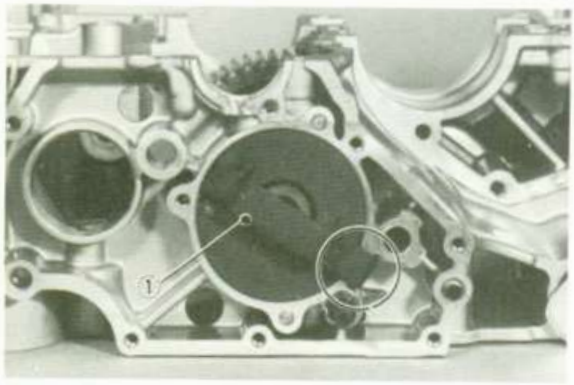
1. Stopper plate 2. Shift cam

19. Remove the three screws holding the drive axle bearing housing and remove the housing.
    Using the drive axle werench (special tool) remove the three countersunk, Loctited screws securing the drive axle bearing housing.
    Remove the housing.



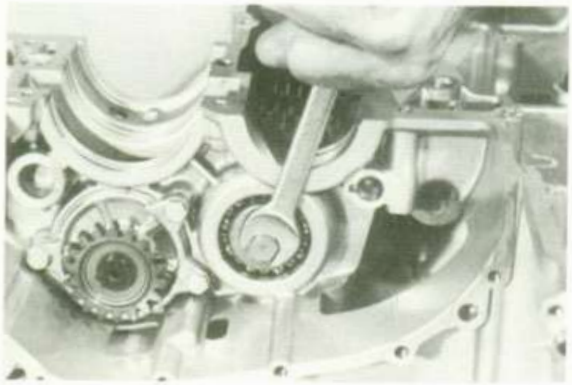
1. Drive axle wrench

20. Mount the drive axle holding tool (special tool) on the end of the drive axle.
21. Place the projection of the tool against the shift lever eccentric screw in the crankcase.

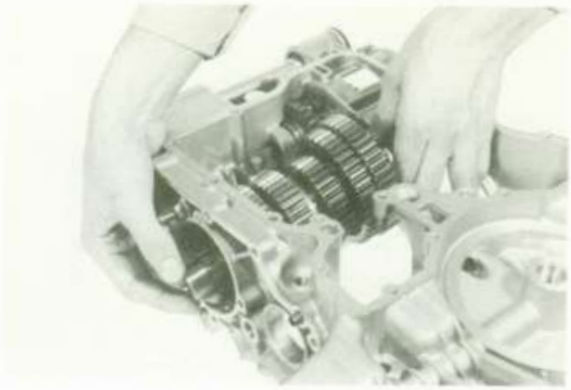


1. Drive axle holding tool

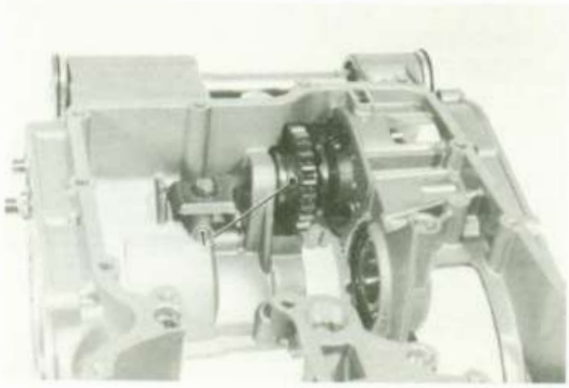
22. Loosen the washer based bolt on the opposite end of the drive axle.



23. To remove the drive axle, tilt it up and pull it out of the lower crankcase.



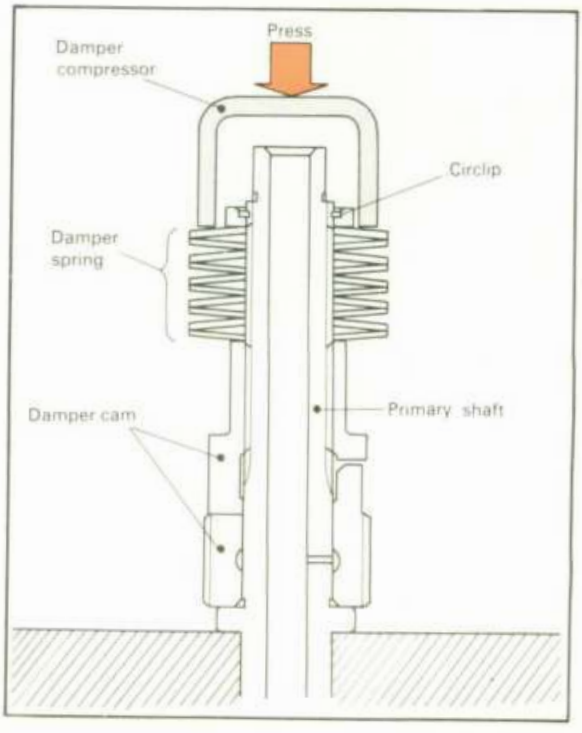
24. Remove the kick idle gear from the lower case half.



1. Kick idle gear

K. Primary Shaft Disassembly

1. Disassembly of the primary shaft requires the special primary shaft damper tool (special tool) and a hydraulic press. Place the shaft in a press with the special tool in place as shown.



2. Apply minimal hydraulic pressure to the special tool and remove the snap ring. Slowly relieve the hydraulic pressure and remove the tool and primary shaft assembly.

INSPECTION AND REPAIR

A. Cylinder Head Cover

Place head cover on a surface plate. There should be no warpage. Correct by re-surfacing as follows:

Place No. 400 or No. 600 grit wet sandpaper on surface plate and re-surface head cover using a figure-eight sanding pattern. Rotate head cover several times to avoid removing too much material from one side.

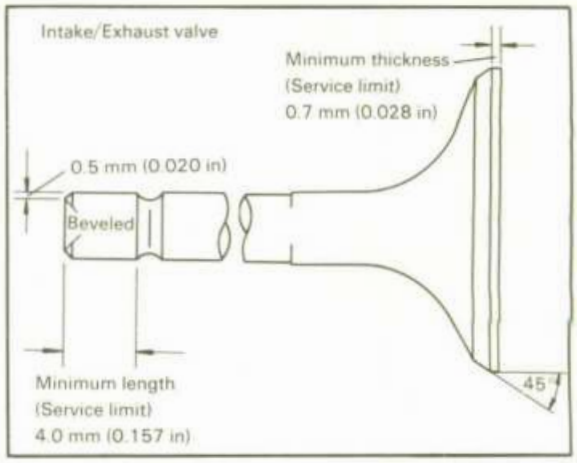
B. Cylinder Head

1. Remove spark plugs.
2. Remove valves.
3. Using a rounded scraper, remove carbon deposits from combustion chamber. Take care to avoid damaging spark plug threads and valve seats. Do not use a sharp instrument. Avoid scratching the aluminum.
4. Place on a surface plate. There should be no warpage. Correct by re-surfacing as follows:

   Place No. 400 or No. 600 grit wet sandpaper on a surface plate and re-surface head using a figure-eight sanding pattern. Rotate head several times to avoid removing too much material from one side.

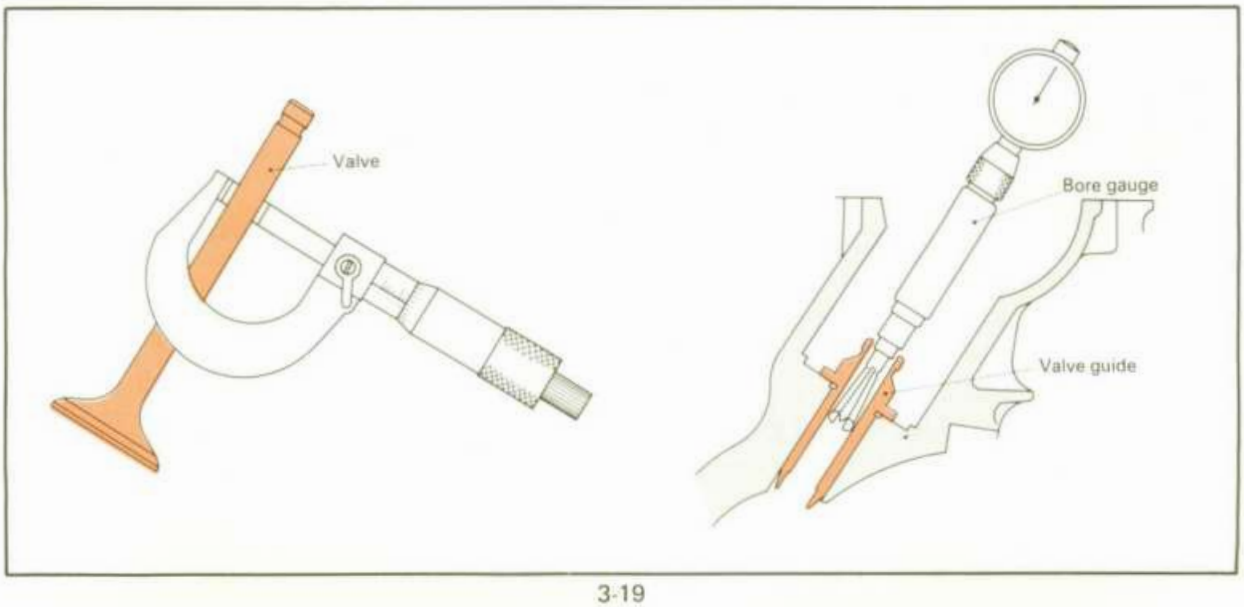
C. Valve, Valve Guide and Valve Seat

1. Check the valve face and the stem end for wear. If the valve face and/or the stem end are pitted or worn, regrind the valve with a valve refacer. Replace the valve if any dimension exceeds the specifications in the illustration.



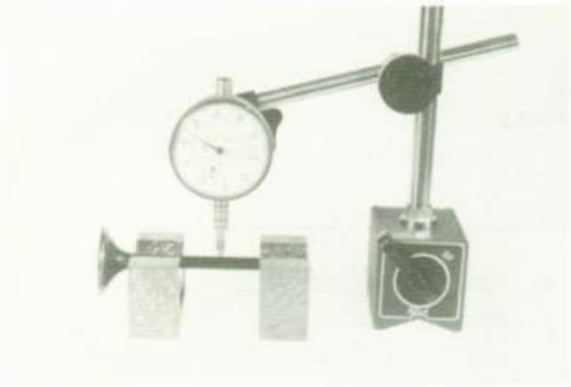
2. Valve stem wear must be measured and then combined with valve guide measurements to guide clearance. This clearance must be within tolerances. If it exceeds the maximum limit, then replace either or both valve and guide, as necessary.

	Valve Stem Clearance	Maximum
Intake	0.020~0.041 mm (0.0008~0.0016 in)	0.10 mm (0.004 in)
Exhaust	0.035~0.059 mm (0.0014~0.0023 in)	0.12 mm (0.005 in)



3. Valve stem end
   Inspect end of valve stem. If the end appears to be "mushroomed" or has a larger diameter than the rest of the stem, the valve, valve guide, and oil seal should be replaced.
4. Turn valve on a "V" block and measure the amount of stem runout with a dial gauge. *If it exceeds* the maximum limit, replace the valve.

Maximum Valve Stem Runout:
0.03 mm (0.0012 in)



5. Valve guide and valve oil seal replacement
   If oil leaks into the cylinder through a valve due to a worn valve guide, or if a valve is replaced, the valve guide should also be replaced.

NOTE:
The valve oil seal should be replaced whenever a valve is removed or replaced.

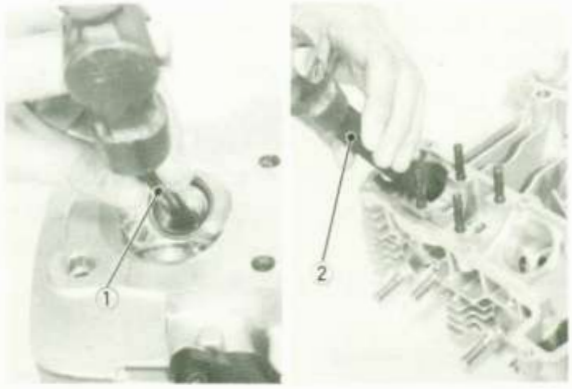
a. Measure valve guide inside diameter with a small bore gauge. If it exceeds the limit, replace with an oversize valve guide.

Guide diameter (I.D.):
Limit: 7.10 mm (0.280 in)

b. To ease guide removal and reinstallation, and to maintain the correct interference fit, heat the head to 100°C (212°F). Use an oven to avoid any possibility of head warpage due to uneven heating.

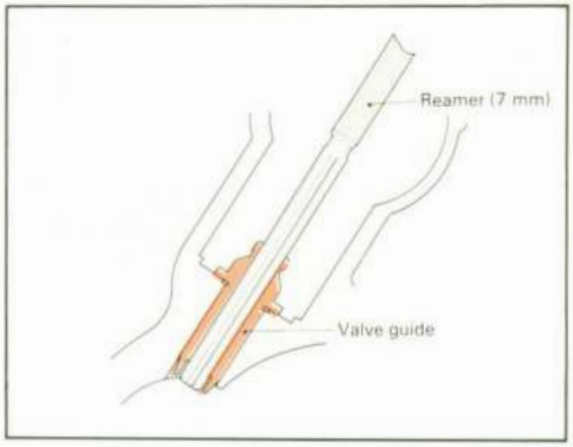
c. Use the appropriate shouldered punch (special tool) to drive the old guide out and drive the new guide in.

NOTE:
When a valve guide is replaced, the o-ring should also be replaced.

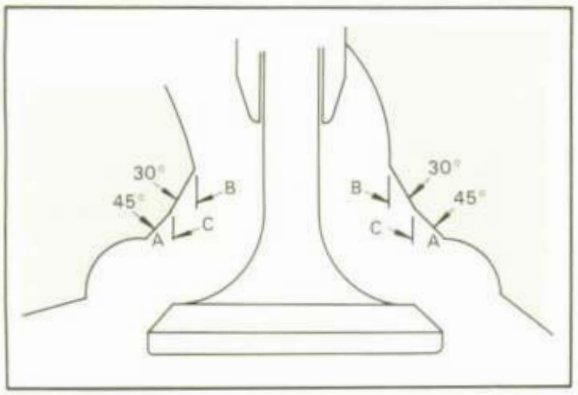


1. Valve guide remover
2. Valve guide installer

d. After installing the valve guide, use the 7 mm reamer (special tool) to obtain the proper valve guide to valve stem clearance.



e. After installing the valve guide in the cylinder head, the valve seat must be recut. The valve should be lapped to the new seat.
6. Grinding the Valve Seat
a. The valve seat is subject to severe wear. Whenever the valve is replaced or the valve face is re-surfaced (see caution) the valve seat should be re-surfaced at a 45° angle. If a new valve guide has been installed the valve seat must be recut to guarantee complete sealing between the valve face and seat.



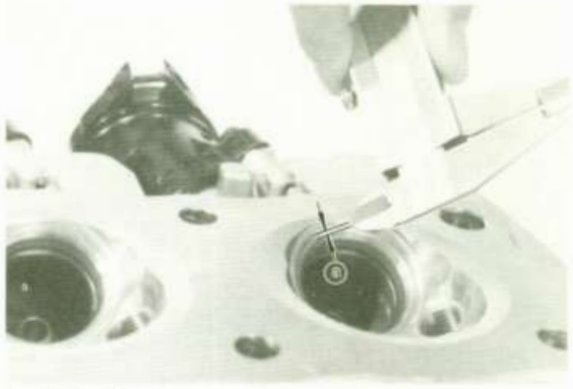
CAUTION:

If the valve seat is obviously pitted or worn, it should be cleaned with a valve seat cutter. Use the 45° cutter, and when twisting the cutter, keep an even downward pressure to prevent chatter marks.

If cutting section "A" of the valve seat, use 30° cutter. If cutting section "B", use the 45° cutter. If cutting section "C" use 60° cutter.

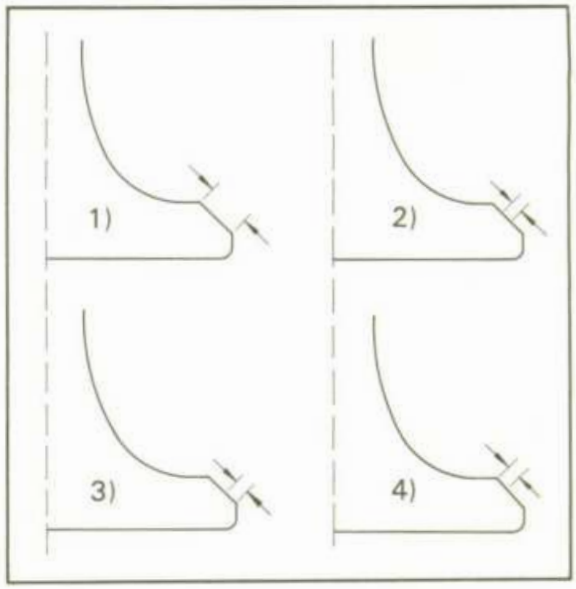
b. Measure valve seat width. Apply mechanic's bluing dye (such as Dykem) to the valve face and valve seat, apply a very small amount of fine grinding compound around the surface of the valve face insert the valve into position, and spin the valve quickly back and forth. Lift the valve, clean off all grinding compound, and check valve seat width. The valve seat and valve face will have removed bluing wherever they contacted each other. Measure the seat width with vernier calipers. It should measure approximately 1.3 mm (0.05 in). Also, the seat should be uniform in contact area. If valve seat width varies, or if pits still exist, further cutting will be necessary. Remove just enough material to achieve a satisfactory seat.

	Standard Width	Wear Limit
Seat width	1.3 mm (0.050 in)	2.0 mm (0.080 in)

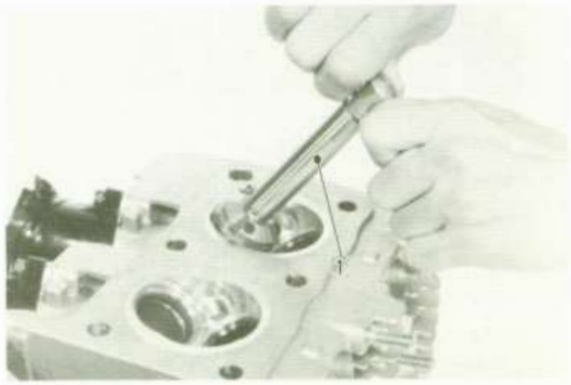


a. Seat width

c. If the valve seat is uniform around the perimeter of the valve face, but is too wide or not centered on the valve face, it must be altered. Use either the 30°, 45° or 60° cutters to correct the improper seat location in the manner described below:



1) If the valve face shows that the valve seat is centered on the valve face, but too wide, then lightly use both the 30° and the 60° cutters to reduce the seat width to 1.3 mm (0.05 in).



1. Valve seat cutter

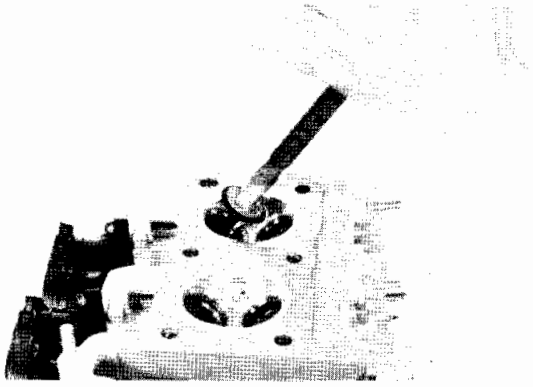
2) If the seat shows to be in the middle of the valve face, but too narrow, use the 45° cutter until the width equals 1.3 mm (0.05 in).
3) If the seat is too narrow and right up near the valve margin, then first use the 30° cutter and then the 45° cutter to get the correct seat width.
4) If the seat is too narrow and down near the bottom edge of the valve face, then first use the 60° cutter and then the 45° cutter.

6. Lapping the valve/valve seat assembly

a. The valve/valve seat assembly should be lapped if neither the seat nor the valve face are severely worn.

b. Apply a small amount of coarse lapping compound to valve face. Insert the valve into the head. Rotate the valve until the valve and valve seat are evenly polished. Clean off the coarse compound, then follow the same procedure with fine compound.

Continue lapping until the valve face shows a complete and smooth surface all the way around. Clean off the compound material. Apply bluing dye to the valve face and seat and rotate the valve face for full seat contact which is indicated by a grey surface all around the valve face where the bluing has been rubbed away.



c. Valve leakage check

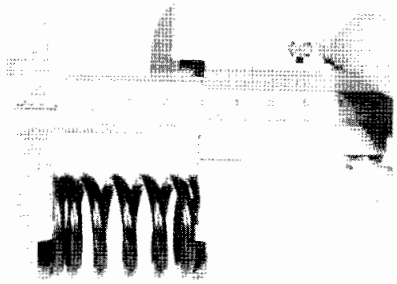
After all work has been performed on the valve and valve seat, and all head parts have been assembled, check for proper valve/valve seat sealing by pouring solvent into each of the intake ports, then the exhaust ports. There should be no leakage past the seat. If fluid leaks, disassemble and continue to lap with fine lapping compound. Clean all parts thoroughly, reassemble and check again with solvent. Repeat this procedure as often as necessary to obtain a satisfactory seal.

D. Valve Spring and Lifters

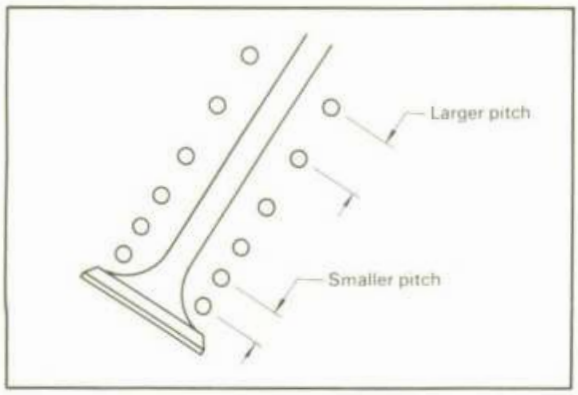
1. Checking the valve springs

a. This engine uses two springs of different sizes to prevent valve float or surging. The valve spring specifications show the basic value characteristics.

b. Even though the spring is constructed of durable spring steel, it gradually loses some of it's tension. This is evidenced by a gradual shortening of free length. Use a vernier caliper to measure spring free length. If the free length of any spring has decreased more than 2 mm (0.080 in) from its specification, replace it.



c. Another symptom of a fatigued spring is insufficient spring pressure when compressed. This can be checked using a valve spring compression rate gauge. Test each spring individually. Place it in the gauge and compress the spring first to the specified compressed length with the valve closed (all spring specifications can be found in the previous section, Valve Spring), then to the length with the valve open. Note the poundage indicated on the scale at each setting. Use this procedure with the outer springs, then the inner springs.



NOTE:
All valve springs must be installed with greater pitch upward as shown.

Valve Spring Specifications

	OUTER	INNER
Free length	39.9 mm (1.571 in)	35.6 mm (1.402 in)
Installed length (valve closed)	34.5 mm (1.358 in)	31.5 mm (1.240 in)
Installed pressure	16.27~18.73 kg (35.9~41.3 lb)	6.75~8.25 kg (14.9~18.2 lb)
Compressed length (valve open)	26.0 mm (1.024 in)	23.0 mm (0.908 in)
Compressed pressure	49.29~56.71 kg (108.7~125 lb)	25.57~29.43 kg (56.4~64.9 lb)
Allowable tilt from vertical	1.6 mm (0.063 in) or 2.5°	—

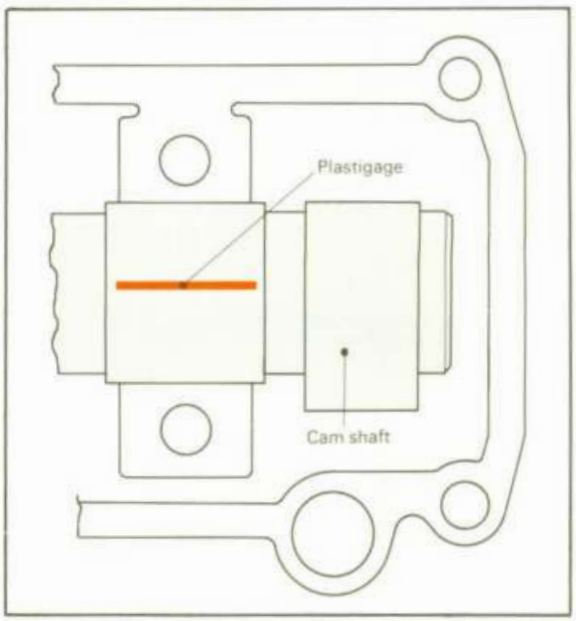
2. Valve lifter
   a. Check each valve lifter for scratches or other damage. If the lifter is damaged in any way, the cylinder head surface in which it rides is probably also damaged. If the damage is severe, it may be necessary to replace both the lifter and the cylinder head.

NOTE:
For proper valve lifter-to-head clearance, always install lifters on their original valves.

E. Camshafts, Cam Chain and Cam Sprockets

1. Camshaft
   a. The cam lobe metal surface may have a blue discoloration due to excessive friction. The metal surface could also start to flake off or become pitted.
   b. If any of the above wear conditions are readily visible, the camshaft should be replaced.
   c. Even though the cam lobe surface appears to be in satisfactory condition, the lobes should be measured with a micrometer. Cam lobe wear can occur without scarring the surface. If this wear exceeds a pre-determined amount, valve timing and lift are affected. Replace the camshaft if wear exceeds the limits.
   d. Install the camshaft on the cylinder head. Place a strip of Plastigage between camshaft and camshaft cap as illustrated (lengthwise along camshaft). Tighten the nuts with specified torque. Remove the camshaft cap and determine the clearance by measuring the width of the flattened Plastigauge.

Cap Nut Tightening Torque:
1.0 m-kg (7.2 ft-lb)



NOTE:
Do not turn camshaft when measuring clearance with Plastigage.

Camshaft-to-cap Clearance:
Standard: 0.020~0.054 mm (0.0008~0.0021 in)
Maximum: 0.160 mm (0.006 in)

If the camshaft-to-cap clearance exceeds specification, measure camshaft bearing surface diameter.

Bearing Surface Diameter:	
Standard:	24.97 ~ 24.98 mm (0.9830 ~ 0.9835 in)

1) If camshaft diameter is less than specification, causing excessive clearance, replace camshaft.
2) If camshaft is within specification and cam-shaft-to-cap clearance is excessive, replace cylinder head.

2. Cam Chain
Except in cases of oil starvation, the cam chain wears very little. If the cam chain has stretched excessively and it is difficult to keep the proper cam chain tension, the chain should be replaced.
3. Cam Sprockets
Check cam sprockets for obvious wear.
4. Cam Chain Dampers
Inspect the top cam chain damper (stopper guide) and two (2) vertical (slipper-type) dampers for excessive wear. Any that shows excessive wear should be replaced. Worn dampers may indicate an improperly adjusted or worn-out cam chain.

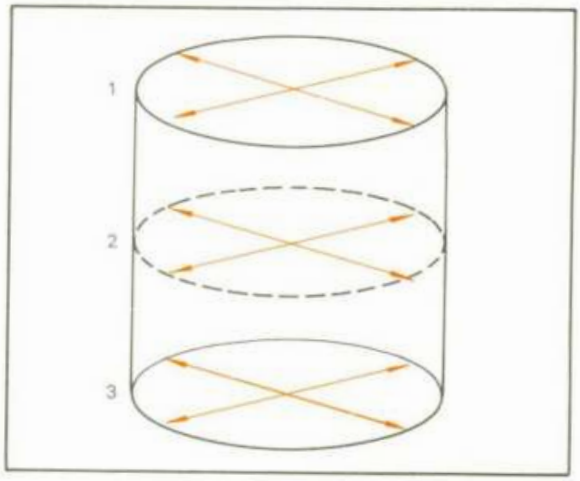




F. Cylinder

1. Inspect the cylinder walls for scratches. If vertical scratches are evident, the cylinder wall should be rebored or the cylinder should be replaced.
2. Measure cylinder wall wear as shown. If wear is excessive, compression pressure will decrease. Rebore the cylinder wall and replace the piston and piston rings.
Cylinder wear should be measured at three depths with a cylinder bore gauge. (See illustration.)

	Standard	Wear Limit
Cylinder bore	71.5 mm (2.815 in)	71.6 mm (2.819 in)
Cylinder taper	—	0.05 mm (0.002 in)
Cylinder out-of-round	—	0.01 mm (0.0004 in)

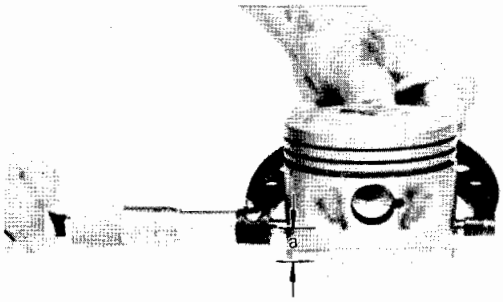


If the cylinder wall is worn more than the wear limit, it should be rebored.

G. Piston and Piston Rings

1. Piston
a. Measure the outside diameter of the piston at the piston skirt.
Measurement should be made at a point 10 mm (0.4 in) above the bottom edge of he piston. Place the micrometer at right angles to the piston pin.

Standard	Size
Oversize 1	71.75 mm (2.8248 in)
Oversize 2	72.00 mm (2.8346 in)
Oversize 3	72.25 mm (2.8445 in)
Oversize 4	72.50 mm (2.8543 in)



a. 10 mm (0.4 in)

b. Determine piston clearance as follows:

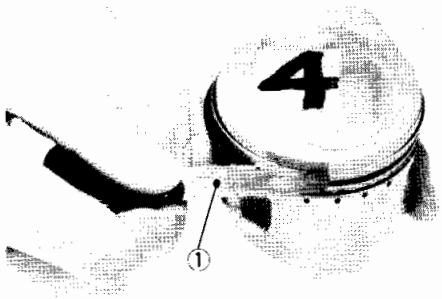
Minimum bore measurement
− Maximum piston measurement
= Piston clearance

EXAMPLE:
71.50 mm (2.8150 in)
− 71.46 mm (2.8134 in)
= 0.04 mm (0.0016 in) piston clearance

Piston clearance:
Standard — 0.040 ~ 0.045 mm (0.0016 ~ 0.0018 in)
Service limit — 0.1 mm (0.0039 in)

c. Piston ring/ring groove fit must have correct clearance. If the piston and ring have already been used, the ring must be removed and the ring groove cleaned of carbon. The ring should then be reinstalled. Use a feeler gauge to measure the gap between the ring and the land.

Side Clearance	Top	0.04~0.08 mm (0.0016~0.003 in)
	2nd	0.03~0.07 mm (0.0012~0.0028 in)



1. Feeler gauge

2. Piston Ring

a. The oversize top and middle ring sizes are stamped on top of the ring.

Oversize 1	0.25 mm (0.0098 in)
Oversize 2	0.50 mm (0.0197 in)
Oversize 3	0.75 mm (0.0295 in)
Oversize 4	1.00 mm (0.0394 in)

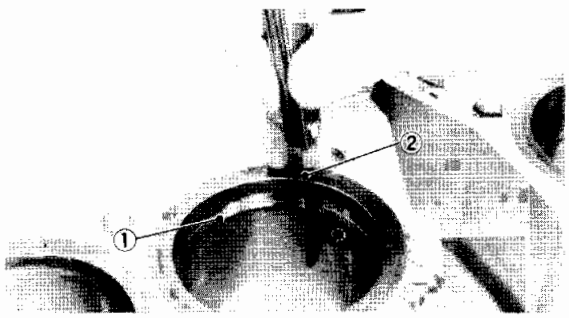
b. The expander spacer of the bottom ring (oil control ring) is color-coded to identify sizes.
The color mark is painted on the expander spacer.

Size	Color
Oversize 1	Brown
Oversize 2	Blue
Oversize 3	Black
Oversize 4	Yellow

c. Push the ring into the bore and check end gap clearance with a feeler gauge.

NOTE:
The end gap on the expander spacer of the oil control ring is unmeasureable. If the oil control ring rails show excessive gap, all three components should be replaced.

	Standard	Limit
Top/2nd ring	0.2~0.4 mm (0.008~0.016 in)	1.0 mm (0.039 in)
Oil control (Rails)	0.2~0.9 mm (0.008~0.035 in)	1.5 mm (0.059 in)



1. Piston ring 2. Feeler gauge

H. Piston Pin

1. Apply a light film of oil to pin. Install in connecting rod small end. Check for play. There should be no noticeable vertical play. If play exists, check connecting rod small end for wear. Replace pin and connecting rod as required.

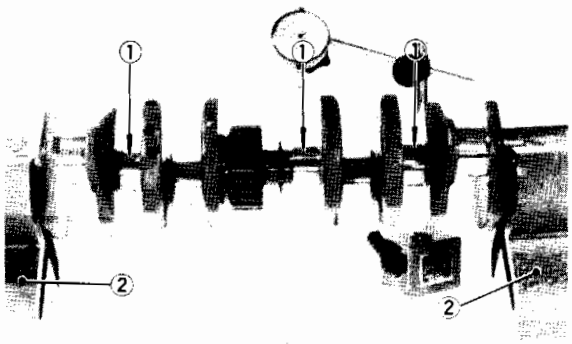
2. The piston pin should have no noticeable free play in piston. If the piston pin is loose, replace the pin and/or the piston.

I. Crankshaft

1. Crankshaft Run-out
   Support the crankshaft at both ends on V-blocks. Measure the amount of crankshaft run-out on the main bearing journals with a dial gauge while rotating crankshaft.

Run-out limit: 0.04 mm (0.0016 in)

If run-out exceeds limit, replace crankshaft.

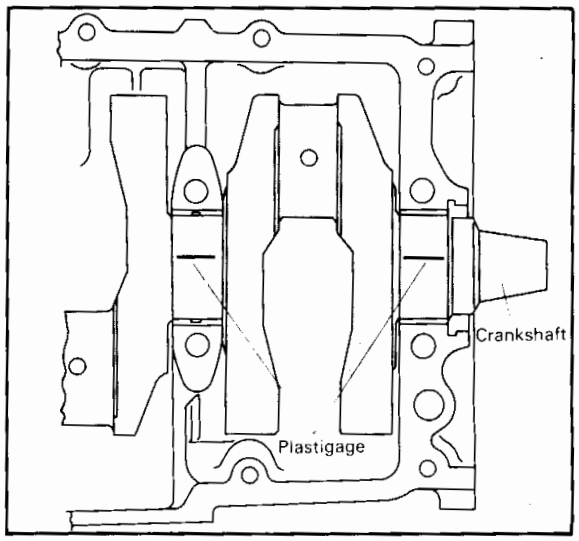


1. Measuring points 2. V-blocks

2. Inspection of Inserts
   Check the bearing inserts. If the inner or outer surface is burned, flaked, rough, scratched or worn, the insert should be replaced.
3. Measuring Main Bearing Oil Clearance

a. Clean all crankshaft and crankcase journal surfaces.
b. Place upper crankcase half upside-down on a bench. Install bearing inserts into top crankcase.
c. Install crankshaft into upper crankcase.
d. Place Plastigage on crankshaft journal surface to be inspected.

NOTE:
Do not move crankshaft until clearance check has been completed.

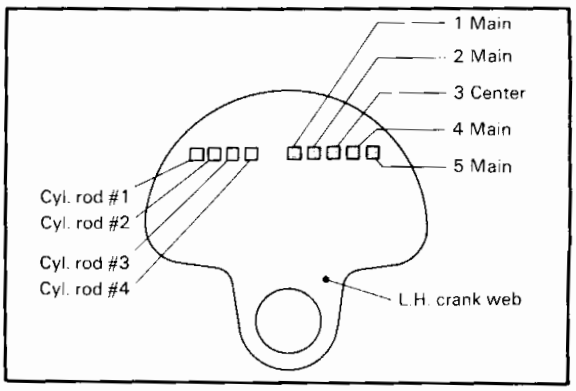


e. Install bearing inserts into bottom crankcase. Carefully, place lower crankcase onto upper crankcase.
f. Install crankcase holding bolts 1 through 10. Tighten to full torque in torque sequence cast on crankcase.
g. Remove bolts in reverse assembly order (10, 9, 8 ... etc.)
h. Carefully remove lower crankcase. Measure width of Plastigage on crankshaft journals to determine clearance.

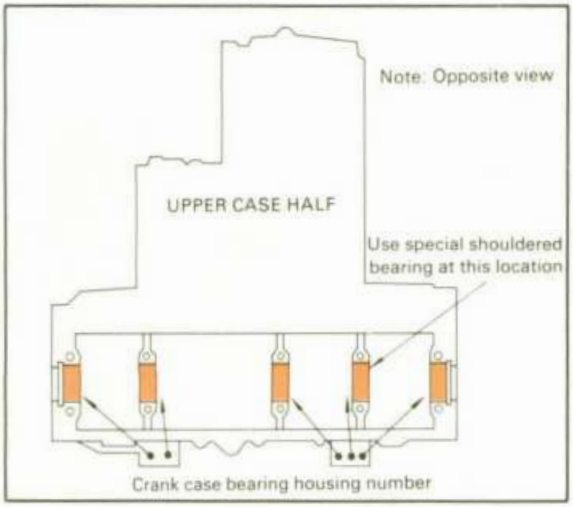
Main bearing oil clearance: 0.022 ~ 0.044 mm (0.0009 ~ 0.0017 in)

4. Crankshaft Main Bearing Selection

a. Numbers used to indicate crankshaft journal sizes are stamped on the L.H. crank web. The first five (5) are main bearing journal numbers, starting with the left journal and proceding to left center, center, right center, and right. The four (4) rod bearing journal numbers follow in the same sequence.



b. Each main bearing journal is numbers 1, 2 or 3. Each crankcase bearing housing is numbered 4, 5 or 6. The proper insert selection is made by subtracting the crankshaft journal number from the crankcase number. The result is the insert size (number).



Use the color code table to choose the proper insert.

INSERT COLOR CODE	
No. 1	Blue
No. 2	Black
No. 3	Brown
No. 4	Green
No. 5	Yellow

EXAMPLE:
Case No. (Minus) Journal No.
= Insert No.

$$4 - 2 = 2$$

No. 2 insert is Black. Use a black main bearing insert.

NOTE:
There is a special thrust bearing (insert) located in the No. 4 main bearing housing in the upper crankcase. The function of this insert is to provide a bearing surface for crankshaft side thrust.

c. When assembling, apply a liberal coat of motor oil to all bearing surfaces.
d. Observe normal crankcase holding bolt torque sequence.

J. Connecting Rod

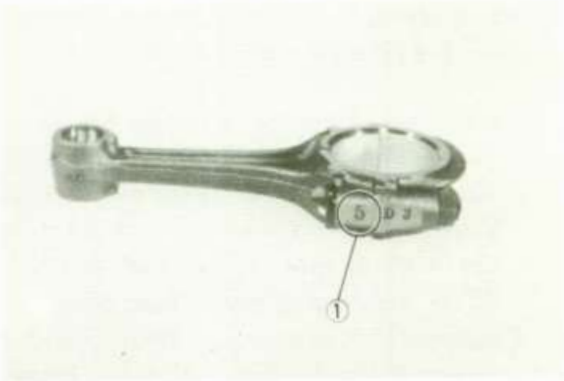
1. Remove rod cap securing nuts, rod cap and inserts.
2. Inspection
a. Examine bearing inserts for scratches, flaking or other obvious signs of wear or damage. If the inner or outer surfaces are worn or damaged, the inserts should be replaced.
b. Examine the connecting rods and crankshaft.
3. Measure Rod Bearing Clearance
Measurement of rod bearing clearance is similar to main bearing clearance measurement.
a. Clean all bearing surfaces.
b. Place a piece of Plastigage on connecting rod cap. Place cap on crankshaft journal. Do not allow the cap to move. Install special bolts and apply molybdenum disulfide grease to the threads. Install rod cap and nuts. Tighten rod caps evenly to specified torque:

Rod cap torque: 3.9 m-kg (28 ft-lb)

c. Remove connecting rod and cap. Measure width of Plastigage to determine oil clearance.

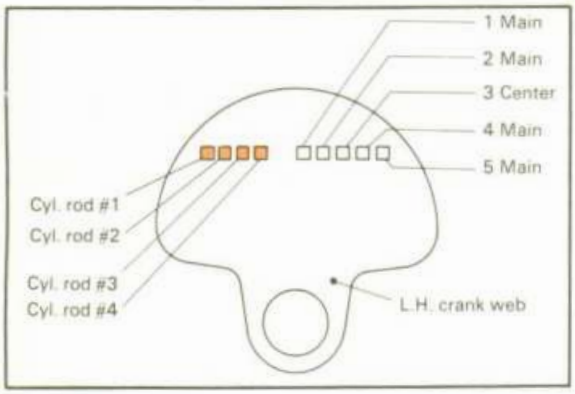
Oil clearance (rod):
0.032 ~ 0.054 mm
(0.0013 ~ 0.0021 in)

d. Remove Plastigage from bearing surfaces.
4. Selecting Rod Bearing Inserts
a. Connecting rod size numbers are indicated by 4, 5 or 6 and are marked in ink on the connecting rods and caps.



1. Size number

b. The rod bearing journal size numbers are indicated by 1, 2 or 3 and are stamped on the left end of the crankshaft.



c. The proper insert selection is made by subtracting the crankshaft journal number from the rod size number. Use the color code to choose the proper insert.
EXAMPLE:

Rod No. (Minus) Journal No.
= Insert No.
5 − 2 = 3

No. 3 insert is Brown. Use Brown bearing inserts.

INSERT COLOR CODE	
No. 1	Blue
No. 2	Black
No. 3	Brown
No. 4	Green
No. 5	Yellow

d. When assembling, apply a liberal coat of motor oil to all bearing surfaces.

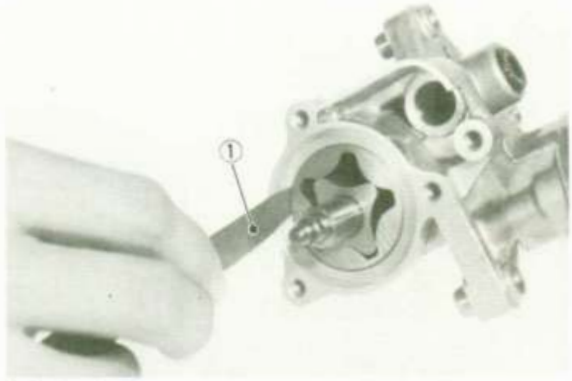
NOTE:
When applying final torque to the rod caps, observe the following procedures:

Apply molybdenum disulfide grease to connecting rod bolt threads. Apply torque evenly to both ends of the cap. While tightening, if a torque of 3.3 m-kg (24 ft-lb) or more is reached, DO NOT STOP tightening until final torque is reached. If tightening is interrupted between 3.3 m-kg and 3.8 m-kg, loosen the nut to less than 3.3 m-kg and start again. Tighten to full torque specification without pausing.

K. Oil Pump

1. Check the clearance between housing and outer rotor.

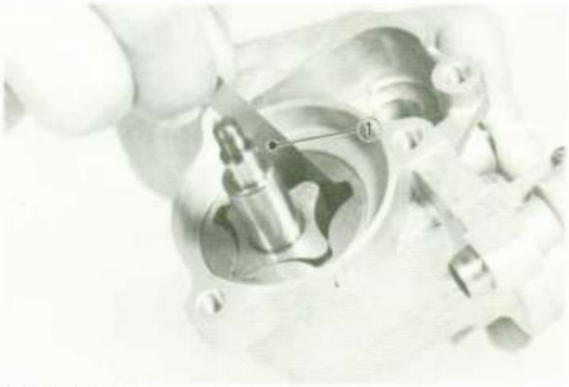
Standard clearance:
0.09 ~ 0.15 mm
(0.0035 ~ 0.0059 in)



1. Feeler gauge

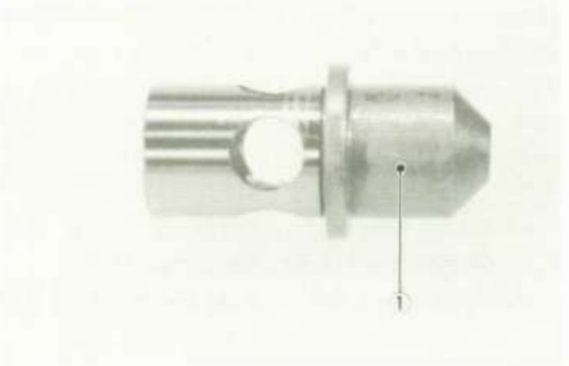
2. Check the clearance between outer rotor and inner rotor.

Standard clearance:
0.12 mm (0.0047 in)



1. Feeler gauge

3. Check the plunger for scratches and wear.



1. Relief valve plunger

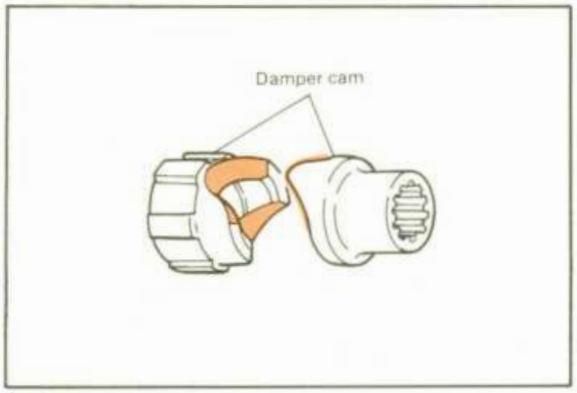
L. Primary Shaft Damper Hy-Vo Chain

1. "Hy-Vo" Chain

   The "Hy-Vo" primary chain is a plate-and-pin type that does not use rollers as in the case of a conventional motorcycle drive chain. The plates of the chain form a mating surface for the primary gear teeth. That is, the primary gears actually mesh with the chain plates. This chain is extremely durable and, under normal conditions, can be expected to last the life of the motorcycle engine. However, if obvious damage is caused through serious oil starvation or abrasive oil contamination, the chain should be replaced.

2. Primary shaft damper

a. Inspect the damper cam surfaces. Check for smooth cam action and excessive wear on the cam surface. If cam surface is severely worn, replace damper assembly.



b. Inspect the damper springs for fatigue, wear and damage. Replace as necessary.

c. Primary shaft damper reassembly



1. Damper cams 2. Damper springs 3. Collar 4. Circlip

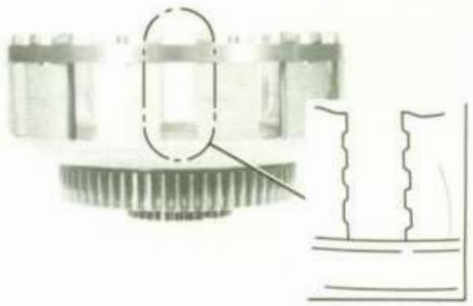
1) Install the damper cams on the primary shaft.
2) Install the damper springs as shown.
3) Install the collar.
4) Use a press and the special tool to install the circlip.

NOTE:
Always install a new circlip.

M. Primary Drive

1. Clutch housing

a. Check dogs on clutch housing. Look for cracks and signs of galling on edges. If damage is moderate, deburr. If severe, replace clutch housing.



NOTE:
Galling on the friction plate dogs of the clutch housing will cause erratic clutch operation.

b. Apply a thin film of oil to transmission main shaft and inside surface of clutch housing. Slip clutch housing over main shaft.

2. Clutch boss

a. The clutch boss contains a built-in damper beneath the first clutch plate (clutch plate 2). It is not normally necessary to remove the circlip and disassemble the built-in damper unless there is serious clutch chattering.

b. Check splines on clutch boss for galling. If damage is slight to moderate, deburr; if it is severe, replace clutch boss.



NOTE:
Galling on clutch plate splines will cause erratic operation.

3. Friction and Clutch Plates
   Check clutch steel plates and friction plates for heat damage. Measure friction plate thickness at 3 or 4 points. Measure clutch plates for warpage with a dial gauge and stand. Replace clutch plate or friction plates as a set if any is faulty or beyond wear limits.

	Standard	Wear Limit
Friction plate thickness	3.0 mm (0.12 in)	2.8 mm (0.11 in)
Clutch plate warp limit	—	0.1 mm (0.0039 in)





1. Feeler gauge

4. Clutch Push Screw Assembly
   Check the end of the clutch push screw for indentation. If severe, clutch adjustment may be difficult. Check for smooth operation of the push screw assembly. If end is indented or operation is not smooth replace the push screw assembly.

