YAMAHA

TX500-TX500A

SERVICE MANUAL

LIT 11613-71-01

NOTICE

This manual has been written by Yamaha Motor Company for use by Authorized Yamaha Dealers and their qualified mechanics. In light of this purpose it has been assumed that certain basic mechanical precepts and 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, and for this reason we must advise that all repairs and/or service be performed by an Authorized Yamaha dealer who is in possession of the requisite basic product knowledge. Other information is produced by the U.S. distributor, Yamaha International Corporation, and is necessary to provide total technical coverage regarding the product.

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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 changes in specifications or procedures will be forwarded to all Authorized Yamaha Dealers and will, where applicable, appear in future editions of this manual.

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TX500/500A
SERVICE MANUAL

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BUENA PARK, CALIF. 90620

LIT 11613-71-01

FOREWORD

This service manual has been designed to furnish all dealers and service personnel with specific information concerning the TX500A, including disassembly and assembly procedures, inspection and analyzation of worn parts, and subsequent repair or adjustment procedures.

The manual should be thoroughly read. This will provide full familiarity with the design of this machine and all correct repair procedures.

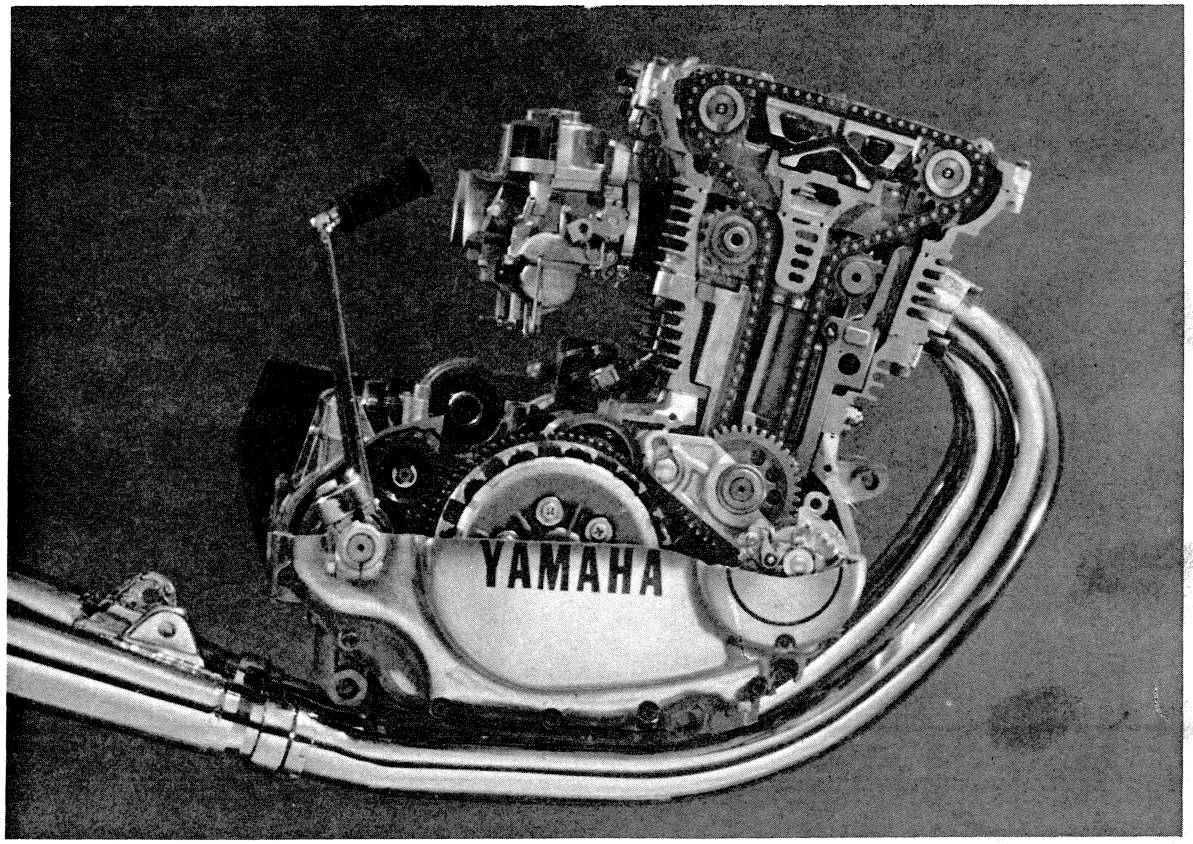
Because Yamaha engineers are constantly searching for new and more efficient engine advancements, it is possible that some of this information may be modified in the future. Any changes in design, adjustments, or repair procedures will be immediately forwarded to all Authorized Yamaha Dealers through Service and/or Parts News Bulletins.

YAMAHA MOTOR CO.,LTD.
Service Department

CONTENTS

I. GENERAL

FEATURES



1. D.O.H.C. and Eight Valves
Here's the new Yamaha TX500A that packs many unique technical design features. Built as a high-speed road bike, it has a powerful twin-cylinder engine aided by double overhead camshafts (D.O.H.C.) and eight valves. These valves are the key to the high engine performance, providing a greater efficiency of intake and exhaust. In addition, the hemispherical combustion chamber is specially designed for better combustion and heat dissipation.

2. Over-square, 180° –phased Integrated Crankshaft
To prolong the life of the pistons, piston rings and cylinders, the TX500A employs pistons of the over-square type, which reduces piston velocity.
The crankshaft, phased at 180°, is made in one piece for high torsional rigidity.

3. Omni-phase Balancer
To counterbalance the inertia force and rocking couple generated by the 180° crankshaft and pistons, a new omni-phase balancer is adopted. The principle of this balancer differs from that of the balancer employed in the TX750. In addition, the balancer timing chain is installed on the right side of the cylinder block; therefore, the cylinder pitch (distance between the centers of two cylinders) can be shortened. This is a great advantage for reducing engine vibration.

4. Pressure-feed, Wet Sump System
The TX500A engine is lubricated by a wet sump system using two oil pumps. One is a feed pump, and the other is a scavenging pump, which pumps out the oil collected in the crankcase bottom.
As a result, the oil temperature will not rise abnormally nor will the oil deteriorate quickly.
The transmission gears are bathed in oil to reduce the gear noise and prolong the service life of gears.

5. Twin CV-carburetors

The CV-carburetor functions independently of the throttle opening. It precisely responds to variations in the intake manifold pressure caused by engine speed changes. That is, the CV carburetor supplies fuel and air according to the load on and the speed of the engine. High engine performance is thereby maintained over the entire range of engine speed. In addition, both acceleration and fuel economy have been improved greatly. No diaphragm is used and this increases the reliability of the carburetor.

6. Anti-pollution Measures

a) The spark plug is positioned in the center of each cylinder. This results in better combustion efficiency and cleaner exhaust gases.
b) Sintered titanium alloy valve seats are press-fitted into the cylinder head so that non-leaded gasoline can be used.
c) The air cleaner is provided with a sub-chamber to reduce the intake noise.

7. Safety Measures

a) A special device is incorporated to prevent gears from shifting in the wrong order.
b) To prevent the throttle from staying at full-open position, a new throttle valve return mechanism is employed.
c) Should the stop lamp burn out, an instrument cluster pilot lamp flashes to warn the driver.

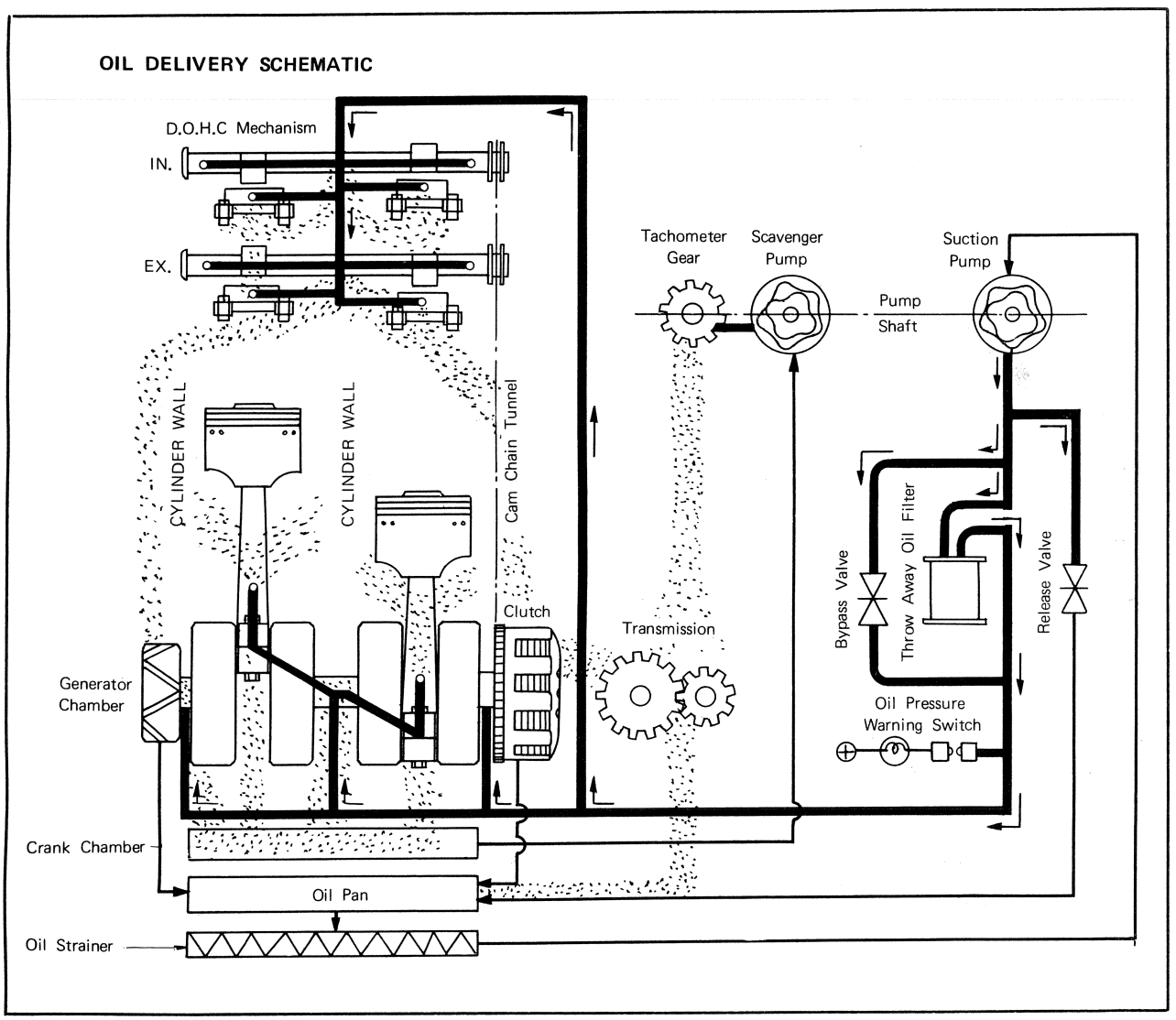
8. Miscellaneous

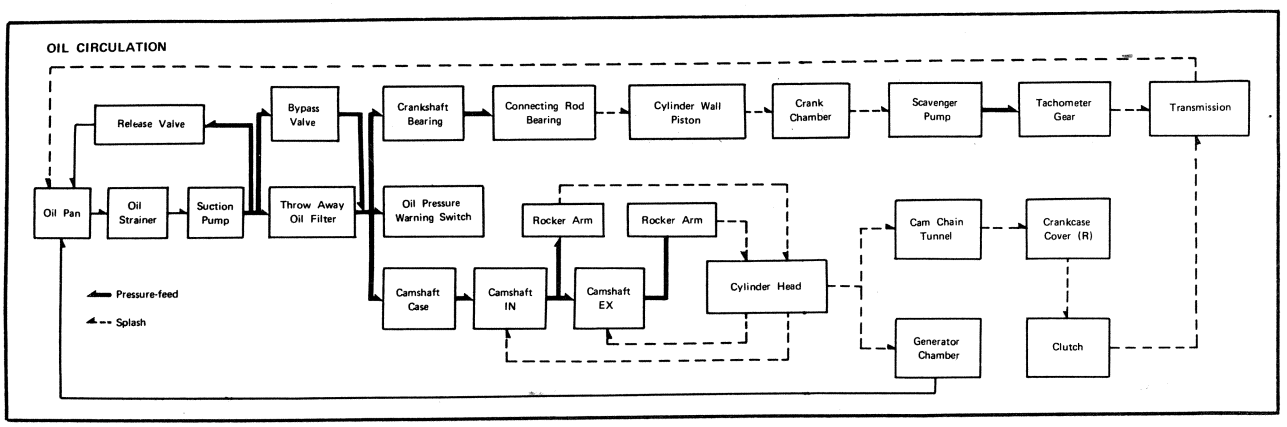
To prevent oil leakage, all the sealing surfaces where gaskets are used are made wider and, for better sealing, the sealing surfaces are serrated.

Wet Sump Lubrication System

Description

The Yamaha TX500A employs a unique wet sump system for engine lubrication. In this wet sump lubrication system, a apir of trochoidal pumps are used; one feeds oil under pressure to the crankshaft journals and double overhead camshafts through an oil filter, and the other pumps out the oil collecting in the crank chamber bottom. By these two pumps, the oil level in the crank chamber is maintained low and constant, and therefore, the oil is not stirred by crankshaft components. In this way the oil temperature is kept from rising and thus oil deterioration of the oil is prevented. Another feature of this wet sump system is that the oil levels in the clutch chamber, transmission chamber, oil pan, and crank chamber are separately set so as to suit their respective functions.





1) Oil pumps

The oil pumps are located in the rear of the transmission. They are mounted on the same pump shaft; the scavenger pump (trochoidal pump width 20 mm) is positioned above the suction pump (trochoidal pump width 24 mm). The pump shaft is driven at a speed of 1/3.95 the crankshaft speed and used as the tachometer driven shaft.

2) Release valve

When the oil temperature is low, the oil pressure rises too high. To reduce the oil pressure properly, the release valve is designed to open automatically at a pressure of 4 kg/cm^2.

3) Bypass valve

The bypass valve is designed to open when the difference in the oil pressure before and after the oil passes the oil filter is great. That is, when the oil filter has clogged or broken, the bypass valve prevents a lack of oil in the lubrication system. The bypass valve opening pressure is 0.65 kg/cm^2.

4) Oil filter

The oil filter is of a cartridge type and is located inside the crankcase cover (L). For better filter performance a filter paper is used and, therefore, it must be replaced periodically.

5) Oil pressure warning light switch

When the oil pressure is low, the oil pressure warning light switch is actuated to light up the oil pressure warning light, and when the pressure rises to 0.1-0.2 kg/cm^2 (1.4-2.8 psi) or more, the light is automatically turned off.

Omni-phase Balancer

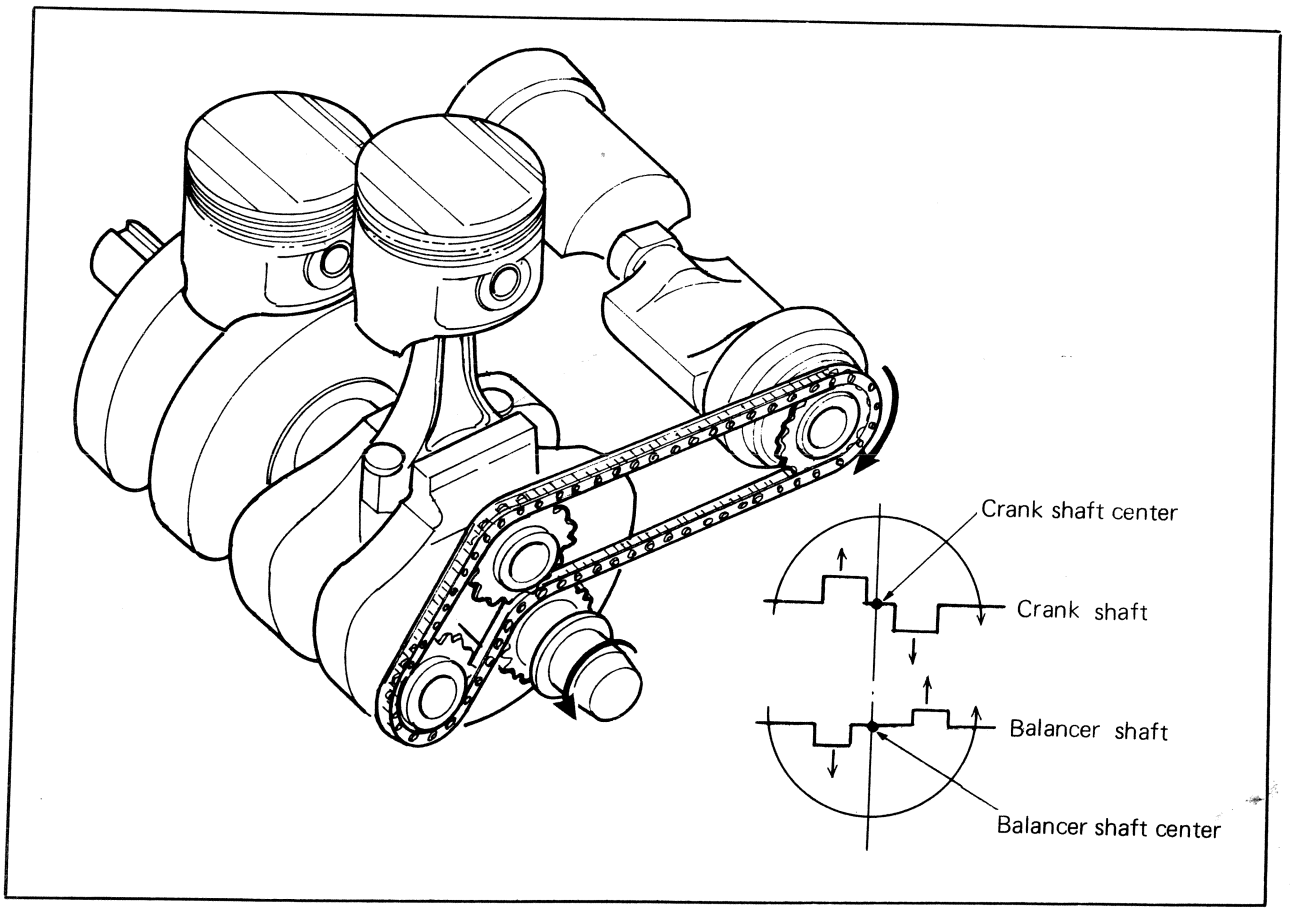
Description

The TX500A engine has parallel twin cylinders having 180°-phased cranks. Unlike the 360°-phased twin-cylinder engine, the primary inertia forces of the crankshaft are balanced by the crankshaft itself, but the primary couples remain unbalanced.

These primary couples are the major cause of the engine vibration in the 180°-phased crank engine. To counter-balance the primary couples, the TX500A uses a pair of balancer weights mounted on a shaft (which is not coaxial with the crankshaft) rotating in the direction opposite to that of the crankshaft. These two weights are positioned 180° offset from each other.

Because of 180° crank shaft, inertia of the right and left cranks make it possible for them to balance each other. That is to say, the right hand-side crank rotates downward when the left hand-side crank rotates upward. The initial inertia force is well-balanced by the upward and downward inertia force being generated at the same time. However, the inertial couple generates around the right and left cranks, which is the cause of vibration.

The couple of the direction opposite to the generated inertia couple should be generated in order for them to balance each other. In this way, vibration is eliminated. The balancer which is bent in contrast to the crank shaft rotates in the opposite direction at the same rotating ratio, as shown in the drawing.



PERIODIC MAINTENANCE INTERVALS

Page	Item	Remarks	Preoperational Check	Initial (miles)				Thereafter every (miles)	
				250	500	1,000	2,000	1,000	2,000
135 123	Brake System (Complete)	Chk/Adj as req'd repair as req'd	○		○	○	○		○
25	Clutch	Check/Adjust as required	○		○	○	○		○
18	Battery	Top-Off/Ck spec. gr. as req'd-monthly - or	○	○	○	○		○	○
151	Spark Plug(s)	Inspect/Clean or replace as req'd	○	○	○	○		○	
132 133	Wheels & Tires	Pressure/Spoke Tension/Runout	○	○	○	○		○	
166	Fittings & Fasteners	Tighten before each trip and/or	○	○	○	○		○	
137	Drive Chain	Tension/Alignment #1	○	○	○	○		○	
24	Engine Oil Level	Unit level/Engine warm	○			○		○	
26	Air Filter	Cleaning #2				○	○	○	
91	Fuel Petcock(s)	Clean/Flush tank as req'd	○	○		○	○		○
152	Ignition Timing	Adjust/Clean or repl. pts. as req'd			○	○	○		○
26 92	Carburetor Adjustment	Check Operation/Synch./Fittings.			○	○	○		○
96	Carburetor Overhaul	Clean/Repair as Req'd/Refit/Adjust						4,000	
24	Cylinder Compression	Preventive Maintenance Check			○	○	○		○
43	Camshaft Drive Chain	Adjust Tension		○		○	○		○
24	Oil Filter Element	Replace		○	○	○	○		4,000
24	Oil Filter System	Clean All-Includes Traps, etc.							8,000
43	Valves	Adjust/Regrind per tests as req'd				○	○		○

Service Notes:

#1 DRIVE CHAIN: In addition to tension and alignment, chain must be lubricated every 200-250 miles. If unit is subjected to extremely hard usage, such as racing or dirt riding, chain must be checked constantly. See "Lubrication Intervals" for additional details.

#2 AIR FILTER: Must be clean at all times to function properly.
Remove and clean filter at least once per month or every 2,000 miles; more often if possible.

NOTE:
If unit is subjected to extremely hard usage, such as dirt riding, etc., clean filter daily.

LUBRICATION INTERVALS

Page	Item	Remarks	Preop ck	Type	Period						
					Initial (miles)				Thereafter every (miles)		
					250	500	1,000	2,000	1,000	2,000	4,000
24	Engine Oil Change	Warm engine before draining	○	#1	○	CHK	CHK	○	CHK	○	
137	Drive Chain	Remove/Clean/Lube/Adjust		#2				○		○	
21 105	Control & Meter Cables	All - Apply thoroughly		#3			○	○		○	
	Throttle Grip & Housing	Light Application		#4				○		○	
110	Tach & Speedo Gear Hsgs.	Light Application		#4				○			○
108	Rear Arm Pivot Shaft	Zirc - Apply until shows		#5				○		○	
20	Brake Pedal Shaft	Light Application		#4				○		○	
20	Change Pedal Shaft	Light Application		#4				○		○	
	Stand Shaft Pivot(s)	Light Application		#4				○		○	
103	Front Forks	Drain Completely - CK Specs.		#2		CHK		○		CHK	○
106	Steering Ball Races	Inspect Thoroughly/Med. pack		#6				○			○
148 149	Point Cam Lubr. Wick	Very Light Application		#7				○			○
117	Hyd. Brake Fluid Res.	Use New Fluid Only-- Yearly or:		#8	CHK		CHK		CHK		8,000
133	Wheel Bearings.	Do Not Over - Pack		#6				○			○

Service Notes;

#1. For average operation at ambient temperatures of 30-90°F, use Yamalube 4-cycle or SAE 20W-40 type "SE" motor oil. In extremely cold areas, the SAE 10W-30 type "SE" motor oil is recommended.

#2. Use SAE 10W-30 type "SE" motor oil. (If desired, specialty type lubricants of quality manufacture may be used.) **NOTE:** Drive chain must be lubricated every 200-250 miles. If unit is subjected to extremely hard usage, chain must be inspected constantly and serviced as required.

#3. Use SAE 10W-30 type "SE" motor oil. (If desired, or at ambient temperatures below 30°F, a graphite base "dry" lubricant of quality manufacture may be used.)

#4. Light duty: Lithium soap base (white) grease. Heavy duty: Standard lube grease (Do not use lube grease on throttle/throttle housing. Use lithium base light-weight grease.)

#5. Use standard lube grease - - - smooth, not coarse.

#6. Medium-weight wheel bearing grease of quality manufacture - - preferably waterproof.

#7. Light-weight machine oil.

#8. Change yearly or every 8,000 miles. Use quality manufacture corresponding to DOT#3 or #4 specifications. Keep clean. Do not allow water, etc., to contaminate. Do not mix types when adding.

PRE–OPERATION CHECK CHART

BRAKES	Check Operation/Adjustment/Hydraulic Reservoir
CLUTCH	Check Operation/Lever Adjustment
ENGINE OIL	Check Level/Top-up as required
DRIVE CHAIN	Check Alignment/Adjustment/Lubrication
BATTERY	Check Electrolyte Level Weekly/Top-up Monthly
SPARK PLUGS	After Break-In Check Color and Cond'n Weekly
AIR FILTER	Dry-Paper Type-Must be Clean
WHEELS & TIRES	Check Pressure/Runout/Spoke Tightness/Axle Nuts
FITTINGS/FASTNERS	Check All-Tighten as Nec'y
LIGHTS/SIGNALS	Check headlight/tail-stop lights/turn sigs., etc.

Pre-operation checks should be made each time the machine is used. Such an inspection can be thoroughly accomplished in a very short time and the added safety assured is more than worth the time involved.

MAINTENANCE & LUBRICATION CHARTS

Interval recommendations and lubricant types listed in the Maintenance and Lubrication Charts are based upon general averages. Extremes in environment or usage may dictate shorter maintenance intervals, different lubricants or shorter lubrication intervals.

Therefore, all recommendations regarding types and intervals are to be considered a guide only. Intervals should not be exceeded but may be shortened as required. Lubricant types may be up-graded, but never down-graded.

CLEANING AND STORAGE

A. Cleaning

Frequent thorough cleaning of your motorcycle will not only enhance its appearance but will improve general performance and extend the useful life of many components.

1. Before cleaning the machine:
   a. Block off end of exhaust pipe to prevent water entry; a plastic bag and strong rubber band may be used.
   b. Remove air cleaner, or protect it from water with plastic covering.
   c. Make sure spark plug(s), gas cap, oil tank cap, transmission oil filler cap and battery caps are properly installed.
2. If engine case is excessively greasy, apply degreaser with a paint brush. Do not apply degreaser to chain, sprockets, or wheel axles.
3. Rinse dirt and degreaser off with garden hose, using only enough hose pressure to do the job. Excessive hose pressure may cause water seepage and contamination of wheel bearings, front forks, brake drums, and transmission seals. Many expensive repair bills have resulted from improper high-pressure detergent applications such as those available in coin-operated car washes.
4. Once the majority of the dirt has been hosed off, wash all surfaces with warm water and mild, detergent-type soap. helpful to reach those hard-to-get-to places.
5. Rinse machine off immediately with clean water and dry all surfaces with a chamois, clean towel, or soft absorbent absorbent cloth.
6. Immediately after washing, remove excess moisture from chain and lubricate to prevent rust.
7. Chrome-plated parts such as handlebars, rims,spokes, forks, etc., may be further cleaned with automotive chrome cleaner.
8. Clean the seat with a vinyl upholstery cleaner to keep the cover pliable and glossy.
9. Automotive-type wax may be applied to all painted and chrome-plated surfaces. Avoid combination cleaner-waxes. Many contain abrasives which may mar paint or protective finish on fuel and oil tanks.
10. After finishing, start the engine immediately and allow to idle for several minutes.

B. Storage

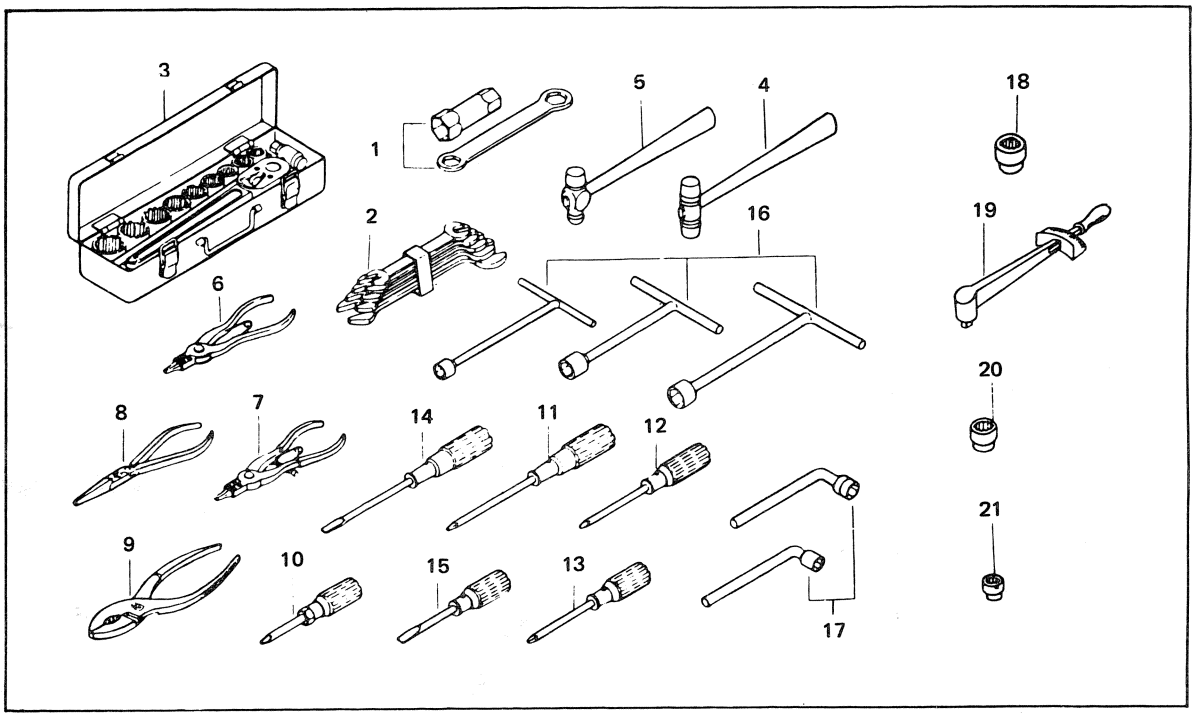
Long term storage (30 days or more) of your motorcycle will require some preventive procedures to insure against deterioration. After cleaning machine thoroughly, prepare for storage as follows.

1. Drain fuel tank, fuel lines, and carburetor float bowl(s).
2. Remove empty fuel tank, pour a cup of 10W to 30W oil in tank, shake tank to coat inner surfaces thoroughly and drain off excess oil. Re-install tank.
3. Remove spark plug(s), pour about one tablespoon of 10W to 30W oil in spark plug hole(s) and re-install spark plugs. Kick engine over several times (with ignition off) to coat cylinder walls with oil.
4. Remove drive chain. Clean thoroughly with solvent and lubricate with graphite-base chain lubricant. Re-install chain or store in a plastic bag (tie to frame for safe-keeping).
5. Lubricate all control cables.
6. Remove battery and charge. Store in a dry place and re-charge once a month. Do not store battery in an excessively warm or cold place (less than 32°F or more than 90°F).
7. Block up frame to raise both wheels off ground. (Main stands can be used on machine so equipped.)
8. Deflate tires to 15psi.
9. Tie a plastic bag over exhaust pipe outlet(s) to prevent moisture entering.
10. If storing in humid or salt-air atmpsphere, coat all exposed metal surfaces with a light film of oil. Do not apply oil to rubber parts or seat cover.

SERVICE TOOLS

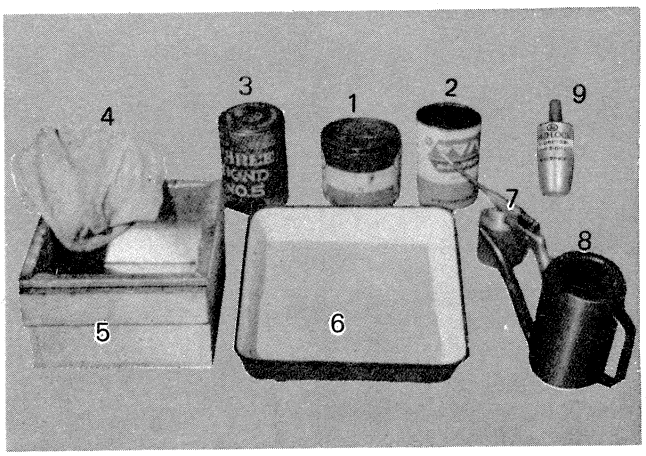
The following additional tools are required to service the YAMAHA TX500A.

1. Standard Tools



1. Plug wrench
2. Open-end wrenches
3. Socket wrenches
4. Soft-faced hammer
5. Steel hammer
6. Circlip pliers ST type
7. Circlip pliers RT type
8. Needle nose pliers
9. Pliers
10. Phillips-head screwdriver (Small)
11. Phillips-head screwdriver (Medium)
12. Phillips-head screwdriver (Large)
13. Slot-head screwdriver (Small)
14. Slot-head screwdriver (Medium)
15. Slot-head screwdriver (Large)
16. T-type socket wrench
17. L-type socket wrench
18. 29mm socket (for Torque wrench)
19. Torque wrench
20. 13mm Socket (for Torque wrench)
21. 10mm Socket (for Torque wrench)
22. Hexagon wrenches
    (3, 4, 5, 6, 8, 10, 17mm)

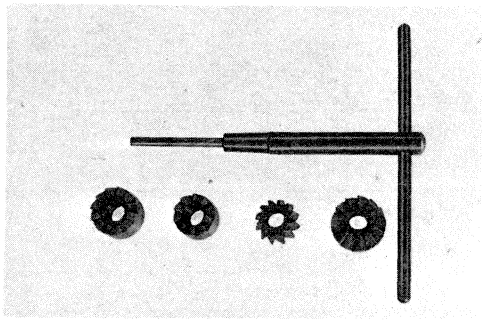
2. Miscellaneous



1. Grease
2. YAMAHA 4 stroke oil
   or Motor oil 20W-40 ("SE")
3. YAMAHA Bond (No.4 and No.5)
4. Wiping materials
5. Overhauling stand
6. Parts tray
7. Oil jug
8. Oil cup
9. Lock-Tite

3. Special Tools

1



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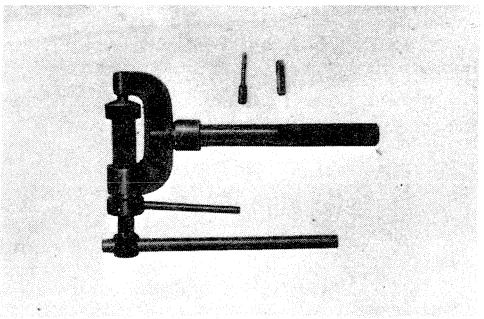

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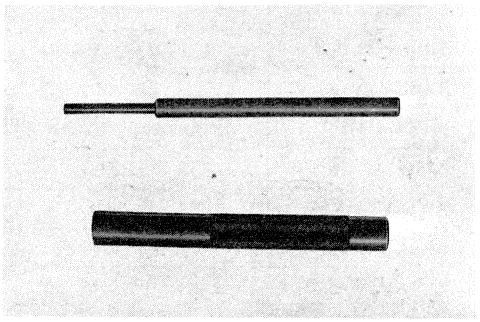

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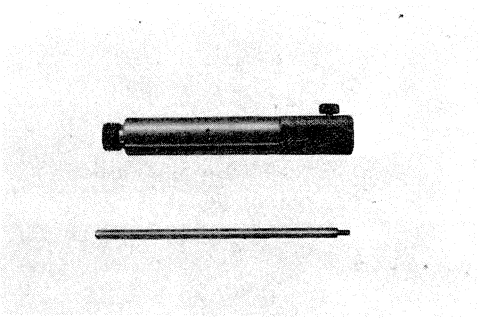

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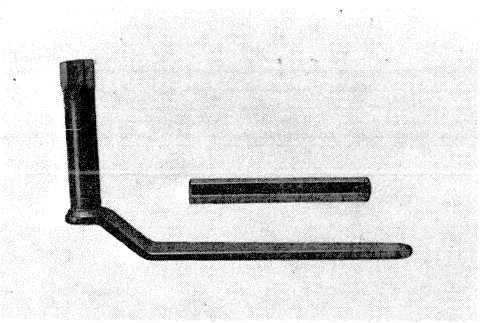

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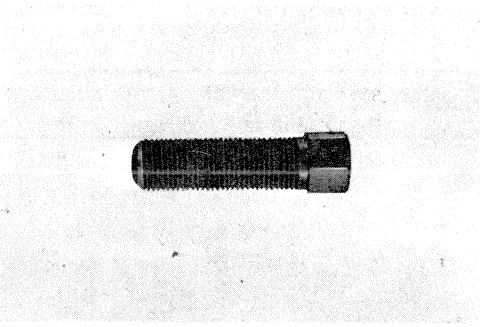

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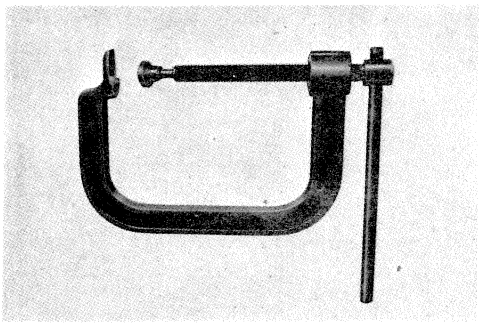

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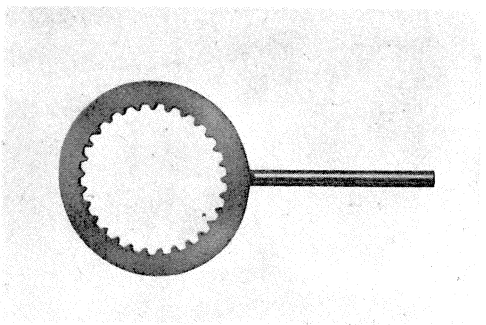

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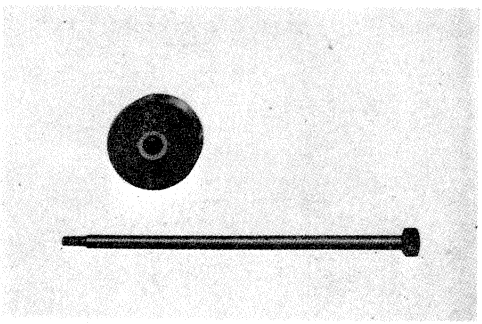
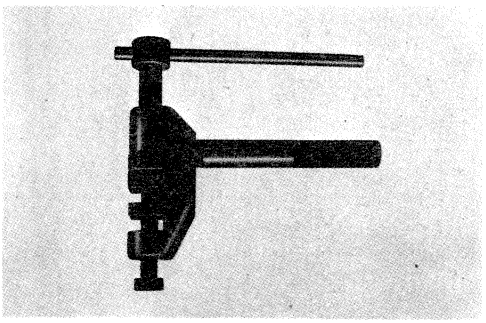


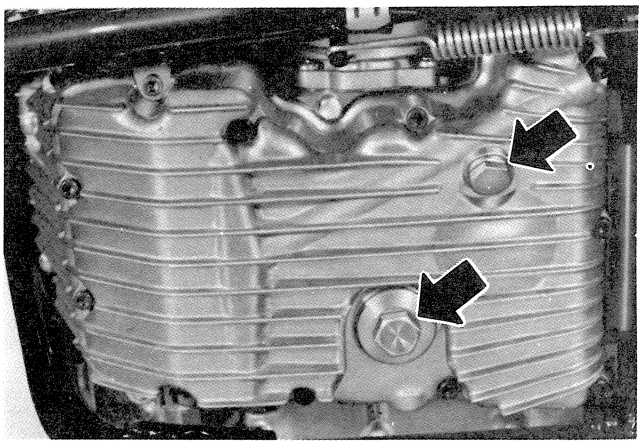


Ref. No.	TOOL NAMES	TOOL No.	Remarks
1.	Valve seat cutters	90890-01114	
-a	45° cutter (Intake/Exhaust)	90890-01118	
-b	15° cutter (Intake/Exhaust)	90890-01133	
-c	Flat cutter (Exhaust)	90890-01119	
-d	Flat cutter (Intake)	90890-01116	
-e	Seat cutter pilot shaft	90890-01121	
2.	Cam chain link cutting/riveting tool	90890-01112	
3.-a	Valve guide removal tool	90890-01122	
-b	Valve guide installation tool	90890-01129	
4.	Dial gauge stand	90890-01126	
5.-a	10mm Hexagon wrench (L: 80mm)	90890-01123	
-b	Clutch adjusting tool	90890-01127	
6.	Rotor puller	90890-01080	Common with TX750 tool
7.	Valve spring compressor	90890-01095	"
8.	Clutch holding tool	90890-01069	"
9.	Rocker arm shaft puller	90890-01084	
		90890-01083	
10.	Drive chain tool	90890-01081	

Note:
The L-shaped 3-mm hexagon wrench, 10-mm off-set wrench, 0.15 mm and 0.20 mm feeler gauges which are to be used for valve clearance adjustment are included in the TX500A service tool kit.

2. ENGINE

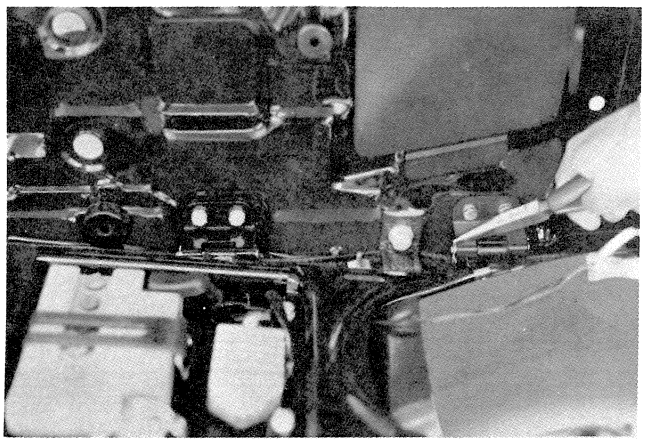
REMOVING ENGINE



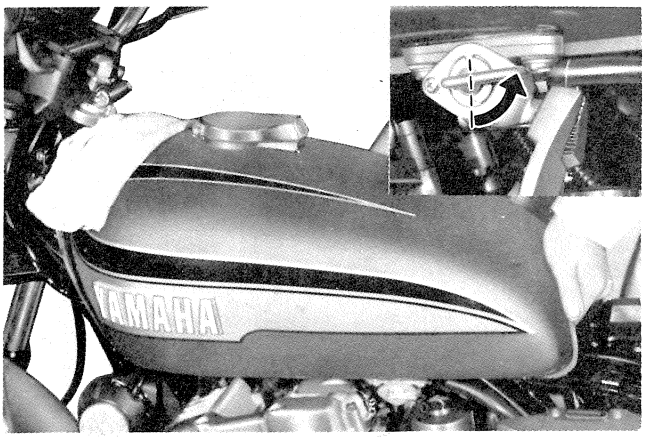
1. Remove the two drain bolts (17-mm and 19-mm) from the crankcase.

NOTE:
When reassembling engine, be sure to install new drain bolt gaskets. The drain bolts should be torqued.

Tightening Torque: 320-360 in-lbs (3.5-4.0 kg-m)

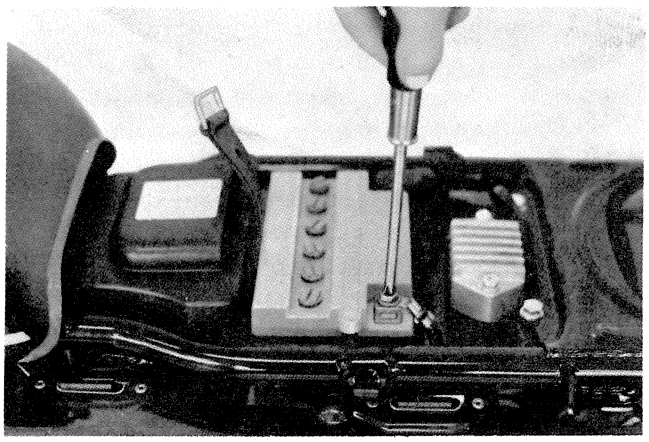


2. Remove the clips and clevis pins, and remove rider's seat from frame.

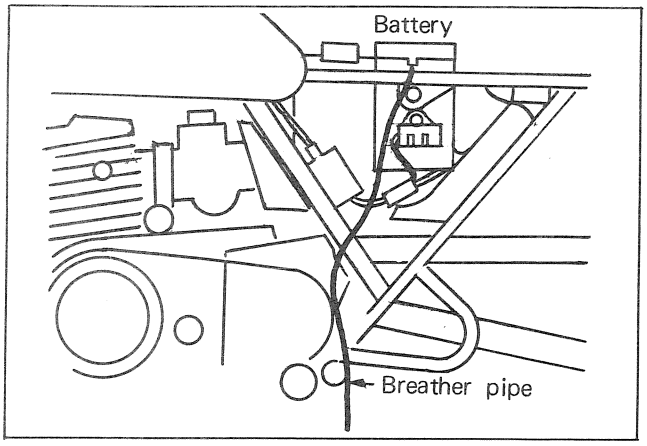


3. Turn both fuel petcocks to STOP.
Disconnect both fuel lines at fuel petcocks. Lift rear of the tank, and slide tank backwards to free it from tank mount.

4. Remove both right and left side covers.



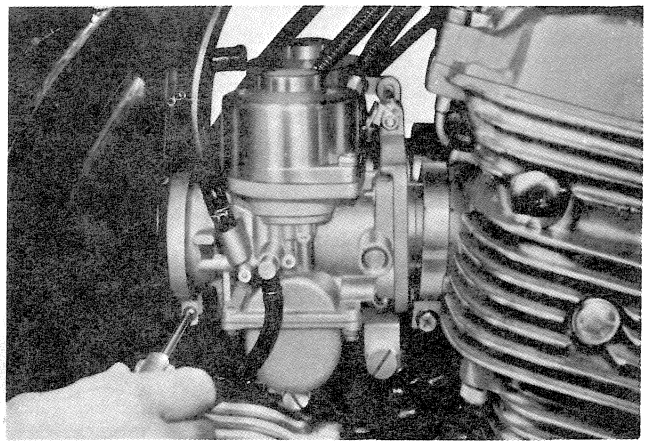
5. Remove the battery. Before removing battery, disconnect the negative lead, then the positive lead, in that order.



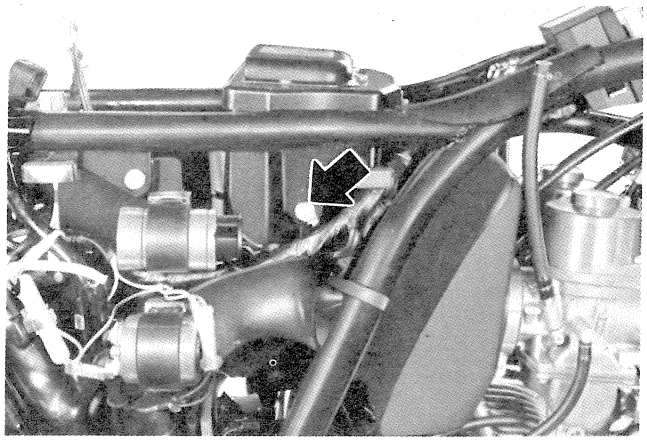
CAUTION:

BATTERY REMOVAL AND INSTALLATION

1. Be careful not to splash the electrolyte on the drive chain.
2. Remove the breather pipe before demounting the battery.
3. After installing the battery, be sure to connect the breather pipe into place. Make sure it is routed correctly.



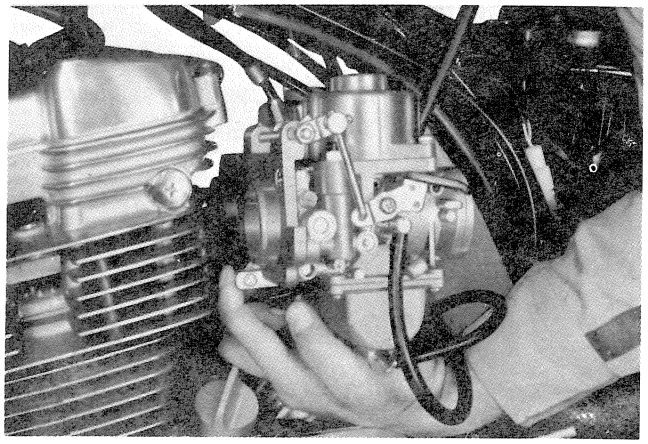
6. Fully loosen the air cleaner joint bands and the carburetor joint bands. Remove the cam chain case cover breather pipe.



7. Remove air cleaner case mounting bolts (both right and left) and shift air cleaner case slightly backward. Keep the sub-chamber attached to the case.

Note:

The right-hand cleaner case mounting bolt also holds the negative lead wire of the battery. Don't forget to install the wire when installing air cleaner case.

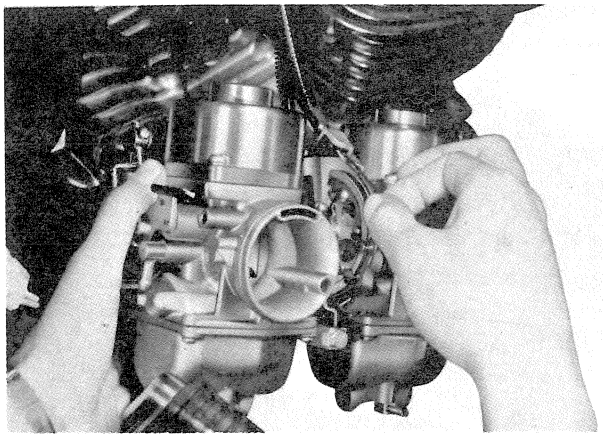


8. Remove the carburetors.

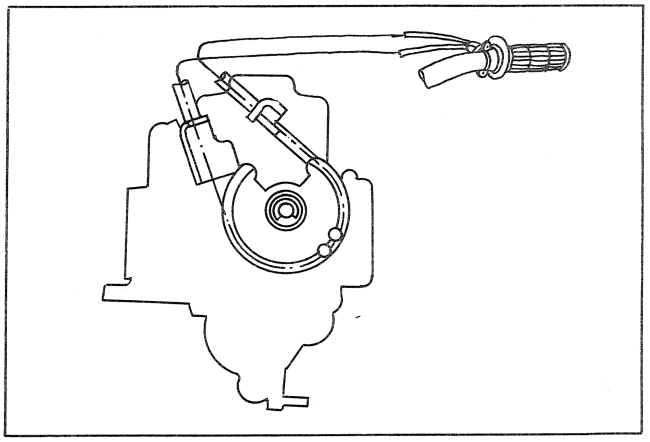
Caution:

When removing the carburetor from the cylinder, take care so that the throttle valve return device (adjusting holder) will not butt the carburetor joint. It is advisable to hold down the throttle valve return device while removing the carburetor.

The right and left CV-carburetors are synchronized with each other. If you should have allowed the throttle valve return device (adjusting holder) to butt the carburetor joint or other parts by accident, they might go out of synchronization. In such a case, check them for synchronization using a vacuum gauge.



9. Remove throttle wires from carburetors.

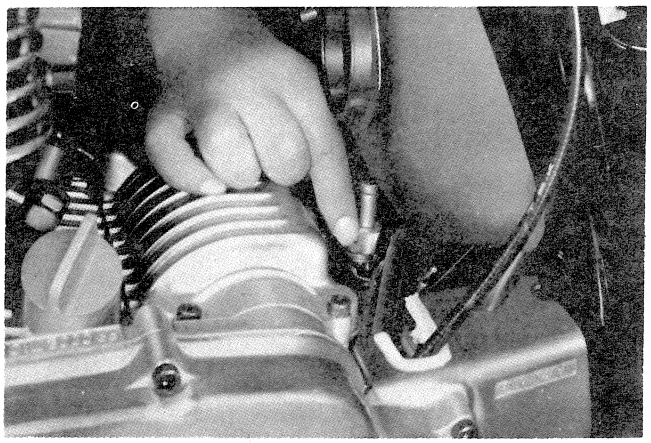


Note:

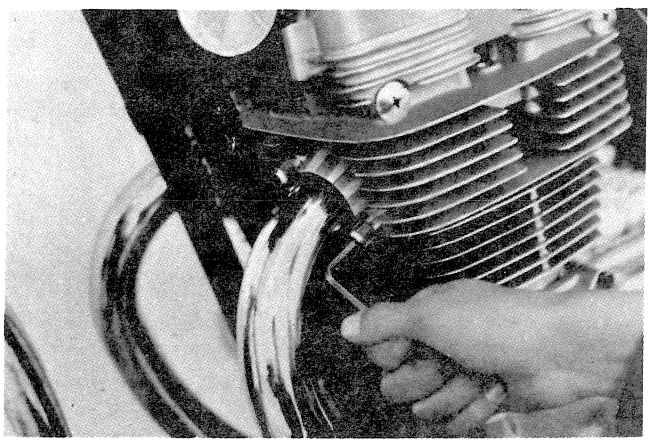
When connecting throttle wires to carburetors, be careful not to reverse their connections.

Wire for opening the throttle: Black

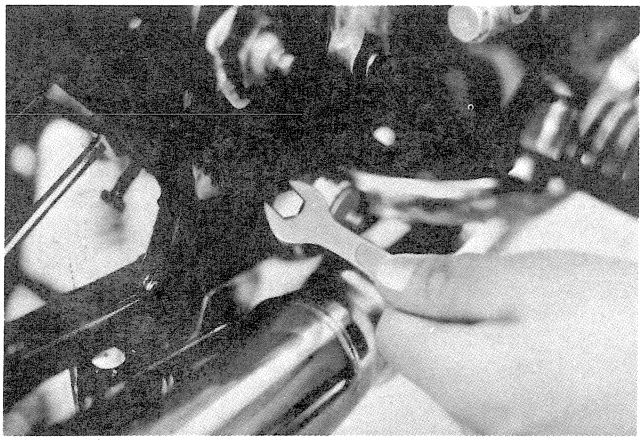
Wire for closing the throttle: Silver



10. Remove tachometer cable and spark plug caps.



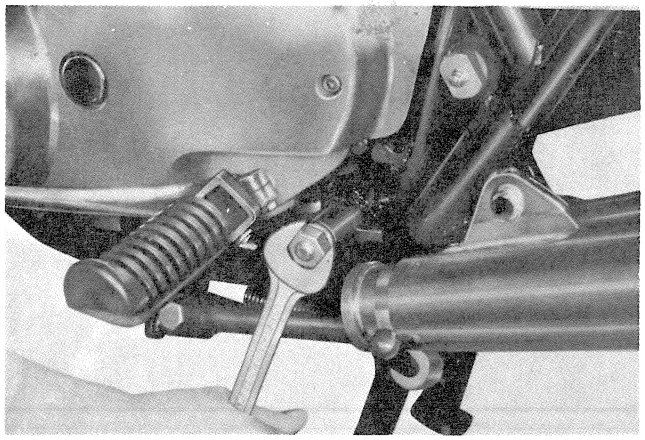
11. Remove exhaust pipes using a 6-mm hexagonal wrench and a ring nut wrench.



12. Remove brake pedal holding bolt and remove brake pedal.

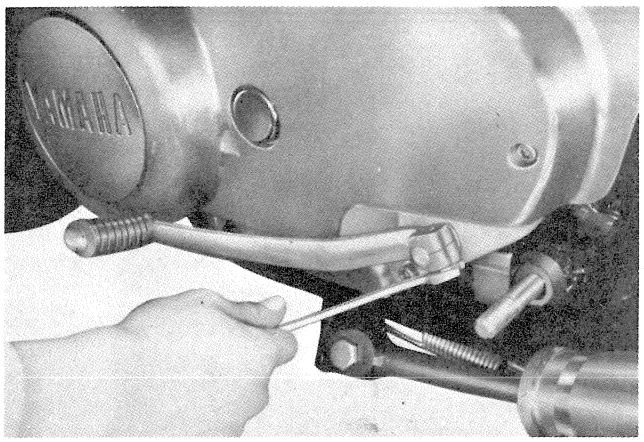
Note:

When installing brake pedal, the punched mark on brake pedal should be aligned with the punched mark on brake shaft end, and then they should be fitted together at the serrated portions.

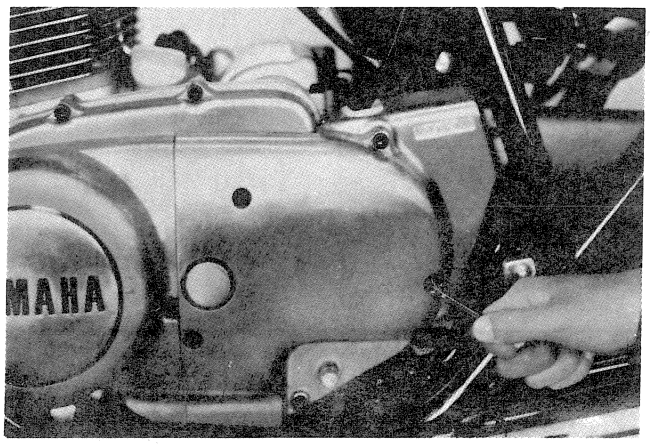


13. Remove foot rests.
The foot rests are held by an engine mounting bolt. Remove the nut and pull out the bolt. Both foot rests can then be removed at the same time.

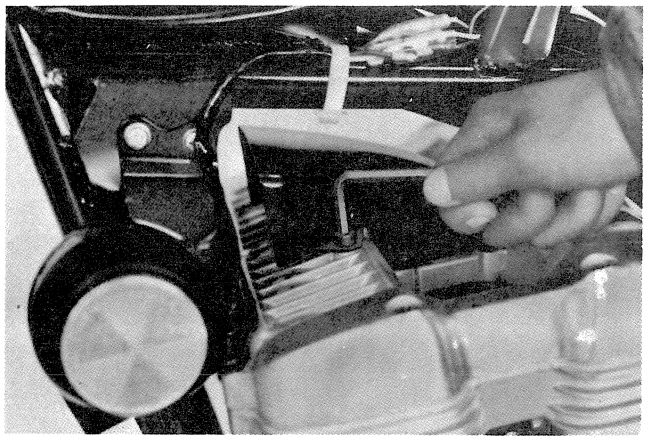
Tightening Torque: 450-630 in-lbs. (5.0-7.0 kg/m)



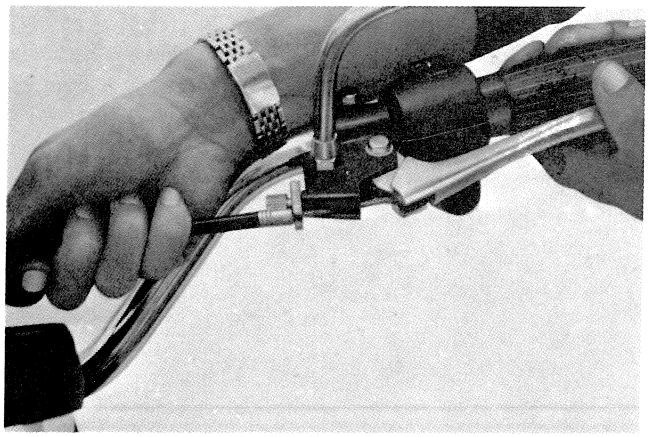
14. Remove change pedal.
When re-installing change pedal, it should be positioned properly by taking into consideration the relative position from the foot rest.



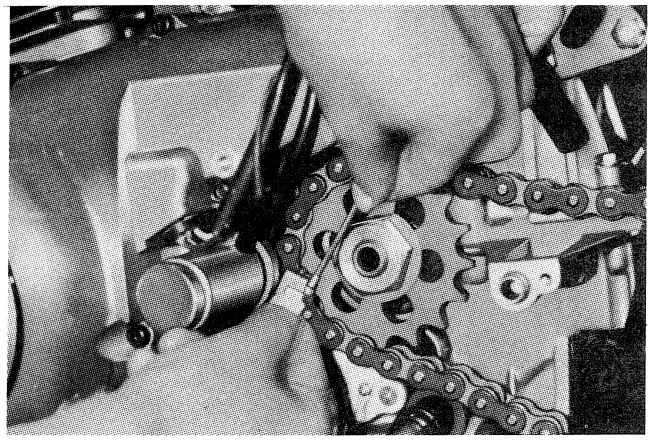
15. Remove rear crankcase cover (L) with a 5-mm hexagonal wrench.
When installing rear crankcase cover (L), take care not to allow lead wires coming from generator to slip out of waterproofing grommet.

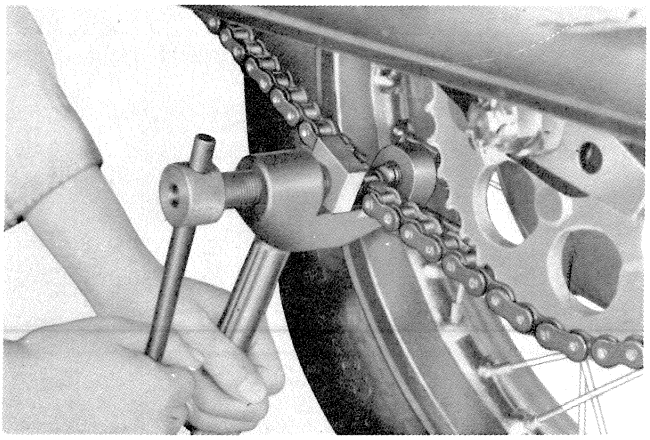


16. Remove air induction cover from camshaft case cover.

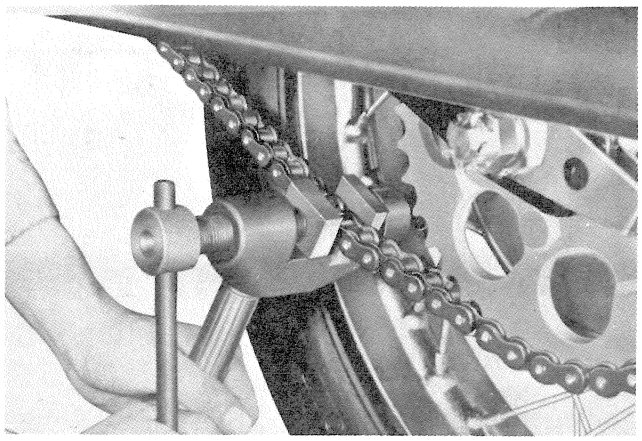


17. Turn clutch cable length adjuster on clutch lever all the way in. Align all cable access slots.
Squeeze in on the clutch lever while holding firmly onto cable outer housing. (This actuates clutch and lengthens inner cable)
Release clutch lever while simultaneously pulling back on outer cable housing.
The cable ferrule will be pulled back and can now be removed from its seat in cable length adjuster.
Next disconnect clutch cable at the joint of the push lever assembly.