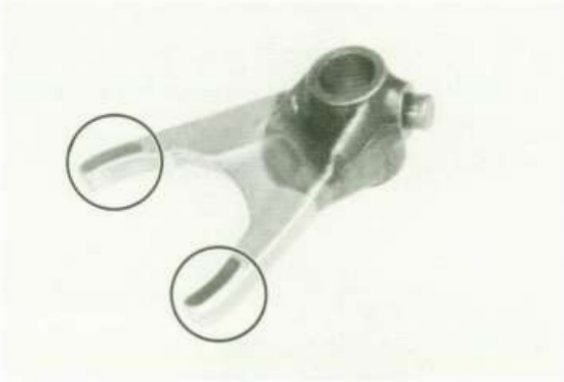


5. Clutch Springs
   Measure the clutch spring free length. Replace the springs as a set if any is less than minimum free length.

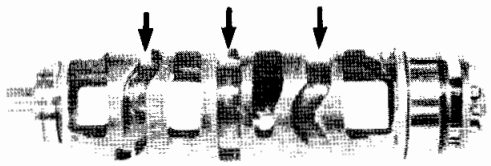
Clutch spring minimum length:
41.8 mm (1.646 in)

N. Transmission

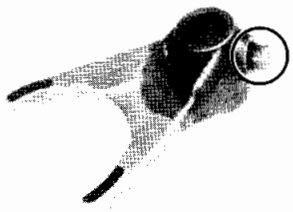
1. Inspect each shift fork for signs of galling on gear contact surfaces. Check for bending. Make sure each fork slides freely on its guide bar.



2. Roll the guide bar across a surface plate. If the bar is bent, replace.
3. Check the shift cam grooves for signs of wear or damage. If any profile has excessive wear and/or damage, replace cam.

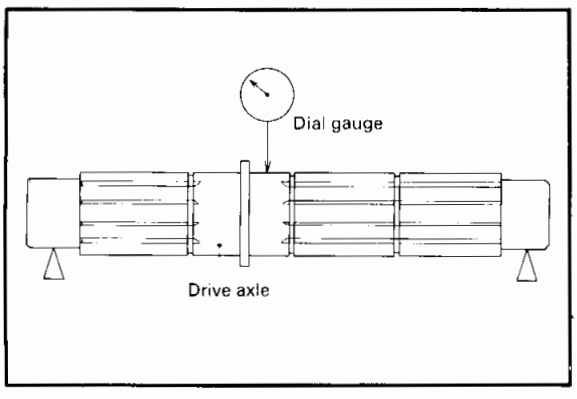


4. Check the cam followers on each shift fork for wear. Check the ends that ride in the grooves in the shift cam. If they are worn or damaged, replace the shift forks.



5. Check shift cam dowel pins and side plate for looseness, damage or wear. Replace as required.
6. Check the shift cam stopper plate and circlip and stopper for wear. Replace as required.
7. Check the transmission shafts using a centering device and dial gauge. If any shaft is bent beyond specified limit, replace shaft.

Maximum run-out: 0.08 mm (0.0031 in)

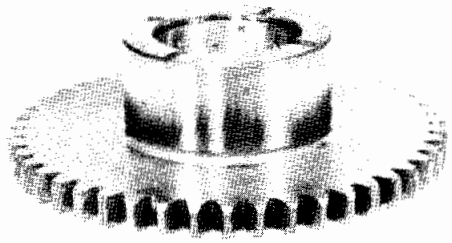


8. Carefully inspect each gear. Look for signs of obvious heat damage (blue discoloration). Check the gear teeth for signs of pitting, galling or other extreme wear. Replace as required.
9. Check to see that each gear moves freely on its shaft.
10. Check to see that all washers and clips are properly installed and undamaged. Replace bent or loose clips and bent washers.
11. Check to see that each gear properly engages its counterpart on the shaft. Check the mating dogs for rounded edges, cracks, or missing portions. Replace as required.

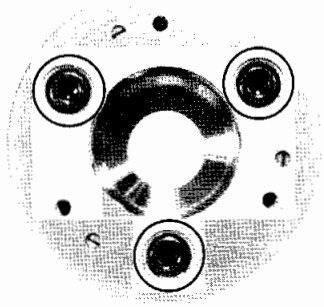
O. Starter Drives

1. Electric Starter Clutch and Gears

a. Check the surface of the idle gear (2) for pitting or other damage. If severe, replace the gear.

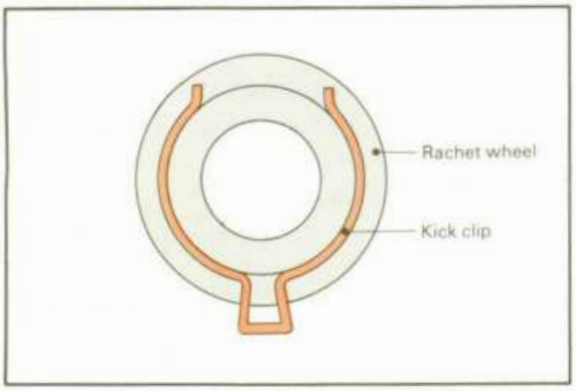


b. Check the spring caps and the springs for deformation or damage. If severe, replace as necessary.
c. Check the starter clutch bolt (allen screw) for looseness. If loose, remove the bolt and replace with new bolt. Apply Loctite to threads and tighten to specified torque. Stake over the end of the bolts.



Starter clutch bolt torque:
2.8 ~ 3.2 m-kg (20 ~ 23 ft-lb)

2. Kick Starter
a. Kick Gears
Check the kick gears for wear or scratches on teeth, particularly in the chamfered area of each gear.
b. Kick Clip Spring
The kick clip is fitted to kick gear and slides in the groove. A too-tight or loose-fitting clip may result in improper operation. If too loose, bend the kick clip so that the friction increases, or replace clip.



P. Crankcases and Strainer Cover

1. Check crankcases for cracks or other damage.
2. Clean all oil passages and blow out with compressed air.
3. Strainer cover: Apply Loctite to strainer cover bolts during reassembly.

Q. Bearings and Oil Seals

1. After cleaning and lubricating bearings, rotate inner race with a finger. If rough spots are felt, replace the bearing.

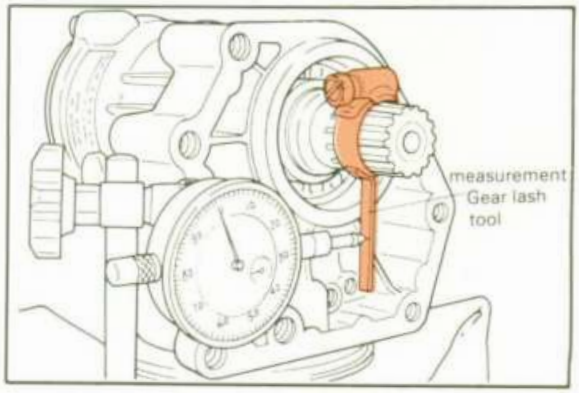
NOTE:
Bearings are most easily removed or installed if the housings are first heated to approximately 95° ~ 125°C (200° ~ 250°F). Bring the case up to proper temperature slowly. Use an oven to avoid distortion.

2. Check oil seal lips for damage and wear. Replace as required.

R. Middle Gear Case

NOTE:
This section involves external inspection only. For middle gear case overhaul and adjustment, refer to the Yamaha Shaft Drive Service Manual.

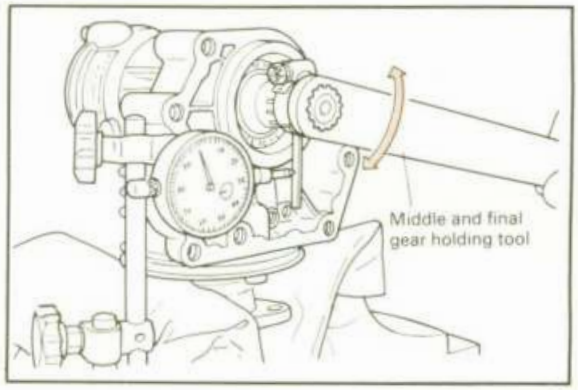
1. Inspect entire exterior for leakage. If leakage is found, the unit should be disassembld.
2. Check middle gear lash as follows:
a. Support gear case in a vise by the output shaft flange. Connect the lash measurement tool to the input shaft as shown.
b. Mount a dial gauge against the lash measurement tool at the scribed mark (34 mm from the center of the shaft).



c. Hold the gear case and rotate the input shaft back and forth using the special wrench. Read the gear lash on the dial gauge.

Middle gear case lash:
0.1 ~ 0.2 mm (0.004 ~ 0.008 in)

If lash is not within tolerance refer to Shaft Drive Service Manual for adjustment procedure.



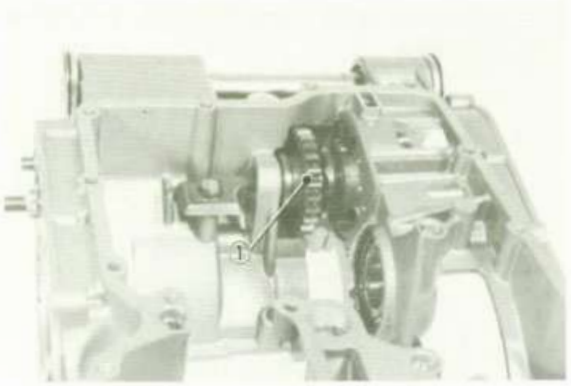
ENGINE ASSEMBLY AND ADJUSTMENT

NOTES:

1) All gaskets and seals should be replaced when an engine is overhauled. All gasket surfaces must be cleaned.
2) Properly oil all mating engine and transmission parts during assembly.
3) All circlips should be inspected before assembly. Replace distorted circlips. Always replace cotter pins and piston pin clips after one use.

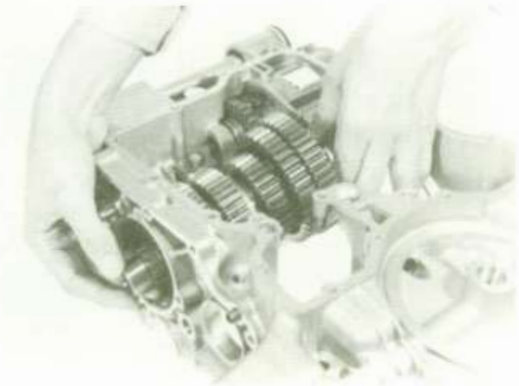
A. Crankcase

1. Begin the reassembly by installing the kick idle gear into the lower case half.

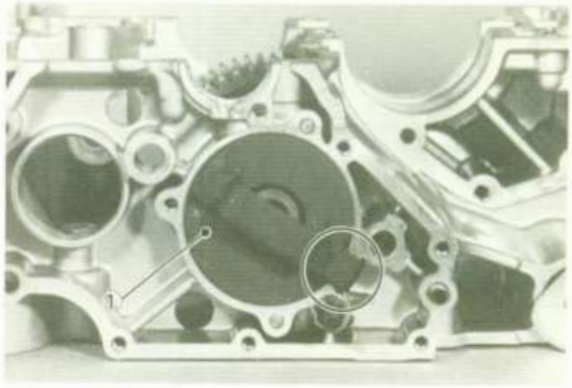


1. Kick idle gear

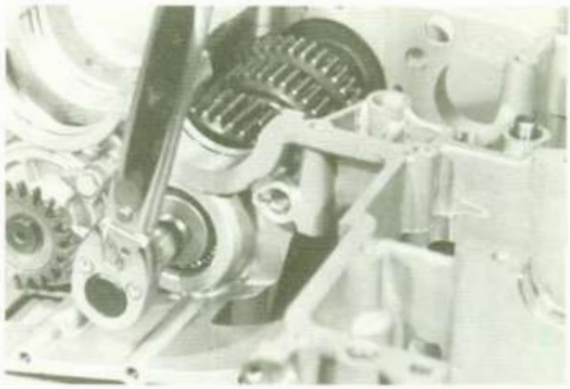
2. Install the drive axle assembly into the lower case as shown.



3. With the drive axle in place, install the special washerbase bolt on the end of the shaft. Place the drive axle special tool over the left end of the drive axle. Note that the projection on the special tool must rest alongside of the shift lever eccentric screw in the crankcase. Tighten the bolt to the specification.

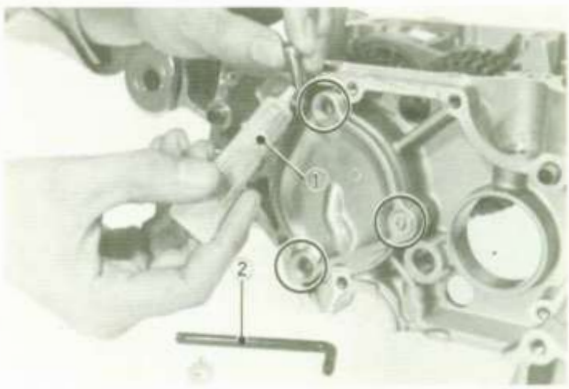


1. Drive axle holder



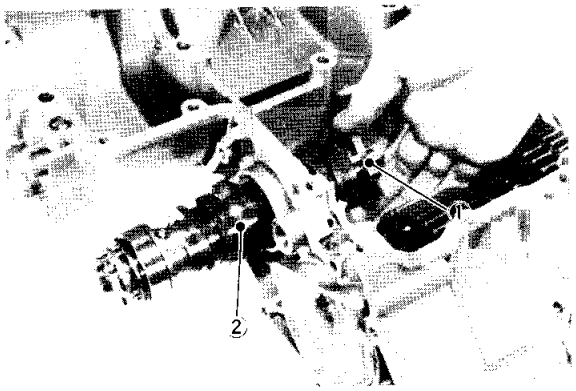
Tightening torque: 7.0 m-kg (51 ft-lb)

4. Remove the special tool and install the drive axle bearing housing. The bearing housing is held in place with three flat head countersunk screws. Loctite these screws, but do not use the impact driver. driver.



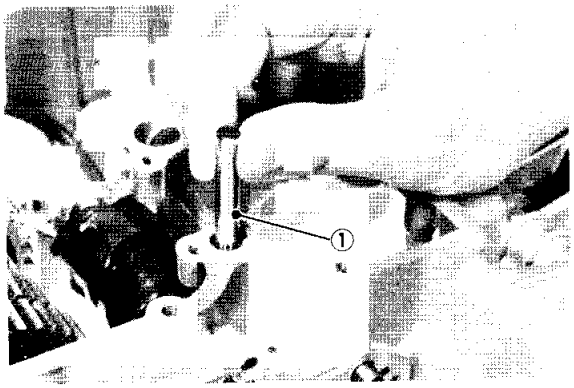
1. Thread locking compound
2. Drive axle wrench

5. Install the shift cam, stopper plate and circlip.



1. Stopper plate
2. Shift cam

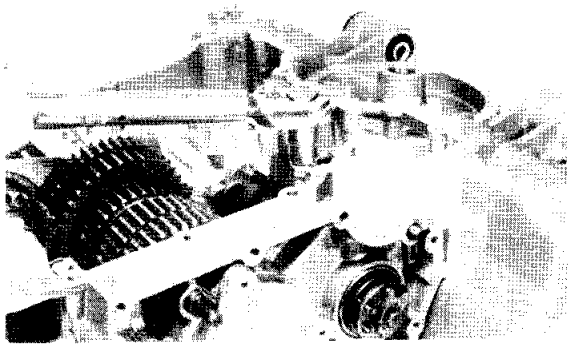
6. Install the shift cam guide pin.



1. Guide pin

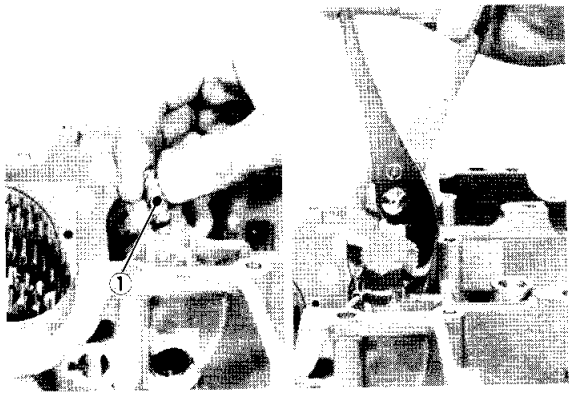
7. Install the retainer, lock washer and bolt. Torque the bolt to the specification and bend over the lock washer.

Tightening torque: 1.0 m-kg (7.2 ft-lb)



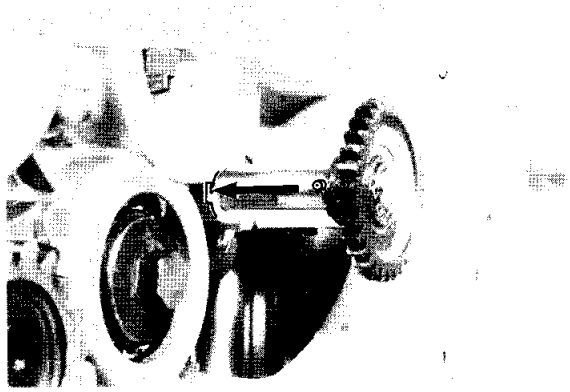
8. Turn the lower crankcase half over and install the shifter detent assembly with lock washer. Torque the bolts to the specification and bend over the lock washer.

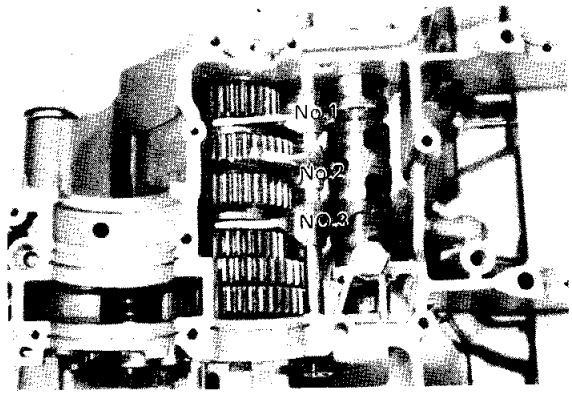
Tightening torque: 2.0 m-kg (14 ft-lb)



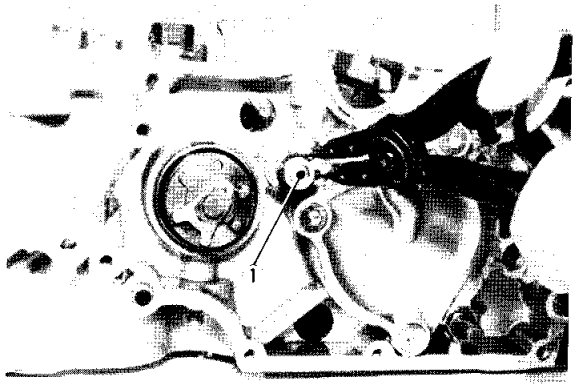
1. Shift cam detent

9. Install the shift fork guide bar and the shift forks. Each shift fork is identified by a number cast on its side.
   Align the pin through the shift fork guide bar with the slot in the case when inserting.



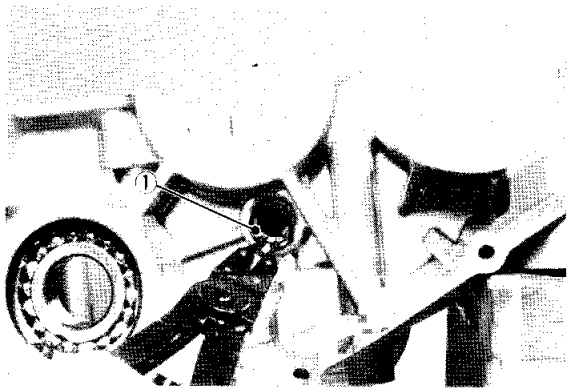


10. Install a new circlip on the end of the shift fork guide bar.



1. Shift fork guide bar

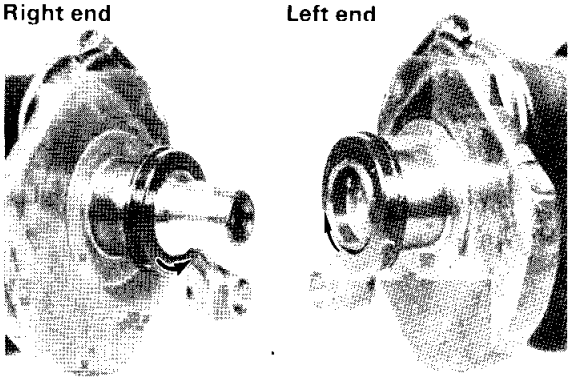
11. Install the starter idle gear.



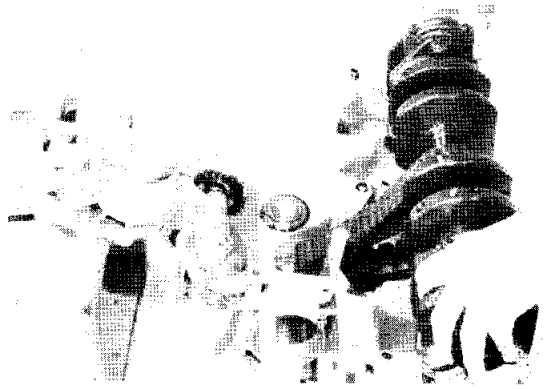
1. Starter idle gear shaft

12. Before installing the crankshaft in the cases, slip the primary chain and cam chain over the crank.
13. Install new crankshaft seals and lube the lips of the seals with a small amount of grease.

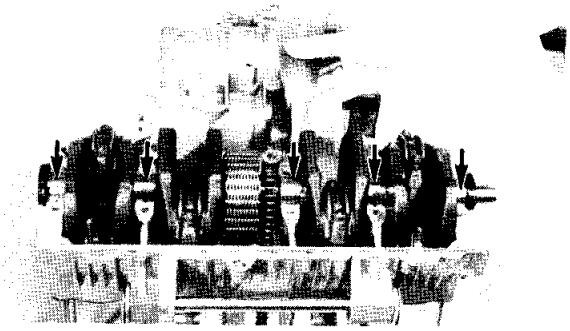
Right end **Left end**



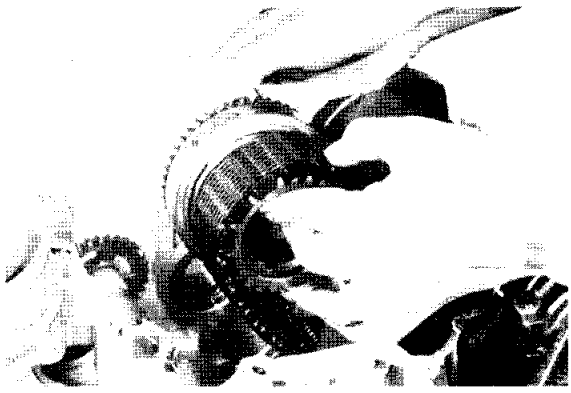
14. Place the crankshaft into the upper case half and be sure the outer lips of the seals fit into the grooves in the case.



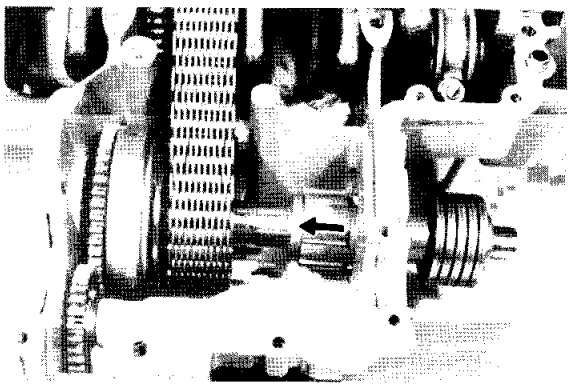
15. Apply a liberal amount of Yamaha 4-cycle oil or 20W/40 motor oil to the crank journals and insert bearings.



16. Slip the start clutch assembly into the primary chain and lower it into the case.



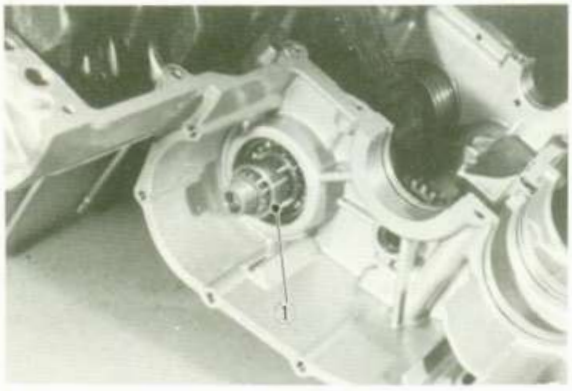
17. Push the primary shaft into the case and slip it through the primary chain and starter clutch assembly.



18. Install new "O-rings" on the primary shaft bearing housing, lubricate thoroughly and tap the housing gently into the case. Install the housing with three allen screws.

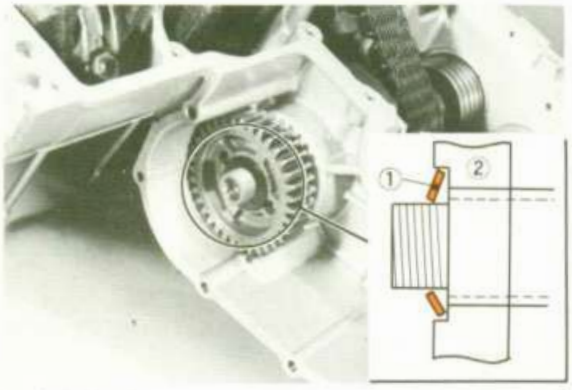


19. Install the spacer on the primary shaft.



1. Spacer

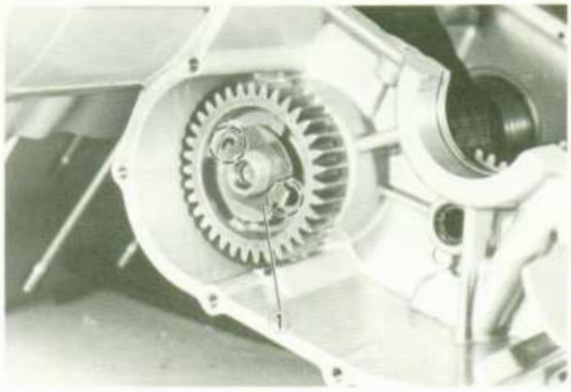
20. Place the primary drive gear and conical washer on the shaft. The cupped side of the washer should face the gear.



1. Conical washer
2. Primary drive gear

21. Using a new lock washer, install the nut on the primary shaft and torquue the nut to the specification. Hold the gear by inserting a large flat blade screwdriver into the slot provided in the crankcase for this purpose.

Tightening torque: 7.0 m-kg (50.6 ft-lb)



1. Lock washer



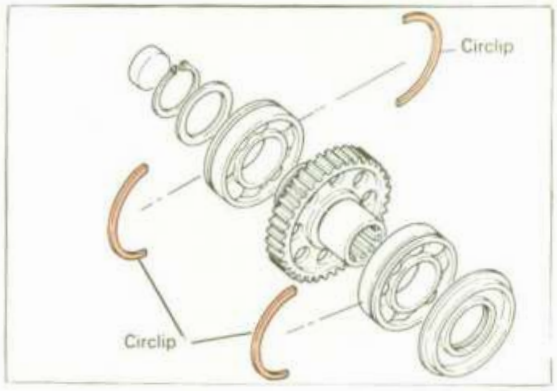
NOTE:
Be sure to use a new lock washer and to bend over the locking tab.

22. Install the main axle in the upper case half. Be sure that the circlips on the bearings fit down into the slot in the crankcase.



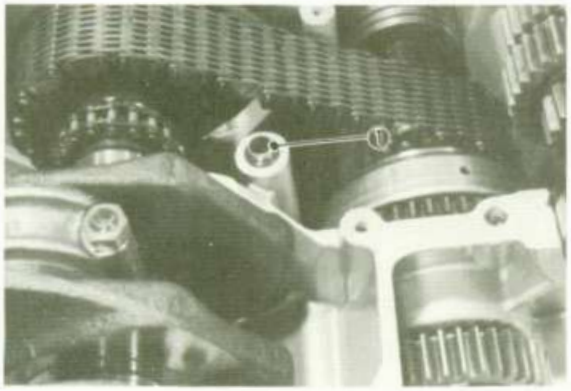
1. Main axle assembly

23. Install the middle driven gear assembly in the upper case half. Lubricate the new seal with grease around its lips.
Be sure that the circlips on the bearings are positioned correctly as shown in the illustration.



24. Replace the "O-ring" on the crankcase center dowel pin as shown.
This is the main oil gallery and must seal properly to maintain oil pressure.

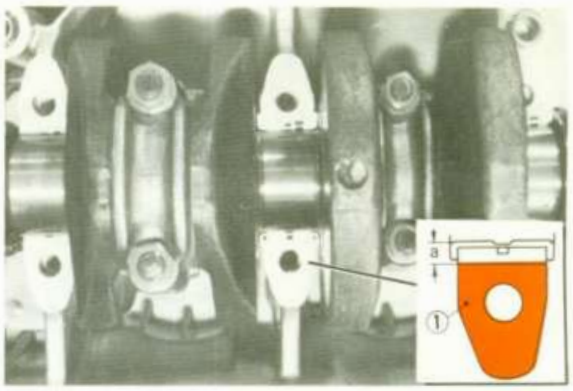
CAUTION:
Do not use any sealant in this area.



"O" ring

25. Apply Yamabond #4 to the crankcase mating surface. Be very careful not to allow any sealant to come in contact with the oil gallery O-ring or crankshaft bearings. It is extremely important, however, that sealant be applied around the case stud holes. Apply sealant to within 2 ~ 3 mm (0.08 ~ 0.12 in) of the insert bearings as shown.

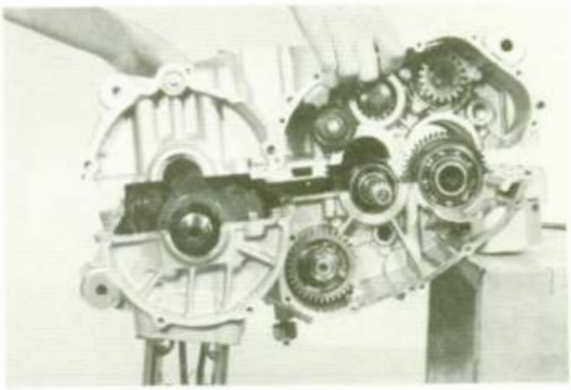
CAUTION:
Failure to apply sealant here will result in reduced oil pressure and possible crank seizure.

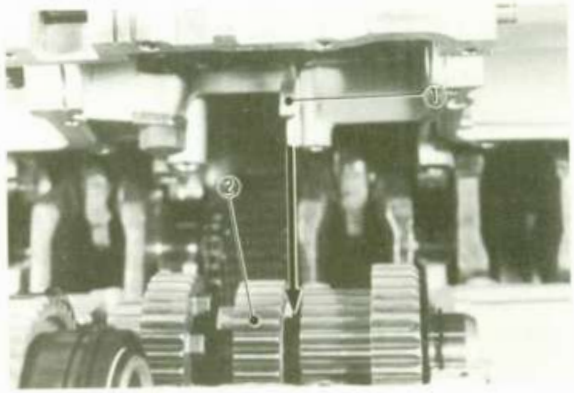


1. Sealant
a. 2 ~ 3 mm (0.08 ~ 0.12 in)
No sealant

26. The crankcases are assembled by placing the upper case half on the bench and lowering the lower case onto it.

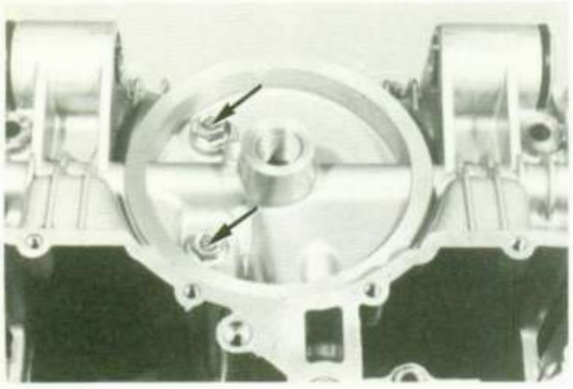
NOTE:
Be sure that shift fork No. 2 engines the groove in the 2nd/3rd pinion.





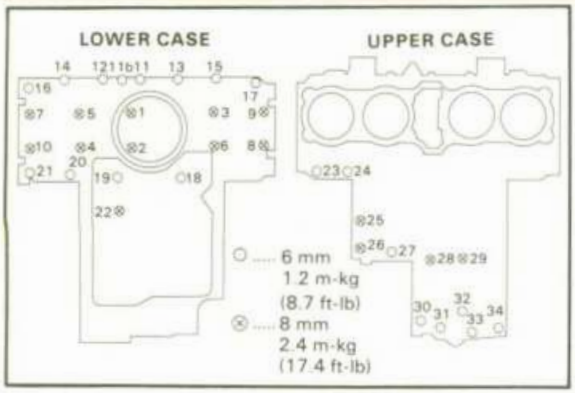
1. No. 2 shift fork
2. 2nd/3rd pinion gear

27. Start installation of the crankcase bolts with the center crankshaft area bolts. Place the two bolts without washers in the oil filter area.



28. The crankcase bolts should be torqued in proper sequence. Refer to the tightening sequence in the illustration.

NOTE:
Be sure not to forget the three bolts located inside the sump area. Also, don't forget the bolt located inside the crankcase breather area.

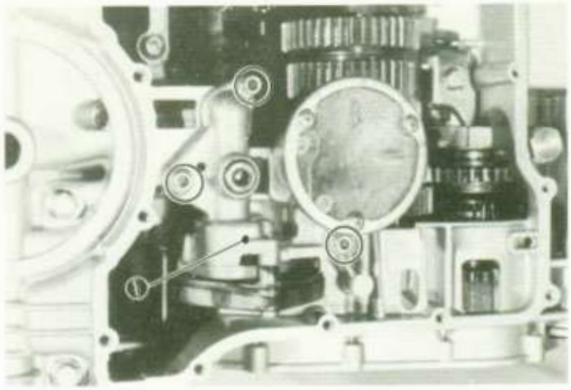


B. Oil Pump and Strainer Cover

1. Install the oil pump and torque the bolts to the specification.

CAUTION:
Failure to properly prime the oil pump will cause extensive engine damage when the engine is started. Fill the oil pump with Yamalube 4-cycle oil.

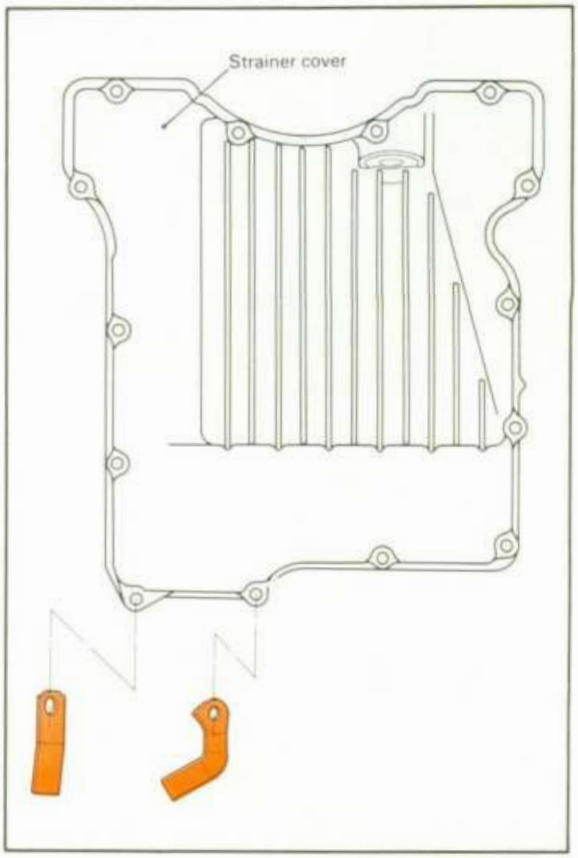
Tightening torque: 1.0 m-kg (7.2 ft-lb)



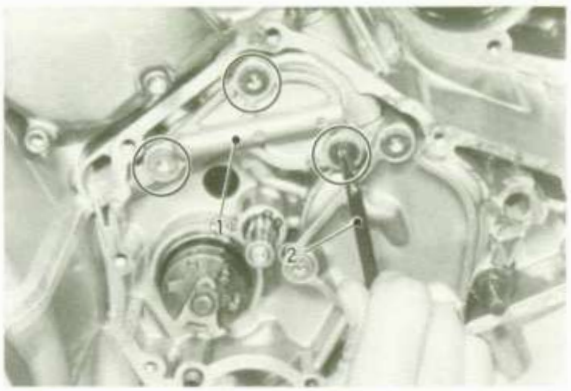
1. Oil pump

2. Install the strainer cover and torque the bolts to the specification. Make sure the wire harness clip is in position. Refer to the wire harness clip illustration.

Tightening torque: 1.0 m-kg (7.2 ft-lb)



3. Inspect the special oil nozzle, clean the screw holes and install a new O-ring. Use Loctite on the screws but do not use an impact drive for these screws.

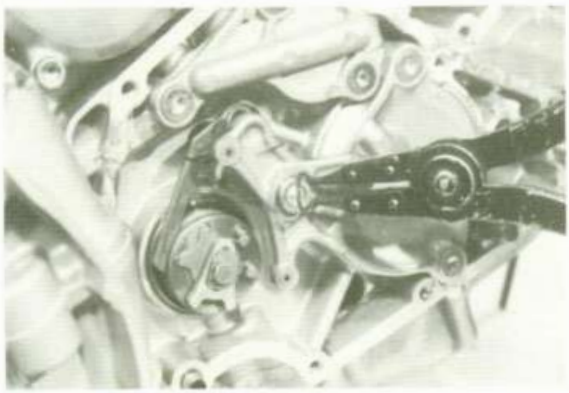


1. Special oil nozzle 2. Drive axle wrench

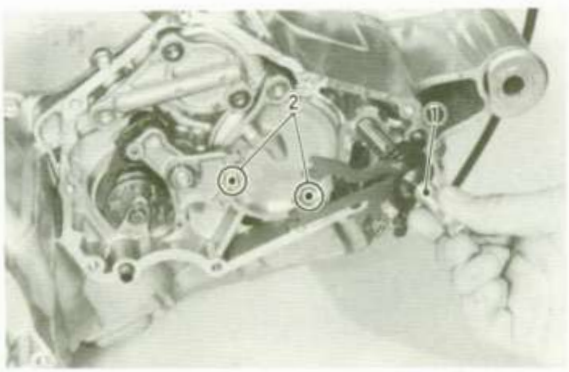
C. Shifter

1. Install the shift lever 2 on the shift fork guide bar.

NOTE:
Use a new circlip.

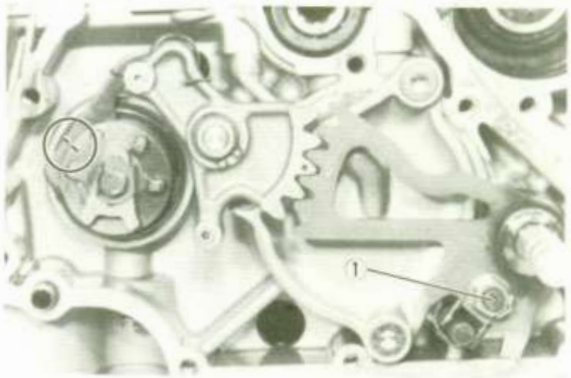


2. Install the shift shaft with the tension spring properly located on the stopper screw. The punch mark on the shift shaft must align with the punch mark on the shift lever 2.



1. Shift shaft assembly 2. Align marks

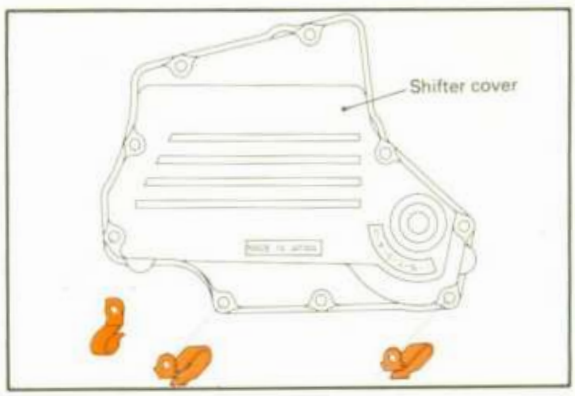
3. With the transmission in second gear the scribed marks on the shift cam and shift lever No. 3 should be aligned. If not, adjust the eccentric screw until the marks are aligned.



1. Eccentric screw

4. Install the shifter cover using a new gasket. Make sure the wire harness clips are properly positioned.

Tightening torque: 1.0 m-kg (7.2 ft-lb)

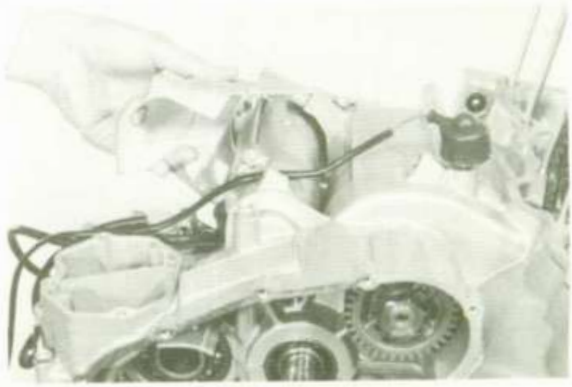


D. Starter Motor/Breather Cover

1. Install the oil pressure switch lead wire.
2. Install the starter motor and the starter motor cover.

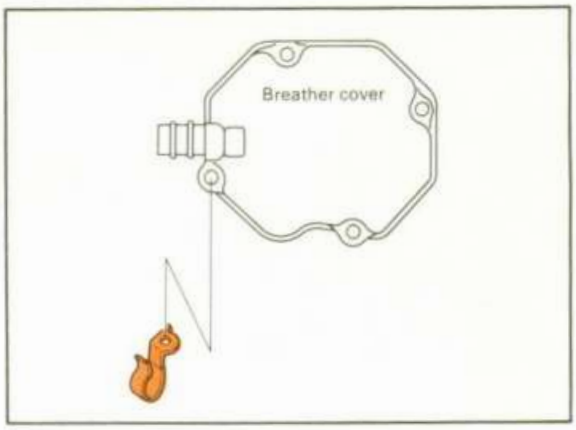
Tightening torque: 1.0 m-kg (7.2 ft-lb)

NOTE:
Thread the oil pressure switch lead wire as shown.

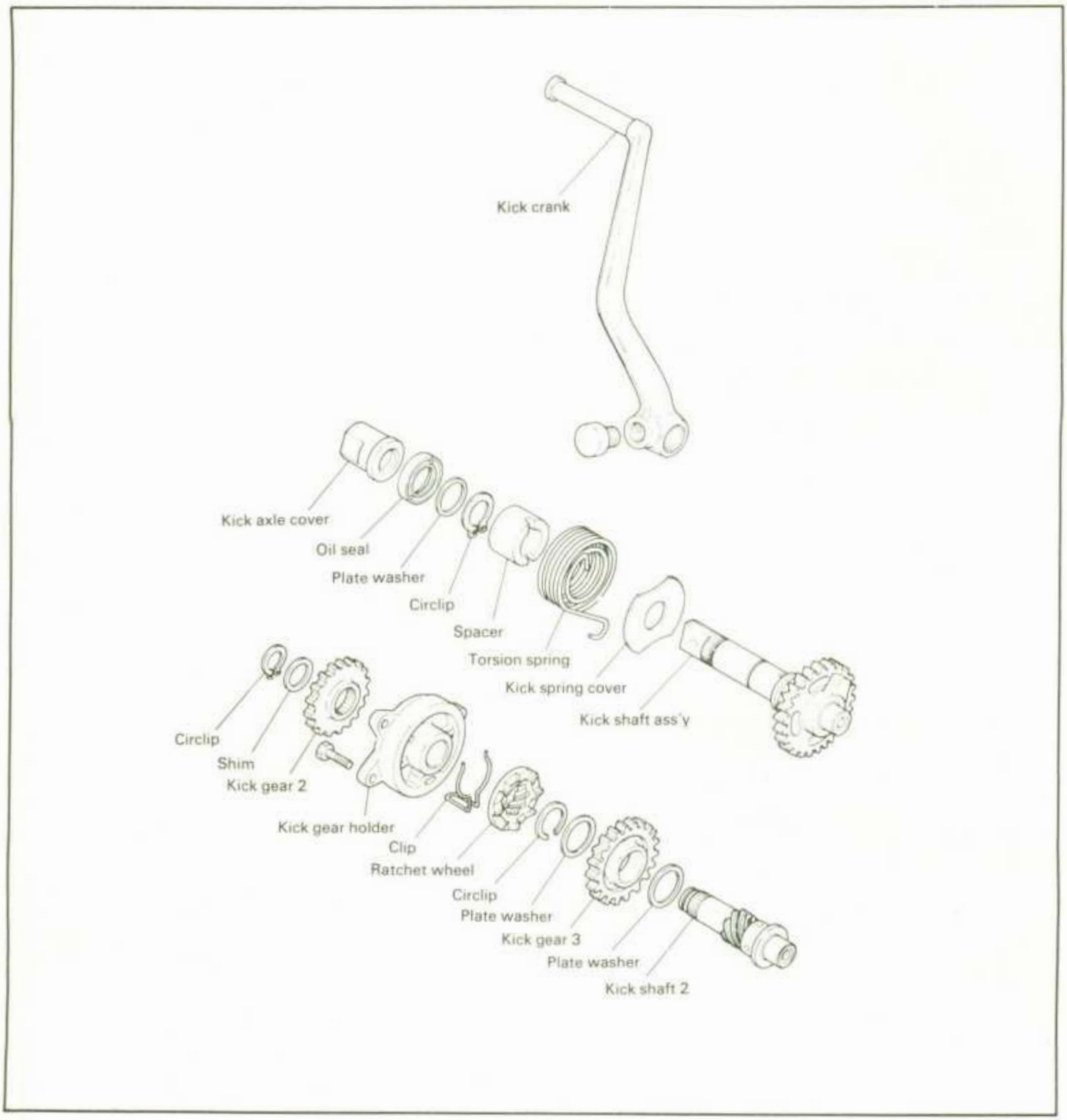


3. Install the breather cover and wire harness clip.

Tightening torque: 1.0 m-kg (7.2 ft-lb)



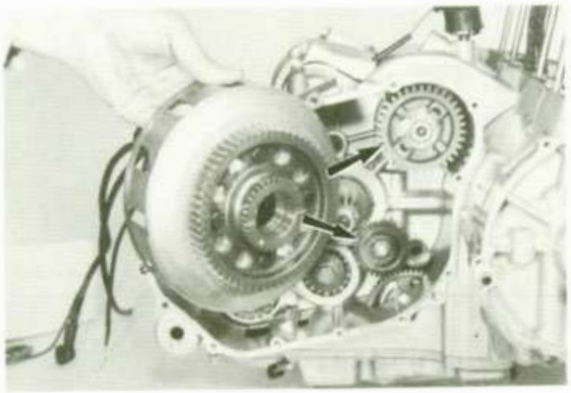
E. Clutch/Kick Gear



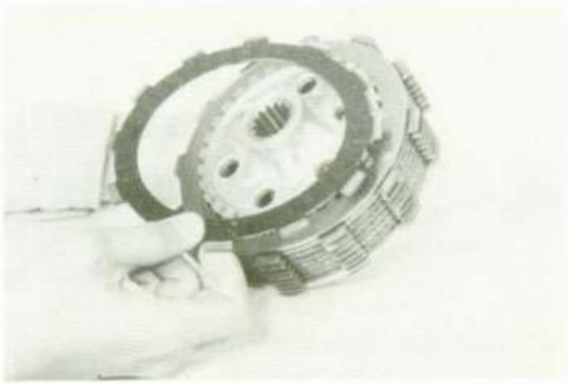
1. Install the thrust washer (2 mm thickness) on the main axle. This is the thicker of the two clutch washers.



2. Install the clutch primary driven gear and the thinner spacer. Make sure the driven gear is properly engaged on both the primary drive gear and the oil pump drive gear.



3. Install the 7 clutch plates and 8 friction plates alternately on the clutch boss assembly, starting with a friction plate and ending with a friction plate.