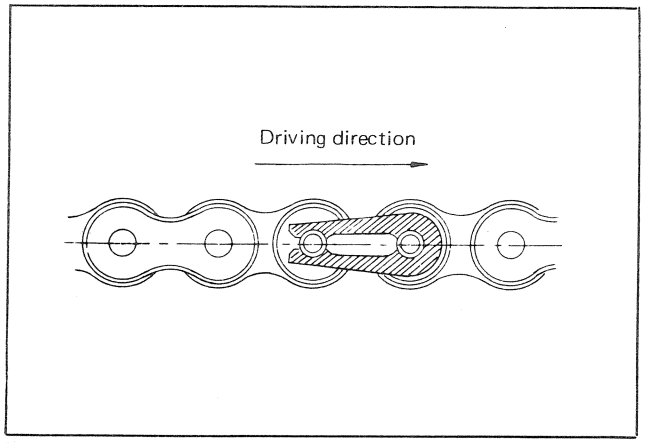


18. Disconnect the drive chain.
a) Removing chain
Fit the special tool with the adapter for removing the chain. Then place the chain joint on the special tool and separate the chain by screwing in the pulling bolt.



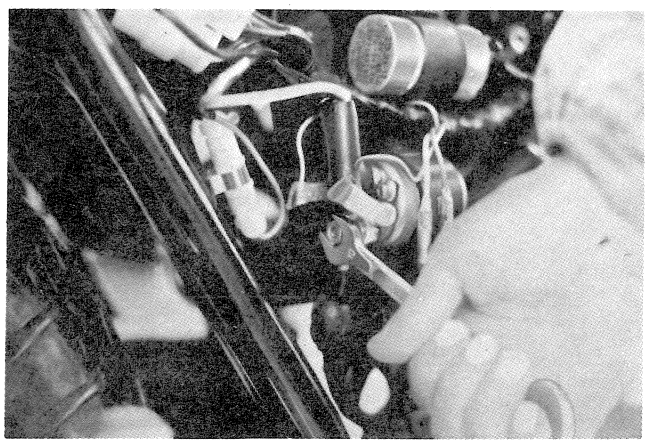
b) Installing Chain

Join the chain ends on rear wheel sprocket using a joint. Place chain joint on sprocket where it is easy to use the special tool. Use the special tool with a chain installing adapter to press on a new joint plate by screwing in the pulling bolt.

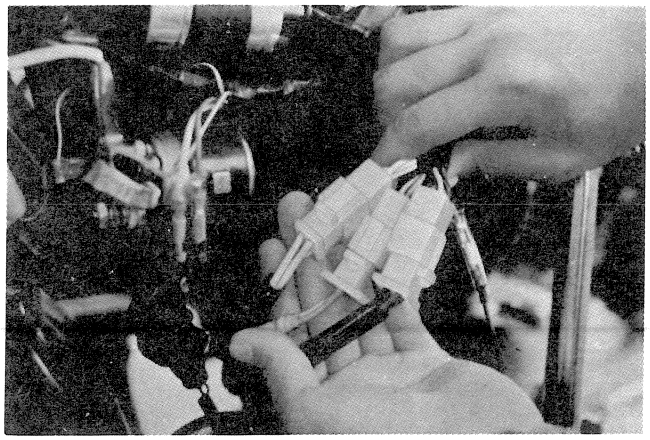


Note:

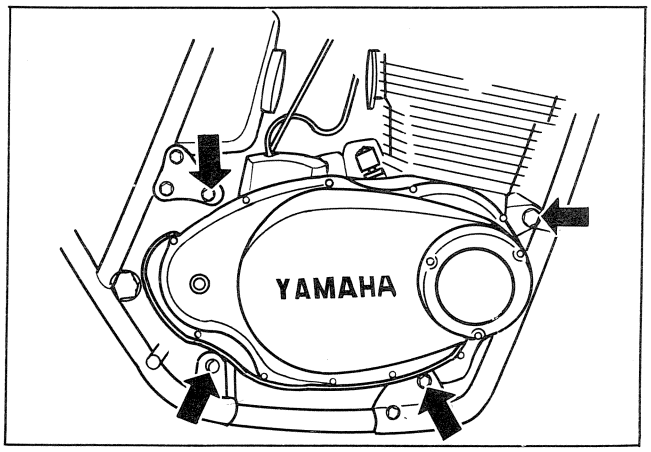
The drive chain clip should be installed as illustrated. If it is installed in the opposite direction, it may contact adjacent parts and slip off.



19. Remove the starter motor lead wire at the starter switch. Remember exactly where the lead wires are threaded through.

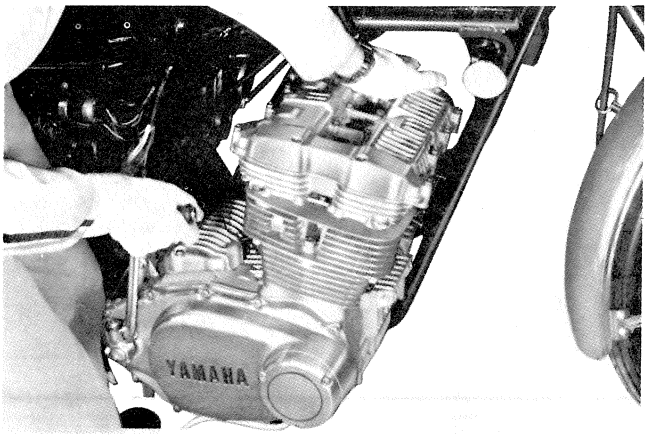


20. Disconnect the neutral switch wire, oil pressure switch wire, contact breaker lead wires and wires coming from the generator at the couplers.

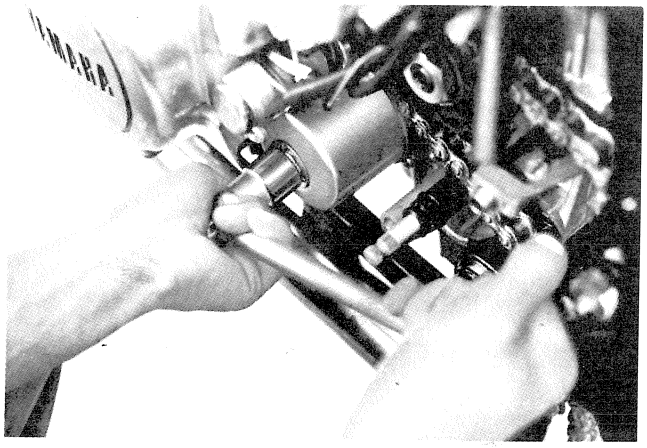


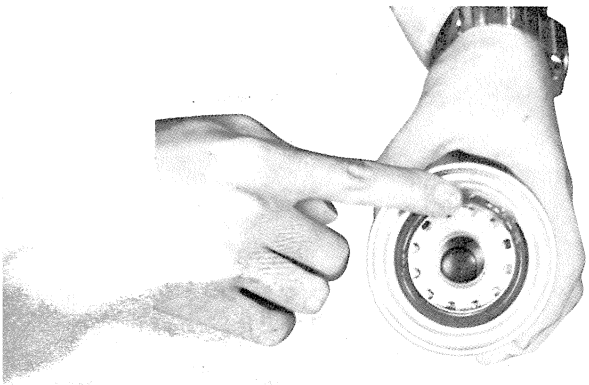
21. Remove the engine mounting bolts, nuts and stays.
Tightening torque:

M 8 bolts	130-200 in-lbs	(1.4-2.2 kg-m)
M10 bolts	240-310 in-lbs	(2.7-3.4 kg-m)
M12 bolts	450-630 in-lbs	(5.0-7.0 kg-m)



22. Hold cylinder exhaust port with your left hand and kick crank with your right hand, and then remove engine from the right side of motorcycle.





SERVICE CHECK AND ADJUSTMENTS

1. Oil Filter Element Replacement

The oil filter element must be replaced periodically to insure a clean filtered oil supply for the engine.

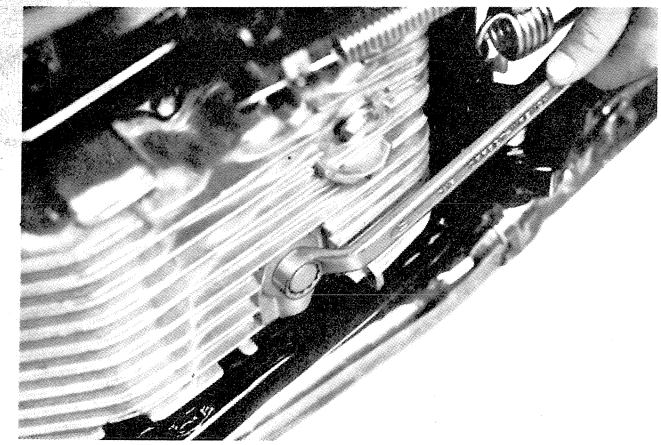
a) Remove the rear left-hand crankcase cover.
b) Remove old oil filter element.
c) Install new oil filter element.

NOTE

Whenever the oil filter element has been replaced, the "O" -ring must be replaced with a new ones. Be sure to tighten the oil filter with correct torque.

Tightening Torque: 180 - 200 in-lbs (2.0 - 2.3 kg-m)

d) Run engine for 5 minutes before re-installing rear left-hand crankcase cover and check for oil leaks.
e) Replace rear left-hand crankcase cover.



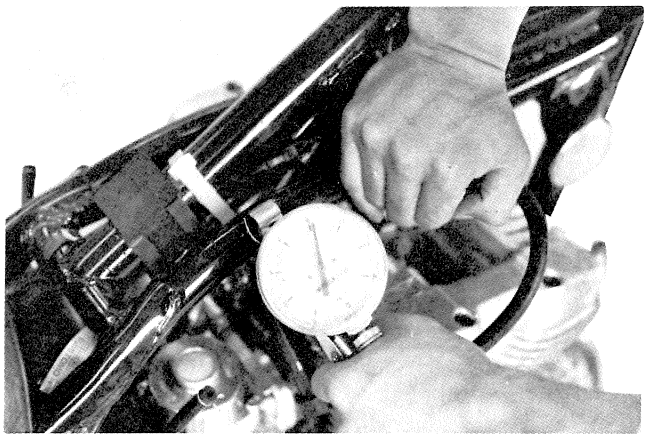
2. Engine Oil Replacement

a) First warm up the engine for a few minutes, then remove the crankcase drain bolts.

NOTE:

To drain the oil, the motorcycle must be placed on level ground, on the mainstand.

b) Fully tighten the drain bolts and pour 3.2 qts (3,000 cc) of SAE 20W-40 type "SE" motor oil into crankcase.
c) Start the engine, run at idle speed 3-5 minutes, turn engine off. Check oil level with gauge. Add oil as necessary until level is correct.



3. Cylinder Compression Check

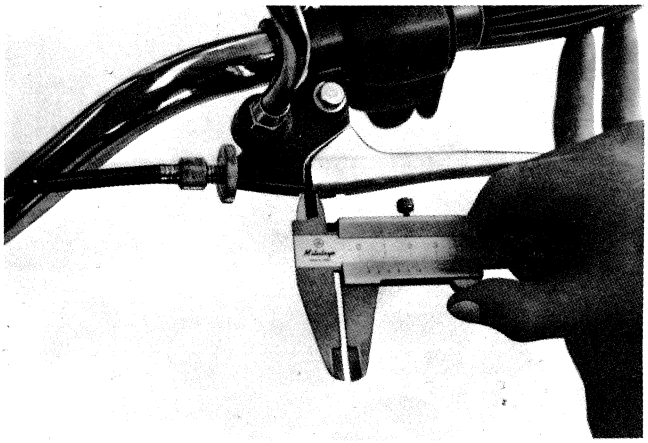
a) Low cylinder compression means that the combustion area is not sealing correctly. A leakage exists at one of the following points: past one of the valves; out of a defective gasket; through a warped head; down past the rings.
b) Remove both spark plugs and screw the compression gauge adaptor tightly into either spark plug hole.
c) Twist the throttle grip FULLY OPEN and kick the engine over several times.
d) With 5 or 6 full kicks the gauge should register 10.5 kg/cm^2 (150 lbs/in^2), but it could measure as low as 9.5 kg/cm^2 (135 lbs/in^2) and still be considered adequate. If compression reads lower than 9.5 kg/cm^2 (135 lbs/in^2), then a failure has occurred in one of the parts directiy associated with the combustion chamber.

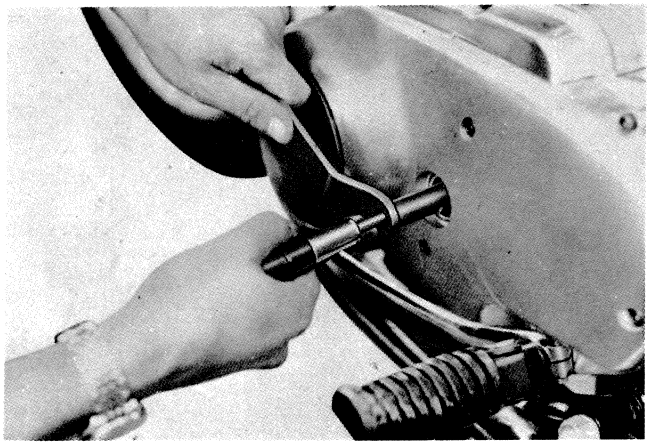
e) If cylinder compression reads more than 10.5 kg/cm^2 (145 lbs/in^2), then carbon has built up on the combustion chamber or piston crown, reducing combustion chamber volume. This in turn creates a higher compression ratio. This situation must be corrected by decarbonizing or excessive heat will develop.

f) Perform steps c) through e) on the other cylinder.

Note

Altitudes above 5000 ft. will cause a drop of approximately 10% in compression pressure.





4. Clutch Adjustment

a) Two clutch adjustments are possible, depending on the action of the clutch and clutch lever. If clutch slippage or incomplete clutch disengagement occurs, adjustment is required at the clutch actuating mechanism.

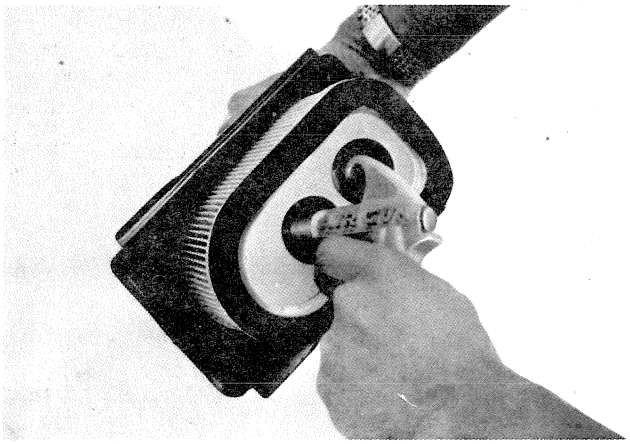
b) First, loosen the lock nut. Then turn the adjuster either in or out depending on which direction is necessary to arrive at 1/16 - 1/8 in. (2 - 3mm) free play.

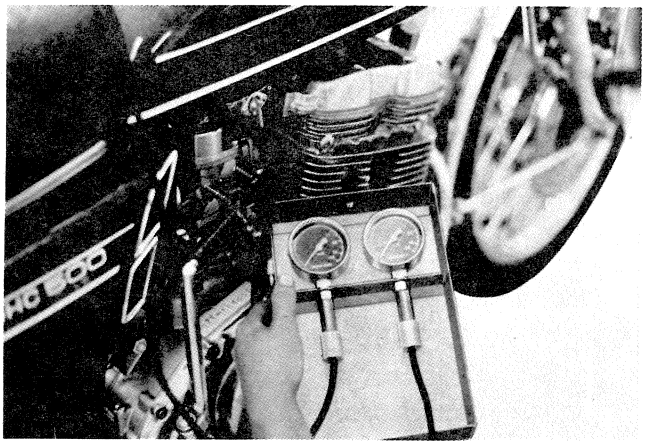
c) The second adjustment is located on the crankcase cover L. Removing the clutch adjusting cover will expose the adjusting set screw and lock nut. Loosen the lock nut, rotate the set screw in until it lightly seats against the clutch push rod that works with the set screw to operate the clutch. Back the set screw out ¼ turn and tighten the lock nut. This adjustment must be checked because heat and clutch wear will affect this free play, possibly enough to cause incomplete clutch operation.

Note:

The clutch cable requires periodic lubrication to prevent the cable stands from rusting or hanging up in the casing. First, disconnect the cable from the clutch lever by screwing the adjuster all the way back to the cable casing. This will provide enough free play in the cable for you to slip the cable out of the lever holder through the slot in the lock nut, adjuster and holder. Hold the cable upright and allow several drops of lubricant to flow down the cable. Hold the cable upright for several minutes to permit complete lubrication.

If the cable needs to be replaced, then perform the steps above and disconnect the cable at the lever. Next, disconnect the cable at the engine. Begin by taking off the rear crankcase cover (L) that houses the clutch actuating mechanism (left side of the engine). Looking at the inside of this cover, you will see the clutch actuating arm. Push the arm up and lift the cable end off. Removing the old cable and hooking up the new one will take but a few moments.





5. **Air Filter Element Cleaning**

One paper element air filter is used to filter the incoming air for both carburetors. It must be removed and cleaned after 1,000 miles (initially) and thereafter every month or 2,000 miles. The seat must be opened to gain access to the air cleaner case. Remove the cleaner case cap and pull out the element set-spring and cleaner case cap 2. Do not clean air filter with any type of solvent. It is made of paper and must be kept dry. High pressure air will remove most of the dust and grit. If the contamination adheres to the filter element, use a soft brush to dislodge the particles and then blow the filter clean with air applied to the inside of the filter.

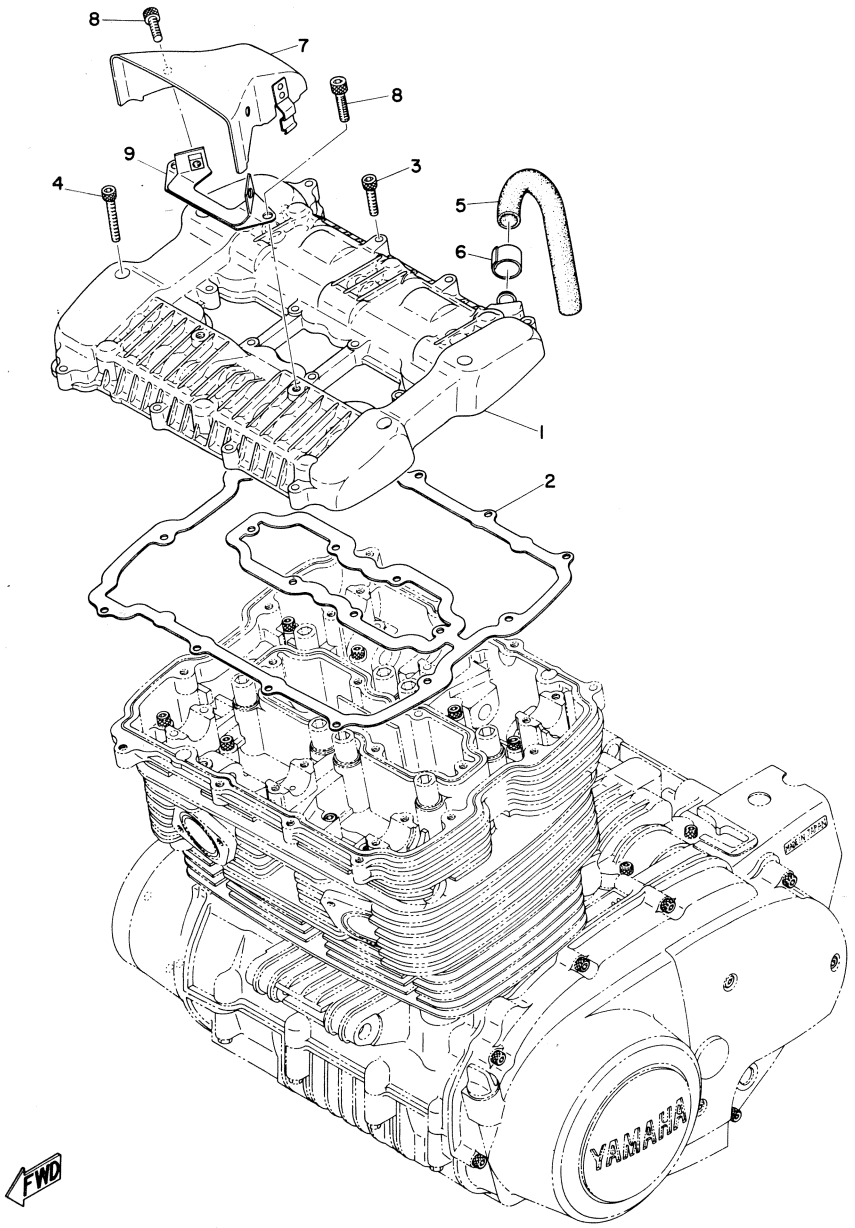
6. **Carburetor Adjustment**

To check whether both carburetors operate correctly, measure the vacuum in each carburetor.

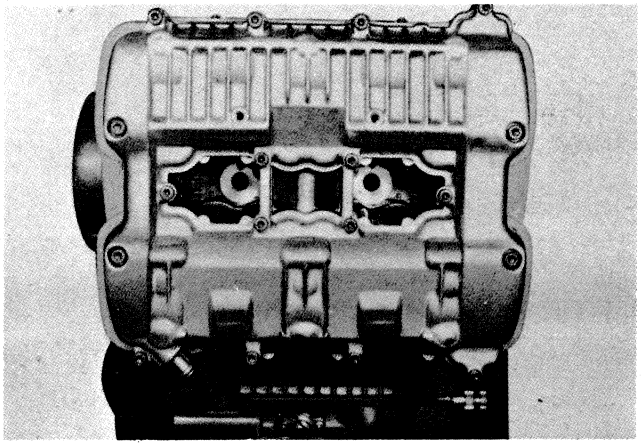
ENGINE DISASSEMBLY NOTES:

1) Keep all parts in separate sections to aid in reassembly.
2) All gaskets, cotter pins, O-rings and circlips, if damaged or worn, should be replaced.
3) Always use proper tools (as listed in the Tools Section) and proper repair techniques. A set of metric Allen wrenches must be available for Allen head screws.
4) Clean all parts with solvent, and if any part has a drilled oil passage, blow out the passage with compressed air.
5) Tighten all nuts and bolts in proper rotation (in cases such as head nuts or case bolts) beginning with the larger bolts (if any) and then going back and tightening the smaller bolts in the proper sequence.
6) Always check the torque specifications section for correct torque, and use a torque wrench.
7) After completing each section, check to make sure every procedure has been done properly and completely to avoid having to go back and do it again.
8) Occasionally, after several hours of operation on a rebuilt engine, oil leaks will develop. This is caused by gasket compression. Re-torque all bolts and nuts should this occur.

CAMSHAFT CASE COVER

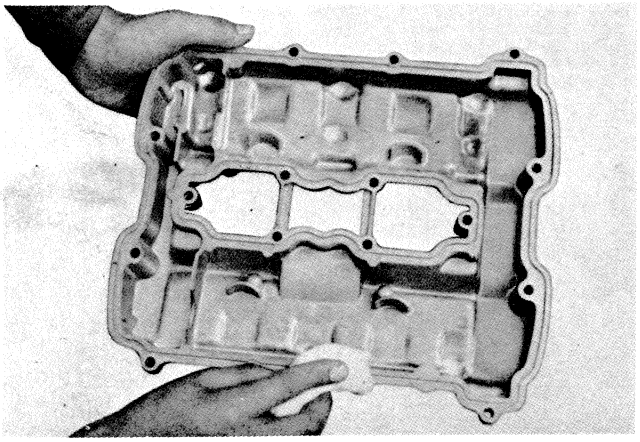


1 Cover, cylinder head
2 Gasket, head cover 1
3 Bolt
4 Bolt
5 Pipe, breather 1 (12-155)
6 Clip, pipe
7 Cover, air induction
8 Bolt
9 Bracket, cover air induction



Disassembly

Remove the 18 hexagon bolts from the camshaft case cover.



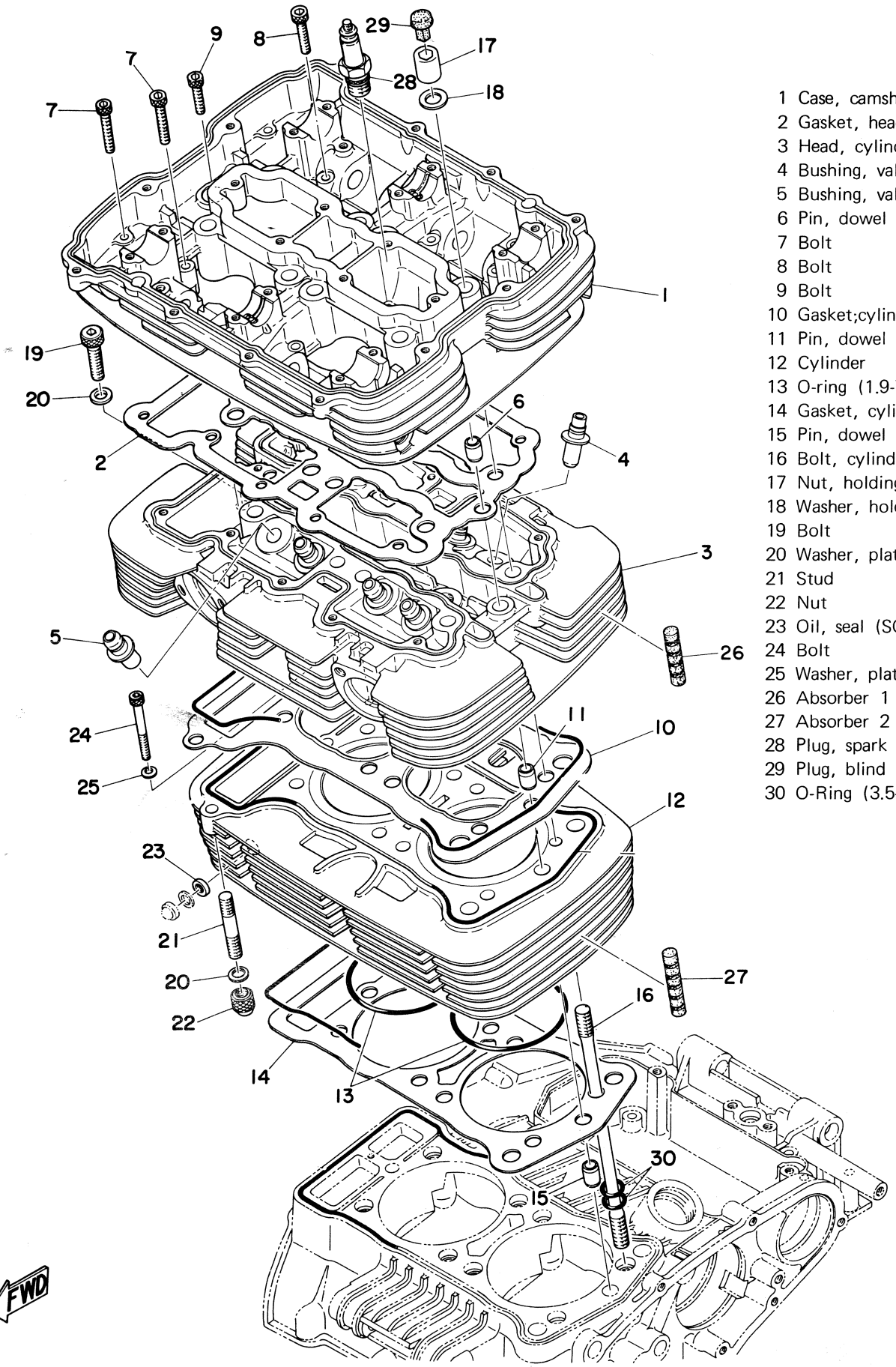
Installation

Use a torque wrench for tightening the bolts. The bolts should be tightened crosswise in steps.
Tightening Torque: 70 - 90 in-lbs (0.8 - 1.0 kg-m)

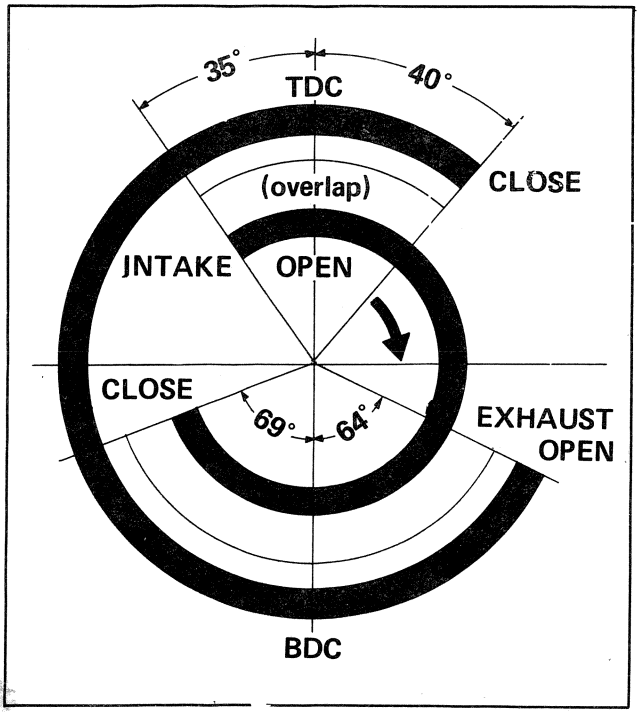
Note:

When installing the camshaft case cover, be sure to use a new gasket. Thoroughly remove the dust and oil from the contact surfaces of the camshaft case cover and camshaft case, and then install the case cover.

CAMSHAFT CASE



1 Case, camshaft
2 Gasket, head cover 2
3 Head, cylinder
4 Bushing, valve guide intake
5 Bushing, valve guide exhaust
6 Pin, dowel (6.4-10-14)
7 Bolt
8 Bolt
9 Bolt
10 Gasket;cylinder head
11 Pin, dowel (6.4-10-14)
12 Cylinder
13 O-ring (1.9-78.5)
14 Gasket, cylinder
15 Pin, dowel (6.4-10-14)
16 Bolt, cylinder holding
17 Nut, holding
18 Washer, holding
19 Bolt
20 Washer, plate
21 Stud
22 Nut
23 Oil, seal (SO-8-12-3)
24 Bolt
25 Washer, plate
26 Absorber 1
27 Absorber 2
28 Plug, spark (D-8ES)
29 Plug, blind
30 O-Ring (3.5-6.4)



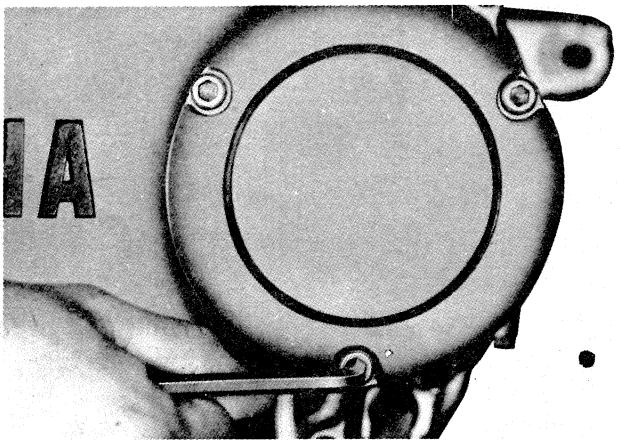
Description

The camshaft case houses four rocker arms, four rocker arm shafts and two cam shafts. One for intake and one for exhaust. The camshafts are driven by a double-row cam chain.

=VALVE TIMING=

The TX500A employs a 180°-phased crankshaft, and as a result, the intake and exhaust valve timing in one cylinder is 180 out of phase from the other.

The intake valve opens 35° before top dead center and closes 69° after bottom dead center, which means the intake valve is held open 284°. The exhaust valve opens 64° before bottom dead center and closes 40° after top dead center. It remains open for a duration of 284° At one point during cam rotation, both the intake and the exhaust valves are open. This is called overlap.



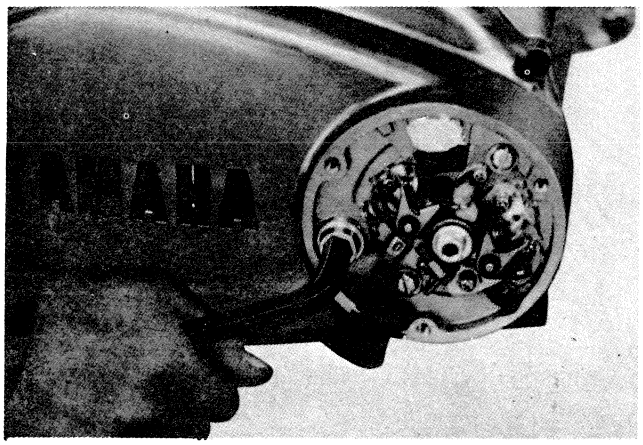
Disassembly

Caution

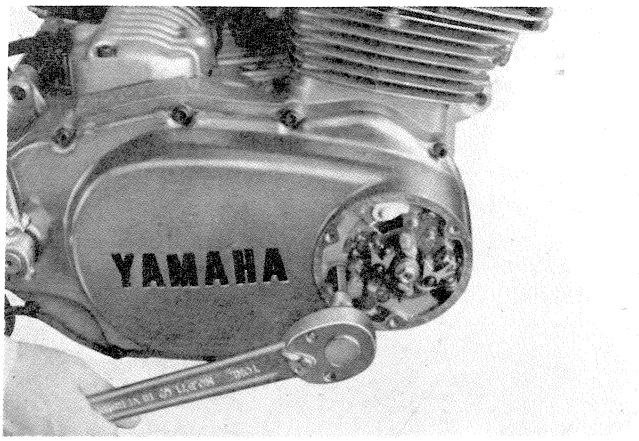
When removing the camshafts from the camshaft case, align the "V" mark of the governor and the timing plate. Otherwise, the camshaft will be forced to turn by the force of the valve springs, and as a result, the shafts, caps, shaft cap holding stud bolts and nuts may be damaged.

Step #1 to #3 below must be followed.

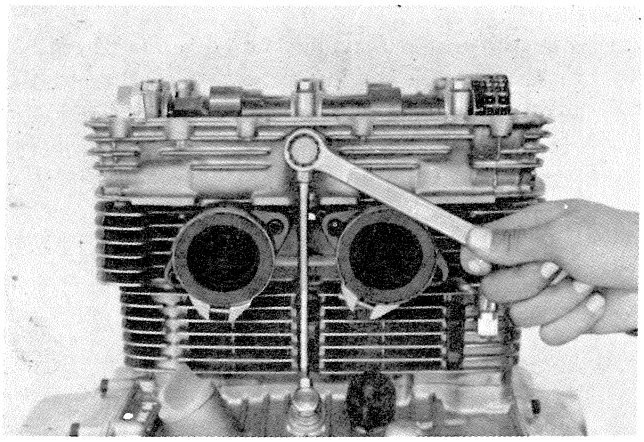
1. Remove the three 5-mm internal hexagon head bolts holding the breaker cover to the crankcase cover (R).



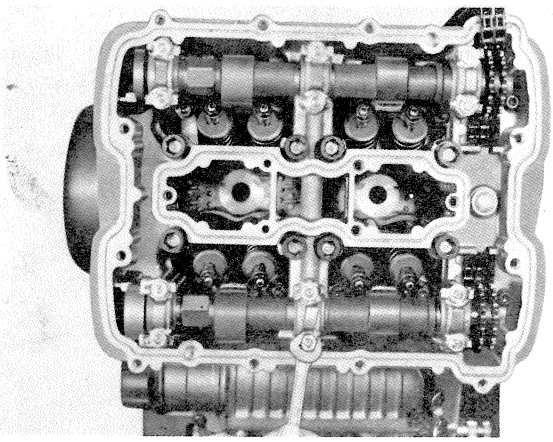
2. Remove the blind plug (with 10-mm internal hexagon head) using the 10-mm hexagonal wrench.



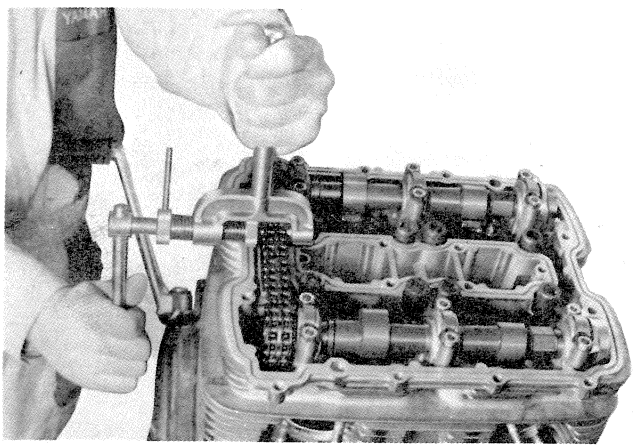
3. Insert the 10-mm hexagonal wrench (the TX500A special tool kit) into the plug hole, and align the mark (the line on the left of the "V" mark) on the governor base with the mark (line) on the timing plate attached to the crankcase cover.



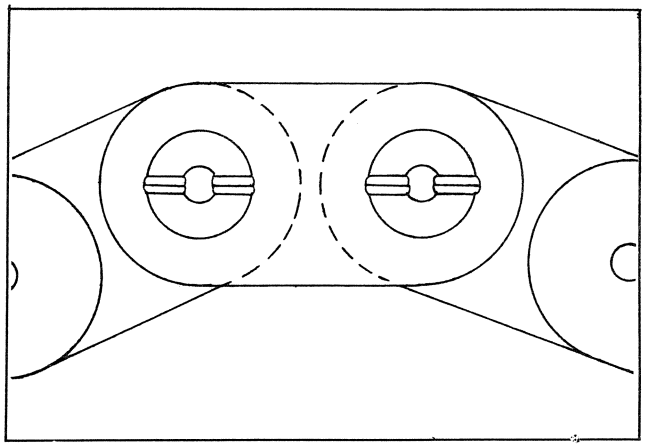
4. Remove the oil delivery line
The oil delivery line is located at the rear of the cylinder. Disconnect it at the crankcase and at the camshaft case where it is held in place by two banjo bolts.



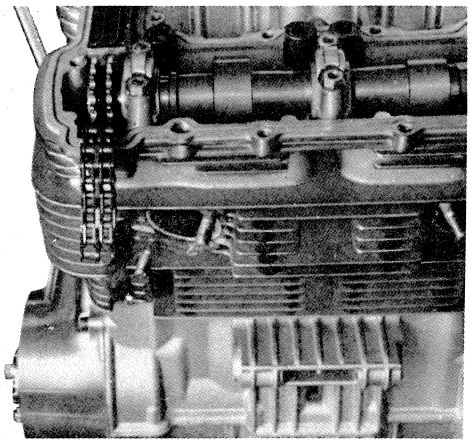
5. Separate the double row cam chain
a) The double row cam chain connects the two camshafts to the crankshaft through the drive gear and cam chain sprocket assembly. The chain is "endless" in that there is no master link to disassemble it, other than the link riveted at the factory when the chain was first installed. The rivet heads on this link have punch marks and slots across the heads.



b) A cam chain link cutting-rivetting tool (the TX500A Special Tool Kit) must be used to remove a selected link. Place a rag between the camshaft sprockets to prevent metal chips from falling into the cam chain housing)

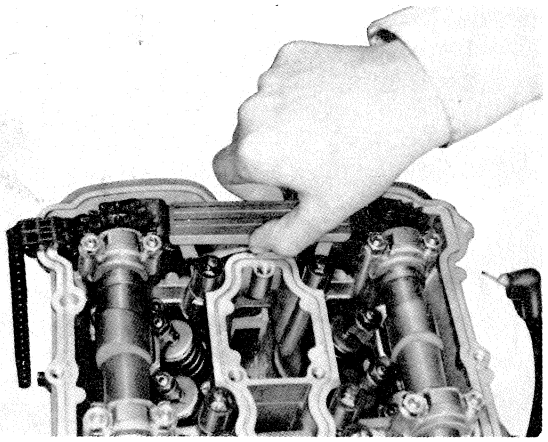


c) Separate the chain link that was originally riveted at the factory.



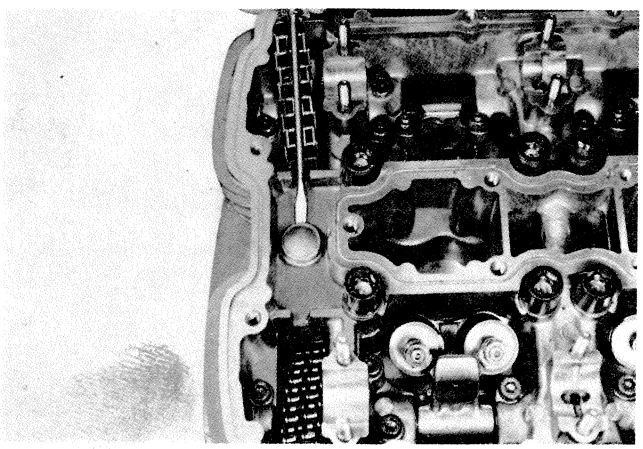
Caution

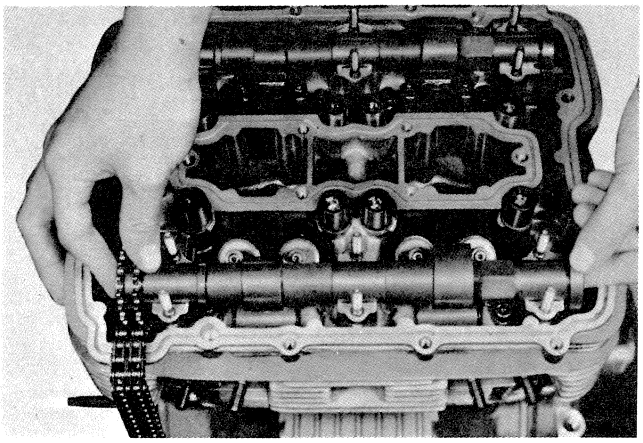
Attach a wire to the chain link on each side of the link to be separated. Do this before separating the chain to prevent the chain from dropping into the crankcase cover (cam chain housing). After separating the chain, anchor both retaining wires to prevent the chain from dropping.



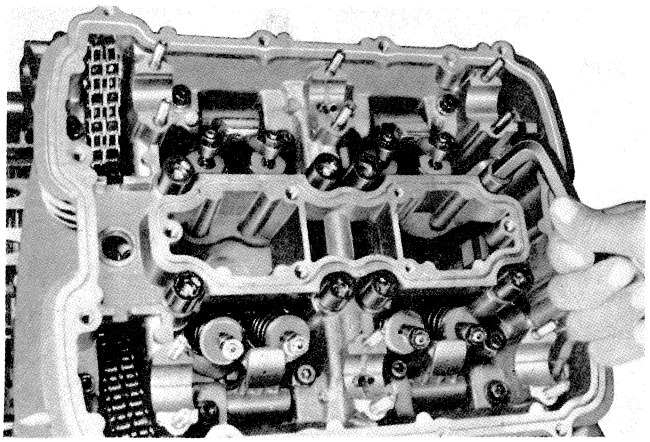
6. Remove chain guide

The chain guide can easily be removed by lifting it. There is a plug under the chain guide, and the plug can be removed by prying it out with a slotted-head screwdriver. Insert the 5-mm hexagonal wrench into the plug hole, and remove bolt holding camshaft case to the cylinder head.

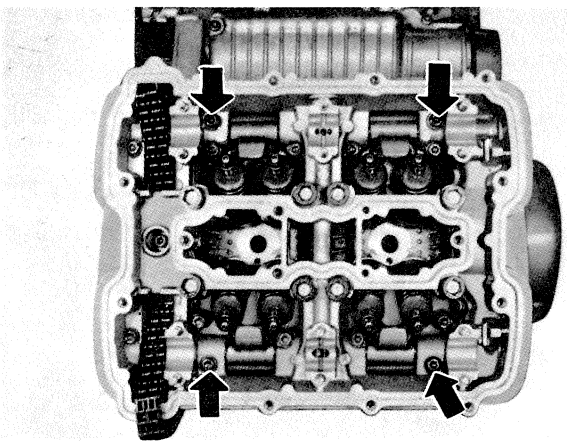




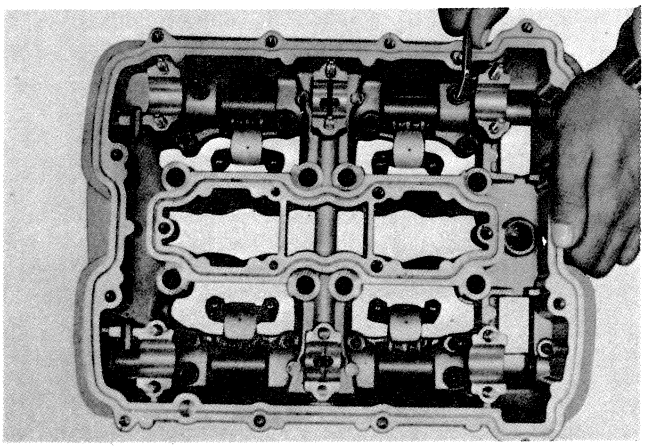
7. Remove the camshafts
When removing camshafts, be sure that valves are closed, and then loosen camshaft cap holding nuts. To check whether valves are closed or not, see page 41.
Take care not to allow nuts and washers to fall into cam chain housing.



8. Remove camshaft case.
First, remove the 10 camshaft case holding bolts using the 5-mm internal hexagonal wrench, and then remove the eight nuts holding the camshaft case, cylinder head and cylinder to crankcase using the 10-mm internal hexagonal wrench.



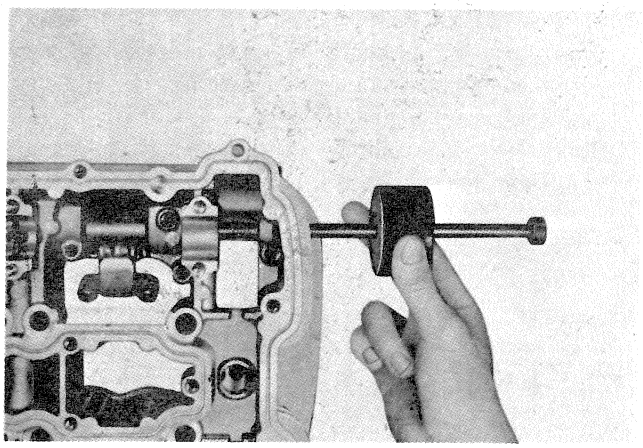
Note:
If removal of the rocker arms is unnecessary, don't remove rocker arm shaft holding bolts.



9. Remove rocker arms and rocker arm shafts.
To remove:

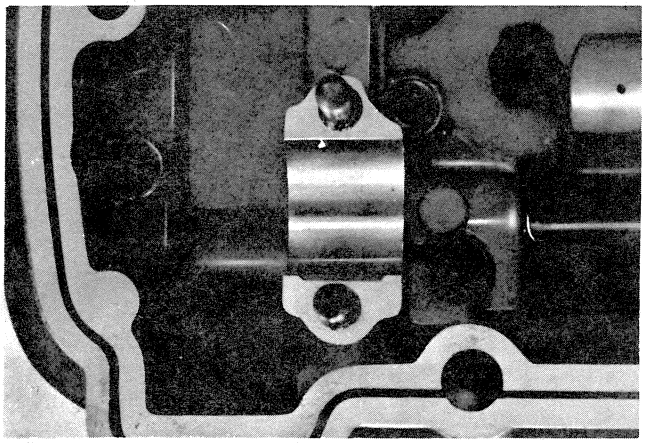
a. Remove rocker arm shaft holding bolts.

b. Remove plugs.



To remove

Set rocker arm shaft puller (in the TX750 special tool kit) and withdraw rocker arm shaft.
It should slide out easily. Remove the rocker arm.
Repeat this procedure for each rocker assembly.

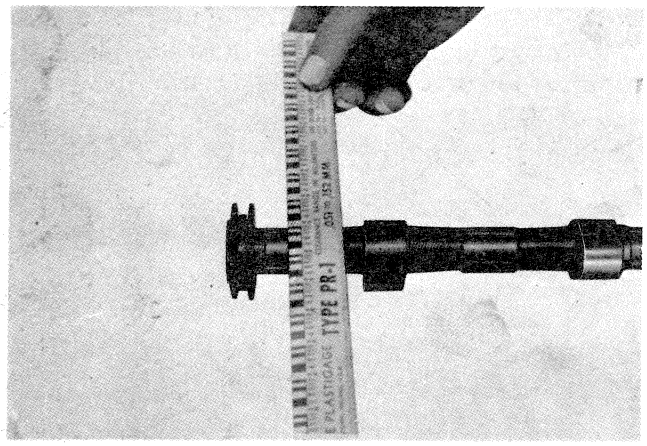


Inspection

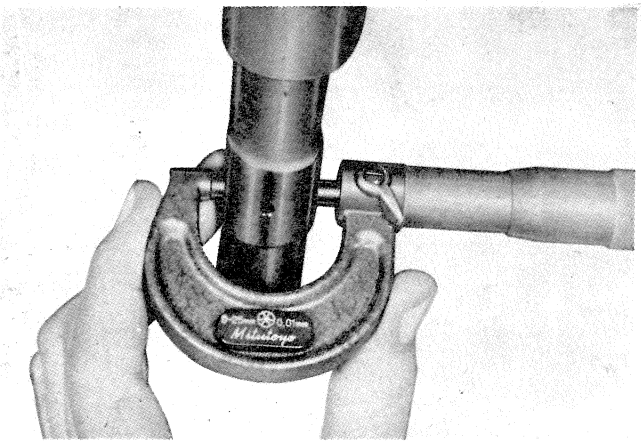
Camshaft

1. Measuring camshaft cap clearance

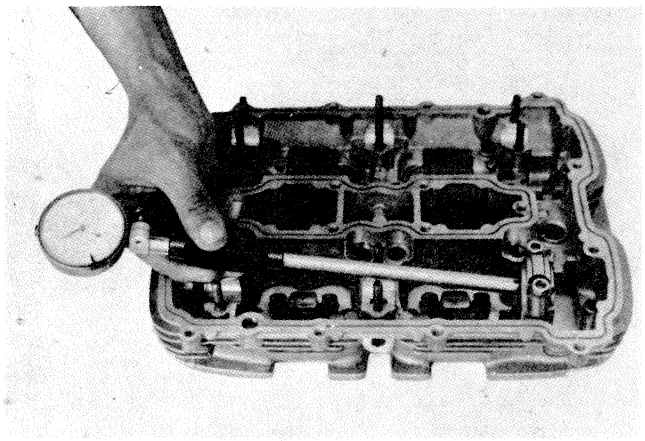
a) As shown in the photo, place a plastigauge on the journal bearing of the camshaft case, and place camshaft on it. Don't rotate shaft with plastigauge in place.
Install the cap, and tighten cap nuts with specified torque (70-90 in.-lbs. or 0.8-1.0 kg-m). Then measure crushed portion of the plastigauge.



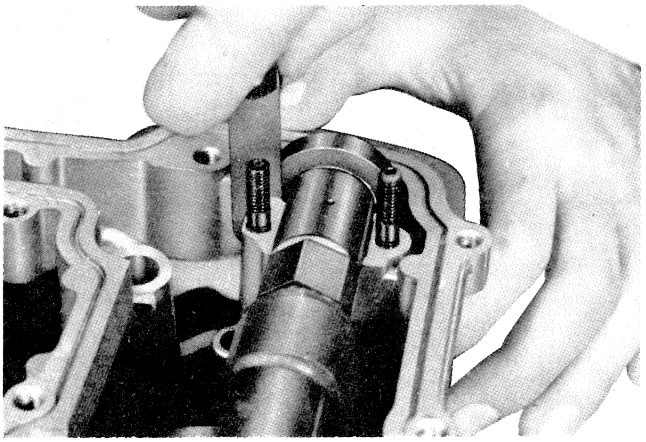
If the clearance is 0.003" or more (0.08mm or more), the journal bearing of the camshaft case, cap, or camshaft is considered to be worn. For replacement, take the following steps.



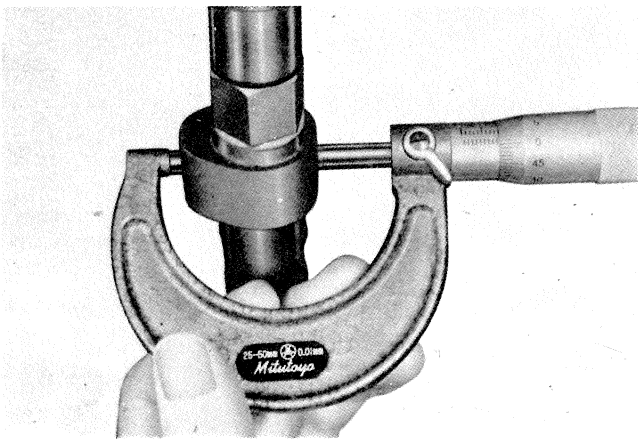
b) Measure outside diameter of camshaft journal using a micrometer. If outside diameter is 0.865" or less (21.97mm or less), replace camshaft together with camshaft caps.



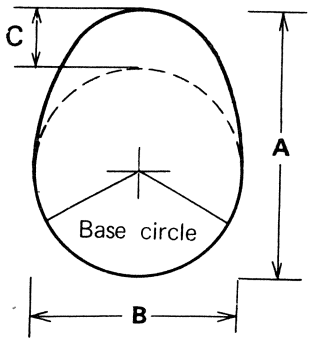
c) Measure inside diameter of hole formed by camshaft case and camshaft cap with an inside dial gauge.
If hole measures between 22.03~22.05mm (0.8673"~0.8681"), both camshaft case and camshaft cap are in good condition. But if more than 22.05mm (0.8681"), they should be replaced as an assembly.



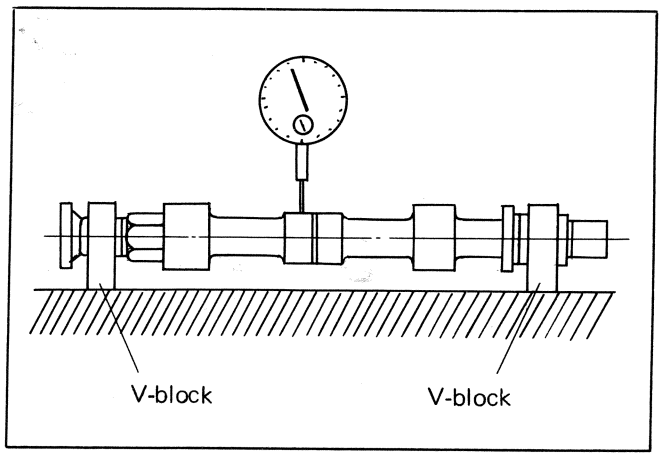
2. Measuring thrust clearance between the camshaft end (thrust stopper) and camshaft case.
Firmly push camshaft toward cam chain side of camshaft case (on right side of engine), and measure gap between the left end of camshaft and camshaft case with a feeler gauge.
If gap measures 0.0157" (0.4mm) or more (standard is 0.0059" (0.15mm), it is advisable to replace camshaft case or uneven wear will be caused on camshaft sprocket or cam chain



3. Measuring cam lift
Using a micrometer, measure the "A" diameter from the base circle to the cam lobe, and measure the "B" diameter. The cam lift (C) will be A minus B. For standard value and minimum limit, see table .



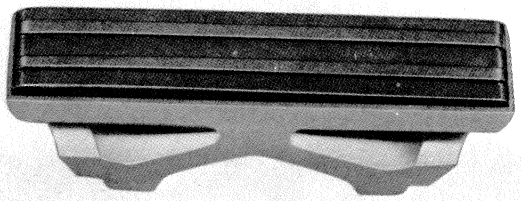
	"A" diameter		"B" diameter		Cam Lift (C)
	Standard Valve	Wear Limit	Standard Valve	Wear Limit	
INTAKE	34.07 ±0.05	33.92	28.24 ±0.05	28.09	6.07
EXHAUST	34.11 ± 0.05	33.96	28.29 ± 0.05	28.14	6.11



4. Measuring camshaft for bends
   Support camshaft by placing two V-blocks under the journals at both ends, and measure deflection of camshaft at center journal. If deflection measures 0.0039 in or more (0.1mm or more), replace camshaft.

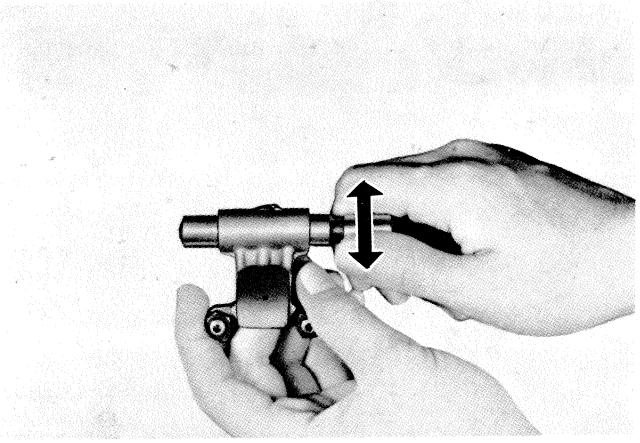
5. Chain Damper - Inspection and Replacement
   If chain damper, located between cam chain sprockets mounted on camshaft, is worn, fatigued, or almost broken, it should be replaced. It can be removed by simply cutting it.

   Before installing a new damper, grease it. Take care not to damage it with teeth of the sprockets.



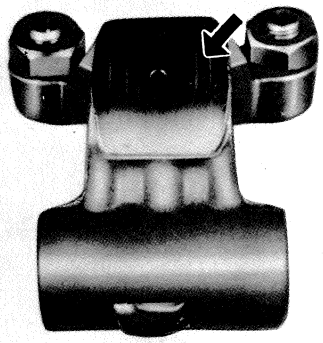
CHAIN GUIDE

If contact surface of cam chain guide is found excessively worn it should be replaced. If spaced ridges are worn lengthwise, cam chain is loose or camshaft is loose axially.



ROCKER ARMS, ROCKER ARM SHAFTS

a. The rocker arm usually wears at two spots: (1) at rocker arm shaft hole where it rubs against rocker arm shaft, and (2) at cam lobe contact surface.

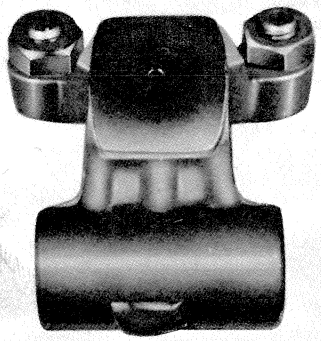


b. Check cam lobe contacting surface of rocker arm for grooved wear on the surface, for deep and obvious scratches, flaking of hardened surface, or a blue discoloration of the metal (obvious evidence of too much heat). Check mating cam lobes in same manner.

c. If any grooved wear is readily apparent, replace rocker arm. Do not try to repair the surface by cleaning with an oil stone or emery cloth as this will change the curvature of the follower and thereby the rate of valve opening.

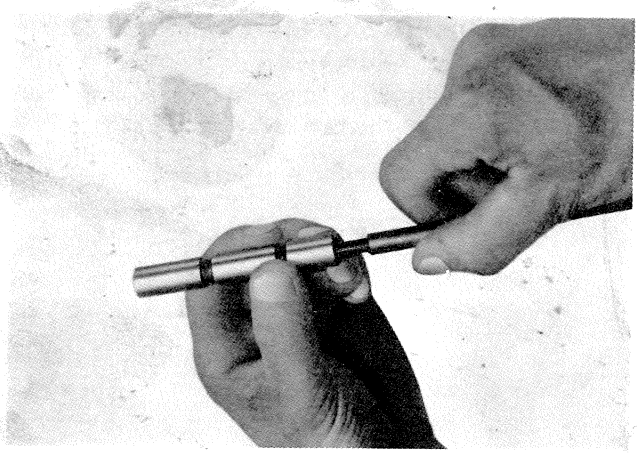
d. Measure the rocker arm shaft hole in rocker arm.

Standard size is $0.4724''\ ^{+0.00071''}_{-0''}$ $(12.0\ ^{+0.018}_{-0}$mm.)



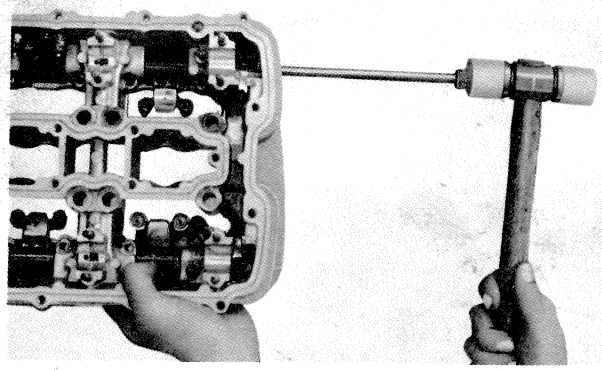
e. Rocker arm shaft diameter measures 12.0 $^{-0.006}_{-0.017}$mm when new.
The shaft has been hardened and it should not wear excessively. If a groove has developed in its surface that can be felt, or if it shows a blue discoloration, then the shaft should be replaced and the lubrication (pump and passages) checked.

f. Standard clearance between rocker arm shaft and hole should be 0.006mm. If measurement shows more than 0.035mm clearance, replace either or both parts as necessary.

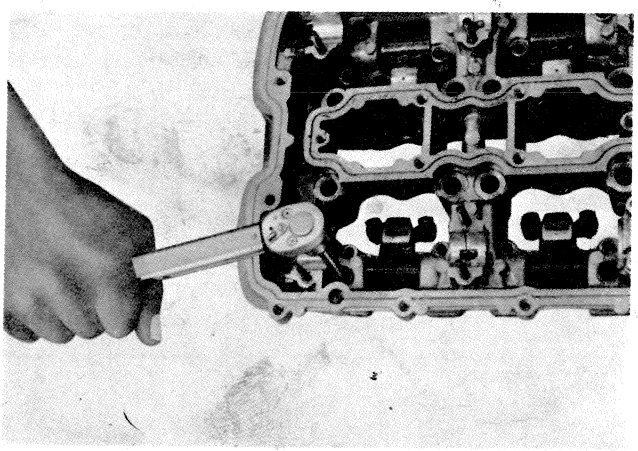


Installation and Adjustments

1. Install the rocker arms and rocker arm shafts in the camshaft case.

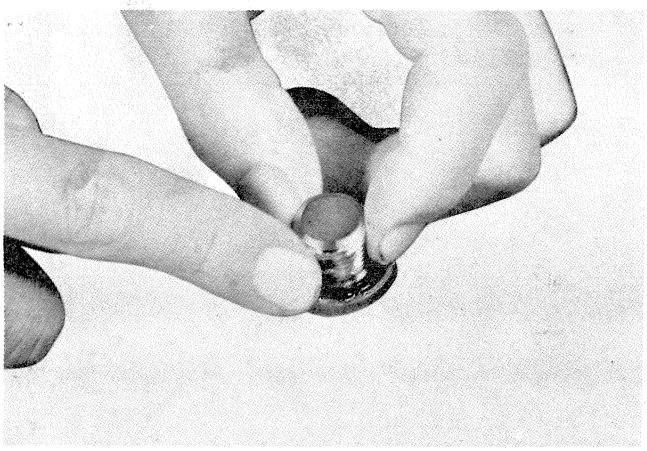


a) When installing rocker arm shafts, the rocker arm shaft puller bolt (in TX750 special tool kit) should be used. It is necessary to slowly push rocker arm shaft into camshaft case so that the groove cut around rocker arm shaft to hold it in place is alighed with the rocker arm shaft holding bolt hole. (See illustration.)