4. Install the pressure plate 2 on the clutch boss assembly.

NOTE:

It may be helpful to install one clutch spring and bolt to help hold this assembly together during installation.



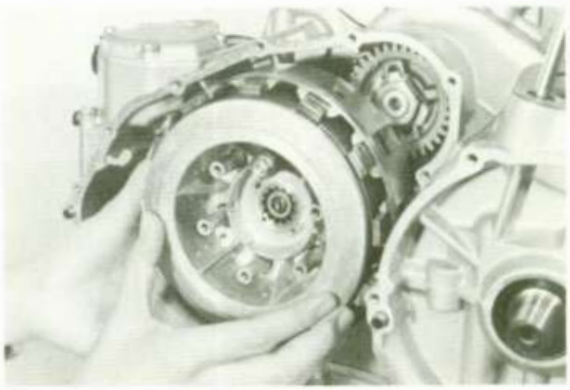
1. Pressure plate 2



5. Install the clutch boss assembly on the primary driven gear.

CAUTION:

Be careful not to bend or break the friction plate tabs.

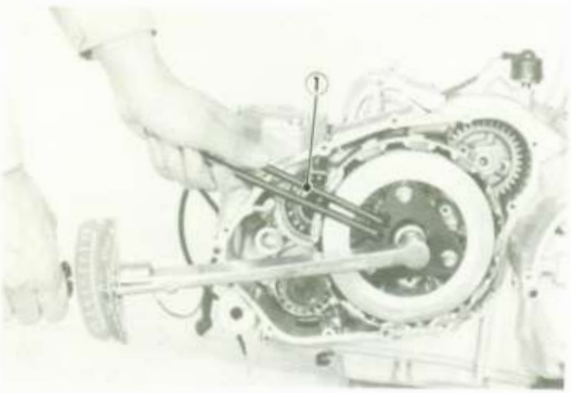


6. Install the spring washer, new lock washer and nut on the main axle. Remove the pressure plate bolt installed previously and install the special clutch

holding tool. Secure the special tool to the clutch with three pressure plate bolts and tighten securely. Failure to secure the tool to the clutch with bolts will damage to the pressure plate bosses. Torque the clutch holding nut to the specification and remove the special tool.

Clutch holding nut torque: 7.0 m-kg (50.6 ft-lb)

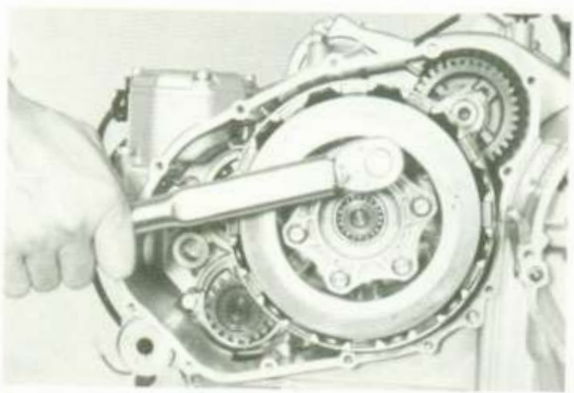
CAUTION:
Don't forget to bend over the lock washer.



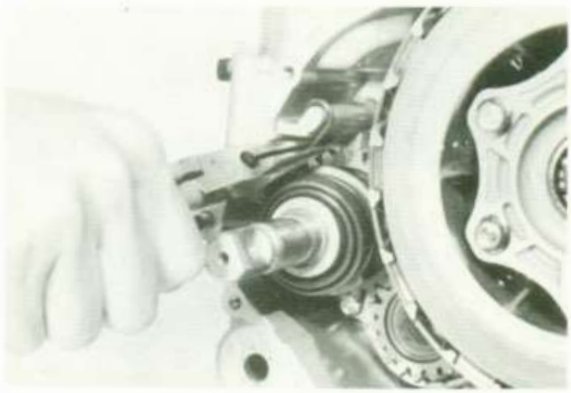
1. Clutch holding tool

7. Install the clutch spring, pressure plate No. 1 and clutch bolts. Tighten the bolts evenly and finally torque to the specification.

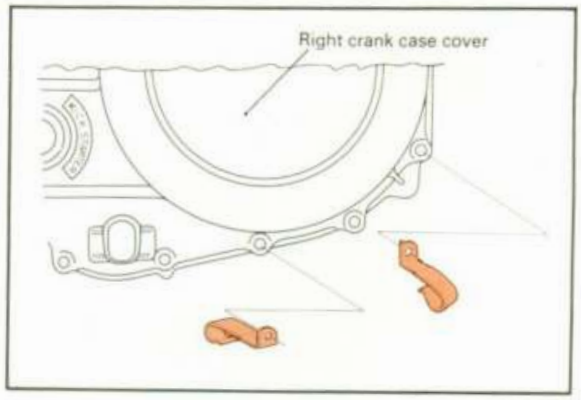
Tightening torque: 1.0 m-kg (7.2 ft-lb)



8. Install the kick gear assembly. Hook the return spring on the crankcase boss, then use the kick crank to turn the assembly about 180° counterclockwise or until the kick gear will engage the kick idler gear. Remove the kick crank.



9. Install the right crankcase cover. Remember to properly install all wiring harness clips.



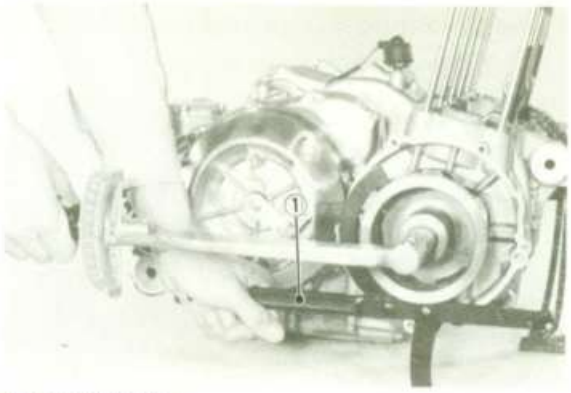
F. Generator (A.C.G.)

1. Install the alternator rotor. Install the spring washer and thick washer on the bolt.



2. Use the universal rotor holding tool (special tool) and torque the bolt to specification.

Bolt tightening torque: 6.5 m-kg (47 ft-lb)



1. Rotor holding tool

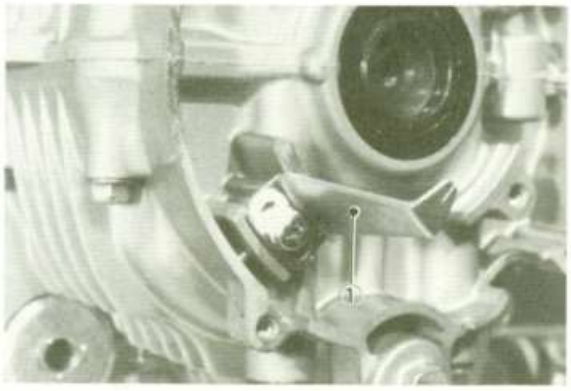
3. Using a new gasket, install the alternator assembly.

Tightening torque: 1.0 m-kg (7.2 ft-lb)



G. Pick-up Coil Assembly

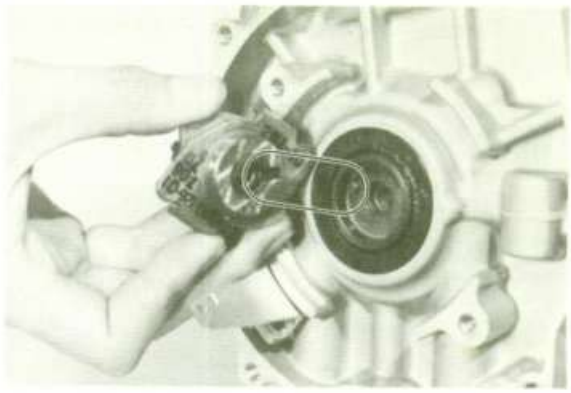
1. Install the timing pointer on the crankcase.



1. Timing pointer

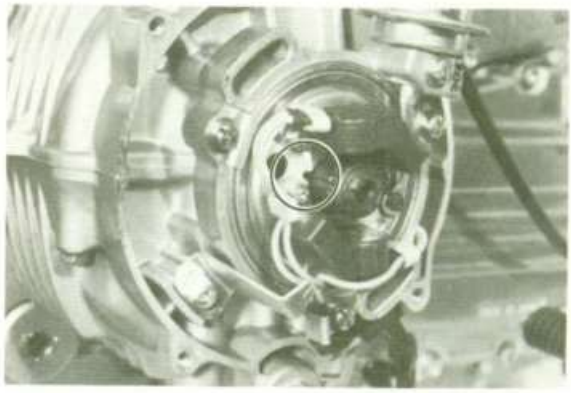
2. Install the governor assembly.

NOTE:
Note the locating pin on the crankshaft when installing it.



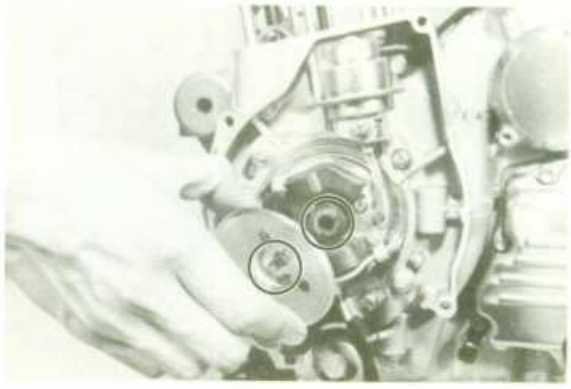
3. Install the pick-up coil assembly over the governor assembly.

NOTE:
Note that there is a projection on the governor shaft and a corresponding slot in the pick-up coil backing plate which must be aligned to install the plate.



4. Install the timing plate.

NOTE:
The locating slot is off-center, so the timing plate can only be installed one way on the governor shaft.

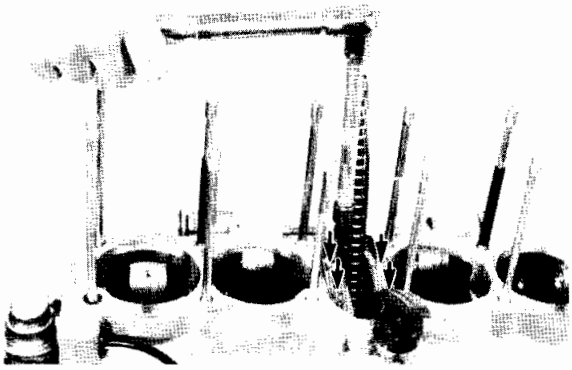


Torque the allen bolt to the specification.

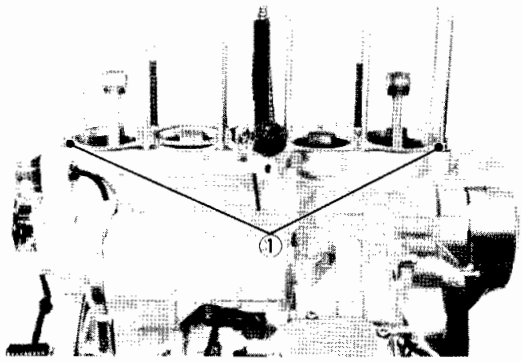
Tightening torque: 2.0 m-kg (14.5 ft-lb)

H. Pistons and Cylinder

1. Install the cam chain damper assembly.

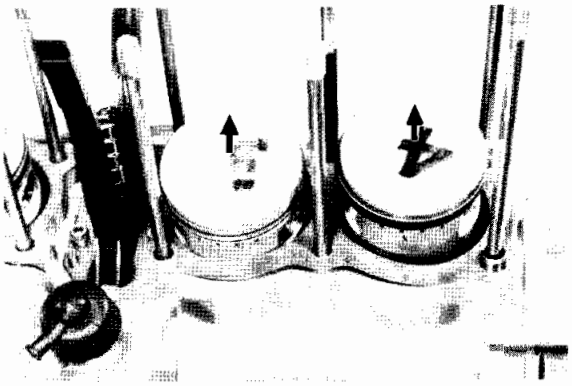


2. Install a new base gasket and make sure the dowels on the two outside rear studs are in place.

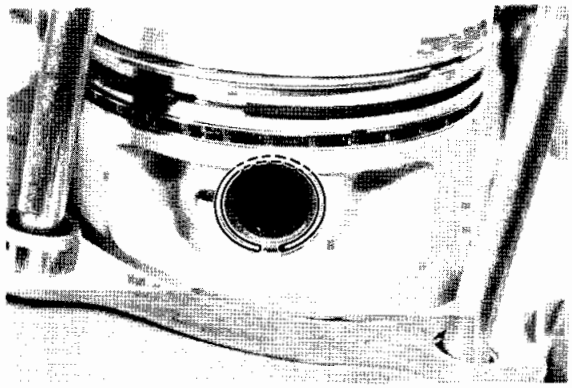


1. Dowel pin

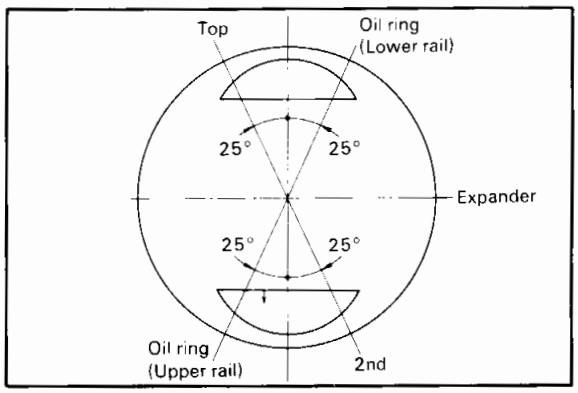
3. Install the pistons on the proper rods with the arrow on the piston crowns pointing toward the front of the engine.



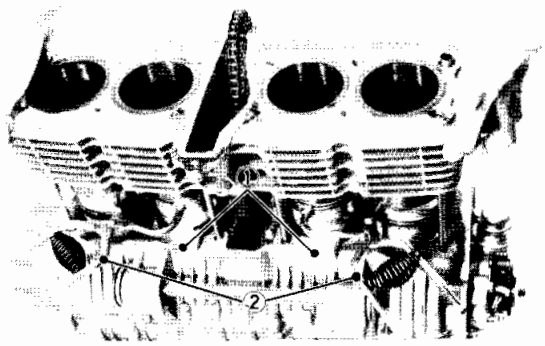
4. Install new piston pin circlips and locate the end gap of the circlips at the 6 o'clock position to prevent them from vibrating loose or breaking.



5. Position the piston ring end gaps as shown. Lubricate the pistons, rings and cylinder walls liberally with Yamalube 4-stroke oil or 20W/30 motor oil.



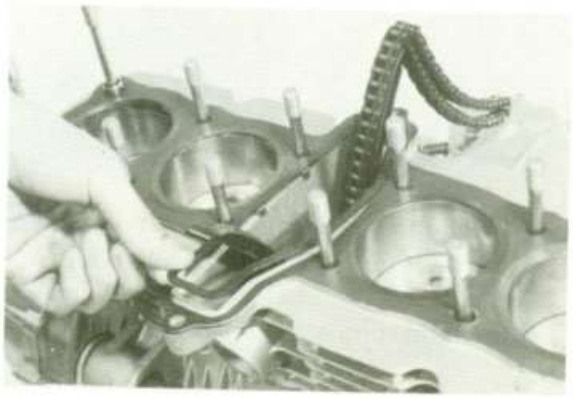
6. Tie the cam chain with a piece of mechanic's wire and feed it through the chain opening. With pistons 2 and 3 up, install the ring compressors as shown. Place two piston support plates beneath these two pistons. Carefully lower the cylinder onto the pistons. Remove the ring compressors and plates and repeat this procedure for pistons 1 and 4.



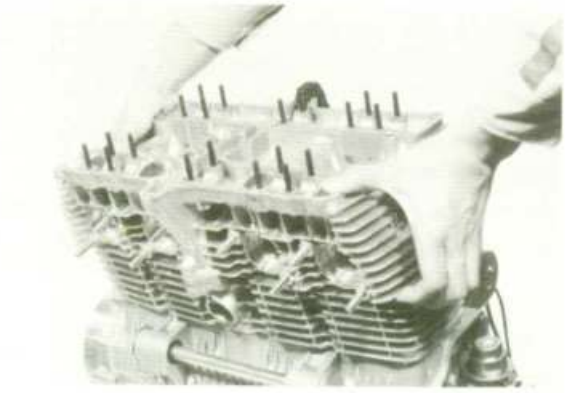
1. Piston support plates
2. Piston ring compressors

I. Cylinder Head and Cam Shafts

1. Install the cylinder head gasket. Locate the cam chain cavity cylinder seal with the tabs down. Make sure the two dowel pins on the outside rear studs are properly positioned.



2. Install the cylinder head onto the cylinder. Pull the cam chain through the cylinder head as it is installed. Tie the cam chain so that it does not fall into the crankcases.

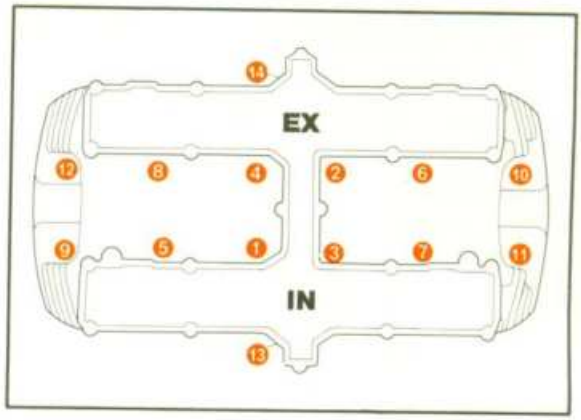


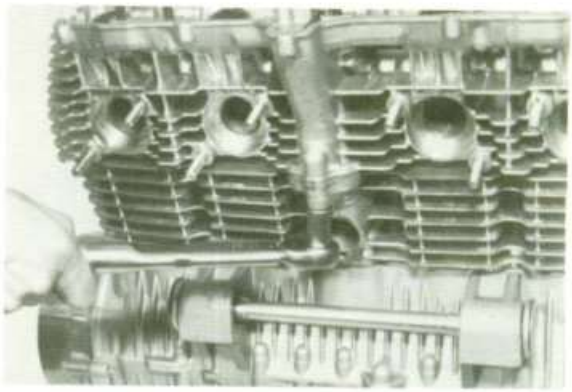
3. Place the upper cylinder head nuts and washers in place. Follow the illustration for the proper tightening sequence. Torque all nuts in two stages and final torque the upper nuts to the specification.

Tightening torque: 3.5 m-kg (25.3 ft-lb)

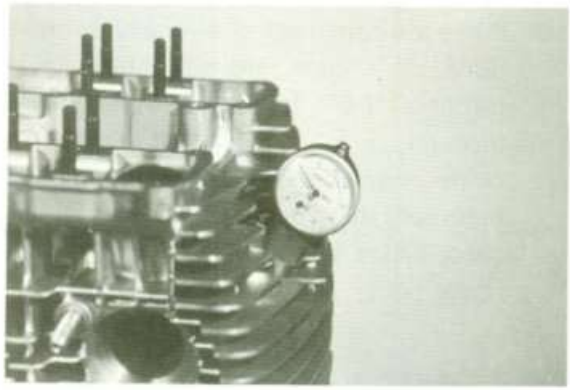
4. Don't forget the lower nuts on the front and rear of the cylinder head. Torque to the specification.

Tightening torque: 2.0 m-kg (14.5 ft-lb)

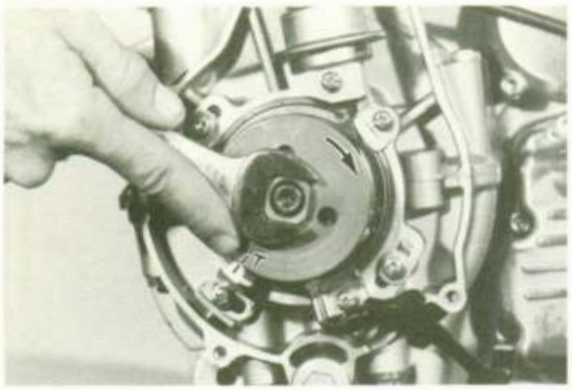




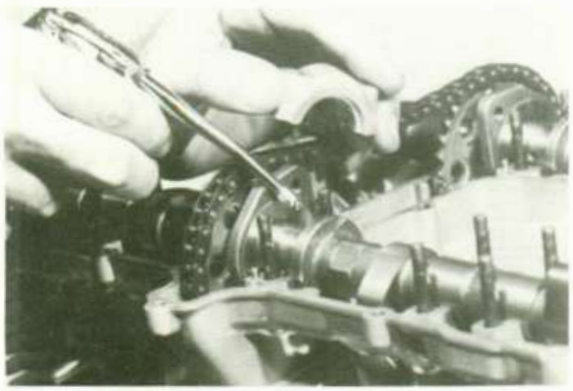
5. To start the valve timing sequence, install a dial indicator in cylinder No. 1.



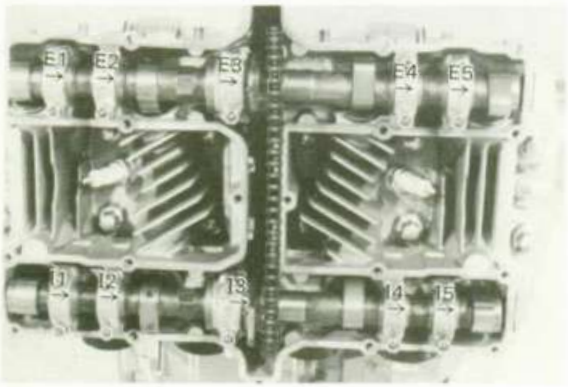
6. Rotate the engine in a clockwise direction until top dead center is found for cylinders No. 1 and No. 4.
7. With cylinders 1 and 4 at the top dead center, loosen the screw on the crankcase pointer and align the pointer with the "T" mark on the timing plate. Recheck the top dead center and alignment of the pointer and "T" mark. When all are aligned, tighten the screw.



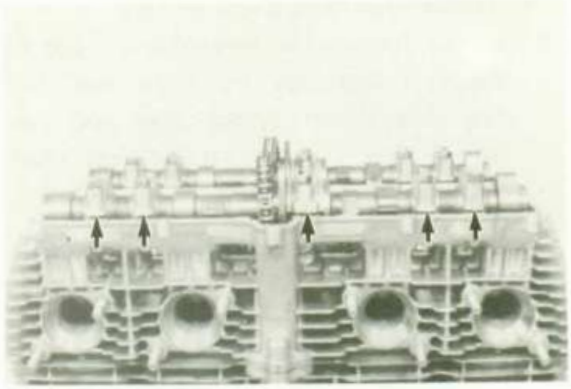
8. Slip the cam chain over the sprockets.
9. Lubricate all cam caps and cam bearings surfaces liberally with oil.



10. Place the cam caps in their proper positions. The caps are identified "I-1" through "I-5" for intake and "E-1" through "E-5" for exhaust. Place the center dowel pinned caps in position first and then position the remaining caps. Install the nuts and washers only finger tight.



CAUTION:
The cam caps must be tightened evenly or damage to the cylinder head, cam caps and cam will result. The spaces between the caps and cylinder head should be equal.



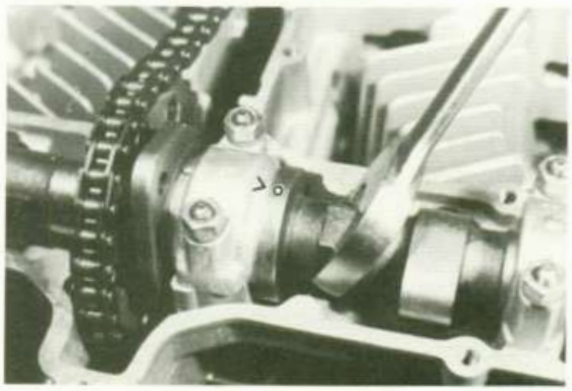
11. Torque the cam caps nuts in two stages and final torque to the specification.

Tightening torque: 1.0 m-kg (7.2 ft-lb)

J. Cam Chain, Cam Sprockets and Chain Tensioner

1. Rotate each cam shaft until the dot on the cam is aligned with the arrow on the center cam cap.

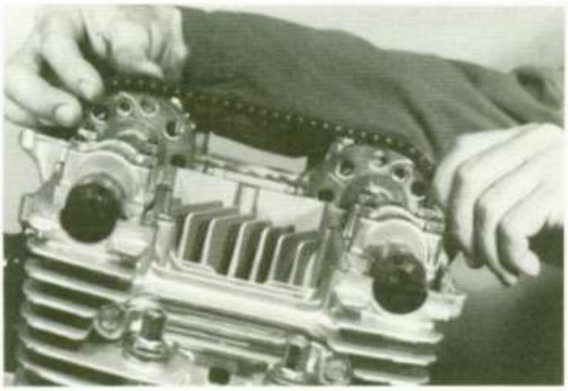
CAUTION:
Use extreme caution when rotating the cams. Two possible dangers exist. First, the wrench may contact the head and fracture it. Or second, a valve may become bent if the cam is turned the wrong way.



2. Carefully lift the cam chain from the intake cam sprocket and pull upward to remove any slack in the chain between the crankshaft and the intake cam sprocket. With all slack removed, place the chain back on the cam sprocket.
3. Grip each sprocket simultaneously and place them on the crankshaft shoulders while continuing to keep tension on the

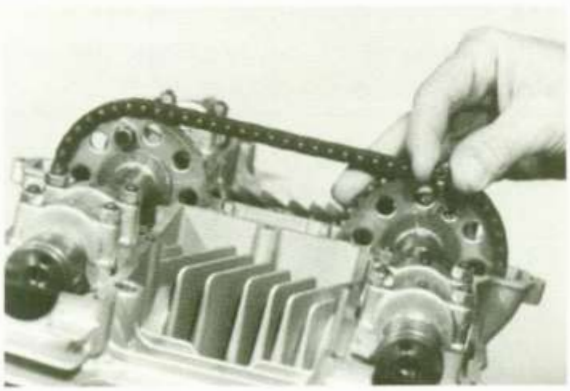
chain from the crankshaft to the intake sprocket.

CAUTION:
Use only the special hardened shouldered bolts to install the cam chain sprockets to the cams.
Make sure the rollers of the cam chain are centered on both chain tensioning slippers.

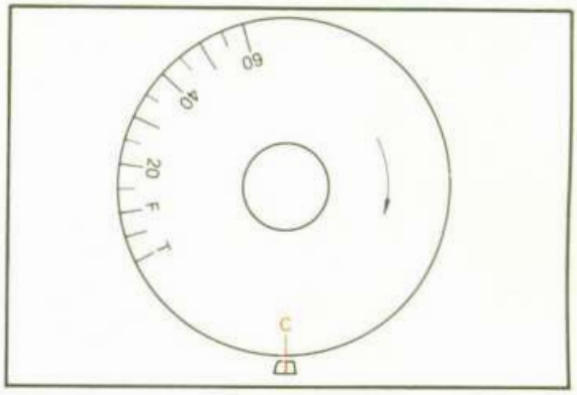


4. Rotate the sprockets slightly to align the bolt holes and insert one special bolt in each sprocket.

NOTE:
Tighten only finger tight at this time.

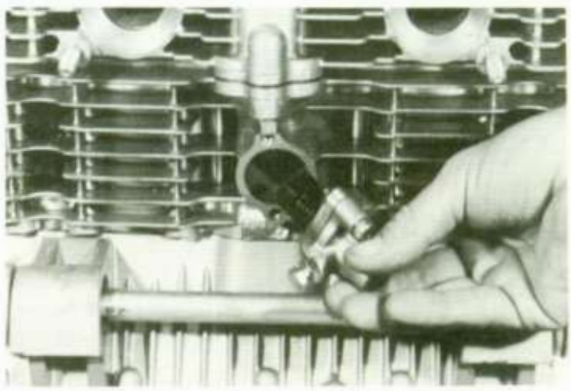


5. Install the guide stopper.
6. Rotate the crankshaft approximately 45° and align the "C" mark on the timing plate with the timing pointer.



7. Compress the cam chain tensioner and lock in the retracted position.
8. Install the chain tensioner to the engine and torque the bolts to the specification.

Tightening torque: 1.0 m-kg (7.2 ft-lb)



9. Release the tensioner holding bolt, an audible click will be heard when the tensioner is released.
10. Torque the holding bolt and the lock nut to the specifications.

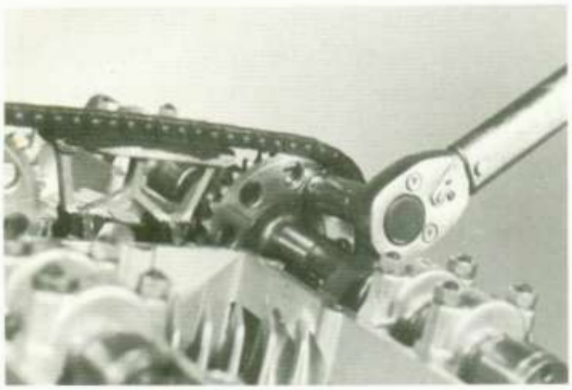
Holding bolt torque:
0.6 m-kg (4.3 ft-lb)
Lock nut torque:
0.9 m-kg (6.5 ft-lb)

11. Rotate the crankshaft more than one full revolution and align the "T" mark on the timing plate with the timing pointer.
With the crankshaft at the "T" mark, the dots on the cams should be aligned with the raised arrows on the center cam caps. If they are not aligned, disassembled the sprockets and chain tensioner and repeat above procedures.

12. Rotate the crankshaft and install the two remaining shoulder bolts into the cam sprockets. Torque all four sprocket holding bolts to the specification.

CAUTION:
Be sure to attain the specified torque value to avoid the possibility of these bolts coming loose and causing serious damage to the engine.

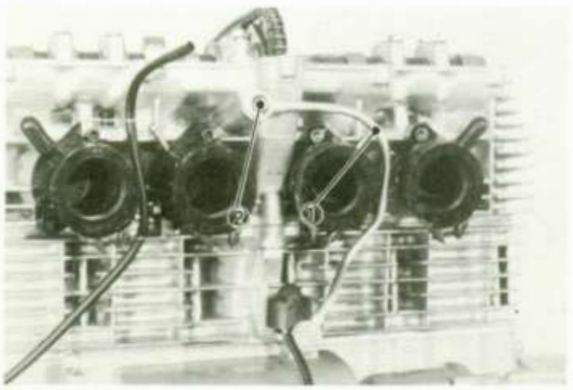
Tightening torque: 2.0 m-kg (14.5 ft-lb)



K. Oil Delivery Pipe and Cylinder Head Cover

1. Install the overhead oil lines using the special bolts with a new copper washer on each side of the banjo fittings. These two bolts are not identical (the larger bolt with the dished head goes in the top).

Tightening torque: 2.0 m-kg (14.5 ft-lb)



1. Oil delivery pipe
2. Dished head bolt

2. Adjust all valves as described in the "PERIODIC INSPECTIONS AND ADJUSTMENTS" (Page 2-4).
3. Install the cylinder head cover with a new gasket.
4. Install the timing cover with a new gasket.
5. Install the middle gear case with a new gasket.

Torque: 2.4 m-kg (17.4 ft-lb)

REMOUNTING ENGINE

A. Remounting Engine

1. Refer to page 3-2 for engine removal. Reverse the applicable removal steps.

CAUTION:
Always use new bolts in the drive shaft coupling.

2. Install and tighten the engine mounting bolts.

Engine mounting bolt torque:
10 mm bolt: 6.7 m-kg (48.5 ft-lb)
12 mm bolt: 10.0 m-kg (72.3 ft-lb)

3. Fill the oil filter with approx. 0.5 lit (0.5 qt.) engine oil and install oil filter.

CAUTION:
The filter must be filled with the specified amount of oil to prime the oil pump of an overhauled engine.

4. Tighten engine oil drain plug, oil filter mounting bolt, and middle drain plug.

Torque:
Engine oil drain plug:
4.3 m-kg (31.1 ft-lb)
Oil filter mounting bolt:
3.2 m-kg (23.1 ft-lb)
Middle gear drain plug:
2.3 m-kg (16.6 ft-lb)

5. Add oil to engine and middle gear case.

Engine oil: 4.0 lit (4.3 US qt.)
Middle gear oil: 0.36 lit (0.38 US qt.)

NOTE:

These oil quantities are for an overhauled engine. Observe oil filter filling procedure.

CAUTION:

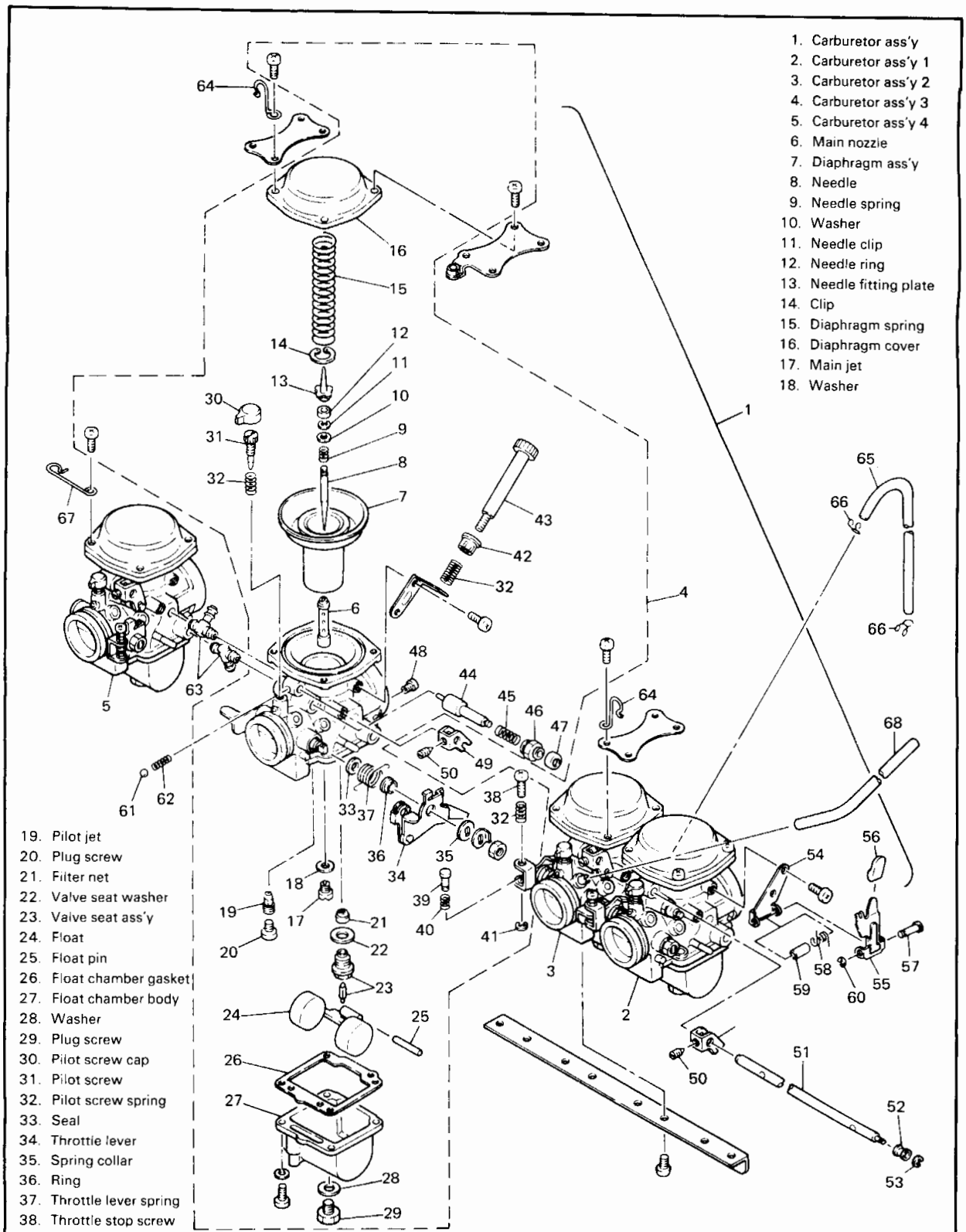
If oil pressure warning light (red light) stays on after starting engine, stop engine immediately. Fill oil filter with oil as in step 3 above. Check for proper operation of the warning light.

CHAPTER 4. CARBURETION

Carburetor 4-2
A. Description 4-2
B. Specifications 4-3
C. Disassembly 4-3
D. Inspection 4-4
E. Adjustments 4-5

4

CHAPTER 4.
CARBURETION



1. Carburetor ass'y
2. Carburetor ass'y 1
3. Carburetor ass'y 2
4. Carburetor ass'y 3
5. Carburetor ass'y 4
6. Main nozzle
7. Diaphragm ass'y
8. Needle
9. Needle spring
10. Washer
11. Needle clip
12. Needle ring
13. Needle fitting plate
14. Clip
15. Diaphragm spring
16. Diaphragm cover
17. Main jet
18. Washer
19. Pilot jet
20. Plug screw
21. Filter net
22. Valve seat washer
23. Valve seat ass'y
24. Float
25. Float pin
26. Float chamber gasket
27. Float chamber body
28. Washer
29. Plug screw
30. Pilot screw cap
31. Pilot screw
32. Pilot screw spring
33. Seal
34. Throttle lever
35. Spring collar
36. Ring
37. Throttle lever spring
38. Throttle stop screw
39. Push rod
40. Adjust spring
41. Clip
42. Adjuster bushing
43. Adjuster ass'y
44. Plunger starter ass'y
45. Plunger spring
46. Plunger cap
47. Plunger cap cover
48. Air pilot jet
49. Starter lever
50. Screw
51. Starter lever shaft
52. Starter lever bushing 2
53. Starter lever clip 2
54. Starter lever bracket 1
55. Starter lever 1
56. Starter lever cap
57. Starter lever pin 1
58. Starter lever spring 1
59. Starter lever pipe 1
60. Starter lever clip 1
61. Ball
62. Spring
63. Nipple
64. Clip
65. Hose
66. Clip
67. Clip
68. Hose

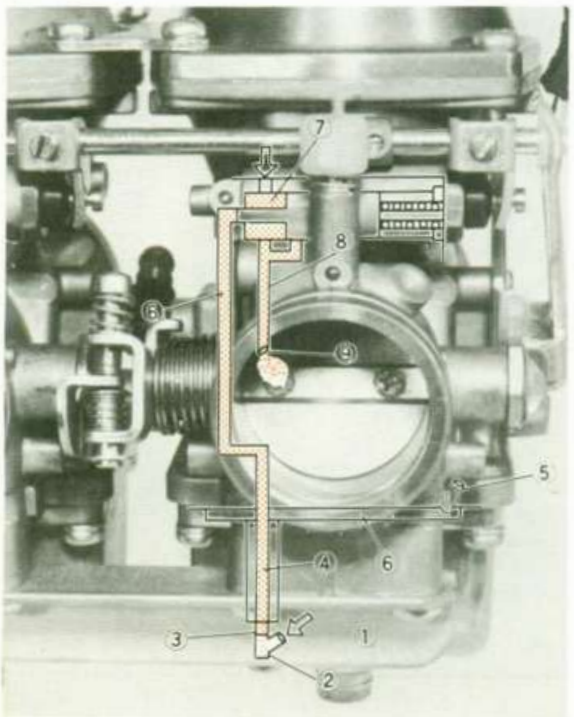
CARBURETOR

A. Description

This model is equipped with four "constant velocity" (CV) carburetors mounted on rubber intake manifolds.

1. Air flow through the venturi is controlled by a throttle slide (vacuum piston). The slide is raised and lowered by engine vacuum rather than a cable linked directly to the throttle grip. This type of carburetor compensates automatically for atmospheric pressure changes such as those encountered when riding at high altitudes.
2. With a conventional one-position starter jet, the air-fuel ratio remains the same as that required to start the engine (despite the fact that the engine temperature rises gradually) until the engine operating temperature rises to the point at which use of the starter jet is no longer necessary. In other words, beyond a certain point, the air-fuel mixture is too rich until the engine operating temperature rises to a certain point and the starter jet is shut off.
   The newly-adopted two-position type starter jet is designed to supply a mixture of more appropriate richness by switching from one jet to another.

a. Routes of fuel and air

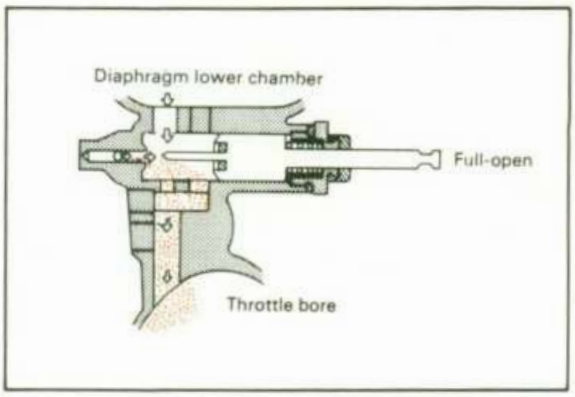


The fuel supplied from the float chamber (1) passes through (2) and is metered by (3). Air is supplied from the air chamber in the float chamber and flows through (5) and (6). It is then mixed with the metered fuel. The resultant mixture passes through (4) and (6) and flows into the two-position starter jet (7) , where it is further mixed with air supplied from the diaphragm (8) and streams into the throttle bore out of (9).

b. Operation of two-position starter jet

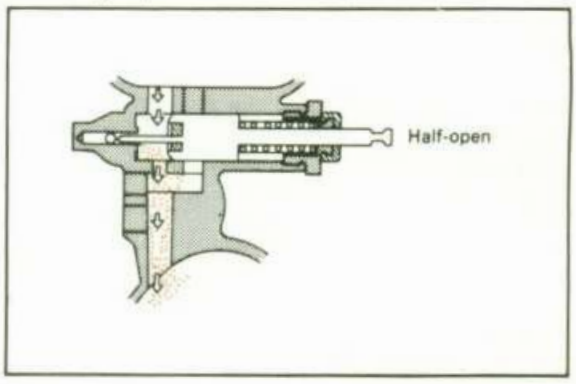
Full-open:

To start a cold engine, a rich mixture is required. To supply a rich mixture, pull the starter lever and the way out so that the needle regulating the fuel flow is set free and the flow rate of incoming fuel is increased to a maximum. The fuel is mixed with the air supplied from the diaphragm lower chamber, and thus a rich mixture is produced.



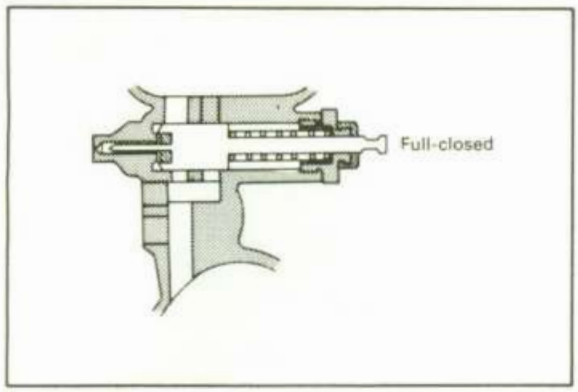
Half-open:

After starting, that is, during warm-up, a slightly rich mixture is required. Push back the starter lever half-way so that the fuel flow is reduced by the needle. The fuel is mixed with the air from the diaphragm lower chamber, and thus a slightly rich mixture is produced.



Full-closed:
When the engine fully warms up, no mixture from the starter circuit is necessary. Push the starter lever all the way in so that the flow of incoming fuel is stopped by the plunger, and thus no mixture enters the throttle bore.

NOTE:
Use of the starter jet in either open position after the engine has warmed up to operating temperature will result in excessive exhaust emissions and poor performance.



B. Specifications

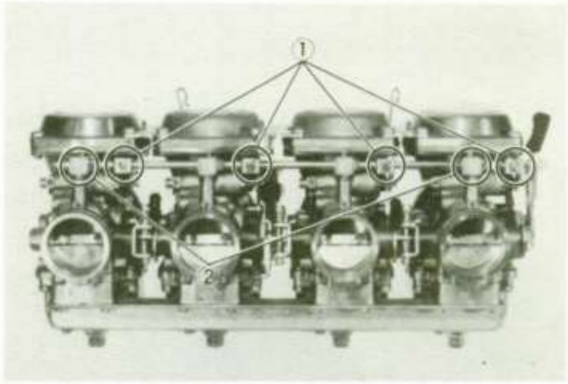
Main jet	No. 137.5
Jet needle	5GZ6/3
Needle jet	X-2
Starter jet	No. 40
Float height	25.7±1 mm (above gasket surface)
Pilot jet	No. 42.5
Idle mixture screw	Preset
Fuel valve seat	2.0 mm (0.079 in)
Engine idle speed	950 ~ 1,050 r/min

NOTE:
The idle mixture screw settings are adjusted for maximum performance at the factory with the use of specialized equipment. Do not attempt to change these settings.
If all other engine systems are functioning correctly, any changes will decrease performance and cause increased exhaust emissions.

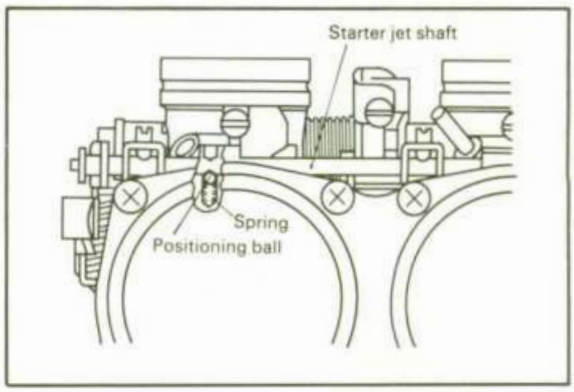
C. Disassembly

1. Prepare to separate the carburetor to be worked on. (Separation of the carburetors is not necessary if only float level adjustment or throttle slide inspection is to be performed). Remove the four screws holding the starter jet shaft to the carburetor.

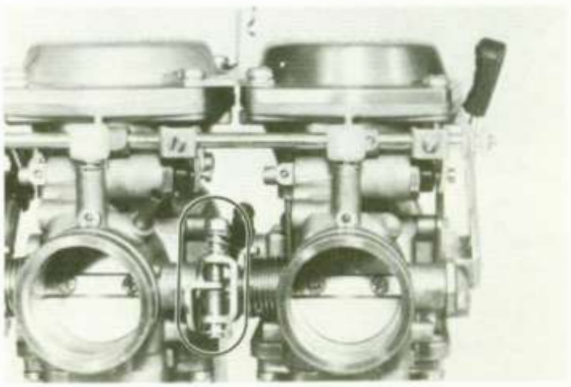
NOTE:
1. While pulling out the starter jet shaft, take care that the shaft positioning balls on the carburetors do not pop out.
2. As illustrated, reassemble the starter jet shaft so that the holding screws fit in the shaft dents.



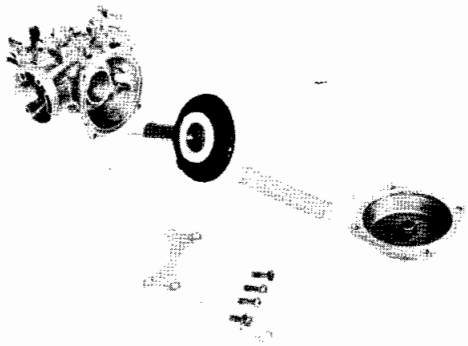
1. Holding screws 2. Positioning balls



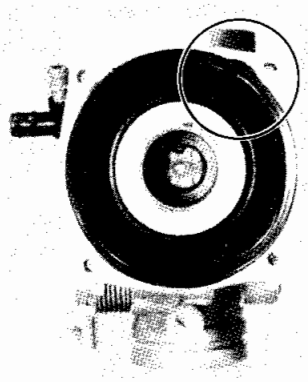
2. Remove upper and lower brackets.
Note position of synchronizing screws for guidance in reassembly. Separate carburetors.



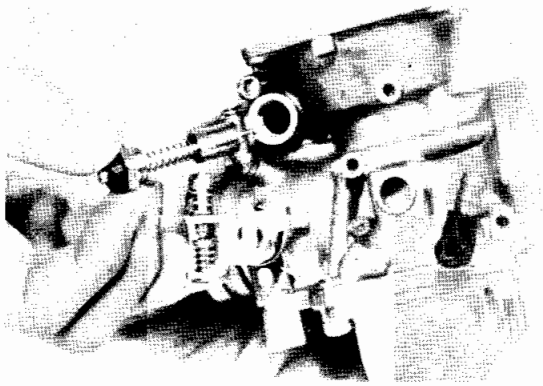
3. Remove vacuum chamber cover. Remove the spring, needle fitting plate, jet needle and diaphragm (vacuum piston).