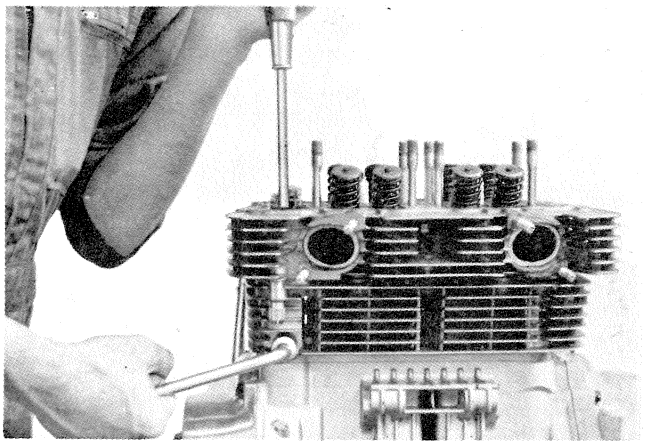


b) Install rocker arm shaft holding bolt.

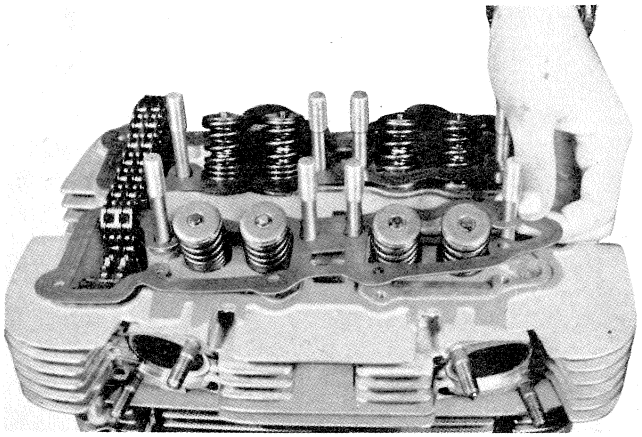
Tightening Torque: 90 - 110 in-lbs (1.0 - 1.2 kg-m)



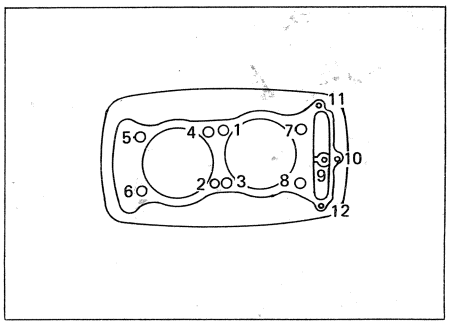
c) Replace O-ring with a new one. Grease it before installing, and install plug.



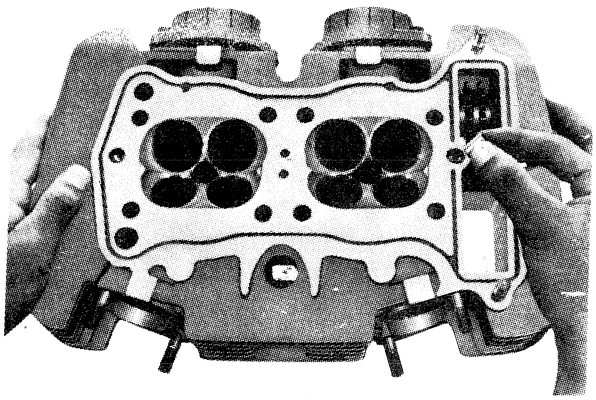
2. Loosen tensioner holding nut (13-mm acorn nut) attached to right side of cylinder, and fully push down tensioner roller sprocket assembly. Then push tensioner roller sprocket assembly holding bolt, and tighten nut.



3. Replace the gasket with a new one, and thoroughly clean cylinder head and camshaft case sealing surfaces with a dry, clean cloth.



Tightening sequence of bolts and nuts



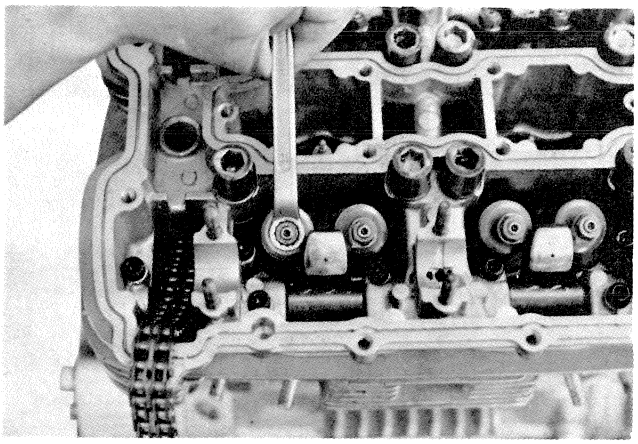
4. Install the two dowel pins on the cylinder head, pass cam chain through camshaft case, and install camshaft case on cylinder head.

Note:

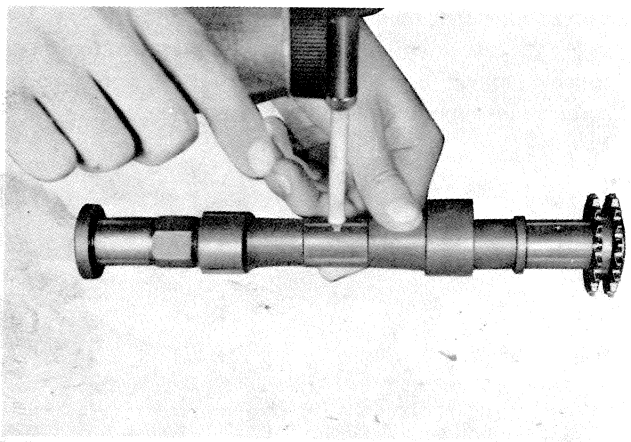
The ten nuts and two bolts should be tightened in specified order and with specified torque.
When installing cylinder and cylinder head, be sure to tighten the three M8 bolts in specified order and specified torque. (See page 166.)

Tightening Torque:

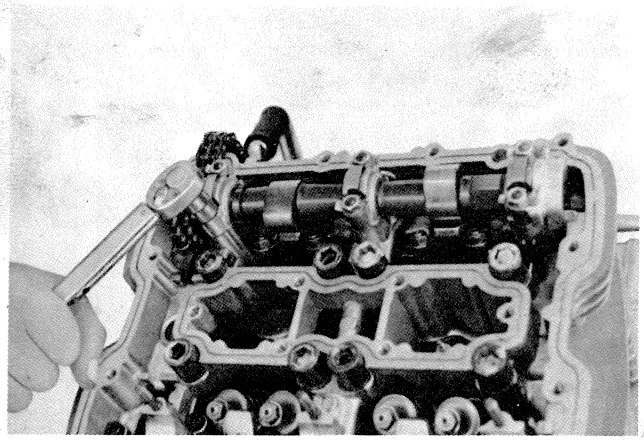
M10	330-360 in-lbs	(3.7-4.0 kg-m)
M6	90-110 in-lbs	(1.0-1.2 kg-m)
M8	180-210 in-lbs	(2.0-2.3 kg-m)



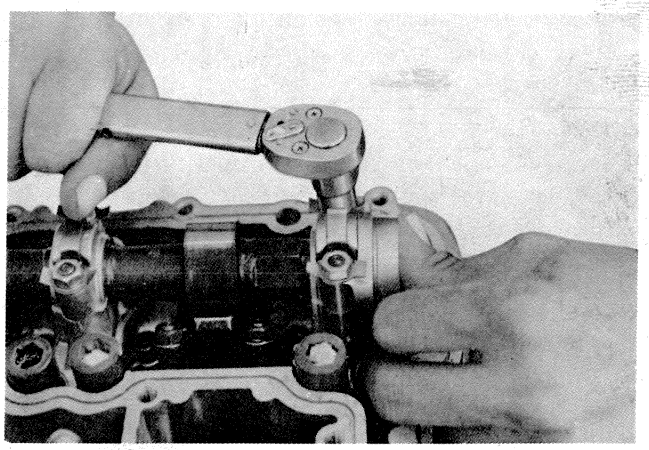
5 Before starting valve clearance adjustment, loosen valve adjusting screw lock nuts (10-mm).



6. Install camshafts in the case.
   a) Plug one of the two oil holes in center journal of the camshaft, and feed oil into other oil hole. Then make sure that the oil runs out of oil holes on both sides. If not, oil holes are clogged. Sparingly oil the journals at three places.

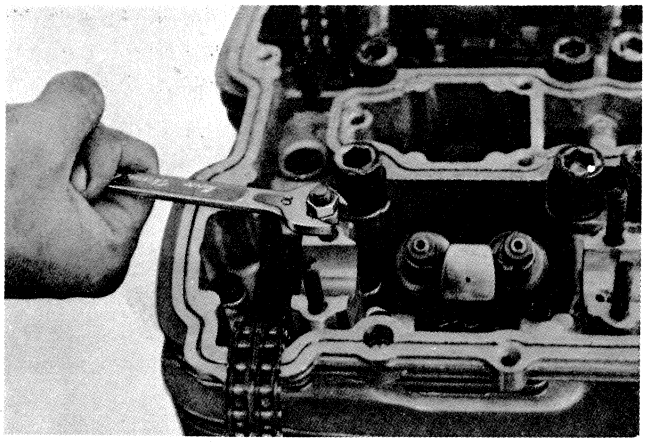


   b) Install the camshafts. There are two camshafts, one for intake valves and the other for exhaust valves. Be sure to install on the proper sides.
   Note: Camshafts are marked IN-EX.
   Next, install camshaft caps, and fasten them with lock washers and nuts. The lock washers should be replaced with new ones, and the nuts should be tightened with specified torque.
   Tightening Torque: 70-90 in-lbs (0.8-1.0 kg-m)

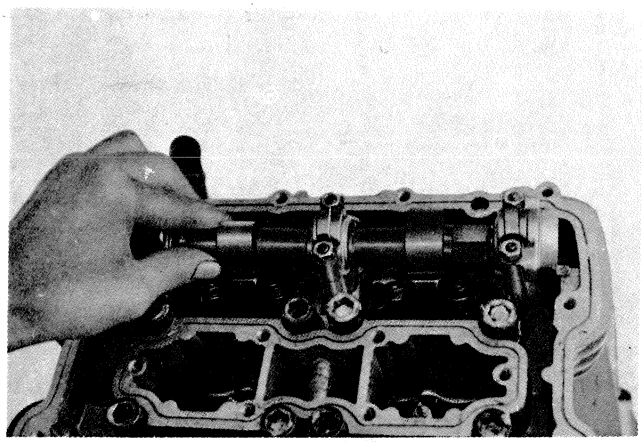


Notes:

1) Note that thrust stoppers at the ends of intake and exhaust cam shafts are covered with breather plates. The breather plates must be so installed that the gap between the plate and camshaft cap will be as small as possible.

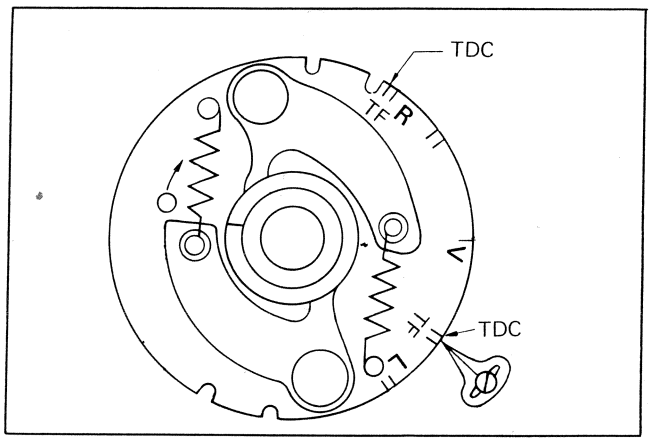


2) If a new stud bolt has to be used because of breakage, coat threaded portion with Locktite, and tighten it by means of double nuts and with specified torque.
Tightening Torque: 70-90 in-lbs (0.8-1.0 kg-m)

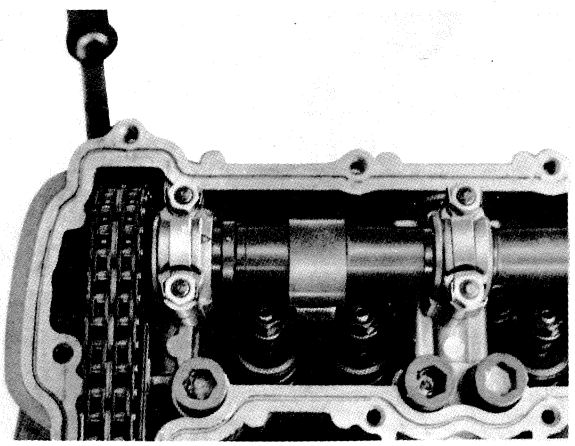


7. Make sure camshaft can be turned slightly by hand. If it is too tight, bearings may seize.

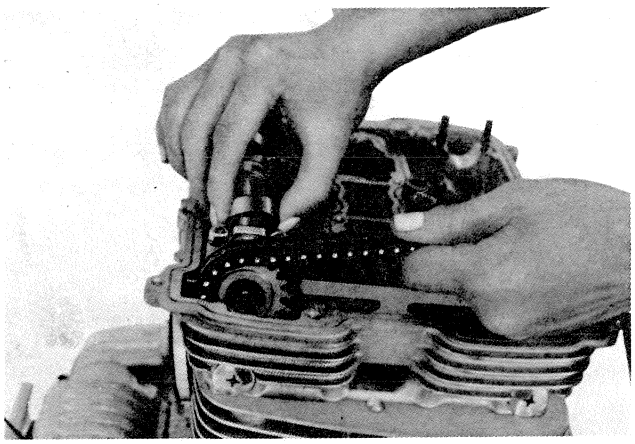
8. Replace plug under chain guide, and install chain guide in camshaft case.



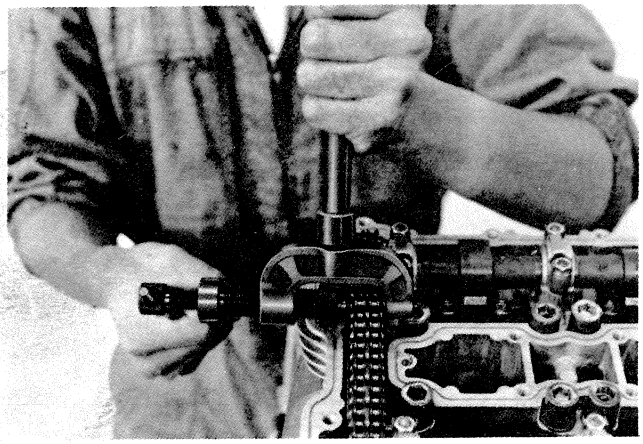
9. Set valve timing correctly, and connect cam chain by a new joint link.
   a) Using the 10-mm hexagonal wrench, turn crankshaft clockwise to align the "V" mark on governor plate with mark on timing plate attached to crankcase cover (R).



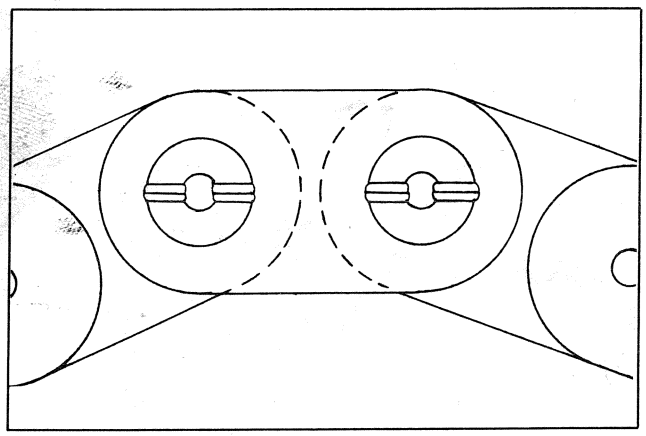
b) Then set both intake and exhaust camshafts so that the dot (o) on each camshaft is in line with the arrow mark on the camshaft cap.

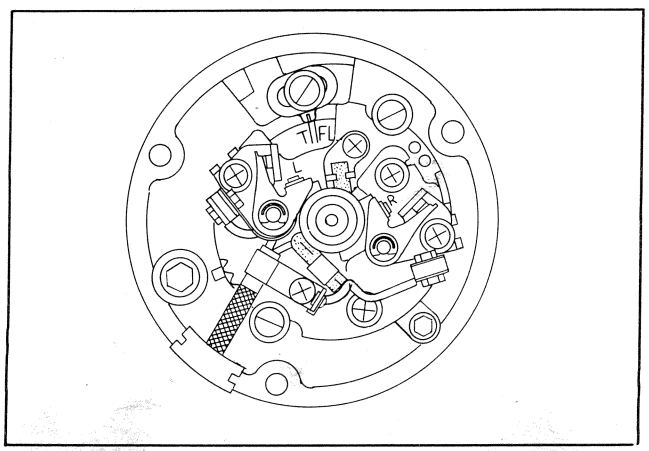


c) Pull the cam chain tight on the intake side, and place it around sprockets. It is necessary to keep tensioner sprocket forced down; otherwise, the operation will be difficult.

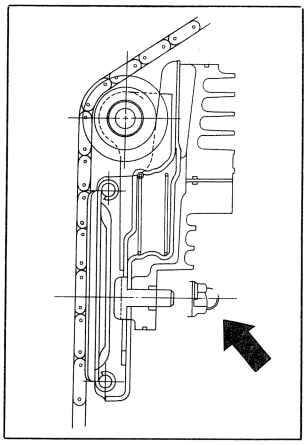


d) Join the chain by installing and riveting a new chain link. Always use a new link each time the chain is reconnected. (Use a cam chain link cutting-riveting tool, not a hammer and punch, to mush-room rivet ends). Make sure the center link plates are installed.

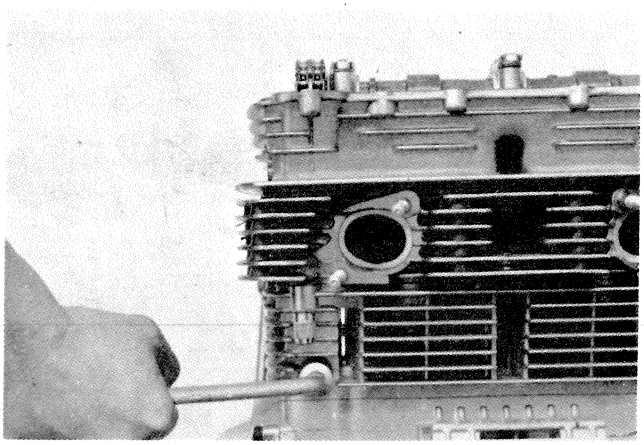




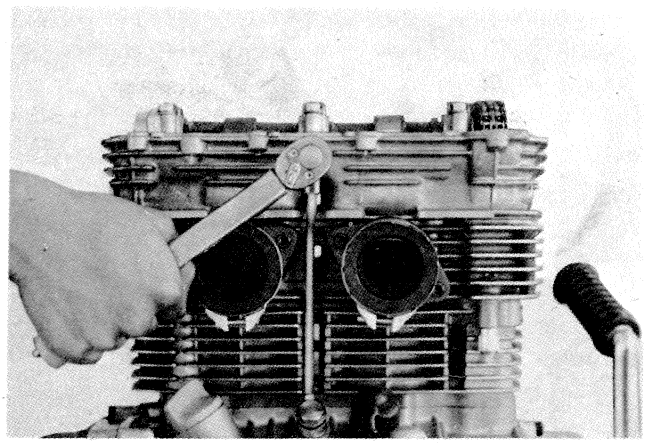
10. Insert the 10-mm hexagonal wrench into hole in contact breaker housing, and turn crankshaft clockwise so that the "T" (top dead center) mark for the right-hand ("R") cylinder on governor plate is aligned with mark on timing plate.



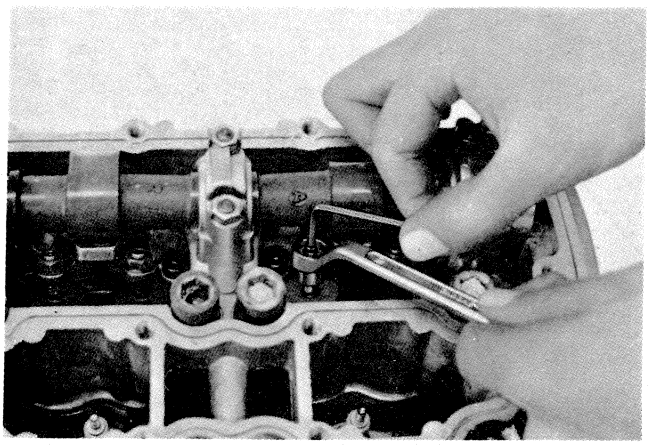
11. a) Loosen cam chain tensioner holding nut using the 13-mm socket wrench. This sets chain tensioner spring free, thus making the chain taut.
(Whether cam chain tensioner is set free or not can easily be checked. When tensioner nut is loosened, a click can be heard.)



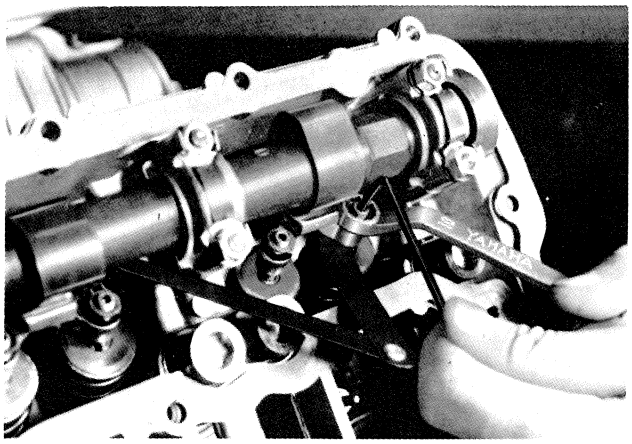
b) Then tighten tensioner nut.



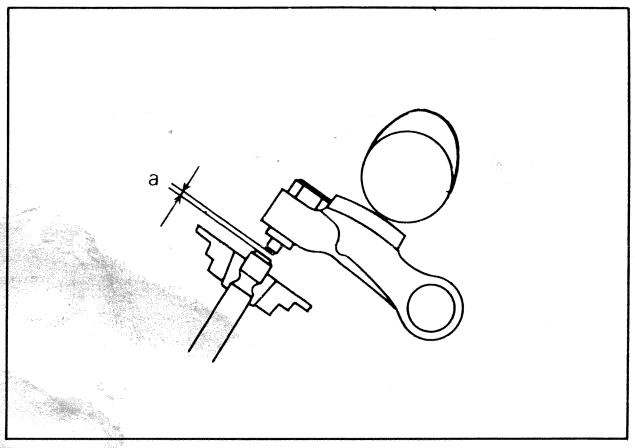
12. Replace copper washers with new ones, and install oil delivery line.
Tightening torque for banjo bolt:
180-200 in-lbs (2.0-2.2 kg-m)



13. Adjust valve clearance properly by using feeler gauges (0.15mm and 0.20mm), 3-mm hexagonal wrench, and 10-mm off-set wrench. For this operation, the engine should be cold.



a) Turn crankshaft clockwise using the 10-mm hexagonal wrench so that cam base circle faces contacting surface of rocker arm.
b) Adjust clearance between adjusting screw and valve stem end by turning adjusting screws in and out with the 3-mm hexagonal wrench. For correct clearance, use feeler gauges.
When correct clearance is obtained, tighten lock nut with specified torque while holding adjusting screw with the 3-mm hexagonal wrench.
Tightening Torque 110-140 in-lbs (1.2-1.5 kg-m)



Intake valve clearance	0.15 mm
Exhaust valve clearance	0.20 mm

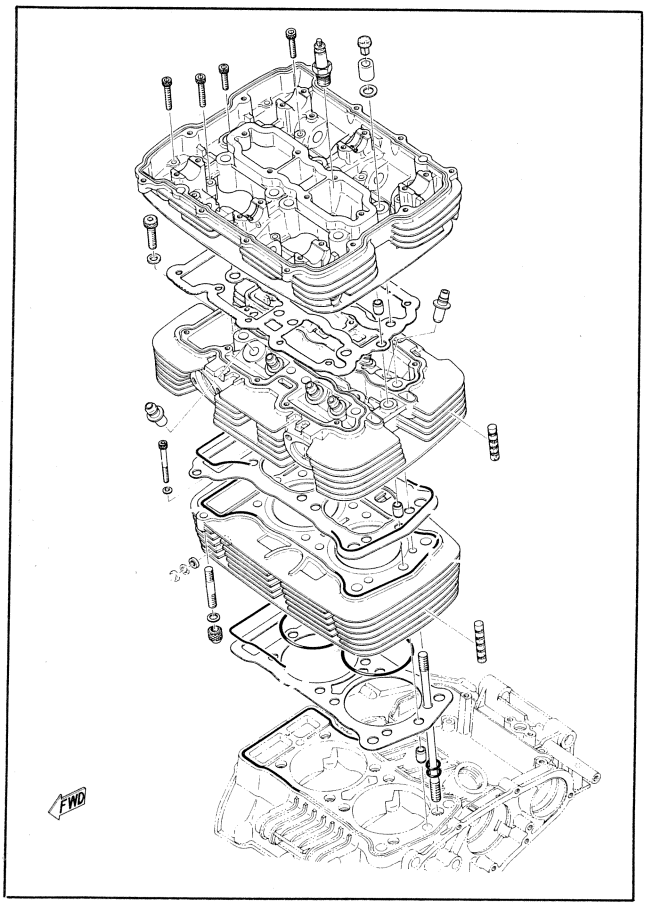
Note:

The valve clearance must be measured at "a". After the adjustment, oil valve stem end. Repeat this procedure for each of the other valves.

14. Replace copper wahser with a new one, and tighten plug (with a 10-mm internal hexagonal head socket) with specified torque. Then install breaker cover.
Tightening Torque: M10 270 - 310 in-lbs (3 - 3.5 kg-m)
M6 60 - 80 in-lbs (0.7 - 0.9 kg-m)

Note:

If copper washer is scratched or plug is not fully tightened, oil may leak through the hole into contact breaker.
Therefore, whenever the plug is re-installed, the copper washer must be replaced with a new one, and the plug must be tightened with specified torque.



CYLINDER HEAD

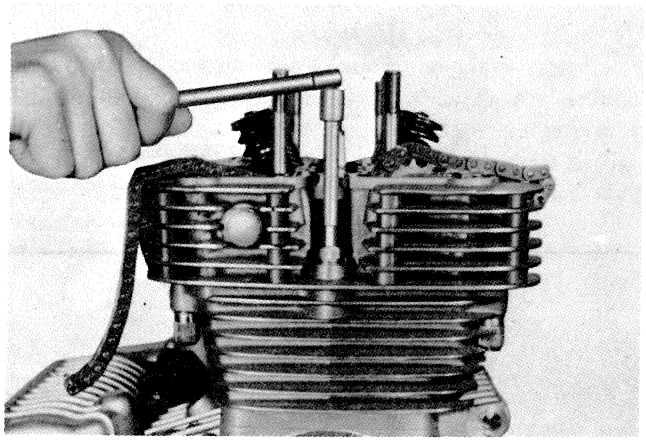
Description

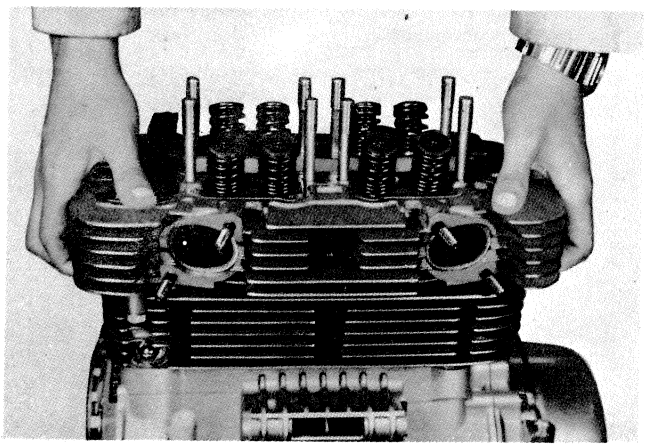
The TX500A twin-cylinder engine has eight valves; there are two intake and two exhaust valves for each cylinder. This means that the total area of valve opening is larger. To operate the eight valves, double overhead camshafts are used. The TX500 engine is built for high speed riding. To allow for use of non-leaded gasoline, the valve seats are made of a sintered titanium alloy. To reduce contact pressure of the rocker arms on the valve stems, variable-rate valve springs are used. Thus, spring load has been decreased and wear on contacting surfaces of the moving parts will be minimized. Despite the reduced spring load, variable-rate springs eliminate surging or bouncing of the valves at high speed operation.

In addition, spark plugs are positioned in the centers of the cylinders, allowing the fuel in the cylinders to be completely burned, resulting in cleaner exhaust gases.

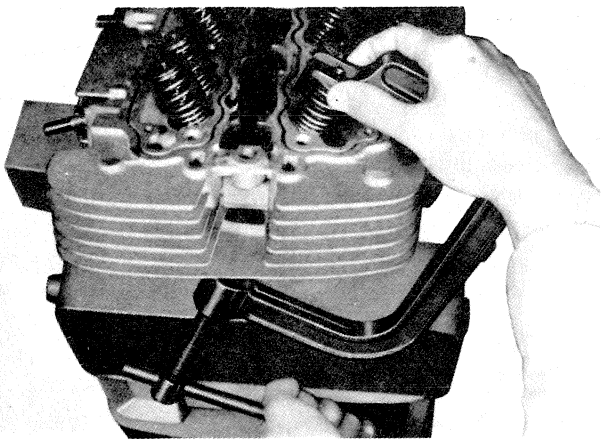
Disassembly

1. Remove camshaft case (See page 33.)





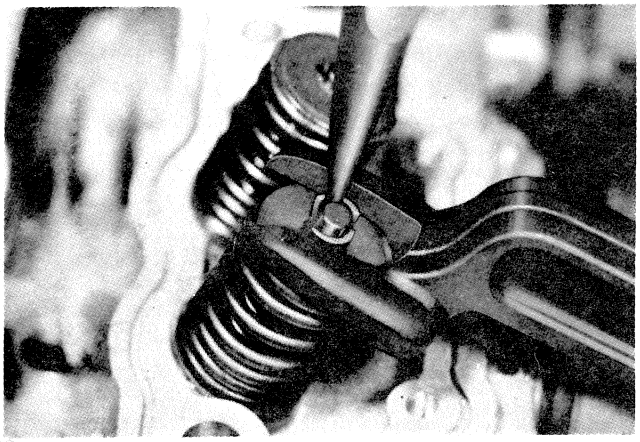
2. Remove the one bolt and two nuts holding the right side of the cylinder head to the cylinder, using the 6-mm hexagonal socket wrench, and remove cylinder head assembly by lifting it vertically.



3. Using the valve spring compressor (in TX750 special tool kit), compress the valve spring, and remove two keepers, the spring retainer, two valve springs and one valve spring seat.

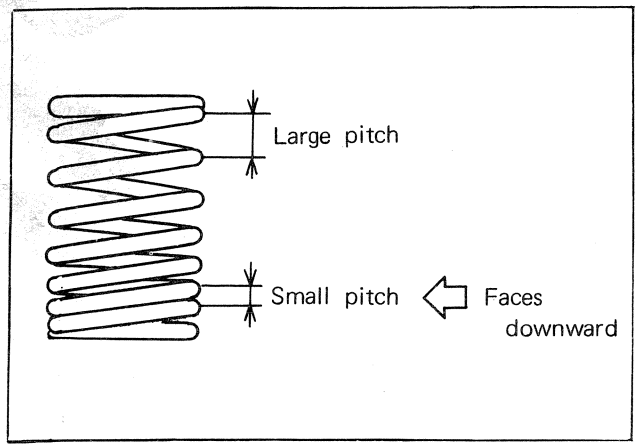
Note:

The keepers are held inside the spring retainer. To remove or install the keepers, it is advisable to use tweezers.



Installation

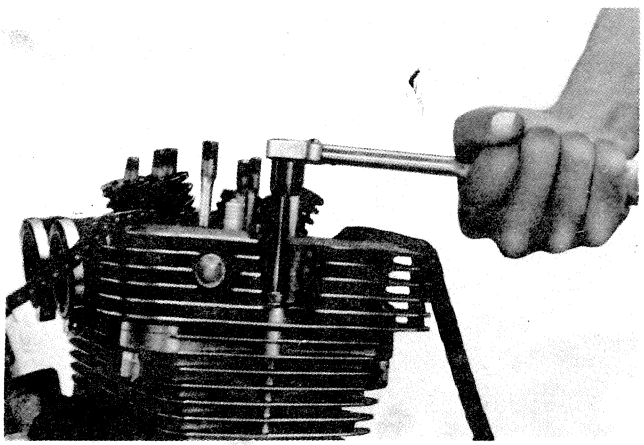
1. Insert valves into valve guides, and install valve spring seat, inner spring, outer spring, and retainer, in that order. Then, install the two keepers using a valve spring compressor.



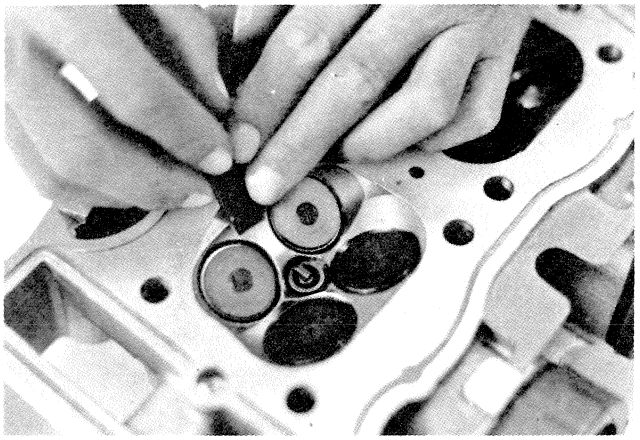
Caution:

In order to prevent valve surge and to increase engine rpm, a progressively-wound spring is used. Be sure that the smaller pitch side is placed downward during installation.

* If the spring is installed upside down, either the spring or valve may break. Also, engine rpm may decrease.



2. Replace cylinder head gasket, and temporarily tighten the three bolts holding the cylinder head to the cylinder. These three bolts must be fully tightened after camshaft case mounting bolts are tightened with correct torque. Specified tightening torque for the three bolts is 180-210 in-lbs (2.0-2.3 kg-m).



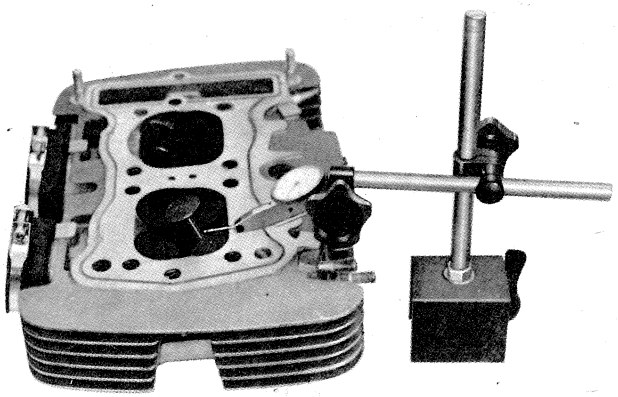
Inspection

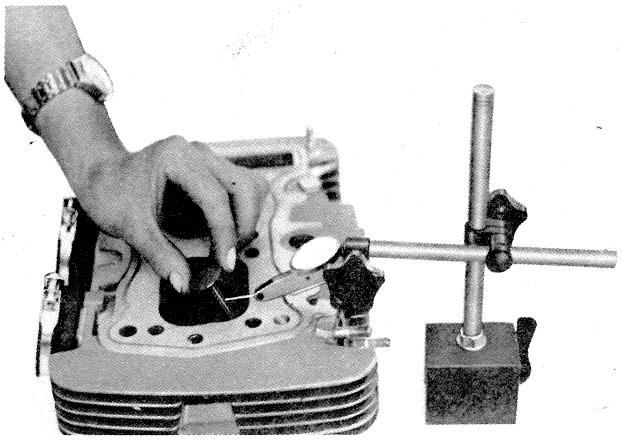
DECARBONIZATION (Cylinder head and components)

Carbon deposits build up in the combustion chambers, on the valves, and in the exhaust ports. Thoroughly clean all parts with a blunt scraper, then wash in solvent and dry with compressed air. The parts can then be examined and measured for wear.

VALVE AND VALVE GUIDE

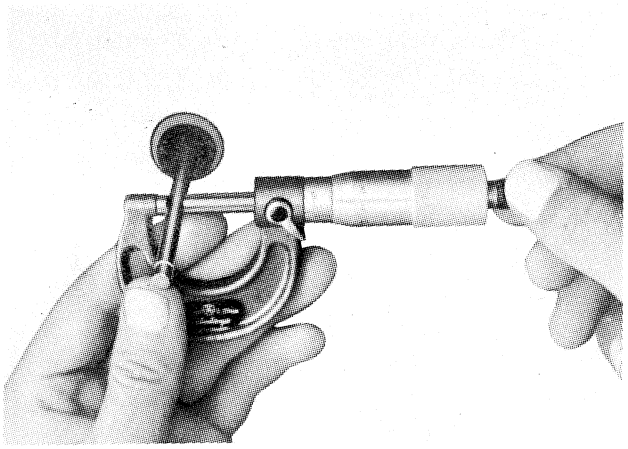
1. Measuring the clearance between the valve stem and the valve guide.
   a) Insert valve stem into valve guide, and set dial gauge (with a handspike) as shown in the photo.

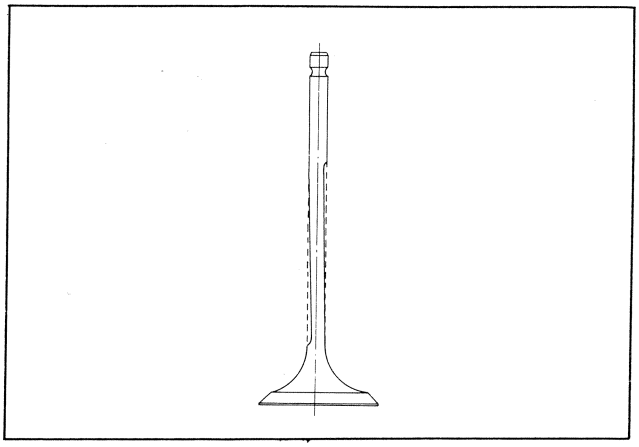




   b) Hold the valve head, and travel it in the direction of the Y axis or the X axis so that a 30-mm gap is allowed between the valve head and the valve seat. With the valve head in this position, measure the clearance between the valve stem and the valve guide. If it measures IN 0.003 in. (0.08 mm) EX 0.004 in. (0.1 mm) or more, replace to valve and the valve guide as an assembly.

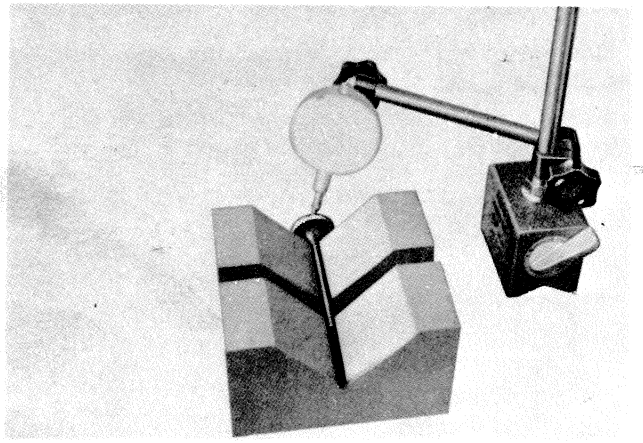
2. Measuring the valve stem
   Using an outside micrometer, measure the outside diameter at three places. If it measures 0.2163 in. (5.495 mm) or less, replace the valve with a new one.





Note:

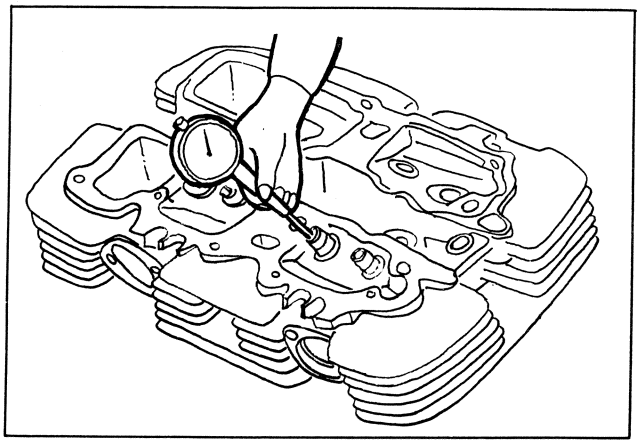
In most cases, the valve stem tends to wear as shown in broken-lines.



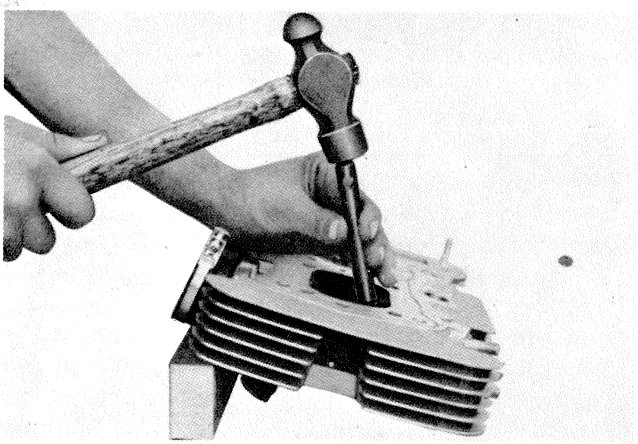
3. Measuring run-out of a valve stem
   As shown in the photo, set V-blocks and dial gauge on surface plate, and place valve on the V-blocks. Hold valve lightly with one hand, and turn it slowly with the other hand. If dial reading is 0.02mm or more, replace the valve with a new one.

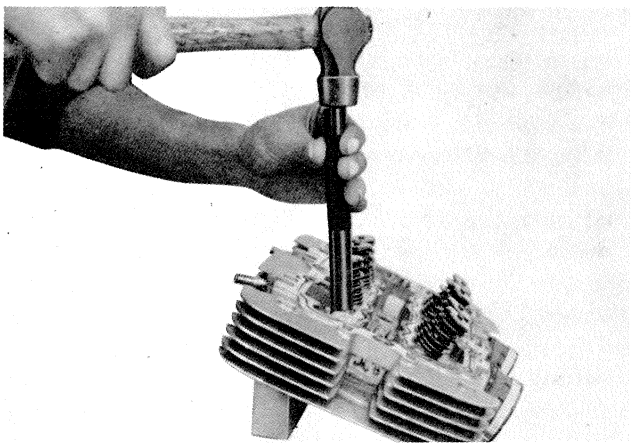
VALVE SPECIFICATION:

			Original Clearance	Replacement Clearance
Intake	Valve Guide ID	$5.5mm^{+0.040}_{+0.030}$	0.020 – 0.045mm	0.100mm
	Valve Stem OD	$5.5mm^{+0.010}_{-0.005}$		
Exhaust	Valve Guide ID	$5.5mm^{+0.040}_{+0.030}$	0.035 – 0.060mm	0.120mm
	Valve Stem OD	$5.5mm^{-0.005}_{-0.020}$		



4. Measuring inside diameter of the valve guide
   The inside diameter must be measured with a ball gauge. Measure at each end and in the center of drilled passage. Compare this measurement, using the largest measurement of these spots, with factory specifications listed in Valve Description. If this measurement exceeds the maximum tolerance, replace guide.





Valve guide – Removal and Installation

a) The valve guide is replaceable. It is held in the cylinder head by an interference fit of approximately 0.04mm (0.0015"). To ease guide removal and re-installation, and to maintain correct interference fit, heat head to 200 - 400° Farenheit. If possible, use an oven to avoid any possibility of head warpage due to uneven heating.

b) Use appropriate shouldered drift punch (Special Tools Kit) to drive the old guide out and the new guide in.

Note:

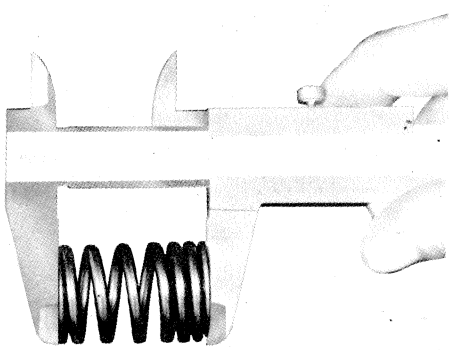
When replacing valve guide or valve, both valve guide and valve stem must be coated with molybdenum bisulfide in order to prevent valve stem from seizing.

VALVE SPRINGS

The TX500 engine uses one inner and one outer valve spring of different sizes to prevent valve float or surging. The chart below shows basic value characteristics.

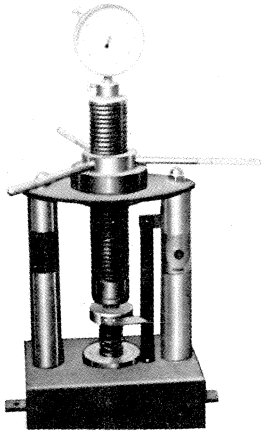
VALVE SPRING SPECIFICATION CHART

	OUTER	INNER
Direction of Winding	Right Hand	Left Hand
Total Windings	5.5	9.0
Free Length	39.0mm	38.2mm
Installed Length (Valve Closed)	35.0mm	31.0mm
Installed Pressure	7.4 ± 0.7 kg	3.65 ± 0.26 kg
*Compressed Length (Valve Open)	27.5mm	23.5mm
Compressed Pressure	30.7 ± 2.15kg	8.9 ± 0.63kg
*Measured with collar All measurements ± three percent		

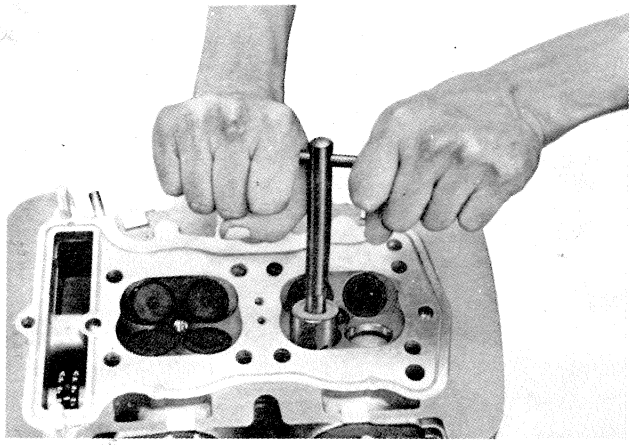


1. Measuring valve spring free length

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



2. Measuring spring constant.
   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 valve closed (all spring specifications can be found in previous section-Valve Springs) then to the length with the valve open. Note poundage indicated on scale at each setting. This procedure must be performed on outer springs, then inner springs.



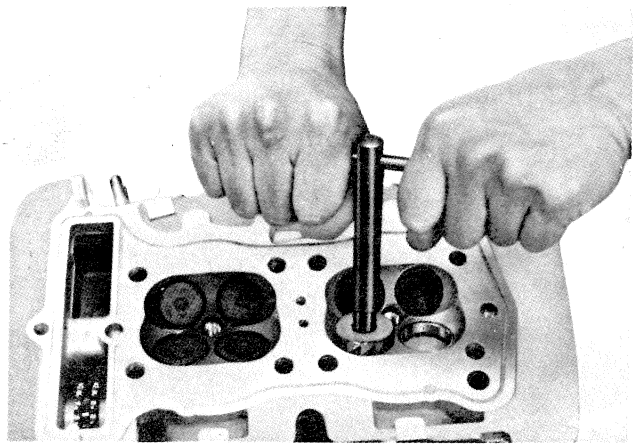
Grinding the valve seat

a) The valve seat is subject to severe wear similar to the valve face. Whenever valve face is resurfaced, the valve seat should also be resurfaced at a 45° angle. In addition, if a new valve guide has been installed (without any valve repair), the valve seat should be checked to guarantee complete sealing between valve face and seat.

Caution

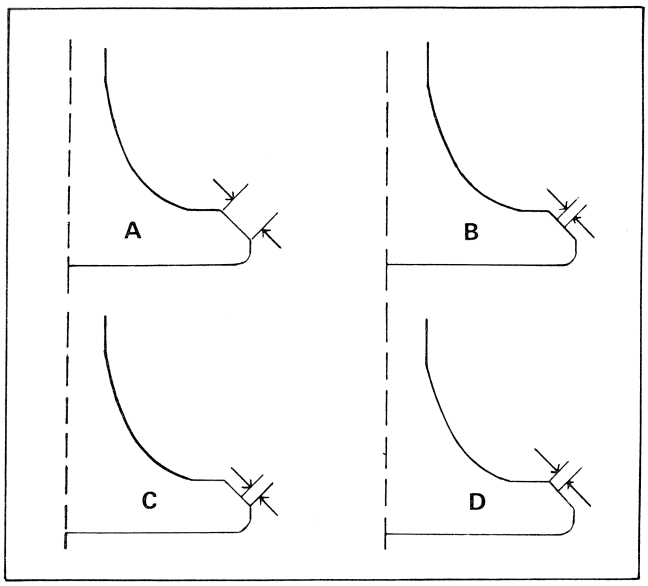
If valve seat is obviously pitted or worn, it should be cleaned with a valve seat cutter. Use 45° cutter, and keep an even downward pressure to prevent chatter marks when twisting cutter. See following page.

b) Measure valve seat width. Apply mechanic's blueing dye (such as Dykem) to valve face, apply a very small amount of fine grinding compound around surface of valve seat, insert valve into position, and spin valve quickly back and forth. Lift valve, clean off all grinding compound, and check valve seat width. The valve seat will have removed the blueing wherever it contacted valve face.
   Measure the seat width with vernier calipers. It should measure approximately 1.0 ± 0.1mm. Also, the seat should be uniform in contact area. If valve seat width varies, or if pits still exist, then continue to cut with 45° cutter. Remove just enough material to achieve a satisfactory seat.



c) If the valve seat is uniform around perimeter of valve face, but is too wide or not centered on valve face, it must be altered. Use either 45° or 15° cutters to correct improper seat location in the manner described on following page.

	Standard Width
Seat Width	1.0 ± 0.1mm

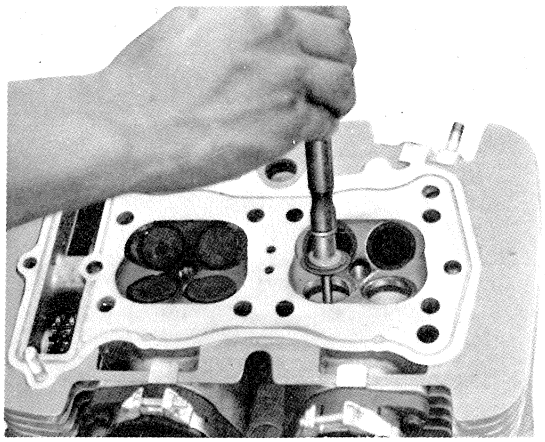


(A) If valve face shows that valve seat is centered on valve face, but is too wide, then lightly use 15° cutter to reduce the seat width to 1.0±0.1mm.

(B) If seat is in the middle of valve face, but is too narrow, use the 45° cutter until the width equals 1.0±0.1mm.

(C) If seat is too narrow, and very near the valve margin, then first use the 45° and flat cutters to get the correct seat width.

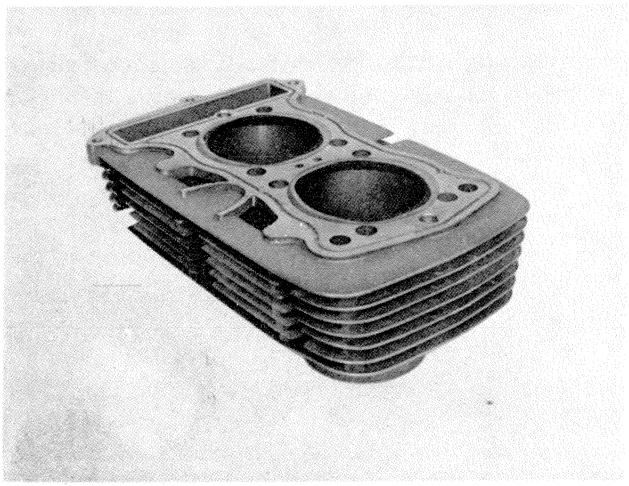
(D) If seat is too narrow and very near the bottom edge of valve face, first use the 15° cutter and then the 45° cutter.



Lapping the valve/valve seat assembly

a) The valve/valve seat assembly should be lapped if, (1) neither the seat nor the valve face are severely worn, or (2) if the valve face and valve seat have been resurfaced and now require a final light grinding operation for perfect sealing.

b) Apply a small amount of coarse lapping compound to valve face. Insert valve into the head. Rotate valve until there is a burnished spot all the way around valve face. Clean off the coarse compound, then follow the same procedure with fine compound. Continue lapping until valve face shows a complete and smooth surface all the way around. Clean off all compound material. Apply blueing dye to valve face and rotate valve face for full seat contact which is indicated by a shiny surface all around valve face where the blueing has been rubbed away.

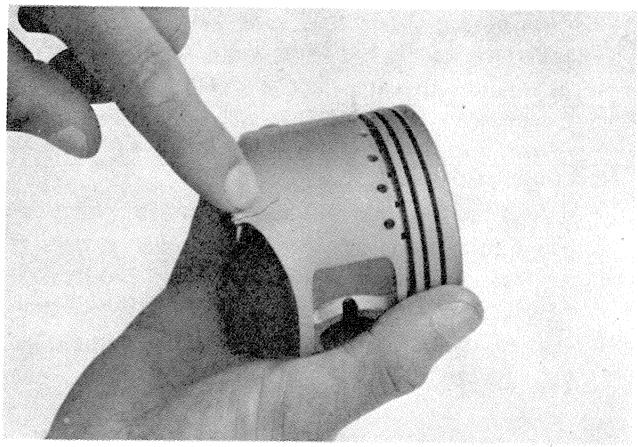


CYLINDER, PISTON and CAM CHAIN TENSIONER

Description

Cylinder

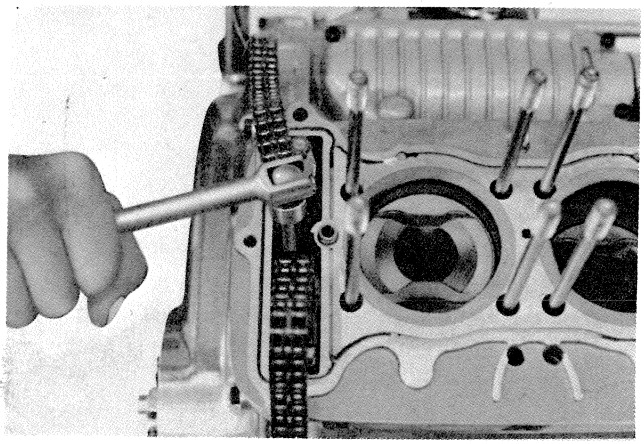
Being made of aluminum, this cylinder with cast iron sleeves installed, is superior in wear proof and radiation. As a structual feature, cam chain channel is fixed at the right-hand side of the cylinder, air passages for cooling are located between the right and left cylinders and between the left hand-side cylinder and cam chain channel, and large radiating fins are fixed (in order to have a large radiating area or to have a large area of contact with the air) in order to increase effectiveness of even radiation.



Piston

The piston crown is flat. It also has four relief areas for valve head clearance during engine operation. The relief areas are unequal in size since the intake valves are larger than the exhaust. An arrow is stamped on the crown to indicate piston position for installation. The piston must be installed with the arrow pointing forward.

Oil drain holes have been drilled in the oil scraper ring groove, and in the piston wall just beneath the bottom groove. This provides an escape path for oil scraped off the cylinder wall. It also provides a path for lubrication of the piston pin and bushing.



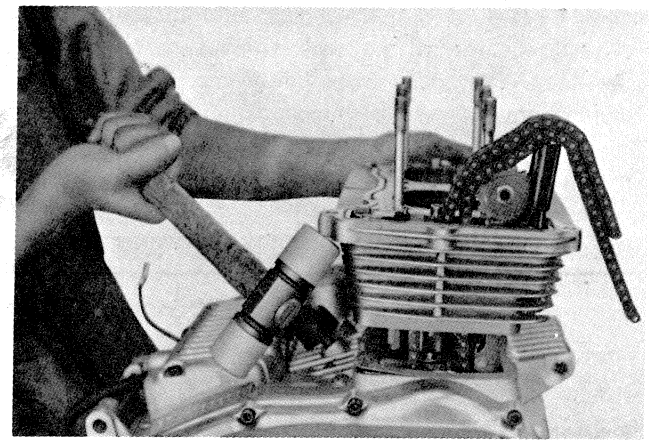
PISTON RING, TENSIONER

Disassembly

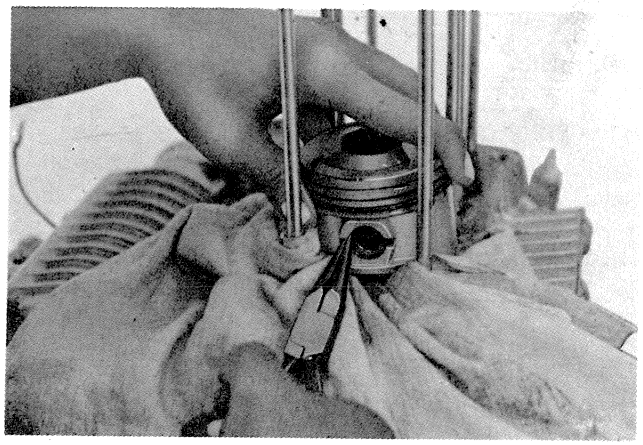
1. Remove camshaft case. (See page 33)

2. Remove cylinder head assembly. (See page 45)

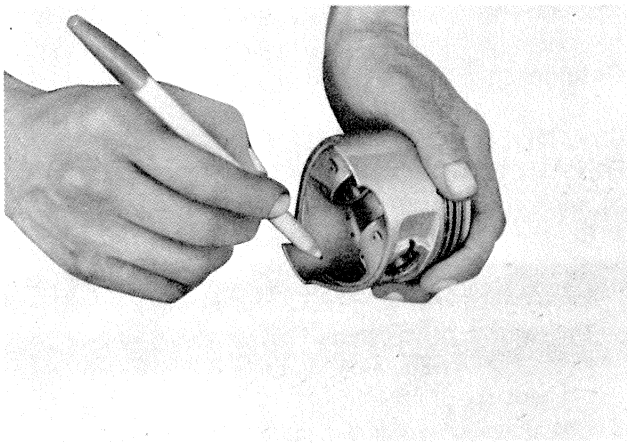
3. Remove cylinder-crankcase mount bolt on the cam chain channel.



4. Remove cylinder by tapping it with a soft hammer. Care should be taken not to break fins.

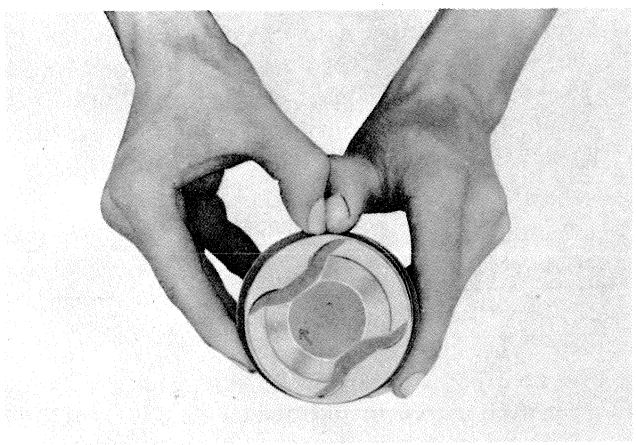


5. Remove outer circlip from each piston. Support piston by hand and push out piston pin using a soft drift pin (do not use a hammer). Lift piston off and set it to one side with piston pin.

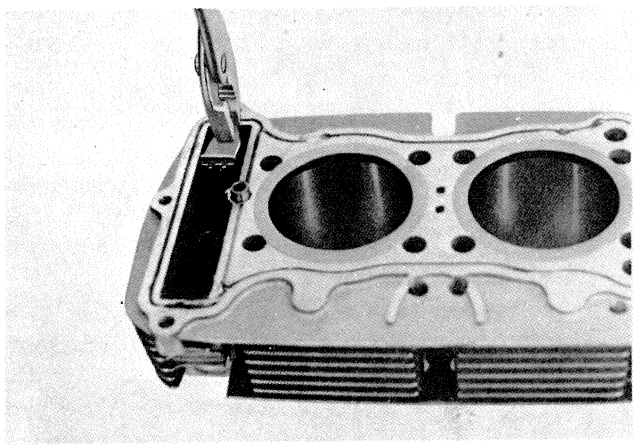


Note:

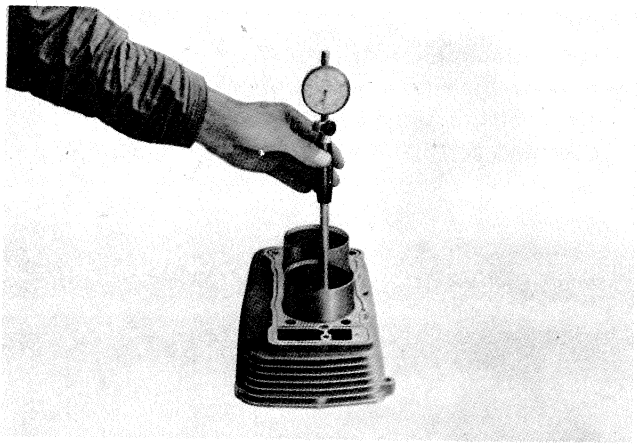
Each piston must be marked as to which cylinder it came from to ensure identical match-up during re-installation. Lightly inseribe an "L" inside left piston skirt and an "R" inside right piston skirt.

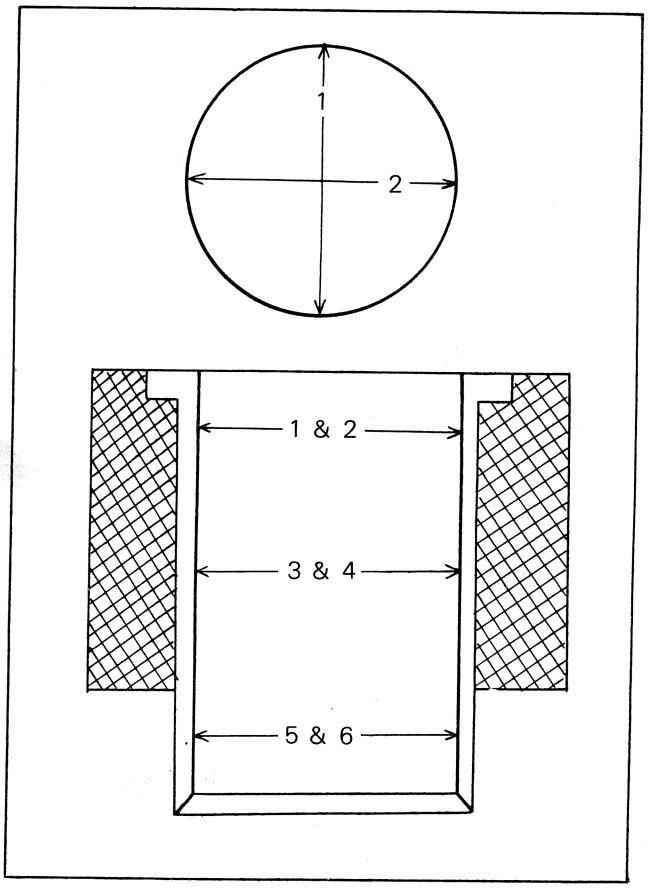


5. Remove piston rings from the piston.
   Push apart piston ring ends with both thumbs so that ring can be slipped out of the groove on the other side with the index fingers.
   Avoid opening ring ends too wide, or ring may be broken. The top ring should be removed first.



6. Using the 13-mm socket wrench and a slotted-head screwdriver, remove cam chain tensioner assembly and cam chain guide.





Inspection

Cylinder

CYLINDER BORE MEASUREMENT and REPAIR PROCEDURES

a) Constant friction between the bore and piston, plus microscopic particles of contamination that enter through the intake, cause a gradual wear of the bore. This wear can be detected by measuring various points in the bore and comparing these measurements against standard specifications.

b) This drawing shows the places to take bore measurements with a cylinder measuring gauge.

c) Subtract the bottom bore measurement from the top bore measurement. The difference between these two dimensions is called the cylinder "taper". Check to see if the amount of taper is still within specified limits.

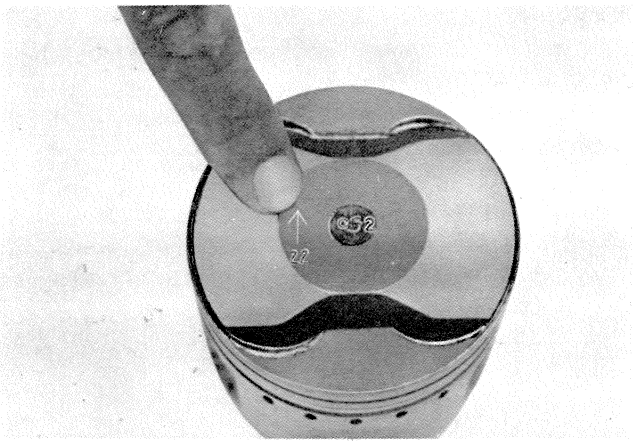
	Standard	Wear Limit
Cylinder Bore (mm)	73.0	73,1
Cylinder Taper (mm)	0.008	0.05

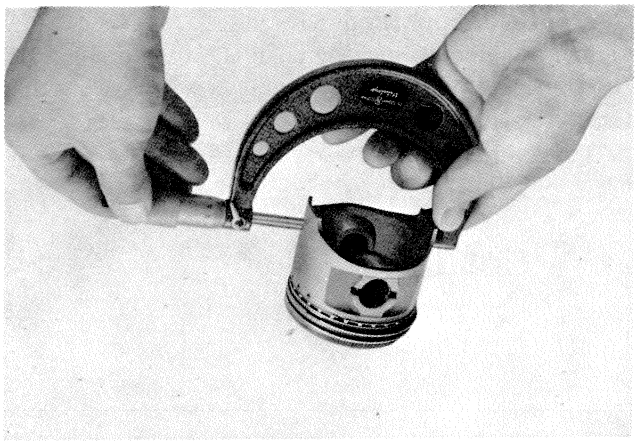
d) The bore might be lightly damaged with scratches or nicks. Run a hone through the bore a few times to see if this removes the blemishes. If these scratches are too severe, a hone cannot remove them, and a cylinder rebore would be necessary. Pistons are available in several oversizes.

Note:

The hone should be used in a low rpm drill and the hone should be moved through the entire bore at an even speed. This should result in a "cross-hatch" pattern which aids ring seating.

e) If the cylinder has been in use for many miles, a ridge may form at the upper edge of the bore. This is mostly carbon. Normally this ridge can be removed by scraping with a soft scraper (to prevent damage to the bore). This ridge is automatically removed when cylinder is bored. Care should be taken that the ridge is completely removed if the cylinder is just to be honed. If scraping does not remove the ridge, previous to honing, a ridge reamer must be used to finish removing the ridge (reamer is commercially available).





Piston

PISTON DIA. MEASUREMENT and WEAR CHECK

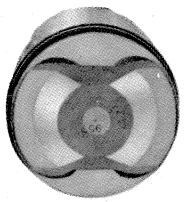
a) First, check piston for cracked or broken sections, including the crown, ring lands, and skirt. Also check piston crown for possible metal disintegration due to excessive heat in the combustion chamber.

b) If severe score marks are found on the skirt, this can be attributed to insufficient lubrication sometime during engine operation or improper clearance. If these marks can be removed with a fine emery cloth the piston can be used again.

c) All of the above wear conditions may require piston replacement (except as noted). If a defective piston is re-installed, the engine will not perform satisfactorily and premature engine failure may occur.

d) Check for additional wear by measuring piston diameter 10 mm (2/5") from the bottom of skirt and at right angles to piston pin holes. Piston standard size is 73 mm.

e) Standard piston wear usually does not exceed 0.05 mm. This measurement is important when determining piston-to-cylinder clearance.

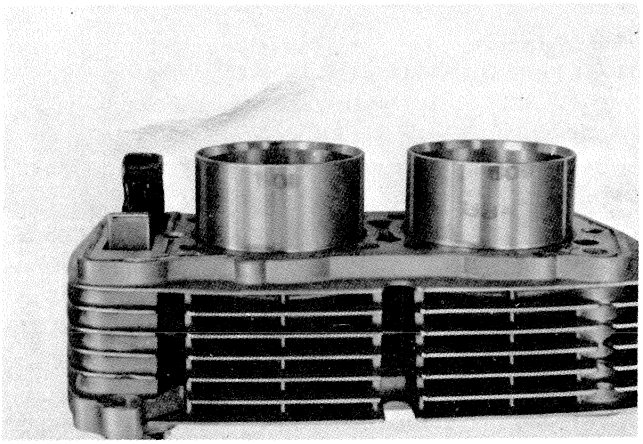


"Piston Clearance"

a) Piston-to-bore clearance is the difference between minimum cylinder bore measurement and maximum piston diameter. Standard clearance is .050 - .055 mm (.0020" - .0022"). If measurements prove that the clearance equals 0.15 mm or more, it is excessive, and one of two corrective measures must be taken to bring the clearance back within tolerances.

b) If cylinder taper is within tolerances, and if the cylinder can be cleaned up by honing, then obtain a larger size standard piston that is large enough to obtain the correct clearance.

c) Bore and hone out the cylinder to the size of a first oversize piston, plus the correct clearance.



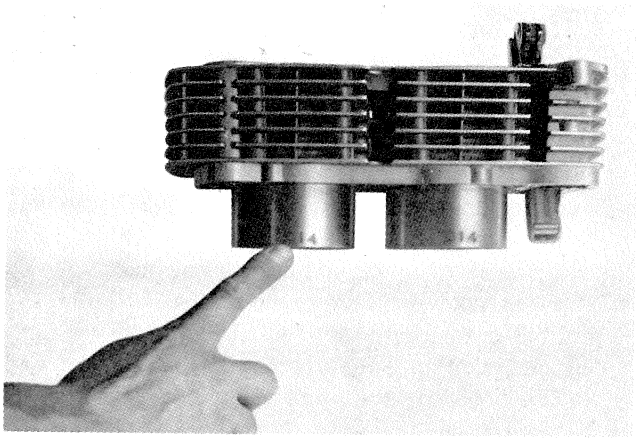
d) **How to Calculate Standard Size Piston-to-Cylinder Clearance from Stamped Numbers**

Nominal piston standard size is slightly less than 73mm. The number stamped on the piston crown is the actual undersize. (The 72 is dropped.)

Example:

.956 on crown really means 72.956 mm piston diameter, or .044 mm undersize.

Cylinder standard bore size is marked in large numbers on the very bottom of the cylinder. It equals 73 mm PLUS the amount marked.



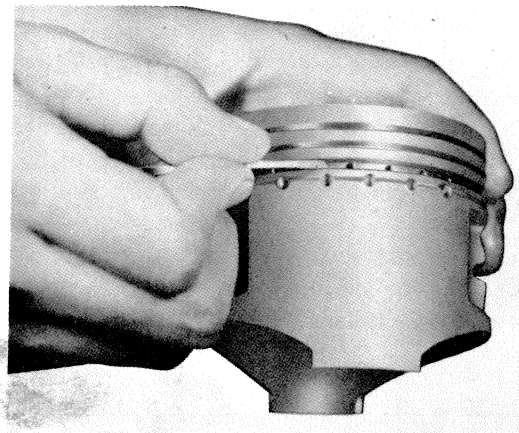
Example:

.007 marked on cylinder really means 73.007 mm cylinder bore, or .007 mm oversize.

If the above piston is used with this cylinder, total clearance would be .051 mm (.0020").

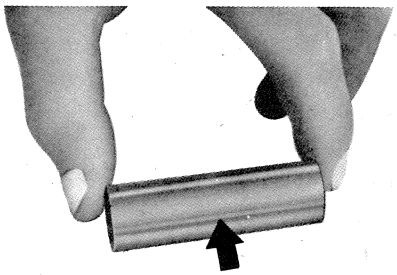
Example:

73.007 (Cylinder)
72.956 (Piston)
.051 (Clearance)



Clearance Piston Ring Grooves

Carbon and varnish gradually build up in the ring grooves. Remove the rings and use the blunt end of a discarded ring to clean all carbon from the grooves. Check to make sure the oil relief holes are not blocked.



Blue discoloration.

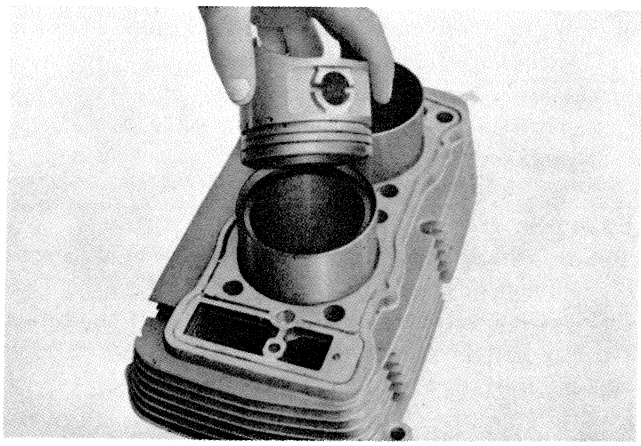
Piston Pin

a) The piston pin oscillates in a bushing. Check the piston pin wear. If any exist, replace the pin or connecting rod. However, a dull finish at the center section of the pin may be noticed. It is normal operating wear and does not indicate a defective pin (unless this dull surface is pitted).

b) Check the pin for blue discoloration. This discoloration is caused by heat and is an indication of inadequate lubrication. The pin should be replaced and the lubrication system checked.

Caution

Whenever the piston pin is replaced, check the connecting rod small end for wear which might require rod replacement.



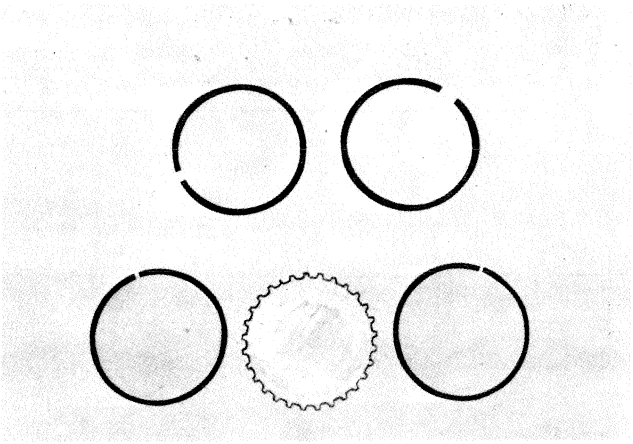
Piston Rings

a) All three rings experience the same type of wear. Any check applied to one ring can be used also to test the others.

b) Before checking for wear, clean all carbon from the ring surface. This insures an accurate wear check.

c) Check for gaps between the ring contacting edge and the cylinder wall. Push the ring into the bore (with an inverted piston to make sure it is not cocked). Slip a piece of white paper beneath the cylinder bore (for visual contrast) and check the outer perimeter for visible gaps between the ring and the cylinder wall.

d) With the ring still positioned in the bore, check end gap clearance with a feeler gauge. Standard specifications and maximum wear limits are listed following page.



Note:

The end gap on the expander spacer of the oil control ring is unmeasurable. If the oil control ring rail show excessive gap, all three components should be replaced.

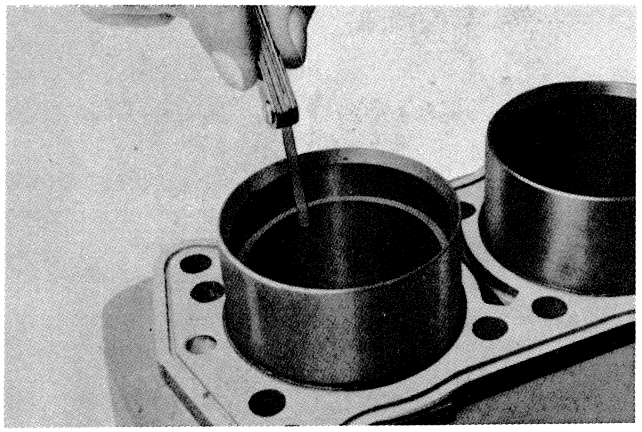
	Standard Gap (mm)	Wear Limit
Compression Ring	0.2 - 0.4	0.8
Wiper Ring	0.2 - 0.4	0.8
Oil Control (Rails)	0.2 - 0.9	1.3

e) Piston ring/ring groove fit must have correct clearance. If the piston and ring have already been used in the engine, the ring must be removed, the ring groove cleaned of carbon, and then the ring should be re-installed. Use a feeler gauge to measure the gap between the ring and the land. The standard tolerance is 0.04mm (.0016") to 0.15mm (.0032"). The wear limit is 0.08mm (.006"). The second standard tolerance is 0.03mm (0.0012") to 0.07mm (0.0028").

Note:

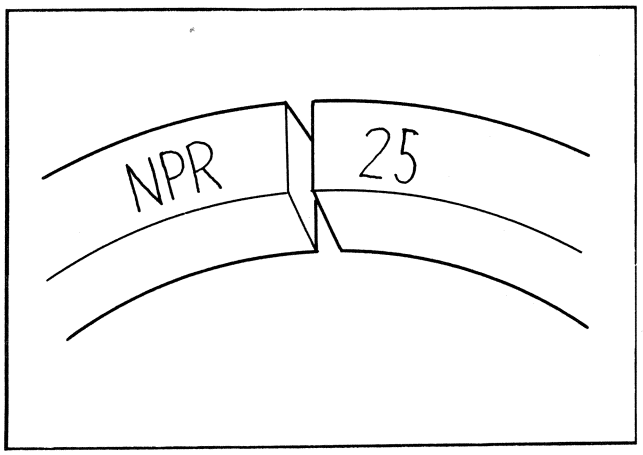
There must be no side gap clearance at all on the oil control ring. If any clearance exists, the expander spacer has become fatigued. Replace the ring.

f) If any of the previous three wear checks prove any of the rings to be worn beyond acceptable tolerances. REPLACE THE ENTIRE SET.



Caution

Whether the rings are new or used, they must always be checked for correct ring end gap clearances. This applies to all three piston rings.

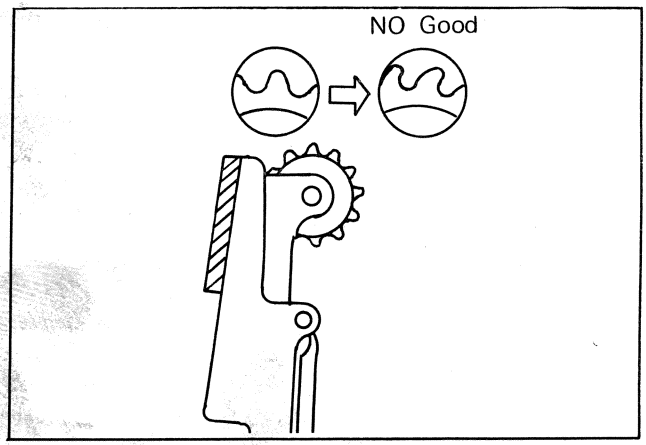


Piston ring (standard and oversize) identification Code

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

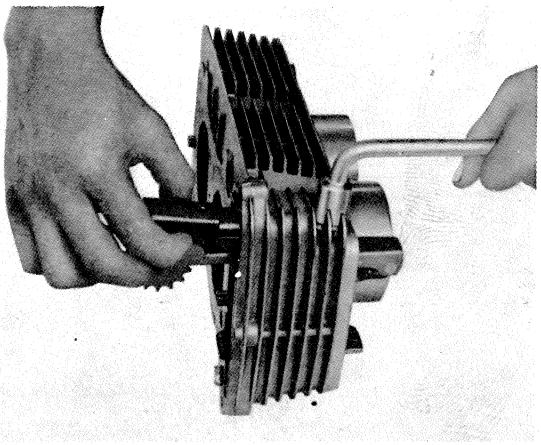
b) All three pieces of the bottom (oil control) ring are colorcoded to identify sizes. The color marks are painted on the ring, 180 opposite the end gap.

	SIZE	COLOR CODE	
Oversize 1st	25 (0.25mm)	Blue	(2 marks)
2nd	50 (0.50mm)	Red	(1 marks)



CHAIN TENSIONER AND CHAIN GUIDE

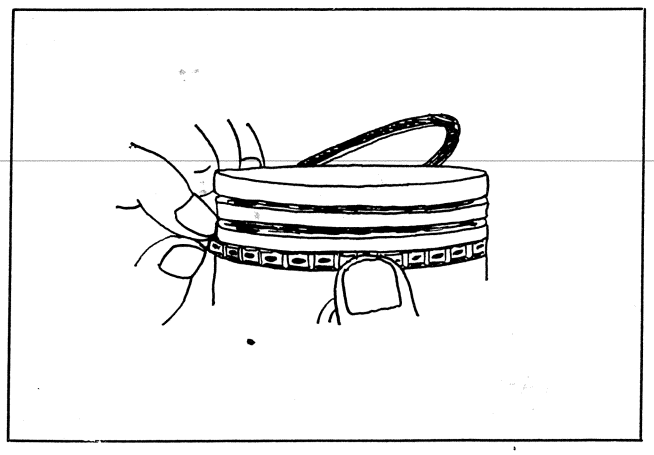
By turning the sprockets with the fingers, check them for smooth rotation. Also check the sprocket teeth for deformation (see the illustration). Check the spring for fatigue and smooth return.
Check the chain guides for wear resulting from contact with the chain.



CHAIN TENSIONER AND PISTON RING

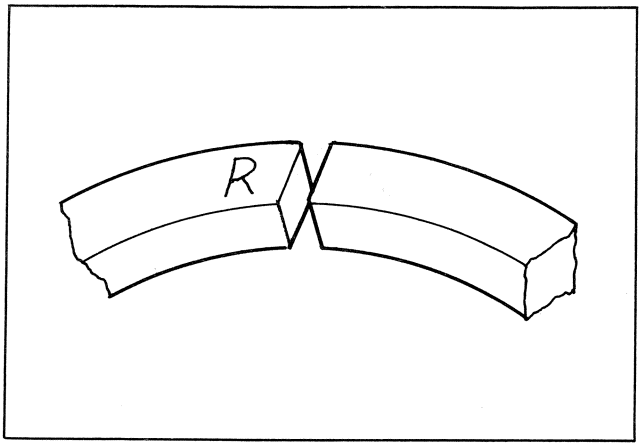
Installation

1) Install the cam chain tensioner and chain guides on the cylinder block.
After temporarily tightening tensioner mounting nuts, push tensioner sprockets down so that tensioner spring is compressed. Then turn in the nut until tight.

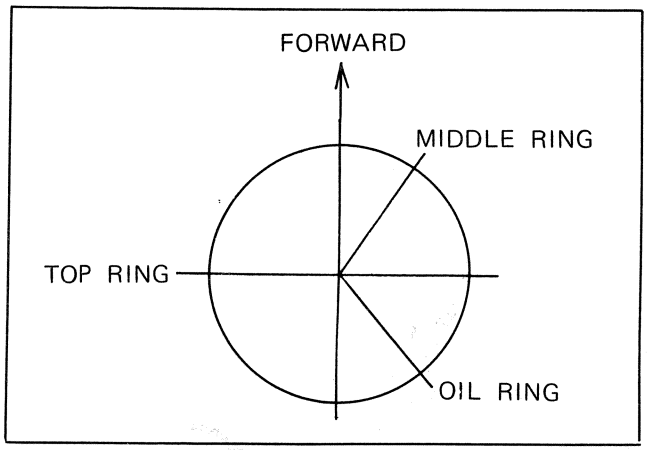


2) Piston ring installation is basically a reversal of the removal process, except for the bottom (oil control) ring.

a. Oil control ring installation (Installed first):
The oil control ring consists of three separate parts, two identical rails and one expanding spacer. First, slip the spacer over the piston, and into the bottom groove. Neither rail has a particular top side. So install one rail into the bottom part of the groove and then position the last rail, either side up, into the top part of the groove. Finally, position the three end gaps approximately 120° from each other.

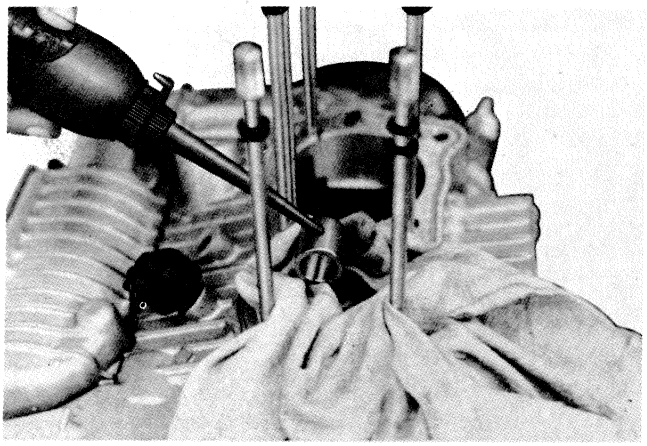


b. Middle and Top Ring Installation
Install the middle ring and top ring. Each ring is stamped with an "R" on one side that must face up toward the piston crown when installed.

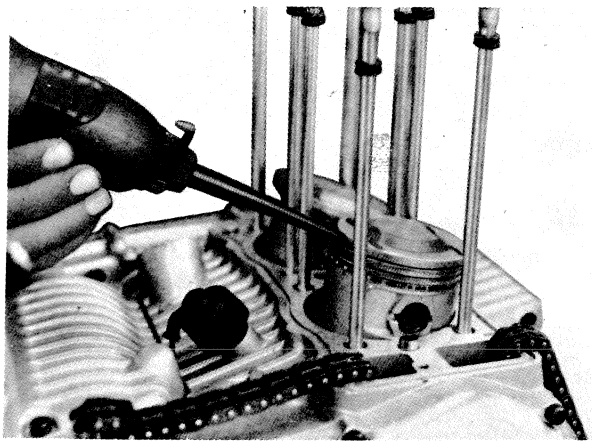


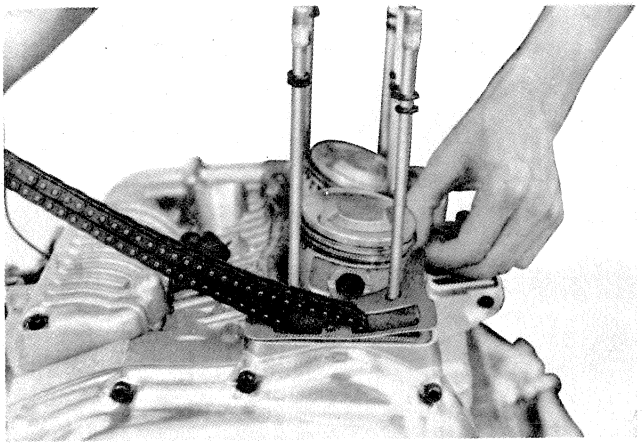
c. Spacing of All Ring End Gaps
All ring end gaps must be off-set from one another to prevent the leakage of compression and oil. Stagger their positions evenly around the perimeter of the piston.

Note:
The oil control ring has three gaps. Use the top rails gap to judge where the compression and wiper ring gaps should be aligned.

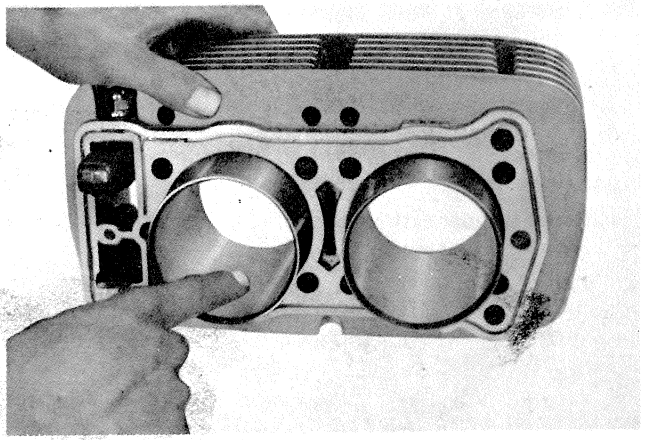


3. Sparingly oil piston pin, insert it into a piston boss, and connect the connecting rod to the piston pin. Then install one piston pin circlip on each end of the piston pin. To prevent anything from falling into the crankcase, cover the crankcase with a cloth.
After installing, make sure that the circlip is snugly fitted in the piston pin clip groove. Always use new circlips.

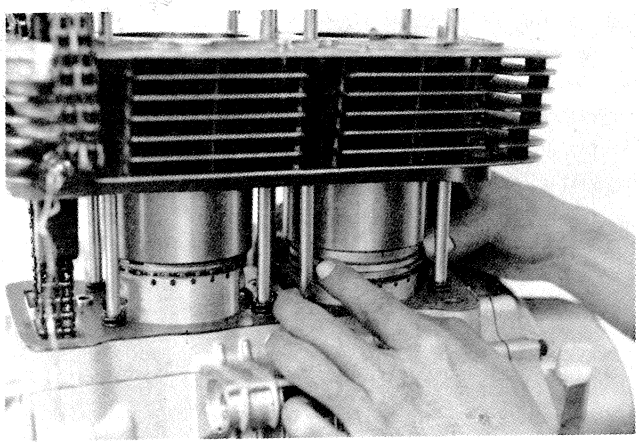




4. Make sure crankcase and cylinder bottom matching surfaces are clean, then install a new base gasket.

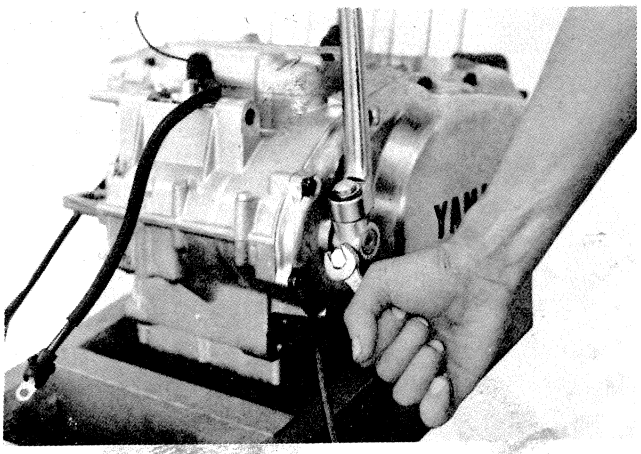


5. Oil the cylinder wall, piston and piston rings. Hold piston rings with both hand. Then insert piston into the cylinder.



Caution

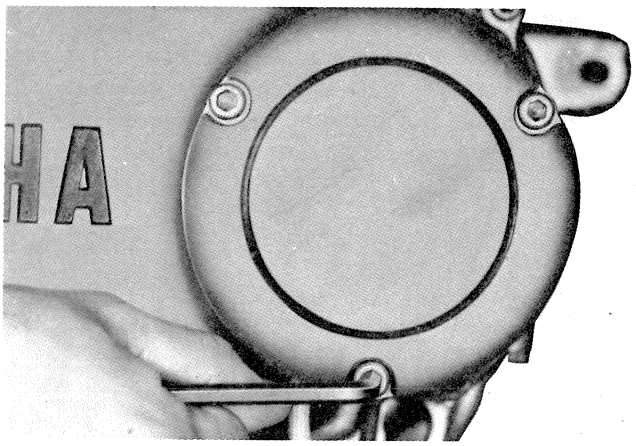
Before putting piston into the cylinder, make sure that all ring end gaps are off-set 120° from one another.



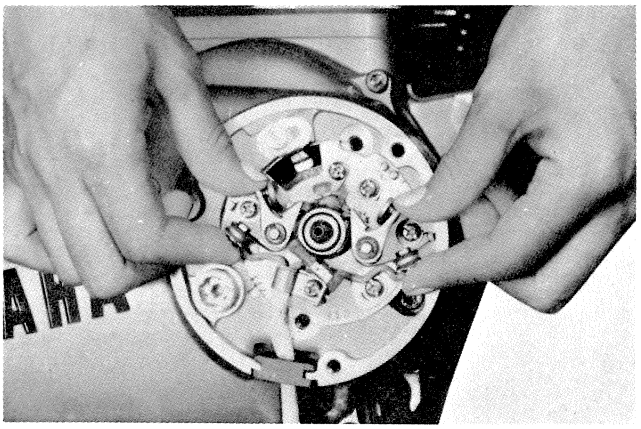
KICK CRANK, CRANKCASE COVER (R)

Disassembly

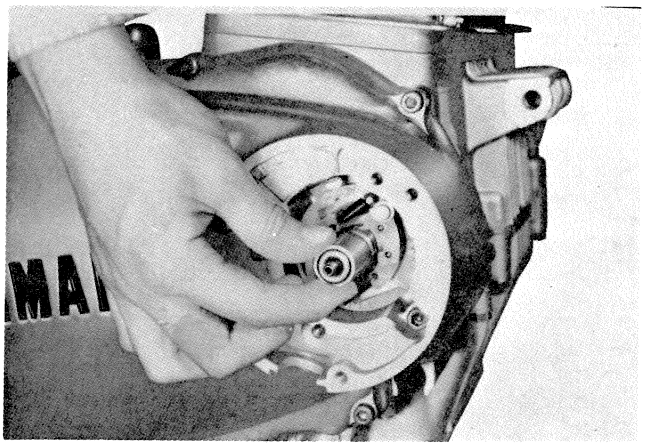
1. Remove kick crank mounting bolt, and remove kick assembly



2. Remove the three breaker cover holding bolts, using the 5-mm hexagonal wrench, and remove breaker cover.



3. Using a slotted-head screwdriver, remove the two breaker base holding screws, and remove breaker assembly.

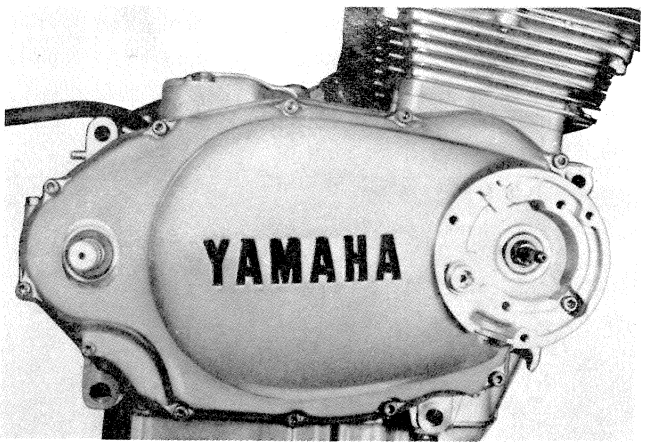


4. Remove the 10-mm nut, spring washer and plain washer, and pull off spark advance assembly with cam (governor assembly) from breaker shaft.

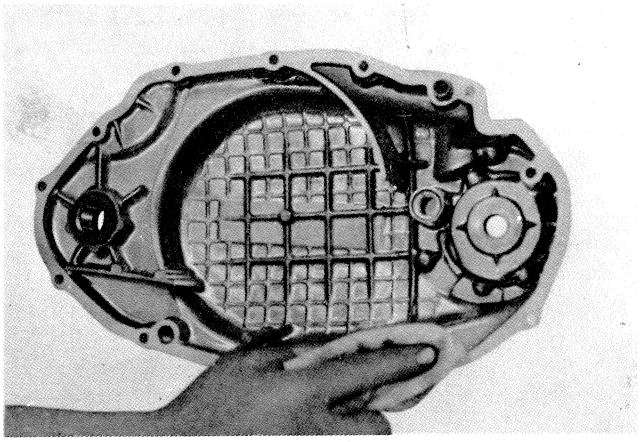
Caution

The crankcase cover can be removed without removing timing plate from crankcase cover. On the TX500A, the mark on the timing plate is used for ignition timing adjustment, and therefore, readjustment is necessary, should timing plate be removed.

For details of ignition timing adjustment, see "Setting the Ignition Timing" on page 152.

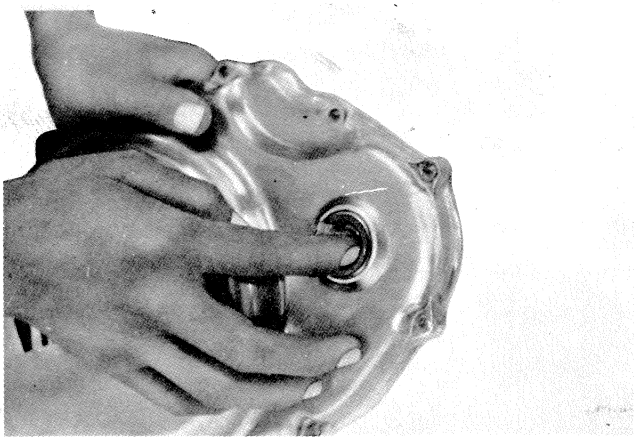


5. Remove the 12 crankcase cover (R) holding bolts using 5-mm hexagonal wrench, and remove crankcase cover (R). Light tapping with a soft hammer may be required to loosen cover. Never pry cover off as gasket surfaces will be damaged.



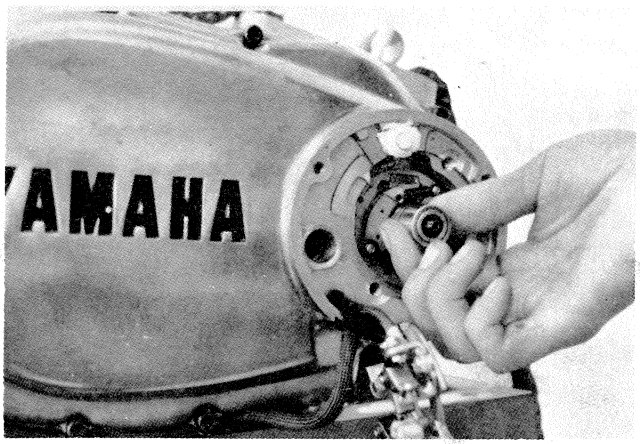
Installation

1. Thoroughly clean the sealing surfaces of the crankcase and crankcase cover. Replace gasket with a new one. The crankcase has two locating pins. Make sure these pins are in place.



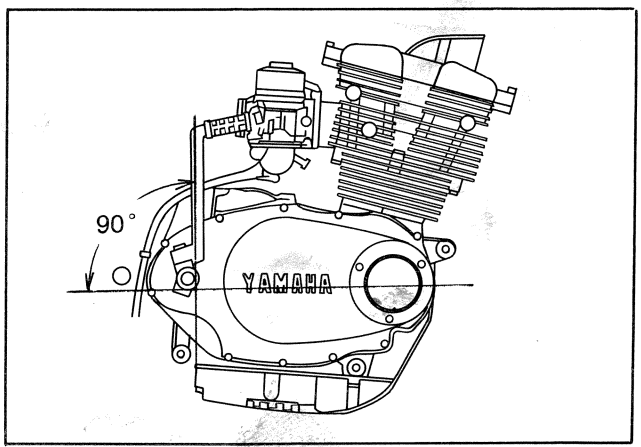
2. Sparingly grease the lips of crankcase cover oil seals, and install crankcase cover on crankcase.

   Tightening torque: 70-90 in-lbs (0.8-1.0 kg-m)



3. Install spark advance assembly and contact breaker assembly, and install breaker cover.

   Tightening torque: 70-90 in-lbs (0.8-1.0 kg-m)

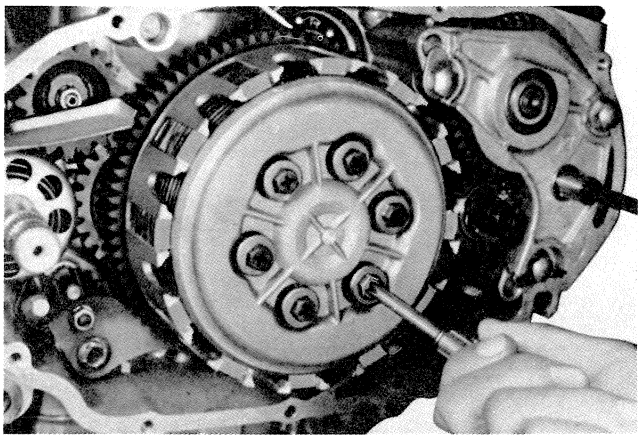


4. Mount kick crank assembly on kick crankshaft. The kick crank must be positioned almost at right angles to ground. If it is impossible because of the serration, the kick crank should be so positioned that it slightly leans over to the front side of the engine.

CLUTCH

Description

This clutch consists of 8 friction plates, and 7 eccentric clutch plates as a countermeasure for the noise of clutch, using the wet type multi-disc and the inner-push type. In this section, particular care should be taken in assembling the eccentric clutch plates and inserting them into clutch boss.

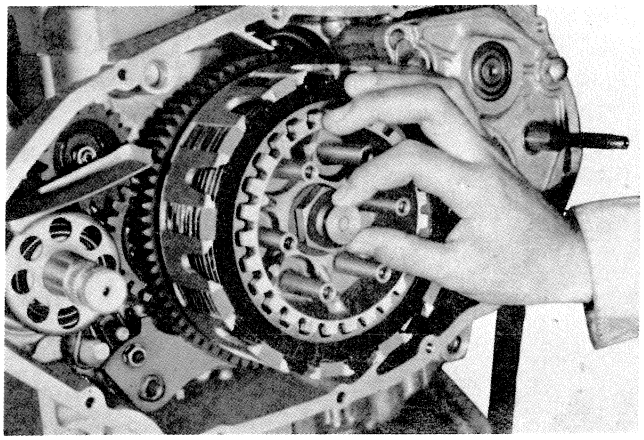


Disassembly

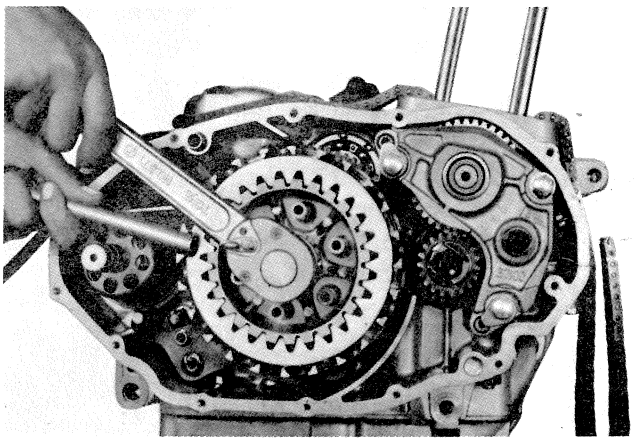
1. Remove all six clutch spring screws and pull off pressure plate.

Note:

Loosen the screws in easy stages using a cross pattern.



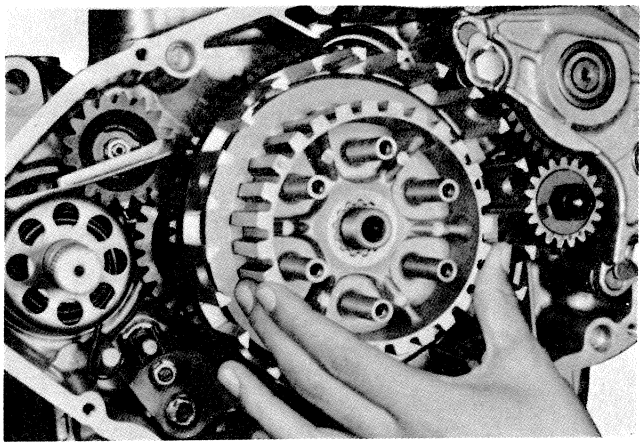
2. Pull out the push crown, the ball directly behind the push crown, and the push rod behind the ball.
   The push rod is most easily removed from the other end of the main shaft.



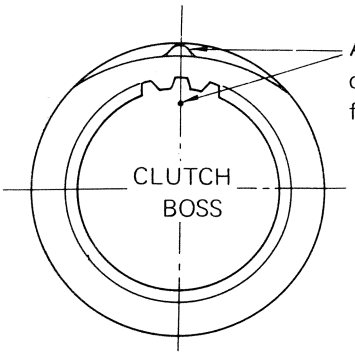
3. Hold the clutch unit with the holding tool (in the Special Tool Kit), and unscrew the clutch boss 29mm lock nut.

Note:

When removing the cam chain sprocket assembly, breaker shaft assembly and drive gear, bend the lock washer flat, and loosen the drive gear mounting bolt using the 10mm hexagonal wrench.

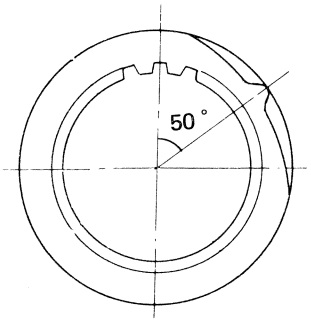


4. Slide out the clutch boss and clutch plates. Behind the boss are two thrust wahsers with flat thrust bearings in between. Remove these parts.



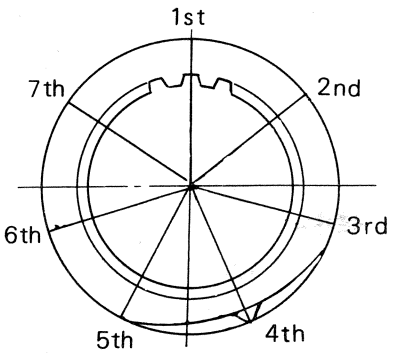
Align the projection with the center of cut-away of the first clutch plate.

#1

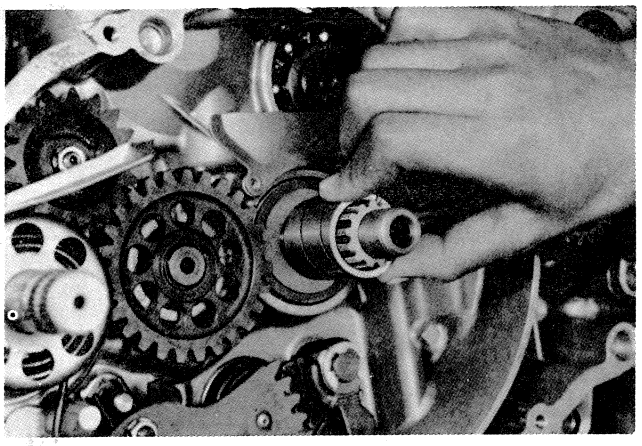


#2

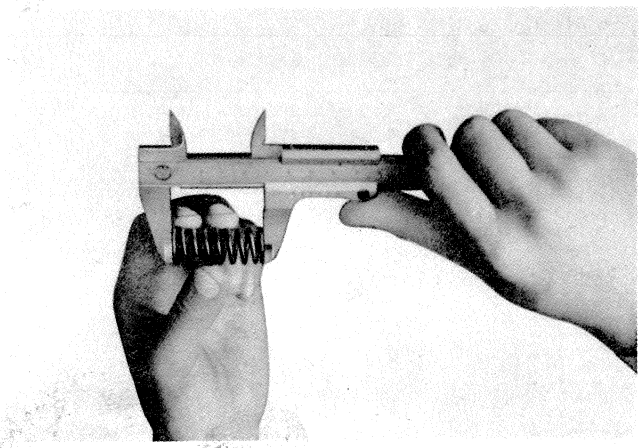
The centers of cut-aways of other clutch plates must be off-set approximately 50° from one another.



#3



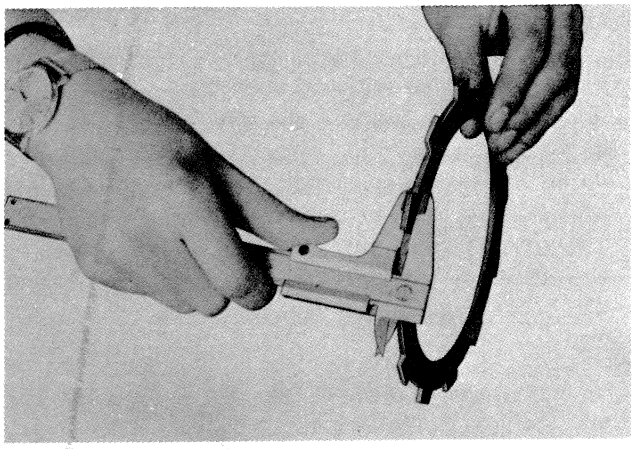
5. The clutch housing with the pump drive gear is now free. After pulling housing off, slide off clutch bushing spacer and thrust plate behind spacer. To remove thrust plate, the pump idle gear must be removed.



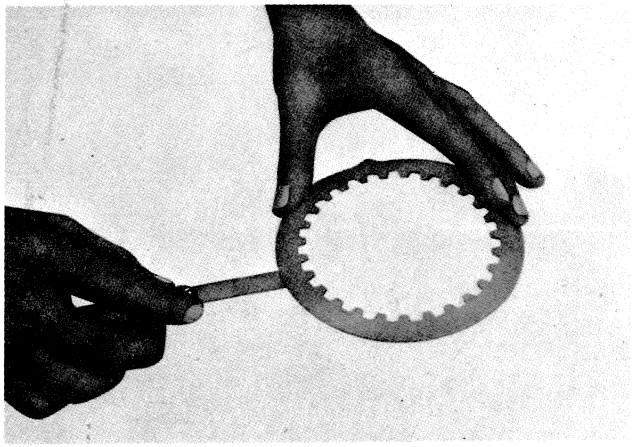
Inspection

1. Measuring free length of clutch springs.
   Measure spring free length with vernier caliper. If standard length has shortened by 1mm (0.04") or more, replace spring.

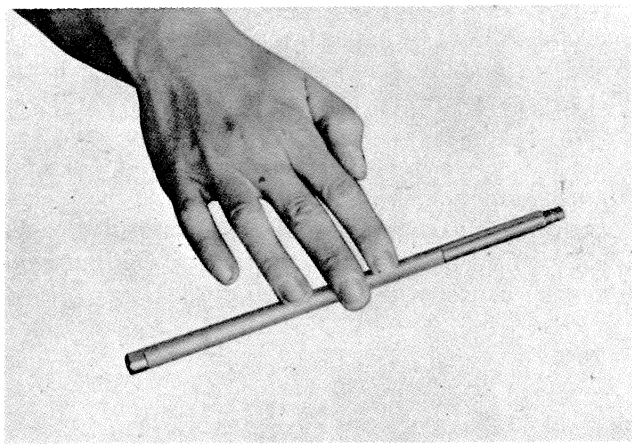
   STANDARD FREE LENGTH: 42.8mm (1.68")



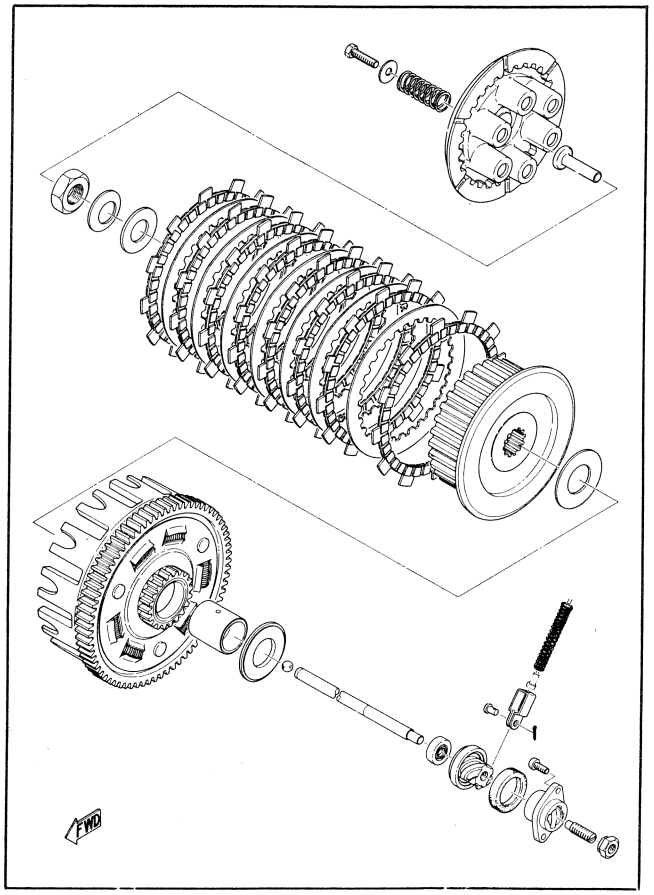
2. Measuring thickness of friction plates.
   Standard thickness is 3.0mm (0.118"). If wear has decreased the thickness to 2.8mm (0.112") replace the plate (measure at two or three points).



3. Measuring clutch plate warpage.
   a) These plates must be flat. Lay each one on a surface plate and check both inner and outer edges for signs of "dishing" (a bow in plate surface). Replace plate if warpage exists.
   b) Run a feeler gauge around the inner and outer edges. Replace any plate that is warpped sufficiently to permit a 0.2mm (0.008") feeler gauge to slide under either edge.



4. Measuring bend of push rod.
   Roll the push rod over a surface plate, and measure the bend with a feeler gauge. If it measures more than 0.2mm (0.008"), or if deep grooves have been worn in the rod, replace it.



Installation

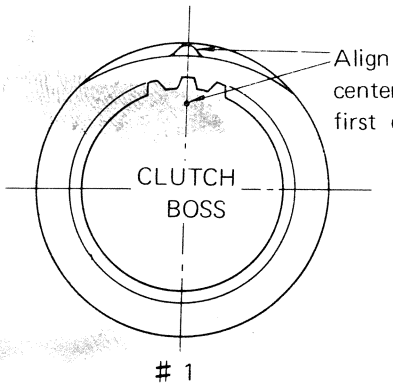
For assembly, reverse the procedure for disassembly, paying attention to the following points.

a. Take care that washers and other small parts are installed in place. That is, don't forget to install a thrust washer on the other side of the pump idle gear (when viewed from the crankcase side), a thrust washer on the other side of the clutch boss, and a thrust washer and a Belleville spring washer under the lock nut holding the clutch housing and the clutch boss.

Note:

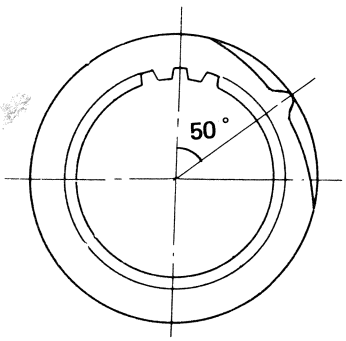
Be sure to install the Belleville spring washer so that it faces in the direction as illustrated.

b. The clutch boss mounting bolt must be torqued to 700 - 800 in-lbs (8.5 - 9.0 kg-m).



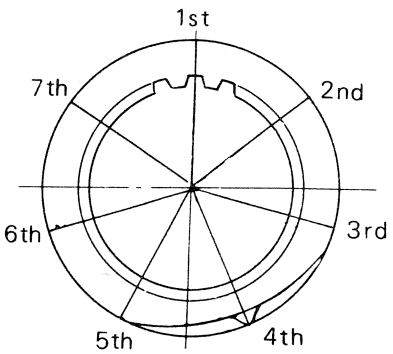
#1

c. In order to reduce noise caused by the clutch plates and clutch boss, each clutch plate is cut away at part of the edge #1. This permits the clutch plate to be thrown outward only in one direction by centrifugal force. Align one of the plate cutaways so that it is centered as shown in #2 with the arrow on the hub. Install a friction plate. Next install a clutch plate 4 notches off from the position of the 1st clutch plate. #3 continue this procedure in a clock-wise direction until all clutch plates are installed.



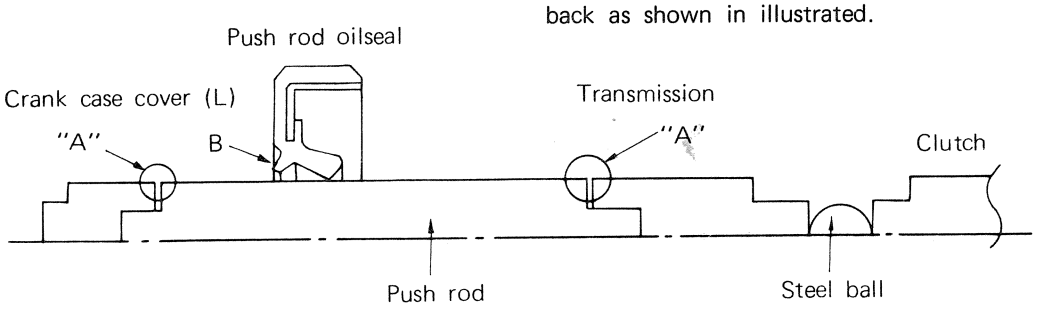
#2

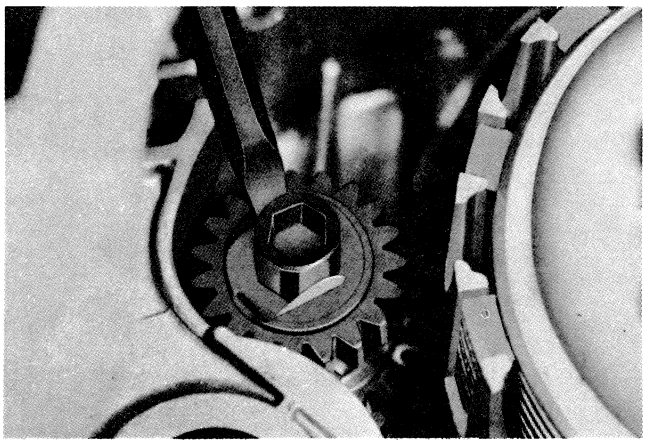
The centers of cut-aways of other clutch plates must be off-set approximately 50° from one another.



#3

d. The push rod must be sparingly greased and inserted into position from the left side of the crankcase. When it is inserted, the push rod seal lip is twisted by the A portion as illustrated of the push rod, and therefore, it is necessary to make sure that the lip is twisted back as shown in illustrated.

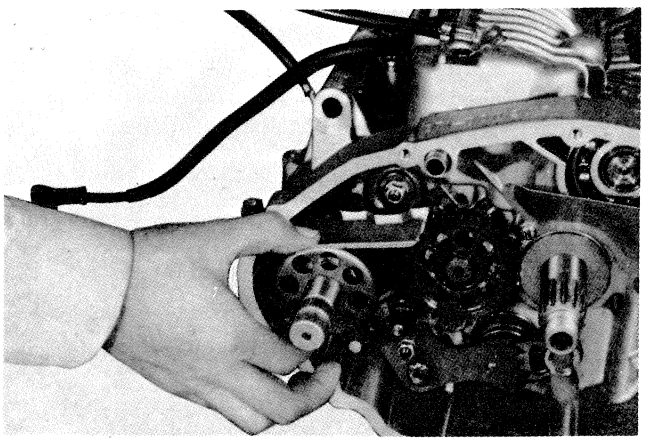




Note:

The primary drive gear is held to the crankshaft by the drive gear mounting bolt, lock washer, and claw washer, together with cam chain sprocket assembly drive gear. To remove primary drive gear, the breaker shaft bracket must be removed. For the procedure for disassembly and assembly, refer to page 69.

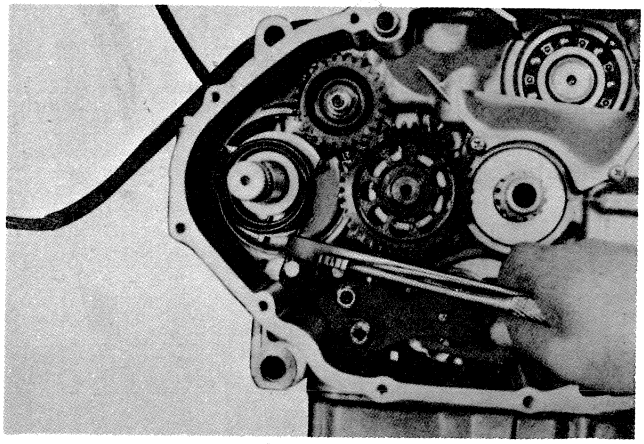
e. If either primary drive gear or primary driven gear is replaced with a new one, it is necessary to properly adjust gear backlash. For adjustment and proper backlash, refer to "Backlash Adjustment".



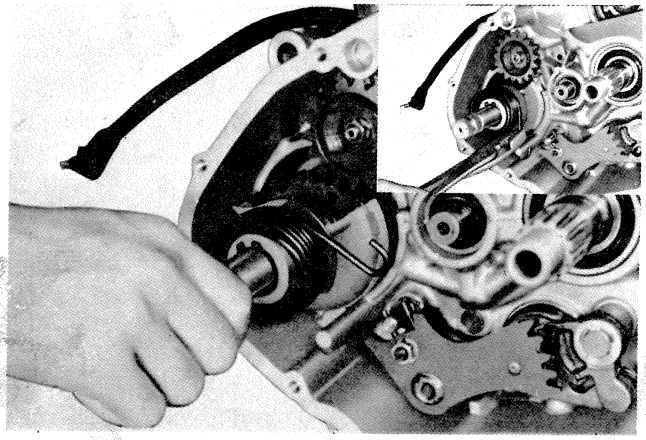
KICK MECHANISM

Disassembly

1. Remove kick spring cover and, using combination pliers, unhook kick spring from crankcase.

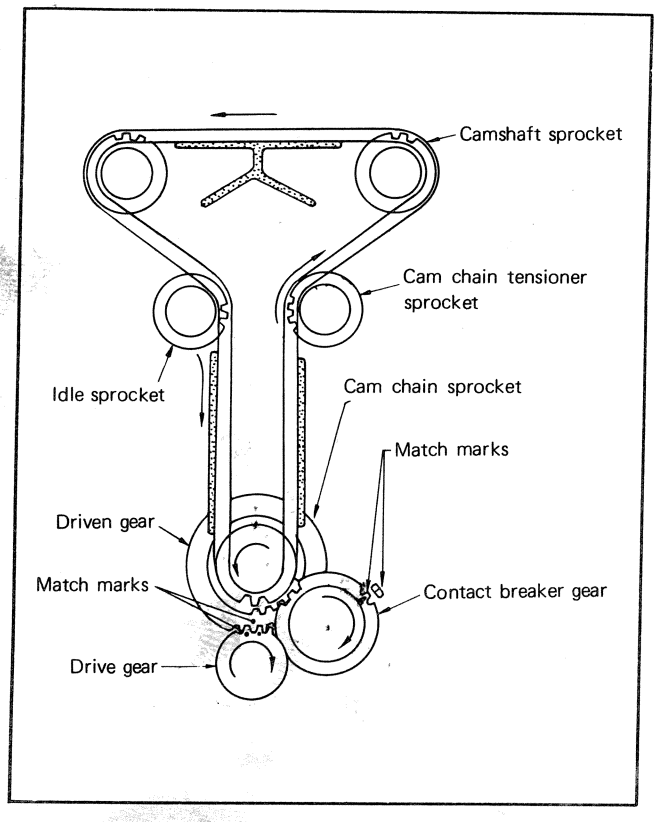


2. Remove kick shaft assembly by pulling toward you.



Installation Note

The kick clip is set in place by the spring guide. Therefore, the kick shaft assembly must be installed so that the spring guide projection must completely fit in the crankcase.

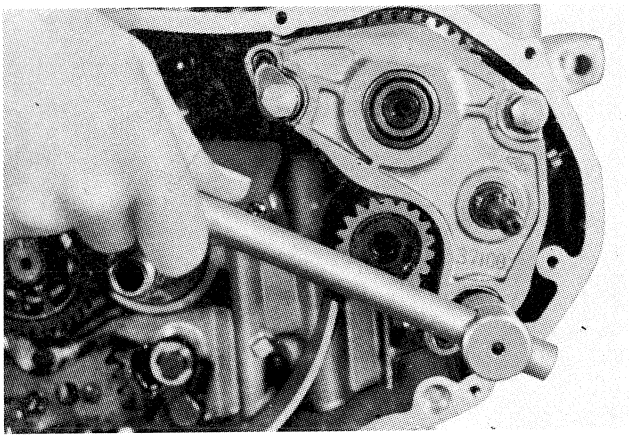


IGNITION AND CAM CHAIN TIMING MECHANISM

Description

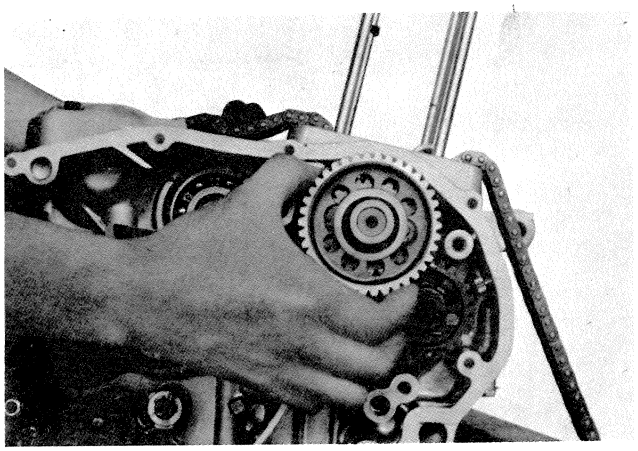
The ignition and camshaft timing is determined by the crankshaft RPM and the relationship between the timing gears. The crankshaft RPM is transmitted to the cam chain sprocket assembly through the drive gear which is keyed to the crankshaft. The cam chain sprocket assembly, driven by the crankshaft, is meshed with the contact breaker shaft assembly.

The intake and exhaust valves are timed to open and close by the camshaft which is driven by the crankshaft through the drive gear, cam chain and cam chain sprocket. If the timing between these gears is incorrectly set, the engine will fail to start. This section deals with the assembly procedure of timing gears.