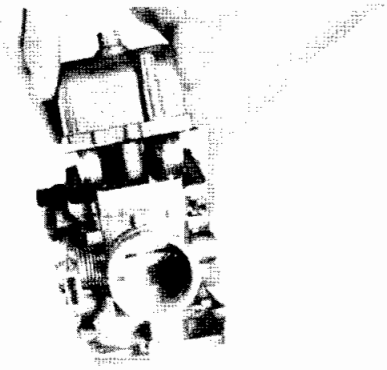
4. Note that there is a tab On the rubber diaphragm. There is a matching recess *in the carburetor* body for the diaphragm tab.



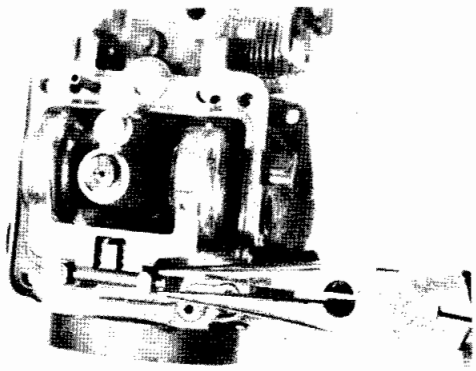
5. To inspect the starter jet, remove the starter assembly to the left side of the carburetor.



6. Remove the four screws holding the float bowl cover. Remove the float bowl cover. The main jet is located under a cover in the float bowl.



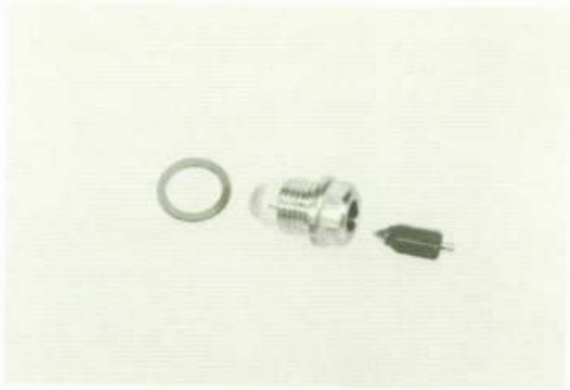
7. Pull out the float pivot pin. Remove the float assembly. Be careful not to lose the float valve needle located under the float level adjustment tang. Remove the needle jet.



8. Reassemble in reverse order. Pay close attention to the installation of the vacuum piston diaphragm.

D. Inspection

1. Examine the carburetor body and fuel passages. If contaminated, wash the carburetor in a petroleum-based solvent. Do not use caustic carburetor cleaning solutions. Blow out all passages and jets with compressed air.
2. Examine the condition of the floats. If the floats are leaking or damaged, they should be replaced.
3. Inspect the inlet needle valve and seat for wear or contamination. Replace these components as a set.

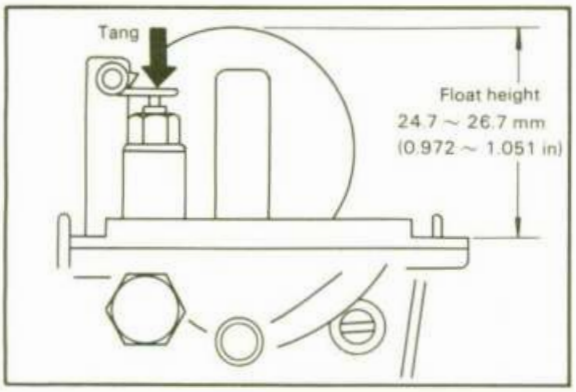


4. Inspect the vacuum piston and rubber diaphragm. If the piston is scratched or the diaphragm is torn, the assembly must be replaced.

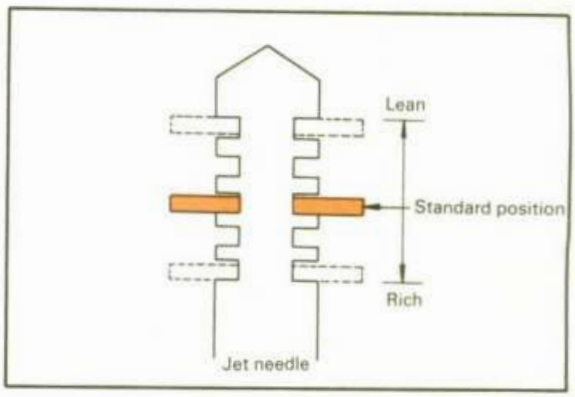


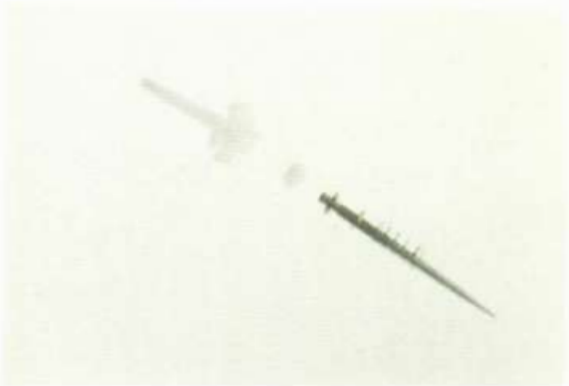
E. Adjustments

1. Float level adjustment
   Measure the distance from the bottom of the float to the float bowl gasket seating surface without the gasket. Bend the tang on the float arm if any float level adjustment is necessary. Both floats must be at the same height. If the float level is too low, a rich air/fuel mixture will be caused by the high fuel level. If the float level is too high, the low fuel level will result in a lean mixture.



2. Jet needle clip position.
   The mid-range air/fuel supply is affected by the position of the needle in the needle jet. Check to see that the needle clip position is correct. If not, change the clip position to the specified position.





CHAPTER 5. CHASSIS

Front Wheel 5-2
A. Removal 5-2
B. Front Axle Inspection 5-2
C. Front Wheel Inspection 5-2
D. Replacing Wheel Bearings 5-2
E. Installing Front Wheel 5-2
Rear Wheel 5-4
A. Removal 5-5
B. Rear Axle Inspection 5-6
C. Replacing Wheel Bearing 5-6
D. Rear Wheel Inspection 5-6
E. Installing Rear Wheel 5-6
Brakes 5-6
A. Caliper Pad Replacement 5-6
B. Caliper Disassembly 5-7
C. Master Cylinder Disassembly 5-8
D. Brake Inspection and Repair 5-8
E. Brake Reassembly 5-9
Wheels, Tires, Tubes 5-11
A. Wheel Inspection 5-11
B. Tire, Tube Removal 5-11
C. Installation 5-11
Front Forks 5-12
A. Removal and Disassembly 5-13
B. Inspection 5-13
C. Assembly 5-13
Steering Head 5-14
A. Adjustment 5-14
B. Removal 5-14
C. Inspection 5-15
D. Reassembly 5-15
Swing Arm 5-16
A. Inspection 5-16
B. Adjustment 5-16
C. Removal 5-17
D. Inspection and Lubrication 5-18
E. Installation 5-18
Rear Shock Absorber 5-18
A. Removal 5-18
B. Inspection 5-18
Cables and Fittings 5-18
A. Cable Maintenance 5-18
B. Throttle maintenance 5-19
Final Drive Gear 5-19
Drive Shaft/Joint 5-20
A. Removal 5-20
B. Inspection 5-20
C. Reinstallation 5-21

CHAPTER 5. CHASSIS

Front Forks
Removal/Disassembly page 5-13
Inspection page 5-13
Assembly page 5-13

Drive Shaft/Joint
Removal page 5-20
Inspection page 5-20
Reinstallation page 5-21

Final Gear
Inspection page 5-19
Reinstallation page 5-21

Front Wheel
Removal page 5-2
Inspection page 5-2
Reinstallation page 5-2

Front Brake
Disassembly page 5-7
Inspection page 5-8
Reassembly page 5-9

Rear Wheel
Removal page 5-5
Inspection page 5-6
Reinstallation page 5-6

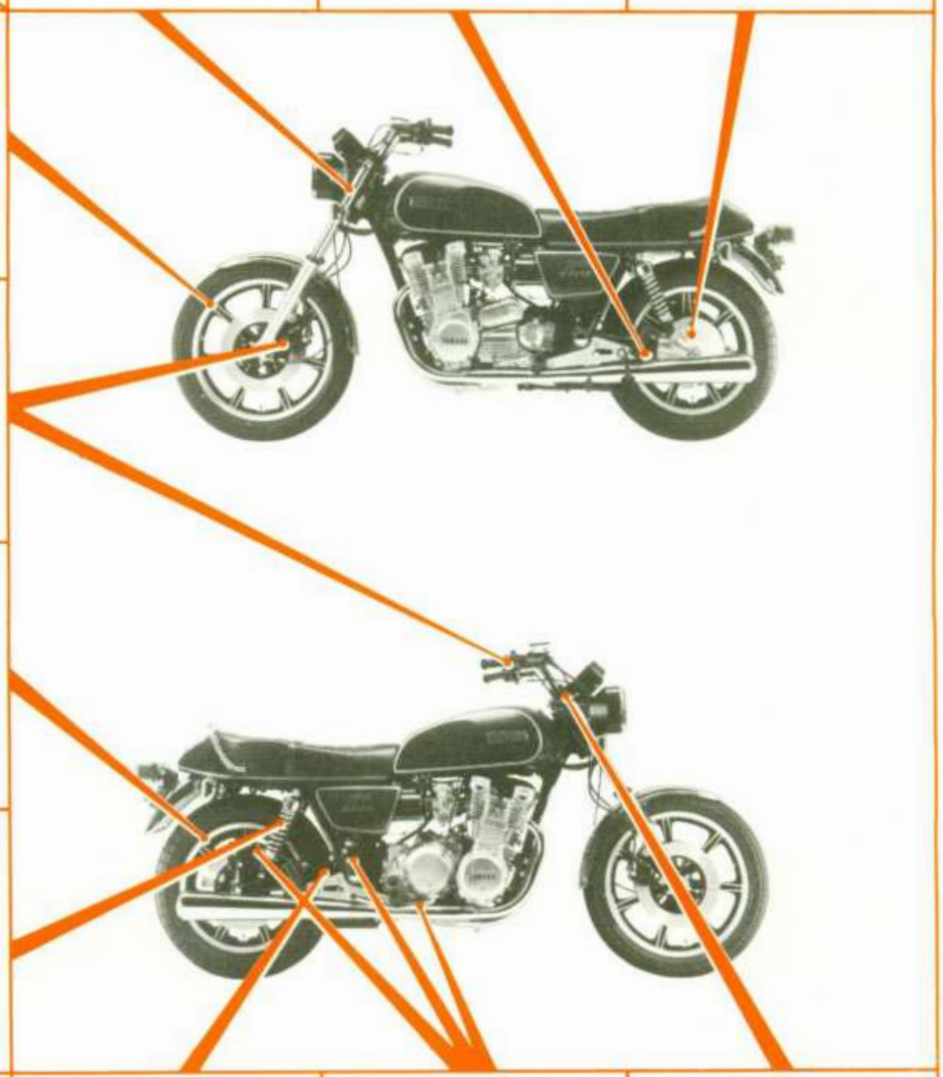
Rear Shock Absorber
Removal page 5-18
Inspection page 5-18

Cables and Fittings
Cable Maintenance page 5-18
Throttle Maintenance page 5-19

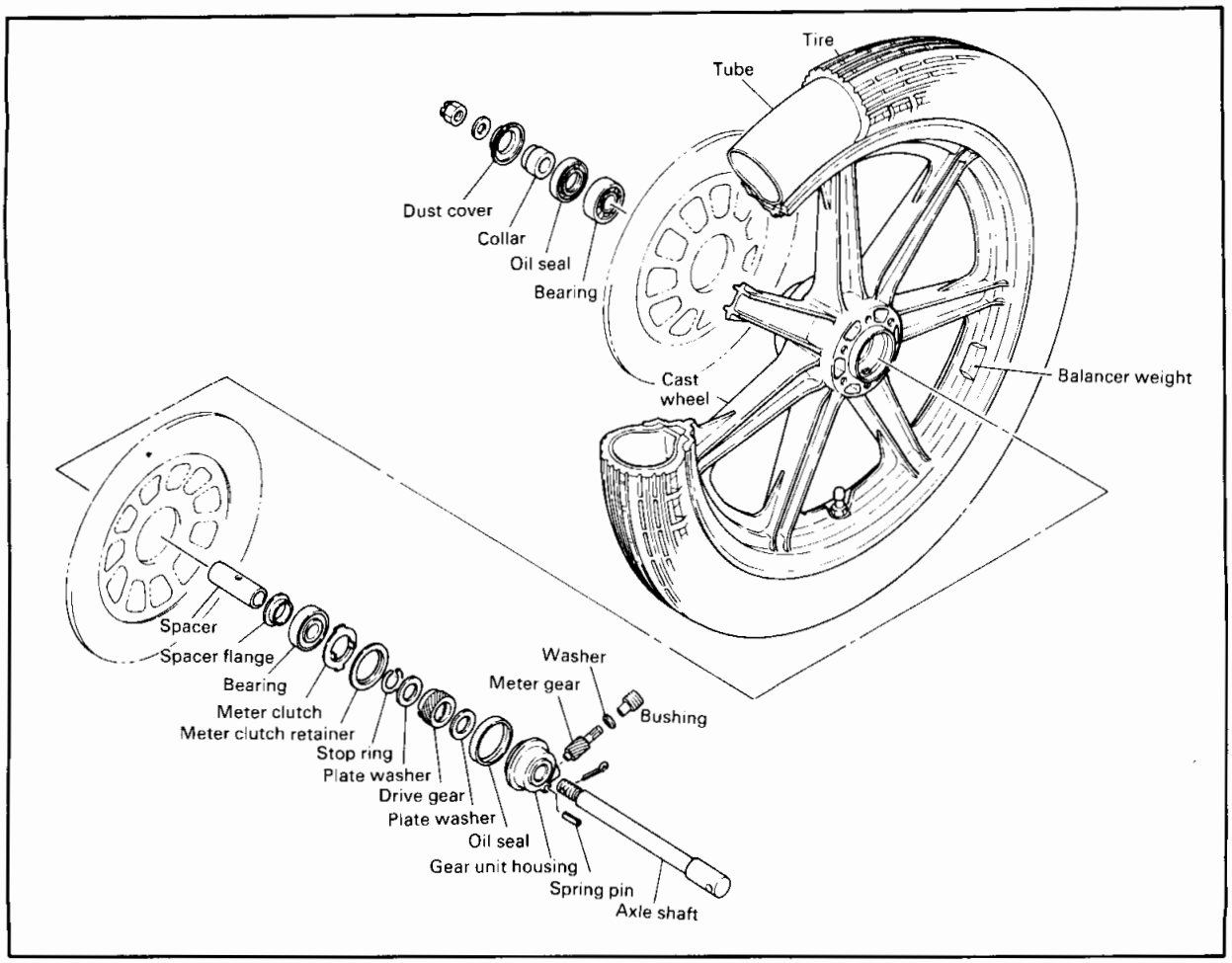
Swing Arm
Inspection/Adjustment page 5-16
Removal/Lubrication page 5-17
Installation page 5-18

Rear Brake
Disassembly page 5-7
Inspection page 5-8
Reassembly page 5-9

Steering Head
Adjustment page 5-14, 2-18
Removal page 5-14
Inspection page 5-15
Reassembly page 5-15



FRONT WHEEL

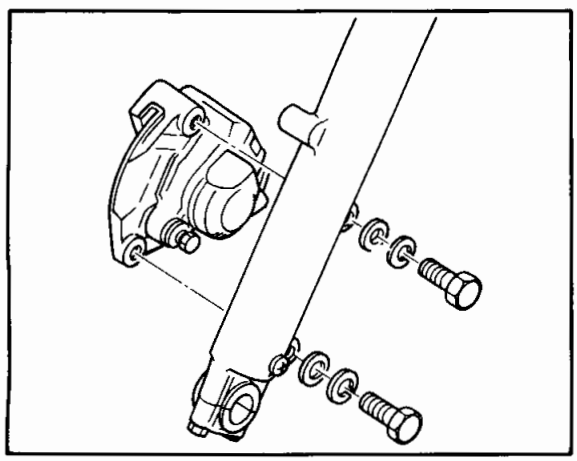


A. Removal

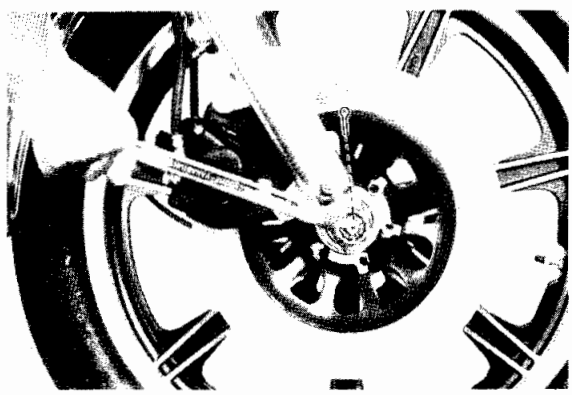
1. Place the machine on the center stand.
2. Remove two bolts holding the left brake caliper to the fork.

NOTE:

Do not disconnect the brake hose.



3. Remove the cotter pin and wheel axle nut.



4. Loosen the wheel axle holder nuts.
5. Remove the axle shaft and the wheel. Make sure the machine is properly supported.

NOTE:

Do not squeeze the brake lever while the wheel is off the machine, as the brake caliper piston will be forced out of the cylinder, making reassembly difficult. Placement of a wooden wedge between the brake pads may be helpful.

B. Front Axle Inspection

Remove any corrosion from the axle with fine emery cloth. Place the axle on a surface plate and check for bends. If bent, replace axle. Do not attempt to straighten a bent axle.

C. Front Wheel Inspection

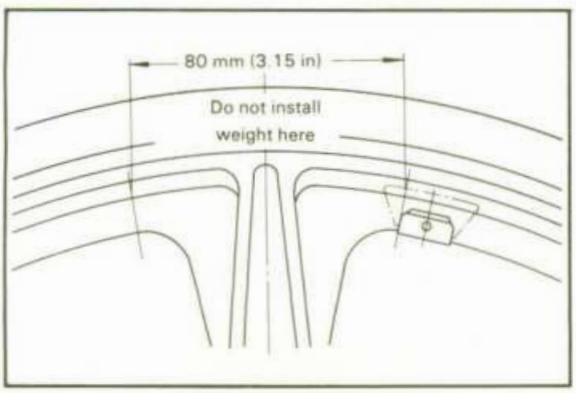
1. Check for cracks, bends or warpage of wheels. If a wheel is deformed or cracked, it must be replaced.
2. Check wheel run-out. If the deflection exceeds the tolerance below, check the wheel bearings or replace the wheel as required.

Rim run-out limits:
Vertical — 2 mm (0.08 in)
Lateral — 2 mm (0.08 in)

3. Check wheel balance. Rotate the wheel lightly several times and observe resting position. If the wheel is not statically balanced, it will come to rest at the same position each time. Install an appropriate balance weight at lightest position (at top) as illustrated.

NOTE:

The wheel should be balanced with the brake discs installed.



D. Replacing Wheel Bearings

If the bearings allow play in the wheel hub or if wheel does not turn smoothly, replace the bearings as follows:

1. Clean the outside of the wheel hub.
2. Drive the bearing out by pushing the spacer aside and tapping around the perimeter of the bearing inner race with a soft metal drift pin and hammer. The spacer "floats" between the bearings. Both bearings can be removed in this manner.

WARNING:

Eye protection is recommended when using striking tools.

3. To install the wheel bearing, reverse the above sequence. Use a socket that matches the outside race of the bearing as a tool to drive in the bearing.

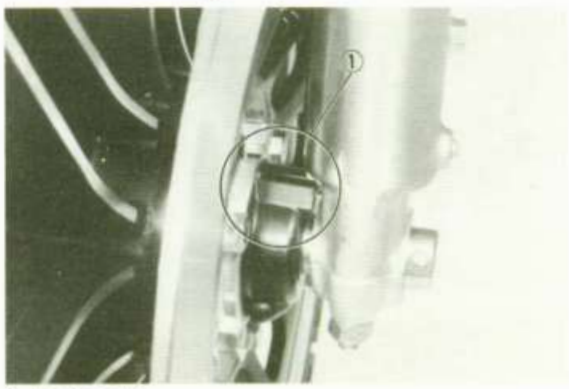
CAUTION:

Do not strike the center race or balls of the bearing. Contact should be made only with the outer race.

E. Installing Front Wheel

When installing the front wheel, reverse the removal procedure. Note the following points:

1. Lightly grease the lips of the front wheel oil seals and the gear teeth of speedometer drive and driven gears. Use lightweight lithium soap base grease.
2. Make sure there is enough gap between the disc pads to slide the disc into place.
3. Check for proper engagement of the boss on the outer fork tube with the locating slot on the speedometer gear unit housing.



1. Locating slot

4. Always secure the front wheel axle as follows:

a. Tighten the front axle nut.

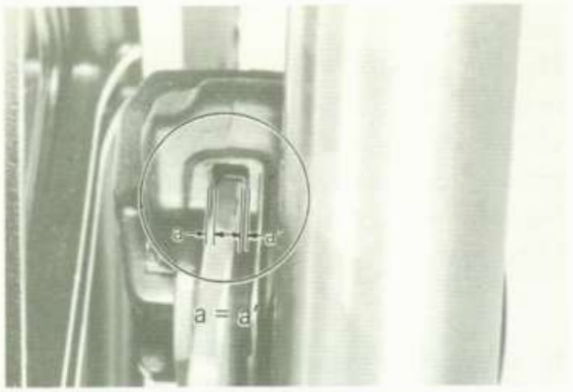
Axle nut torque: 10.7 m-kg (77.4 ft-lb)

b. Install the left disc brake caliper.

Caliper bolt torque: 4.5 m-kg (32.5 ft-lb)

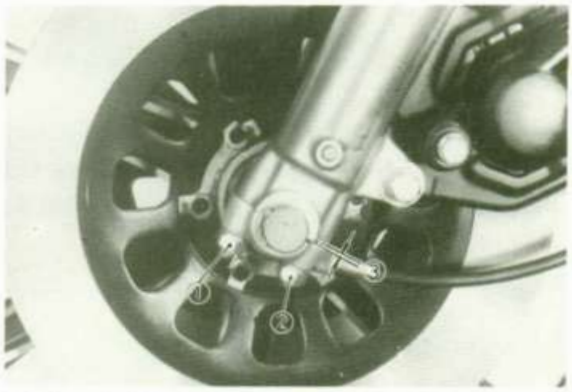
CAUTION:
If it is necessary to separate the brake pads, do so carefully to avoid damaging the pad surfaces.

c. Before tightening the holder nuts stroke the front forks several times to make sure of proper fork operation. With the axle holder nuts still loose, work the left fork leg back and forth until the proper clearances between the disc and caliper bracket are obtained. (See illustration)



d. Tighten the two axle holder nuts. First tighten the nut on front end of axle holder, then tighten the nut on the rear end.

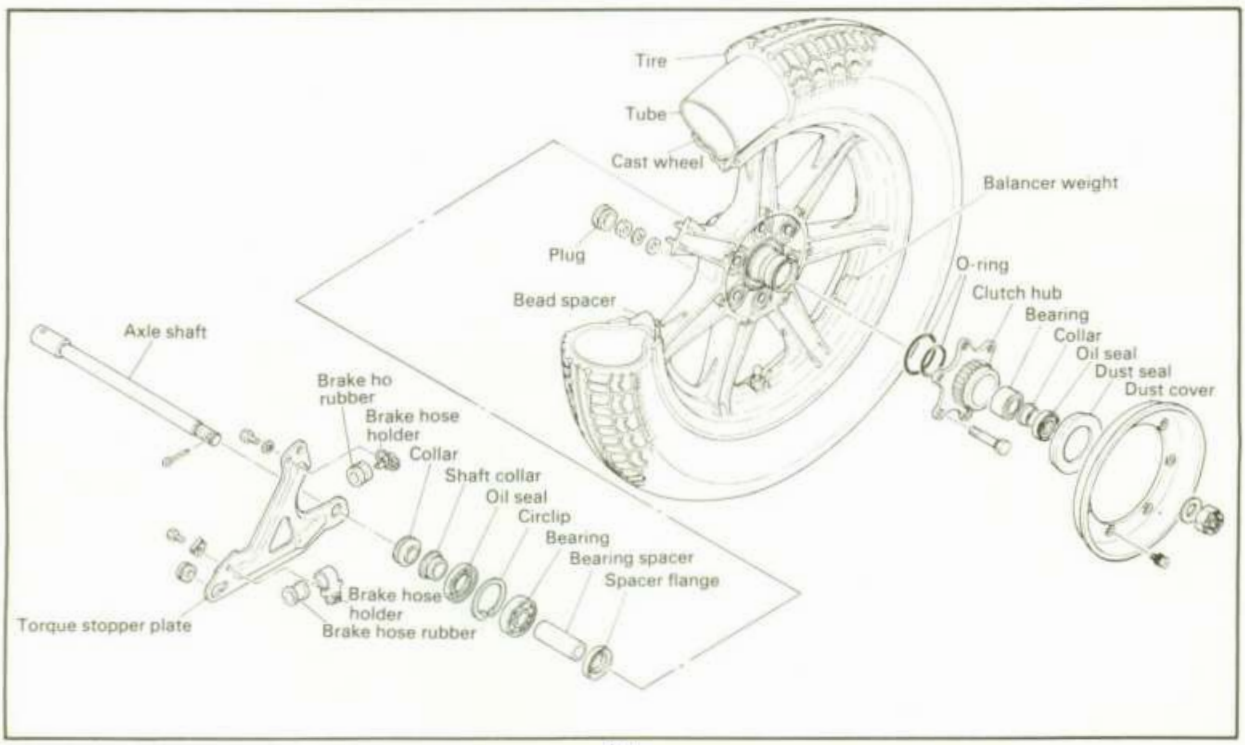
Holder nut torque: 2.0 m-kg (14.5 ft-lb)



1. 1st 2. 2nd 3. Gap

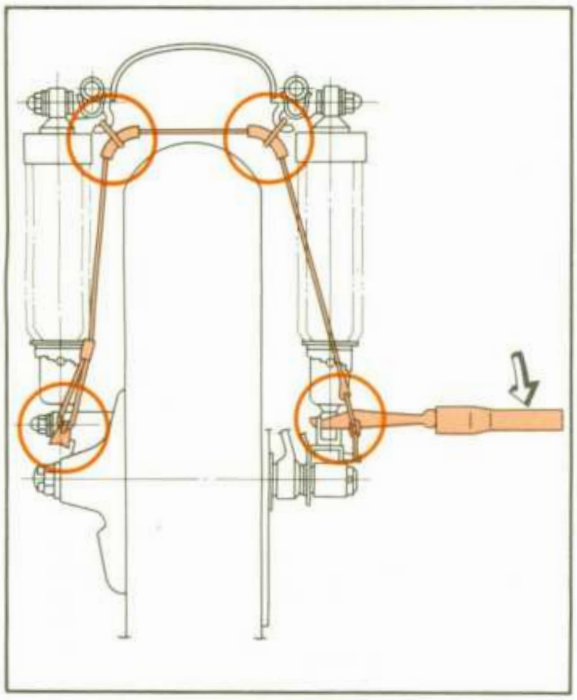
e. Install a new cotter pin.

REAR WHEEL

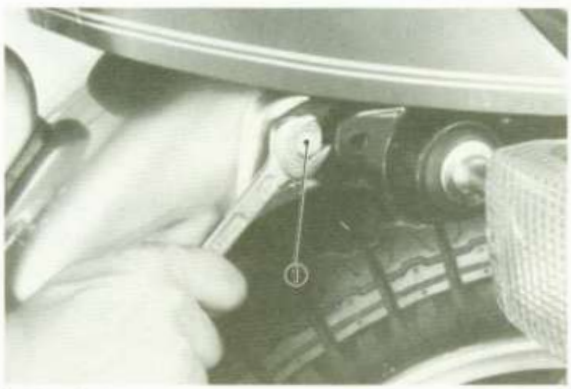


A. Removal

1. Place the machine on the center stand.
2. Hook the wire tool (contained in the owner's tool kit) to the machine as shown.
3. Install the special lever (contained in the owner's tool kit) as shown. While pushing down the lever hook the ring of the wire tool to the hook attached to the swing arm.



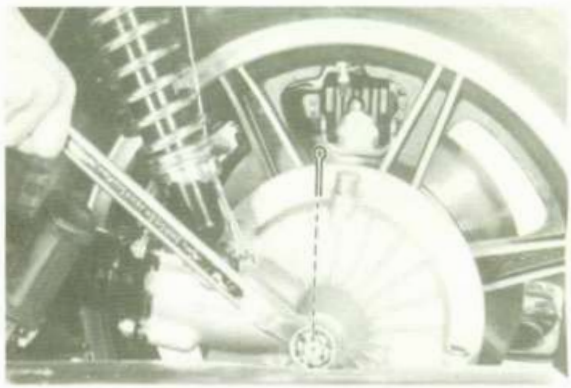
4. Remove the rear fender installation bolts the fender will pivot upward as the wheel is removed.



1. Rear fender installation bolt

NOTE:
It is not necessary to remove the seat in order to remove the rear wheel.

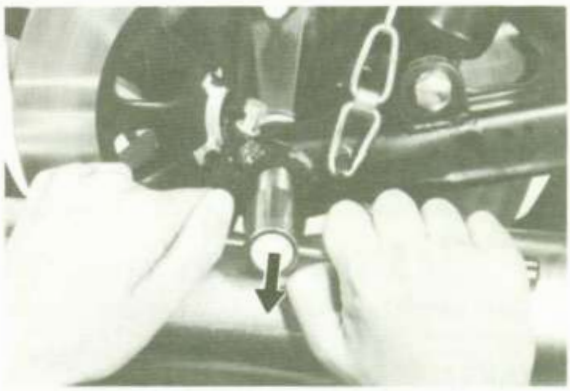
5. Remove the axle nut cotter pin and axle nut.



6. Loosen the rear axle pinch bolt.



7. While supporting the brake caliper, pull out the rear axle.



8. Hold up the brake caliper assembly and place it on the rear arm.
9. Move the wheel to the right side to separate it from the final gear case and remove the rear wheel.

NOTE:
Do not depress the brake pedal when the wheel is off the machine so that the brake caliper piston will be forced out of the cylinder, making reassembly difficult. Placement of a wooden wedge between the brake pads may be helpful.

B. Rear Axle Inspection
(See Front Wheel, Axle Inspection Procedure.)

C. Replacing Wheel Bearings
Rear wheel bearing replacement is similar to the procedure for the front wheel.

D. Rear Wheel Inspection
(See Front Wheel, Inspection Procedures)

E. Installing Rear Wheel

1. Lightly grease lips of rear wheel oil seals.
2. Make sure the brake pads are installed properly and that there is enough gap to installs the rear disc.

CAUTION:
If it is necessary to separate the brake pads, do so carefully to avoid damage to the pad surfaces.

3. Install the wheel assembly and axle.

NOTE:
When installing the rear wheel, be sure the splines on the wheel hub fit into the final gear case. Lightly apply grease to the gear teeth.

Always use a new cotter pin on the axle nut.

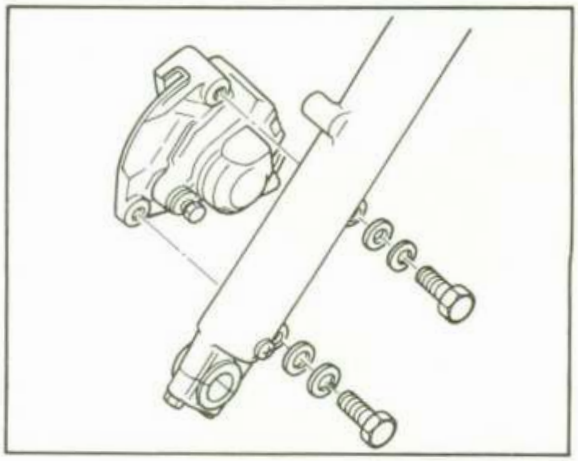
Torque:
Axle nut: 15 m-kg (108 ft-lb)
Axle pinch bolt: 0.6 m-kg (4 ft-lb)

BRAKES

CAUTION:
Disc brake components rarely require disassembly. Do not disassemble components unless absolutely necessary. If any hydraulic connection in the system is opened, the entire system should be disassembled, drained, cleaned and then properly filled and bled upon reassembly. Do not use solvents on brake internal components. Solvents will cause seals to swell and distort. Use only clean brake fluid for cleaning. Use care with brake fluid. Brake fluid is injurious to eyes and will damage painted surfaces.

A. Caliper Pad Replacement

1. It is not necessary to disassemble the brake fluid hoses to replace the brake pads.
2. Remove the caliper assembly support bolt and remove the caliper assembly.

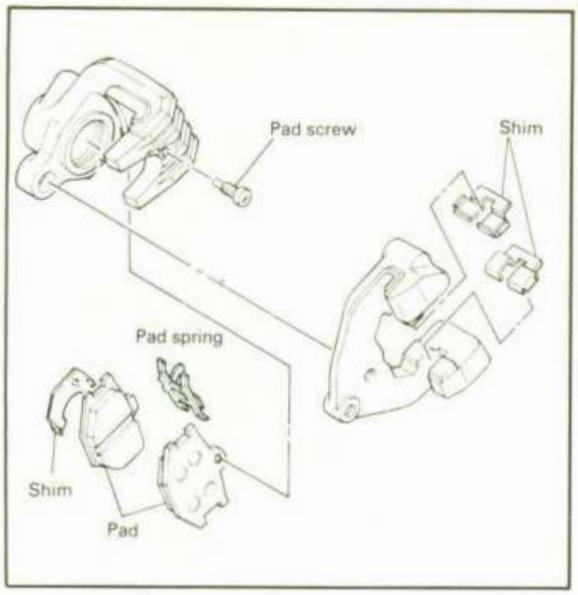


3. Remove the Phillips screw that holds the brake pads.



4. Pull the caliper cylinder out of the caliper frame.
5. Install new brake pads. Always replace pads as a set. Replace the following when pads are replaced:

a. Pad screw
b. Shims
c. Pad spring
d. Pads



6. Lightly grease the surfaces of the shim and of the pad spring where they contact the pad.

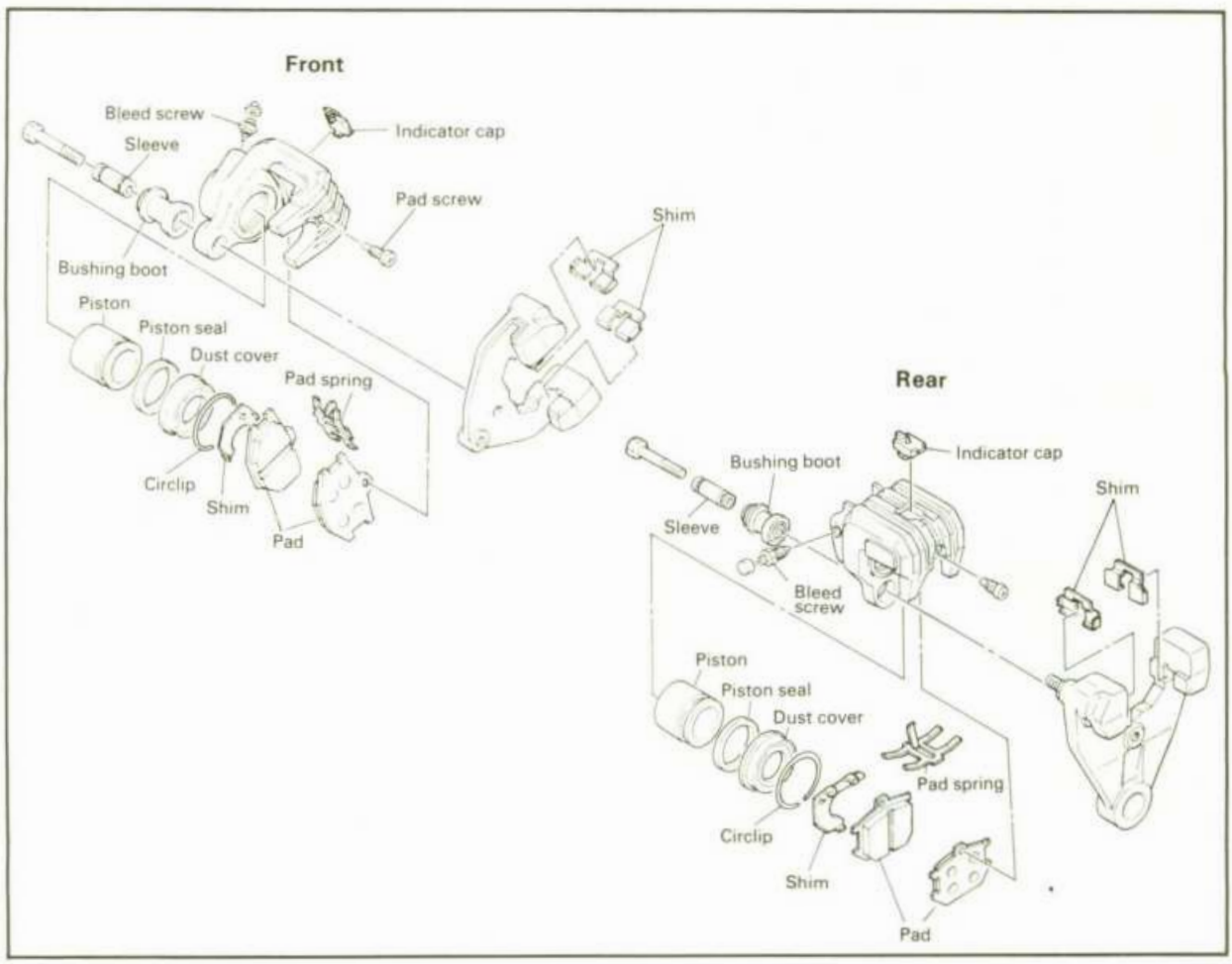
WARNING:

Front and rear pads are exactly alike in shape but not in material.
Be sure to use them in correct position. For this reason an identification mark is stamped on the base plate of the rear pad as follows:

REAR — · — RR

It must be remembered that the use of front pads as rear ones will be dangerous especially when the brake is applied in wet weather.

B. Caliper Disassembly (Front and Rear)



1. Remove the caliper brake hose. Allow fluid in the caliper assembly to drain into a container.
2. Place the open hose end into the container and pump the old fluid out carefully.
3. Remove the caliper support bolt and the pad securing screw as described in the Caliper Pad Replacement procedure (page 5-6)
4. Remove the caliper assembly from the caliper frame.

5. Remove the retaining ring and the dust seal.
6. Remove the piston.

CAUTION:
Cover the piston with a rag. Use care so *that* the piston does not cause injury as it is expelled from the cylinder.

7. Remove the piston seal.

C. Master Cylinder Disassembly

1. Front master cylinder

a. Remove the brake light switch.



b. Remove the brake hose.



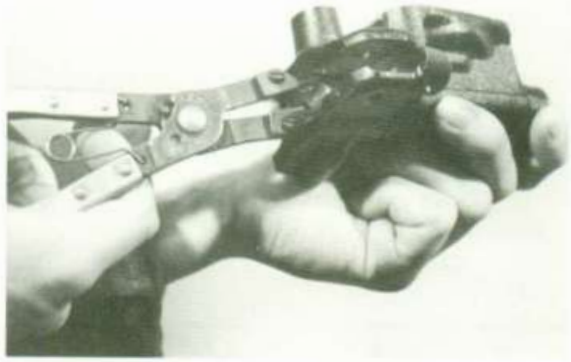
c. Remove the brake lever and spring.
d. Remove the master cylinder from the handlebar. Remove the cap and drain the remaining fluid.

2. Rear master cylinder

a. Remove the brake hose.
b. Remove the two (2) bolts holding the master cylinder to the frame. Remove the reservoir cap and drain the brake fluid.

NOTE:
The following steps 3 and 5 apply to both front and rear systems.

3. Remove the master cylinder dust boot.
4. Remove the snap ring.



5. Remove the master cylinder cup assembly. Note that the cylinder cups are installed with the larger diameter (lips) inserted first.

D. Brake Inspection and Repair

Recommended Brake Component Replacement Schedule:
Brake pads; As required
Piston seal, dust seal; Every two years
Brake hoses; Every four years
Brake fluid; Replace only when brakes are disassembled

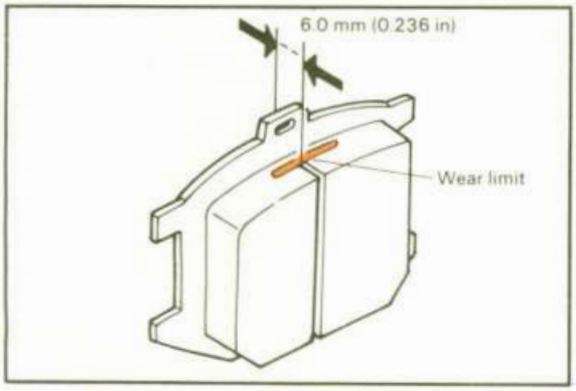
1. Replace the caliper piston if it is scratched.



2. Replace any brake pad worn beyond limits. Always replace the brake pads as a set.

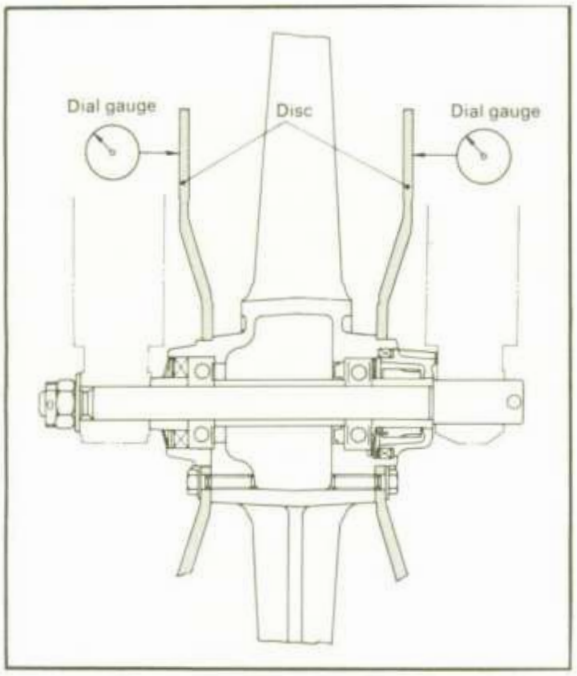
Wear limit:
Front and rear 6.0 mm (0.236 in)

See Caliper Pad Replacement procedure for a listing of the parts to be replaced when pads are replaced.



3. Replace piston and dust seals if damaged. Replace seals every two years.
4. Inspect master cylinder body. Replace if scratched. Clean all passages with new brake fluid.
5. Inspect the brake hoses. Replace every four years or immediately if cracked, frayed, or damaged.
6. Check for wear and deflection of disc.

Maximum deflection (front and rear):
0.15 mm (0.006 in)
Minimum disc thickness (front and rear):
6.5 mm (0.26 in)



If disc is worn beyond minimum thickness or deflection exceeds specified amount, replace disc.

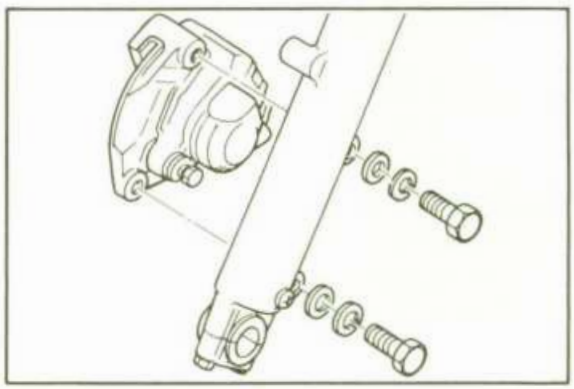
E. Brake Reassembly

1. All internal parts should be cleaned in new brake fluid only. Internal parts should be lubricated with brake fluid when installed.
2. Caliper Reassembly
Replace the following parts whenever a caliper is disassembled: bleed screw and cap, boot bushing, piston seal, dust seal, and retaining ring.

a. Install the piston seal and piston. Place the caliper cylinder into the caliper frame.
b. Install the pad spring, shims and pads.
c. Install the support bolt and remount the caliper on the brackets (rear brake).



d. Install the caliper assembly on the front fork (front brake).

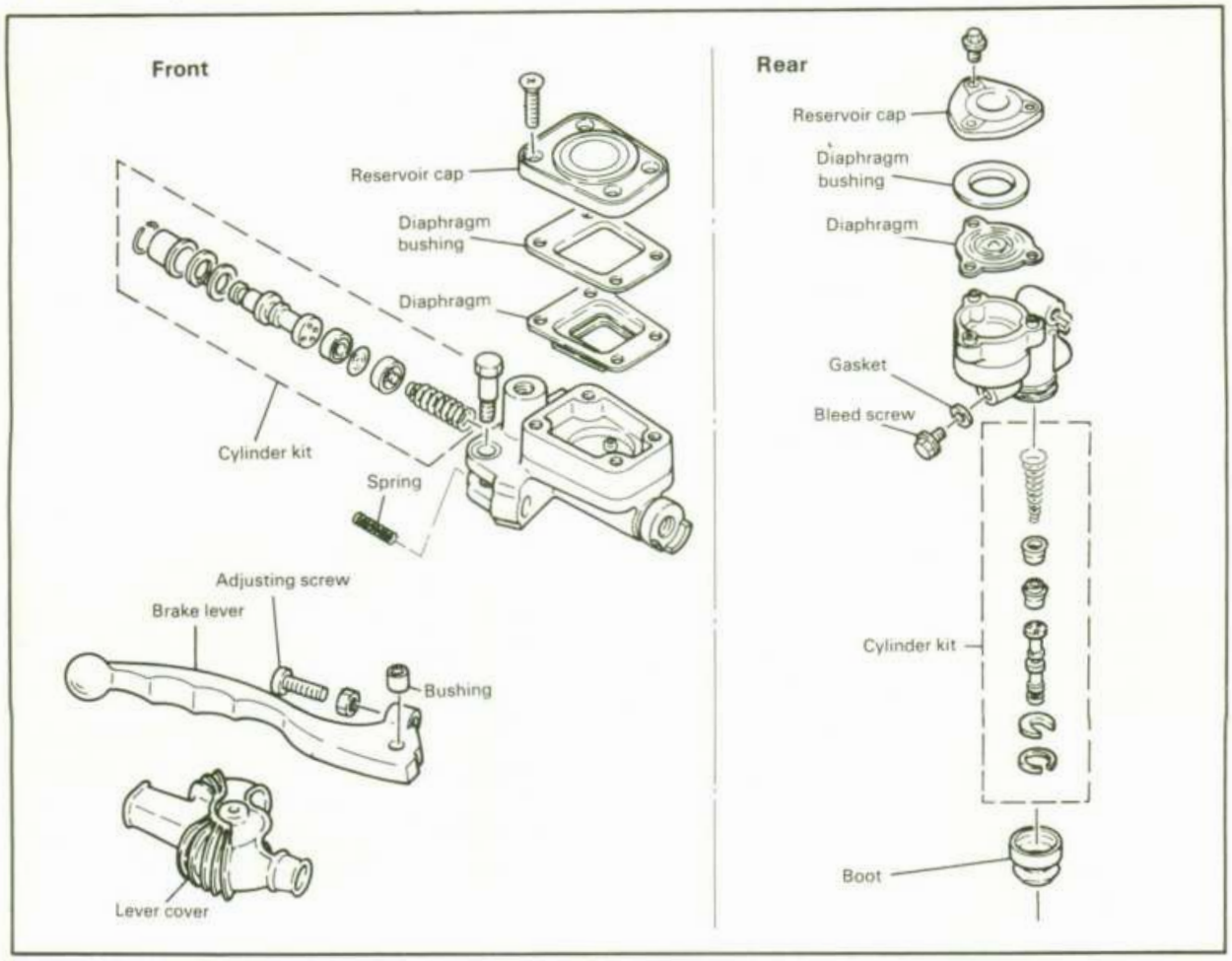


Support bolt (caliper cylinder) torque:
1.8 m-kg (13.0 ft-lb)
Support bolt (caliper bracket) torque:
4.5 m-kg (32.5 ft-lb)

3. Attach the brake hoses (front and rear).

Brake hose torque:
2.6 m-kg (18.8 ft-lb)

4. Master cylinder reassembly



Reassemble master cylinder as shown in illustration.