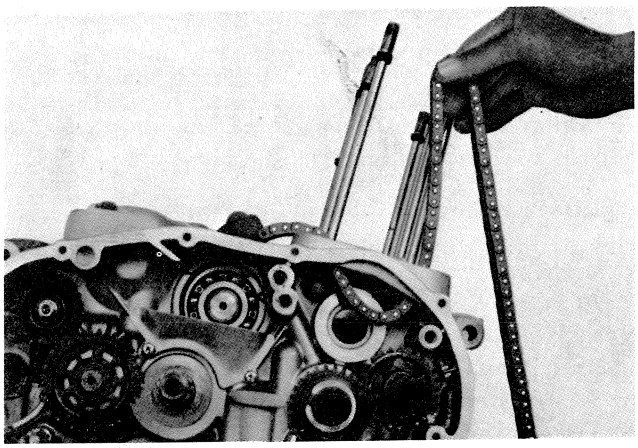


Disassembly

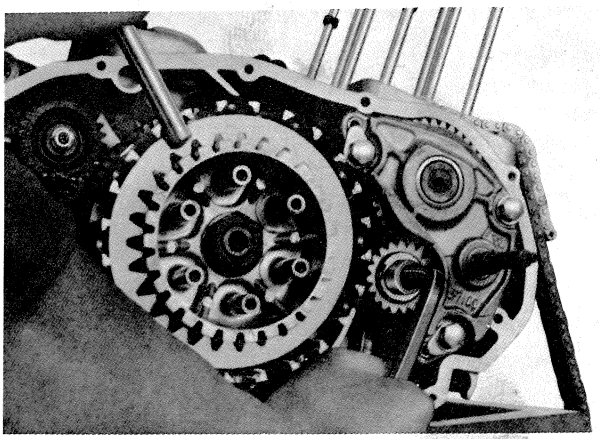
1. Remove the three 13mm bolts, and remove the breaker shaft bracket by pulling toward you.



2. Remove the cam chain sprocket assembly. Note that a washer is mounted on each side of the assembly.



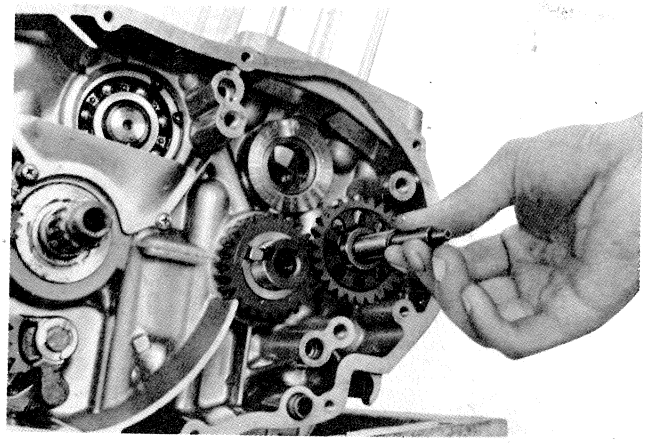
3. Pull out the cam chain.



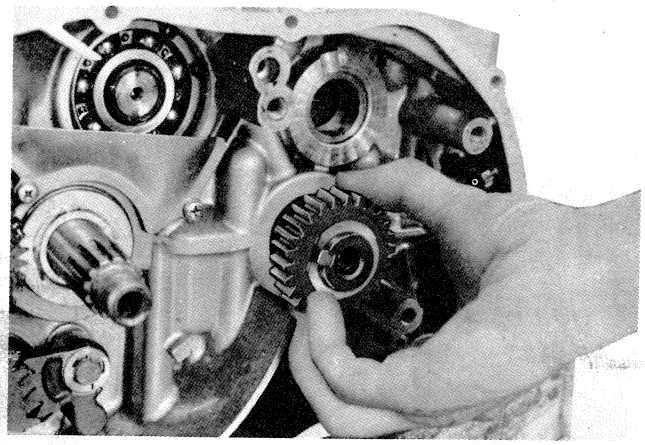
4. Bend the lock washer straight with a chisel, and remove the internal hexagon head bolt using the 10mm Allen wrench. Then remove the claw washer and cam chain sprocket assembly drive gear.

Note:

It is advisable that the internal hexagon head bolt (drive gear mounting bolt) be loosened when the clutch boss mounting bolt is loosened.

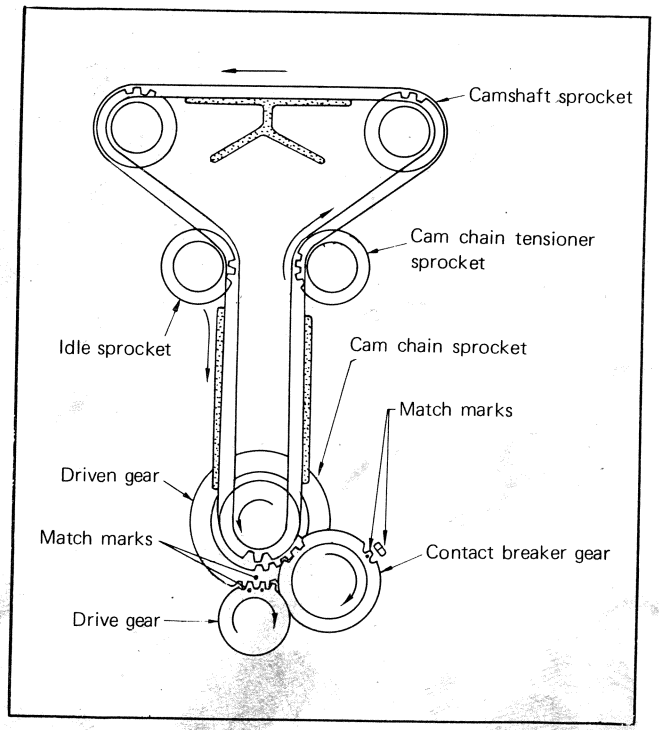


5. Pull the breaker shaft assembly toward you, and remove.



6. Pull the primary drive gear toward you, and remove. Don't forget to remove the square key at the same time. If it is difficult to remove the primary drive gear, use a gear puller.

Installation (Top End Installed)



1. Align mark on drive gear with mark on cam chain sprocket assembly, and install.
   NOTE: If mark on breaker gear is aligned with mark on crankcase, ignition will be correctly timed.

2. Align mark on camshaft cap with locating hole in camshaft. Perform this operation for both intake and exhaust sides.

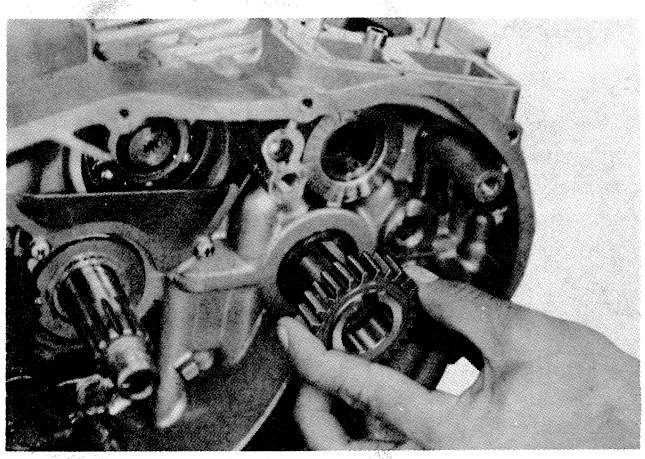
3. Keeping cam chain tensioner depressed with nut, place chain around sprocket.

4. Insert the 10-mm hexagonal wrench into hole in contact breaker housing, and turn crankshaft clockwise so that the "T" (top dead center) mark for the right-hand ("R") cylinder on governor plate is aligned with mark on timing plate.

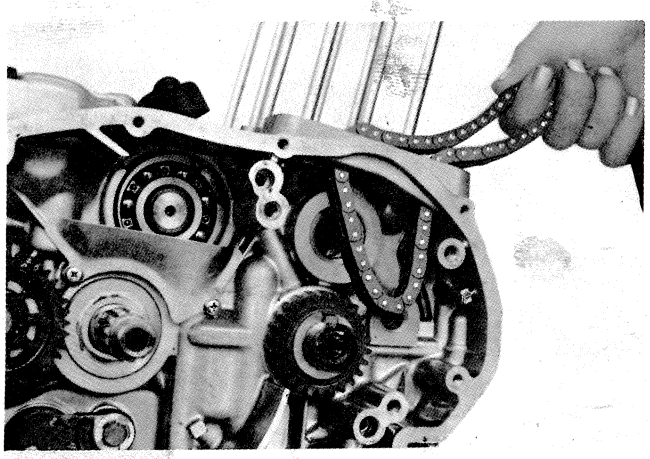
5. Tighten tensioner lock nut.

NOTE: If the cylinder head alone is disassembled and reassembled, procedures #1 and #2 above are not required. Just align the "V" mark on governor base with timing plate. (See illustration on page 149).

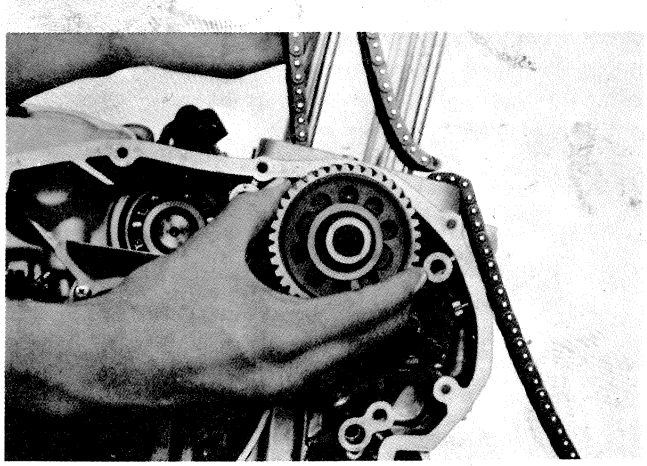
Installation (Top End Removed)



1. Install a square key on the crankshaft, and install primary drive gears.



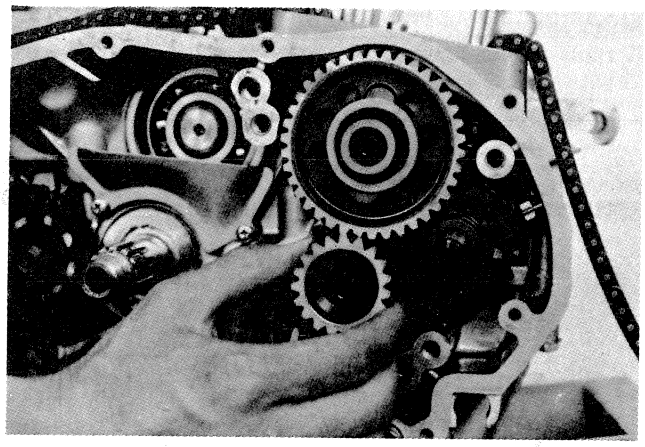
2. Thread cam chain through the two holes in upper part the crankcase.



3. Align mark on drive gear with mark on cam chain sprocket assembly (driven gear), and install this assembly in the crankcase. It is advisable to align mark on breaker gear with mark on crankcase at the same time. All timing gears have now been correctly set.

Note:

Don't forget to install one washer on each side of cam chain sprocket assembly.

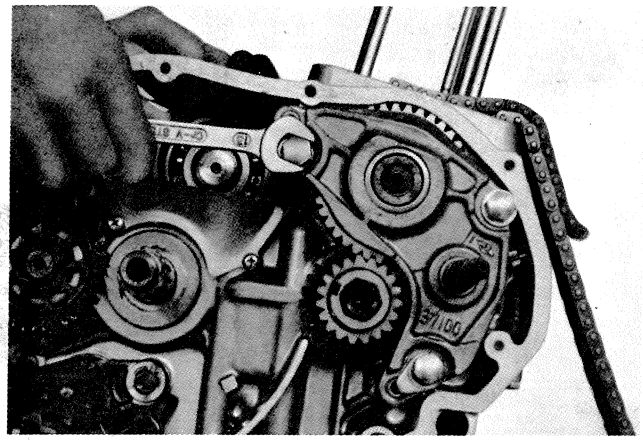


4. Install the claw washer, lock washer and internal hexagon bolt on the crankshaft, and temporarily tighten the bolt. (This bolt can be fully tightened after clutch assembly is mounted.)

   Tightening torque: 310-360 in-lbs (3.5-4.0 kg-m)

5. Install breaker shaft bracket. In this operation, the special washers must be correctly installed in order to hold the two dowel pins in place.

   Tightening torque: 130-220 in-lbs (1.5-2.0 kg-m)



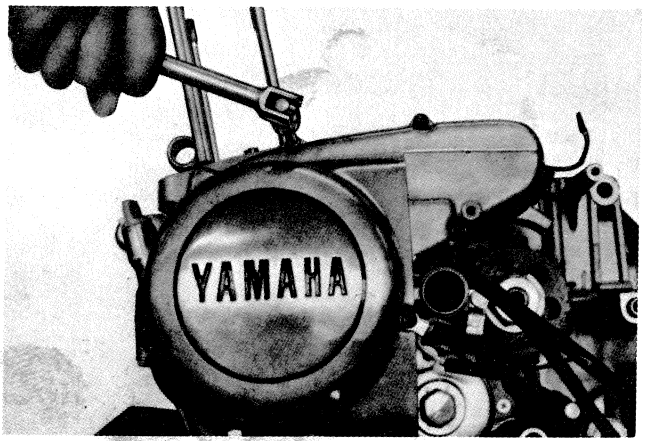
Note on Installation

After steps #1 to #5 above, installation of the ignition and cam chain timing mechanism is now complete.
If the punch marks on intake and exhaust camshafts are aligned with arrow marks on camshaft cap, and the cam chain is installed, the valve timing will be correctly set. (Refer to page 70.)
As for ignition timing, just the fine adjustment is required, because the ignition cam position is already determined by a dowel pin pressfitted into breaker shaft. (Refer to page 149.)

ROUTE OF POWER FLOW FROM THE STARTER MOTOR

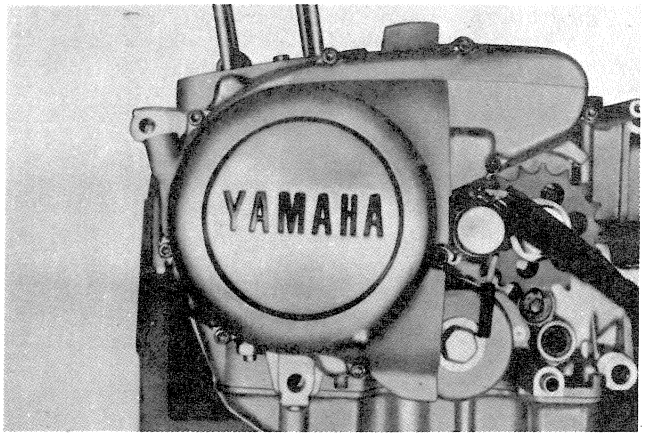
Description of Operation

As the starter button is depressed, the starter motor begins turning. As the starter motor turns, the sprocket held to the starter motor makes the sprocket wheel turn by means of the chain. The sprocket wheel is provided with a one-way roller lock mechanism. As the sprocket wheel begins turning, the one-way clutch is locked. Thus the turning force is carried from sprocket to crankshaft through the chain, sprocket wheel and rotor.
As the engine starts, the crankshaft keeps turning, and the roller lock is released, thus uncoupling starter motor from crankshaft.



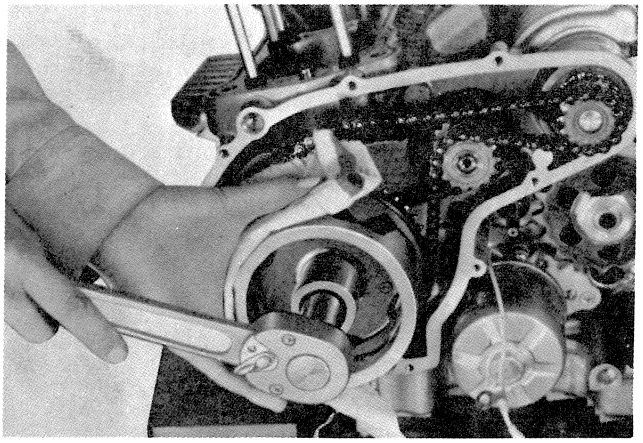
Disassembly

1. Remove nine 5mm internal hexagon head bolts, and remove crankcase cover (L) together with starter coil assembly and field coil assembly.

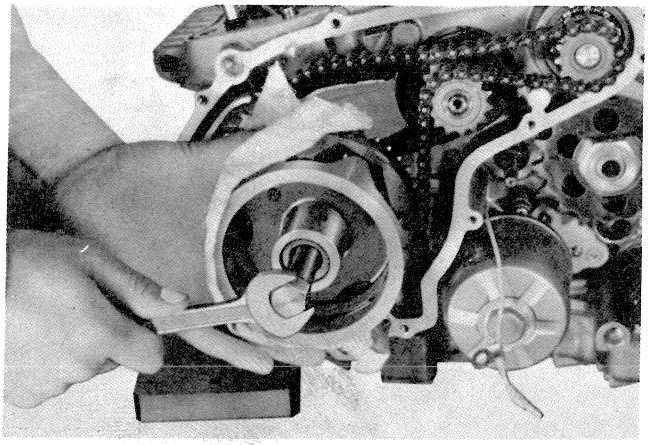


Note:

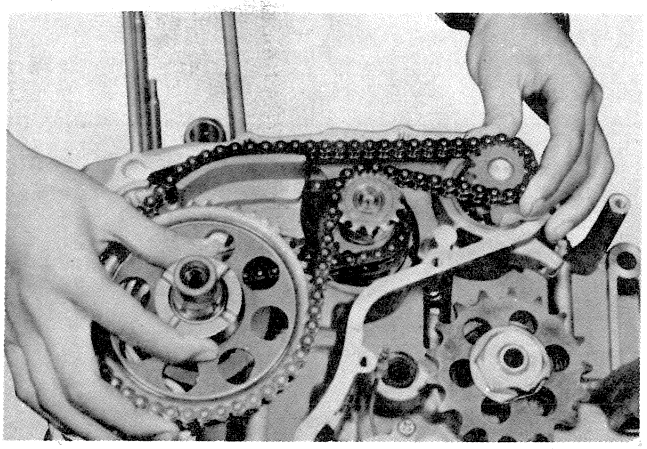
The neutral switch lead wire is connected to the starter assembly lead wires. Therefore, be sure to disconnect these wires at the connector, and then remove crankcase cover.



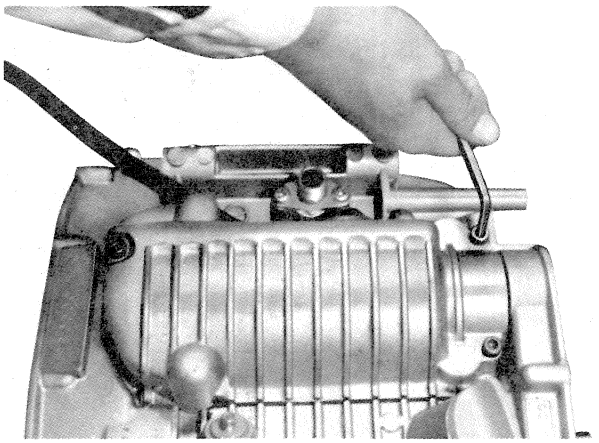
2. Remove rotor assembly mounting bolt. It is advisable to cover rotor assembly with a cloth and hold it by hand.



3. Remove the rotor assembly with the starter clutch outer assembly using the rotor puller bolt (in TX750 special tool kit).

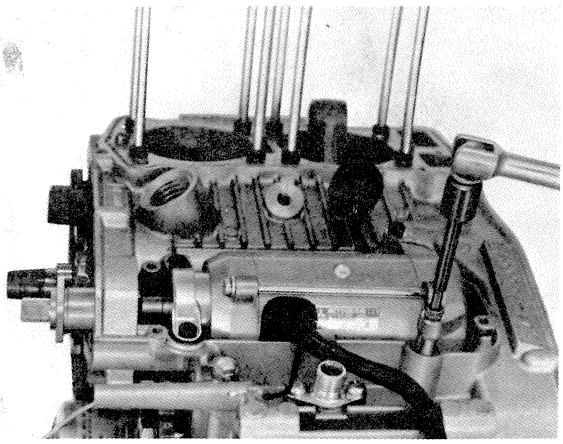


4. Remove starter sprocket 1, starter idle sprocket, and starter wheel assembly as one unit. They should be spaced evenly and kept paralled to each other. The chain and three sprockets can now be removed. Next, remove the shaft.

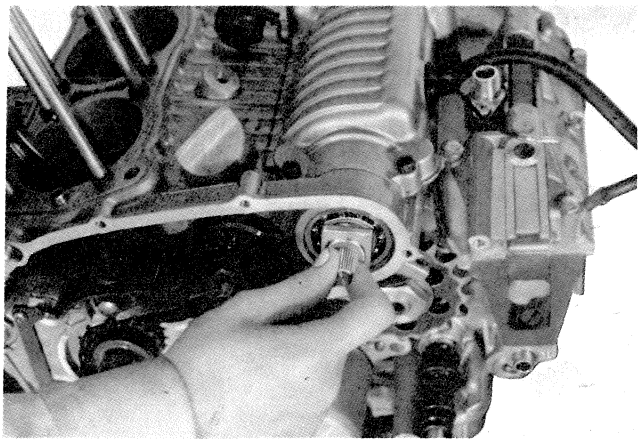


5. Remove three 10mm internal hexagon head bolts, and remove starter motor cover.

6. Remove splined starter drive shaft (see illustration, below).



7. Remove four 10mm internal hexagon head bolts and holder, and remove starter motor from upper crankcase.



Installation

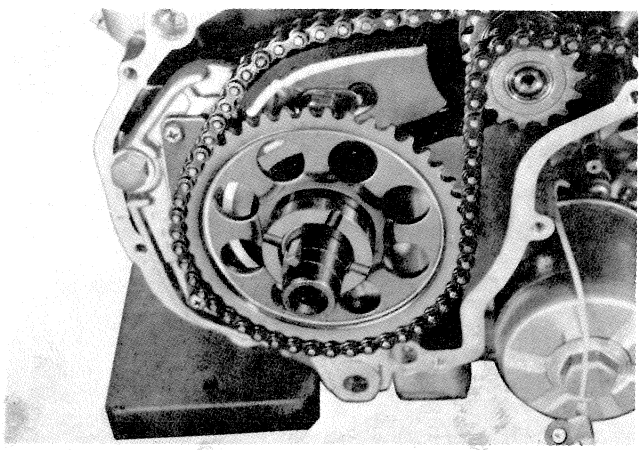
1. Grease the starter motor shaft sparingly, and install.

2. Mount the woodruff key on the tapered end of the crankshaft.

3. Place the chain around starter sprocket 1 and starter wheel assembly, and temporarily install them on the shaft and crankshaft, respectively.

Note:

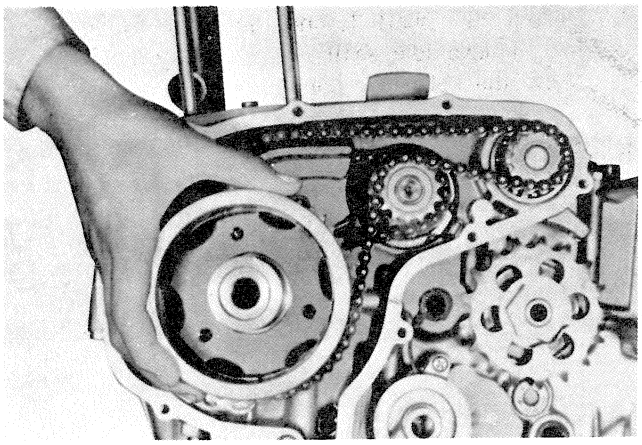
The starter wheel assembly bushing inner surface and tapered portion of the rotor mount should be coated with molybdenum disulfide base lubricant.

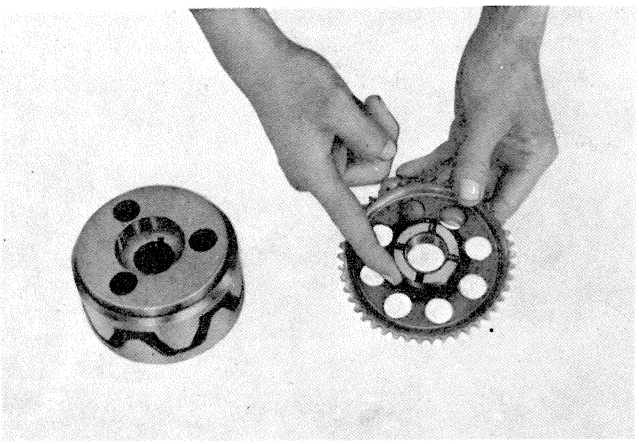


4. Stretch the chain over the starter idle sprocket, and install starter idle sprocket on balancer weight shaft. Before installation, the contact surface of the starter idle sprocket with the shaft should be coated with molybdenum disulfide base lubricant.

Note:

The above three sprockets must be kept parallel to each other so that the chain will not be twisted.

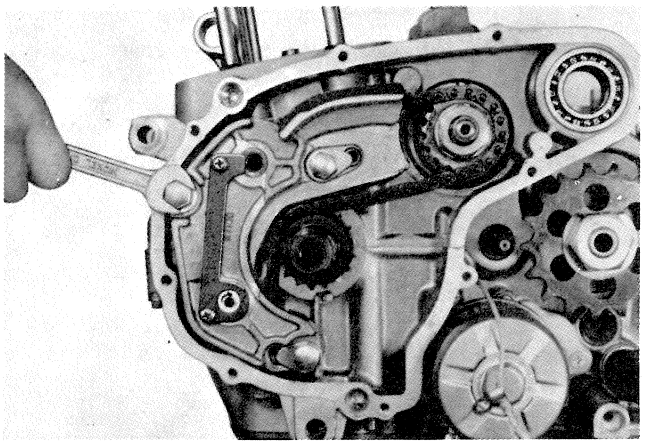




5. Install the starter clutch (rotor assembly).
   After the installation, turn the rotor assembly by hand, and check whether the one-way clutch operates smoothly or not.

Caution

In this electric starter system, a one-way clutch (overrunning clutch) is used. When the engine runs, the starter wheel assembly rotates freely around the crankshaft. It is important, therefore, that the contact surfaces are sufficiently lubricated and free from scratches. Keep this in mind when you perform the assembly operation.



OMNI-PHASE BALANCER

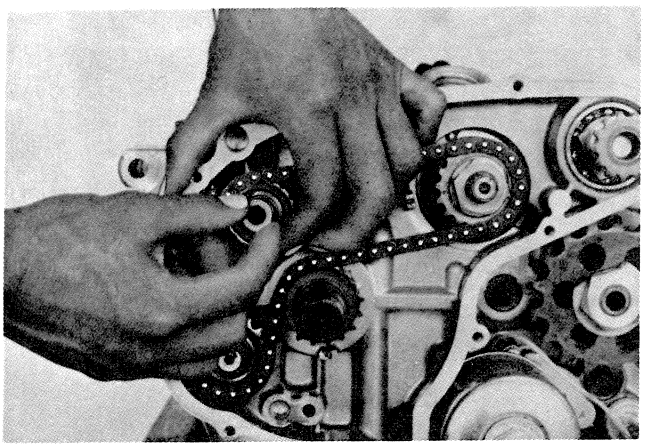
Disassembly

1. Remove crankcase cover (R) and starter power flow mechanism. (Refer to page 72.)

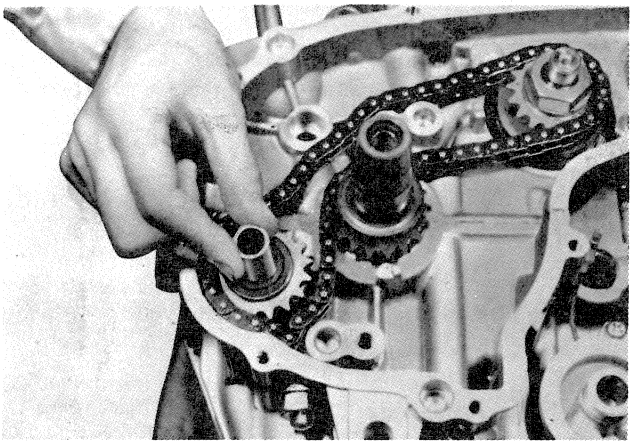
2. Remove three 13mm idle shaft bracket mounting bolts, and remove idle shaft bracket. It is necessary to remove the idle shaft plate from the bracket.

CAUTION

Do not pry against machined surfaces.

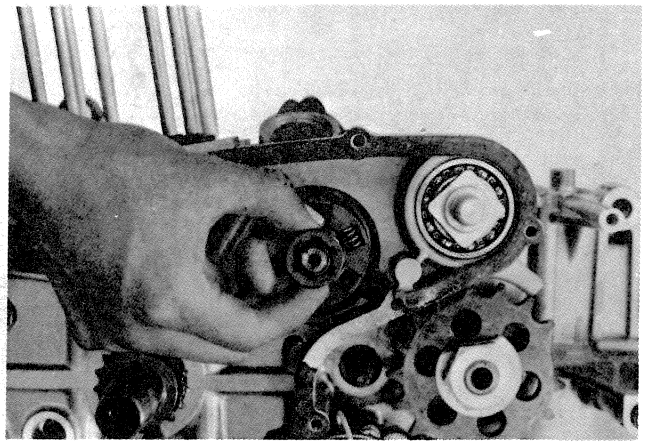


3. Align punch mark on the sprocket wheel with mark on crankcase by turning balancer weight lock nut (26 mm) clockwise, and slackening balancer weight drive chain. (Balancer idle sprocket 2 is an eccentric sprocket. Therefore, with sprocket wheel in above position, the chain can be slackened, and the idle shaft can also be pulled out in the same manner as 3 above.) Refer to the figure to the left.

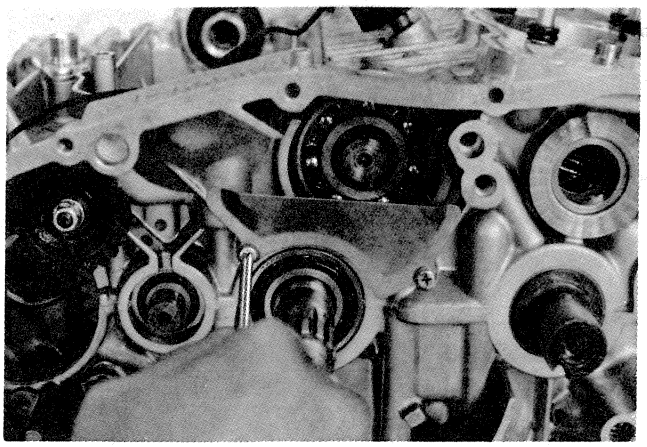


4. Pull out idle shaft 1, and remove idle sprocket 1. Next, remove idle shaft 2 and idle sprocket 2, and remove the balancer chain.

5. Bend the lock washer straight, and remove the balancer weight lock nut.



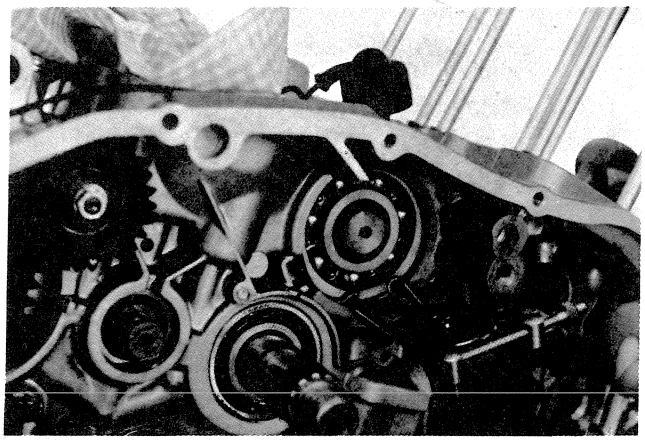
6. Pull out the spacer, balancer weight sprocket wheel, and buffer boss assembly, in that order, and remove them.



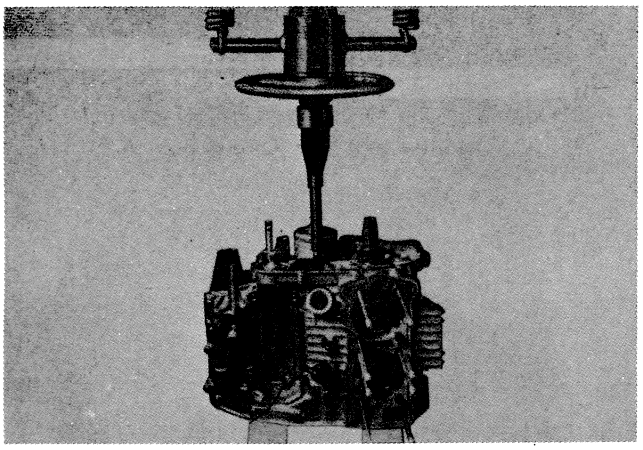
7. Remove the two panhead screws on the crankcase (right half), and remove the balancer cover.

Note:

These two panhead screws are locked with "Lock-Tite". Take care not to damage the slots in the heads.



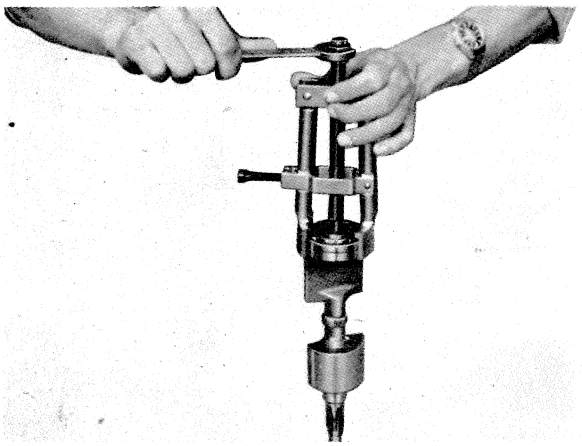
8. Remove the circlip from the crankcase (right-side).



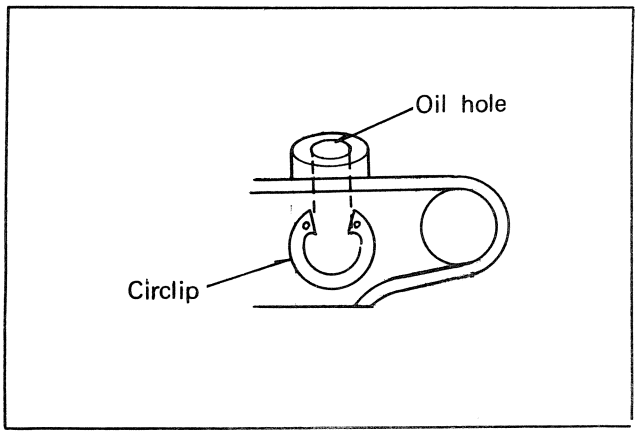
9. Applying a hydraulic press on the left side of the balancer, force it out.

Note:

The balancer weight must be pressed out from the left side, because the L.H. bearing is held with a circlip inside the balancer weight housing.



10. Remove bearing from balancer shaft using bearing puller.



Installation

Balancer Weight Bearing (L) - Installation Note

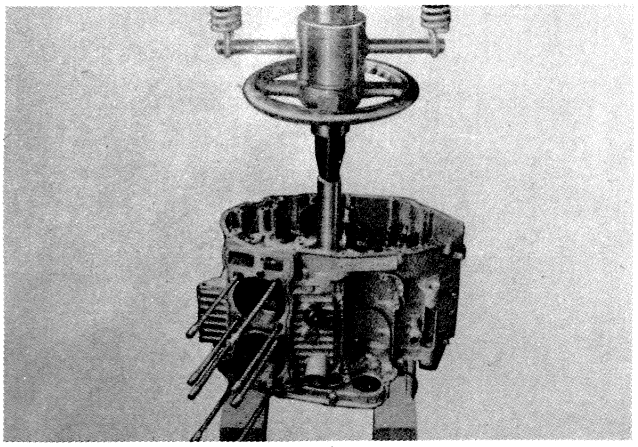
When press-fitting the balancer weight bearing (L) into the case, be sure that the circlip end gap is positioned over the oil hole. (See the figure.)

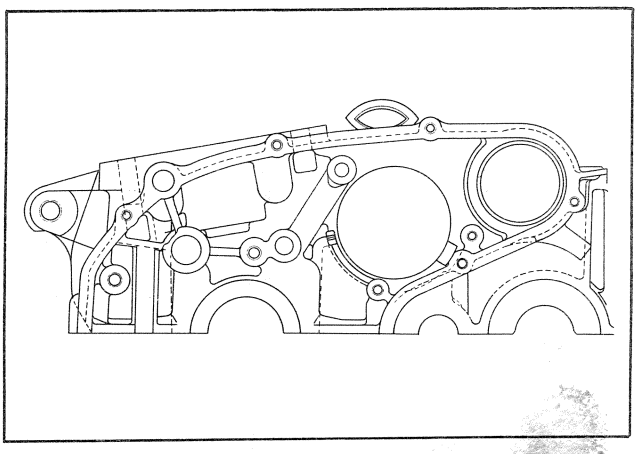
1. Install the bearing on the balancer weight, and press the balancer weight into the crankcase using a hydraulic press.

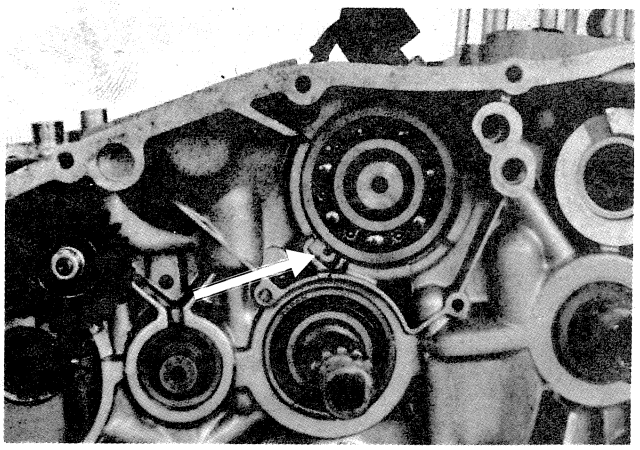
   Press load: 0.5 ton

Note:

a. Before press-fitting the bearing, sufficiently oil the contact surfaces with the crankcase and balancer weight.



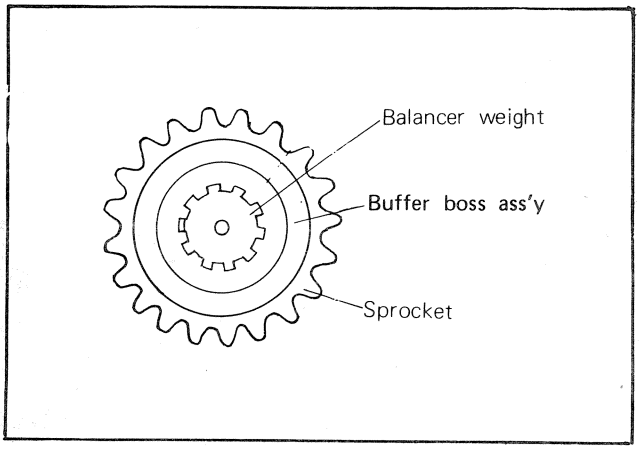




b. Make sure that the pin attached to the bearing outer race is fitted in the notch provided for it in the crankcase. (see arrow)

2. Install the circlip in the case. Make sure that the circlip is completed seated in the clip groove by turing it.

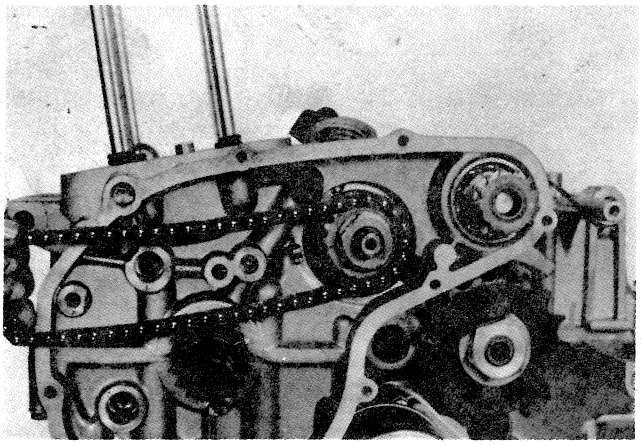
3. Install the balancer cover. Be sure to coat the screws with LOCKTITE.



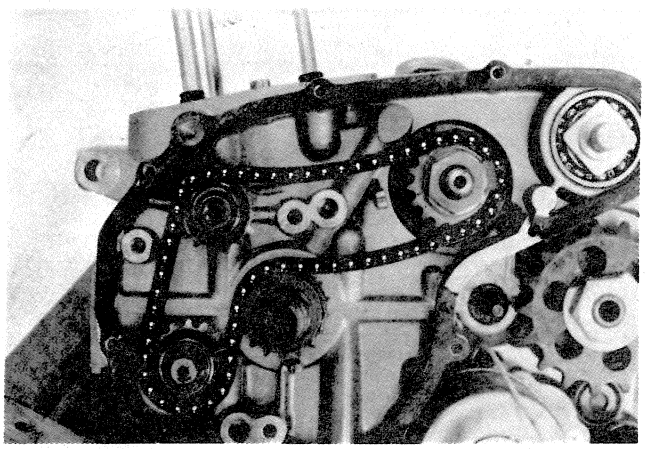
4. Install the balancer weight so that the punch mark on the balancer weight is aligned with the punch mark on the buffer boss assembly. Next, align the punch mark on the buffer boss with the punch mark on the sprocket, and install the sprocket wheel on the buffer boss.

5. Install the spacer and lock washer, and tighten the lock nut with specified torque.

   Tightening torque: 320 - 360 in-lbs (3.5 - 4.0 kg-m)



6. Align the punch mark on the sprocket wheel with the punch mark on the case, and align the mark on the drive sprocket with the mark on the case. Then install the chain.



7. Install idle sprockets 1 and 2 so that they are correctly meshed with the chain, and insert idle shafts 1 and 2 into the sprockets.

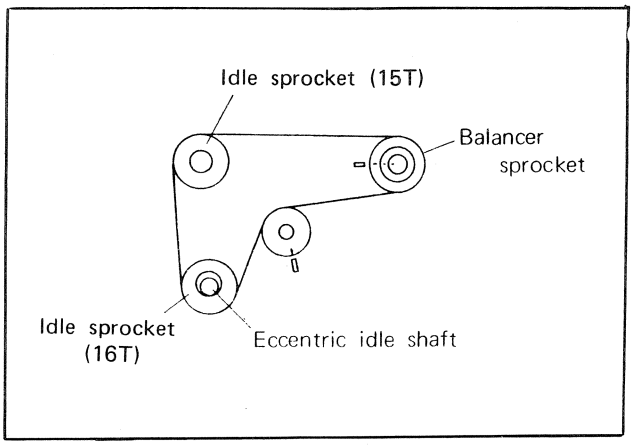


FIGURE 1

Note:

The eccentric idle shaft must be positioned on the bottom. Pay attention to the difference in the number of teeth between the two sprockets. (See Fig. 1).

8; Install the idle shaft bracket.

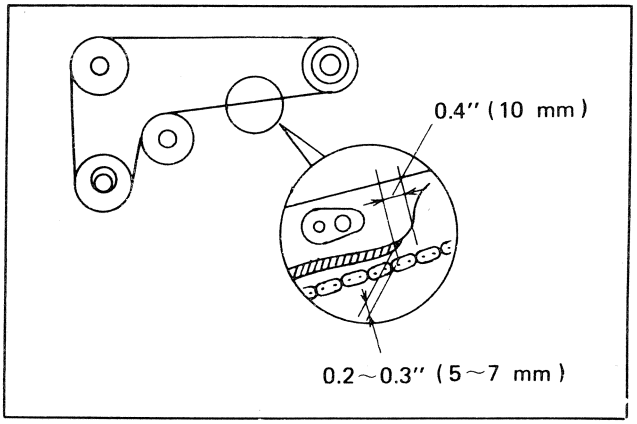


FIGURE 2

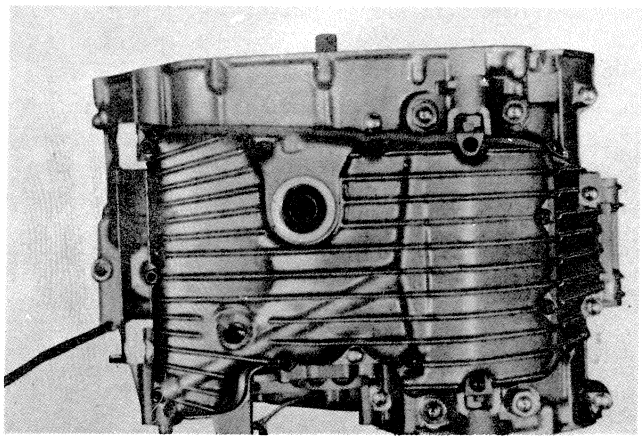
9. After the operation in 7 above, insert the eccentric idle shaft serrated end into the idle shaft plate in a screwing motion. The chain should have a slack of 5 to 10 mm at A in Fig. 2. Next, install the idle shaft plate.

10. Install the starter power flow mechanism and crankcase cover (L). (Refer to pages 60 and 72.)

STRAINER COVER

Description

The strainer cover incorporates a release valve, a bypass valve, and two oil strainers which are important parts in the lubrication system. Any faulty valve or strainer can cause piston seizure or bearing damage because of lack of oil, or cause oil leaks because of excessively high oil pressure.
Whenever the strainer cover is removed, be sure to check the valves for smooth operation and clean the strainers.

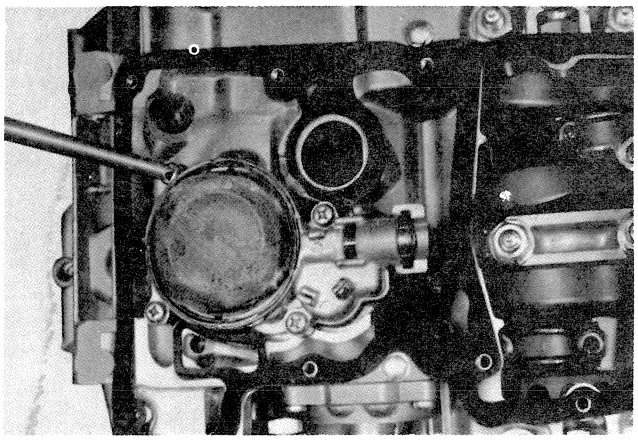


Disassembly

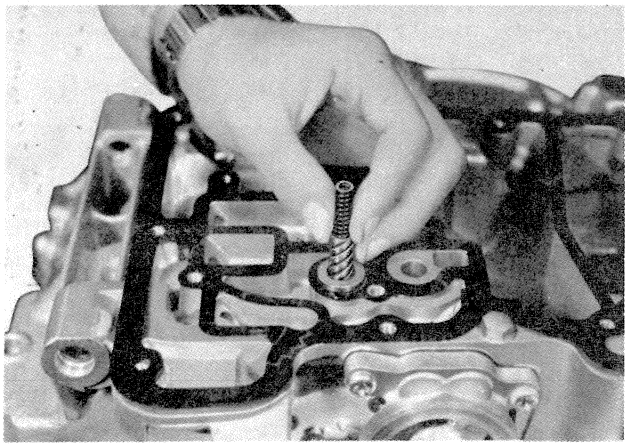
1. Remove the eleven 5mm internal hexagon head bolts using the Allen wrench, and remove strainer 2 and strainer cover.

Note:

Two engine mounting nuts are located under the nut holders. Be sure to remove them.



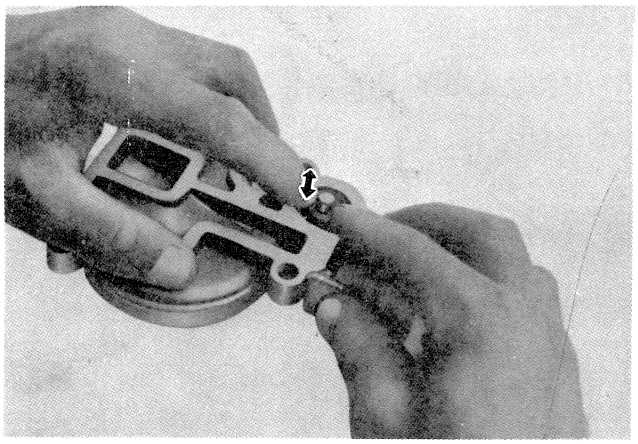
2. Remove the magnet. Remove the four panhead screws. Remove the strainer housing assembly.



Note:

The shift cam stopper and spring are held by the strainer housing assembly. Be sure to remove them whenever the strainer housing assembly is removed.

3. Remove the gasket.

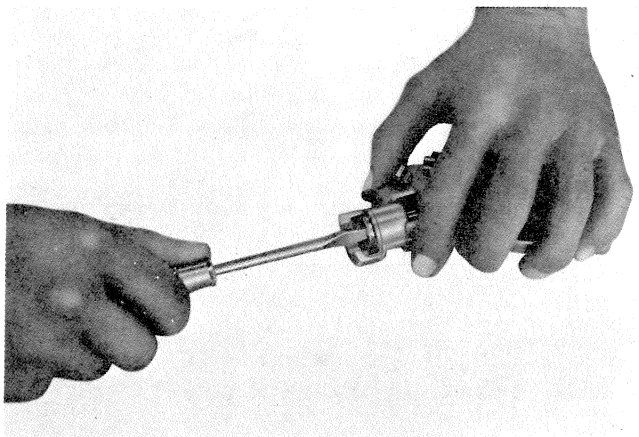


Inspection

Checking the valves for smooth action. After cleaning the strainer housing assembly and valves, oil the valves sufficiently. Push the valves. If they move smoothly, they are in good condition. If any valve is stiff, stuck or scratched, replace with a new one.

Reference:

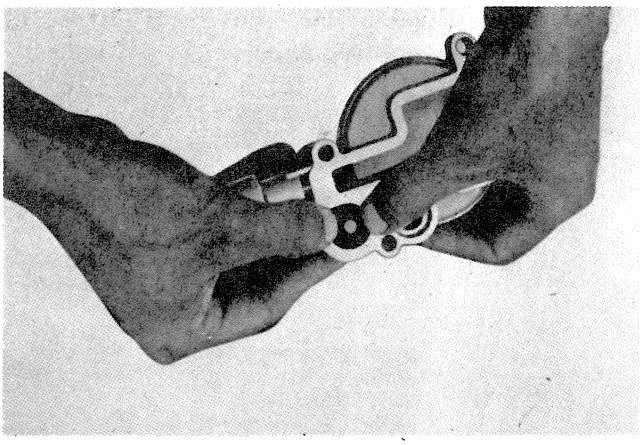
Release valve opening pressure: 56 psi (4 kg/cm²)
Bypass valve opening pressure: 9.1 psi (0.65 kg/cm²)



Valves - Removal and Installation

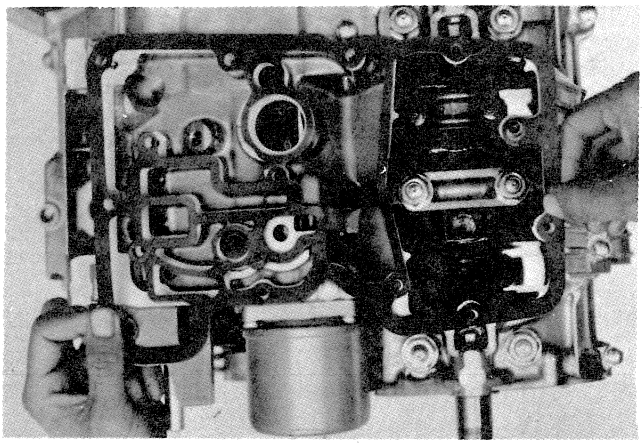
Release Valve

To remove the release valve, lightly push the retainer with a slotted-head screwdriver so that it slips off the slot in the strainer housing, and turn the retainer 180°. To install, reverse the removal procedure. Be sure to oil the valve, and check whether the retainer's projection correctly fits in place. Also check the valve for smooth action.



Bypass Vlave

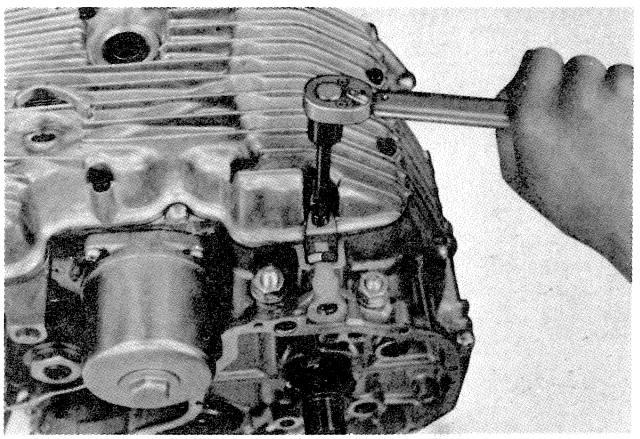
It is impossible to remove the bypass valve because the guide pin is press-fitted in the strainer housing. If the bypass valve becomes faulty, it must be replaced as a unit with the strainer housing assembly.



Installation

1. Replace the gasket with a new one, and install in the crankcase (lower).
2. Install the shift cam stopper pin and spring in the crankcase, and install the strainer housing assembly.

   Tightening torque: 70-90 in-lbs (0.8-1.0 kg-m)



3. Install the magnet in the strainer housing assembly.
4. Install strainer 2 in the strainer cover, and install the strainer cover on the crankcase.

   Tightening torque: 60-80 in-lbs (0.7-0.9 kg-m)

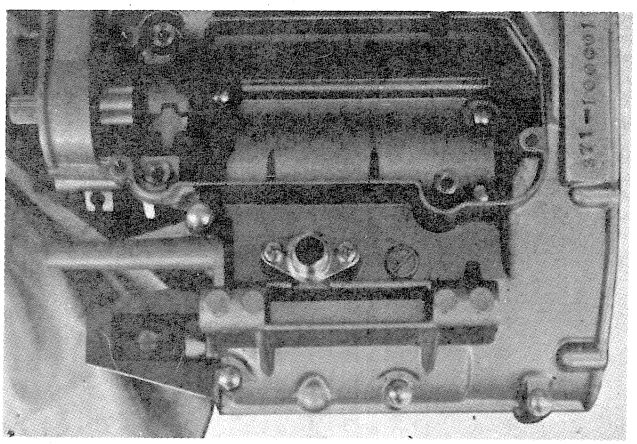
Note:

Important! Install the two engine mounting nuts and nut retainers in the hole in the crankcase (lower) before strainer cover installation.

CRANK CASE

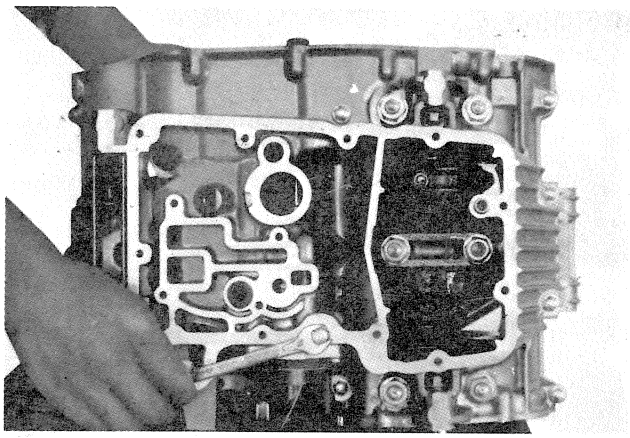
Description

The TX500A crankcase is a horizontally split crankcase. The crankshaft is in the front, the transmission and shifter in the middle, and the trochoidal pumps and tachometer unit are in the rear.



Disassembly (Dividing the Crankcase)

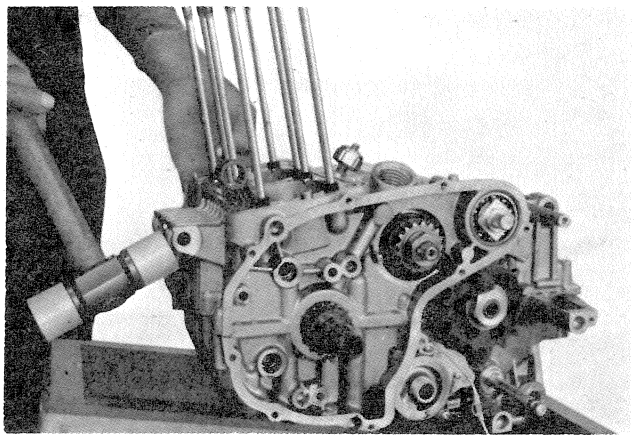
1. Remove the seven 10mm head bolts from the upper crankcase.



2. Remove the seven 10mm head bolts from the lower crankcase. Next, remove the six 17mm nuts.
   In order to prevent the crankcase from distorting, the 17mm nuts must be loosened in steps, a ¼ turn at a time.

Note:

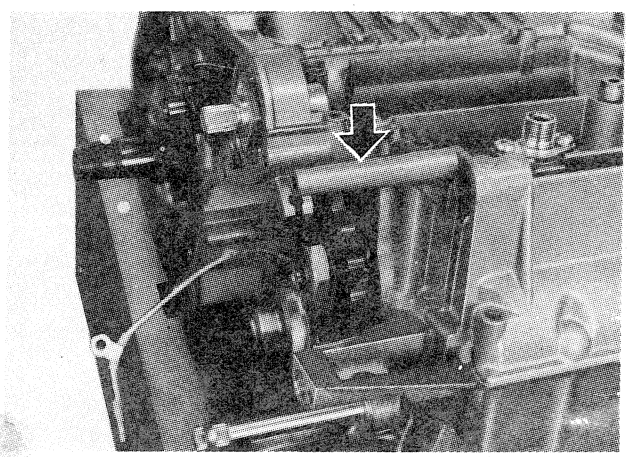
When removing bolts and nuts varying in size, loosen the smallest first and the largest last to relieve strain on the smaller ones.



3. Separate the cases by lifting off the top case. It may be necessary to tap the case with a rubber hammer.

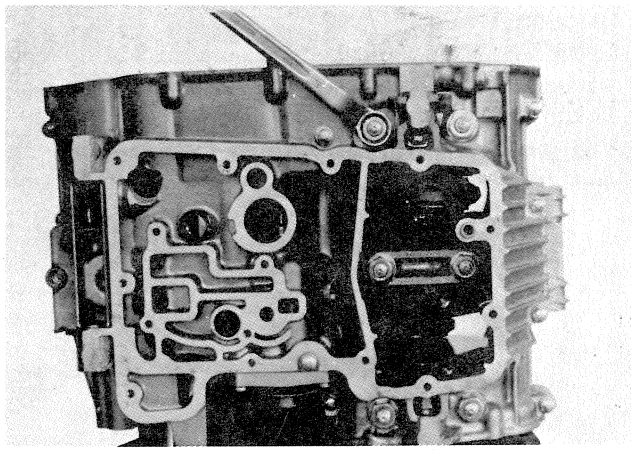
– CAUTION –

Never pry cases apart. Machined surfaces may be damaged.



Caution

Don't hammer on the case cover mounting flange, it may easily break off. (See arrow.)

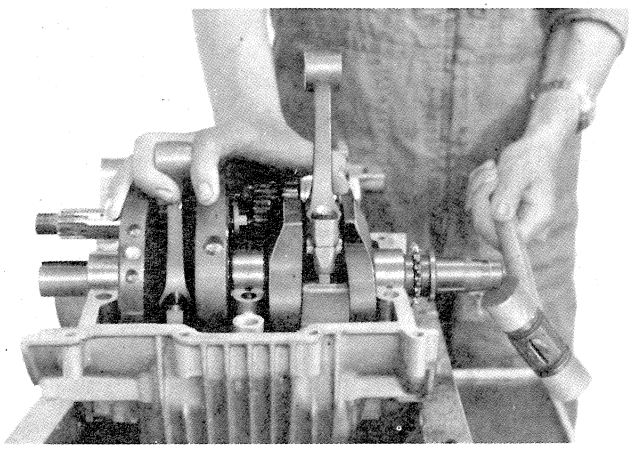


Installation

To assemble, reverse the procedure for removal. The bolts and nuts must be tightened with specified torque and in the correct order. Otherwise, the case could be distroted and oil leakage may result.

Tightening torque and Tightening sequence.

M10	1st 1.0 kg-m	2nd 2.0 kg-m	Final 3.5 kg-m
M6	0.5 kg-m	1.0 kg-m	

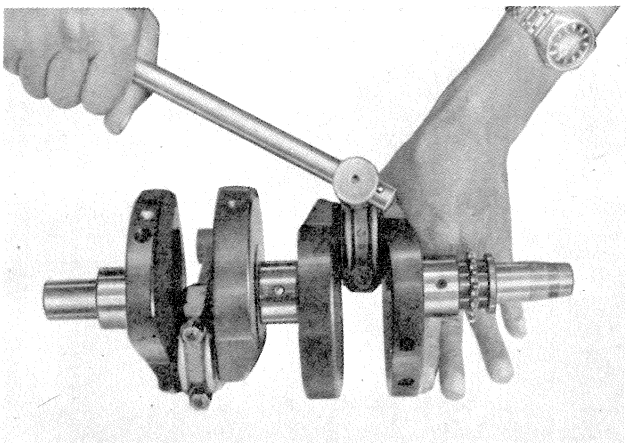


CRANKSHAFT ASS'Y

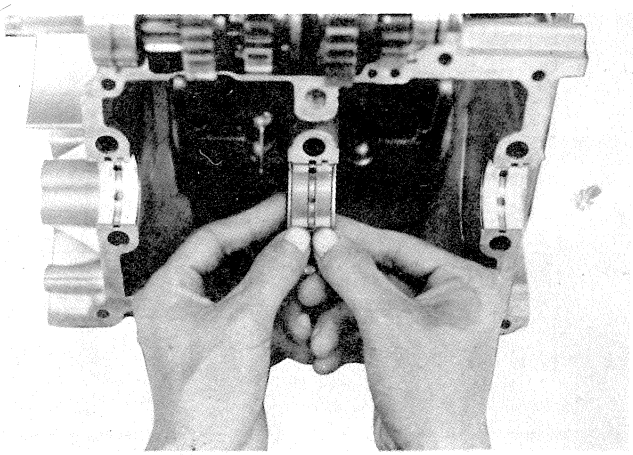
The crankshaft is a one piece forging to ensure high rigidity and easy accessibility for maintenance. The bearings, are of split type, and the connecting rod big end is also split into two sections.

Disassembly

1) Remove the crankshaft assembly by tapping the crankshaft with a soft-faced hammer.



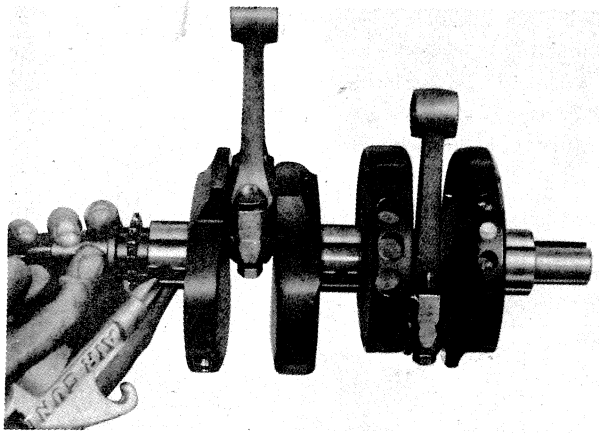
2) Remove the connecting rod.



Removing the bearing inserts

The insert can easily be removed by finger-tip pressure. Never strike it out with a hammer.
The removed inserts should be placed separately. Avoid putting one upon the other.

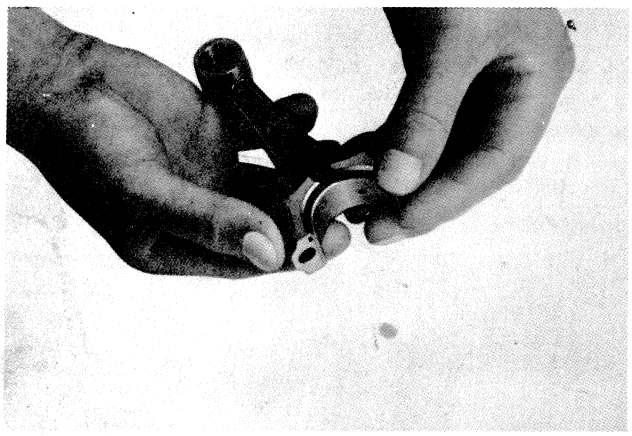
NOTE: Mark inserts to insure their reinstallation in original locations.



Inspection

1) Check the bearing metals. If the outer surface is found flaked, burned, rough, scratched or worn, the metal should be replaced.
   The inner surface should also be checked, and if it is burned with oil, it is considered to lack enough tension and crush. This will result in warping or seizing up.

2) Clean the oil passages with compressed air.



Handling of the Plain Bearings (Inserts)

The inserts must be handled with special care, and the following three points must be adhered to.

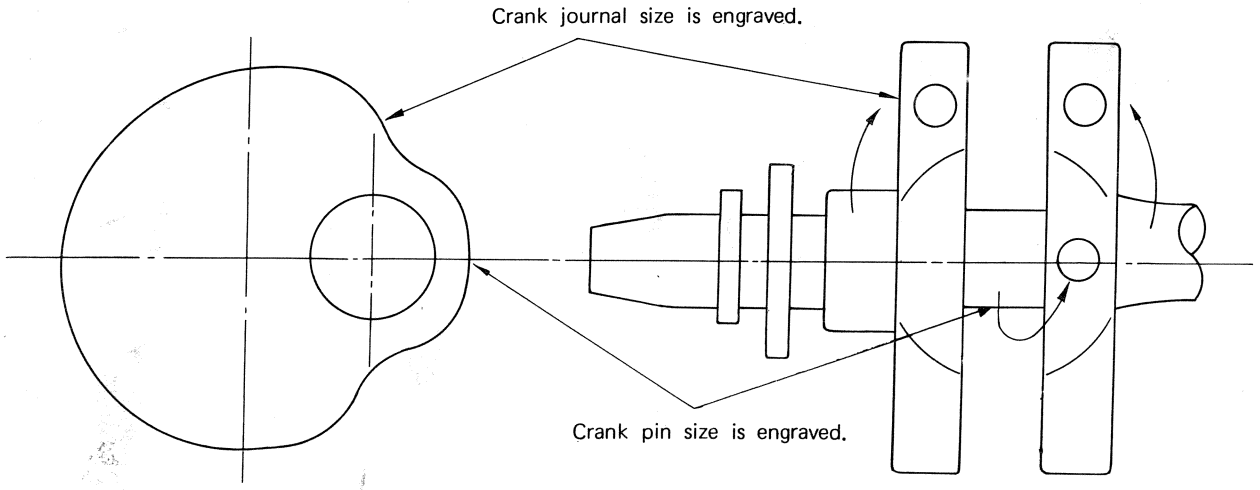
1. Keep the inserts free from dust.
2. Take care not to scratch their mating surfaces during the installation and removal operations.
3. After installation, be sure to oil them amply.

Selection of Inserts for Proper Fit

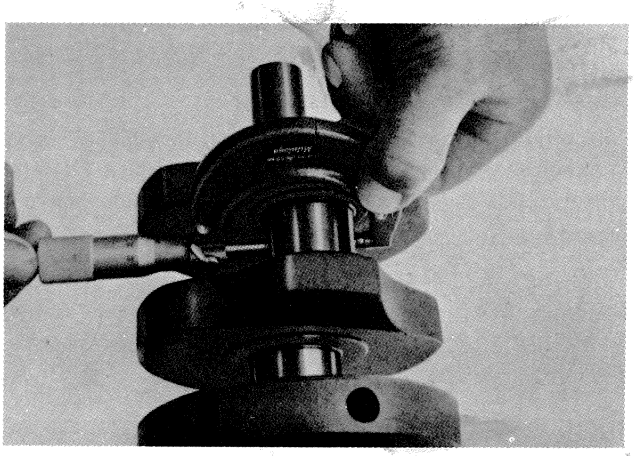
There are five types of bearings (inserts) available, and they must be selected according to the crankcase housing diameter and crankshaft journal diameter, or according to the crank pin diameter, crankshaft journals diameter and crankcase housing diameter.

On the TX500A the inserts are selected in the following manner.

Crankshaft Inserts



Note: For selection of proper bearing inserts, refer to the TX750 Service Manual.



The crankcase housing diameters are numbered 4, 5 and 6, respectively, and these numbers are engraved on the crankcases.
On the other hand, the crankshaft journals are numbered 1, 2 and 3, respectively, and these numbers are shown on the crankwebs.
The inserts can be selected by the following formula:

Housing No. minus (–) Journal No. = Insert Metal No.

Example:
If housing No. is 4 and journal No. is 1, the insert should be 4 – 1 = 3.
Each insert is marked with 1, 2, 3, 4 or 5 on the seat side.

Crankcase	–	Crankshaft	=	Insert

Connecting rod big end inserts

The connecting rod big end inserts should be selected in the same manner.
The housing is marked 4, 5 or 6, while the crankshaft journal is numbered 1, 2 or 3 on the crank web. See table below.

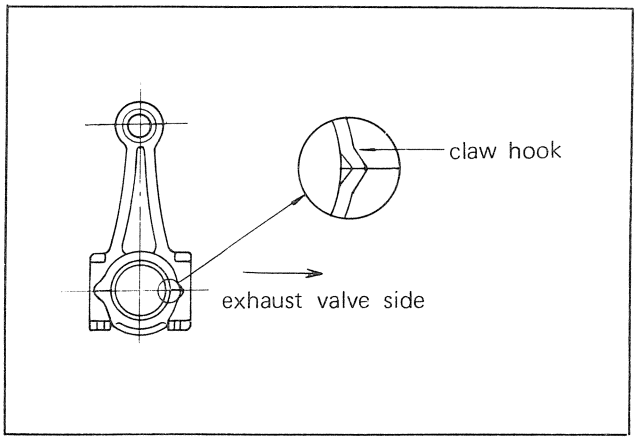
	Center thickness T	Housing diameter	No.	Shaft diameter	No.	Oil clearance
BEARING 1	$1.5^{+0.006}_{+0.002}$	$41^{\phi\,+0.024}_{+0.016}$	4	$38^{\phi\,-0.001}_{-0.008}$	1	0.036~0.059
BEARING 2	$1.5^{+0.002}_{-0.002}$	$41^{\phi\,+0.016}_{+0.008}$	5	$38^{\phi\,-0.009}_{-0.016}$	2	0.036~0.059
BEARING 3	$1.5^{-0.002}_{-0.006}$	$41^{\phi\,+0.008}_{0}$	6	$38^{\phi\,-0.017}_{-0.024}$	3	0.036~0.059
BEARING 4	$1.5^{-0.006}_{-0.010}$					
BEARING 5	$1.5^{-0.010}_{-0.014}$					

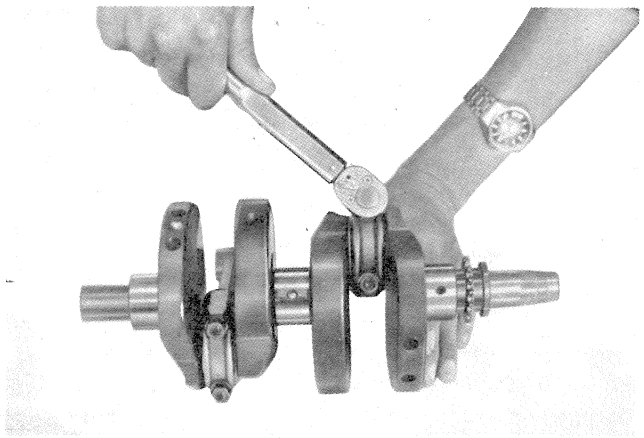
The insert should be selected by the following formula:
Housing No. minus (–) Journal No. = Metal No.

Example:
If housing No. is 6 and journal No. is 2, the insert should be 6 – 2 = 4. That is, insert No. is 4.

This allows for a standard clearance, when all securing bolts are properly torqued of: 320 - 360 in-lbs (3.5 - 4.0 kg-m)

ITEM	NOMINAL	WEAR LIMITS
Crankshaft/Case Journal	0.036mm to 0.059mm	If the oil clearance is beyond 0.0032 in. (0.08mm), the bearing should be replaced with new part.
Connecting Rod/Crank Pin Journal	0.034mm to 0.057mm	





Installation

Bearing clearance measurement

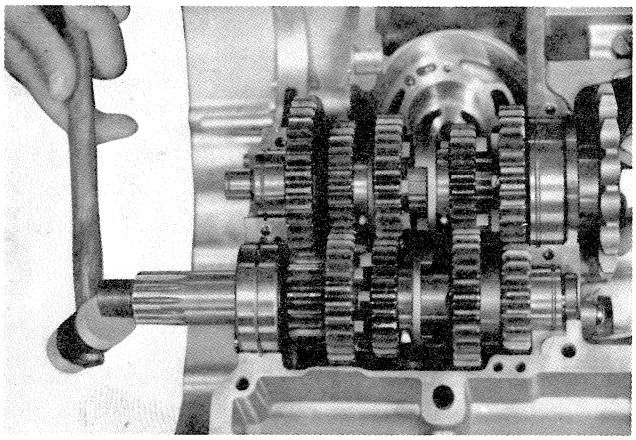
Place the plastigauge in the center of the bearing cap, tighten the housing with the specified torque. Determine the bearing clearance by measuring the thickness of the flattened plastigauge.

Caution

When assembling the connecting rod, be sure that the CRAW HOOK of the insert bearing faces toward the front (exhaust valve side).

1) Thoroughly clean the connecting rod big end housing and inserts, and install the inserts in the housing by pushing them in.

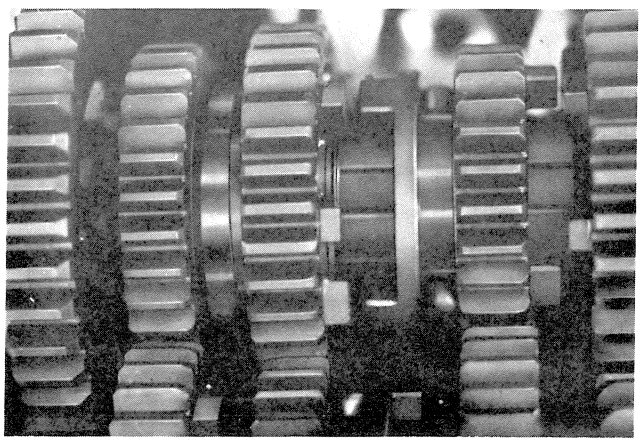
2) Clean the crank pin, and oil it amply.
After installation, apply a MOLYBDENUM oil to the threaded portion of each cap bolt. Tighten the cap bolts gradually to 320 - 360 in-lbs (3.5 - 4.0 kg-m). Make sure that the connecting rod rotates smoothly.



TRANSMISSION

Disassembly

Tap lightly with a rubber hammer to loosen the transmission, then lift it out.

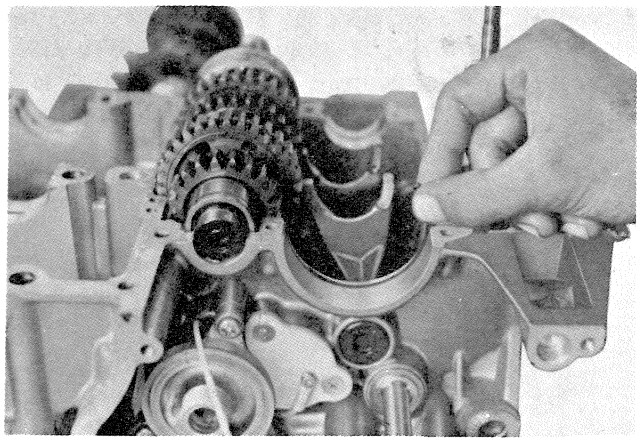


Inspection

a) Check the gears for chipped teeth.
b) Check engagement dogs and slots for rounded edges.
c) Check the sliding gear fork grooves for a blue discoloration. If any of the above mentioned conditions is obviously noticeable, replace the gears and/or forks, as required.

Note:

Especially in the case of damaged engagement dogs, check the mating gear for damage or excessive wear. It is sometimes necessary to replace the parts as a set. Also, check forks for possible damage.

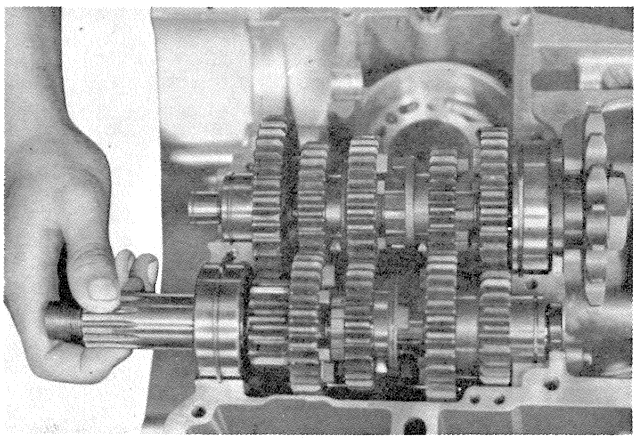


Installation

With both shafts assembled, including all bearings and seals, fit the transmission into the BOTTOM CASE. This permits the shift forks to slip over the sliding gears easily. Be sure both transmission shaft circlips are fitted to the bearings and the circlips have been positioned in the circlip grooves.

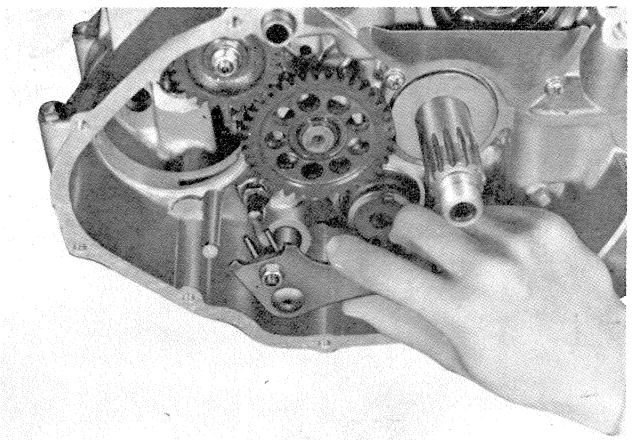
Note:

Transmission installation is easier if the shift drum is rotated to the neutral position.



Very important

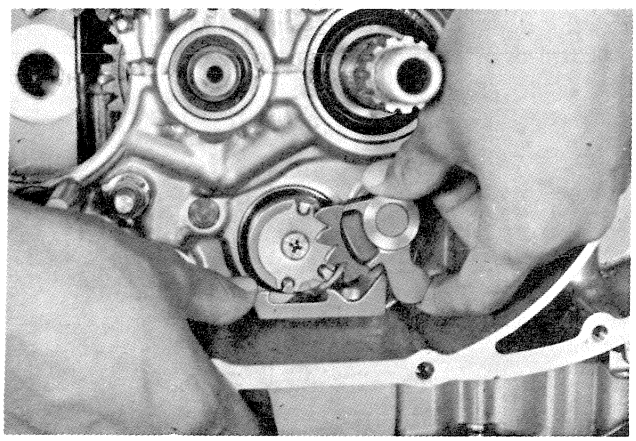
Check for smooth and complete shifting through all gears after installing the shift drum, shift forks, guide bar, and transmission. At the same time check for complete engagement of all engaging dogs into the appropriate gear slots.



SHIFTER

Disassembly

1. Remove the E-clip and washer retaining the change shaft on the crankcase (left side) and remove the change shaft assembly.



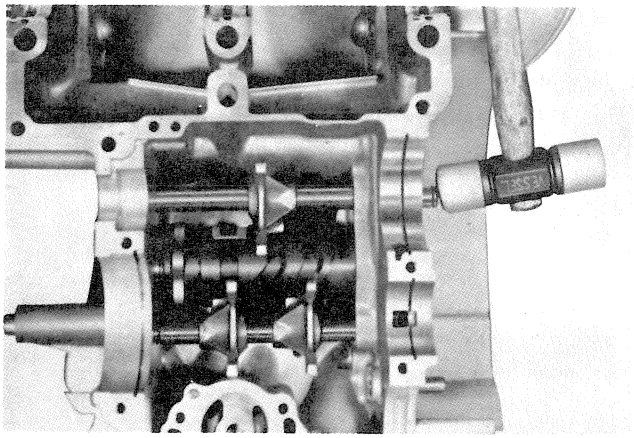
2. Remove the E-clip retaining change lever 2. Push down change lever 3 meshed with the shift drum assembly with your finger, and pull change lever 2 toward you.

Note:

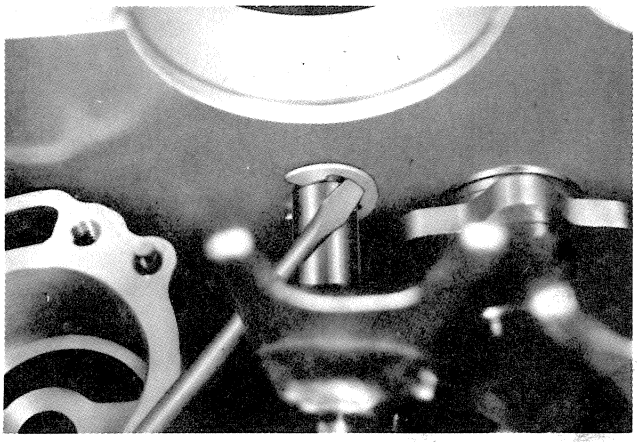
The change shaft assembly, and change levers 2 and 3 can be removed without dividing the crankcase.

3. Divide the crankcase into the upper and lower halves. (Refer to page 82.)

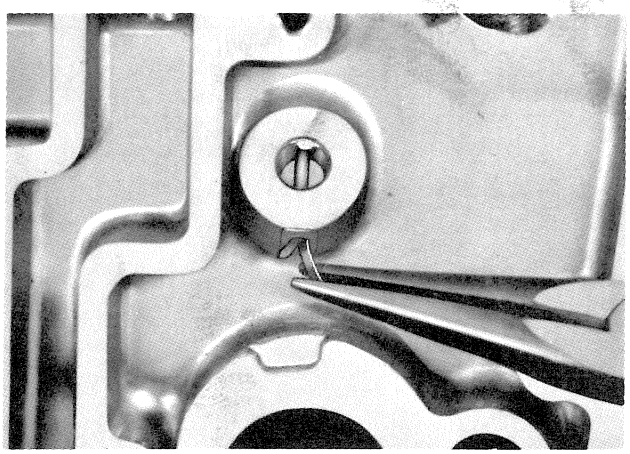
4. Remove the transmission. (Refer to page 86.)



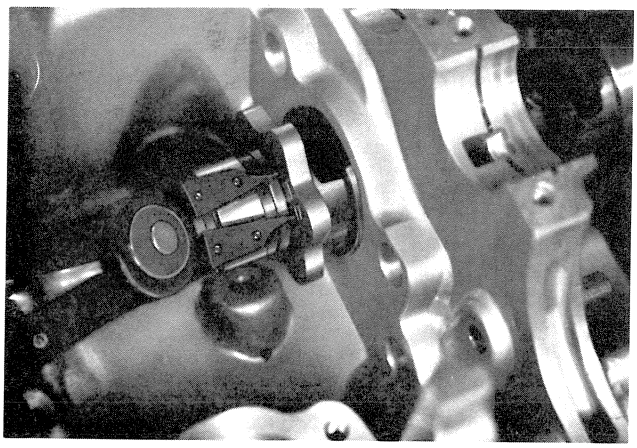
5. Remove shift fork guide bar 1 and shift fork by tapping the right side of shift fork guide bar 1 with a rubber hammer. By removing the E-clip attached to shift fork guide bar 1, the blind plug can be removed.



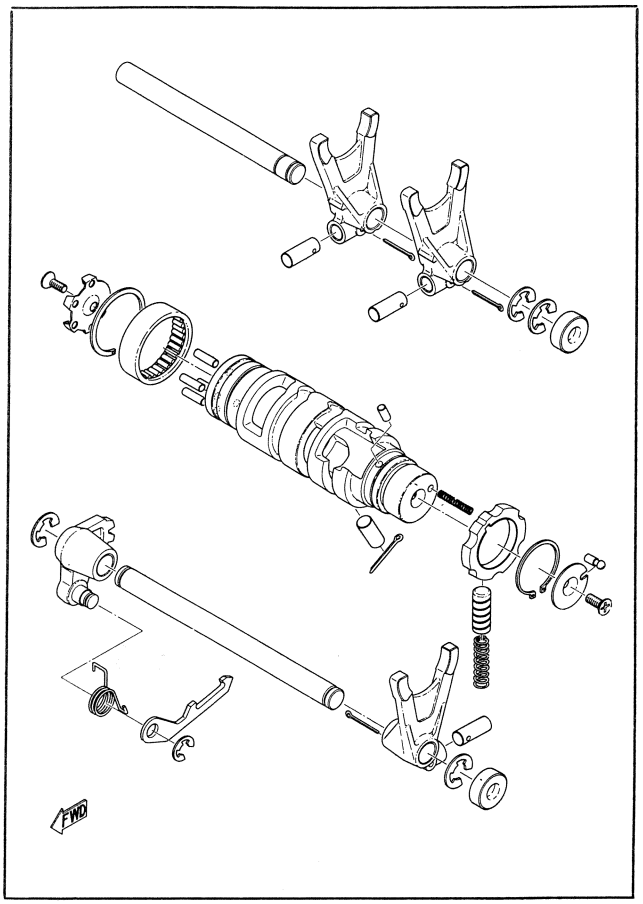
6. Remove the E-clip attached to shift fork guide bar 2 inside the case, and remove shift fork guide bar 2 and two shift forks in the same manner as 5 above.



7. Remove the cotter pin attached to the bottom case, and remove the cam follower pin.



8. Pull out the shift drum assembly halfway toward the right side of the case, and remove the stopper plate retaining circlip. Then remove the shift drum and stopper plate.



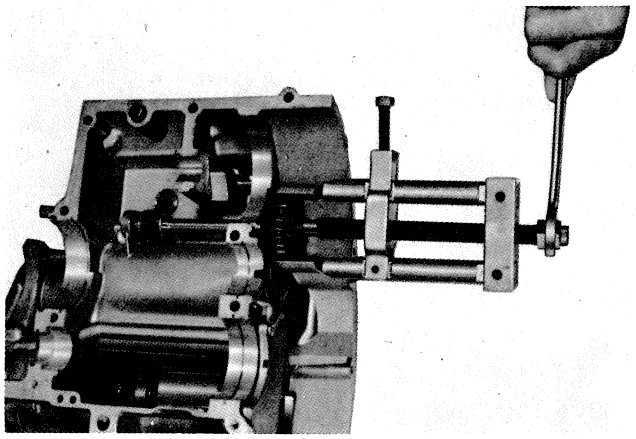
Inspection

Check the guide bar for alignment. Roll it over a surface plate and check for bends. If it is bent, replace it.

Shift drum and shift fork installation:

1) Pay particular attention to the direction and order of fork installation. Fifth gear wheel shift fork has a clearance notch machined into one side to allow clearance for the neutral light button. Fourth gear wheel shift fork is also notched on one side to provide clearance for the neutral position stopper. If these shift forks are incorrectly installed, the neutral stopper and neutral light button will not fit into position.

2) Installation of this unit is a reversal of the previous steps. Be sure to lubricate the shift drum and forks before installation. When installing the cam follower pin, always use new cotter pins. After bending the cotter pins, make sure the bent pin ends do not drag. Check for smooth fork movement on the shift drum after assembly.



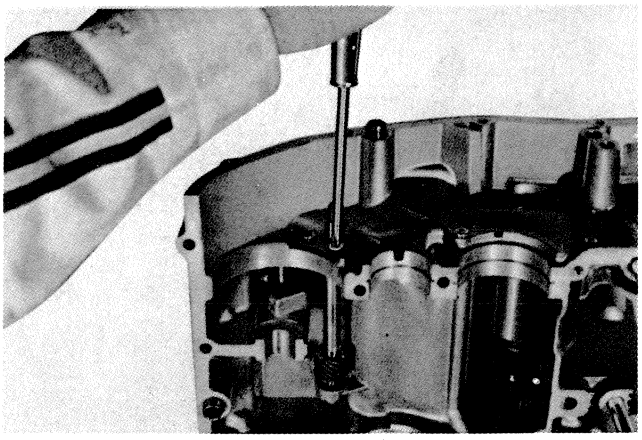
TACHOMETER GEAR UNIT

Disassembly

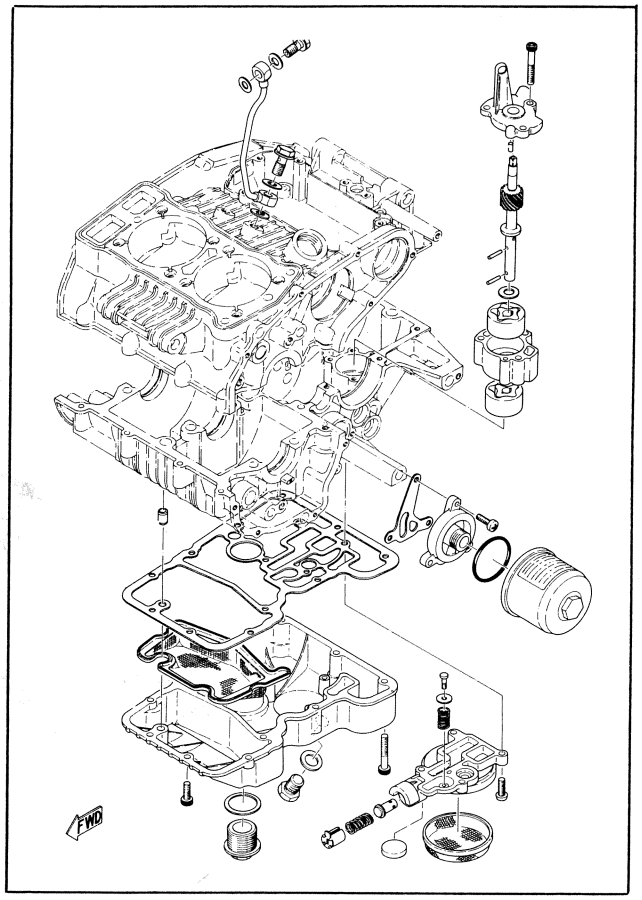
1. Remove the 10mm lock nut and the E-clip, and remove the primary gear using the gear puller.

Note:

Be careful not to lose the square key.



2. Remove the two flat head screws, and remove the drive shaft stopper.



Trochoidal Pumps

Remove the three 5mm internal hexagonal bolts mounting the pump cover, and lift the pump shaft.

a) Remove the dowel pin from the pump shaft, and disassemble the trochoidal pump into the pump cover, pump shaft, and scavenging pump assembly.
   The dowel pin is located in a very narrow space. Do not let the pin fall in the oil passage.
b) Remove the feed pump assembly.

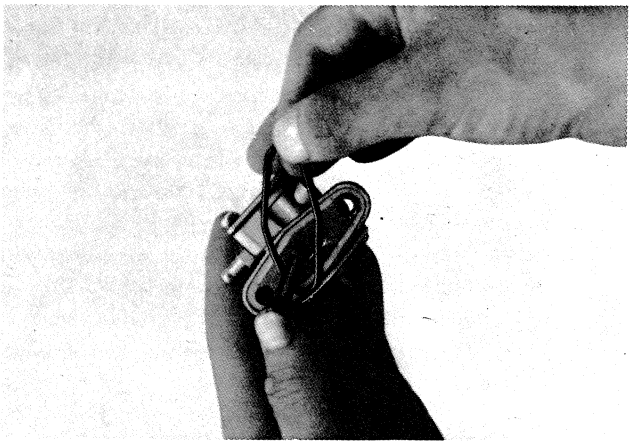
Installation

1. Clean all component parts, and assemble them. To assemble, reverse the procedure for disassembly.
   Oil all parts.

2. When installing the dowel pin for pump mounting, take special care not to drop it into the oil passage.

3. FUEL SYSTEM

The fuel system consits of the fuel tank, two petcocks with integral filters, fuel delivery lines, and two constant vacuum carburetors. Each section of the fuel system should be checked for possible incorrect operation. Trace fuel flow from the tank, through the petcocks, and through the carburetor. Also check for possible air restrictions or leaks.



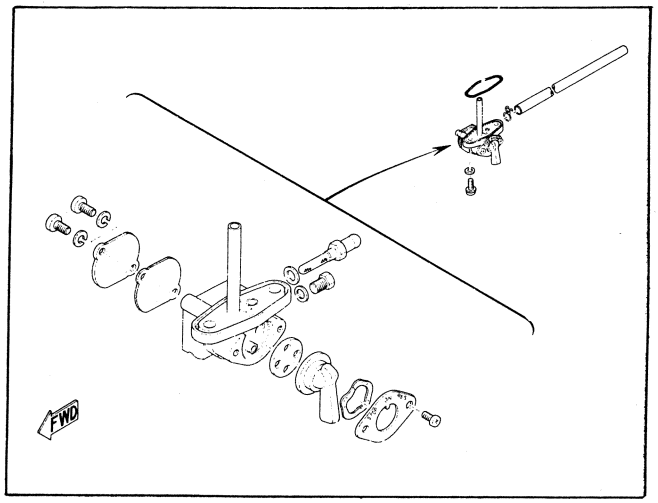
PETCOCK

1) Removal and Installation

a) The two petcocks are bolted to the rear under side of the fuel tank. Remove the two screws holding each petcock.

b) A neoprene O-ring fitted into a groove in the petcock mating surface seals the petcock to the fuel tank. Check the condition of this O-ring and replace if it is broken, flattened, or chipped.

c) Petcock installation is accomplished by fitting the O-ring in position and securing the petcock with the two bolts.



2) Cleaning

Sediment from the fuel tank (including water) can collect in the petcock chamber. A bolt beneath the fuel outlet can be removed to drain the petcock chamber. Larger obstructions can be removed by removing the screw-held plate at the opposite side of the fuel outlet.

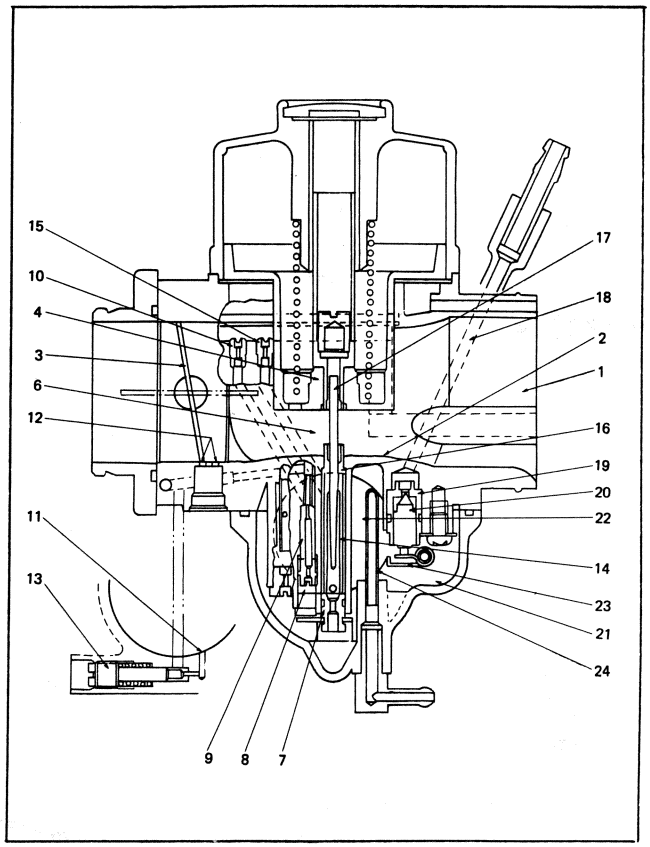
CARBURETOR

Description

The TX500A is equipped with two "constant vacuum" carburetors (design is similar in operation to the SU type carburetor) mounted on rubber intake manifolds. Air flow through the venturi is controlled by a throttle slide (vacuum piston). The slide is lifted and lowered **by manifold vacuum rather than by a cable directly linked to the throttle grip.**

Carburetor Specifications:

MFR/TYPE/I.D. NBR	
Venturi Size	32.0mm (effective)
Main Jet	#120
Main Air Jet	#60
Jet Needle	302001
Needle Jet	3.8 ϕ
Vacuum Piston Cut-Away	11° 00
Pilot Jet	#50
Slow Jet	#50
Slow Air Jet	#110
Pilot Screw (Turn out)	1.0 ± ¼
Float Valve Seat	2.0mm
Starter Air Jet	1.0mm
Starter Jet	#45
Float Level (H)	22.0mm



1. Method of Operation

1. Air Circuit (Fig. 1)

The air filtered by the air cleaner enters the air horn through the inlet (1) and flows through the venturi section (2) and the throttle valve (3) to the engine.

The vacuum piston (4) projects into the venturi section (2) and is forced downward by the vacuum piston spring (5). (If no vacuum piston spring is provided, it would move down of its own weight.) When air flow to the engine is slight, the vacuum piston (4) lowers to form the primary venturi (6), maintaining air velocity around the venturi section (2) to properly vaporize the fuel.

As air velocity increases, vacuum around the venturi section becomes greater. This creates a partial vacuum over the vacuum piston head and makes the piston move up to allow a larger space in the venturi section. As the engine speed rises to a maximum, the vacuum piston moves up further and the secondary venturi is formed, providing a sufficient space for the air-fuel mixture required to produce maximum engine output.

2. Fuel Circuit

a. Slow circuit

After passing through the main jet (7), the fuel flows through the passage (8) regulated by the slow and pilot jets (9). The fuel is mixed with air entering through the slow air jet (10), and the mixture is sprayed through the pilot outlet (11) and the bypass (12) into the space around the throttle valve. The pilot outlet (11) is provided with the pilot screw (13) to regulate the mixture.

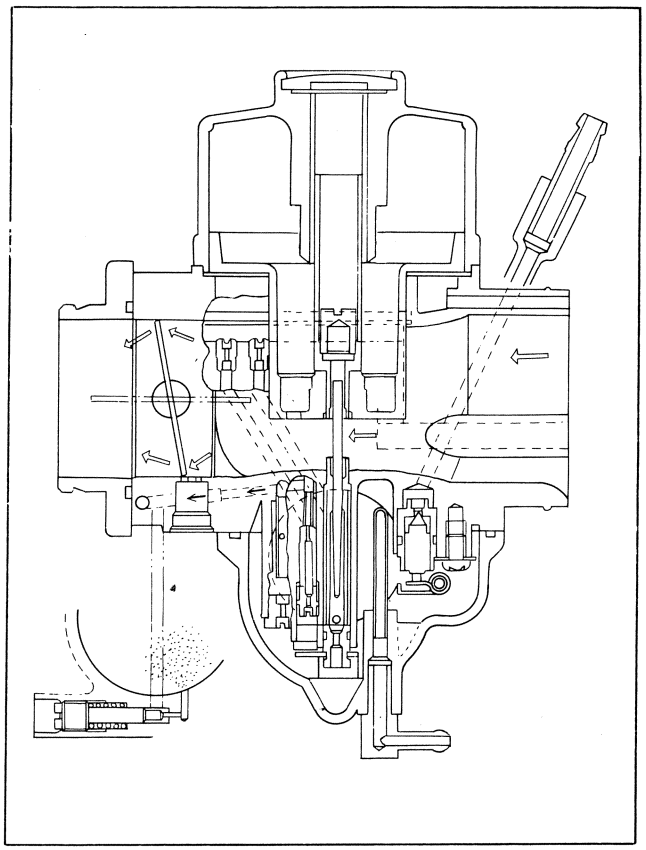
b. Main Circuit

As noted in 2.a., part of the fuel flowing through the main jet (7) goes into the slow circuit, but the greater part of the fuel is mixed in the needle jet holder (14) with the air flowing from the air jet (15). This mixture is sprayed out from the needle jet (16).

When the vacuum piston is in the range from the fully closed position (forming the primary venturi) to the half throttle position, the fuel flow is regulated by the tapered end of the jet needle (17) attached to the vacuum piston (4) in order to prevent excess fuel from streaming out of the needle jet.

3. Float Chamber

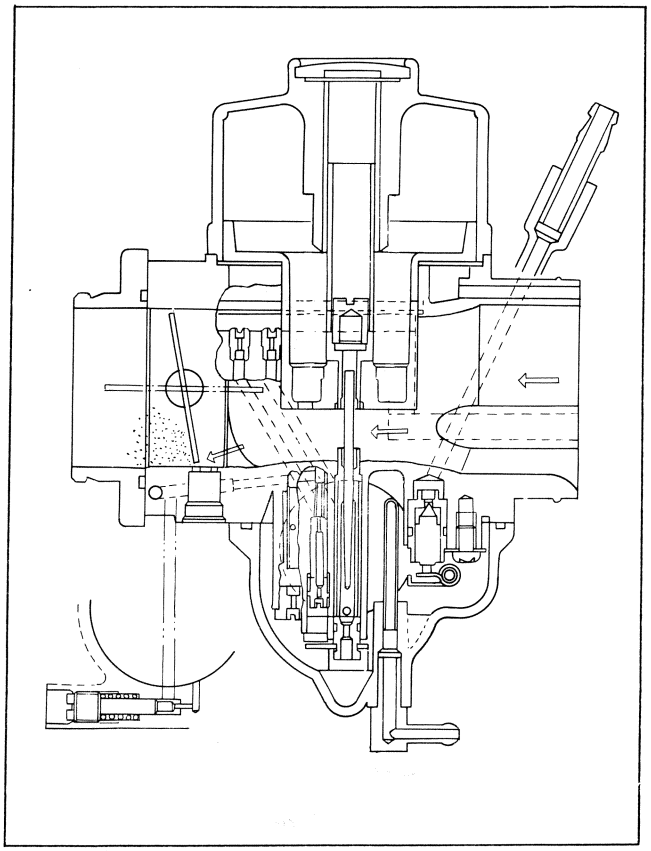
The carburetor must produce an air-fuel mixture matching the throttle opening and the engine speed, and for this reason, the fuel level in the float chamber must be constant. The fuel supplied from the fuel tank flows through the passage (18), valve seat (19) and valve (20) to the float chamber (21). As the fuel level rises, the float (22) moves up and causes the float arm (23) to push the valve (20) into the valve seat. Thus the fuel stops flowing into the float chamber. As the fuel level goes down, the float also lowers. This makes the fuel inlet open, and the fuel begins to flow into the float chamber. By repeating the up-and-down movements, the float maintains a constant level of fuel in the float chamber. A flat spring is used to prevent the excessive downward movement of the float due to road shock. In addition, in order to prevent the fuel level from rising excessively when dust on the valve seat keeps the fuel inlet open or when the vehicle leans over to one side too much, the float chamber has an over-flow pipe (24).



4. Functions and Adjustments

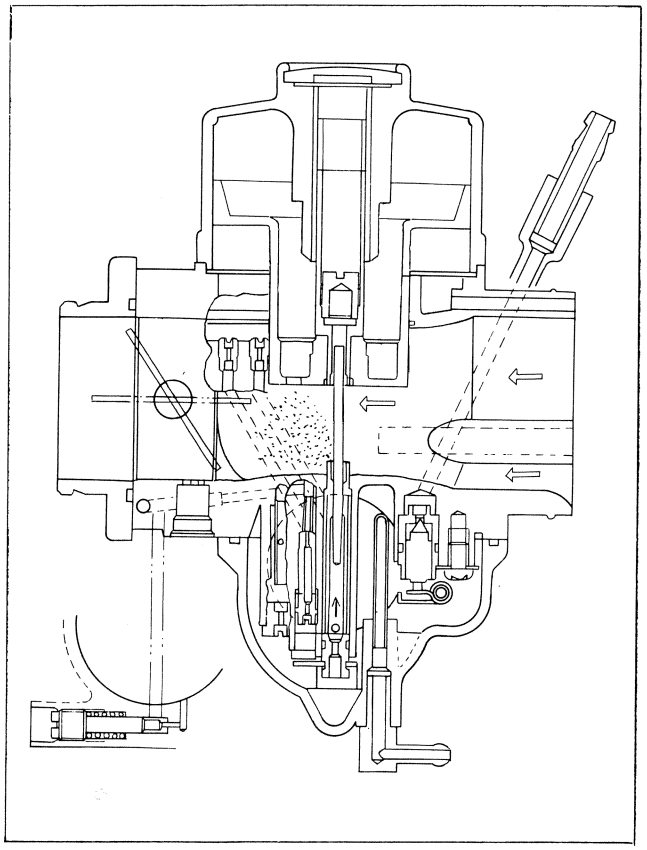
1) Idling (Fig. 2)

When the engine idles, the throttle is almost closed, and the fuel is sprayed through the pilot outlet (11). Therefore, the strength of the mixture is regulated by the pilot screw (13). Loosening the pilot screw makes the mixture richer, and tightening makes the mixture leaner.

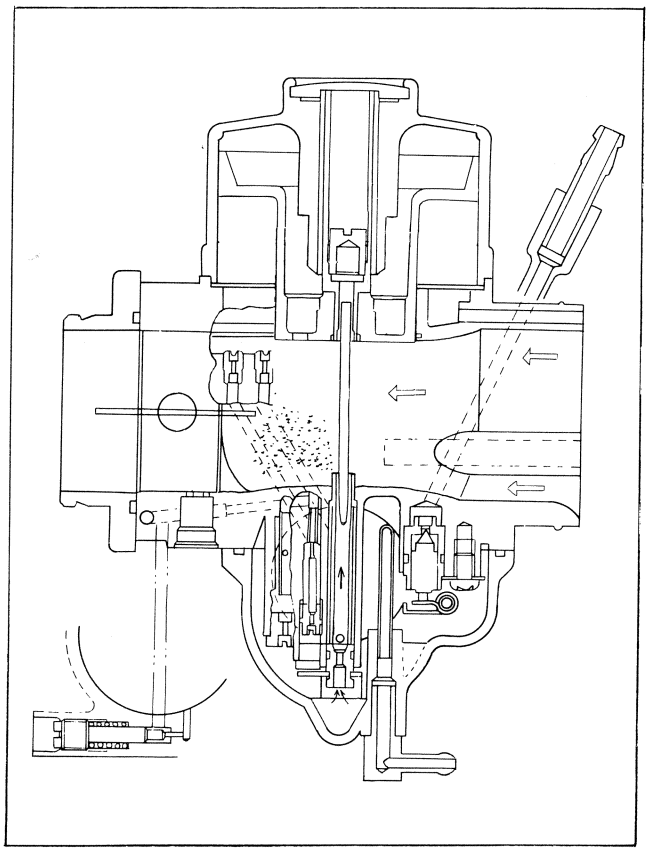


2) Low-speed and Touring (Fig. 3)

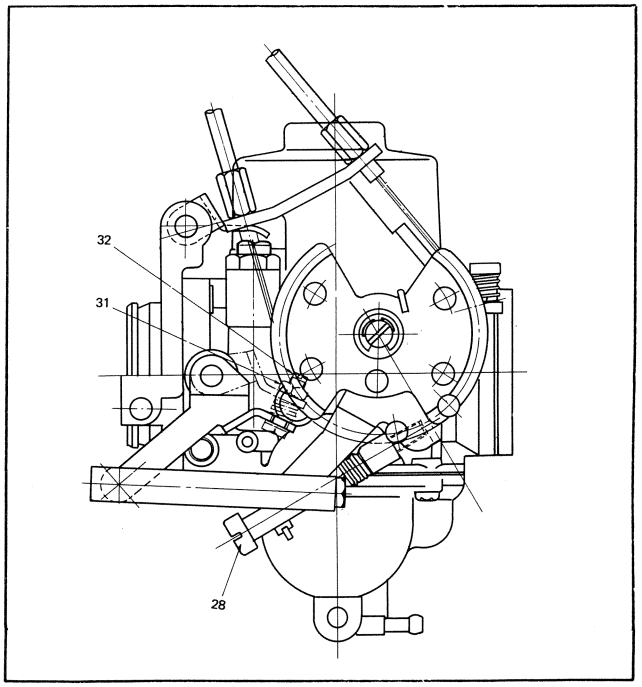
The throttle valve is kept open slightly, and the fuel flows mainly through the bypass (12). The mixture is regulated by the slow and pilot jets (9).



3) Medium-speed (Fig. 4)
The throttle opening is larger, and the vacuum piston begins to move up. The fuel is supplied through the main circuit (needle jet) and the amount of fuel is regulated by the jet needle (17). As the vacuum piston opening increases, the amount of fuel sprayed from the needle jet (16) also increases, and therefore, the strength of the mixture is regulated by changing the position of the jet needle (17). The higher the **jet needle position, in relation to vacuum piston position, the richer the mixture**



4) High-speed (Fig. 5)
Both throttle valve and vacuum piston are in the full-open position; the jet needle to the highest position; and the fuel is sprayed from the needle jet. The strength of the mixture is controlled by the main jet (7).
It should be pointed out that on the border line between the two speed ranges, more than one jet continues to function, and therefore, adjustments 1 to 4, foregoing, must be made with special care.

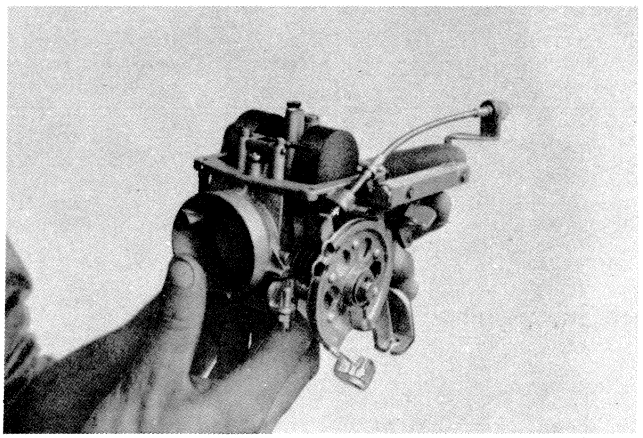


Idle-speed Adjustments (Fig. 6)

The idling speed can be adjusted by the knurled throttle stop screw located at the lower left side of the left carburetor. When the throttle stop screw is turned in, engine speed increases, and when the screw is turned out, engine speed decreases. If turning out the screw fails to reduce engine speed, it is necessary to adjust the length of the throttle wire at the wire adjustor. Butterfly synchronization: Both butterfly valves must be adjusted to open and close simultaneously. Fully close the throttle grip so that the butterfly valve actuator mechanism rests against the throttle stop screw.

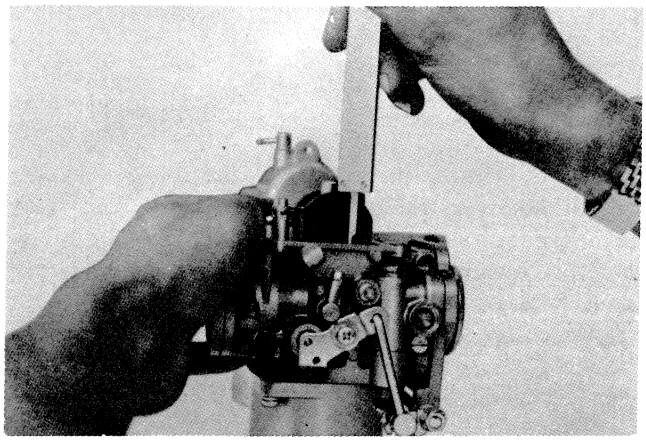
With the throttle fully closed, both throttle cables should have approximately 1mm free play before the butterfly valves start to lift. Next, remove the plugs on the manifold side of the carbs. With the plugs removed, a manifold vacuum gauge can be fitted for idle synchronization. Vacuum must be 2.3 - 2.5 lbs. on each side (120 - 130mm Hg) with idle at 900-1,000 rpm. Change synch. screw (32) as required, then tighten lock nut (31) thoroughly.

Note:
Idle speeds on both carburetors MUST BE SET before synchronizing butterfly operation.

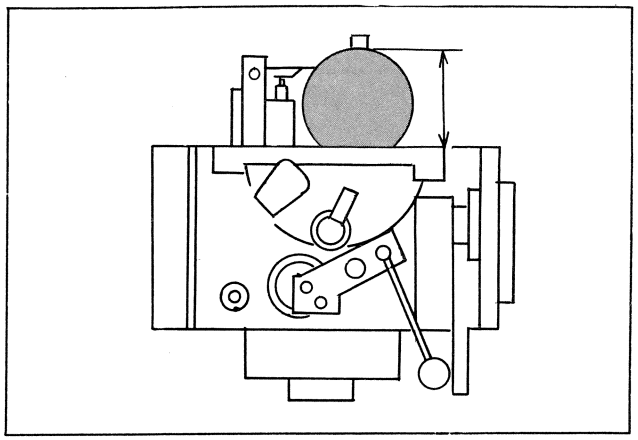


Fuel Level Adjustment

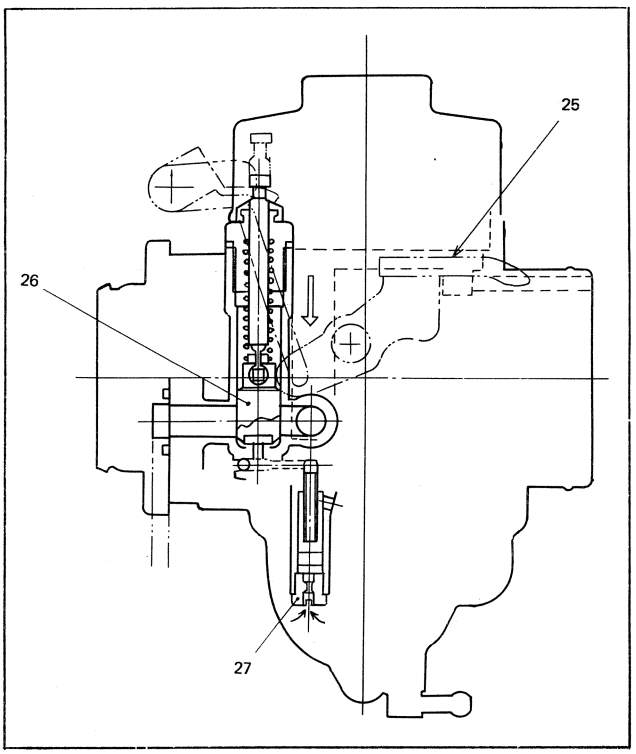
1) Remove the float bowl from the mixing chamber body. Place the mixing chamber body upside down.



2) Keeping the float arm tang contacting the float valve pin lightly, measure the distance from the mating surface of the float bowl and mixing chamber body to the top of the float.
If the fuel level is incorrect, it should be adjusted by bending the float arm tang. Check the float valve for dust and grooved wear at the same time.



Specific float level:	22.0mm
Difference in float level between right and left carburetors:	0.5mm or less



Starter (Fig. 7)

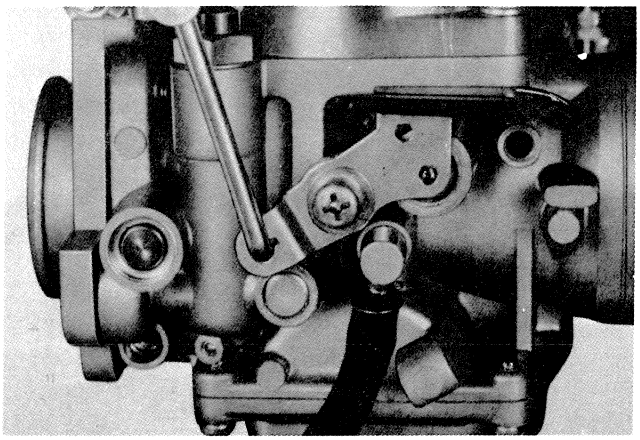
To start a cold engine, a rich mixture is needed, so the starter jet circuit is incorporated. As the starter lever (25) is turned down, the starter plunger (26) moves upward. Fuel passing through the starter jet (27) is mixed with air from the starter air jet. This rich mixture is supplied to the engine.

To start the engine, the starter lever must be pressed downward(the throttle valve must be fully closed). After the engine is warm, the starter lever must be returned to the home position.

Disassembly and Assembly Procedures (For replacement or cleaning)

Note on Throttle Wire Installation

Because of the smaller cylinder pitch, it is difficult to remove or install the throttle wires with the carburetors mounted. That is, the wires for opening and closing the throttle are installed in a narrow space. Demount the carburetors, before starting the operation. Otherwise, throttle wires could easily be bent.

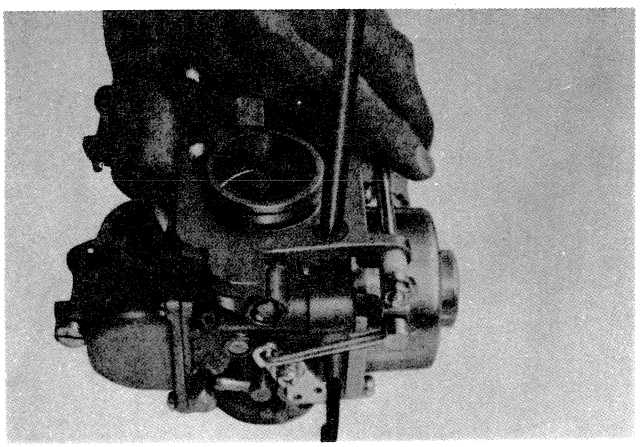


Separating the carburetors

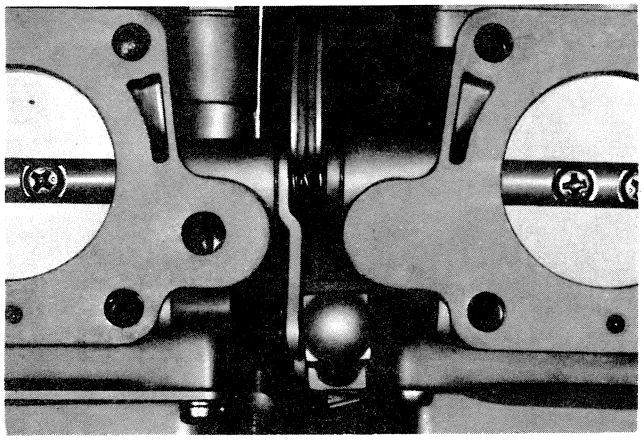
Caution:

The float bowl and vacuum chamber body can be removed without removing the carburetors from the carburetor mounting stay, and therefore, it is advisable not to remove the carburetors from the carburetor mounting stay if at all possible.

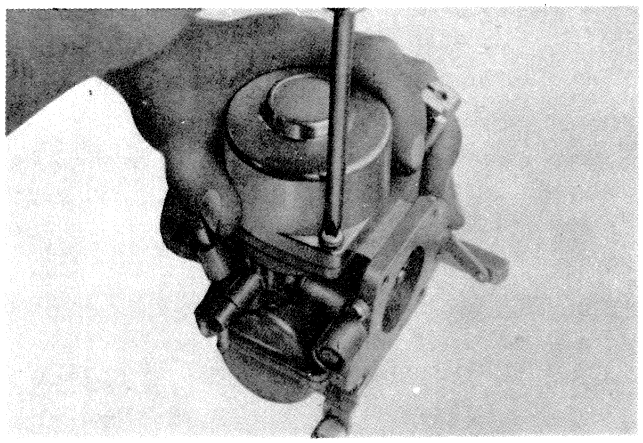
1. Loosen the starter knob lock screw, and separate the knob rod from the link shaft assembly.



2. Remove the four flat head screws, and remove the carburetors from the carburetor mounting stay

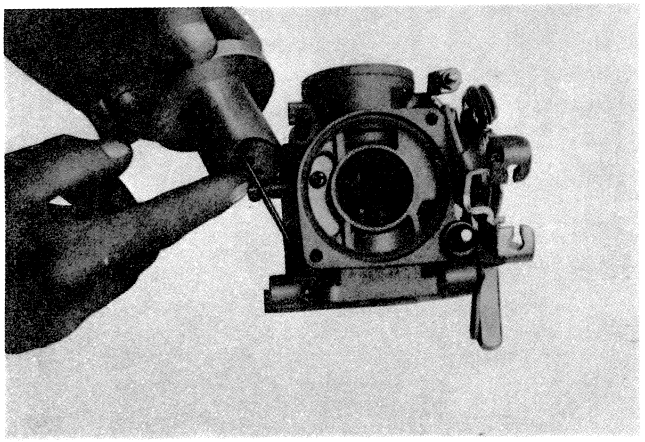


Note:
To keep the butterfly valve shafts, both right and left, from shaking axially, a compression spring is installed. When separating the carburetors, take special care so that the spring will not fall.

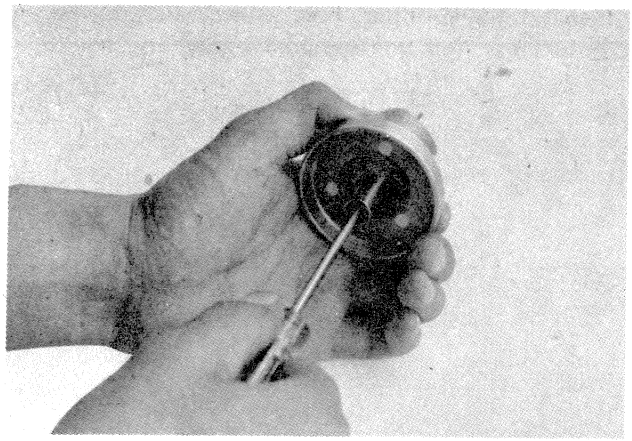


VACUUM CHAMBER

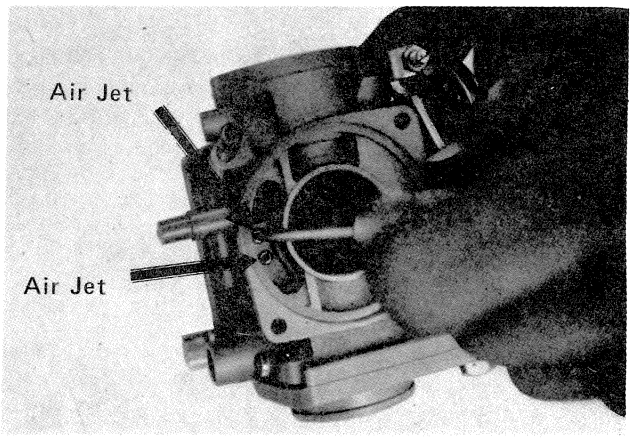
1) The vacuum chamber cover on top is held in place by two screws. Remove these screws and lift off the chamber cover.



2) Once the cover has been removed, the spring and vacuum piston with jet needle can be removed



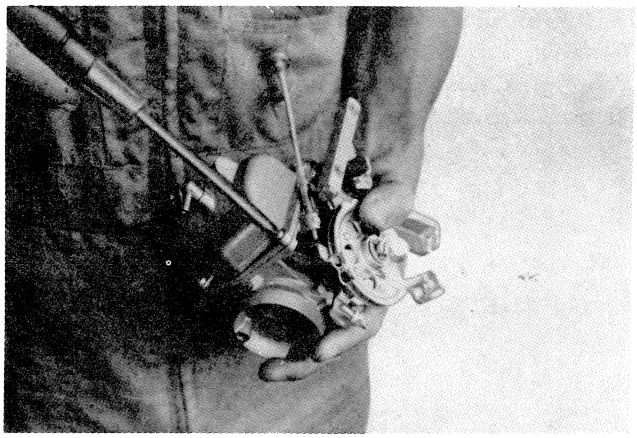
3) Remove the jet needle set-screw from the vacuum piston using a slotted-head screwdriver. Remove the jet needle.



4) Remove the phillips-head screw (pan-head), remove the steel and fiber plates, and remove the slow air jet (S.A.J.) and main air jet (M.A.J.).

Caution

Take care so that the slow air jet and main air jet are not installed in reversed positions. The slow air jet is installed on the engine side, the main air jet towards the air cleaner side.

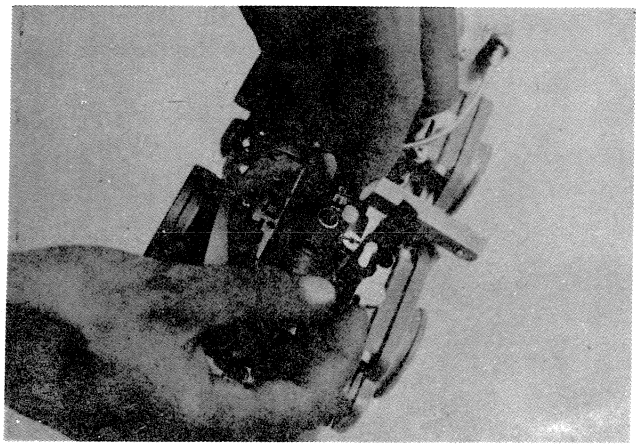


Float Chamber

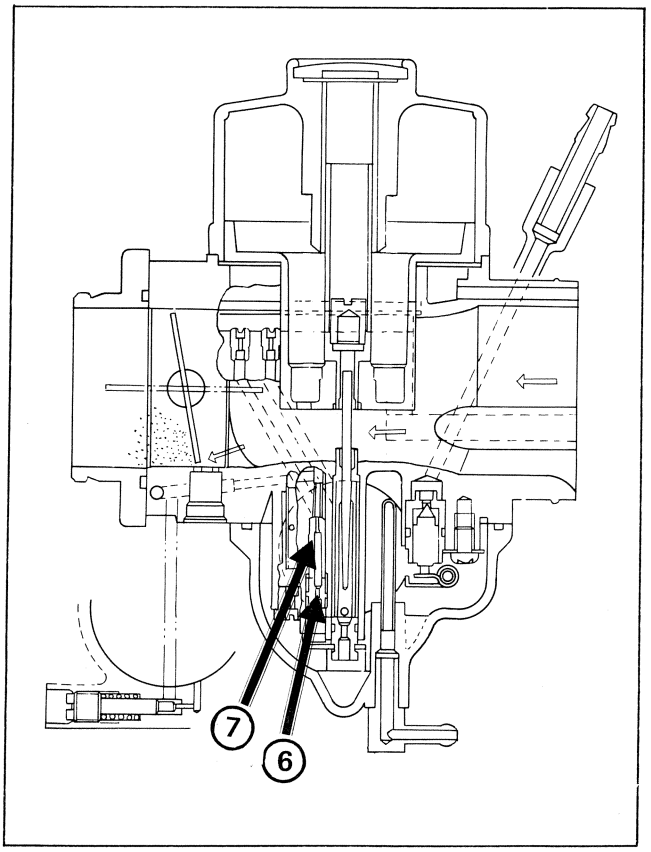
1) Remove the four pan head screws, and remove the float bowl from the mixing chamber body.