Brake hose torque: (all brake union bolts)
2.6 m-kg (18.8 ft-lb)

5. Brake disc assembly
If the brake disc has been removed from the hub or is loose, tighten the bolts. Use new locking washers and bend over the locking tabs after the bolts are tightened.

Disc bolt torque:
2.0 m-kg (14.5 ft-lb)

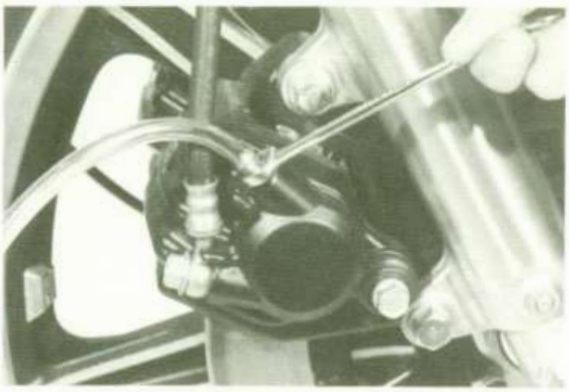
6. Air bleeding

WARNING:

If the brake system is disassembled or if any brake hose has been loosened or removed, the brake system must be bled to remove air from the brake fluid. If the brake fluid level is very low or brake operation is incorrect, bleed the brake system.

Failure to bleed the brake system properly can result in a dangerous loss of braking performance.

a. Add proper brake fluid to the reservoir. Install the diaphragm, being careful not to spill or overflow the reservoir.
b. Connect the clear plastic tube of 4.5 mm (3/16 in) inside diameter tightly to the caliper bleed screw. Put the other end of the tube into a container.



c. Slowly apply the brake lever or pedal several times. Pull in lever (push down pedal). Hold lever or pedal in "on" position. Loosen bleed screw. Allow the pedal or lever to travel slowly toward its limit. When the limit is reached, tighten bleed screw. Then release lever (or pedal).
d. Repeat step "c" procedure until all air bubbles are removed from system.

NOTE:
If bleeding is difficult, it may be necessary to let the brake fluid system stabilize for a few hours. Repeat the bleeding procedure when the tiny bubbles in the system settle out.

WHEELS, TIRES, TUBES

A. Wheel Inspection

Wheels should be inspected frequently. Wheel run-out and balancing is discussed in Chapter 5-1. In addition, wheels must be carefully inspected for small cracks, bends or warpage. Any wheel damaged or beyond specified limits should be replaced. Do not attempt to straighten a bent wheel.

WARNING:
The aluminum wheels of this model are not designed for use with tubeless tires.

B. Tire, Tube Removal

1. Remove the valve cap, valve core and valve stem lock nut.
2. When all air is out of the tube, separate the tire bead from the rim (both sides) by stepping on the tire with your foot.
3. Use two (2) wide, flat tire irons with rounded edges to work the tire bead over the edge of the rim, starting 180° opposite the tube stem. Be careful not to pinch the tube as you do this.
   Be careful also not to damage the aluminum wheel rim or the tire bead. Use of Yamaha Tire Lubricant is recommended.
4. After you have worked one side of the tire completely off the rim, slip the tube out. Be very careful not to damage the stem while pushing it back out of the rim hole.

NOTE:
If you are changing the tire itself, then finish the removal by working the second bead off the rim using the same procedure as in No. 3 above.

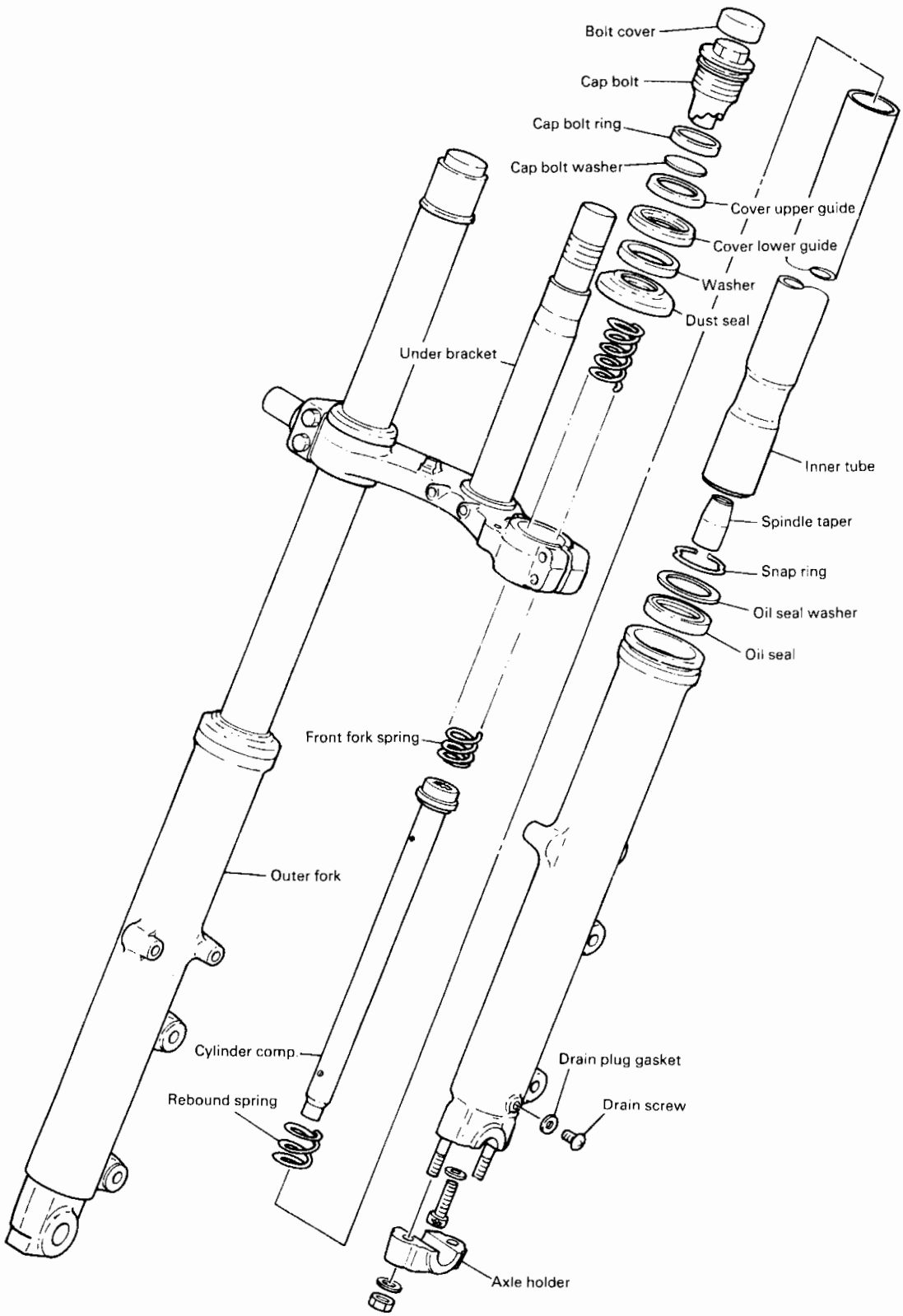
C. Installation

Reinstall the tire and tube by reversing the disassembly procedure. After the tube has been installed, but before the tire has been completely slipped onto the rim, put a small amount of air into the tube. This removes any creases that might exist. Release the air and continue with reassembly. After the tire has been completely slipped onto the rim, make sure the stem comes out of the hole in the rim at a right angle to the rim. Finally, inflate the tire.

	Front	Rear
Cold tire pressure: Up to 90 kg (198 lb) load	1.8 kg/cm² (26 psi)	2.0 kg/cm² (28 psi)
90 kg (198 lb) load ~ 153 kg (337 lb) load	2.0 kg/cm² (28 psi)	2.5 kg/cm² (36 psi)
153 kg (337 lb) load ~ 217 kg (478 lb) load (Maximum load)	2.0 kg/cm² (28 psi)	2.8 kg/cm² (40 psi)
High speed riding	2.6 kg/cm² (36 psi)	2.8 kg/cm² (40 psi)

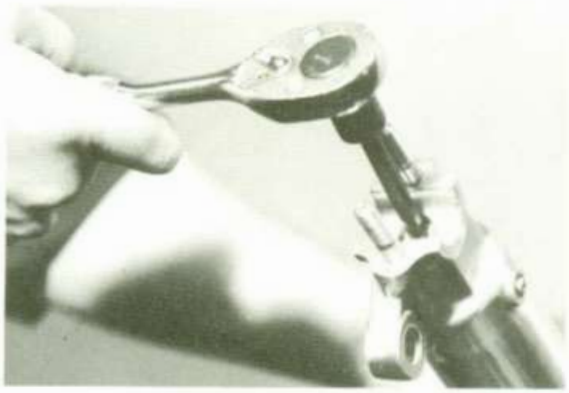
NOTE:
Make sure the wheel is balanced every time the tire is replaced. (Refer to Front Wheel Inspection.)

FRONT FORKS


Bolt cover
Cap bolt
Cap bolt ring
Cap bolt washer
Cover upper guide
Cover lower guide
Washer
Dust seal
Under bracket
Inner tube
Spindle taper
Snap ring
Oil seal washer
Oil seal
Front fork spring
Outer fork
Cylinder comp.
Rebound spring
Drain plug gasket
Drain screw
Axle holder

A. Removal and Disassembly

1. Disconnect the speedometer cable. Disconnect the brake calipers and remove the front wheel. Place a wooden wedge or other object into the caliper reassemblies to keep the brake pads from falling out. Remove the front fender.
2. Remove fork tube cap spring seats, springs, and oil drain screws. Drain fork oil.
3. Loosen the pinch bolt on the steering stem and the two pinch bolts crown and remove fork.
4. Remove the Allen bolt from the bottom of the fork assembly. Pull the inner tube out of the outer tube.



5. To remove the fork seal, pull off the dust cover. Remove the spring clip over the oil seal. Pry out the oil seal, being very careful to not damage the fork tube surfaces.



B. Inspection

1. Examine fork inner tube for scratches and straightness. If the tube is scratched severely or bent, it should be replaced.

WARNING:

Do not attempt to straighten a fork tube, since this may weaken the part dangerously.

2. Check the seal outer seat. If leakage is from this area, replace the seal. If this does not care the leakage, replace the outer tube.
3. Check the outer tube for dents. If any dent causes the inner tube to "hang up" during operation, the outer tube should be replaced.
4. Check the free length of the springs.

Fork spring free length:
503.5 mm (19.82 in)

5. Check the "O-ring" on the cap bolt. If damaged, replace the "O-ring".

C. Assembly

1. Make sure all components are clean before assembly. Always install a new fork seal. Do not re-use a seal.
2. Apply oil to the fork seal and install the seal spacer and seal by pressing in with a large socket. Install the retaining clip.
3. Install the inner tube into the outer tube. Install dust cover. Install and tighten Allen bolt and washer. The assembly procedure is the reverse of the disassembly procedure.

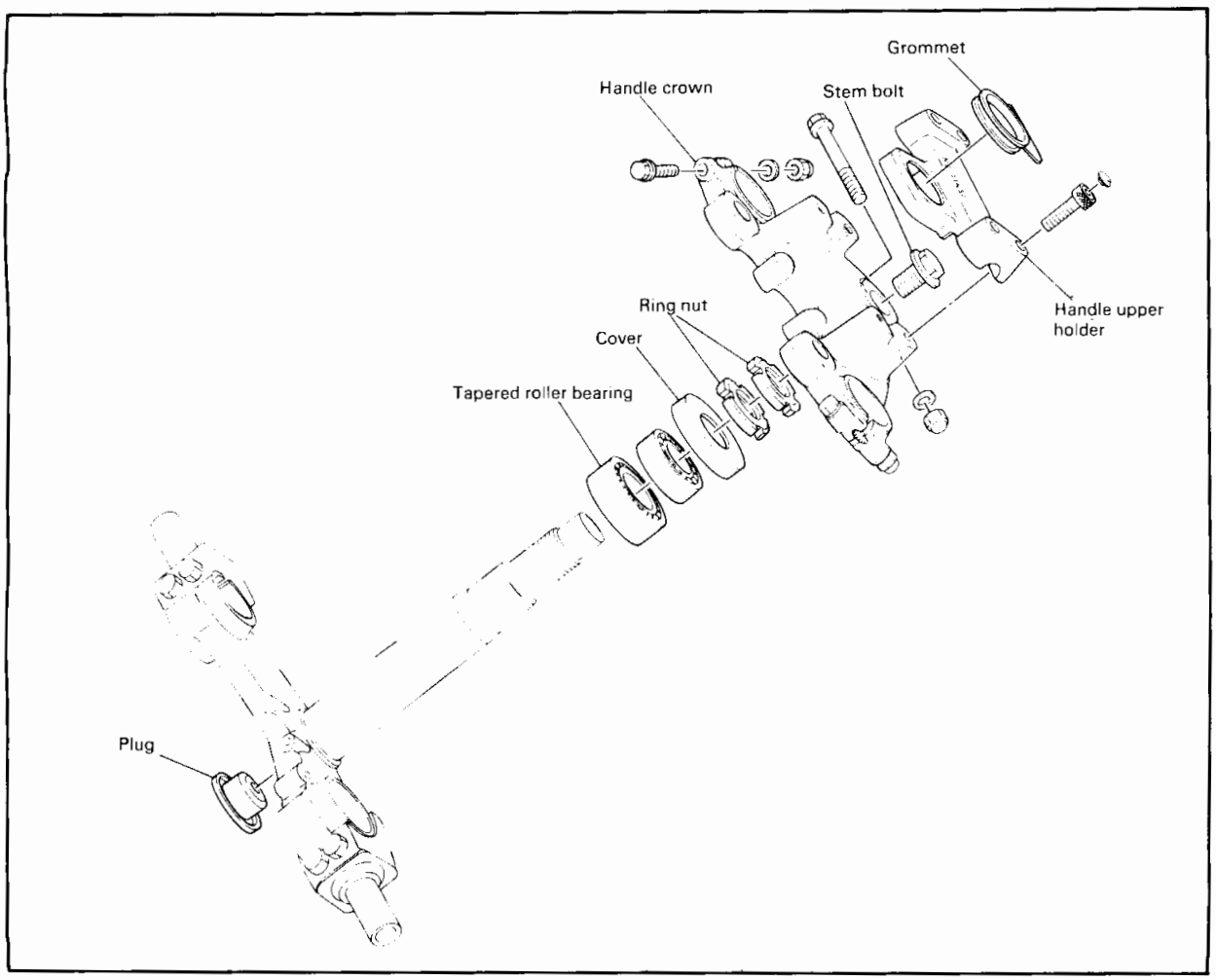
NOTE:

When installing the fork springs, the greater pitch should be at the bottom. The main fork spring has a small coil diameter at the bottom.



Small End → Bottom

STEERING HEAD

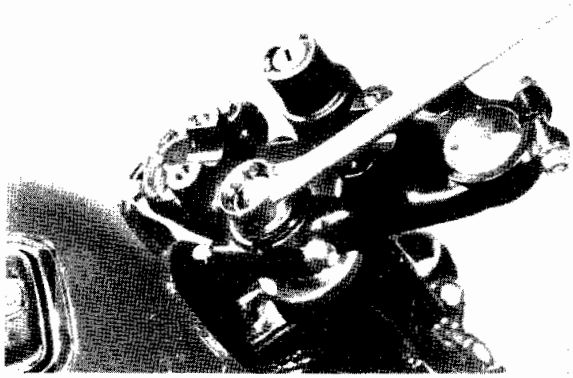


A. Adjustment

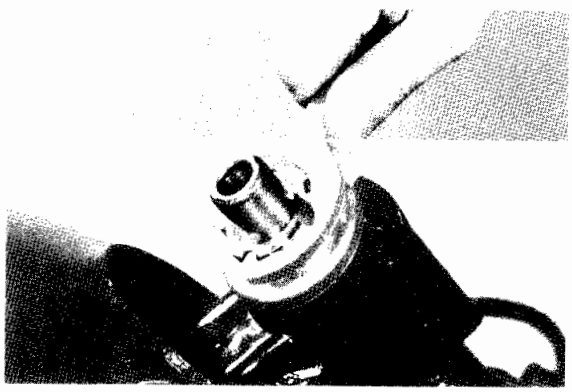
(See Chapter 2 for Steering Head Adjustment.)

B. Removal

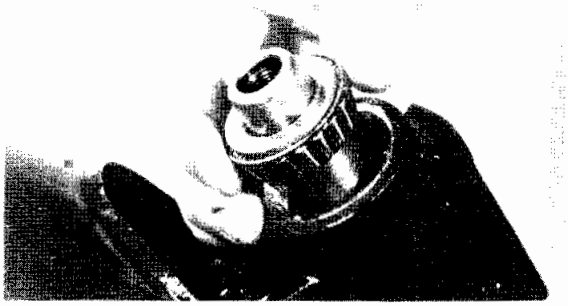
1. Remove the front wheel, front forks and handle bars.
2. Remove the front brake pipe junction.
3. Loosen the steering stem (upper bracket) pinch bolt. Remove the stem bolt and washer.

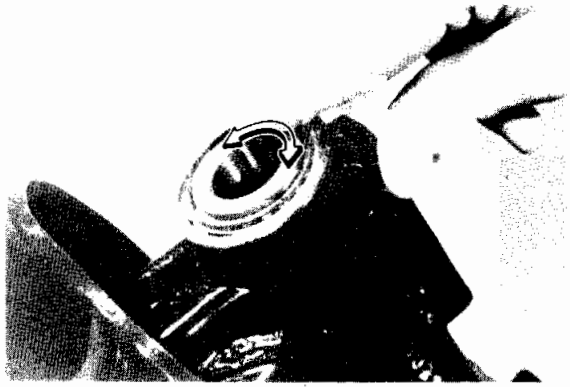


4. Remove the steering crown.
5. Remove the top fitting nut (ring nut).



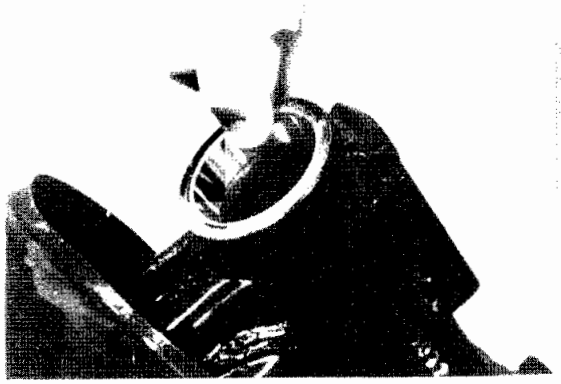
6. Support the steering stem (under-bracket) and remove the bottom fitting nut (ring nut).
7. Remove the bearings.





C. Inspection

1. Wash the bearings in solvent.
2. Inspect the bearings for pitting or other damage. Replace the bearings if pitted or damaged. Replace the races when bearings are replaced.
3. Clean and inspect the bearing races. If races are damaged, replaces the and bearings.



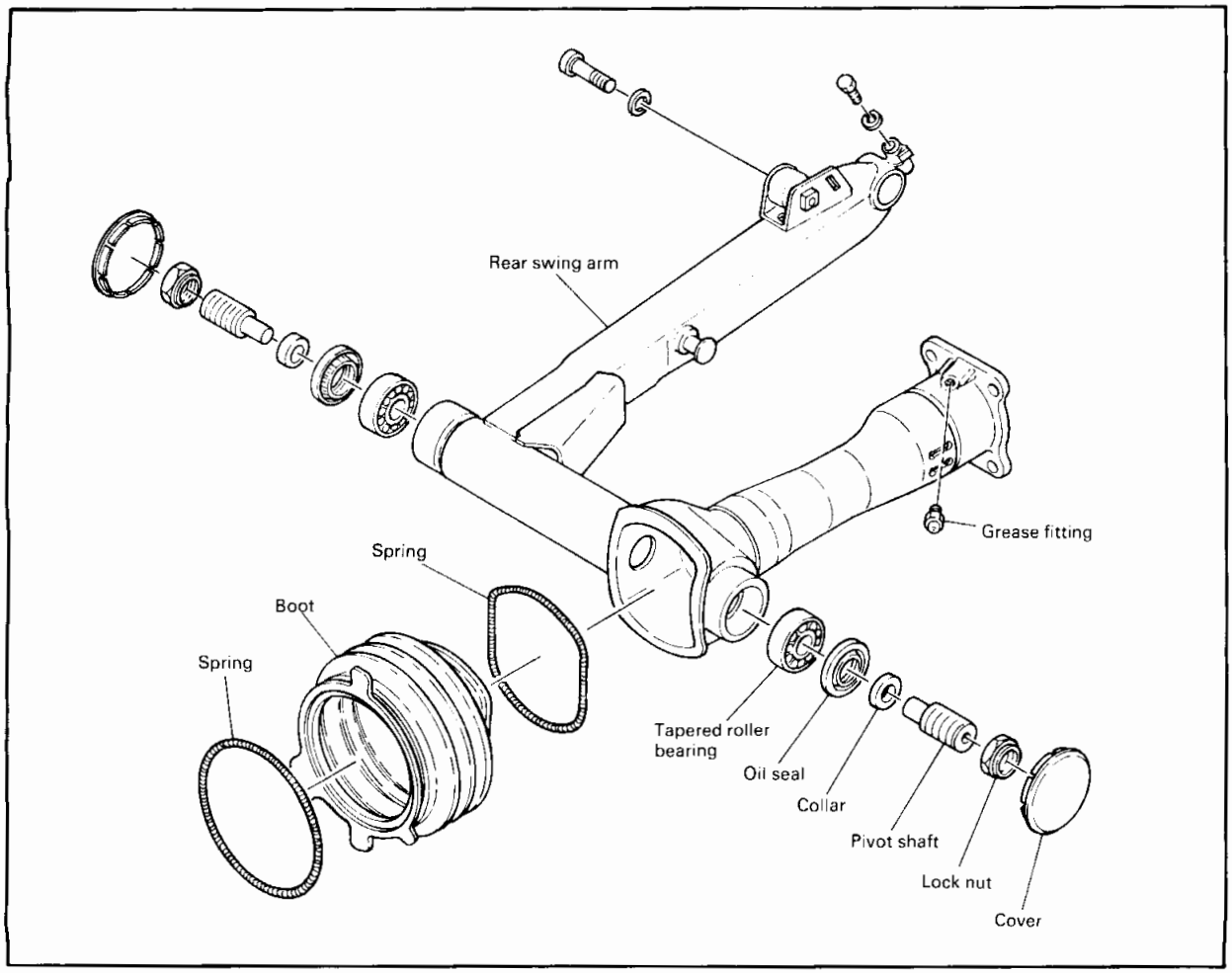
4. Install the bearings in the races. Spin the bearings by hand. If the bearings hand up or are not smooth in their operation in the races, replace bearings and races.

D. Reassembly

1. Grease the bearings and races with wheel bearing grease.
2. Install the steering stem (underbracket) and bearings.
3. Install the bottom fitting nut. Tighten it to approximately 1.0 ~ 1.2 m-kg (7.2 ~ 8.7 ft-lb). Do not over-tighten it. Tighten the top fitting nut.
4. Continue reassembly in the reverse of assembly order.
5. When assembly is complete, check the steering stem by turning it from lock to lock. If there is any binding or looseness, readjust the steering stem tightness.

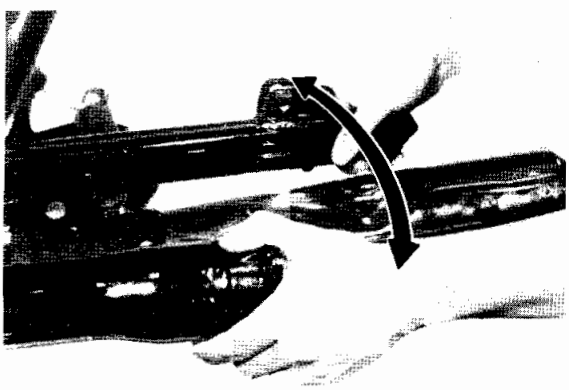
Pinch bolt torque: 2.0 m-kg (14.5 ft-lb) Steering stem bolt torque: 8.5 m-kg (61.5 ft-lb)

SWING ARM

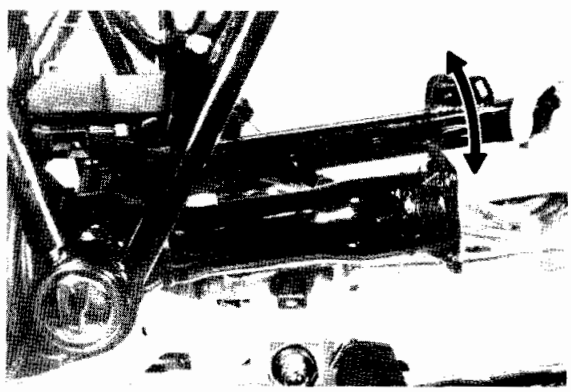


A. Inspection

1. Free play inspection
   Remove the rear wheel and both shock absorbers. Grasp the swing arm and try to move it from side to side as shown. There should be no noticeable side play.

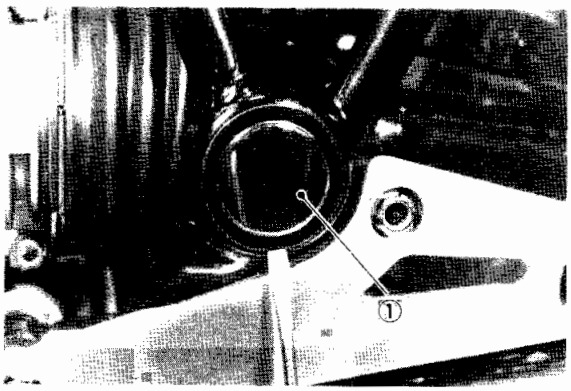


2. The swing arm is mounted on tapered bearings. Move the swing arm up and down as shown. The swing arm should move smoothly, without tightness, binding or rough spots that could indicate damaged bearings.



B. Adjustment

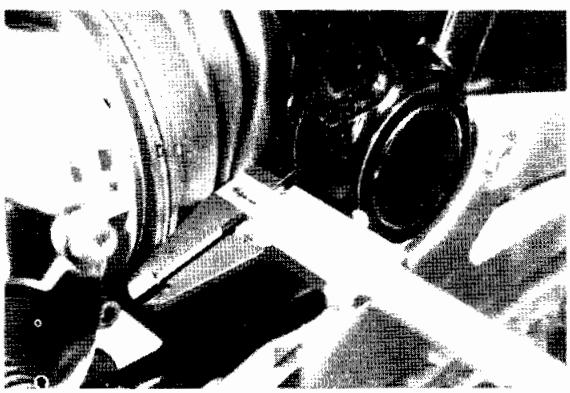
1. Remove the pivot shaft caps from the left and right sides ofo the swing arm.

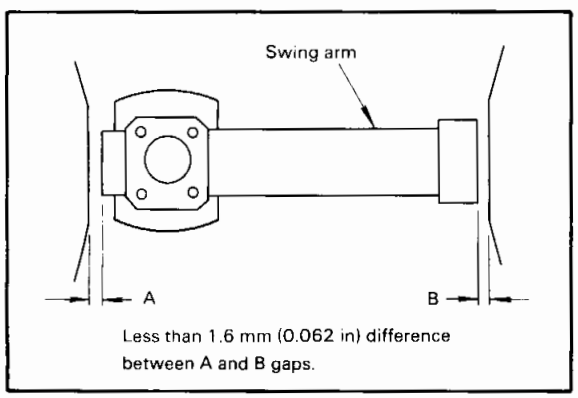


1. Pivot shaft cap

2. Measure the gap between the frame and the swing arm on the left and right sides. There should be no more than 1.6 mm (0.062 in) difference between the left and right gaps.

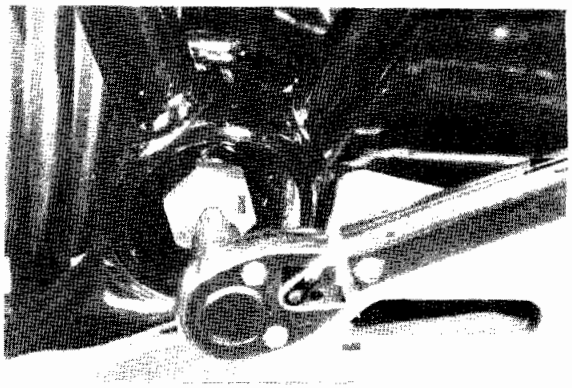
NOTE:
It may be easier to inspect the gaps with the rear wheel removed; however, such removal is not necessary.





Less than 1.6 mm (0.062 in) difference between A and B gaps.

3. If the left and right gaps differ by more than the limit (1.6 mm) adjust as follows:
   a. Loosen both the left and right pivot shafts lock nuts.
   b. Loosen the pivot shaft on the side of the greater swing arm/frame gap. Loosen only slightly (counterclockwise, approximately one-half turn). After loosening, tighten the opposite pivot shaft (clockwise) to 0.5 ~ 0.6 m-kg (43 ~ 52 in-lb).



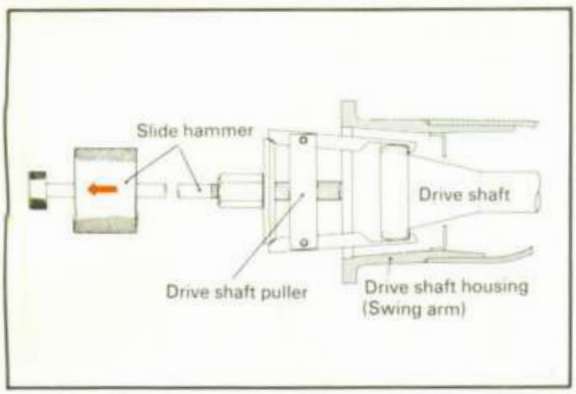
   c. Measure the gap again between the frame and the swing arm. If the left and right gaps are not within 1.6 mm (0.062 in) of each other, repeat step (b).
   b. When the left and right gaps are adjusted properly, tighten the pivot shaft lock nut.

NOTE:
Do not allow the pivot shaft to turn while tightening the lock nut.

Pivot shaft lock nut torque:
10 m-kg (72.3 ft-lb)

C. Removal

1. Remove the middle gear flange holding bolt.
2. Remove the rear wheel and shock absorbers. Remove the rear brake assembly.
3. Remove the final gear assembly.
4. Install the drive shaft puller attachment (special tool) on the slide hammer (special tool). Insert the 2 arms of the puller into the mouth of drive shaft housing. Tighten the 2 arms around the toothed flange of the drive shaft. Use the slide weight to pull the drive shaft out of the universal joint. Remove the drive shaft from the housing.



5. Remove the swing arm pivot caps, the pivot shafts and the swing arm.

D. Inspection and Lubrication

1. Remove the oil seals and the bearings. Inspect the bearings for pitting or other damage. Make sure that the bearings roll freely. If a bearing is damaged, both bearings and both sets of inner and outer bearing races should be replaced.



CAUTION:

Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.

NOTE:

When installing new bearings, grease liberally with lithium base, waterproof wheel bearing grease.

2. Always replace the grease seals when bearings are removed.
3. Examine the rubber boot for damage. Replace if damaged.



E. Installation

Installation of the swing arm can be accomplished by reversing the removal procedure. Observe adjustment procedures for obtaining equal frame/swing arm spacing.

REAR SHOCK ABSORBER

A. Removal

1. Remove one (1) rear shock absorber at a time, inspect and reinstall before removing the other.

B. Inspection

1. Check the rod. If it is bent or damaged, replace the shock absorber.
2. Check for oil leakage. If oil leakage is evident, replace the shock absorber.
3. Operate shock absorber rod to check damping. There should be no noticeable damping as the shock extends.
4. Install the shock absorber on the machine.

Upper (right and left side):	3.2 m-kg (23.1 ft-lb)
Bottom (right side):	4.2 m-kg (30.4 ft-lb)
Bottom (left side):	3.2 m-kg (23.1 ft-lb)

CABLES AND FITTINGS

A. Cable Maintenance

NOTE:

See Maintenance and Lubrication intervals charts. Cable maintenance is primarily concerned with preventing deterioration through rust and weathering and providing proper lubrication to allow the cable to move freely

within its housing. Cable removal is straight forward and uncomplicated. Removal will not be discussed within this section.

WARNING:

Cable routing is very important. For details of cable routing, see the cable routing diagrams at the end of this manual. Improperly routed or adjusted cables may make the vehicle unsafe for operation.

1. Remove the cable.
2. Check for free movement of cable within its housing. If movement is obstructed, check for fraying or kinking of the cable strands. If damage is evident, replace te cable assembly.
3. To lubricate the cable, hold it in a vertical position. Apply lubricant to the uppermost end of cable. Leave it in the vertical position until lubricant appears at the bottom. Allow any excess to drain and reinstall the cable.

NOTE:

Choice of lubricant depends upon conditions and preferences. However, a semi-drying chain and cable lubricant will perform adequately under most conditions.

B. Throttle Maintenance

1. Remove the Phillips head screws from throttle housing assembly and separate the two halves of housing.
2. Disconnect the cable end from the throttle grip assembly and remove the grip assembly.
3. Wash all parts in a mild solvent and check all contact surfaces for burrs or other damage. (Also clean and inspect righthand end of the handlebar.)
4. Lubricate all contact surfaces with a light coat of lithium soap base grease and reassemble.

NOTE:

Tighten the housing screws evenly to maintain an even gap between the two halves.

5. Check for smooth throttle operation and quick spring return when released and make certain that the housing does not rotate on the handlebar.

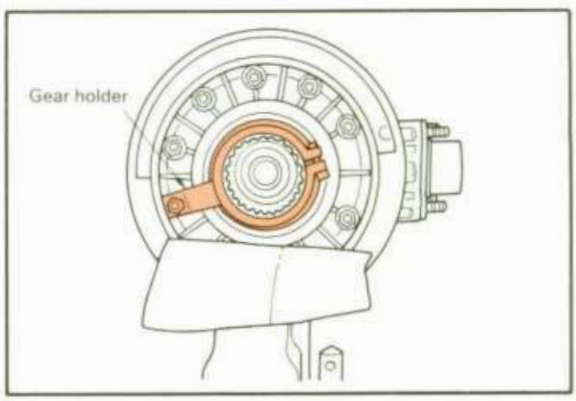
FINAL DRIVE GEAR

NOTE:

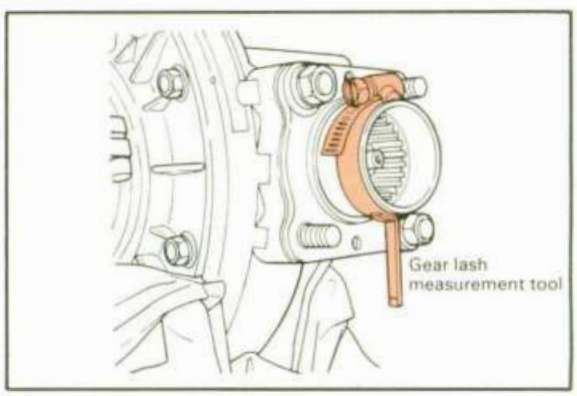
This section describes external inspection only. See the Yamaha Shaft Drive Section Manual for overhaul and adjustment of the final drive gear.

1. Inspect the exterior for leakage. Refer to the Shaft Drive Service Manual for correction of leakage.
2. Check the final drive gear lash as follows:

a. Remove the final drive gear case.
b. Place the gear case in a vise or other support.
c. Remove one nut from a final drive case stud bolt. Place the gear holder (special tool) over the ring gear surface and stud bolt. Tighten the holder on the gear. Tighten the holder to the stud bolt with nut.

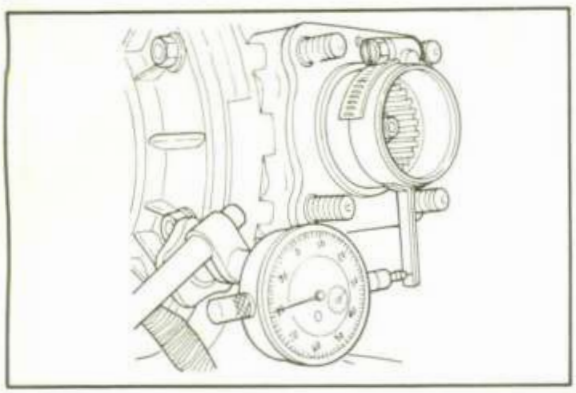


d. Install the final gear lash measurement tool on the gear coupling (input side).



e. Place a dial gauge and stand as shown to measure gear lash (movement). Gear lash is the measurement from gear

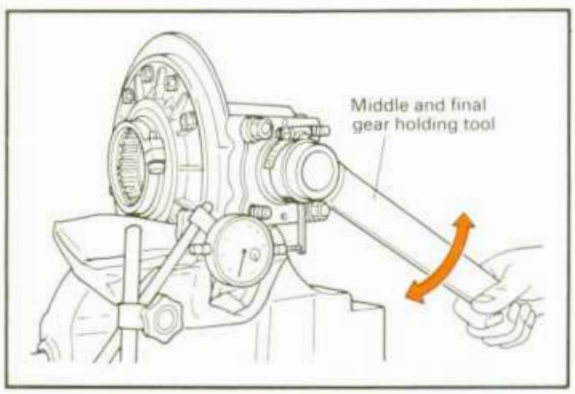
engagement to gear engagement as the gear coupling is rotated. The measurement point on the tool is 36 mm (1.42 in) from the surface of the gear coupling.



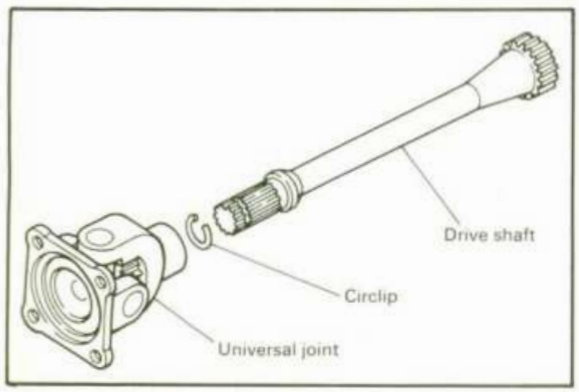
f. Use the special wrench to gently rotate the gear coupling from engagement to engagement. Note the lash measurement on the dial gauge.

Final gear lash:
0.25 ~ 0.50 mm (0.010 ~ 0.020 in)

If lash is not within tolerance, refer to Shaft Drive Service Manual for adjustment procedure.



DRIVE SHAFT/JOINT



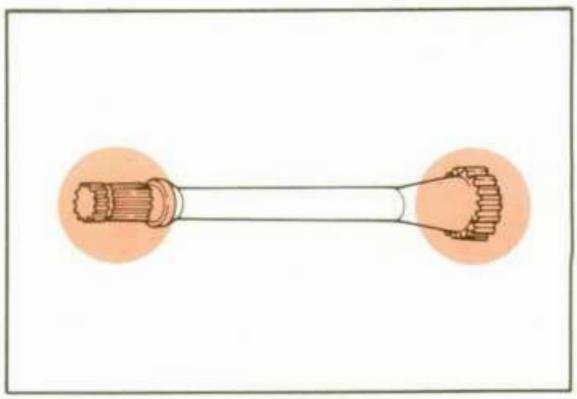
A. Removal

1. Remove the rear wheel. See CHAPTER 5, REAR WHEEL A. Removal.
2. Remove the final gear case assembly.
3. Remove the drive shaft as shown.
4. To remove the universal joint, it is necessary to remove the middle gear assembly or to remove the swing arm. Remove the universal joint assembly.

B. Inspection

1. Drive shaft
   Inspect the shaft splines for wear and/or damage. If excessive, replace the drive shaft.

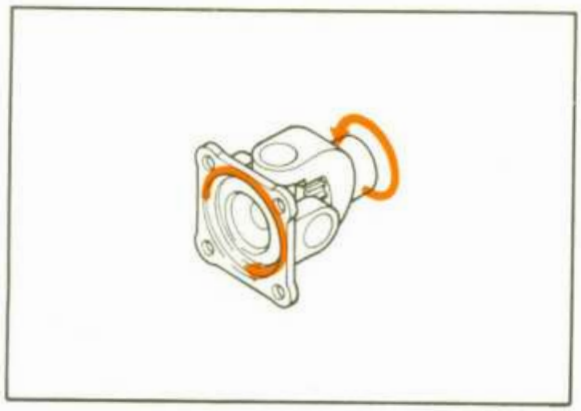
NOTE:
When installing the drive shaft, lubricate splines with molybdenum disulfied grease.



2. Universal joint

a. There should be no noticeable play in the universal joint bearings. If there is any play in the bearing, replace the universal joint assembly.

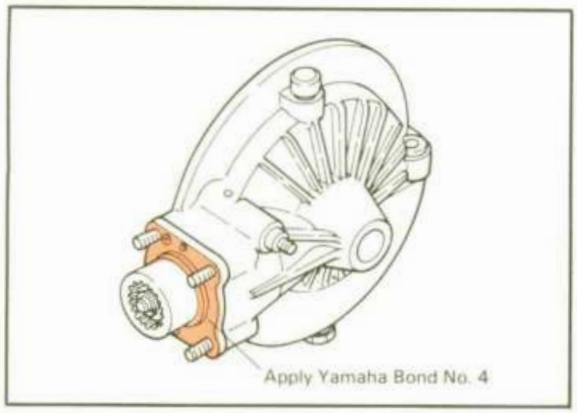
b. Move the universal joint up and down and from side to side. The universal joint should move smoothly, without tightness, binding or rough spots that could indicate damaged bearings. If damaged, replace the universal joint assembly.



C. Reinstallation

When installing the drive shaft and the universal joint, reverse the removal procedure. Note the following points:

1. Lubricate the shaft splines with molybdenum disulfied grease.
2. Before installing the final gear case, clean the mating surfaces with solvent and apply Yamaha Bond No. 4 as shown.