Note:

Spring washers are used for the screws fastening the throttle stop screw mounting stay and float bowl. Do not forget to install these washers when installing the float chamber.



2) Remove the clip plate, main jet and needle jet.
Both main jet and needle jet can be removed by pulling them toward you by hand. No tools are necessary.
Take care so that the needle jet is not installed in the inverted position.



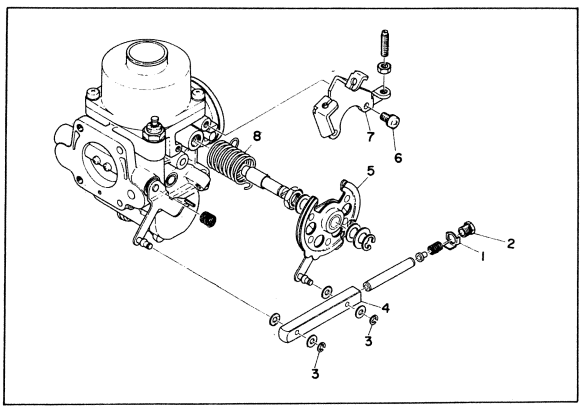
3) The slow jet (S.J.) (7) is threaded into the mixing chambers body and the pilot jet (P.J.) (6) is threaded into the mixing chamber beneath the slow jet. Remove these two jets using a slotted-head screwdriver.

As noted above, the two jets, pilot and slow, are used in the pilot circuit in order to maintain a constant amount of fuel supply to the engine even when the brake is applied suddenly.

That is, the abrupt application of the brake causes the fuel level to fluctuate greatly. In addition, the inertia of fuel flow makes it difficult to regulate the flow of fuel by a single jet. For this reason, two jets are used, and thus, the fuel flow can be regulated more precisely.

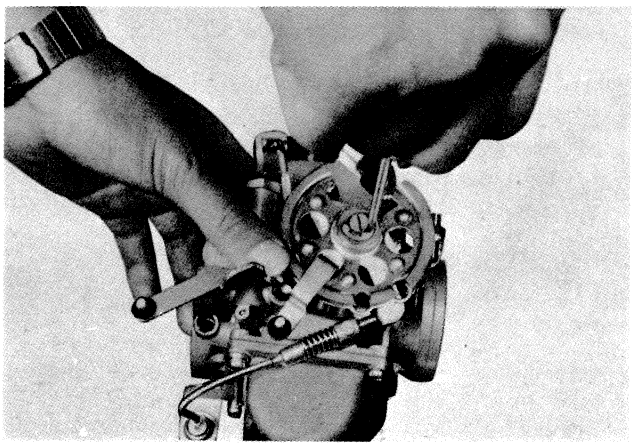
The fuel flowing through the pilot passage passes through the main jet, pilot and slow jet, in that order.

4) If necessary, remove the starter jet.

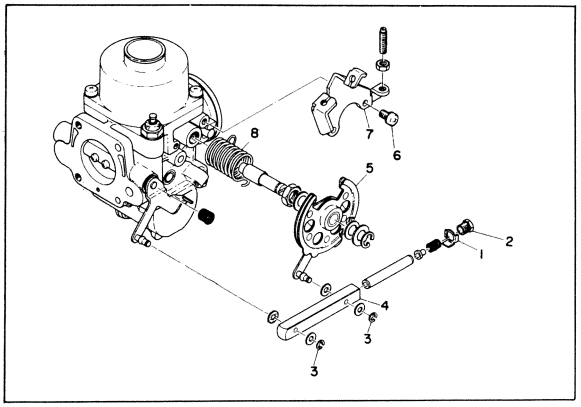


Removing the throttle valve return mechanism

1. Straighten the adjusting holder lock washer (1), and remove the holding bolt (2). Next, remove the two bar clips (3), and remove the adjusting holder (4) from the throttle levers (5). The adjusting holder is attached with many small parts. Be careful not to lose any one of them.



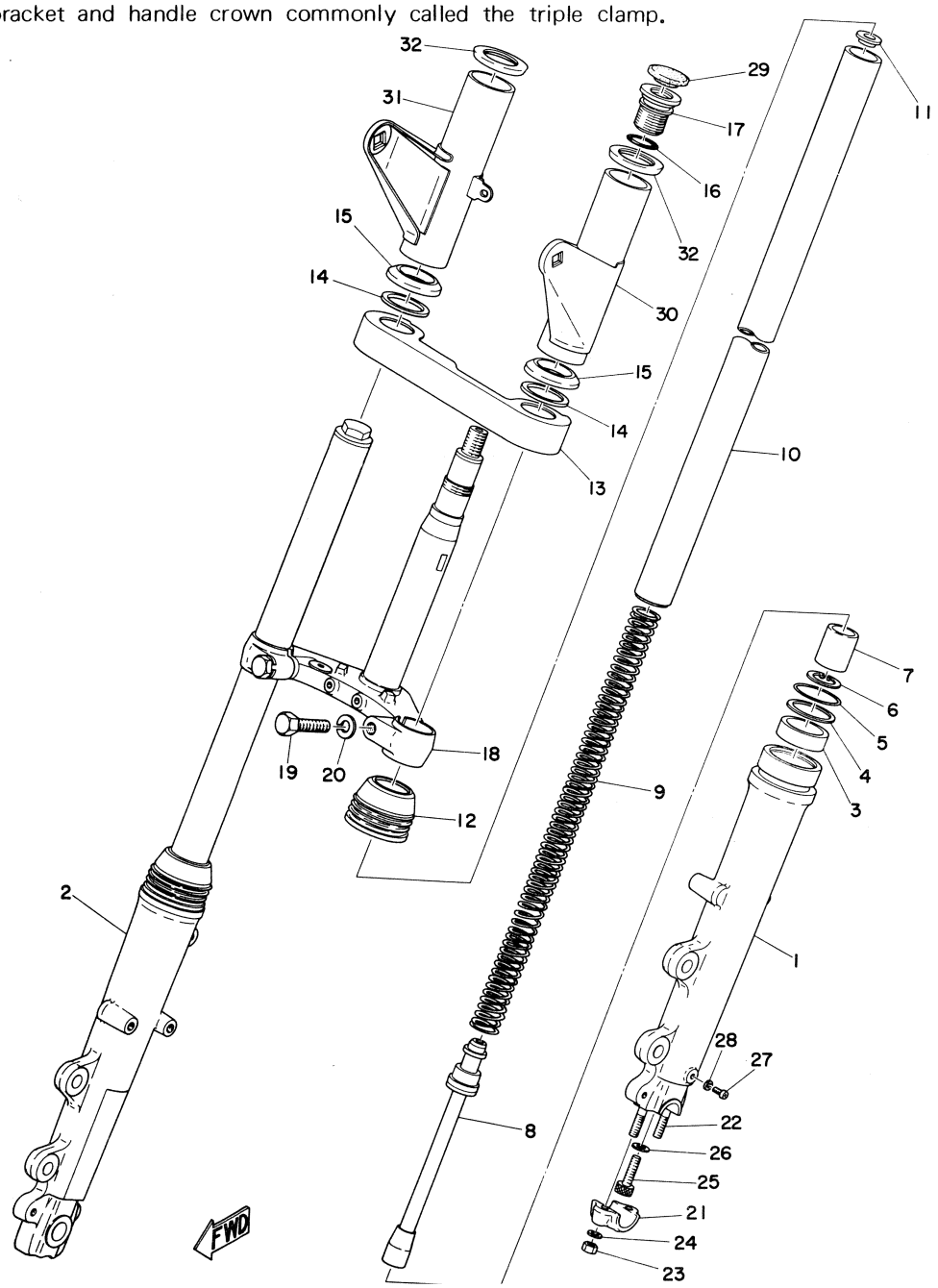
2. Remove the E clip, and remove the throttle lever. Note that plate washers (made of vinyl chloride or steel) are placed on both sides of the throttle lever. Do not forget to install them when assembling the adjusting holder.



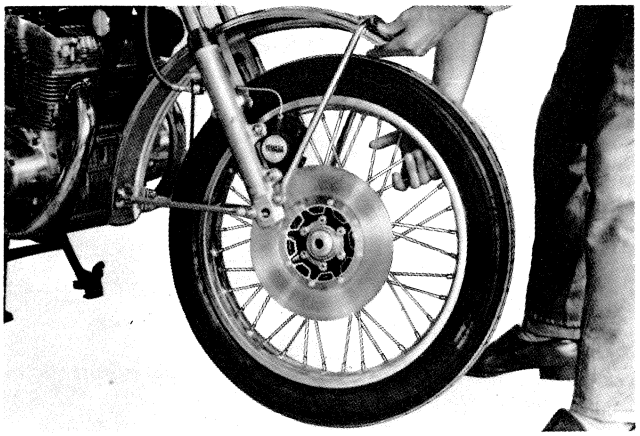
3. Remove the two panhead screws (6), add remove the wire holder (7). The torsion spring (8) can be removed at the same time.

FRONT FORKS

The front forks consist of two individual fork legs, each one having a two-way hydraulic dampening action and an internal spring to extend the fork leg during operation. In addition, the forks are held solidly in place by an under-bracket and handle crown commonly called the triple clamp.



1 Tube, outer left
2 Tube, outer right
3 Oil seal
4 Washer, oil seal
5 Clip, oil seal
6 Circlip (R-28)
7 Piston
8 Cylinder comp.
9 Spring
10 Tube, inner
11 Seat, spring upper
12 Seal, dust
13 Cover, outer
14 Packing
15 Cover guide, under
16 Packing
17 Bolt, cap
18 Under bracket comp.
19 Bolt
20 Washer, spring
21 Holder axle
22 Bolt, stud
23 Nut
24 Washer, spring
25 Bolt
26 Packing
27 Plug, drain
28 Packing
29 Cap
30 Cover, upper left
31 Cover, upper right
32 Guide, cover upper

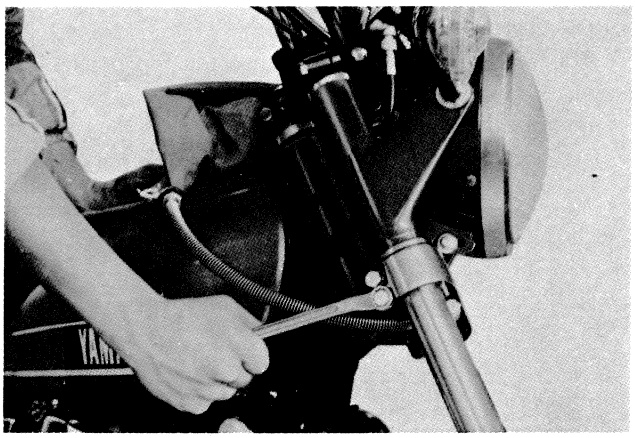


Disassembly

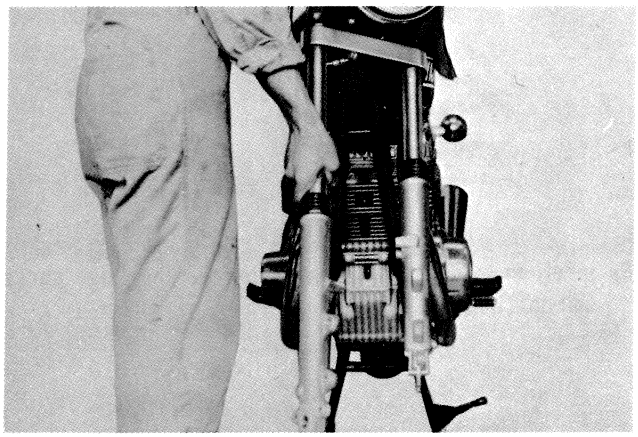
Note:

Remove the front wheel and front fender before starting this procedure.

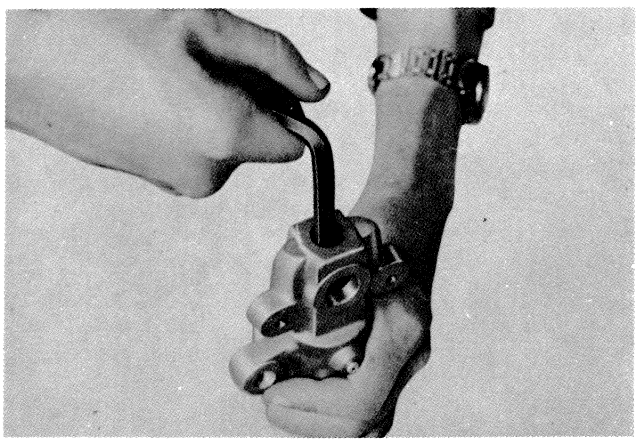
To remove the front fork leg (right), the disc brake caliper must be removed.



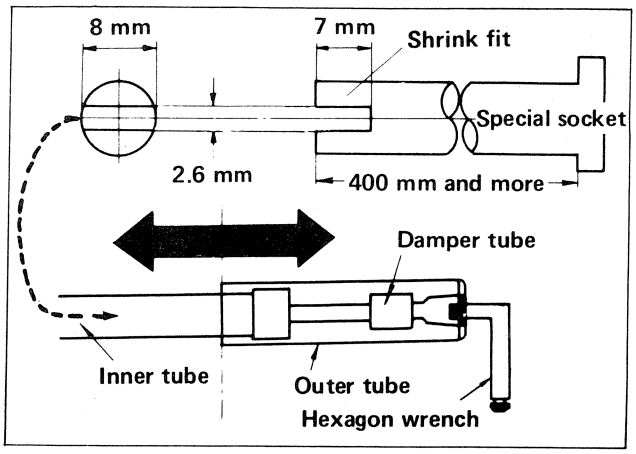
1) Loosen the underbracket bolts and front fork holding bolt on handle crown.



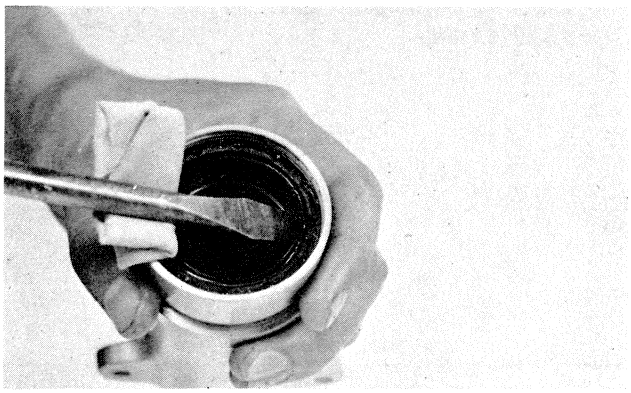
2) Pull the inner fork tube out of the mounting brackets.



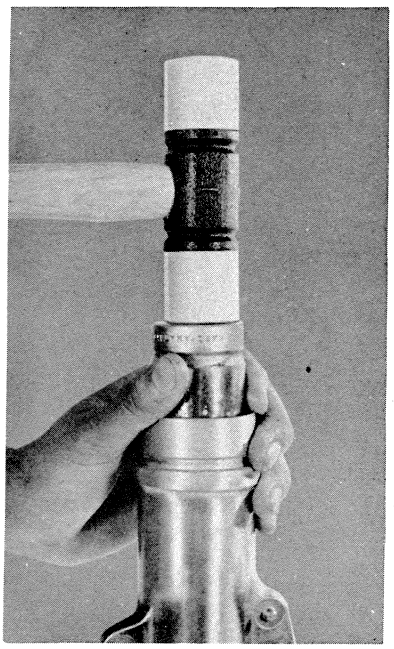
3) Remove the cylinder mounting bolt at the bottom end of the outer tube.
If it is difficult to remove the bolt because of the cylinder revolving, take the following steps.



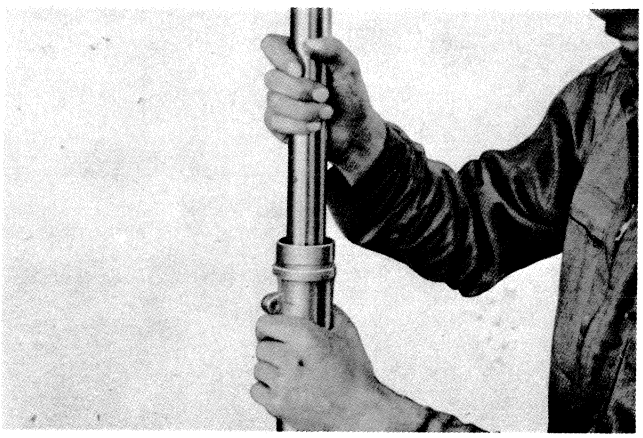
4) Remove the bolt by pulling the inner tube to the full limit of its travel. This will cause friction to be applied to the damper. If this is unsuccessfull, a special socket must be made to attach to the top of the damper tube inside the inner fork leg.

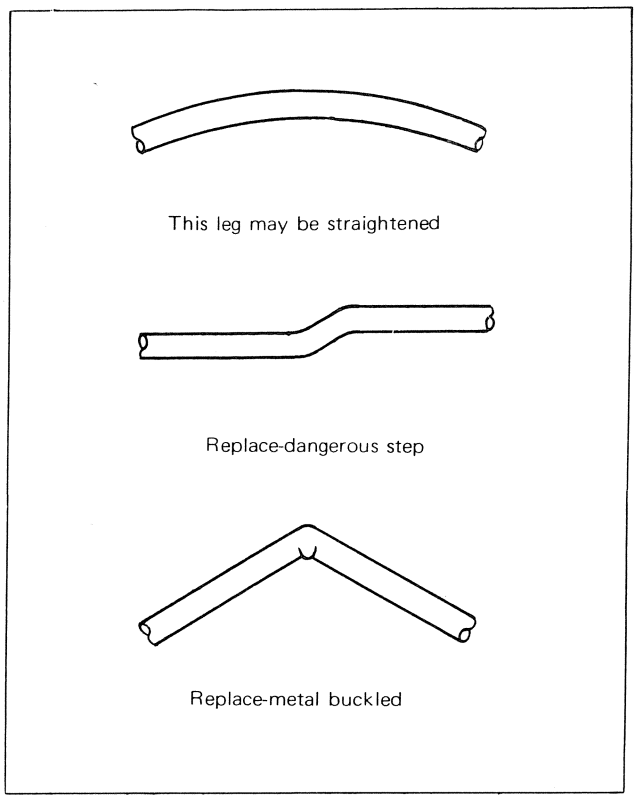


5) Oil Seal
The oil seal that is pressed into the top of the outer nut should be replaced whenever the forks are disassembled.



6) **Insert new seal "open" side down using large socket and soft hammer.**





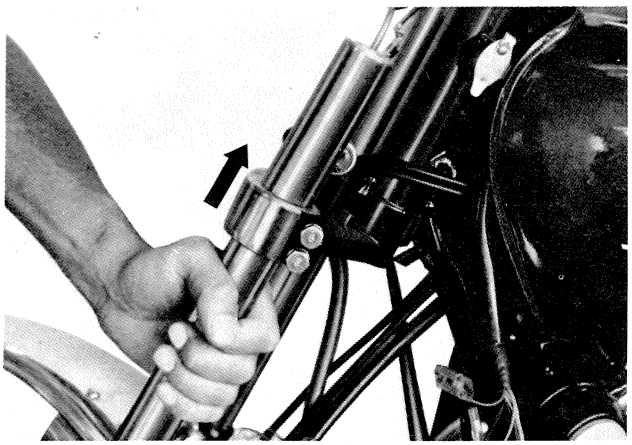
Inspection

Fork Wear

1) Inner fork tube:
   a) The inner fork tube must be checked for surface wear and bends. The tube gets scratched from dirt working past the seal and continually rubbing against the tube. In addition, the tube can become deeply grooved if it is bent.

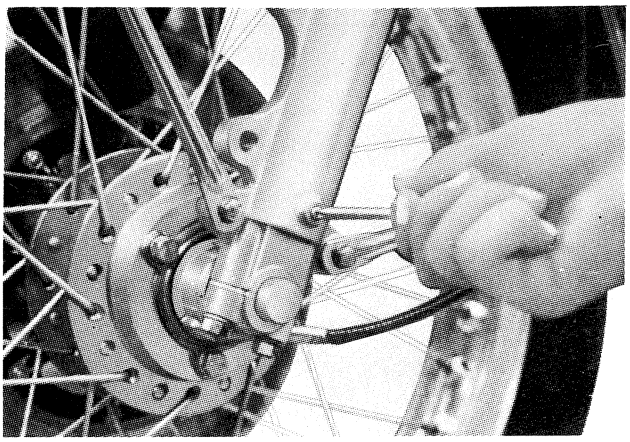
   b) Deep grooves, or nicks, can quickly wear out the seal lips and permit oil to blow past the seal. Replace the tube if these deep grooves are evident.

   c) Also check for a bent tube. If the tube is found to be bent for any reason, the safest procedure is to replace it.



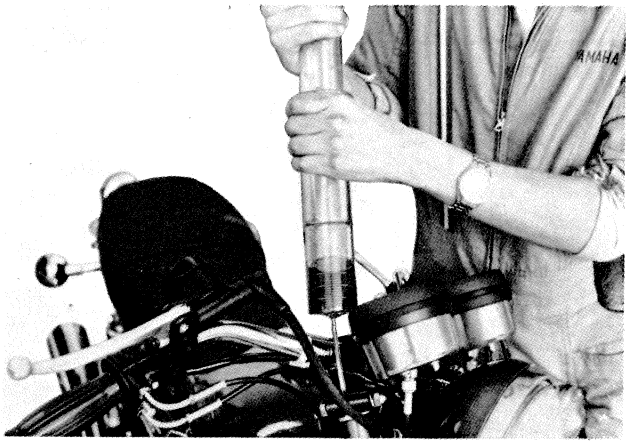
Fork Installation

a) Slide the inner fork leg up through the underbracket and handle crown and tighten the underbracket bolts and pinch bolts.
   This firmly locks the inner tube in place.



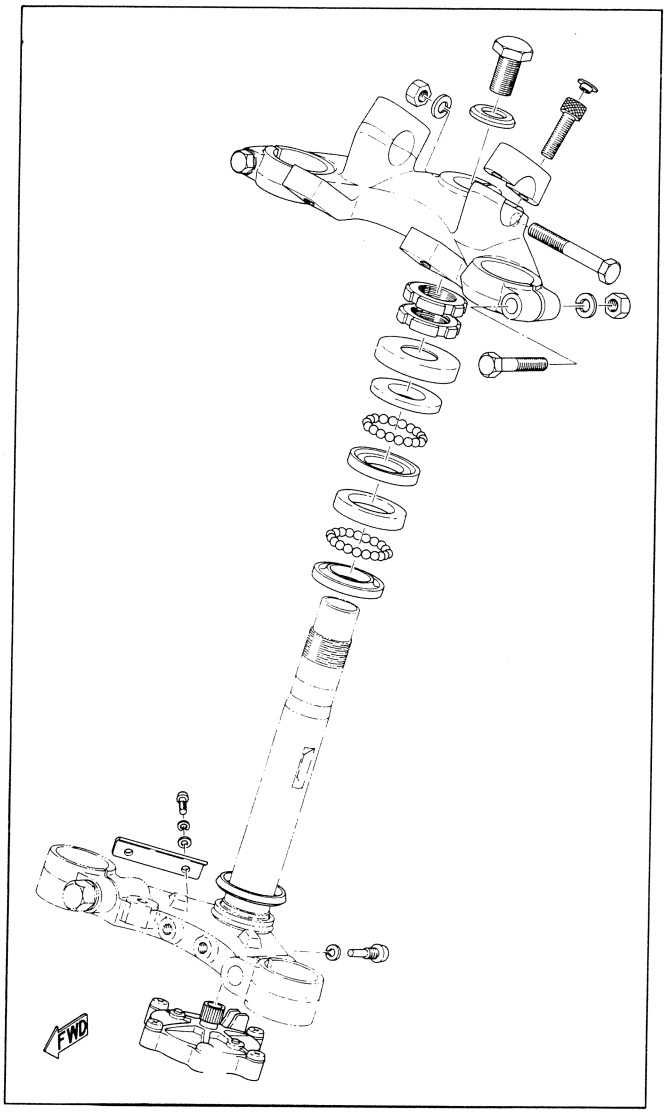
Changing fork oil

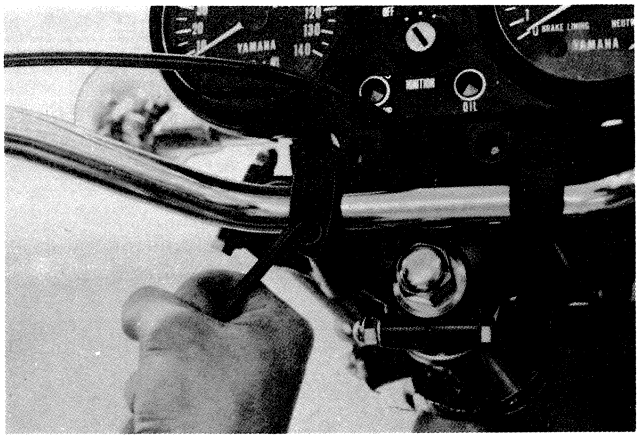
a) Remove the drain screw from the outside of both forks and allow the oil to drain out. Push down on the handlebar a few times to compress the forks and pump out any remaining oil.



b) Install both drain screws, then unscrew both fork cap screws. Pour 173cc (5.8 fl.oz) of 10W/30 into each leg. Install both cap screws.

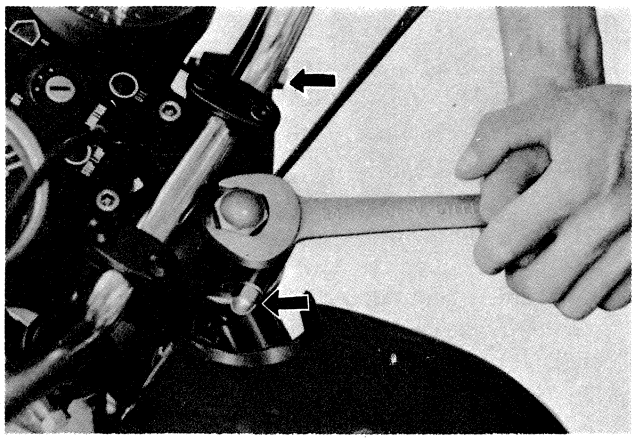
HANDLE CROWN/UNDERBRACKET



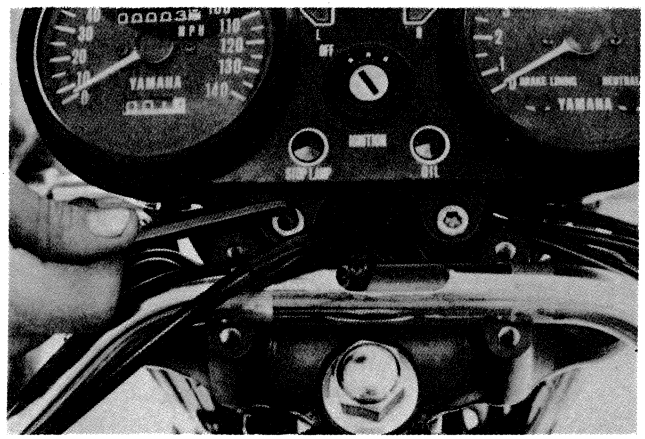


Note:
The following procedures can be performed with the entire fork unit still attached.

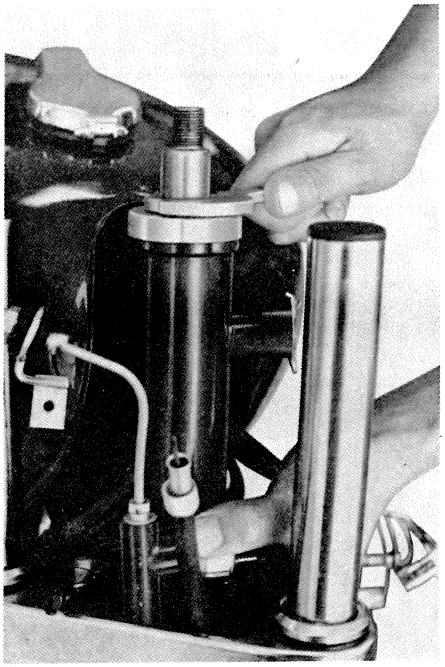
1) Remove the handlebar holder retaining bolts, then remove the holder.



2) Loosen the handle crown lock nut, unscrew the steering stem bolt, and remove the front fork bolts. The handle crown can now be removed.



3) Remove the meter panel mounting bolts.



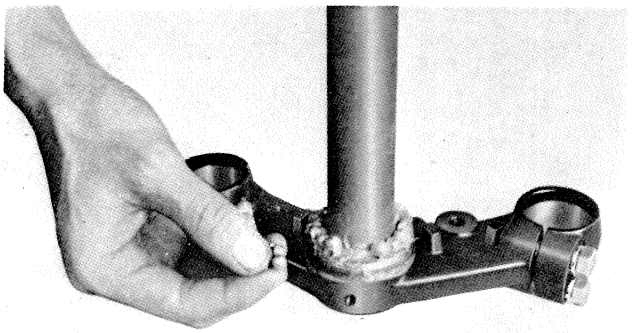
4) When removing the under bracket, it is necessary to remove the wiring inside the head lamp body, disc brake oil hose joint nut, and head lamp clamp bolt.

5) Beneath the handle crown are two stem ring nuts that holds the underbracket in place. Remove it.

6) Take care when removing the bottom ring nut, as the underbracket will begin to drop down, away from the steering head.

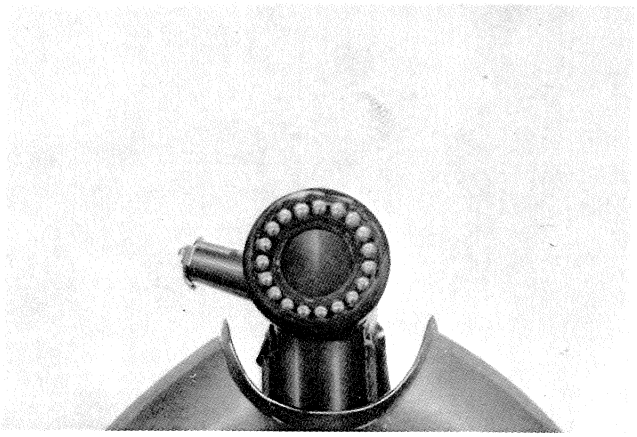
Caution

The top and bottom steering head balls (including top and bottom races for each set of balls) are held in place by the underbracket and ring nut. Take care when removing the underbracket that none of the balls drop out and become lost.



7) Examine all the balls for pits or partial flatness. If any one is found defective, the entire set (including both races) should be replaced. If either race is pitted, shows rust spots, or is damaged in any way, replace both races and all balls.

8) Mount both bottom races and the balls onto the underbracket (balls completely greased).



9) Carefully slip the underbracket stem up into the steering head. Hold the top bearing assembly in place so the stem does not knock any balls out of position.

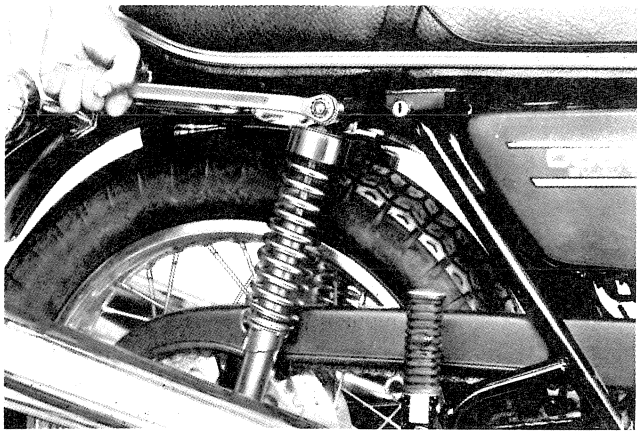
10) Install both top races and balls into the top of the steering head. Be sure the balls are completely greased during installation.

11) Thread the ring nut down over the stem to hold the underbracket in place.

Important

Tighten the lower ring nut so that all free play is taken up, but so that the bracket can still pivot freely from lock to lock. Recheck for free play after the entire fork unit has been installed and tighten the upper ring nut reassembled.

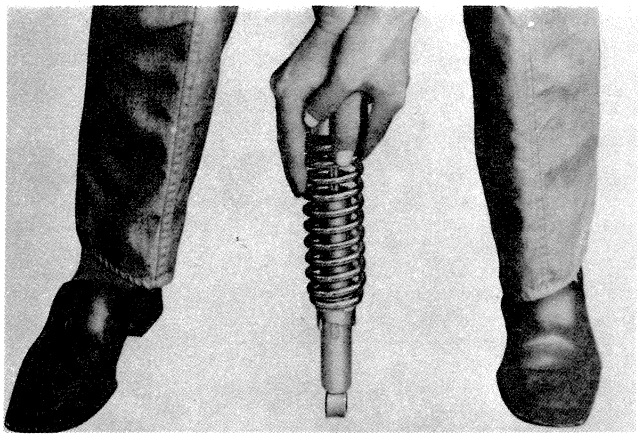
12) Set the handle crown into position over the ring nut. Locate both crown arms over the upper covers and lock in place by threading on and tightening the stem lock nut.



REAR SUSPENSION UNIT

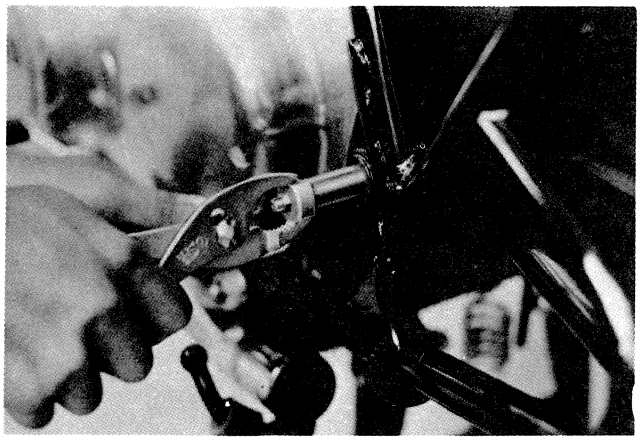
Disassembly

Remove both mounting bolts and pull the suspension unit out of the frame and swing arm mounts.



Inspection

A unit that has lost its suspension qualities will compress quite easily and rebound quickly. To test the effectiveness of the unit, compress it as far as possible and then immediately take all weight off the shock. A suspension unit that is working properly will rebound quickly halfway and then slowly expand the second half. A defective shock will rebound to its fullest length without hesitation.

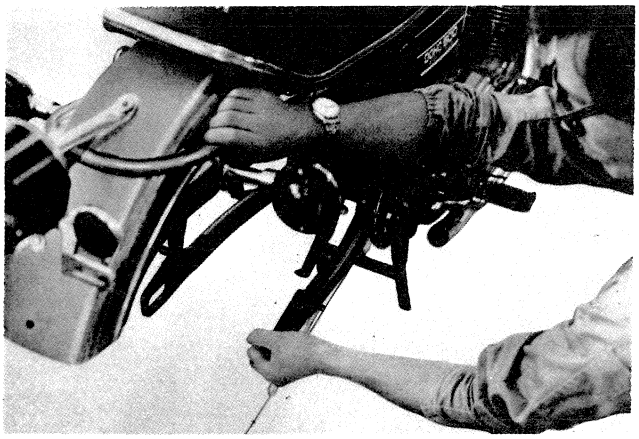


SWING ARM REMOVAL

Note:

The rear wheel assembly and rear shock lower mounting bolts must be removed before the swing arm can be removed.

The swing arm is held to the frame by a pivot shaft. Bend the shaft lock tab down, remove the lock nut, and pull out the pivot shaft. The swing arm can now be removed from the frame.

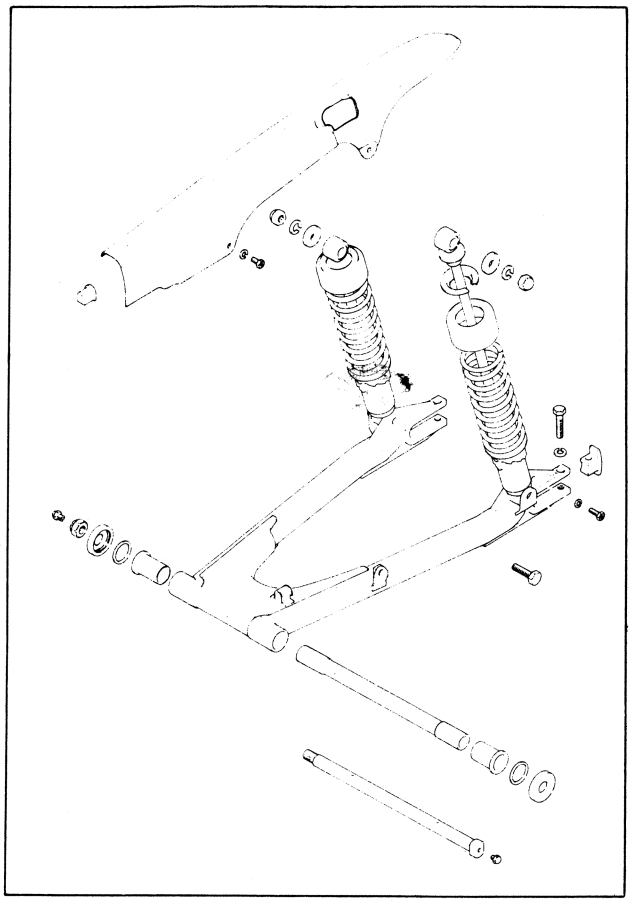


Inspection

Wear

Wear of the swing arm pivot shaft bushings can cause wheel hop and wobble. With the swing arm installed (rear shocks and wheel removed) grasp the swing arm, twist slightly to feel for excessive shaft play in the bushings.

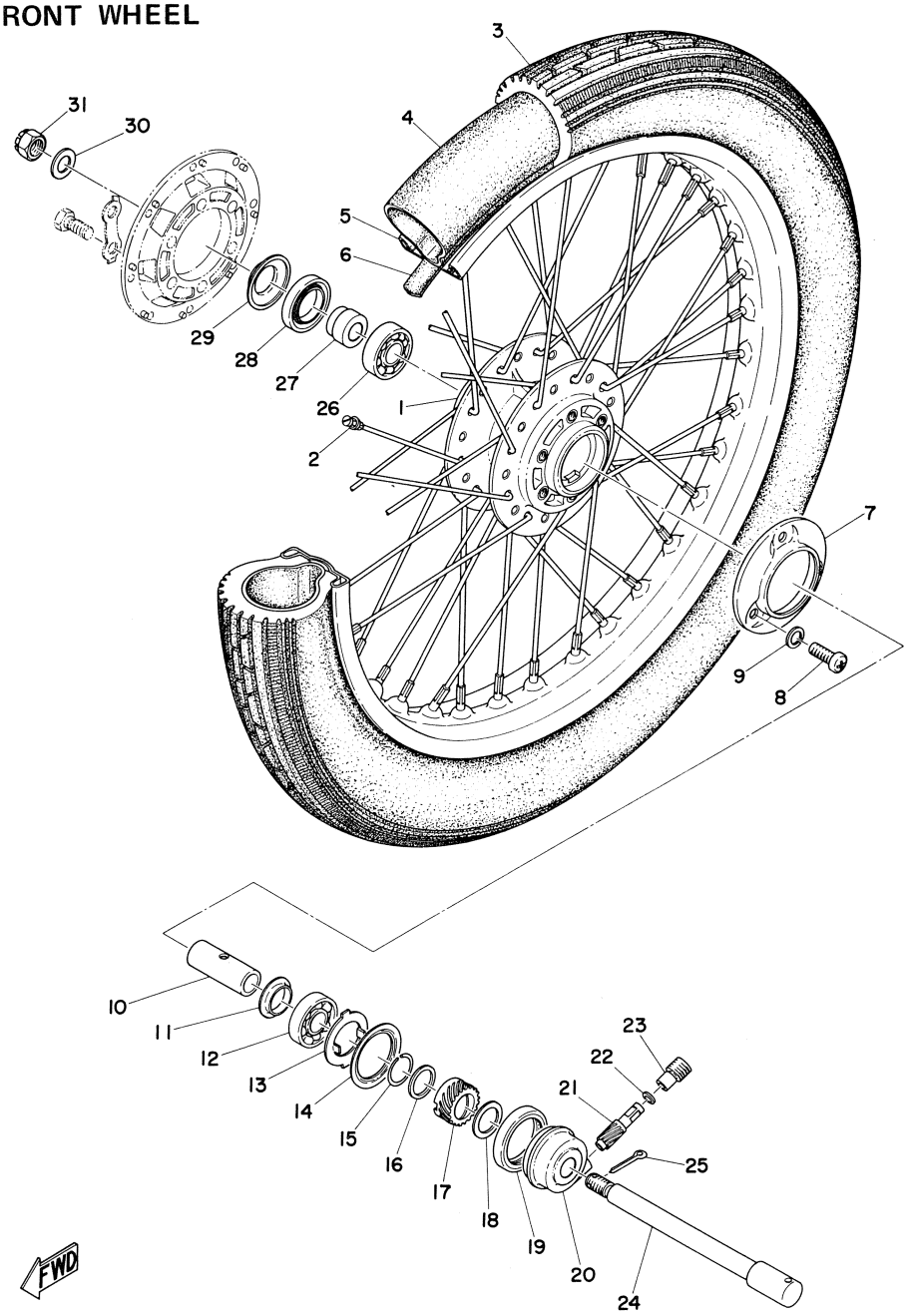
There should be virtually no play at all for the bushings to be useable. If play exists, the bushings are worn. Press them out of the swing arm and install new ones.



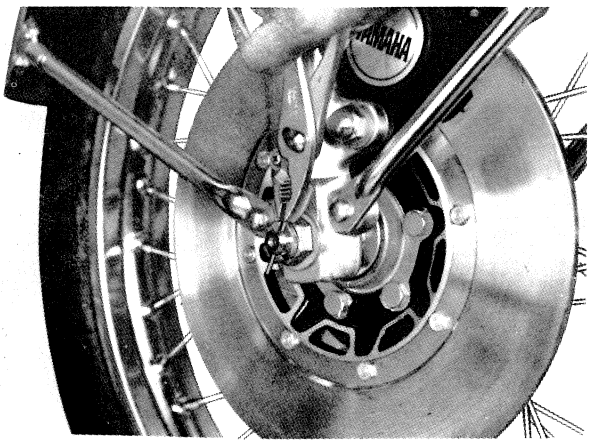
Lubrication

The swing arm pivot shaft end is fitted with a zirc grease fitting. Pressure feed a small amount of grease into this fitting per recommendation.

FRONT WHEEL

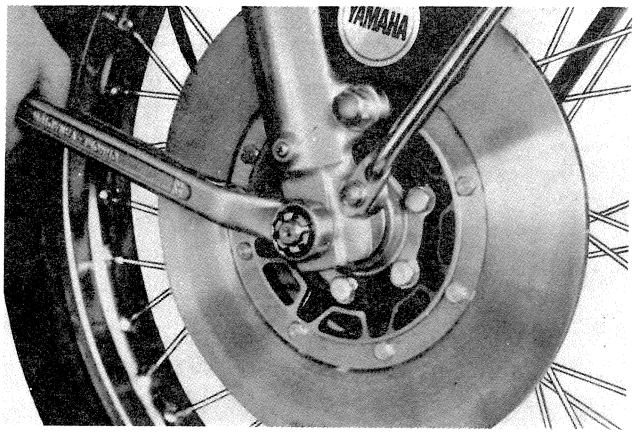


1 Hub, front
2 Spoke set
3 Tire, front (3.25-19-4PR)
4 Tube (3.25-19)
5 Rim (1.60A-19)
6 Band, rin (3.25-19)
7 Cover, housing
8 Screw, panhead
9 Washer, spring
10 Spacer, bearing
11 Flange, spacer
12 Bearing (B6303Z)
13 Clutch, meter
14 Retainer, clutch meter
15 Ring, stop
16 Washer, thrust 2 (25-29-1.0)
17 Gear, drive
18 Washer, thrust 1 (25-32-1.0)
19 Oil seal (SDD-45-56-6)
20 Housing, gear unit
21 Gear, meter
22 Washer (6.2-9.5-0.8)
23 Bushing
24 Shaft, wheel
25 Pin, cotter
26 Bearing (B6303)
27 Collar, wheel shaft
28 Oil seal (SD28-47-7)
29 Cover, hub dust
30 Washer, plain
31 Nut, shaft

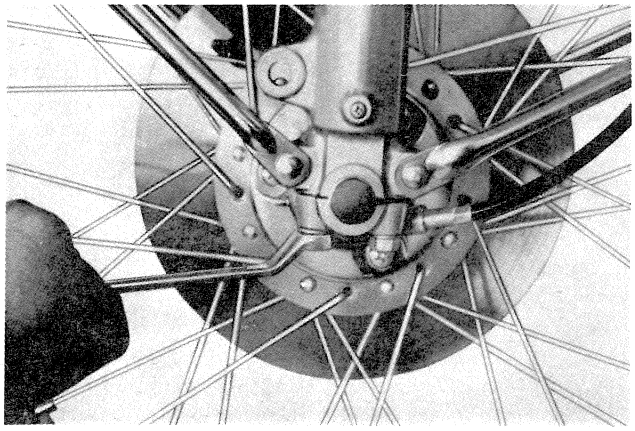


Disassembly

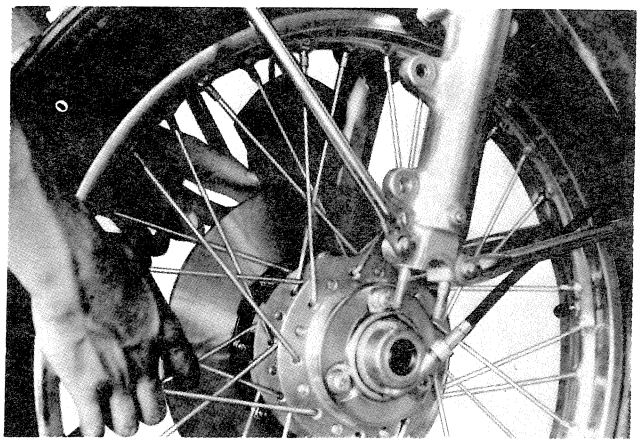
1) Remove the front wheel shaft nut lock pin.
The pin must be replaced with a new one each time it is removed.



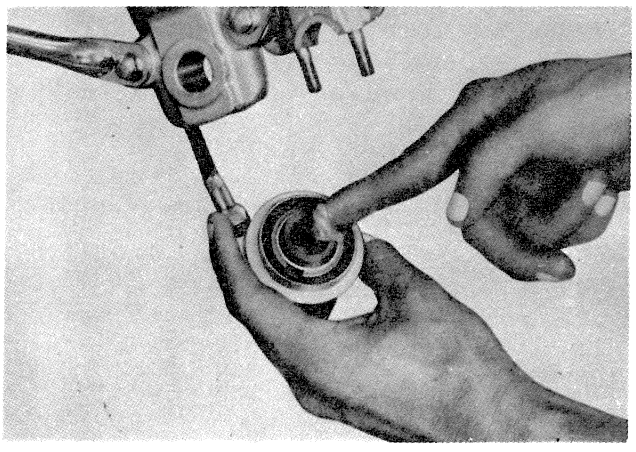
2) Remove the front wheel shaft nut.



3) Loosen the two front wheel shaft lock bolts.

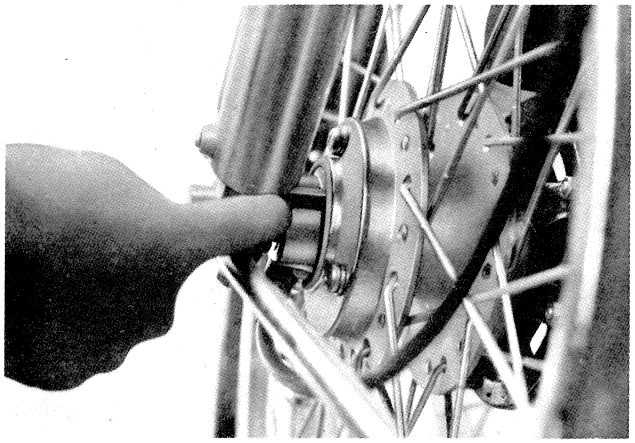


4) Pull out the front wheel shaft, and remove the front wheel assembly. In this case, the speedometer housing must be removed.



Installation

1) Grease the meter clutch and oil seal inside the meter housing.

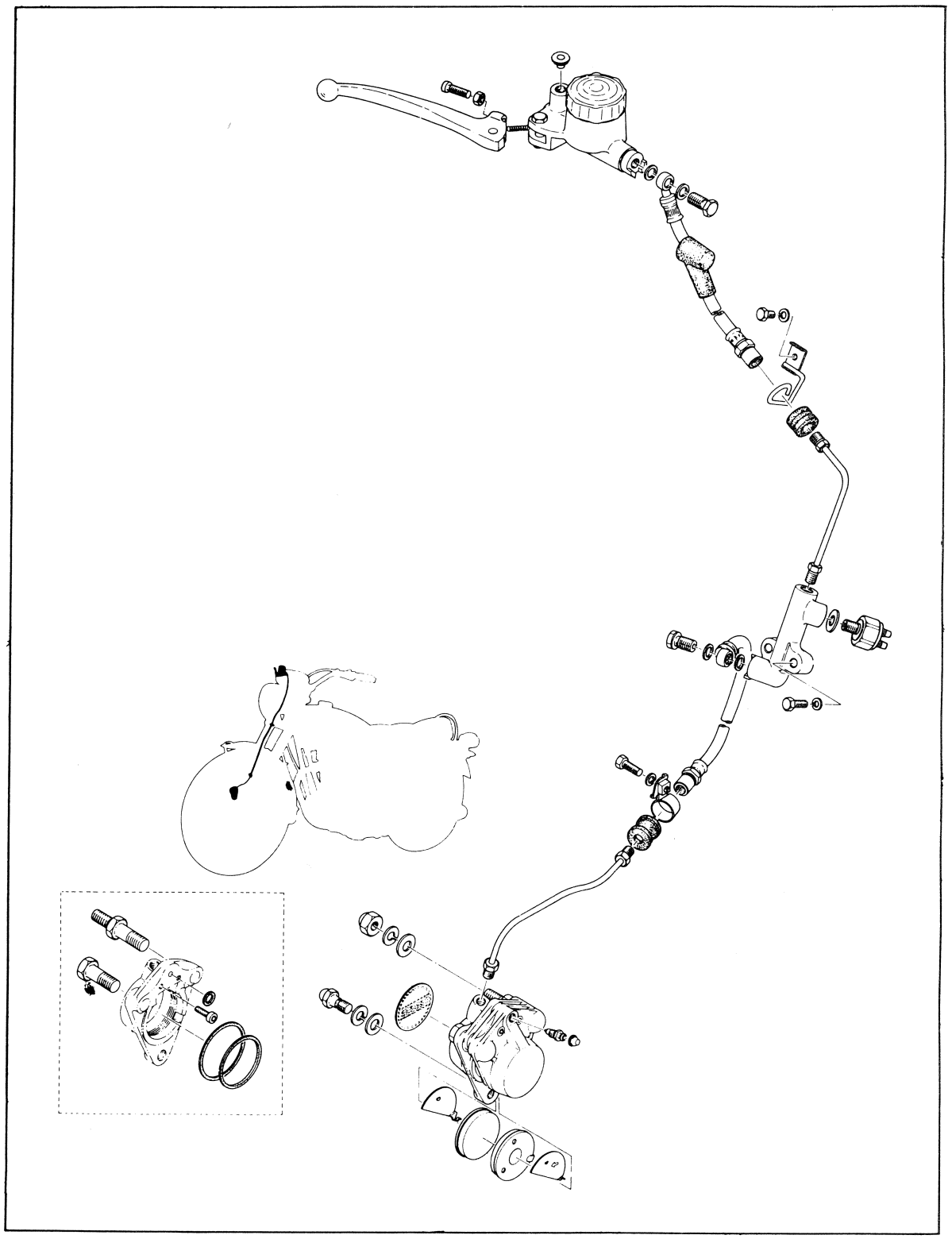


2) Sub-assemble the front wheel assembly and meter housing and install this sub-assemble on the frame.
Be sure the produced portion (torque stopper) of the meter housing is positioned as below.

DISC BRAKE

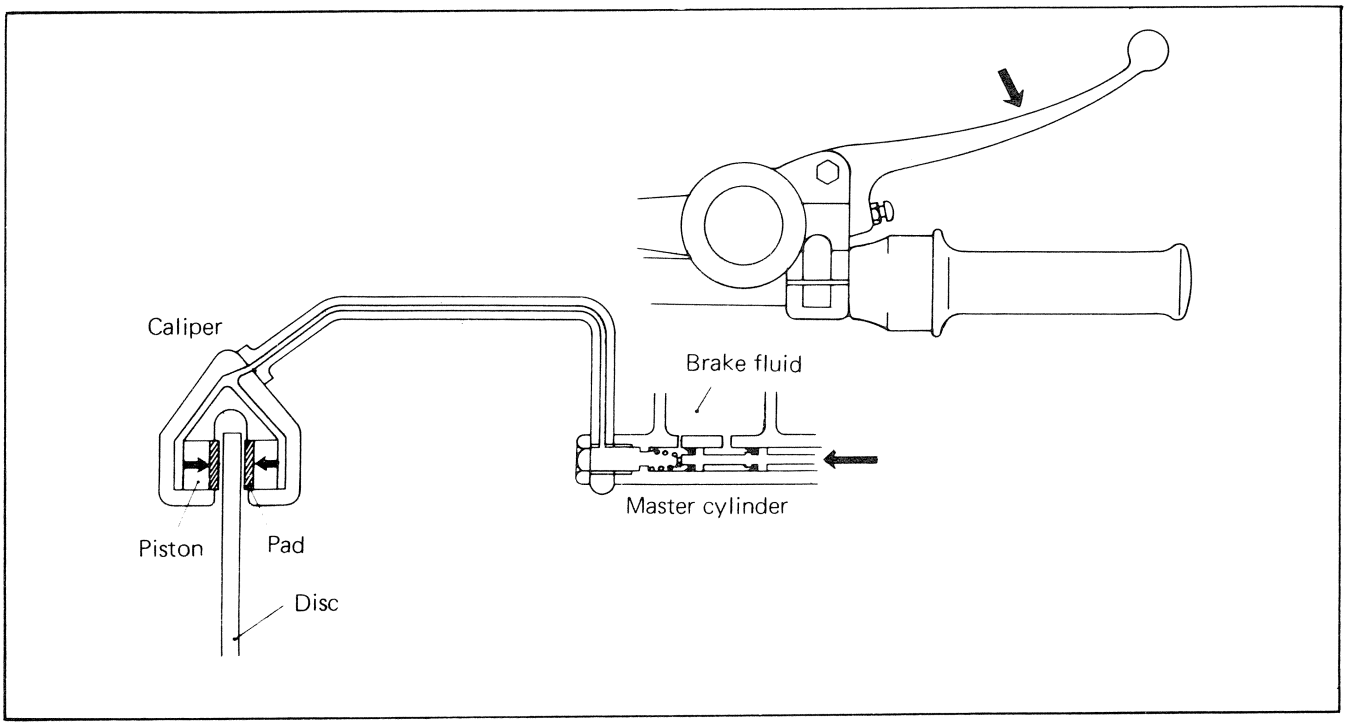
Construction

A fixed-disc type brake, in which the two flat pads grip the rotating disc, is in use. The right part of the handlebar has a brake lever and a master cylinder. The calipers are installed on the front fork while the brake disc is mounted on the front hub. The master cylinder is connected to the calipers by a brake hose and pipe.



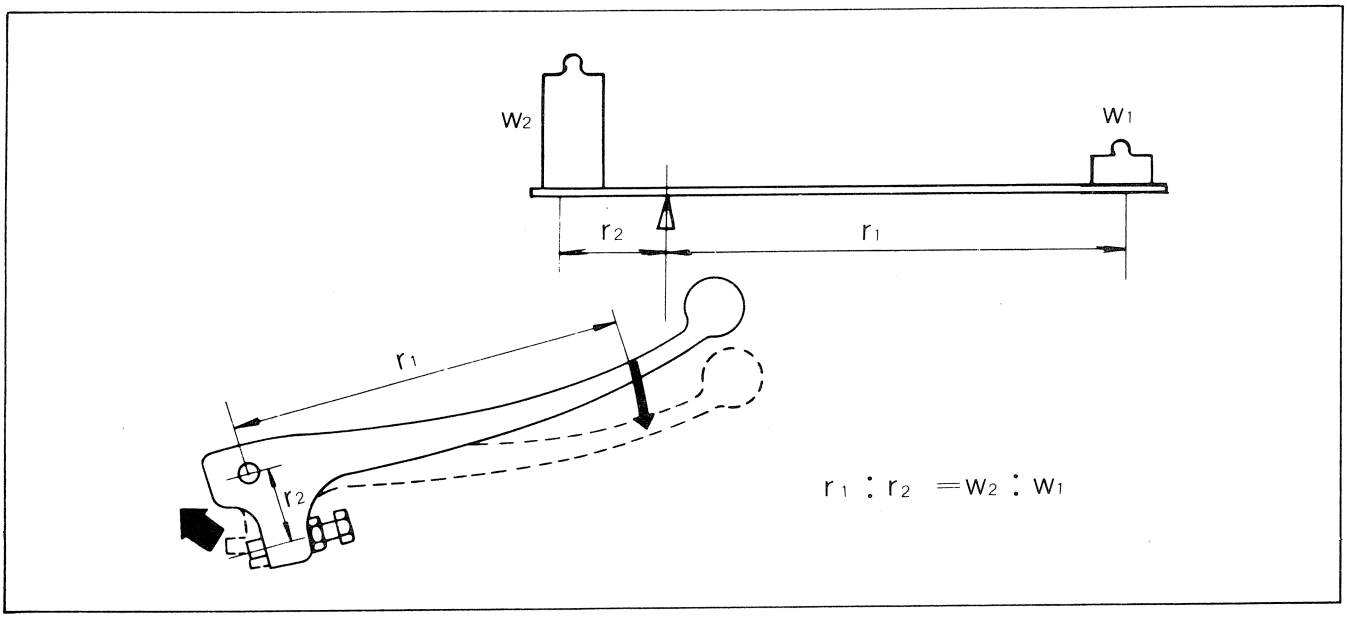
Operation

When the front brake lever is squeezed, it forces the master cylinder piston to move. As the piston cup moves past the compensating port, it traps the brake fluid in the cylinder. Pressure rises rapidly, and the fluid is forced through the brake hose to the caliper cylinders. The brake fluid forces the pistons in the caliper cylinders, and the pads located on each side of the disc are forced against the disc. The friction between the pads and revolving disc then provides the braking action. As the brake lever is released, both brake lever and pistons are forced back to their respective original positions by the force of return springs, and seal elasticity.



Brake lever

When the brake lever is squeezed, it produces a push at the master cylinder piston about four times greater than the force applied to the brake lever.

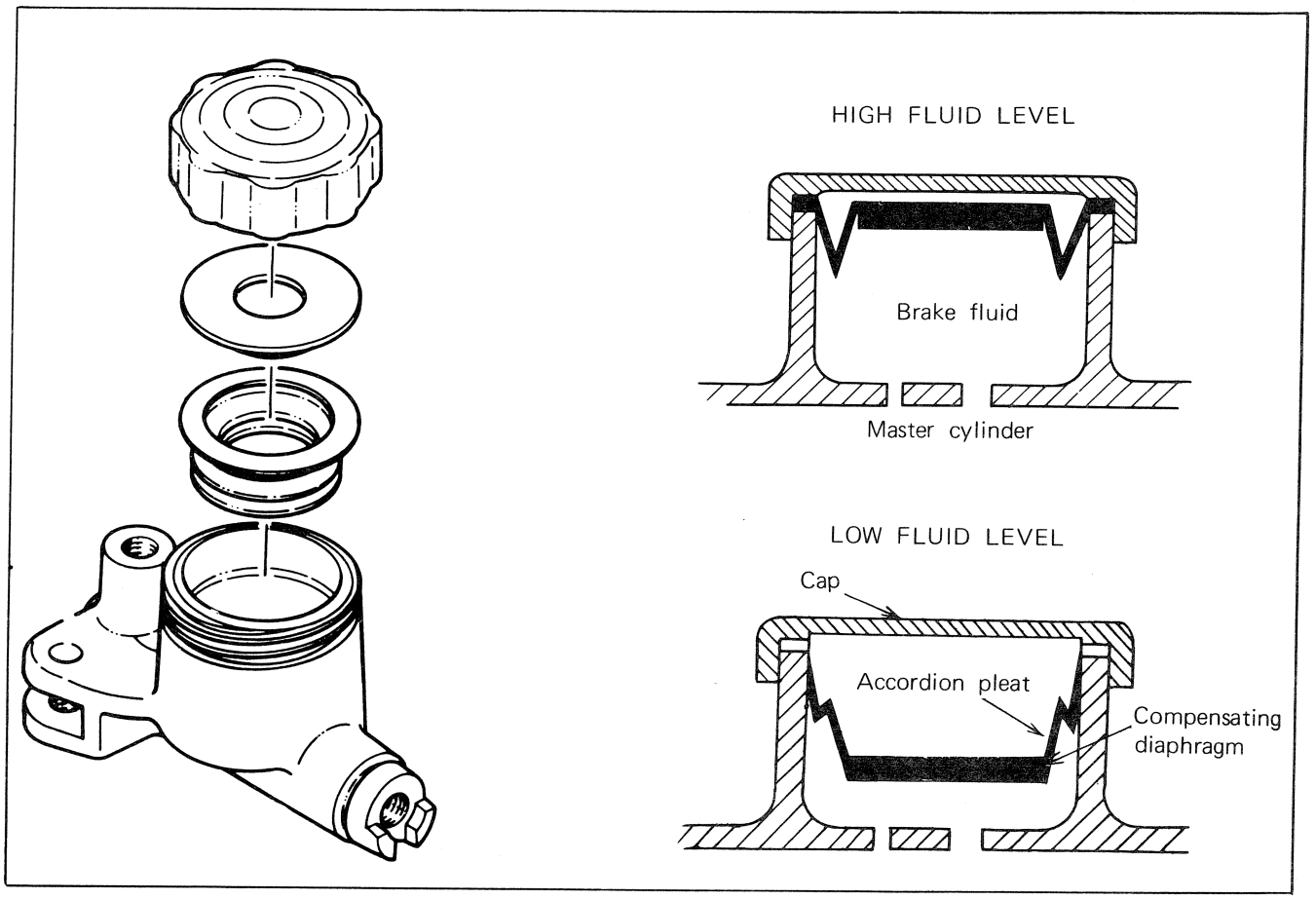


Mster cylinder

The master cylinder piston is linked to the brake lever. When the brake lever is squeeeed, the piston forces the brake fluid through the hose and pipe to the calipers.