Final gear case tightening torque:
4.2 m-kg (30.4 ft-lb)
Universal joint tightening torque:
4.4 m-kg (31.8 ft-lb)

CHAPTER 6. ELECTRICAL

Electric Starting System 6-3
A. Circuit Diagram 6-3
B. Starter Motor 6-3
C. Starter Relay Switch 6-5
Charging System 6-5
A. Circuit Diagram 6-5
B. A.C. Generator 6-5
C. Voltage Regulator 6-6
Ignition system 6-8
A. Circuit Diagram 6-8
B. Description 6-8
C. Operation 6-8
D. Troubleshooting/Inspection 6-10
Fuel Gauge 6-14
A. Circuit Diagram 6-14
B. Description 6-15
C. Troubleshooting/Inspection 6-15
Tachometer 6-16
A. Circuit Diagram 6-16
B. Description 6-16
C. Troubleshooting/Inspection 6-16
Lighting and Signal System 6-17
A. Circuit Diagram 6-17
B. Lighting Tests and Checks 6-18
C. Reserve Lighting System 6-18
D. Self-Cancelling Flasher System 6-20
E. Switches 6-22
F. Battery 6-22

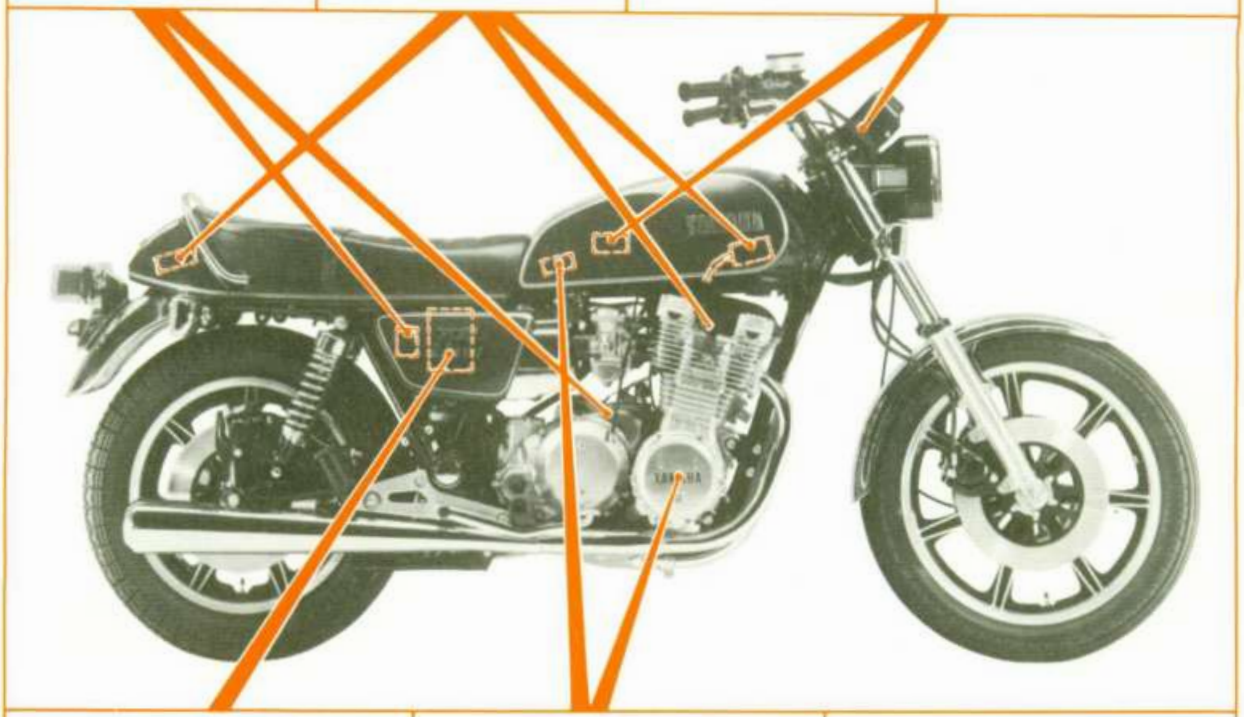
CHAPTER 6. ELECTRICAL

Starting System
Circuit Diagram page 6-3
Starter Motor page 6-3
Starter Relay Switch page 6-5

Ignition System
Circuit Diagram page 6-8
TCI Description page 6-8
Spark Plug page 6-14
Governor page 6-12

Fuel Gauge
Circuit Diagram page 6-14
Description page 6-15
Troubleshooting/Inspection page 6-15

Tachometer
Circuit Diagram page 6-16
Description page 6-16
Troubleshooting/Inspection page 6-16



Battery
Description page 6-22
Charging page 6-23

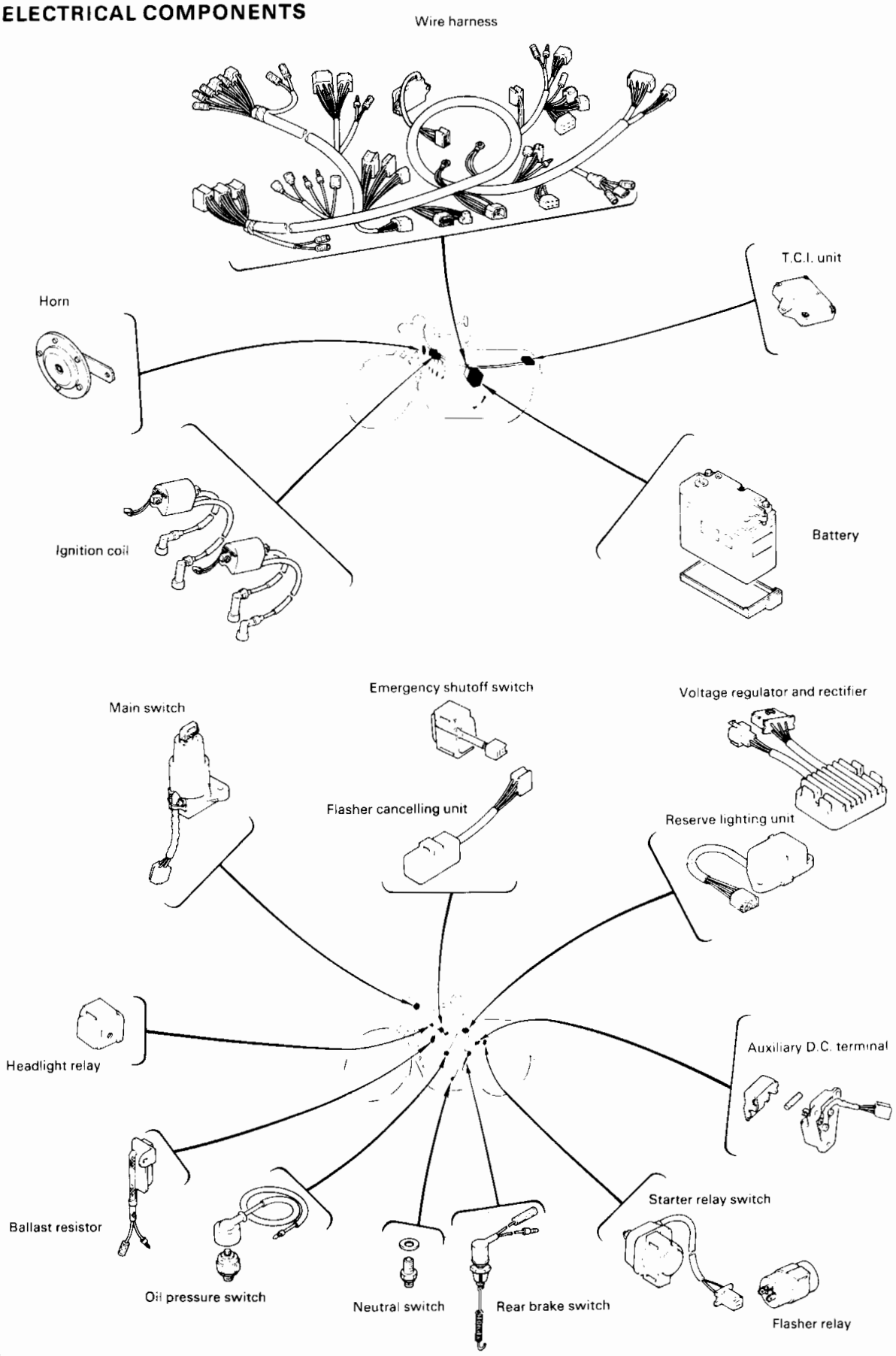
Charging System
Circuit Diagram page 6-5
A.C. Generator page 6-5
Rectifier/Regulator page 6-6

Lighting/Signal Systems
Lighting Tests page 6-18
Reserve Lighting System page 6-18
Self-Canceling Flasher System page 6-20
Switches page 6-22

Special Tools

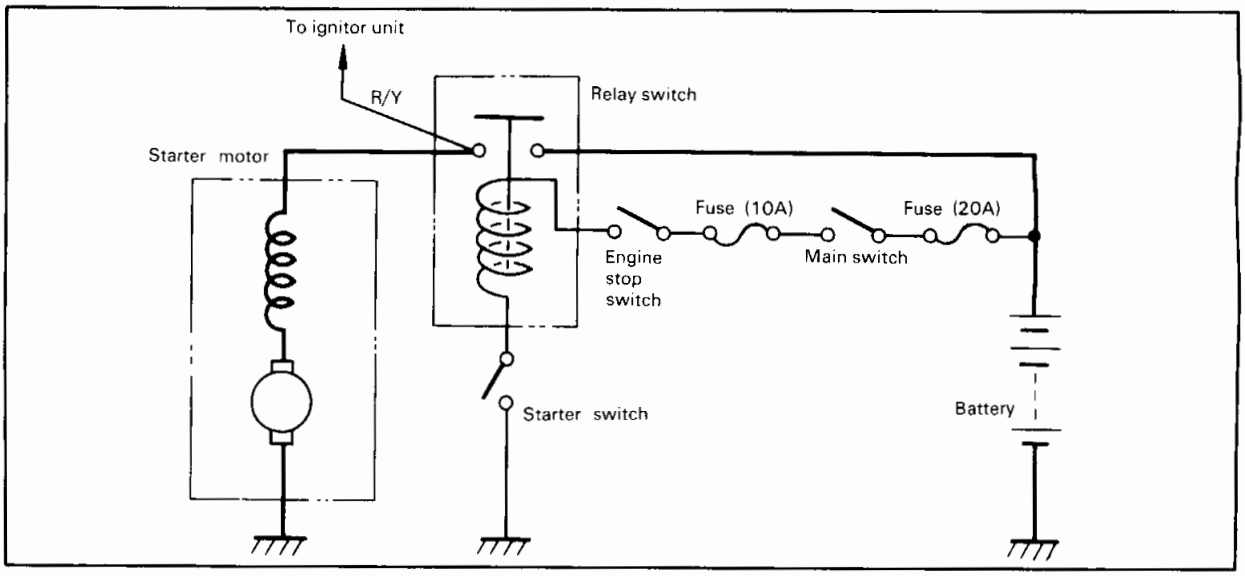
1. Pocket tester P/No. 90890-03104
2. Electro tester P/No. 90890-03021

ELECTRICAL COMPONENTS



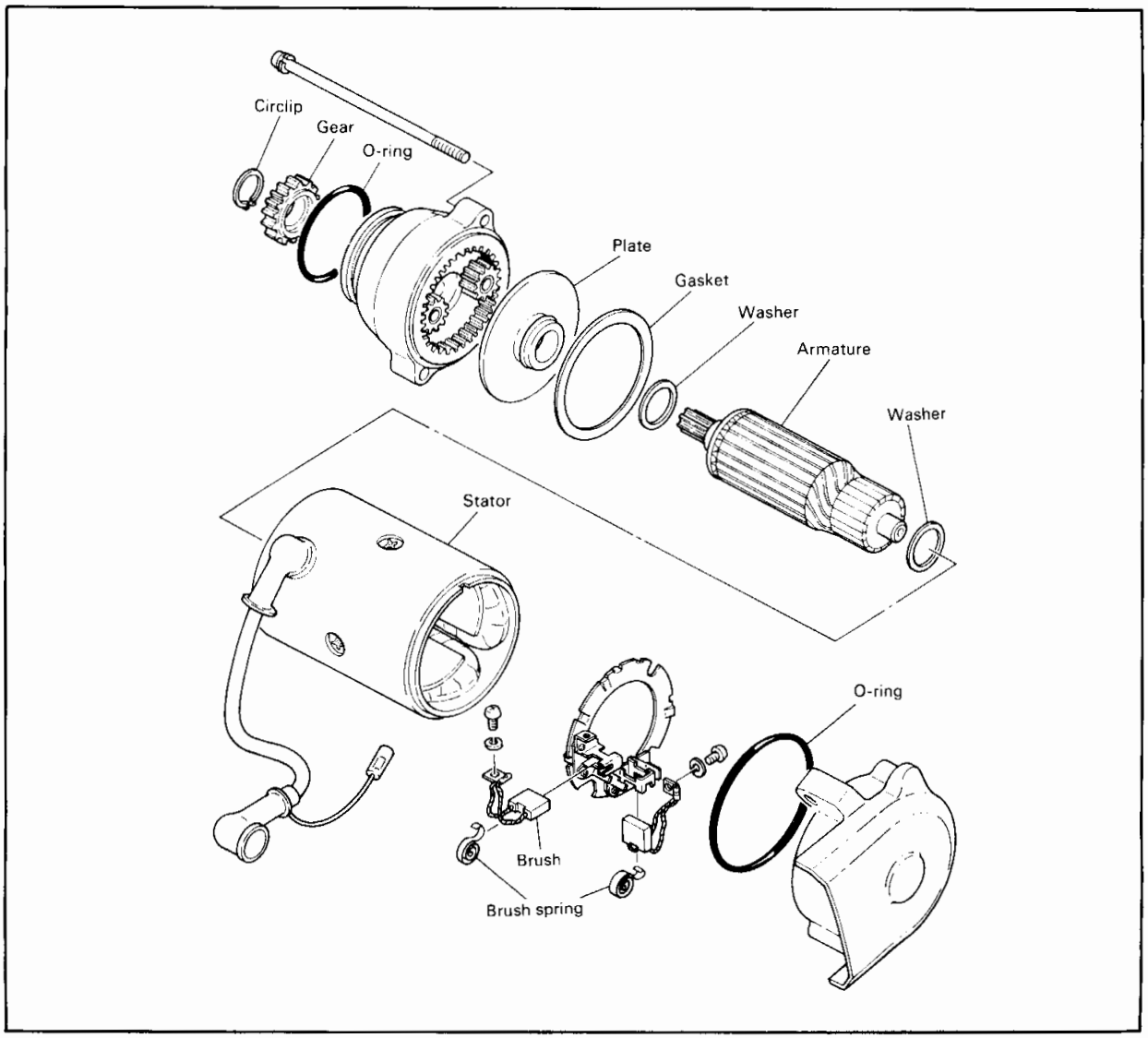
ELECTRIC STARTING SYSTEM

A. Circuit Diagram



B. Starter Motor

1. Removal (see Chapter 3. Engine Disassembly)

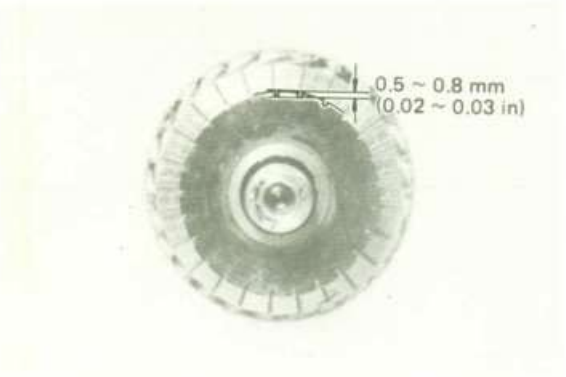


2. Inspection and repair

a. Check the outer surface of the commutator. If its surface is dirty, clean with *No. 600* grit sand paper.

b. The mica insulation between commutator segments should be 0.5 ~ 0.8 mm (0.02 ~ 0.03 in) below the segment level. If not, scrape to proper limits with appropriately shaped tool. (A hack saw blade can be ground to fit.)

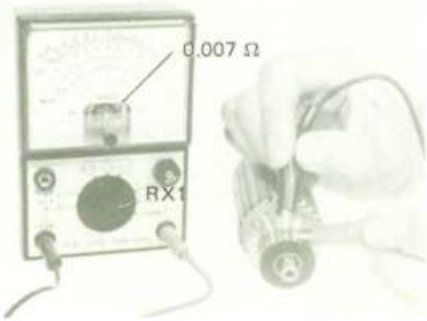
NOTE:
Mica insulation of commutator must be undercut to ensure proper operation of commutator.



c. The starter's armature and field coil should be checked with an ohm meter for insulation breakdown (shorting to each other or to ground) and for continuity. Reference figures are given below.

Coil resistance:
Armature coil: 0.007Ω (20°C)
Field coil: 0.01Ω (20°C)

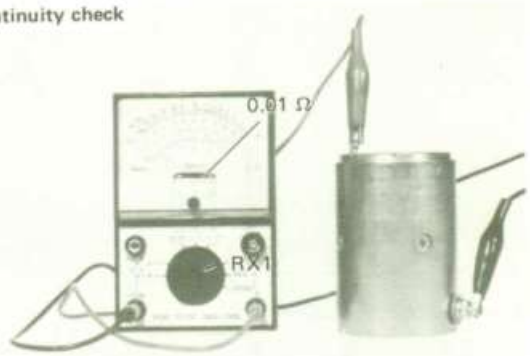
Continuity check



Insulation check



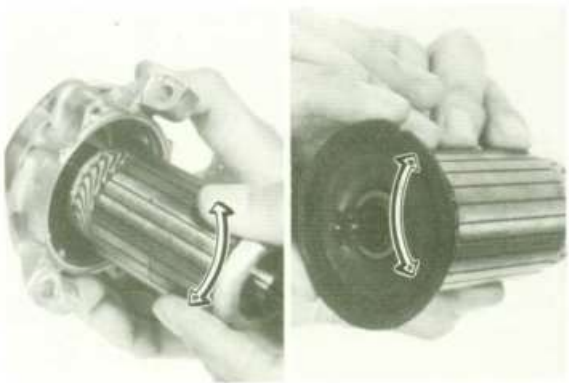
Continuity check



Insulation check

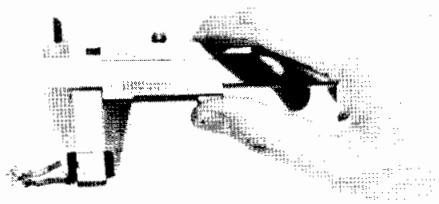


d. Check the front and rear cover bearings for damage. If damaged, the starter assembly must be replaced.



e. Check brush length. Replace brush if at, or near, limits.

Minimum brush length:
5.5 mm (0.22 in)



f. Check brush spring pressure. Compare it with a new spring. Replace the old spring if it is weak.

C. Starter Relay Switch

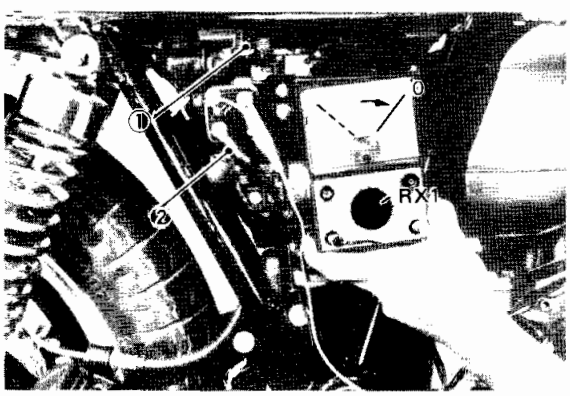
1. Inspection

a. Disconnect starter relay leads at the relay.

b. Connect pocket tester leads to the relay terminals (ohms x 1 scale).

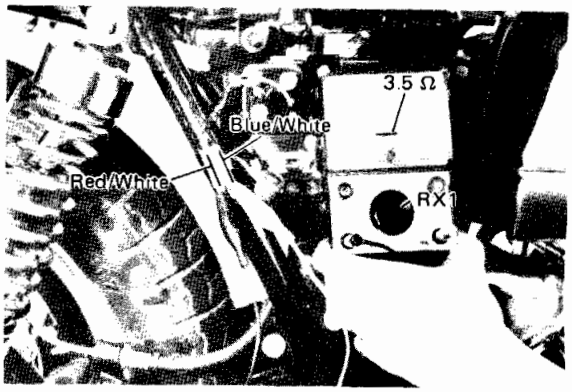
c. Turn ignition to "ON" position and engine stop switch to "RUN"

d. Push the starter button. The relay should click once and the scale should read zero does not read zero, the relay must be replaced.



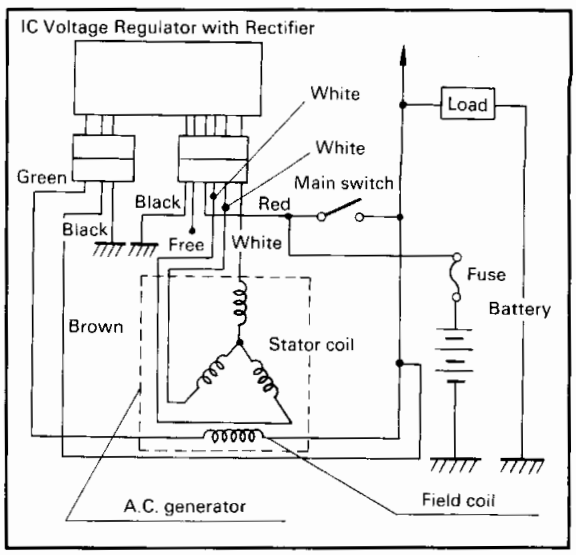
1. Battery lead wire (+)
2. Starter motor lead wire

e. If the relay does not click, check the wires from the starter button and from the battery (red/white, blue/white). Turn the ignition off. Use (ohms × 1) scale on tester. The resistance between these wires should be no more than 3.5 ohms. If there is more resistance, the relay should be replaced.



CHARGING SYSTEM

A. Circuit Diagram



B. A.C. Generator

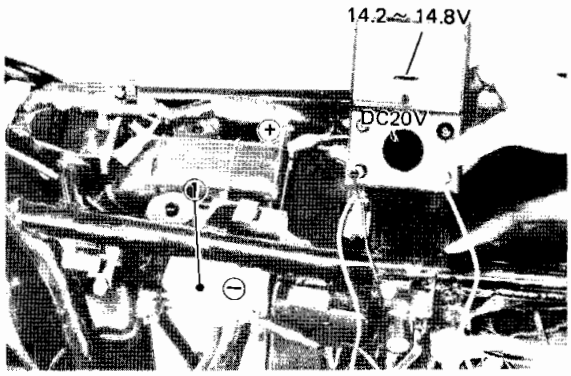
1. Checking method.

a. Connect D.C. voltmeter to the battery terminals.

b. Start engine.

c. Accelerate engine to approximately 2,000 rpm or more and check generated voltage.

Generated voltage: 14.5 ± 0.3V



1. Battery

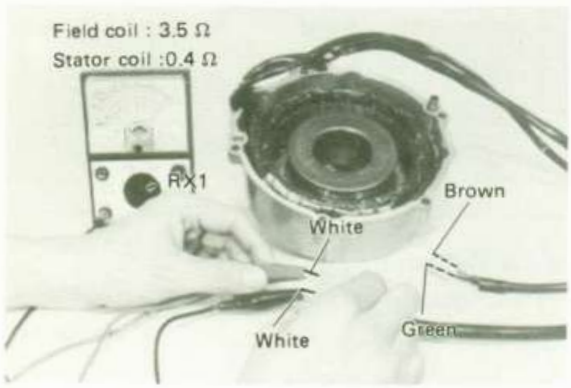
d. If the indicated voltage cannot be reached, then perform the tests in step 2.

CAUTION:
Never disconnect wires from the battery while the generator is in operation. If the battery is disconnected, the voltage across the generator terminals will increase, damaging the semiconductors.

2. Resistance test of field coil and stator coil.

Check the resistance between terminals. If resistance is out of specification, coil is broken. Check the coil connections. If the coil connections are good, then the coil is broken inside and it should be replaced.

Field coil resistance: (Green-Brown)
3.5Ω ± 10% at 20°C (68°F)
Stator coil resistance:
0.4Ω ± 10% at 20°C (68°F)



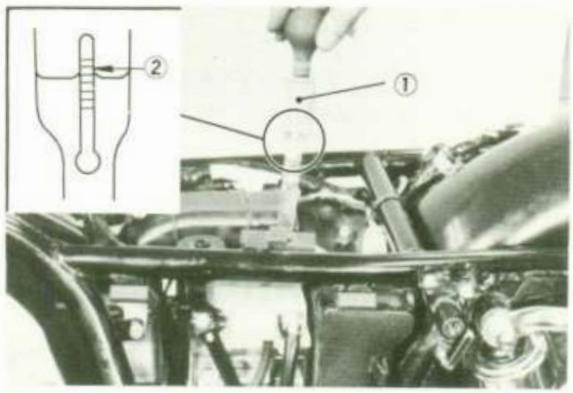
C. Voltage Regulator

The IC Voltage Regulator is a small and, normally,very reliable component. Due to its construction, it is lightweight and free from the wear and misadjustment associated with mechanical voltage regulators. If the following inspection reveals that the regulator is faulty, it cannot be adjusted and must be replaced.



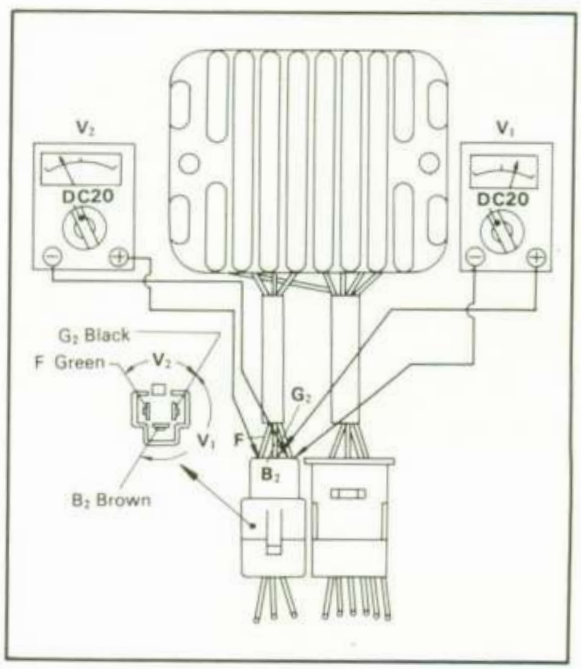
1. Voltage regulator

1. Checking IC Voltage Regulator
a. Remove the seat and the fuel tank. (See page 3-2)
b. Remove the left side cover.
c. Measure the specific gravity of the battery fluid. If it is less than 1.26, remove the battery and recharge until it is more than 1.26. (See page 6-22 for charging procedures)



1. Hydrometer 2. Reading

d. Check the battery terminals and couplers for looseness.
e. Connect two Yamaha pocket testers to the regulator coupler as illustrated.



CAUTION:

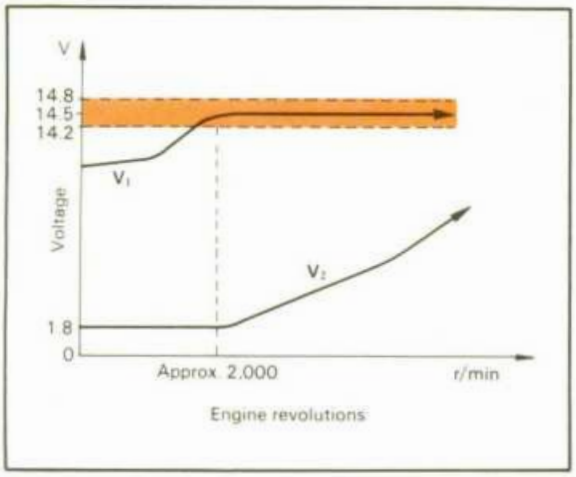
Be careful not to let the tester leads short circuit when connecting them to the regulator snap connecter leads.

f. Turn the main switch on. Make sure that V_2 is less than 1.8V.

NOTE:

Do not turn on lights or signals.

g. Make sure that V_2 gradually ingreases up to 9 ~ 11V when the engine is started and its revolutions go up.

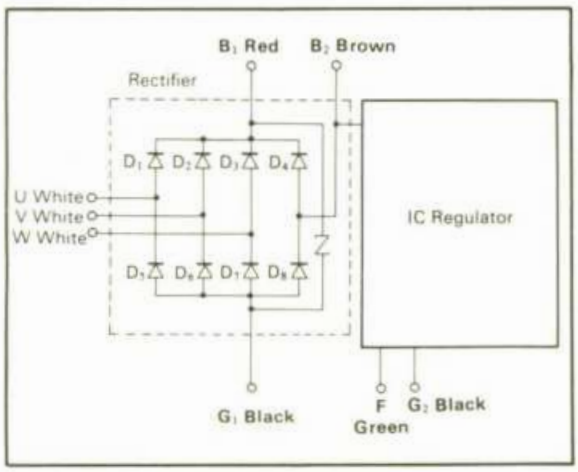


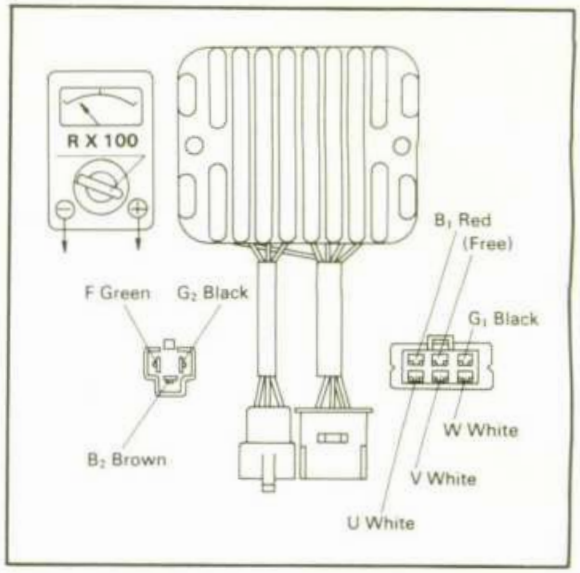
h. Make sure that V_1 maintains the level of 14.2 ~ 14.8V even when engine revolutions increase.

i. If these levels are not maintained, the regulator is defecttive and must be replaced.

2. Checking the silicon rectifier

a. Check the silicon rectifier as specified using the yamaha pocket tester.





Checking element	Pocket test connecting point (+) (red)	Pocket test connecting point (−) (black)	Good	Replace (element shorted)	Replace (element opened)
D_1	B_1	U	○	○	x
	U	B_1	x	○	x
D_2	B_1	V	○	○	x
	V	B_1	x	○	x
D_3	B_1	W	○	○	x
	W	B_1	x	○	x
D_4	B_1	B_2	○	○	x
	B_2	B_1	x	○	x
D_5	U	G_1	○	○	x
	G_1	U	x	○	x
D_6	V	G_1	○	○	x
	G_1	V	x	○	x
D_7	W	G_1	○	○	x
	G_1	W	x	○	x
D_8	B_2	G_1	○	○	x
	G_1	B_2	x	○	x

○ : Continuty

x : Discontinuty (∞)

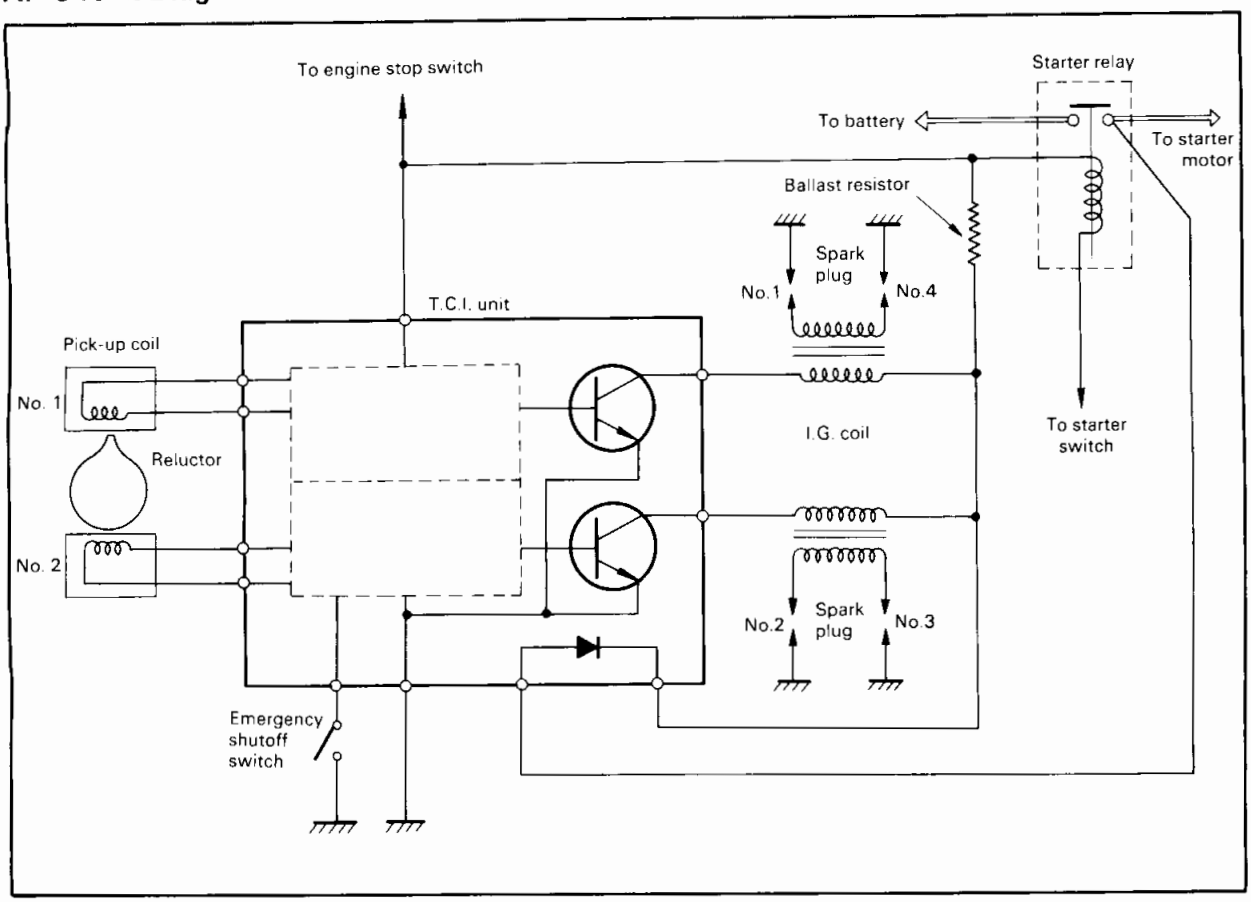
b. Even if only one of the elements is broken, replace the entire assembly.

CAUTION:

The silicon rectifier can be damaged if subjected to overcharging. Special care should be taken to avoid a short circuit and/or incorrect connection of the positive and negative leads at the battery. Never connect the rectifier directly to the battery to make a continuity check.

IGNITION SYSTEM

A. Circuit Diagram



B. Description

This model is equipped with a battery operated, fully transistorized breakerless ignition system that incorporates a ballast resistor for the ignition coils.

By using magnetic pick-up coils the need for contact breaker points is eliminated. This adds to the dependability of the system by eliminating frequent cleaning and adjustment of points and ignition timing. The TCI unit incorporates a bypass circuit to bypass the primary coil ballast resistor when the starter is activated, allowing voltage (unresisted) to operate the coils.

This provides easier cold starting.

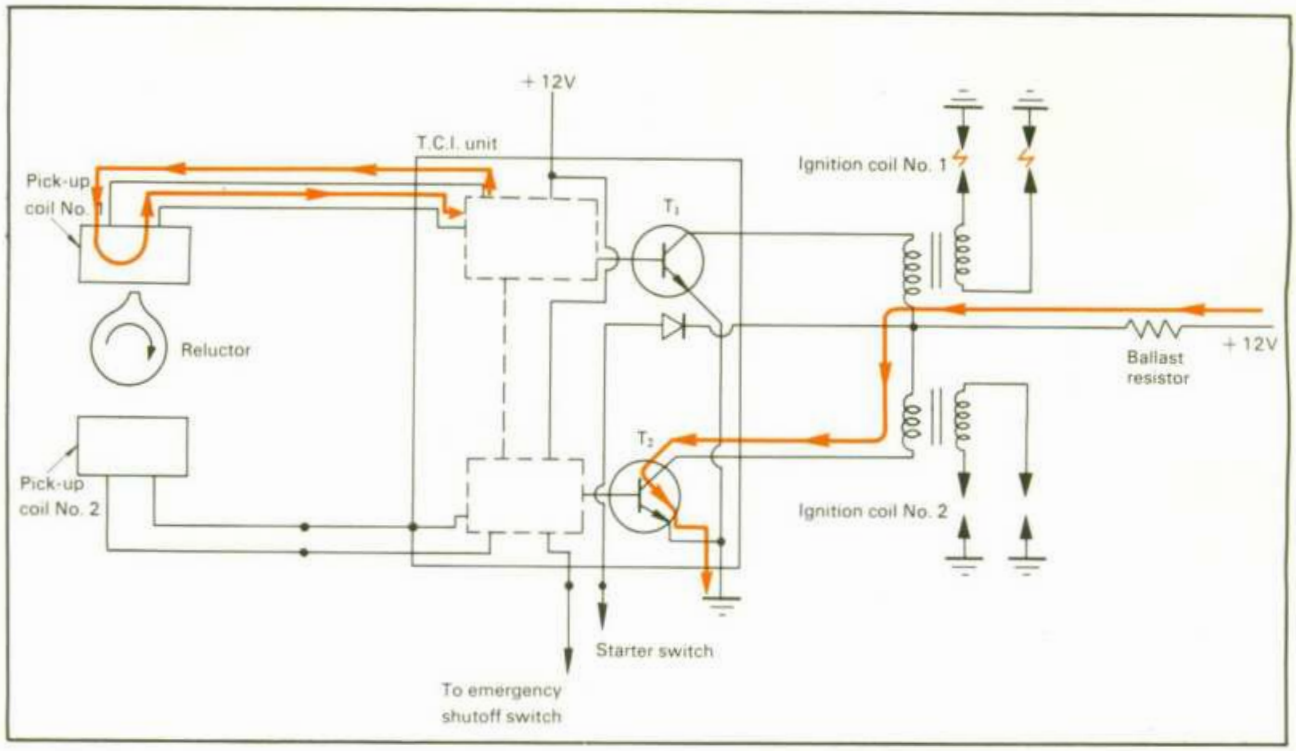
The TCI unit also incorporates a protective circuit for the ignition coils. If the ignition switch is turned on and the crankshaft is not turned, the protective circuit stops current flow to the primary coils within a few second. When the crankshaft is turned over 180°, the current is turned on again by signals generated by the pick-up coils.

C. Operation

The TCI functions on the same principle as a conventional DC ignition system with the exception of using magnetic pick-up coils and a transistor control box (TCI) in place of contact breaker points. The ballast resistor is used to drop the voltage and current to the coils during normal operation, after starting.

1. The pick-up coils produce a small current signal when the reluctor (projection on the governor assembly) passes by. When the reluctor passes the number 1 pick-up coil, this current is sent to the ignitor unit which amplifies this signal and stops current flow through the ignition coil of No. 1 and No. 4 cylinders, producing a spark.

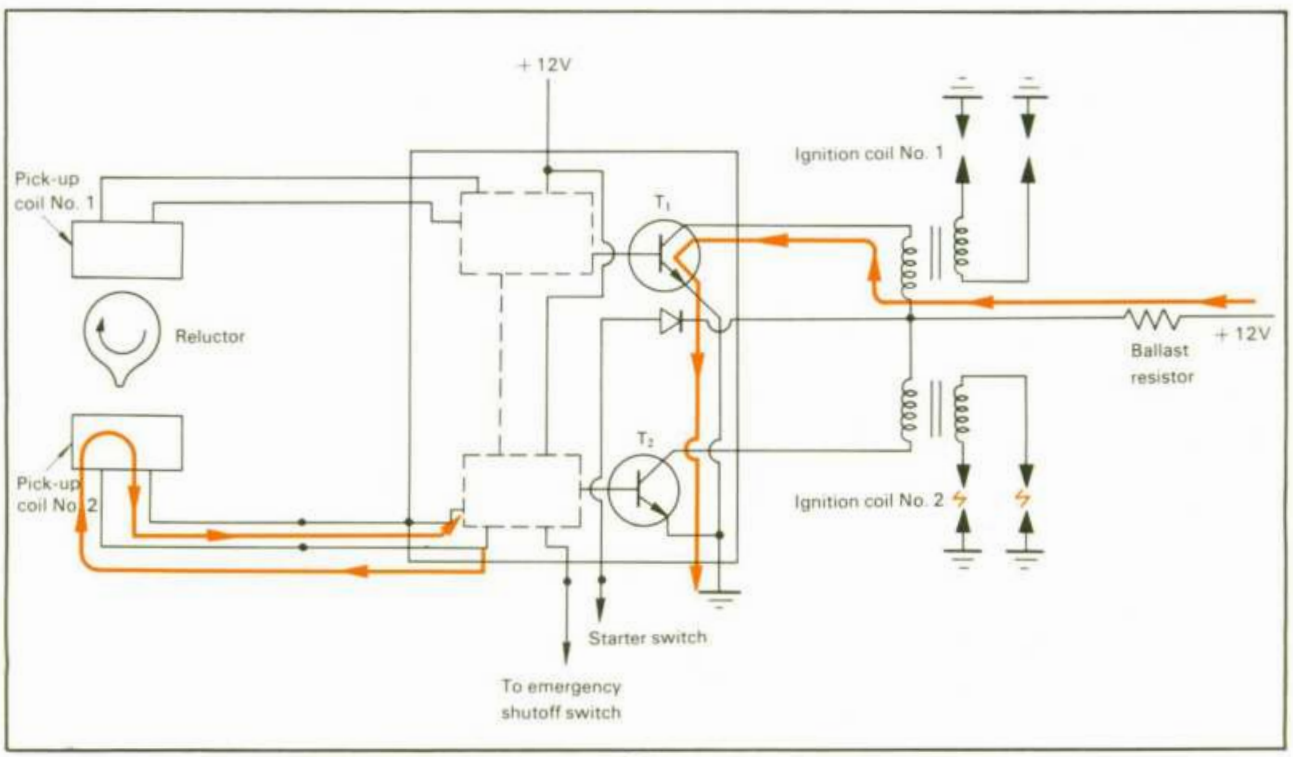
   At the same time, a distributor circuit in the ignitor unit "turns on" the current flow through the No. 2 and No. 3 ignition coil.



2. When the governor assembly inductor passes by the No. 2 pick-up coil, it stops currrent flow in the cylinders No. 2 and No. 3 ignition coil, producing a spark and turning current flow on in cylinders No. 1 and No. 4 ignition coil. This cycle is completed with every revolution of the crankshaft.

NOTE:

Even though two spark plugs fire at the same time only one cylinder is on compression stroke at a time. The other cylinder is on the exhaust stroke and the spark in that cylinder has no effect.

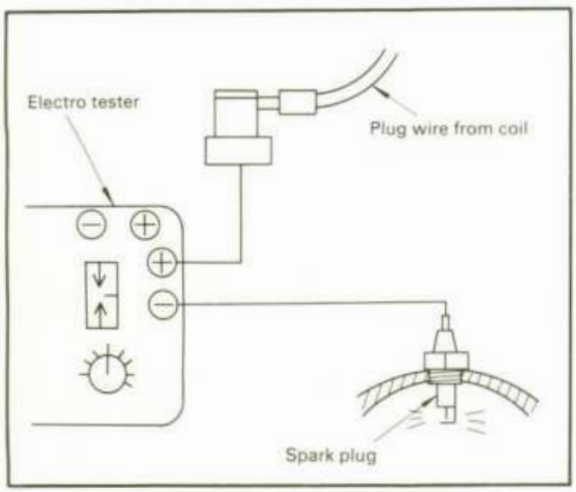


CAUTION:

Do not run the engine without all spark plug caps in place. Due to the high secondary voltage, it is possible to damage the internal insulation of the secondary coil.

D. Troubleshooting/Inspection

1. The entire ignition system can be checked for misfire and weak spark using the Electro Tester. If the ignition system will fire across a sufficient gap, the engine ignition system can be considered good. If not, proceed with individual component tests until the problem is found.



   a. Warm up engine thoroughly so that all electrical components are at operating temperature.
   b. Stop the engine and connect the tester as shown.
   c. Start the engine and increase the spark gap until misfire occurs. (Test at various rpm between idle and red line.)

Minimum spark gap: 6 mm (0.24 in)

CAUTION:

Do not run engine in neutral above 6,000 rpm for more than 1 or 2 seconds.

2. If the ignition system should become inoperative, the following troubleshooting aids will be useful.

Check entire ignition for connections	Poor connection	Correct
↓ OK ↓		
Check battery for voltage and specific gravity	Low voltage & specific gravity	Recharge battery
↓ OK ↓		
Check fuse and fuse connections	Weak connection or open circuit	Correct connection or replace fuse
↓ OK ↓		
Check for voltage at both ignition coils	Low or no voltage	Check connection of ballast resistor terminals. Check ballast resistor. 1.6Ω ± 10% at 20°C. Replace if damaged.
↓ OK ↓		
Check resistance of ignition coils (primary and secondary) Primary: 1.5Ω ± 10% at 20°C Secondary: 15 KΩ ± 20% at 20°C	If other than specified	Replace ignition coil
↓ OK ↓		
Check pick-up coils for resistance. (See "NOTE") Pick-up coil: 720Ω ± 20%	If other than specified	Replace pick-up coil assembly
↓ OK ↓		
Check operation of emergency shutoff switch (see page 6-12)	Faulty	Replace switch
↓ OK ↓		
Check TCI unit (see page 6-11) Replace unit if necessary		

NOTE:

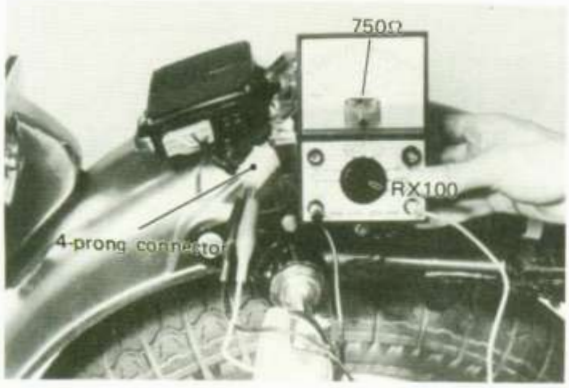
Unplug the 4-prong connector from the TCI unit and check resistance.

White/Red to White/Green:

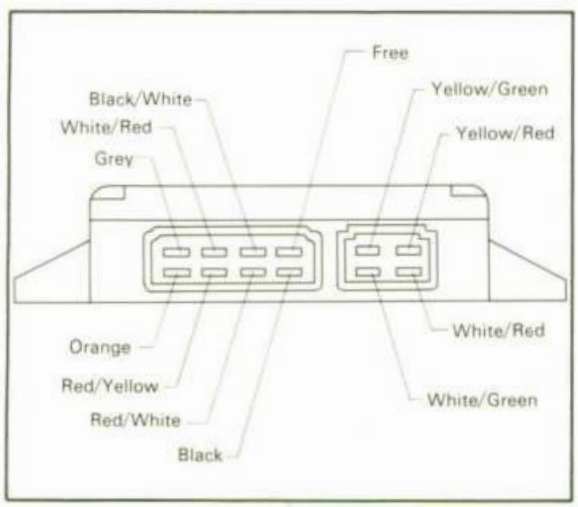
No. 1 pick-up coil.....720Ω ± 20%

Yellow/Green to Yellow/Red:

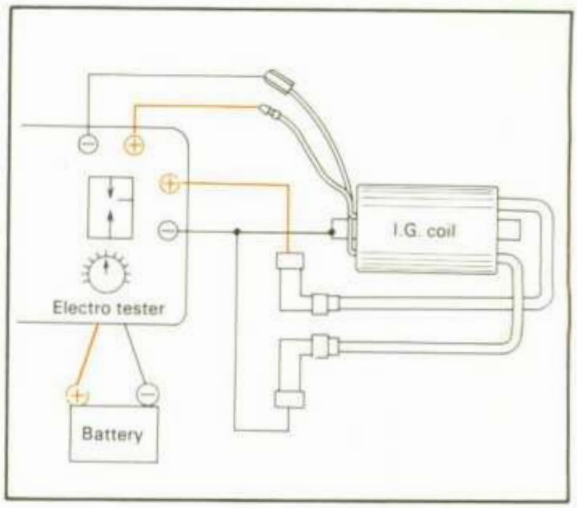
No. 2 pick-up coil.....720Ω ± 20%



3. TCI unit voltage checks
   With all components in the ignition system connected, the following tests may be made to verify the condition of the unit.
   a. Remove the seat.
   b. Turn the ignition switch to "ON".
   c. Check for the voltage at the unit terminals. Use a pocket tester with DC 20V scale.
      1) Gray to ground — 12 volts
      2) White/Red to ground — 12 volts
      3) Black/White to ground — 6 volts
      4) Orange to ground — 12 volts
      5) Red/White to ground — 12 volts



   d. Check the resistance of Black to ground with "ohms x 1" scale. It should show 0Ω resistance.
   e. If the test results match the specifications but the ignition system *is still inoperative*, replace the TCI unit.
4. Ignition coil
   a. Coil spark gap test.
      1) Remove the fuel tank and disconnect the ignition coil from wire harness and spark plugs.
      2) Connect the Electro Tester as shown.



CAUTION:

When testing twin secondary lead coils, one lead must always be grounded and the other lead may not exceed the maximum spark gap because the insulation on the secondary windings may be destroyed by the overly high voltages that can be generated.

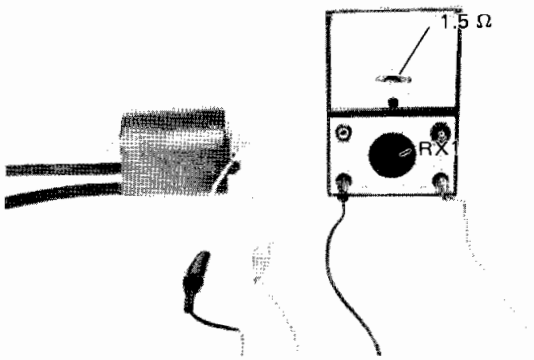
      3) Connect fully charged battery to tester.
      4) Turn on spark gap switch and the increase gap to maximum unless misfire occurs first.

Minimum spark gap: 6 mm (0.24 in)

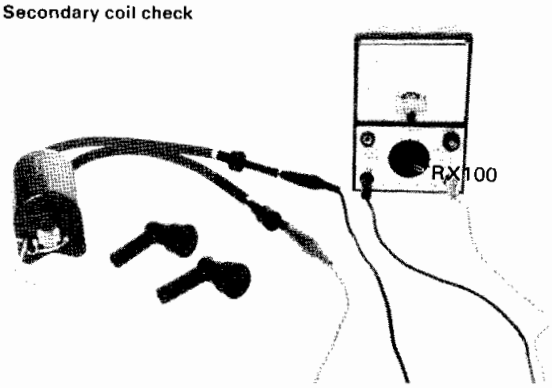
   b. Direct current resistance test. Use a pocket tester or equivalent ohmmeter to determine resistance and continuity of primary and secondary coil windings.

Standard values:
Primary coil resistance:
1.5Ω ± 10% at 20°C
Secondary coil resistance:
15kΩ ± 20% at 20°C

Primary coil check



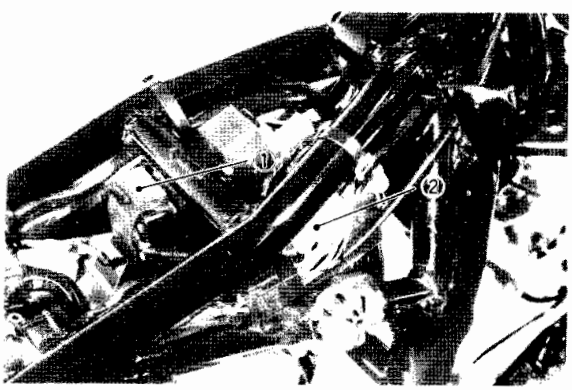
Secondary coil check



5. Emergency shutoff switch
The emergency shutoff switch is a mechanical switch and mounted under the fuel tank. This switch will shut off the ignition system if for any reason the motorcycle reaches a lean angle of 60 degrees or more from vertical.

a. Removal

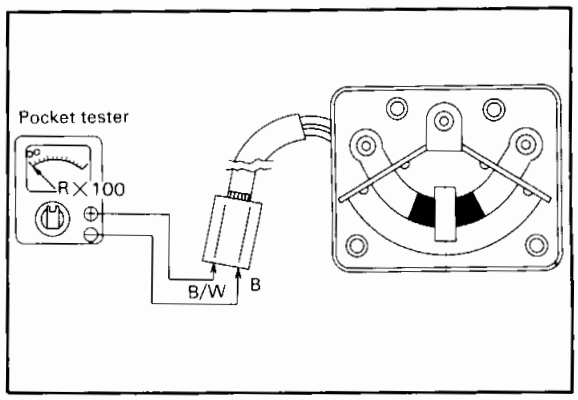
1) Remove the seat and the fuel tank.
2) Disconnect the lead wires from the wire harness and pull out the switch assembly from the frame.



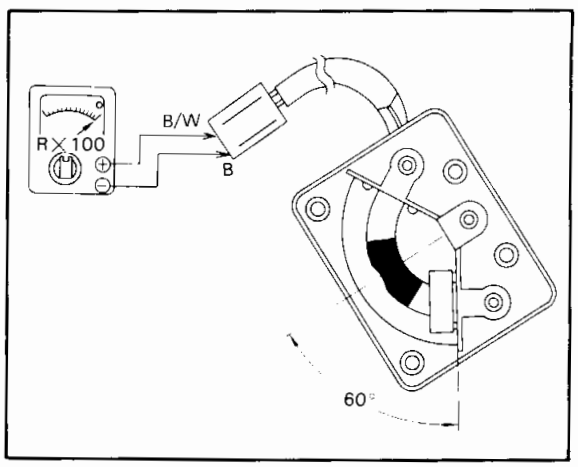
1. Emergency shut off switch 2. Switch lead wires

b. Inspection

1) Connect the pocket tester leads as shown.
2) The tester (with ohms x 100 scale) needle should show infinity (∞) when the switch is positioned vertically as shown. Replace the switch if it shows 0Ω.



3) The tester (with ohms×100 scale) needle should swing to 0Ω when the switch is leaned about 60 degrees or more to either left or right from the vertical position.
Replace the switch if it shows infinite resistance (∞).



6. Governor assembly

a. Removal
See Chapter 3 Engine Disassembly.

b. Inspection (Centrifugal advance)'

NOTE:
Refer to Chapter 2, Periodic Inspection and Adjustment for farther informations.

1) Both weights must pivot smoothly or ignition advance will not occur at the proper rpm, nor will it advance to its

fullest extent. On occasion, molybdenum disulfide grease must be applied sparingly to the weight pivot pins.



1. Apply a molybdenum disulfide grease

2) Check the operation of the reluctor on the governor shaft. It must rotate smoothly.



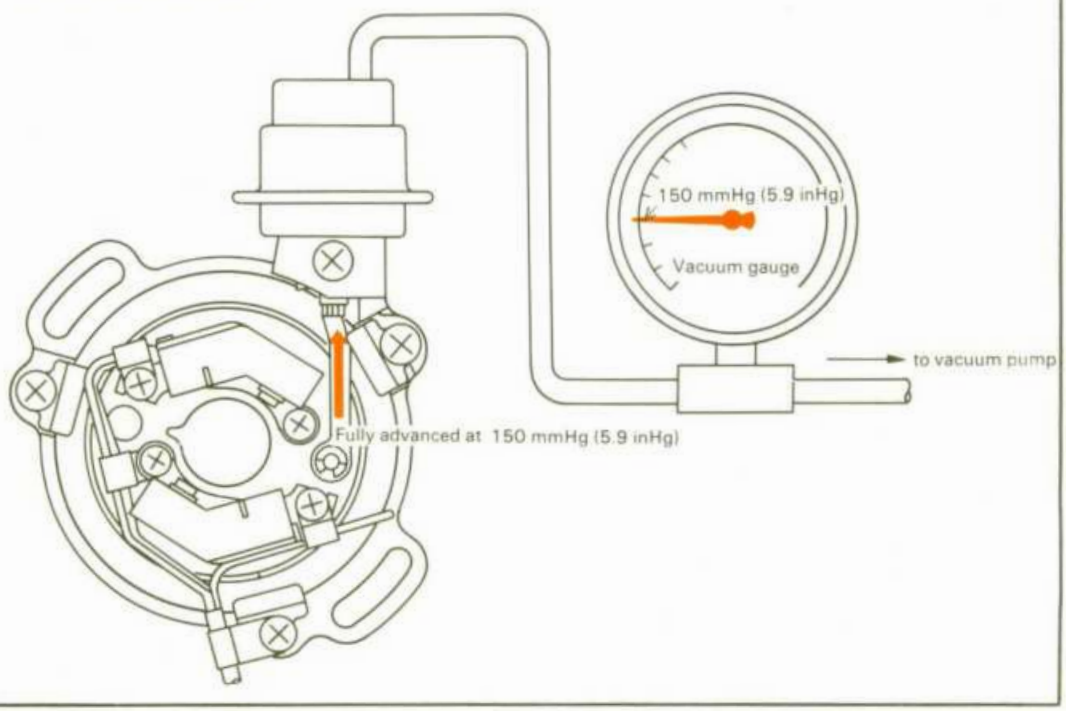
c. Inspection (Vacuum advance)

1) Check the base plate bearing in the pick-up coil assembly for smooth rotation. Replace the pick-up coil assembly if damaged.



2) Connect the hand operated vacuum pump (with vacuum gauge) to the vacuum advancer and check the operation of vacuum advancer. It should be fully advanced at 150 mm Hg (5.9 *in Hg*). Replace the pick-up coil assembly if damaged.

VACUUM ADVANCE CHECK



7. Spark plug
The life of a spark plug and its discoloring vary according to the habits of the rider. At each periodic inspection, replace burned or fouled plugs with new ones of the specified type. It is actually economical to install new plugs often since it will tend to keep the engine in good condition and prevent excessive fuel consumption.

a. Inspection

1) Inspect and clean the spark plug every 3,200 km (2,000 mi).

2) Clean the electrodes of carbon and adjust the electrode gap to the specification.

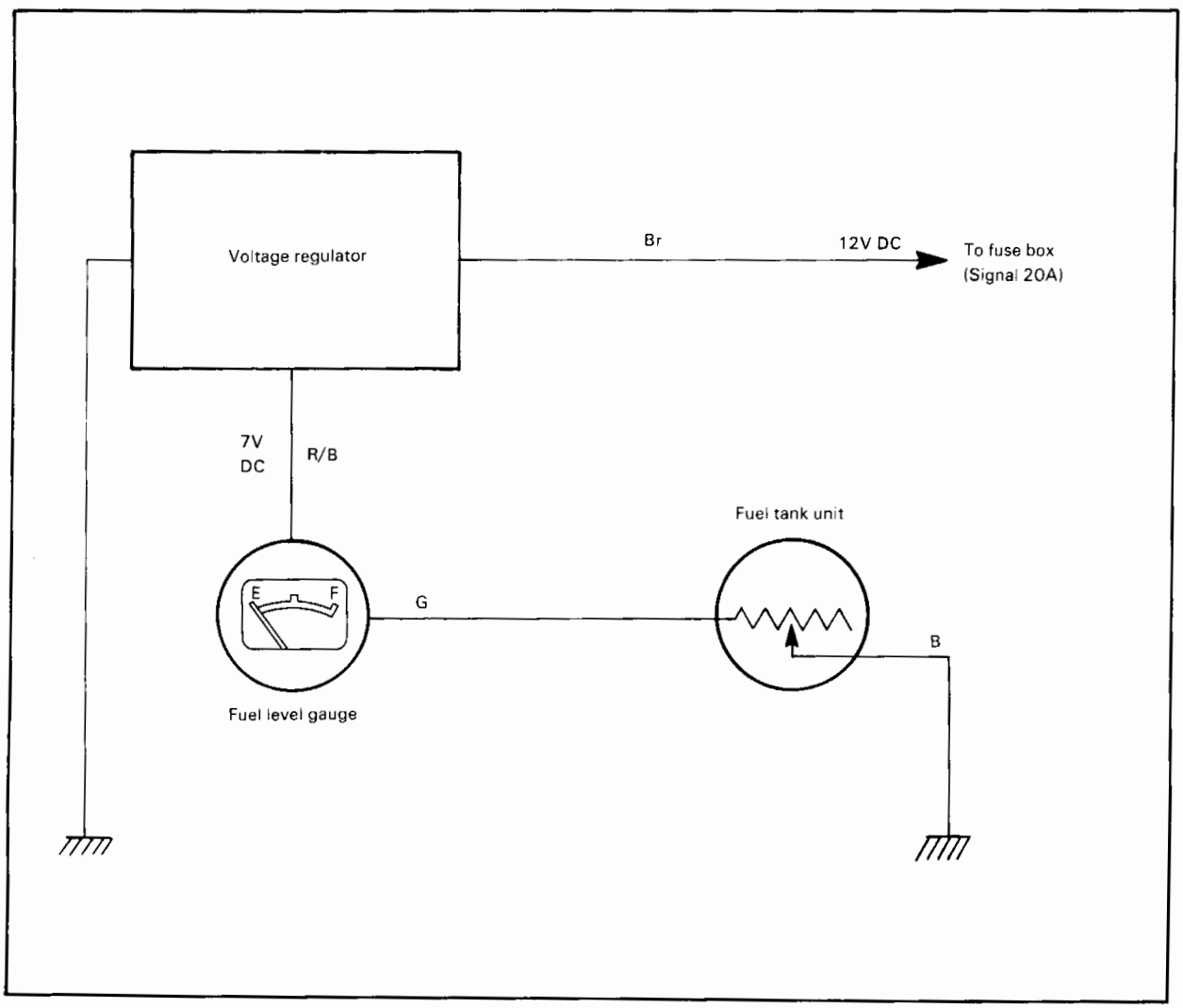
b. Installation

Be sure to use the proper reach, type and electrode gap plug(s) as a replacement to avoid overheating, fouling or piston damage.

Type:
BP6ES (NGK) or N-8Y (Champion)
Electrode gap:
0.7 ~ 0.8 mm (0.028 ~ 0.031 in)
Tightening torque:
2.0 m-kg (14.5 ft-lb)

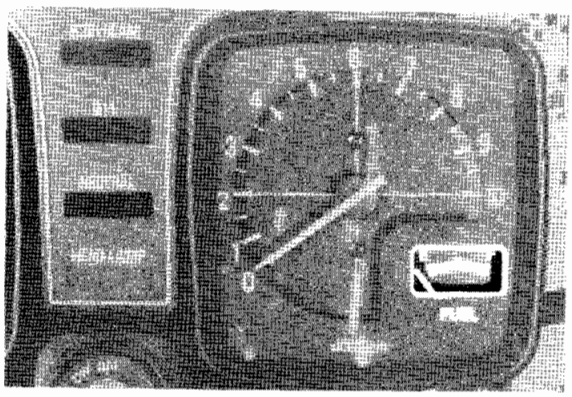
FUEL GAUGE

A. Circuit Diagram



B. Description

The fuel level indicator (fuel gauge) is an electrically operated gauge located in the tachometer housing. This gauge registers fuel level in the tank when the ignition key is in the "ON" position.



C. Troubleshooting/Inspection

1. If the fuel gauge should become inoperative, the following troubleshooting steps will be useful.
   a. Remove the headlight rim.
   b. Turn the ignition switch to the "ON" position.
   c. Inside the headlight shell, use a pocket tester to check the multiple connector going to the tachometer housing. Set the meter selector to the "DC 20V" position.

Brown to ground should show 12 volts	Less than specified	check battery voltage. Recharge battery if necessary.

↓

YES

↓

Green to ground should show 7 volts	Less than or more than specified	Replace fuel meter *regulator*

↓

YES

↓

Disconnect fuel tank sending unit lead wires at rear of the fuel tank. Green wire in wire harness should show 7 volts	Less than specified	Weak connection or open circuit in fuel gauge circuit between connectors in headlight shell and fuel tank.

↓

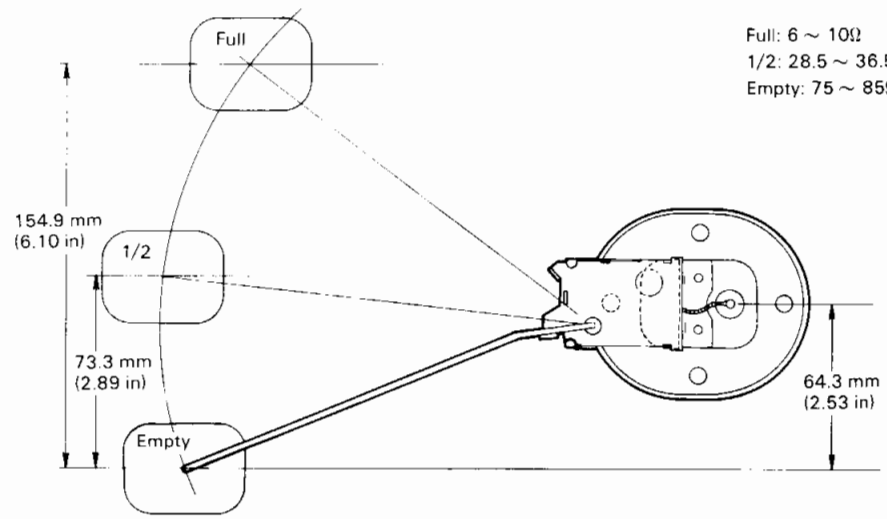
YES

↓

Check fuel tank sending unit (see next step for unit checking procedures)	OK	Replace fuel gauge assembly

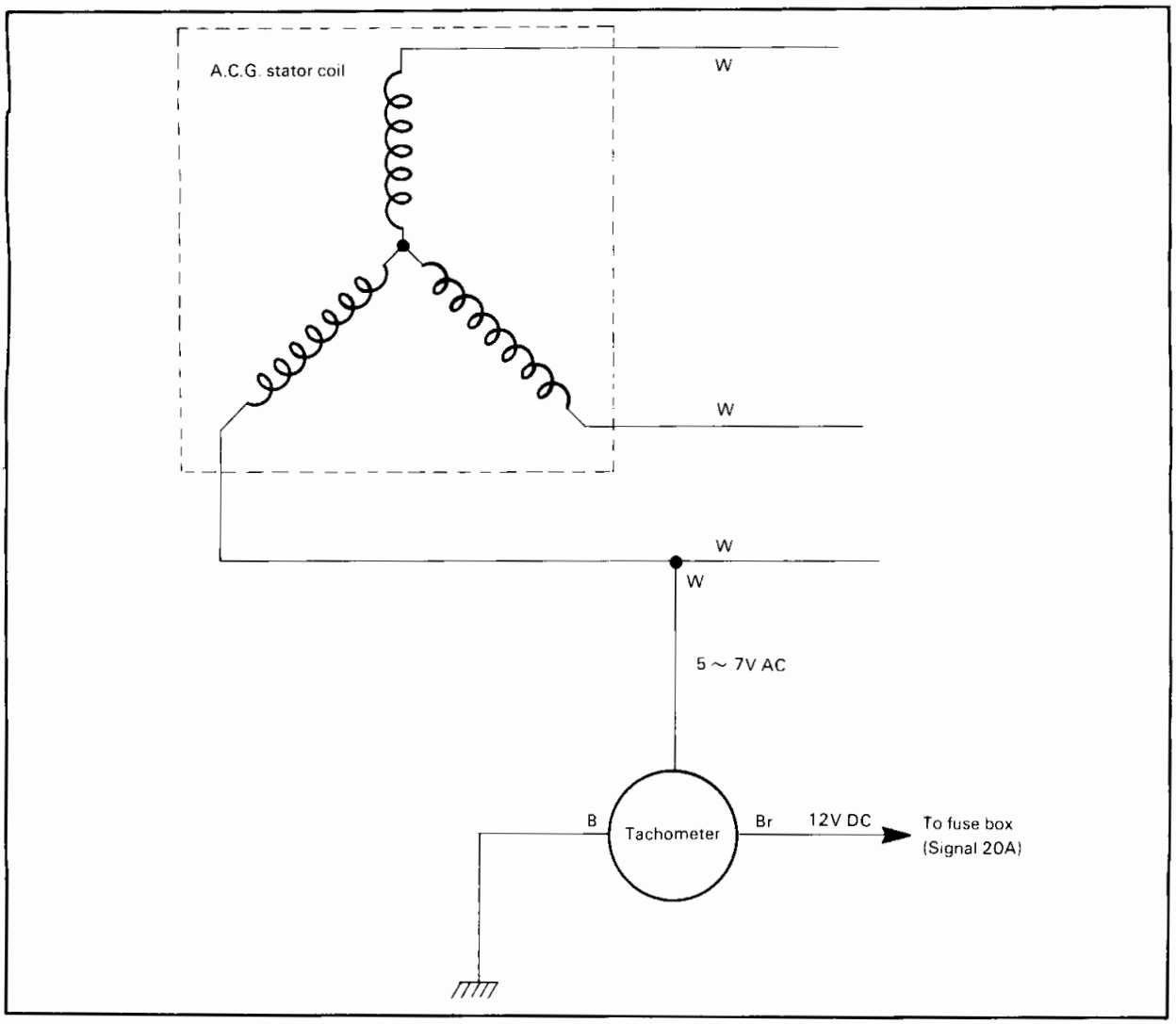
2. Fuel tank sending unit check
   Use a pocket tester (with ohm × 1 scale) for this check.
   a. Remove the sending unit from the fuel tank.
   b. Connect the pocket tester leads across the green wire and the black wire of the sending unit. The meter should show the following resistances at the specified fuel level. If not, replace.

FUEL TANK SENDING UNIT CHECK



TACHOMETER

A. Circuit Diagram

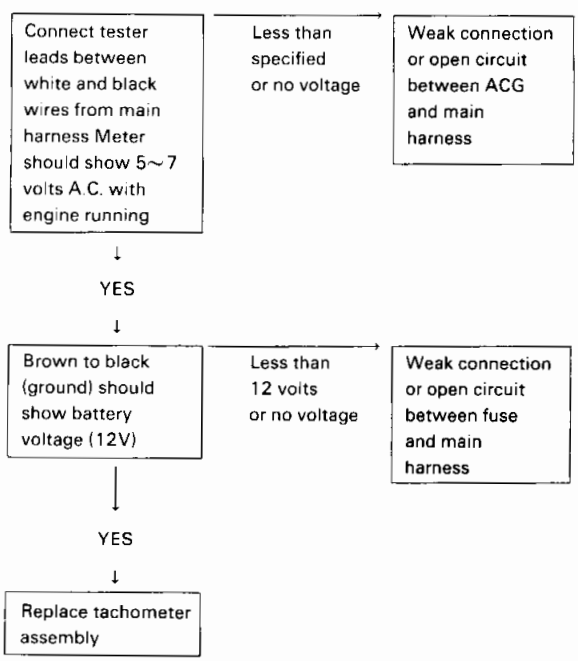


B. Description

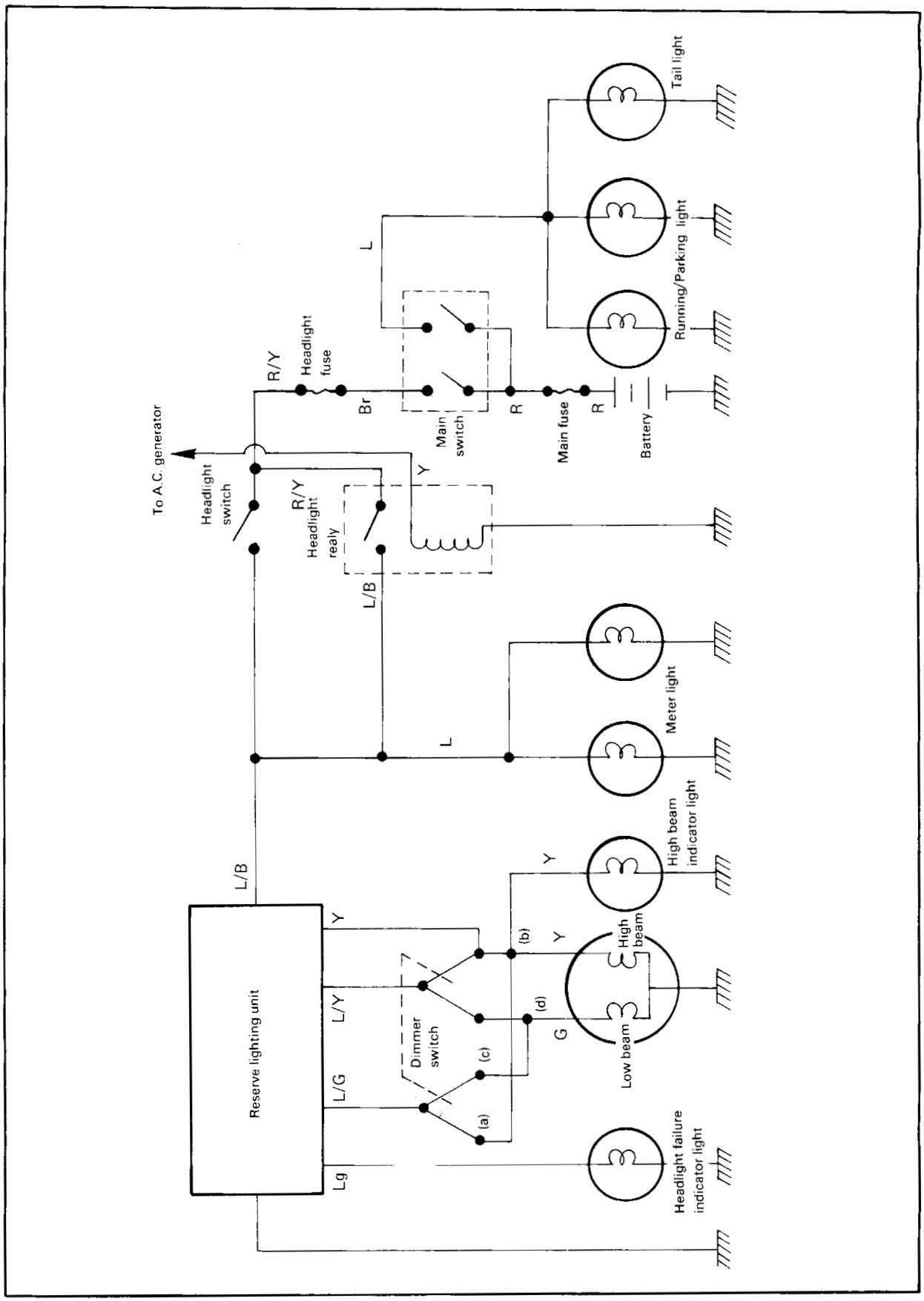
This model has been equipped with an electric tachometer. This tachometer receives its impulses from one of the stator leads of the alternator.

C. Troubleshooting/Inspection

1. If the tachometer should become inoperative, the following troubleshooting steps will be useful.
   a. Remove the headlight rim.
   b. Turn the ignition switch to the "ON" position.
   c. Inside the headlight shell disconnect the tachometer leads from the main harness. Use a pocket tester to check and set the meter selector to the "DC 20V" position.



A. Circuit Diagram

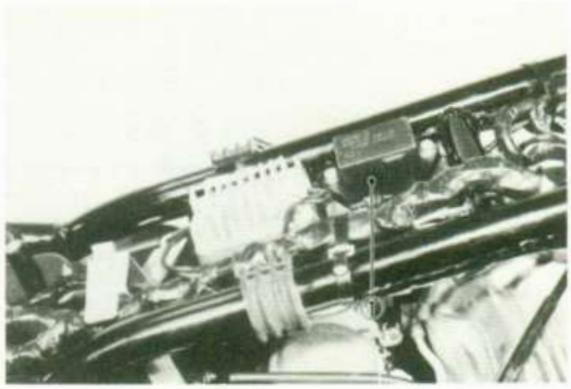


B. Lighting Tests and Checks

The battery provides power for operation of the headlight, running light, horn, taillight, brakelight, neutral light, and flasher light. If none of the above operates, always check battery voltage before proceeding further. Low battery voltage indicates either a faulty battery, low battery water, or a defective charging system. See page 6-5 "CHARGING SYSTEM" for checks of battery and charging system. Also check fuse condition. Replace any "open" fuses. There are individual fuses for various circuits (see complete Circuit Diagram).

1. Horn does not work:
   a. Check for 12V on brown wire to horn.
   b. Check for good grounding of horn (pink wire) when horn button is pressed.
2. Brake light does not work:
   a. Check bulb.
   b. Check for 12V on yellow wire to brake light.
   c. Check for 12V on brown wire to each brake light switch (front brake and rear brake switches).
3. Taillight does not work:
   a. Check bulb.
   b. Check for 12V on blue wire.
   c. Check for ground on black wire to tail/brake light assembly.
4. Flasher light(s) do not work:
   a. Check bulb.
   b. Right circuit:
   1) Check for 12V on dark green wire to light.
   2) Check for ground on black wire to light assembly.
   c. Left circuit:
   1) Check for 12V on dark brown wire to light.
   2) Check for ground on black wire to light assembly.
   d. Right and left circuits do not work:
   1) Check for 12V on brown/white wire to flasher switch on left handlebar.
   2) Check for 12V on brown wire to flasher relay.
   3) Replace flasher relay.
   4) Replace flasher switch.
   e. Check flasher self-cancelling system. (Refer to flasher self-cancelling system.)
5. Neutral light does not work:
   a. Check bulb.
   b. Check for 12V on sky blue wire to neutral switch.
   c. Replace neutral switch.
6. Oil pressure light does not work:
   a. Connect oil pressure switch (black/red wire) to ground. If light comes on, check for proper oil pressure.
   b. If oil pressure is correct, replace oil pressure switch.

C. Reserve Lighting System



1. Reserve lighting unit

1. Description:
   The reserve lighting system has two functions: (1) it notifies the rider that one of the head lamp filaments is inoperative, and (2) it switches current from the inoperative filament to the remaining functional filament.
   The system is connected to the headlight circuit only. The reserve lighting system unit is located under the fuel tank.

NOTE:
This model has been equipped with a headlight relay so that the headlight comes on automatically when the engine is started even with the headlight switch "OFF".

Headlight condition	Headlight failure indicator light	Reserve lighting function
Normal	Comes on (very dim)	—
High beam faulty	Comes on	Low beam comes on
Low beam faulty	Comes on	High beam comes on at low brilliance

2. Troubleshooting/Inspection

(Refer to page 6-17)

a. Headlight does not come on when engine is running with handle switch off

Check for voltage on "Y" wire to headlight relay → No voltage → Check AC generator or wiring circuit

↓ Voltage OK

Check for battery voltage (12V) on "R/Y" wire to headlight relay → No voltage → Check fuse "Head" or wiring circuit

↓ Voltage OK

Check for battery voltage (12V) on "L/B" wire to headlight relay → No voltage → Replace headlight relay

b. Headlight does not function

Check for battery voltage on "L/B" wire to reserve unit → No voltage → Headlight switch or wiring circuits

↓ Voltage OK

Check for battery voltage on "L/Y" wire to reserve unit → No voltage → Unit is defective

↓ Voltage OK

Poor headlight ground, poor connection at coupler or open wiring circuit → No voltage → Dimmer switch or wiring circuits

↓ Voltage OK

Check for voltage at headlight connectors (High and low beam)

c. "Head" indicator bulb does not glow

check for battery voltage on "Lg" wire to reserve unit → No voltage → Reserve lighting unit is defective

↓ Voltage OK

Indicator bulb or connections are bad

d. High beam does not light when low beam is defective

Check for battery voltage on "L/G" wire to reserve unit → No voltage → Reserve unit is defective

↓ Voltage OK

Check for battery voltage at dimmer switch terminal (a) → No voltage → Dimmer switch defective

↓ Voltage OK

Check for battery voltage at headlight high beam terminal (b) → No voltage → Open or poor connection between headlight (b) and dimmer switch

↓ Voltage OK

Poor ground or poor connection of headlight wiring

e. Low beam does not light when high beam is defective

Check for battery voltage on "L/G" wire to reserve unit → No voltage → Reserve unit is defective

↓ voltage OK

Check for battery voltage at dimmer switch terminal (c) → No voltage → Dimmer switch is defective

↓ Voltage OK

Check for battery voltage at headlight low beam terminal (d) → No voltage → Open or poor connection between headlight (d) and dimmer switch terminal (c)

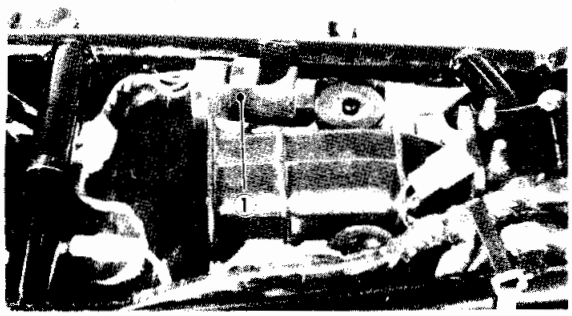
↓

Voltage OK

↓

Poor ground or poor connection of headlight wiring

D. Self-Cancelling Flasher System



1. Self-cancelling flasher unit

1. Description:
   The self-cancelling flasher system turns off the turn signal after a period of time or distance involved in turning or changing lanes. Generally, the signal will cancel after either 10 seconds, or 150 meters (164 yards), whichever is greater. At very low speed, the function is determined by distance; at high speed, it is determined by time. At low speed, especially when changing speeds, the cancelling determination is a combination of both time and distance.
2. Operation:
   The handle switch has three positions: L (left), OFF, and R (right). The switch lever will return to the "OFF" position after being pushed to L or R, but the signal will function. By pushing the lever in, the signal may be cancelled manually.
3. Inspection
   If the flasher self-cancelling system should become inoperative, proceed as follows:

a. Pull off the 6-pin connector from the flasher cancelling unit, and operate the handle switch. If the signal operates normally in L, R, and OFF, the following are in good condition.

1) Flasher unit
2) Bulb
3) Lighting circuit
4) Handle switch light circuit

If (1) through (4) are in good condition, the following may be faulty:

1) Flasher cancelling unit.
2) Handle switch reset circuit.
3) Speedometer sensor circuit.

b. Pull off the 6-pin connector from the flasher cancelling unit, and connect a tester (ohms x 100 range) across the white/green and the black lead wires on the wire harness side. Turn the speedometer shaft. If the tester needle swing back and forth between 0 and ∞, the speedometer sensor circuit is in good condition. If not, the sender or wire harness may be inoperative.

c. Pull off the 6-pin connector from the flasher cancelling unit. check if there is continuity between the yellow/red lead wire on the wire harness side and the chassis.

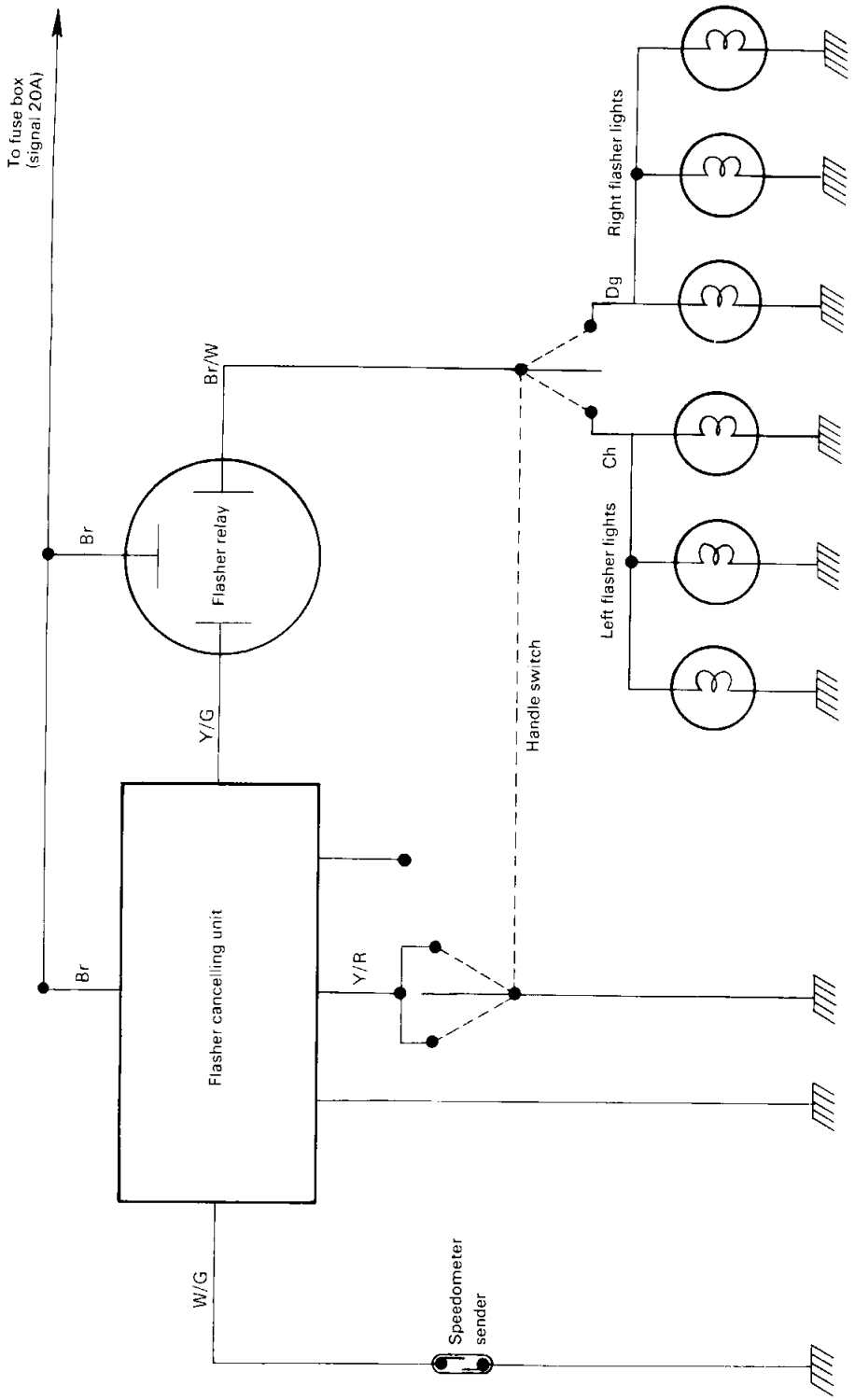
Flasher switch OFF: ∞ Flasher switch L or R: 0 ohms

If the tester needle does not swing as indicated above, check the handle switch circuit and wire harness.

d. If no defect is found with the above three check-ups and the flasher cancelling system is still inoperative, replace the flasher cancelling unit.

e. If the signal flashes only when the handle switch lever is turned to L or R and it turns off immediately when the handle switch lever returns to center, replace the flasher cancelling unit.

SELF-CANCELLING FLASHER SYSTEM



E. Switches

Switches may be checked for continuity with a pocket tester on the "ohm x 1" position.

1. Main switch

Switch Position	Wire Color		
	R	Br	L
ON	○	○	○
OFF			
LOCK			
P (parking)	○		○

2. Engine stop switch

Switch Position	Wire Color	
	R/W	R/W
RUN	○	○
OFF		

3. Lighting switch (right handlebar)

Switch Position	Wire Color	
	L/B	R/Y
ON	○	○
OFF		

4. Starter button (right handlebar)

Button Position	Wire Color	
	L/W	Ground
PUSH	○	○
OFF		

5. Dimmer switch (left handlebar)

Switch Position	Wire Color			
	Y	L/Y	G	L/G
HI	○	○	○	○
LO		○	○	
	○			○

6. Turn (flasher) switch (left handlebar)

Switch Position	Wire Color				
	Ch	Br/W	Dg	Y/R	Ground
L	○	○		○	○
L → N	○	○			
N → Push					
R → N		○	○		
R		○	○	○	○*

7. Horn button (left handlebar)

Button Position	Wire Color	
	P	Ground
PUSH	○	○
OFF		

F. Battery

This model has been equipped with a long life type battery; however, the battery fluid should be checked at least once a month or every 1,600 km (1,000 mi).

1. Checking
   If the battery shows the following defects, it should be replaced.
   a. The battery voltage will not rise to a specific value or no gassing occurs in any cell even after many hours of charging.
   b. Sulfation of one or more cells is indicated by the plates turning white or an accumulation of material in the bottom of the cell.
   c. Specific gravity readings after a long slow charge indicate a cell to be lower than any others.
   d. Warpage or buckling of plates or insulators is evident.

WARNING:
Battery fluid is poisonous and dangerous, causing severe burns, etc. Contains sulfuric acid. Avoid contact with skin, eyes or clothing.
Antidote: EXTERNAL-FLUSH with water. INTERNAL-Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or veg. oil. Call physician immediately.
Eyes: Flush with water for 15 minutes and get prompt medical attention. Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc., away. Ventilate when charging or using in enclosed space. Always shield eyes when working near batteries.
KEEP OUT OF REACH OF CHILDRE.

2. The service life of a battery is usually 2 to 3 years, but lack of care as described below will shorten the life of the battery.

a. Negligence in keeping battery topped off with distilled water.
b. Battery being left discharged.
c. Over-charging with heavy charge.
d. Freezing.
e. Filling with water or sulfuric acid containing impurities.
f. Improper charging voltage or current on new battery.

Battery	12V20AH
Electrolyte	Specific gravity: 1.28
Initial charging current	2.0 amp for 10 hours (new battery)
Recharging current	10 hours (or until specific gravity reaches 1.28)
Refill fluid	Distilled water (to maximum level line)
Refill period	Check once per month (or more often, required)

3. If the motorcycle is not to be used for a long time, remove the battery and have it stored. The following instructions should be observed:
a. Recharge the battery periodically.
b. Store the battery in a cool, dry place.
c. Recharge the battery before reinstallation.

CHAPTER 7. APPENDICES

Specifications 7-1
General Specifications 7-1
Maintenance Specifications 7-2
Torque Specifications 7-8
General Torque Specifications 7-10
Conversion Tables 7-10
Consumer Information 7-11
Stopping Distance 7-11
Acceleration and Passing Ability 7-11
Lubrication Chart 7-13
Cable Routing 7-15
Wiring Diagram 7-16

SPECIFICATIONS
General Specifications

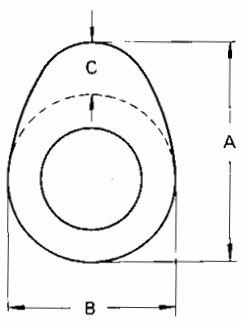
Basic color	Macho Maroon
Dimensions:	
Overall length	2,260 mm (89.0 in)
Overall width	920 mm (36.2 in)
Overall height	1,175 mm (46.3 in)
Seat height	810 mm (31.9 in)
Wheelbase	1,545 mm (60.8 in)
Minimum ground clearance	150 mm (5.9 in)
Caster (steering head angle)	29.5°
Trail	130 mm (5.12 in)
Weight:	
Net	255 kg (562 lb)
Engine:	
Type	D.O.H.C., air-cooled, gasoline
Bore x stroke x cylinders	71.5 mm x 68.6 mm x 4 (2.815 in x 2.701 in x 4)
Displacement	1,102 cc (67.25 cu.in)
Compression ratio	9.2 : 1
Lubrication:	
Lubrication system	Pressure lubricated, wet sump
Delivery pump type	Trochoid
Carburetion:	
Manufacture	Mikuni
Type	BS34II, constant velocity
Rated venturi size	30.3 mm (1.19 in)
Air filter	Dry foam rubber
Ignition:	
Type	Battery ignition (Full transistor ignition)
Spark plug	NGK BP-6ES, Champion N-8Y
Charging:	
Type	Three-phase, regulated alternator
Manufacture, I.D. No.	Hitachi LD120-04
Maximum output	14.5V/20 Amp at 5,000 r/min
Battery type	12V 20 Amp-Hour
Battery dimensions	91 x 162 x 205 mm (3.583 x 6.378 x 8.071 in)
Regulator/Rectifier	Matsushita, RD1143, I.C. type, full wave
Regulating voltage (No load)	14.5 ± 0.3V
Starting	Electric and kick starter
Primary drive:	
Type	HY-VO chain + Gear
Teeth, ratio	25/25 x 58/35 = 1.657
Clutch:	Wet, multiple disc.
Transmission:	
Type	Constant mesh, 5-speed, drum shifter
Teeth, ratio 1st	38/17 2.235
2nd	39/24 1.625
3rd	36/28 1.285
4th	32/31 1.032
5th	30/34 0.882
Secondary drive:	
Type	Shaft drive
Transmission output:	
Type, teeth, ratio	Spur gear, 44/47 0.936

Middle gear case: Type, teeth, ratio	 Bevel gear, 19/18 1.056
Final gear case: Type, teeth, ratio	 Bevel gear, 33/10 3.3
Chassis:	
Frame	Tubular steel double cradle
Suspension: Front (type, travel)	Telescopic fork, 175 mm (6.9 in)
Rear (type, travel)	Swing arm, 108 mm (4.3 in)
Tires: Front	3.25H19—4PR Bridgestone
rear	4.50H17—4PR Bridgestone
Brakes: Front	Dual hydraulic disc
Rear	Single hydraulic disc
Fuel tank	20 lit (5.3 US gal.) Regular gasoline
Wheels: Front	1.85 x 19 Cast Aluminum
Rear	MT 2.50 x 17 Cast Aluminum

Maintenance Specifications

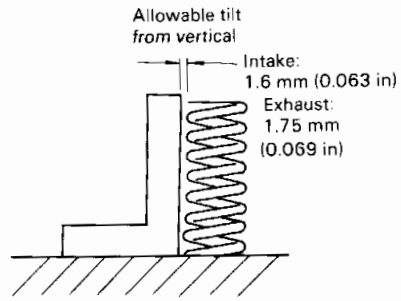
1. Engine

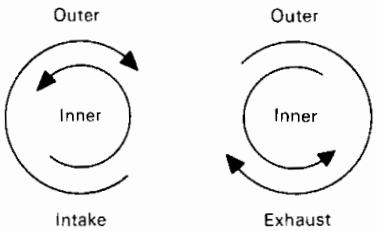
Engine oil capacity:	
Dry	4,000 cc (4.3 US qt.)
Oil and filter change	3,500 cc (3.7 US qt.)
Oil change	3,000 cc (3.2 US qt.)
Recommended lubricant:	
If temperature does not go below 5°C (40°F)	SAE 20W/40 SE motor oil
If temperature does not go above 15°C (60°F)	SAE 10W/30 SE motor oil
Middle gear case capacity:	0.36 lit (0.38 US qt.)
Recommended lubricant:	
If temperature does not go below 5°C (40°F)	SAE 90 Hypoid gear oil, GL-4
If temperature does not go above 15°C (60°F)	SAE 80 Hypoid gear oil, GL-4
All weather	SAE 80W/90 Hypoid gear oil, GL-4
Cranking pressure (at sea level)	10 kg/cm² (142 psi)
Maximum difference between cylinders	1 kg/cm² (14 psi)
Camshafts	
Camshaft bearing surface diameter	24.967 ~ 24.980 mm (0.9830 ~ 0.9835 in)
Camshaft-to-cap clearance:	
Standard	0.020 mm (0.0008 in) ~ 0.054 mm (0.0021 in)
Maximum	0.160 mm (0.006 in)
Camshaft runout limit	0.1 mm (0.004 in)



Dimensions		Standard size	Wear limit
Intake	A	36.805 ± 0.05 mm (1.449 ± 0.002 in)	36.65 mm (1.443 in)
	B	28.341 ± 0.05 mm (1.116 ± 0.002 in)	28.19 mm (1.110 in)
	C	8.805 mm (0.347 in)	—
Exhaust	A	36.305 ± 0.05 mm (1.429 ± 0.002 in)	36.15 mm (1.423 in)
	B	28.341 ± 0.05 mm (1.116 ± 0.002 in)	28.19 mm (1.110 in)
	C	8.305 mm (0.327 in)	—

Valves:

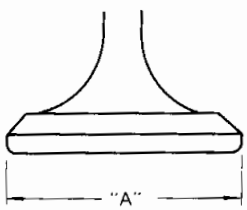


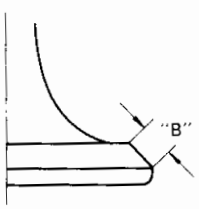


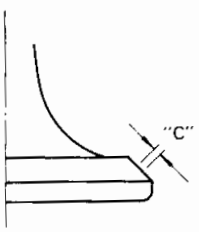
Direction of windings
(Top to bottom)

	Inner Intake/Exhaust	Outer Intake/Exhaust
Free length	35.6 mm (1.402 in)	39.9 mm (1.571 in)
Spring rate	2.36 kg/mm (132.2 lb/in)	4.18 kg/mm (234.1 lb/in)
Installed length (valve closed)	31.5 mm (1.240 in)	34.5 mm (1.358 in)
Installed pressure (valve closed)	7.5 ± 0.75 kg (16.5 ± 1.65 lb)	17.5 ± 1.2 kg (38.6 ± 2.65 lb)
Compressed length (valve open)	23.0 mm (0.906 in)	26.0 mm (1.024 in)
Wire diameter	2.8 mm (0.110 in)	3.9 mm (0.154 in)
Number of windings	7.75	6.4
Winding O.D.	$15\ ^{+0.3}_{0}$ mm $(0.591\ ^{+0.012}_{0}$ in)	$21.6\ ^{0}_{-0.3}$ mm $(0.850\ ^{0}_{-0.012}$ in)

Valve stem run-out maximum	0.03 mm (0.0012 in)
Valve seat width standard/maximum	1.1 mm (0.043 in)/2.0 mm (0.080 in)

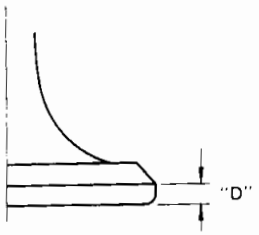






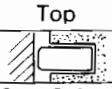
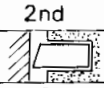
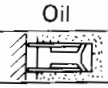
INTAKE

Clearance (Cold engine)	0.16 ~ 0.20 mm (0.0063 ~ 0.00791 in)
"A" head diameter	$36\ ^{+0.2}_{0}$ mm $(1.4173\ ^{+0.0080}_{0}$ in)
"B" face width	2.26 ± 0.57 mm (0.0890 ± 0.0224 in)
"C" seat width	1.1 ± 0.1 mm (0.0433 ± 0.0039 in)
"D" margin thickness (minimum)	0.7 mm (0.0276 in)
Stem diameter (O.D.)	$7\ ^{-0.010}_{-0.025}$ mm $(0.2756\ ^{-0.0004}_{-0.0010}$ in)
Guide diameter (I.D.)	$7\ ^{+0.015}_{0}$ mm $(0.2756\ ^{+0.0006}_{0}$ in)
Stem-to-guide clearance	0.010 ~ 0.040 mm (0.0004 ~ 0.0016 in)



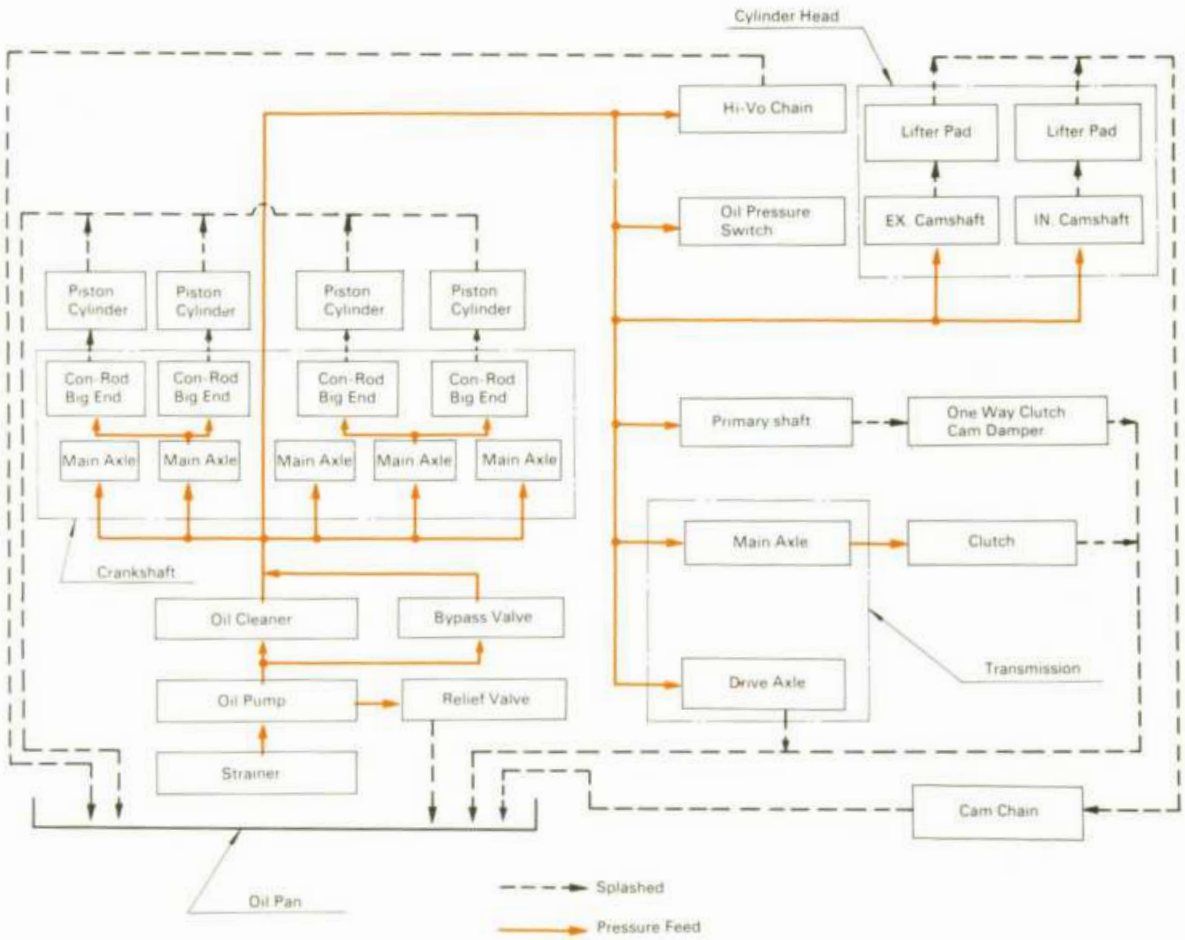
EXHAUST

Clearance (Cold engine)	0.21 ~ 0.25 mm (0.0083 ~ 0.0098 in)
"A" head diameter	$31\ ^{+0.2}_{0}$ mm ($1.2205\ ^{+0.0080}_{0}$ in)
"B" face width	2.26 ± 0.57 mm (0.0890 ± 0.0224 in)
"C" seat width	1.1 ± 0.1 mm (0.0433 ± 0.0039 in)
"D" margin thickness (minimum)	0.7 mm (0.0276 in)
Stem diameter (O.D.)	$7\ ^{-0.025}_{-0.040}$ mm ($0.2756\ ^{-0.0010}_{-0.0016}$ in)
Guide diameter (I.D.)	$7\ ^{+0.15}_{0}$ mm ($0.2756\ ^{+0.0006}_{0}$ in)
Stem-to-guide clearance	0.025 ~ 0.055 mm (0.0010 ~ 0.0022 in)

Cylinder and piston:				
Cylinder material		Aluminum		
Cylinder liner		Pressed in; special cast iron		
Bore size:	standard	$71.5\ ^{+0.02}_{0}$ mm ($2.8150\ ^{+0.0008}_{0}$ in)		
	wear limit	71.6 mm (2.8189 in)		
Cylinder taper limit		0.05 mm (0.0020 in)		
Cylinder out-of-round limit		0.01 mm (0.0004 in)		
Piston clearance:	standard	0.040~0.045 mm (0.0016~0.0018 in)		
	maximum	0.1 mm (0.0039 in)		
Piston weight		210.7 g (7.43 oz)		
Piston rings:		Top	2nd	Oil
Design				
End gap (installed):	standard	0.2 ~ 0.4 mm (0.0079 ~ 0.016 in)	0.2 ~ 0.4 mm (0.0079 ~ 0.016 in)	0.2 ~ 0.9 mm (0.0079 ~ 0.0035 in)
	limit	1.0 mm (0.0394 in)	1.0 mm (0.0394 in)	1.5 mm (0.0591 in)
Side clearance:	standard	0.04~0.08 mm (0.0016~ 0.00031 in)	0.03~0.07 mm (0.0012~0.0028 in)	
	limit	0.15 mm (0.0059 in)	0.15 mm (0.0059 in)	
Crankshaft:				
Crank journal/bearing oil clearance		0.022 ~ 0.044 mm (0.0009 ~ 0.0017 in)		
Position of thrust bearing		No. 4 Journal (Upper)		
Main journal run-out (maximum)		0.04 mm (0.0016 in)		
Connecting rods				
Weight		486.7g (17.2 oz)		
Main bearing oil clearance		0.022 ~ 0.044 mm (0.0009 ~ 0.0017 in)		
Rod bearing oil clearance		0.032 ~ 0.054 mm (0.0013 ~ 0.0021 in)		

Oil pump:	
Housing-to-outer rotor clearance	0.09 ~ 0.15 mm (0.0035 ~ 0.0059 in)
Outer rotor-to-inner rotor clearance	0.12 mm (0.0047 in)
Clutch:	
Friction plate thickness: standard	3.0 mm (0.12 in)
minimum	2.8 mm (0.11 in)
Clutch plate warp maximum	0.1 mm (0.0039 in)
Clutch spring length: standard	42.8 mm (1.685 in)
minimum	41.8 mm (1.646 in)
Spring rate	1.22 kg/mm (68.3 lb/in)
Clutch lever freeplay (at lever pivot point)	2 ~ 3 mm (0.08 ~ 0.12 in)
Transmission shaft run-out maximum	0.08 mm (0.0031 in)
Middle gear case lash	0.1 ~ 0.2 mm (0.0039 ~ 0.0079 in)

LUBRICATION CHART



2. Carburetion

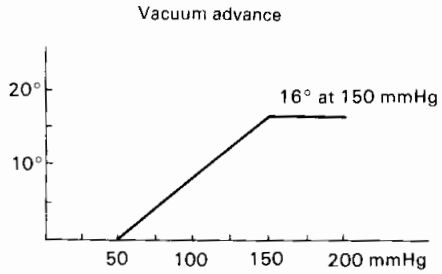
Manufacturer	Mikuni	Float height	25.7 ± 1 mm (1.012 ± 0.039 in)
Model I.D. No.	BS34-II 2H7-00	Pilot screw	Preset (1-1/4 turns out)
Main jet	No. 137.5	Air jet, Main	No. 140
Needle jet	X-2	Air jet, Pilot	No. 180
Pilot jet	No. 42.5	Throttle valve	No. 135
Starter jet	No. 40	Inlet valve size	2.0 mm (0.079 in)
Jet needle/Clip position	5GZ6/3	Engine idle speed	950 ~ 1,050 r/min

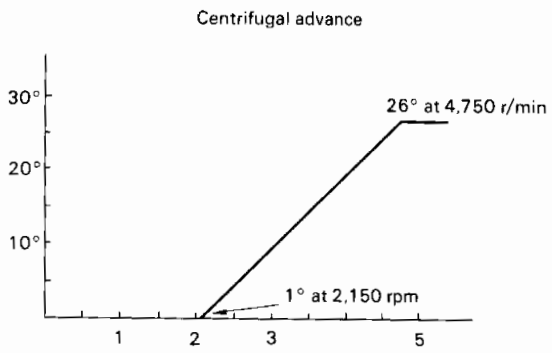
3. Chassis

Wheels and tires:		
Rim run-out: vertical	2.0 mm (0.079 in)	
horizontal	2.0 mm (0.079 in)	
Tire pressure (cold)	Front	Rear
Up to 90 kg (198 lb) load	1.8 kg/cm² (26 psi)	2.0 kg/cm² (28 psi)
90 kg (198 lb) ~ 153 kg (337 lb) load	2.0 kg/cm² (28 psi)	2.5 kg/cm² (36 psi)
153 kg (337 lb) ~ 217 kg kg (478 lb) load (Maximum load)	2.0 kg/cm² (28 psi)	2.8 kg/cm² (40 psi)
High speed riding	2.6 kg/cm² (36 psi)	2.8 kg/cm² (40 psi)
Brakes:		
Recommended fluid	DOT No. 3	
Pad thickness wear limit	6.0 mm (0.24 in)	
Brake disc maximum deflection	0.15 mm (0.006 in)	
Brake disc minimum thickness	Front/rear: 6.5 mm (0.26 in)	
Front brake free play (end of lever)	5.0 ~ 8.0 mm (0.2 ~ 0.3 in)	
Rear brake free play (end of pedal)	13.0 ~ 15.0 mm (0.51 ~ 0.59 in)	
Front forks:		
Travel	175 mm (6.89 in)	
Spring free length	503.5 mm (19.82 in)	
Spring preload length	476.2 mm (18.75 in)	
Spring rate 0 ~ 103 mm (0 ~ 4.055 in)	0.56 kg/mm (31.4 lb/in)	
103 ~ 175 mm (4.055 ~ 6.890 in)	0.63 kg/mm (35.3 lb/in)	
Fork oil capacity (each side)	212 cc (7.17 oz)	
Oil type	SAE 10Wt motor oil	
Rear shock absorbers:		
Spring free length	233 mm (9.17 in)	
Spring preload length	206 mm (8.11 in)	
Spring rate 0 ~ 45 mm (0 ~ 1.772 in)	2.15 kg/mm (120.4 lb/in)	
45 ~ 80 mm (1.772 ~ 3.150 in)	2.85 kg/mm (159.6 lb/in)	
Travel	80 mm (3.15 in)	

4. Electrical

Ignition timing retarded: Ignition timing advance:	10° at 1,000 r/min





Spark plug: Electrode gap	 NGK BP6ES or CHAMPION N-8Y 0.7 ~ 0.8 mm (0.023 ~ 0.032 in)
Spark plug cap resistance:	5.0 KΩ
Ballast resistor: Resistance	 1.6Ω ± 10% at 20°C (68°F)
Pick up coil: Resistance	 720Ω ± 20% at 20°C (68°F)
Ignition coil type: Spark gap Primary resistance Secondary resistance	Hitachi CM12-08 6 mm (0.24 in) or more at 500 r/min (18 KV/100 ~ 9,000 r/min) 1.5Ω ± 10% at 20°C (68°F) 15 KΩ ± 20% at 20°C (68°F)
Starter motor type: Armature coil resistance Field coil resistance Brush length: standard minimum Brush spring pressure Armature mica undercut	Mitsuba SM-224F 0.007Ω at 20°C (68°F) 0.01Ω at 20°C (68°F) 12.5 mm (0.492 in) 5.5 mm (0.22 in) 620 ± 60g (21.87 ± 2.12 oz) 0.5 mm (0.02 in)
Battery type: Charging rate	G.S. GM18Z-3A 2.0 Amps for 10 Hours
Generator type: Output Field (inner) coil resistance Stator (outer) coil resistance	Hitachi LD120-04 14V 20A at 5,000 r/min 3.5Ω ± 10% at 20°C (68°F) 0.4Ω ± 10% at 20°C (68°F)
Regulator type: Regulated voltage Allowable amperage	Matsushita RD1143 14.5 ± 0.3V 4A
Starter relay switch: Cut-in voltage Winding resistance	Hitachi A104-70 6.5V 3.5Ω at 20°C (68°F)
Headlight: Tail/brake light: Flasher light: Pilot lights: Flasher High beam	12V, 65W/50W 12V, 8W (3CP)/27W (32CP) x 2 12V, 27W (32CP) x 4 12V, 3.4W x 2 12V, 3.4W x 1

Neutral	12V, 3.4W x 1
Headlight outage	12V, 3.4W x 1
Oil pressure	12V, 3.4W x 1
Meter light	12V, 3.4W x 4
Parking light (Running light):	12V, 8W (3CP) x 2

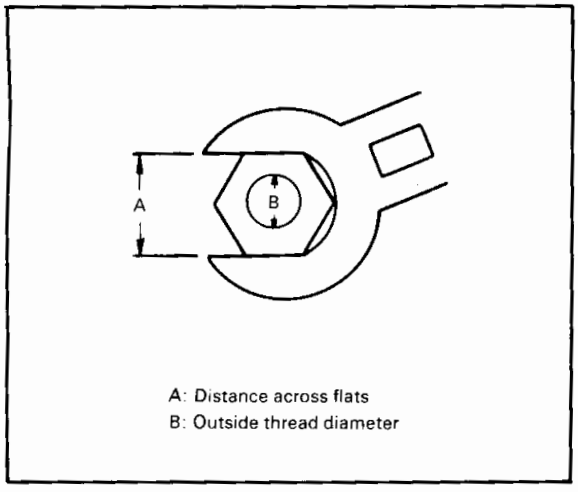
Torque Specifications

	Tightening torque	Remarks
Engine:		
Cylinder head cover and cylinder head	1.0 m-kg (7.2 ft-lb)	
Cylinder head	3.5 m-kg (25.3 ft-lb)	Apply oil
Spark plug	2.0 m-kg (14.5 ft-lb)	
Cylinder and cylinder head 8 mm nut	2.0 m-kg (14.5 ft-lb)	
Cylinder and cylinder head 6 mm bolt	1.0 m-kg (7.2 ft-lb)	
Cam shaft cap	1.0 m-kg (7.2 ft-lb)	
Cam sprocket	2.0 m-kg (14.5 ft-lb)	
Cam chain tensioner 6 mm bolt	0.6 m-kg (4.3 ft-lb)	
Cam chain tensioner 8 mm nut	0.9 m-kg (6.5 ft-lb)	
Connecting rod	3.9 m-kg (28.2 ft-lb)	Apply molybdenum disulfide grease
Generator (rotor)	6.5 m-kg (47.0 ft-lb)	
Generator (stator)	1.0 m-kg (7.2 ft-lb)	
Governor	2.0 m-kg (14.5 ft-lb)	
Pick-up base	0.8 m-kg (5.8 ft-lb)	
Drain plug (engine oil)	4.3 m-kg (31.1 ft-lb)	
Drain plug (middle gear oil)	4.3 m-kg (31.1 ft-lb)	
Oil filter	3.2 m-kg (23.1 ft-lb)	Apply oil
Delivery pipe (crankcase, cylinder head)	2.0 m-kg (14.5 ft-lb)	
Pump cover	0.8 m-kg (5.8 ft-lb)	
Strainer cover (gear cover)	1.0 m-kg (7.2 ft-lb)	
Strainer cover (strainer cover)	1.0 m-kg (7.2 ft-lb)	
Strainer cover (baffle plate)	0.8 m-kg (5.8 ft-lb)	Use LOCKTITE
Oil pressure switch	2.0 m-kg (14.5 ft-lb)	Use LOCKTITE
Crankcase 6 mm bolt	2.4 m-kg (17.4 ft-lb)	Use oil
Crankcase 8 mm bolt	1.2 m-kg (8.7 ft-lb)	Use oil
Clutch boss	7.0 m-kg (50.6 ft-lb)	
Clutch spring screw	1.0 m-kg (7.2 ft-lb)	
Primary drive gear	7.0 m-kg (50.6 ft-lb)	
Kick crank	4.5 m-kg (32.5 ft-lb)	
Change pedal	1.0 m-kg (7.2 ft-lb)	
Neutral switch	2.0 m-kg (14.5 ft-lb)	
Exhaust pipe	2.0 m-kg (14.5 ft-lb)	
Clutch adjusting screw lock nut	2.0 m-kg (14.5 ft-lb)	
Chassis:		
Engine mounting bolt Frong, upper	6.7 m-kg (48.5 ft-lb)	
Engine mounting bolt Front, under	6.7 m-kg (48.5 ft-lb)	
Engine mounting bolt Rear	10.0 m-kg (72.3 ft-lb)	
Handle crown and steering shaft 8 mm	2.0 m-kg (14.5 ft-lb)	
Handle crown and steering shaft 14 mm	8.5 m-kg (61.5 ft-lb)	
Handle crown and inner tube	2.0 m-kg (14.5 ft-lb)	
Handle crown and handle holder	2.0 m-kg (14.5 ft-lb)	
Under bracket and inner tube	1.7 m-kg (12.3 ft-lb)	
Rear shock absorber and frame	3.2 m-kg (23.1 ft-lb)	
Rear shock absorber and rear arm	4.2 m-kg (30.4 ft-lb)	
Rear shock absorber and final gear case	3.2 m-kg (23.1 ft-lb)	

Front wheel axle	10.7 m-kg (77.4 ft-lb)	
Front fork and axle holder	2.0 m-kg (14.5 ft-lb)	
Pivot shaft	10.0 m-kg (72.3 ft-lb)	
Rear wheel axle	15.0 m-kg (108.5 ft-lb)	
Torque stopper plate and bracket	2.0 m-kg (14.5 ft-lb)	
Damper clutch and clutch hub	5.5 m-kg (39.8 ft-lb)	
Front fork cap bolt	2.3 m-kg (16.6 ft-lb)	
Brake disc and hub (front)	2.0 m-kg (14.5 ft-lb)	
Caliper and front fork	4.5 m-kg (32.5 ft-lb)	
Caliper and brake hose	2.6 m-kg (18.8 ft-lb)	
Caliper and bleed screw	0.6 m-kg (4.3 ft-lb)	
Master cylinder and brake hose	2.6 m-kg (18.8 ft-lb)	
Brake disc and hub (rear)	2.0 m-kg (14.5 ft-lb)	
Caliper and caliper bracket	1.8 m-kg (13.0 ft-lb)	Use LOCKTITE
Caliper and brake hose	2.6 m-kg (18.8 ft-lb)	
Caliper and bleed screw	0.6 m-kg (4.3 ft-lb)	
Master cylinder and brake hose	2.6 m-kg (18.8 ft-lb)	
Master cylinder and frame	2.3 m-kg (16.6 ft-lb)	
Brake hose and joint	2.6 m-kg (18.8 ft-lb)	
Front master cylinder and bracket	0.9 m-kg (6.5 ft-lb)	
Master cylinder and master cylinder cap:		
Front	0.2 m-kg (1.4 ft-lb)	
Rear	0.2 m-kg (1.4 ft-lb)	
Muffler stay and muffler bracket	3.0 m-kg (21.7 ft-lb)	
Final gear assembly and rear arm	4.2 m-kg (30.4 ft-lb)	
Middle gear flange and universal joint	4.4 m-kg (31.8 ft-lb)	
Muffler bracket and frame	7.4 m-kg (53.5 ft-lb)	
Muffler bracket and rear footrest	6.7 m-kg (48.5 ft-lb)	
Rear fender and frame	0.9 m-kg (6.5 ft-lb)	
Muffler stay and muffler bracket	2.2 m-kg (15.9 ft-lb)	
Silencer band (muffler left and right)	2.0 m-kg (14.5 ft-lb)	
Silencer band (exhaust pipe and muffler)	2.0 m-kg (14.5 ft-lb)	
Rear fender and frame	6.7 m-kg (48.5 ft-lb)	
Middle gear case:		
Drive shaft	11.0 m-kg (79.6 ft-lb)	
Mount cover	2.5 m-kg (18.1 ft-lb)	Use LOCKTITE
Oil drain bolt	2.3 m-kg (16.6 ft-lb)	
Bearing cap	2.5 m-kg (18.1 ft-lb)	Use LOCKTITE
Final gear case:		
Bearing cap	2.2 m-kg (15.9 ft-lb)	
Oil filler screw	2.3 m-kg (16.6 ft-lb)	
Oil drain screw	2.3 m-kg (16.6 ft-lb)	

General Torque Specifications

This chart specifies torque for standard fasteners with standard I.S.O. pitch threads. Torque specifications for special components or assemblies are included in the applicable sections of this book. To avoid warpage, tighten multi-fastener assemblies in a criss-cross fashion, in progressive stages, until full torque is reached. Unless otherwise specified, torque specifications call for clean, dry threads. Components should be at room temperature.



A: Distance across flats
B: Outside thread diameter

A	B	Torque specification		
		m-kg	ft-lb	in-lb
10 mm	6 mm	1.0	7.2	85
12 mm	8 mm	2.0	15	175
14 mm	10 mm	3.5 ~ 4.0	25 ~ 29	300 ~ 350
17 mm	12 mm	4.0 ~ 4.5	29 ~ 33	350 ~ 400
19 mm	14 mm	4.5 ~ 5.0	33 ~ 36	400 ~ 440
22 mm	16 mm	5.5 ~ 6.5	41 ~ 49	480 ~ 570
24 mm	18 mm	5.8 ~ 7.0	42 ~ 50	500 ~ 600
27 mm	20 mm	7.0 ~ 8.3	50 ~ 60	600 ~ 700

CONVERSION TABLES

METRIC TO INCH SYSTEM			
	KNOWN	MULTIPLIER	RESULT
TORQUE	m-kg	7.233	ft-lb
	m-kg	86.80	in-lb
	cm-kg	0.0723	ft-lb
	cm-kg	0.8680	in-lb
WT.	kg	2.205	lb
	g	0.03527	oz
FLOW/DISTANCE	km/l	2.352	mpg
	km/hr	0.6214	mph
	km	0.6214	mi
	m	3.281	ft
	m	1.094	yd
	cm	0.3937	in
	mm	0.03937	in
VOL./CAPACITY	cc (cm^3)	0.03382	oz (US liq)
	cc (cm^3)	0.06102	cu.in
	l (liter)	2.1134	pt (US liq)
	l (liter)	1.057	qt (US liq)
	l (liter)	0.2642	gal (US liq)
MISC.	kg/mm	56.007	lb/in
	kg/cm^2	14.2234	psi (lb/in^2)
	Centigrade(°C)	9/5(°C) + 32	Fahrenheit(°F)

INCH TO METRIC SYSTEM			
	KNOWN	MULTIPLIER	RESULT
TORQUE	ft-lb	0.13826	m-kg
	in-lb	0.01152	m-kg
	ft-lb	13.831	cm-kg
	in-lb	1.1521	cm-kg
WT.	lb	0.4535	kg
	oz	28.352	g
FLOW/DISTANCE	mpg	0.4252	km/l
	mph	1.609	km/hr
	mi	1.609	km
	ft	0.3048	m
	yd	0.9141	m
	in	2.54	cm
	in	25.4	mm
VOL./CAPACITY	oz (US liq)	29.57	cc (cm^3)
	cu.in	16.387	cc (cm^3)
	pt (US liq)	0.4732	l (liter)
	qt (US liq)	0.9461	l (liter)
	gal (US liq)	3.785	l (liter)
MISC.	lb/in	0.017855	kg/mm
	psi (lb/in^2)	0.07031	kg/cm^2
	Fahrenheit(°C)	5/9(°F − 32)	Centigrade(°F)

DEFINITION OF TERMS:

m-kg	= Meter-kilogram(s) (usually torque)
g	= Gram(s)
kg	= Kilogram(s) (1,000 grams)
l	= Liter(s)
km/l	= Kilometer(s) per liter (fuel consumption)
cc	= Cubic centimeter(s) (cm^3) (volume or capacity)
kg/mm	= Kilogram(s) per millimeter (usually spring compression rate)
kg/cm^2	= Kilogram(s) per square centimeter (pressure)

CONSUMER INFORMATION

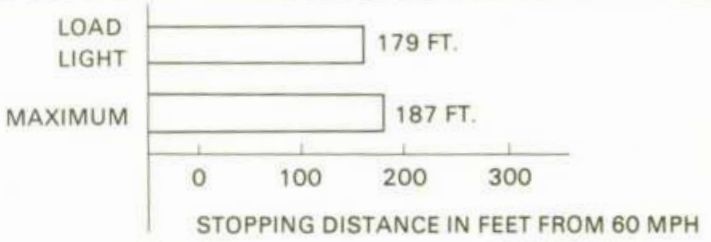
Notice

The information presented represents results obtainable by skilled drivers under controlled road and vehicle conditions, and the information may not be correct under other conditions.

STOPPING DISTANCE

This figure indicates braking performance that can be met or exceeded by the vehicles to which it applies, without locking the wheels, under different conditions of loading and with partial failures of the braking system.

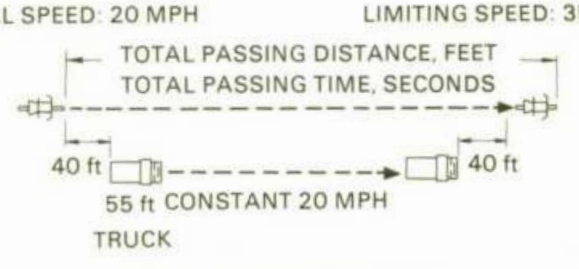
FULL OPERATIONAL SERVICE BRAKE
("Partial failure" information is not applicable and is not included)

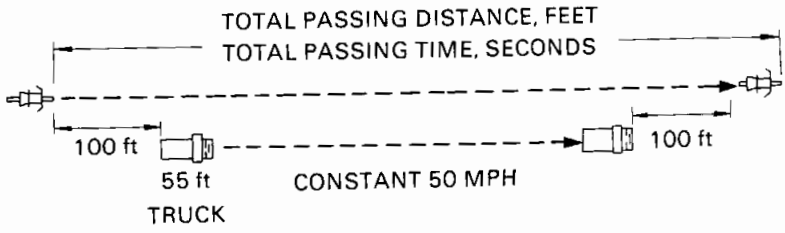


ACCELERATION AND PASSING ABILITY

This figure indicates passing times and distances that can be met or exceeded by the vehicles to which it applies, in the situations diagrammed below. The low-speed pass assumes an initial speed of 20 mph. and a limiting speed of 35 mph. This high-speed pass assumes an initial speed of 50 mph. and a limiting speed of 80 mph.

LOW SPEED PASS

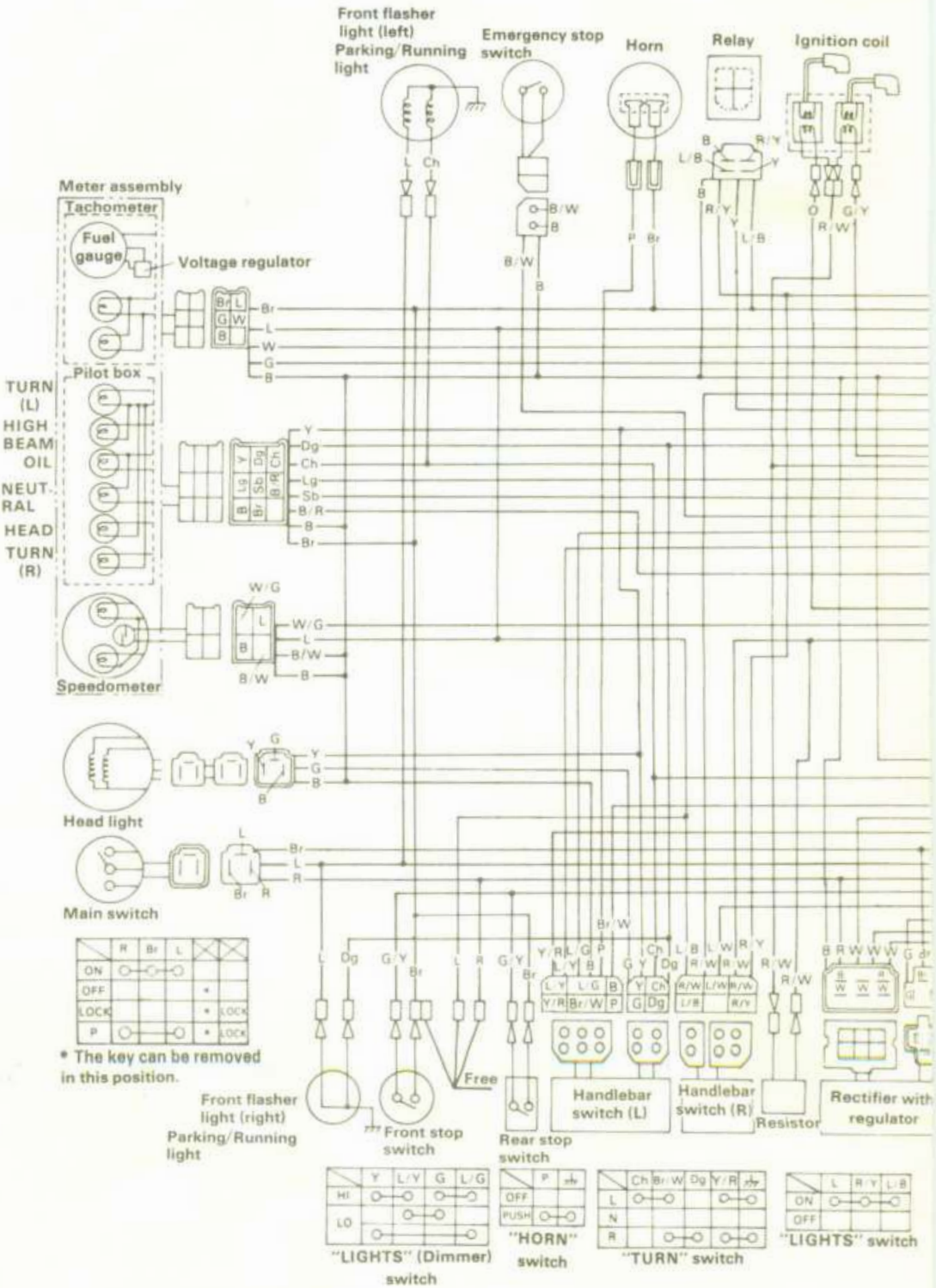


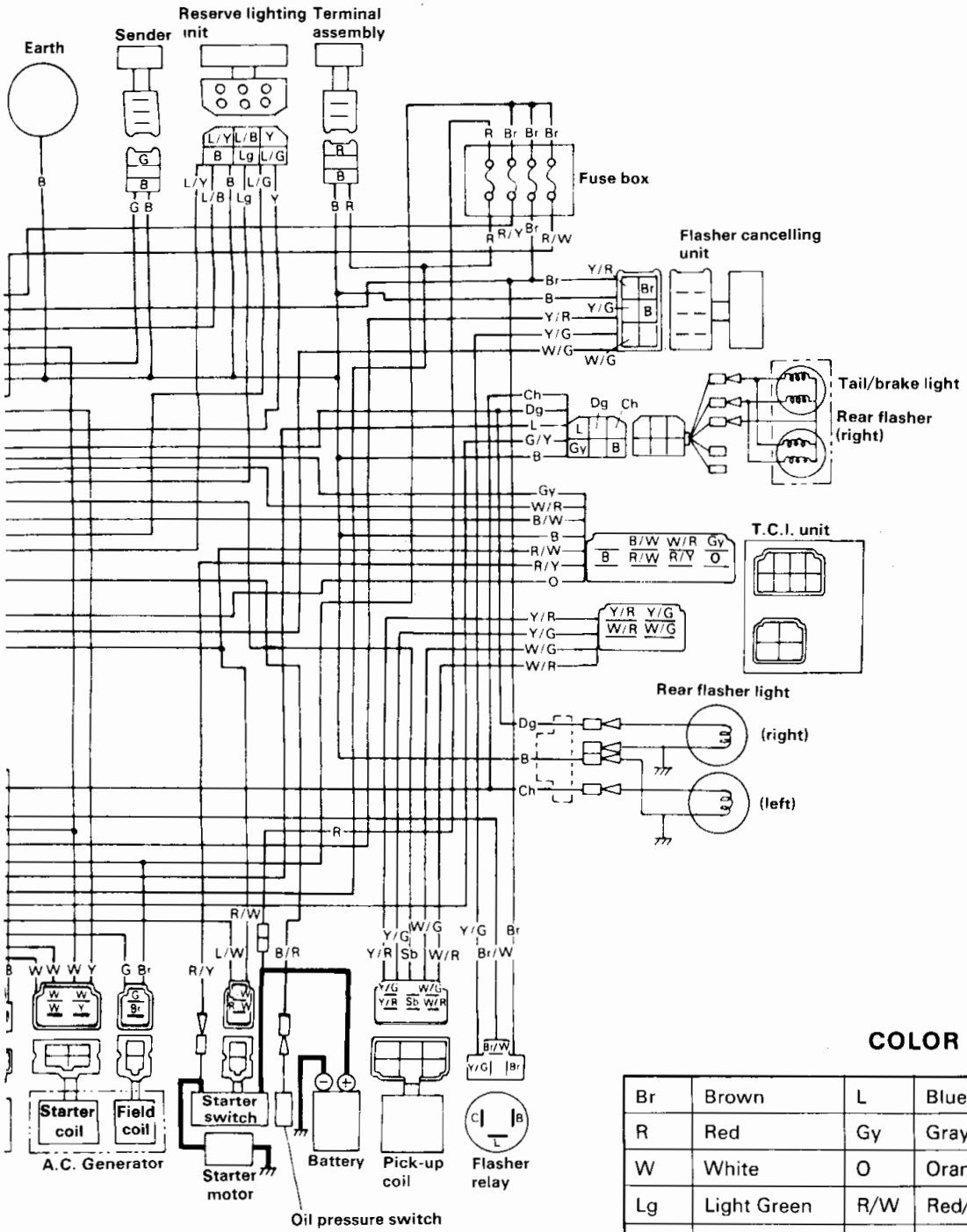
HIGH SPEED PASS	INITIAL SPEED: 50 MPH LIMITING SPEED: 80 MPH 

SUMMARY

Low speed pass..... 352 feet; 7.1 seconds.
High speed pass..... 824 feet; 7.6 seconds.

XS1100E WIRING DIAGRAM

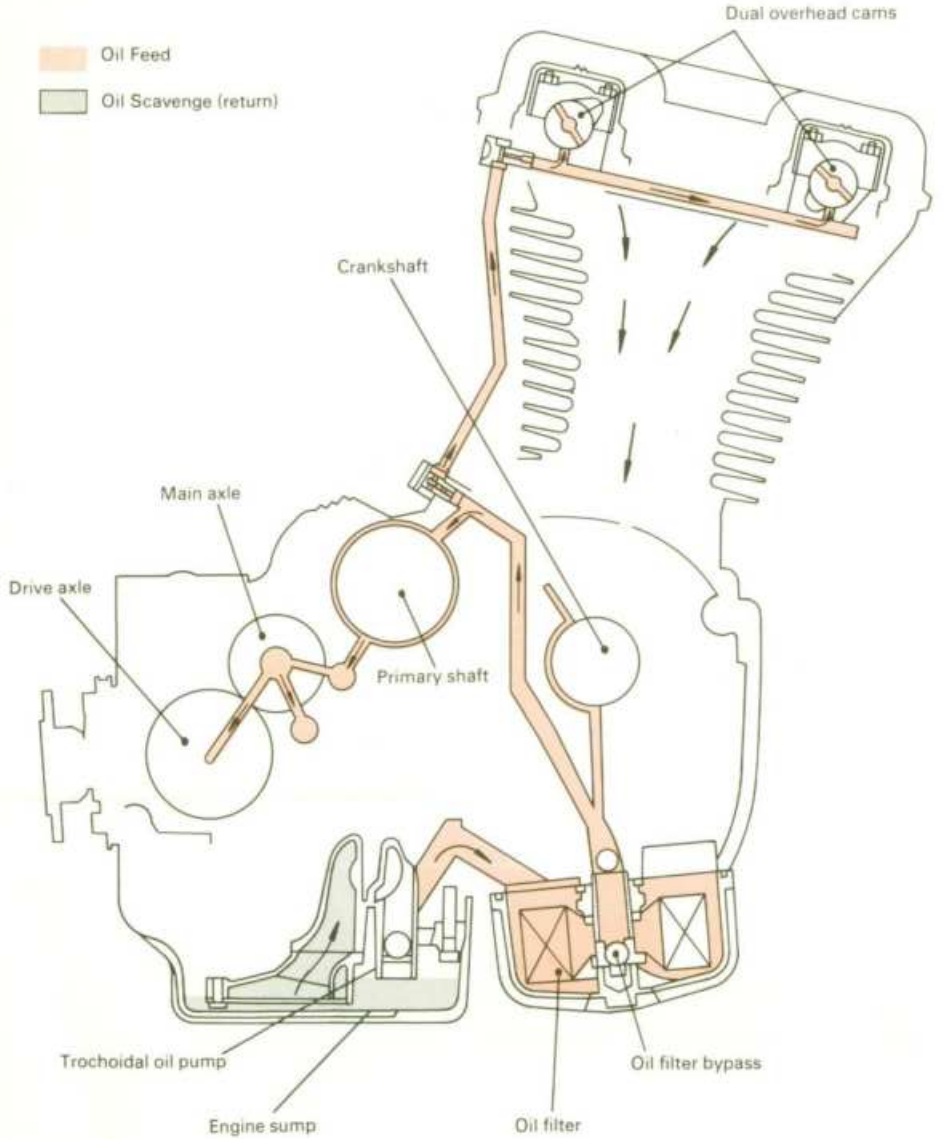




COLOR CODE

Br	Brown	L	Blue	Y/B	Yellow/Black
R	Red	Gy	Gray	Br/W	Brown/White
W	White	O	Orange	Y/G	Yellow/Green
Lg	Light Green	R/W	Red/White	W/G	White/Green
B	Black	L/W	Blue/White	Y/R	Yellow/Red
Y	Yellow	R/L	Red/Blue	W/R	White/Red
Dg	Dark Green	L/Y	Blue/Yellow	G/R	Green/Red
Ch	Chocolate	L/G	Blue/Green		

LUBRICATION CHART



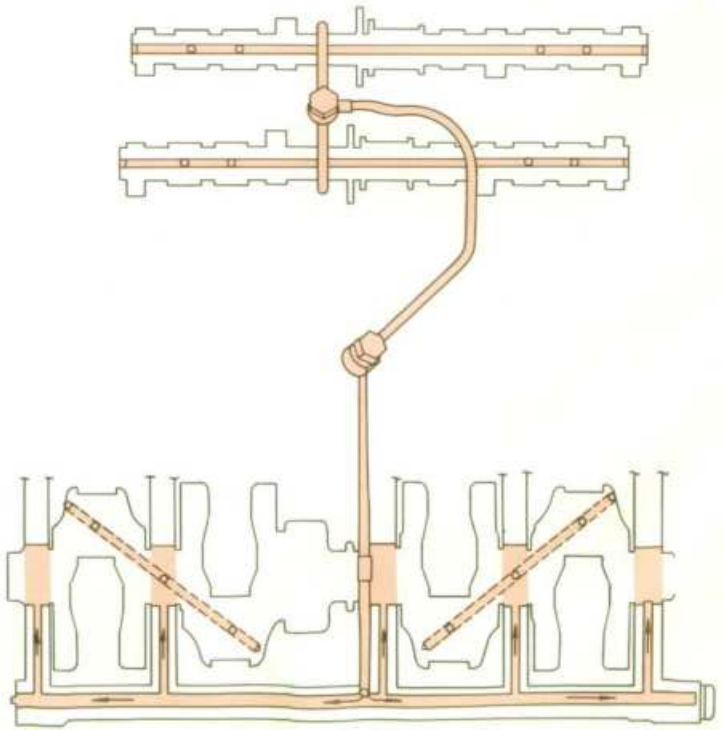
OIL PRESSURE INFORMATION

Relief valve opening 4.8 kg/cm² (70 psi)

Cruising speed oil pressure
(at operating temperature) over 3 kg/cm² (42 psi)
3 kg/cm² (42 psi)

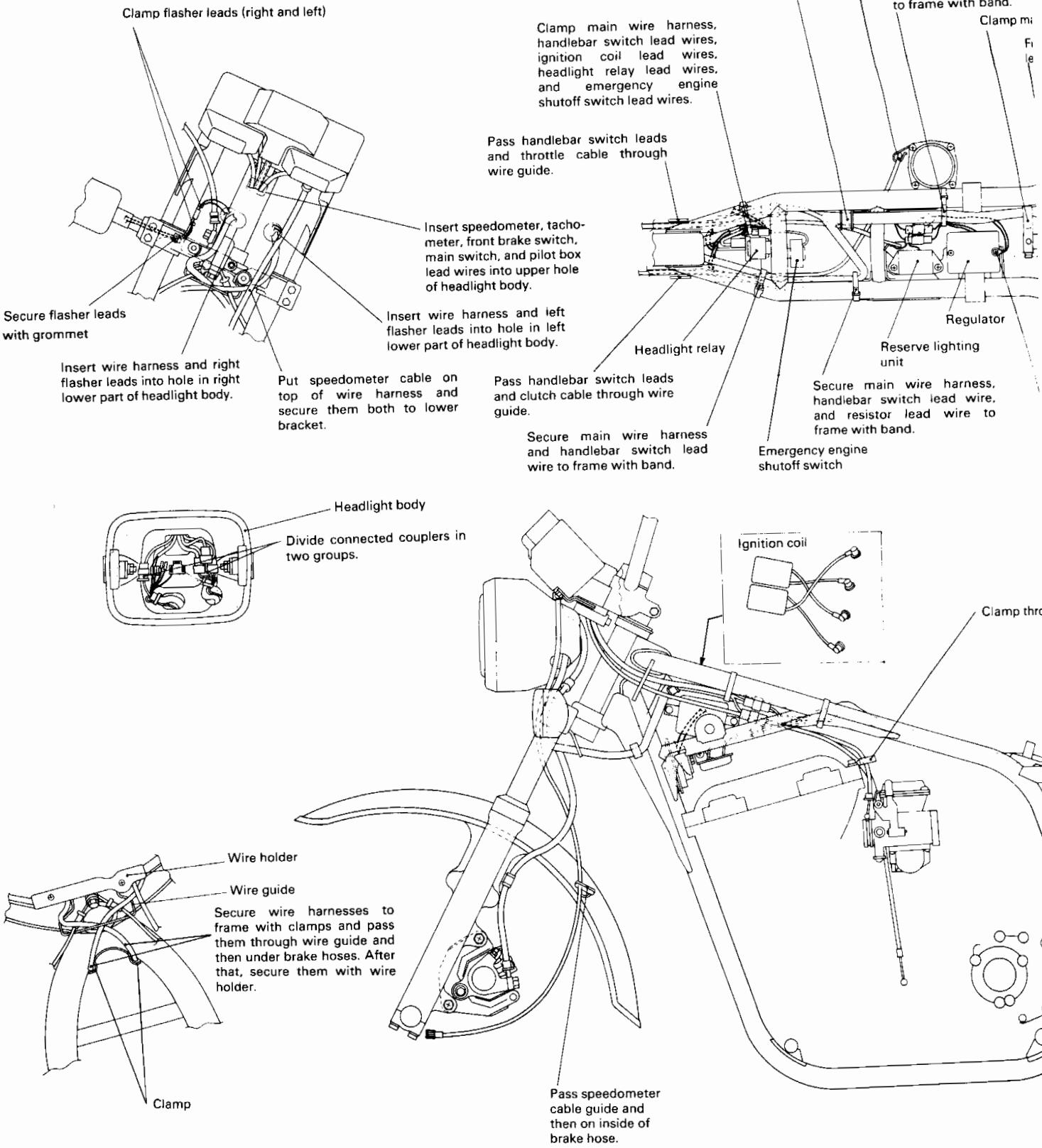
Oil warning light
Activation pressure 0.3 kg/cm² (4.2 psi)

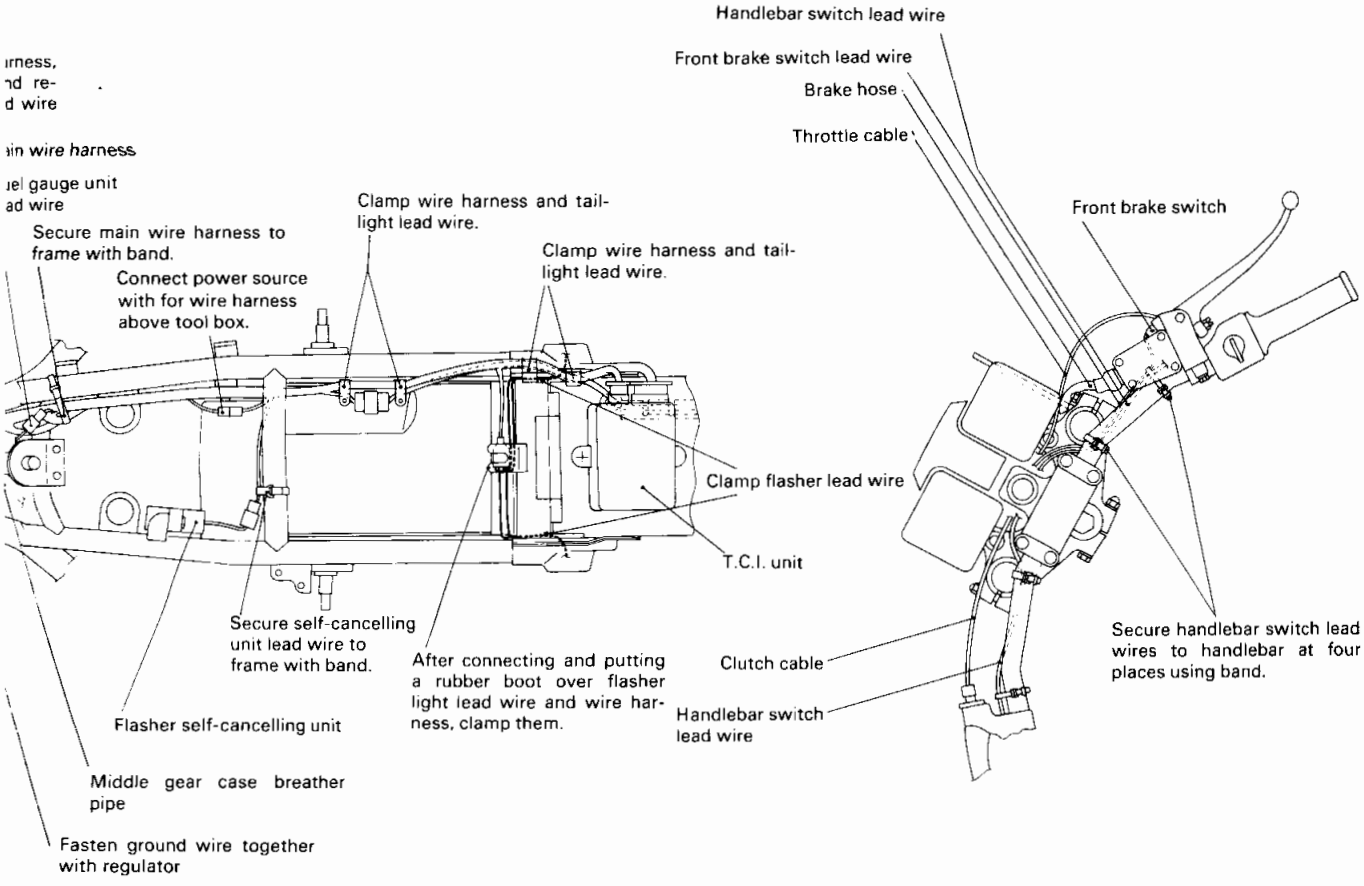
Cruising oil temperature 102°C at 88 km/h
(216°F at 55 mph)

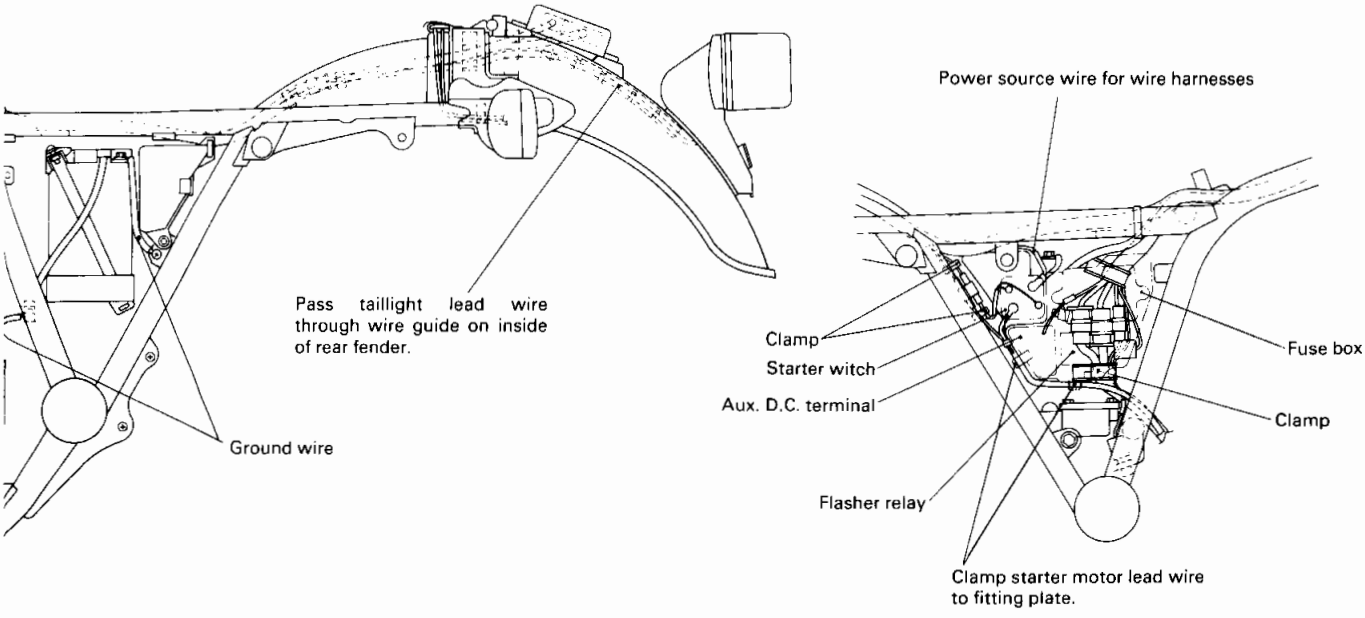


FRONT VIEW

CABLE ROUTING




Handlebar switch lead wire
Front brake switch lead wire
Brake hose
Throttle cable
Front brake switch
Clamp wire harness and tail-light lead wire.
Clamp wire harness and tail-light lead wire.
Secure main wire harness to frame with band.
Connect power source with for wire harness above tool box.
Clamp flasher lead wire
T.C.I. unit
Secure self-cancelling unit lead wire to frame with band.
After connecting and putting a rubber boot over flasher light lead wire and wire harness, clamp them.
Clutch cable
Handlebar switch lead wire
Secure handlebar switch lead wires to handlebar at four places using band.
Flasher self-cancelling unit
Middle gear case breather pipe
Fasten ground wire together with regulator


Power source wire for wire harnesses
Pass taillight lead wire through wire guide on inside of rear fender.
Clamp
Starter witch
Aux. D.C. terminal
Fuse box
Clamp
Flasher relay
Ground wire
Clamp starter motor lead wire to fitting plate.