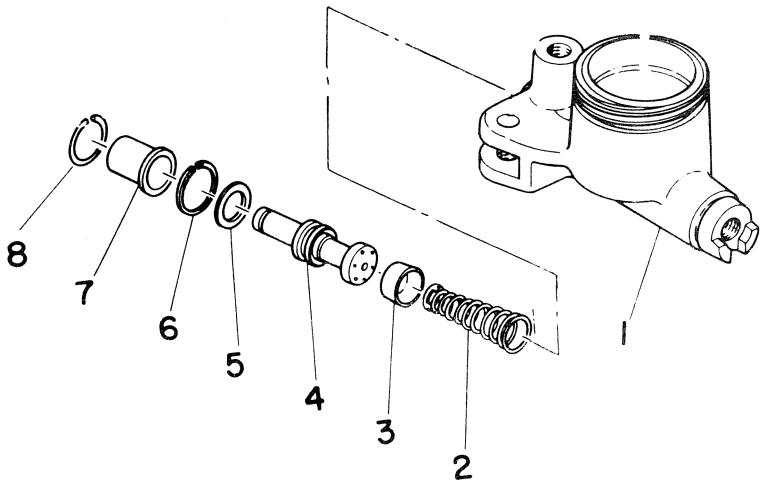
Reservoir tank

As wear on the brake pads increases, the amount of brake fluid must be increased to maintain proper hydraulic pressure. The reservoir tank supplies this brake fluid. (tank capacity is approximately 30cc). To prevent air from entering the brake line when the brake fluid level lowers, especially on a rough road or in an inclined postiion, a compensating diaphragm is provided for the reservoir tank.

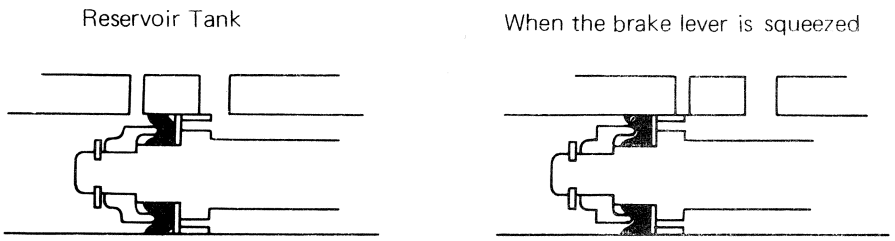


Piston

The master cylinder piston has two cups; one maintains good sealing between the cup and the cylinder wall of the master cylinder, and the other prevents the brake fluid from leaking out from the clyinder to the brake lever side. The return spring forces the brake lever to its home position, when the lever is released.



1 Master cylinder body
2 Conical spring
3 Cylinder cup
4 Piston ass'y
5 Spacer
6 Circlip
7 Master cylinder boot
8 Boot stopper

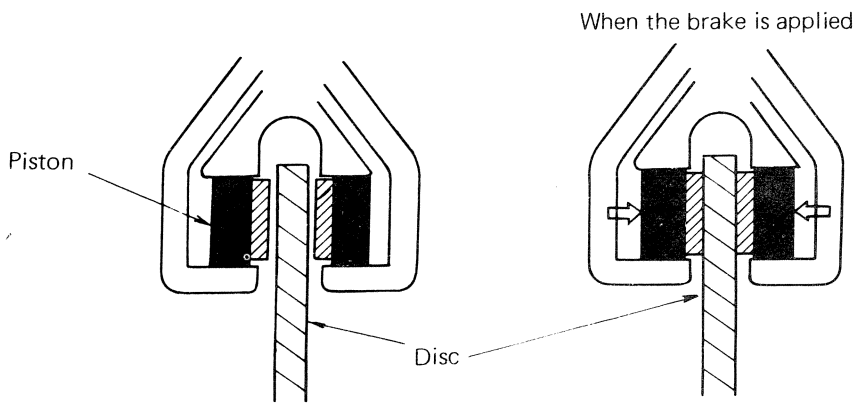


Brake hose and pipe

The brake hose and pipe carry hydraulic pressure to the calipers. The brake hose is flexible and capable of withstanding a hydraulic pressure of 350 kg/cm^2 in conforming to SAEJ-1401.

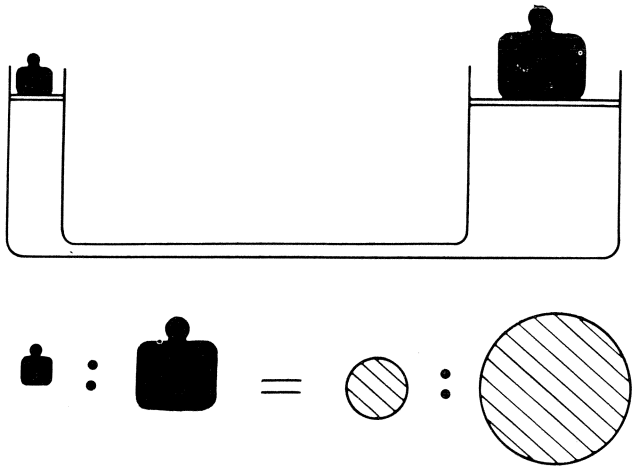
Calipers

The hydraulic pressure carried to the calipers forces the caliper pistons out, by which the pads are pushed out to grip the revolving disc.



Piston

The caliper pistons are forced against the brake pads by hydraulic pressure. The force created is about nine times the force applied to the master hydraulic cylinder piston. Combined with the mechanical advantage of the brake hand lever, the total force applied to the brake disc is approximately 36 times the force applied to the brake hand lever.

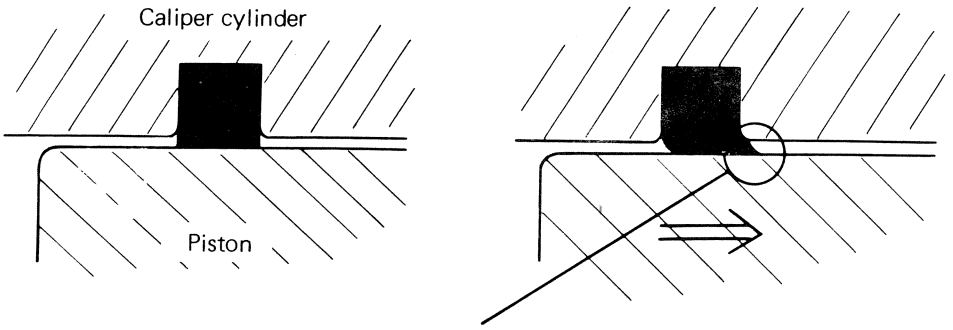


The applied force is proportional to the area ratio.

Seals

Each caliper cylinder has a piston seal (to maintain good sealing between the piston and the caliper cylinder wall) and a dust seal (to prevent dirt and water from entering the clylinder).

The piston seal is designed to move the piston back to its home position by making use of its torsional moment after the brake lever is released. The torsional moment is produced by the frictional force and elasticity of the piston seal. The piston seal also serves as an automatic adjuster of the clearance between the disc and the pad. (The clearance between the disc and the pad is normally 0.1 to 0.3mm.)



The friction between piston seal and piston and elasticity of the seal cause the piston to return to its home position.

Pads
The pads are forced against the revolving disc by the caliper cylinder pistons to grip the disc. They are composed of resin molded asbestos.

Bleed Screw
Air in the hydraulic line impairs hydraulic action. To expel air from the caliper cylinder, a bleed screw is provided on the caliper assembly.

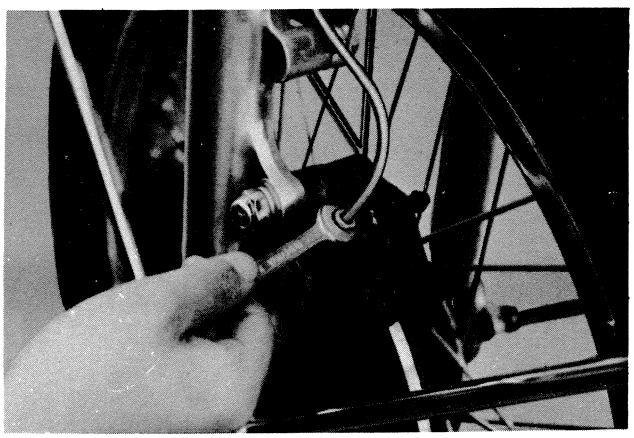
Disc
The stainless steel disc is attached to the front wheel hub and is gripped by the pads located on each side of the disc.

Brake Fluid
The brake fluid is compressed in the master cylinder, and the hydraulic pressure thus produced is carried to the caliper cylinder pistons. In this sense, the brake fluid plays a very important role. The brake fluid must meet the following requirements:

1. Proper viscosity and liquidity must be maintained at working temperatures.
2. Good stability must be maintained. (That is, the fluid will not separate, change in viscosity, and/or precipitate).
3. Boiling point is high. (No vapor lock will result.)
4. It will not deteriorate rubber.
5. Water resisting properties must be excellent. Note that the disc brake fluid must be of genuine quality, because the fluid temperature tends to rise higher as compared with the drum brake.
   Required brake fluid minimum specifications:
   DOT #3 or #4.

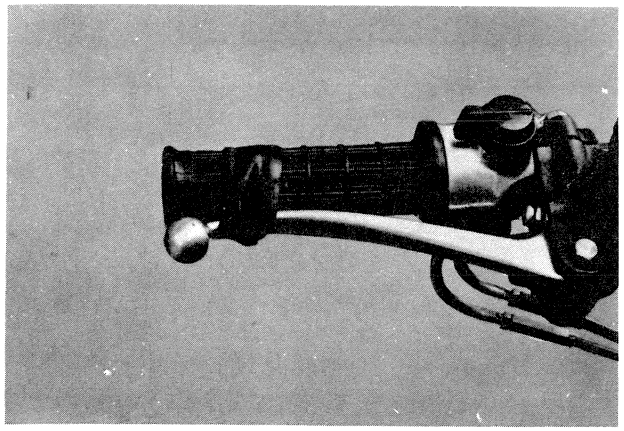
NOTE:
Do not mix brake fluids with different brand names. Some brake fluids are not compatible with others.

Disassembly
The tire and bearings can be disassembled without removing the brake disc. Do not attempt to remove the brake disc unnecessarily.
Tools and Parts required for Disassembly:
General service tools
Hexagon wrench, 5mm
Clip pliers
Air compressor
Rags
Torque wrench

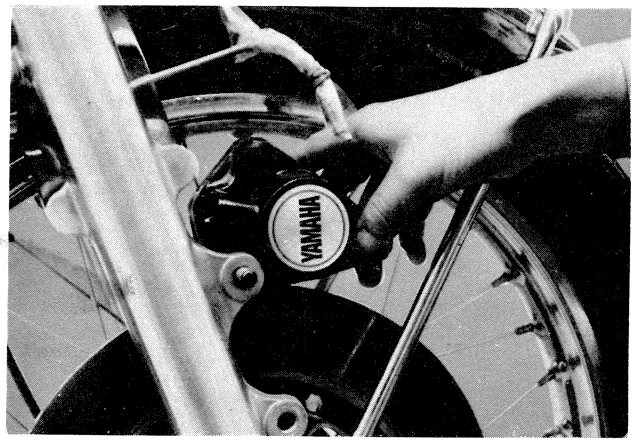


Removing the Caliper
1) Remove the brake pipe from the caliper assembly
   Put the removed brake pipe in a clean vinyl bag so that it can be kept free from dust and dirt.

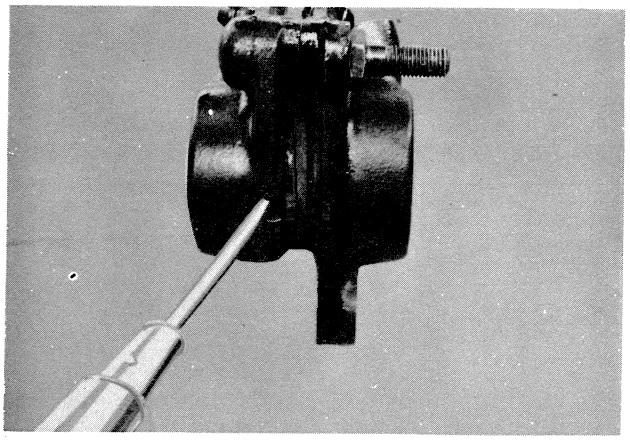
Note:
It is advisable to keep the brake lever squeezed, because this brake lever position prevents the fluid from leaking out of the reservoir. Tie the brake lever to the handle grip with a rubber band.



2) Remove the caliper mounting bolts and nuts.

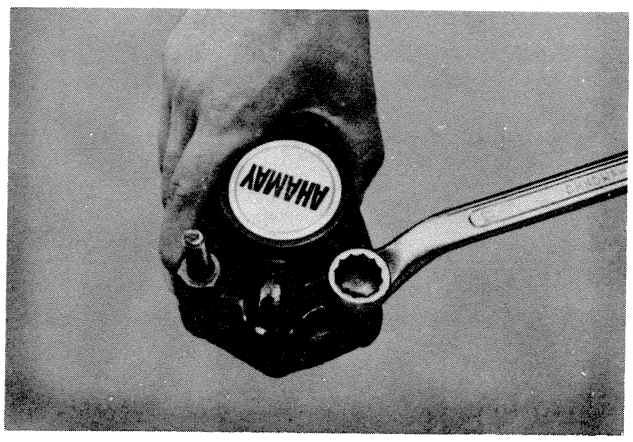


3) Rotate the caliper assembly upward, and remove it.



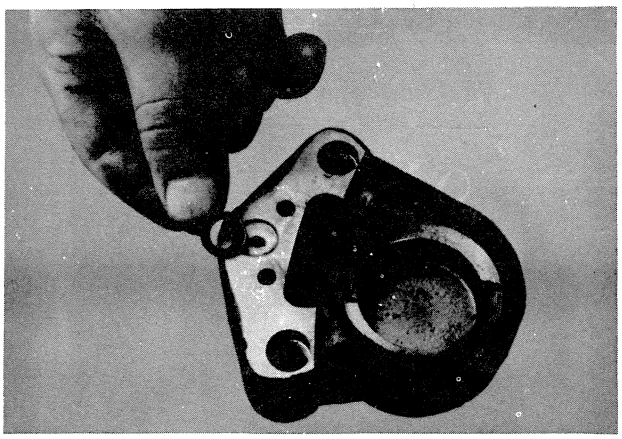
Removing the Pads

4) Remove the pads from their seats.

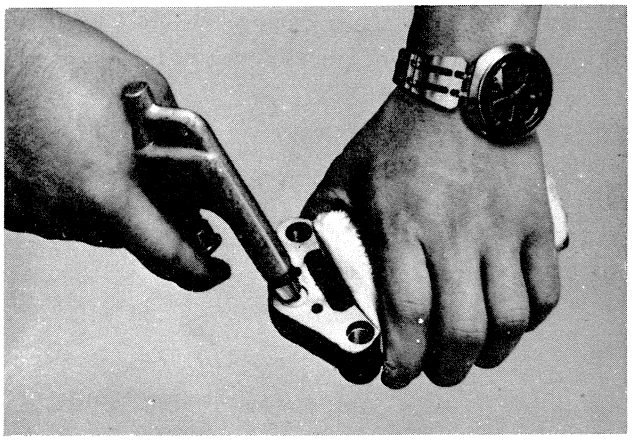


Removing the Caliper Pistons and Seals:

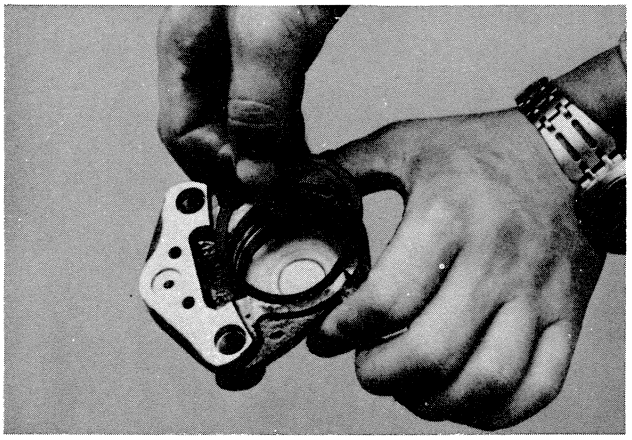
5) Remove the two bridge bolts and two hexagon bolts.



6) Remove the caliper seal.



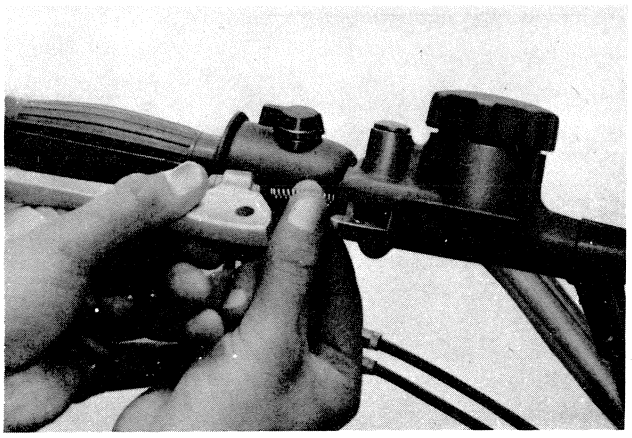
7) Force the piston out from the caliper cylinder by feeding compressed air into the cylinder through the fluid inlet. Never attempt to push the pistons with a screw driver.



8) Remove the piston seal and dust seal from the caliper body.
The foregoing applies to both pistons.

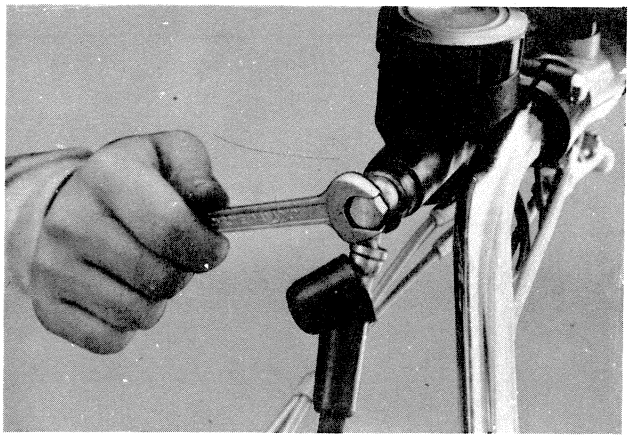
Note:

- The removed parts should be kept free from gasoline, kerosene, engine oil, etc. If any oil attaches to a seal, it will swell up or deteriorate.
- **Wash all parts with fresh, clean brake fluid prior to reassembly.**



Master Cylinder

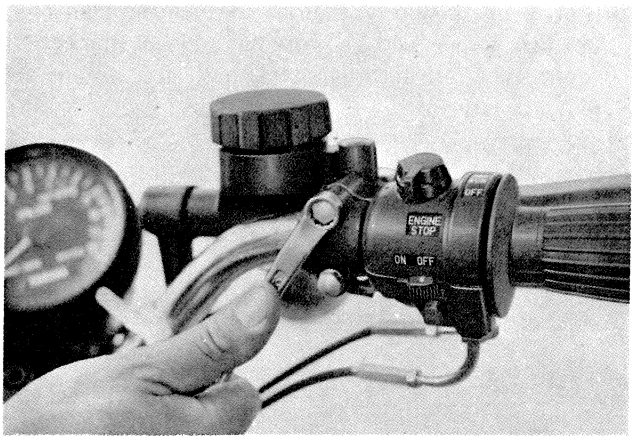
1) Remove the brake lever.
(Take care not to misplace the brake lever return spring.)



2) Remove the brake hose.

– CAUTION –

Do not allow brake fluid to contact plastic or painted parts.

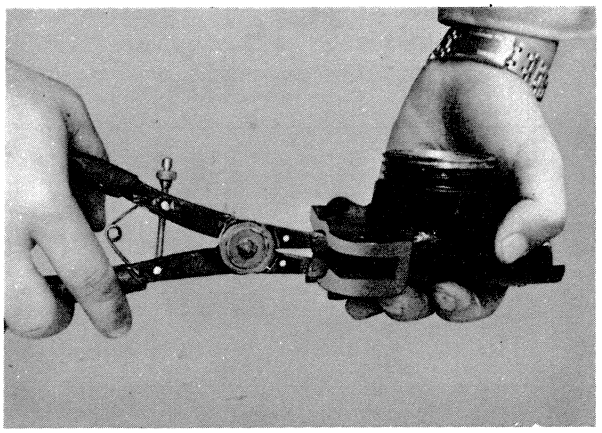


3) Remove the two master cylinder mounting bolts, and remove the master cylinder from the handlebar.

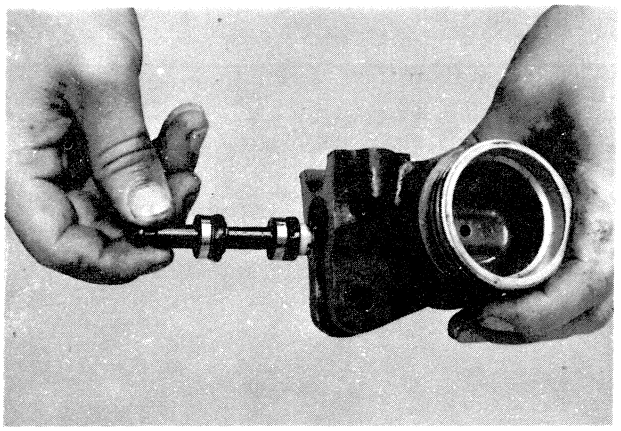
4) Remove the reservoir tank cap, and remove the diaphragn..

5) Drain the brake fluid from the reservoir tank.

6) Remove the master cylinder boot.

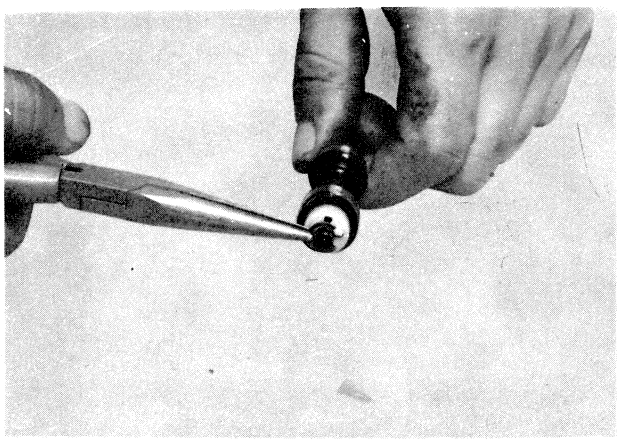


7) Remove the snap ring with clip pliers.

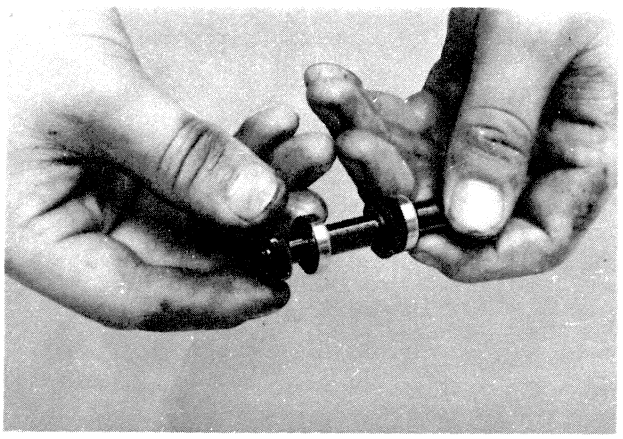


8) Remove the piston. (Note that a spring remains in the master cylinder.)

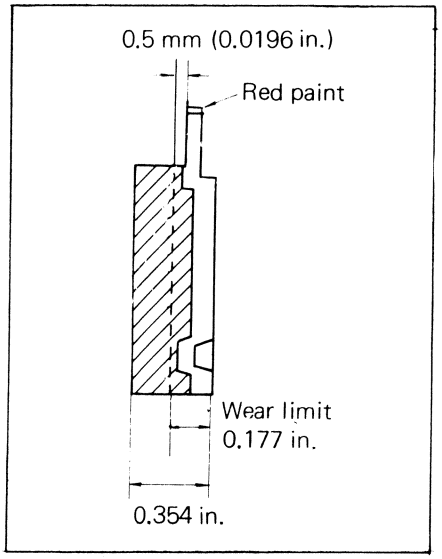
9) Remove the spring.



10) Remove the E clip, and remove the cylinder cup retainer.



11) Remove the cylinder cup.



Inspection

Measuring Instruments required for Inspection

Dial gauge
Dial gauge adapter
Micrometer 9-25mm
Vernier calipers 150mm

Pads

If any pad is found excessively worn, replace it.
Min allow pad thickness: 0.5mm (0.0196 in.)

Pistons

If any piston is found scratched or worn, replace it.

Piston Seal and Dust Seal

If any seal is found damaged, replace it. It is advisable to replace the seat every two years of use, whether it appears damaged or not.

Bridge Bolt

Replace the bridge bolts each time they are removed for disassembly, whether damaged or not.

Master Cylinder Body

1) If the master cylinder has any grooved wear on its wall, replace it.
2) If the outlet end has any scratch or dent, replace it.
3) Check the compensating port for clogging.
4) Check for any foreign matter inside the cylinder and the reservoir tank.

Piston

1) If the piston has any scratches or grooved wear, replace it.
2) If the piston has any rust, replace it.

Cylinder Cups

1) If any cylinder cup has scratches or grooved wear on its contacting surface, replace it.
2) If any cylinder cup is found swollen, replace it together with the other seal and rubber parts.
   Thoroughly wash all reas which are exposed to the brake fluid and clean in new brake fluid.
3) Whether worn or not, replace the cylinder cups every two years of use.

Reservoir Diaphragm and Master Cylinder Boot

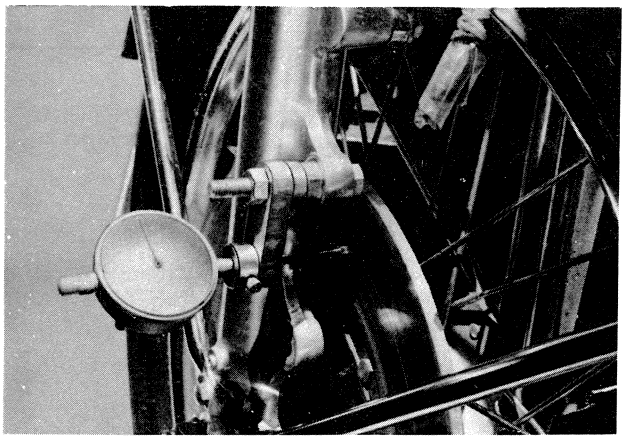
1) Check the flange and accordion pleats for damage, cracks and aging.
2) Check for swelling. (If swollen, take the same steps as in the case of the cylinder cup.)
3) Replace both every two years of use, whether they are in good condition or not.

Conical Spring

1) Check the spring for breakage and wear.
   Min. free length..... 60.4mm (2.38")

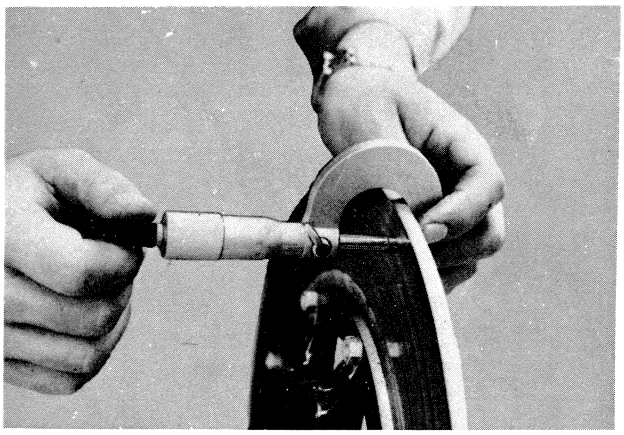
Brake Hose and Brake Pipe

1) Check them for leakage and damage.
2) Replace the brake hose every four years of use, whetehr it appears to be in good condition or not.



Disc

1) Check the disc assembly for run-out.
   If the disc shows a deflection of 0.15mm or more, check the disc itself and the wheel shaft bearings.
   Check near outer edge.



2) If the disc has excessive wear or damage, replace it.
   Min. allow. disc thickness: 6.5mm

Cleaning

All the removed parts should be washed in the following manner before they are installed.

1) **Only new brake fluid should be used as a cleaning agent.** (The use of any mineral oil should be avoided, because it causes rubber parts to swell. The same can be said of alcohol. Any rubber dipped in alcohol will swell.)

2) If an oil of any other kind (such as mineral oil) is mixed in the system by mistake, the piston cups and seals should be replaced with new ones. All other parts should be washed with fresh, clean, new brake fluid. In addition, the lines, ports, passage, etc., should be thoroughly flushed with clean, new brake fluid.

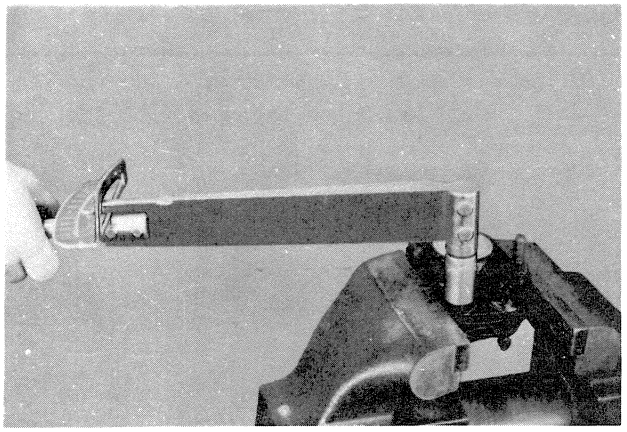
Calipers

Piston Installation

1) Install the piston seal and dust seal in their seats in the caliper cylinder.

2) Coat the caliper cylinder walls and piston with new brake fluid.

3) Insert the piston into the caliper cylinder by hand. In inserting the piston, special care should be taken so that the piston goes into the cylinder smoothly.



Assembling the outer and inner calipers

4) Install the caliper seals in their seats.

5) Put together the outer and inner calipers.
(Make sure that no dust or dirt is attached to the mating surfaces.)

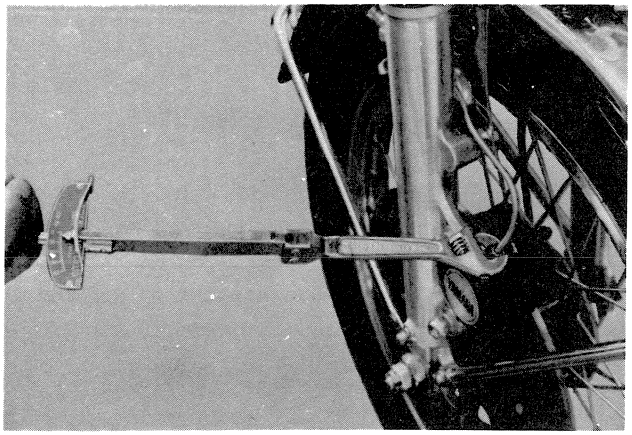
6) The two bridge bolts must be replaced with new ones. Tighten the two hexagon bolts. (The bridge bolts should be tightened later.)
Tightening torque: 190–275 in-lbs.

7) They are very important parts viewed from operational safety, and therefore, the removed bridge bolts should always be replaced. Be sure they are tightened with correct torque:
Tightening torque: 675–855 in-lbs.

Pad Installation

8) Install the pads in their seats.

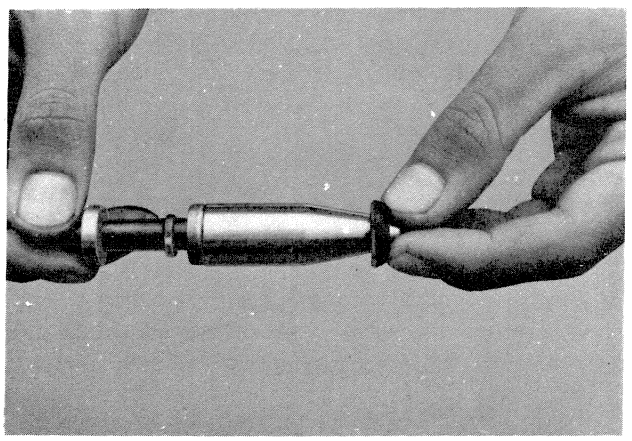
9) When replacing the pads alone, it is necessary to push back the piston so that new pads can easily be installed. (When the piston is pushed back, and the compensating port is open, the brake fluid level in the reservoir tank will rise steeply. Loosen the bleed screw if necessary, and bleed off the excess brake fluid.



Installing the Calipers

10) To install the calipers on the front forks, reverse the procedures for removal.
Tightening torque: 400 ~ 500 kg-cm
(360 ~ 450 in-lbs)

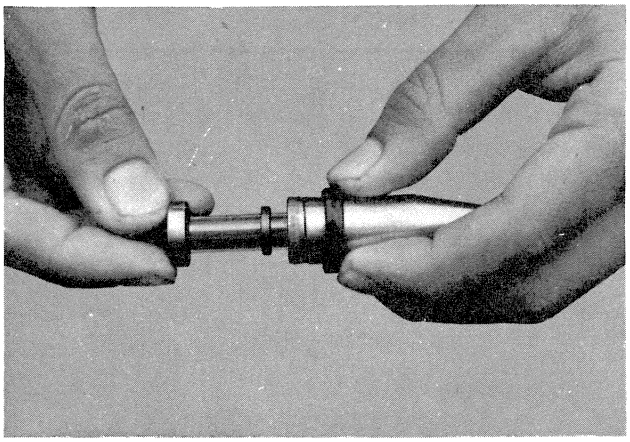
11) Install the brake pipe.
Tightening torque: 130 ~ 180 kg-cm
(120 ~ 160 in-lbs)

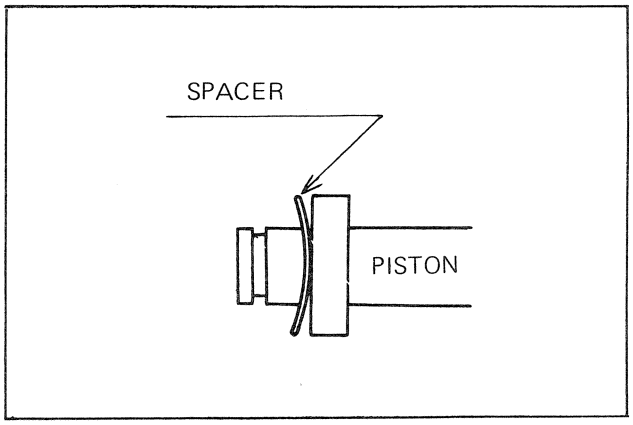


Master Cylinder

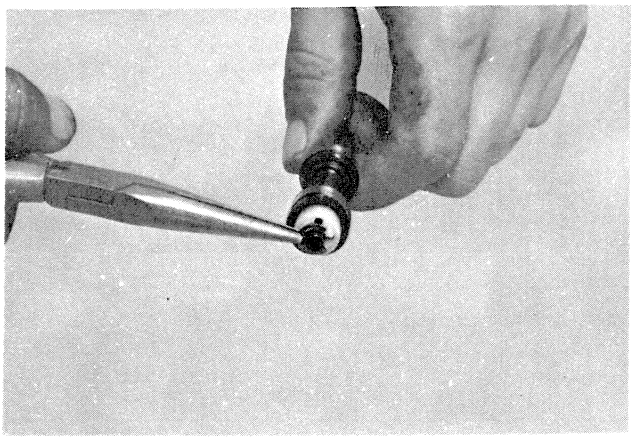
Installing the Cylinder Cup

1) Dip the cup in new brake fluid, and install it.
Take care not to scratch the cup and the piston.
(Use the jigs.)

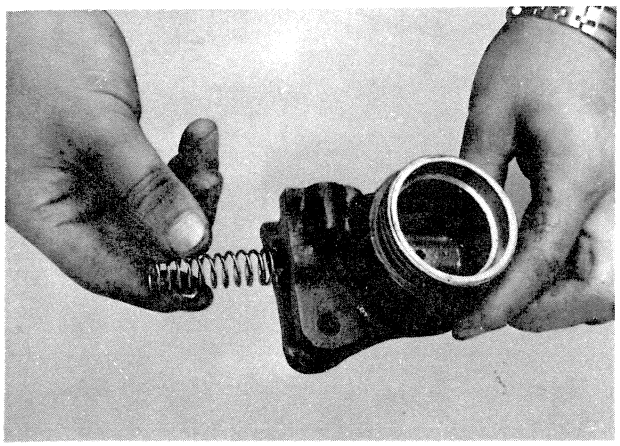




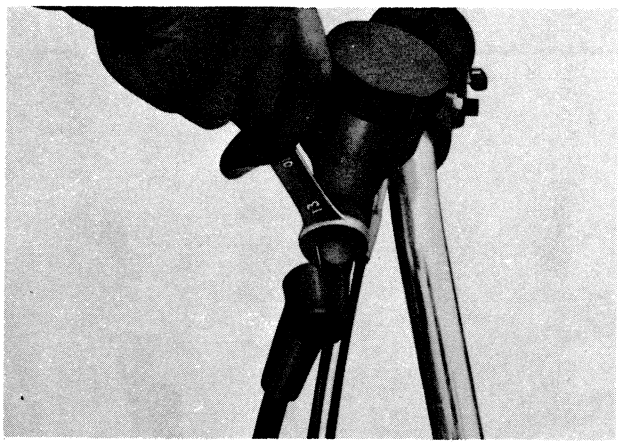
2) Install the spacer. Be sure that the spacer is positioned correctly.



3) Install the cup, retainer and E clip.



4) Insert the spring into the master cylinder body.

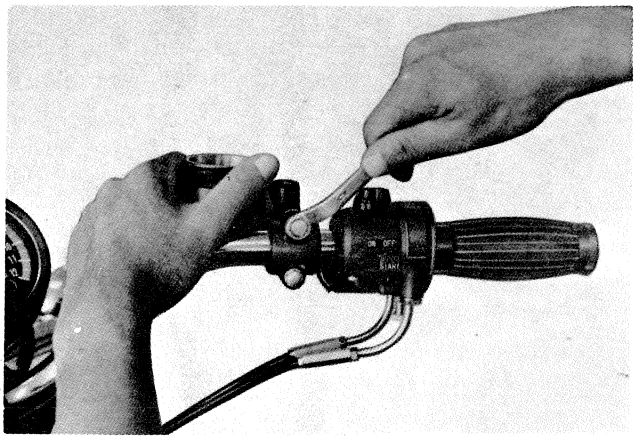


Installing the Piston

5) Check the piston surfaces and cup surfaces for scratches, and then, insert the piston into the cylinder.
Avoid forcing the piston into the cylinder. Otherwise the cylinder wall will be scratched, thus allowing the brake fluid to leak past.

6) Install the snap ring.

7) Install the boot in the master cylinder groove and the piston groove, respectively.



Installing the master cylinder on the handlebar

8) Install the master cylinder on the handlebar in such a position that the fluid is level within.
9) Adjust the clearance between the piston and the push rod.

Note:

Fully tighten the adjusting screw lock nut so that it will not become loose.

10) Fasten the brake hose to the master cylinder with the union bolt.

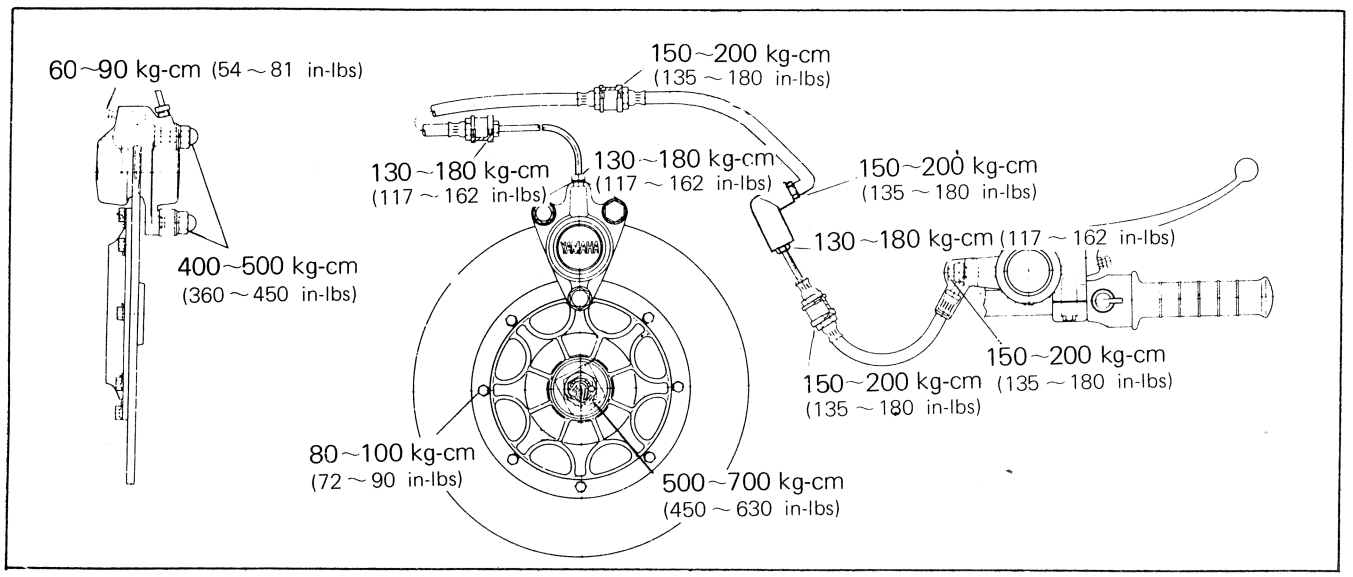
NOTE:

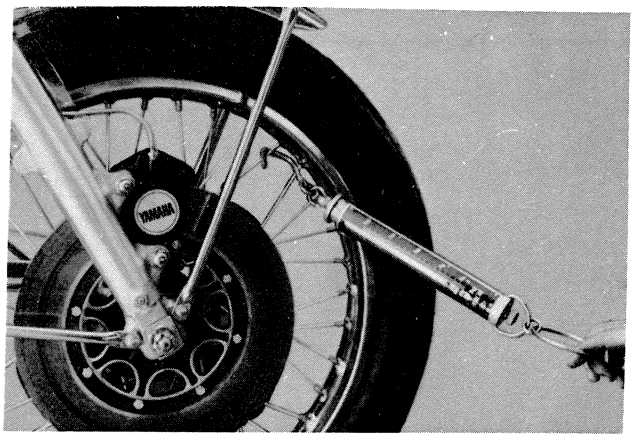
If the gasket is found scratched, it should be replaced.

11) Feed approximately 30cc of brake fluid into reservoir tank prior to bleeding.

Brake Hose and Brake Pipe

The brake hose and brake pipe fittings should be fastened with the following torque.





Disc

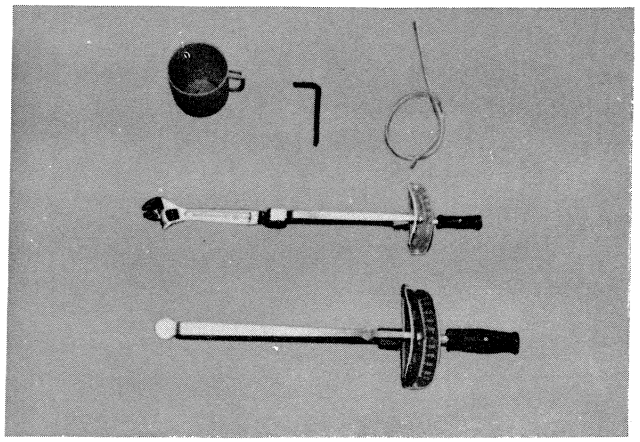
1) The disc mounting bolts should be tightened gently and in pattern with the correct torque. The lock tabs should be properly positioned and bent tightly over the bolt heads.
   Tightening torque: 80 - 100 kg-cm (70 - 90 in-lbs)

2) The deflection of the disc assembly should be within the specified value (0.15mm).

3) The disc trailing torque drag should be within the specified amount after it is assembled.
   Torque: 200 - 400 kg-cm (180 - 350 in-lbs) when assembled as shown in the figure.

   If the value exceeds this limit, check the disc for run-out.

* On the disc brake, a slight drag can be neglected. A slight drag will not result in serious trouble, and will not develop into a worse condition.

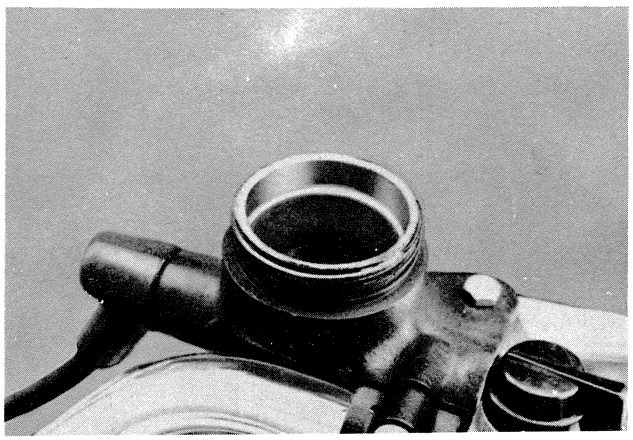


Air Bleeding

When any parts relating to the brake fluid are re-installed, be sure that each metal fastner is fully tightened and then bleed.

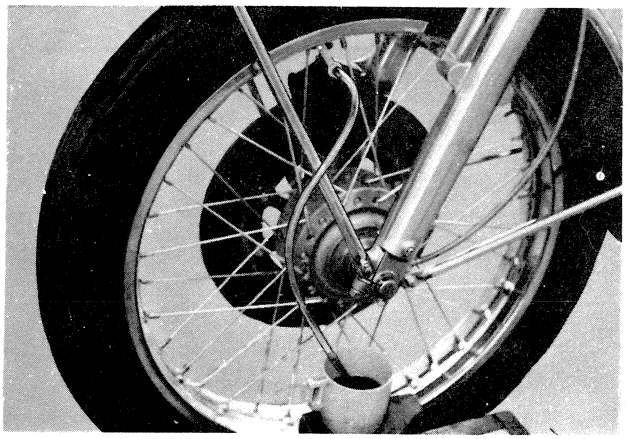
Tools and Parts

Wrench
Torque wrench
Vinyl tube inside dia 4mm
Brake fluid (DOT #3 or #4)
Brake fluid receiving vessel
Rags

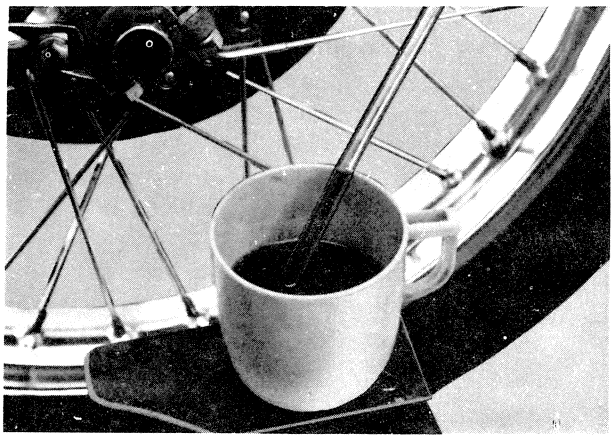


1) Fill with fresh clean brake fluid so that the reservoir level reaches the specified line.

2) Install the diaphragm to prevent the brake fluid from escaping.

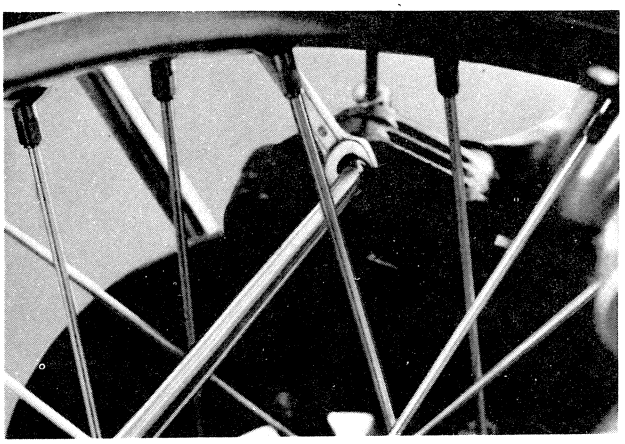


3) Connect the vinyl tube to the caliper bleed screw tightly so that no brake fluid will spill.



4) Place the brake fluid receiving vessel at the end of the vinyl tube.

Note: Do not reuse brake fluid emitted during bleeding procedure.



5) Apply the brake lever slowly a few times. With the brake lever squeezed, loosen the bleed screw.

6) As fluid and air espaces, the lever will close. Tighten the bleed screw before the lever bottom on the handle bar grip.

Note:

When bleeding the air, do not operate the brake lever quickly. Otherwise, the air will turn into fine bubbles, thereby making the air bleeding difficult.

7) Repeat the procedures in 5 - 6 above until air bubbles will completely disappear in the vinyl tube.

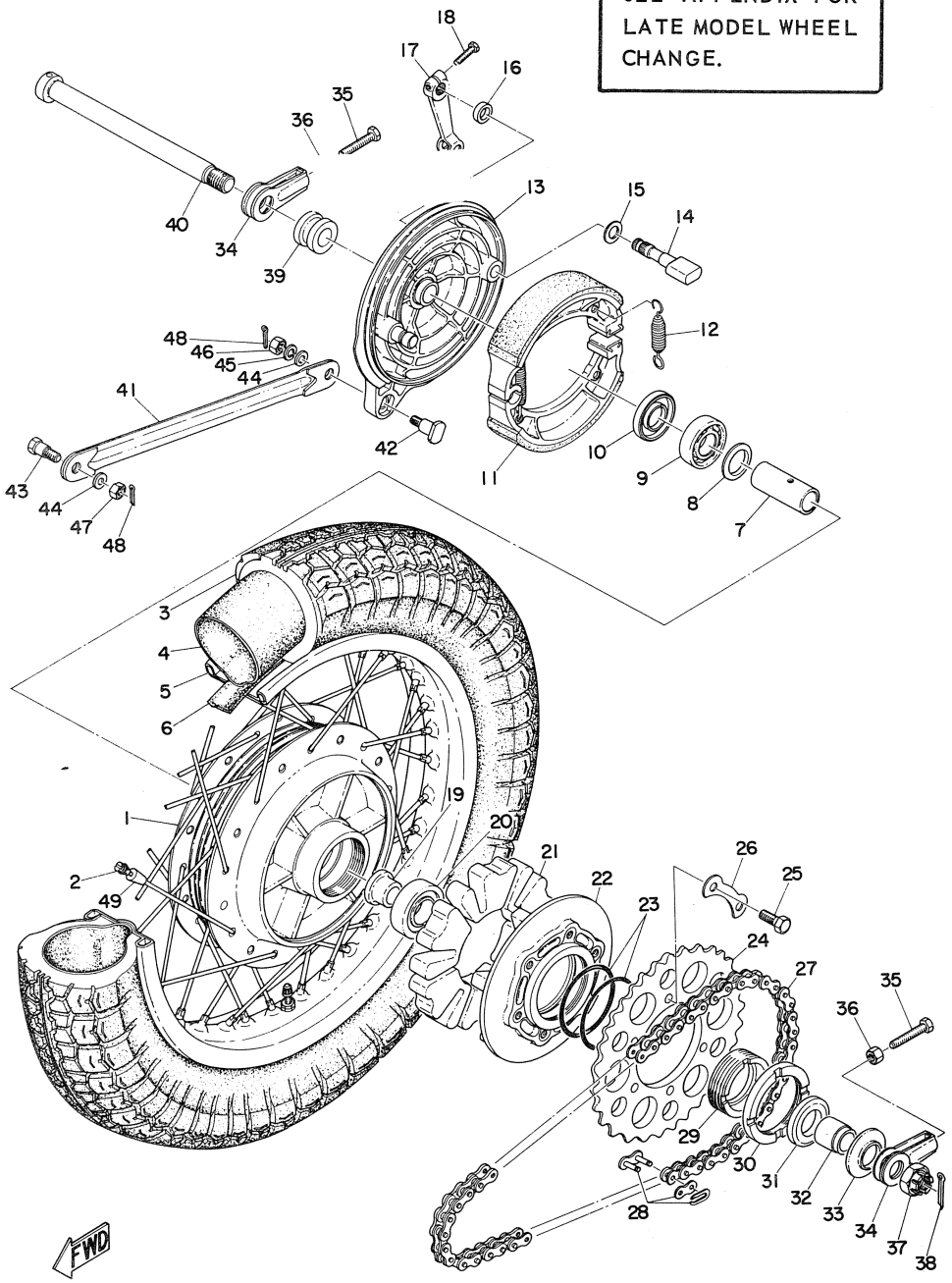
Note:

Bleed screw tightening torque: 60 - 90 kg-cm (54 - 81 in-lbs)

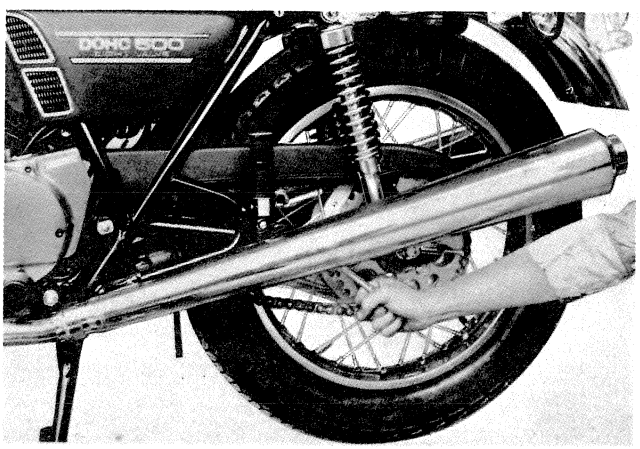
8) Refill with brake fluid so that the level will again reach the specified line.

REAR WHEEL

SEE APPENDIX FOR LATE MODEL WHEEL CHANGE.

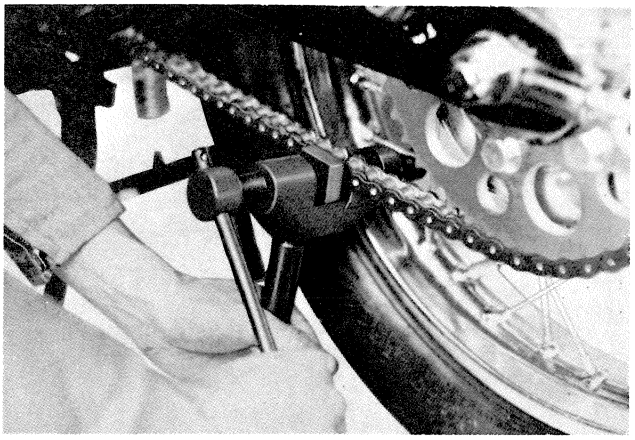


1 Hub, rear
2 Spoke set
3 Tire, rear (4.00-18-4PR)
4 Tube (4.00-18)
5 Rim (2.15B-18)
6 Band, rim (4.00-18)
7 Spacer, bearing
8 Flange, spacer
9 Bearing (B6304Z)
10 Oil seal (SO-27-52-5)
11 Brake shoe comp.
12 Spring, return
13 Plate, brake shoe
14 Camshaft
15 Shim, cam shaft
16 Seal, cam shaft
17 Lever, cam shaft
18 Bolt
19 Collar
20 Bearing (B6305Z)
21 Damper, clutch
22 Clutch, hub
23 O-ring (3.0-76.0)
24 Gear, sprocket wheel (43T)
25 Bolt, fitting
26 Washer, lock
27 Chain (DK530HDS 105L)
28 Joint, chain
29 Retainer, bearing
30 Nut, lock
31 Oil seal (SD-30-52-8)
32 Collar, shaft
33 Cover, dust
34 Puller, chain
35 Bolt, chain puller
36 Nut
37 Nut, shaft
38 Pin, cotter
39 Collar, wheel shaft
40 Shaft, wheel
41 Bar, tension
42 Bolt, tension bar 2
43 Bolt, tension bar
44 Washer, plain
45 Washer, spring
46 Nut
47 Nut
48 Pin, cotter
49 Blancer, wheel

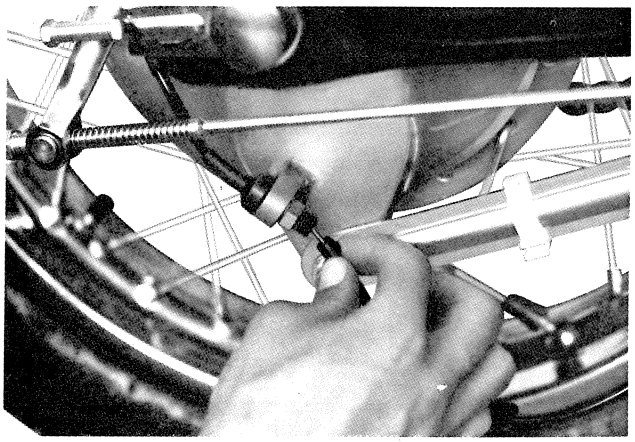


Disassembly

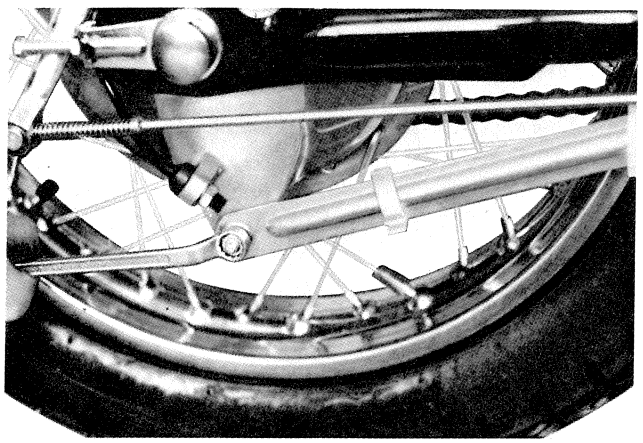
1) Remove the muffler assembly.



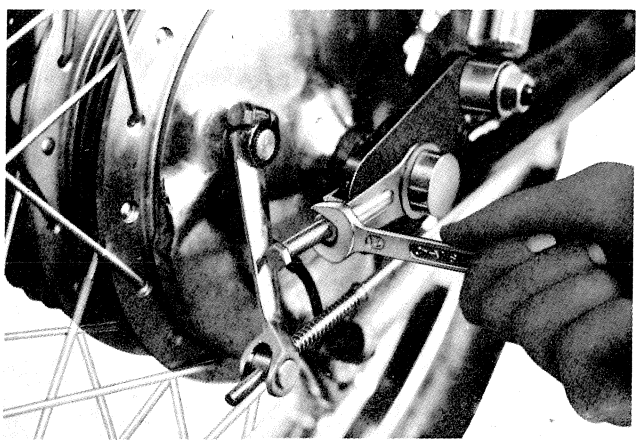
2) Remove the drive chain by use of a special tool.



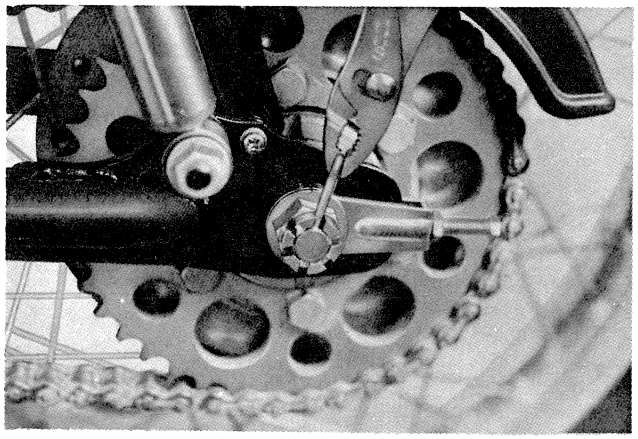
3) Remove the lead wire for warning switch.



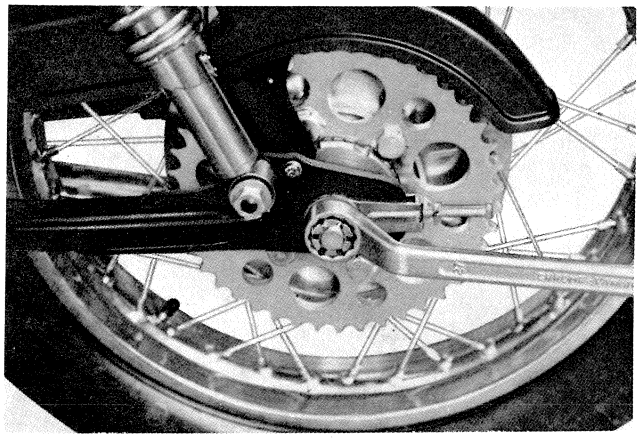
4) Disconnect the tension bar and the brake rod from the rear shoe plate. Pay strict attention to the presence and location of the tension bar lock washer and cotter key. These are safety parts and must be included during assembly.



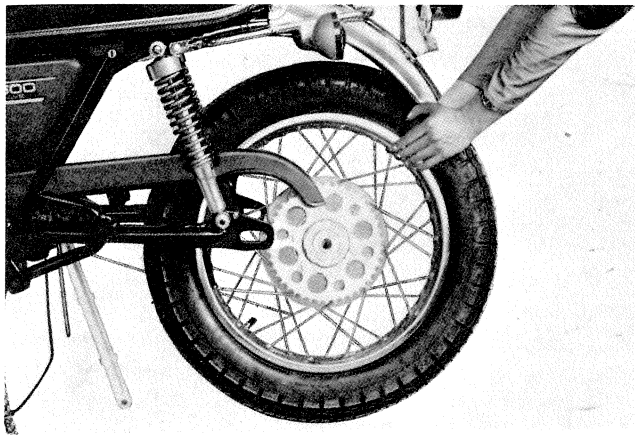
5) Loosen the lock nut and chain tension adjusting bolts on both right and left sides.



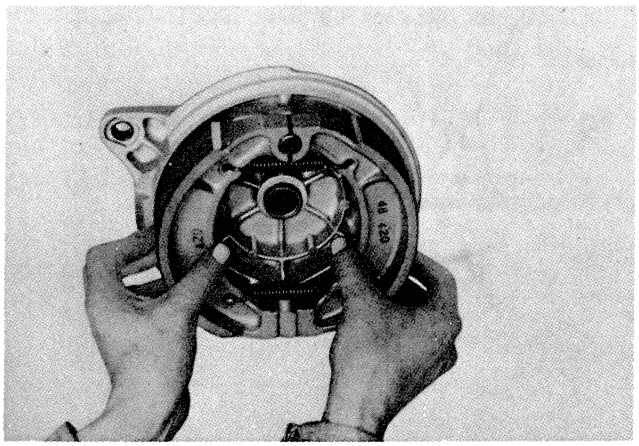
6) Remove the rear axle cotter pin.



7) Remove the rear axle securing nut.
Tightening torque:
20.0 kg-m (150 ft-lbs)



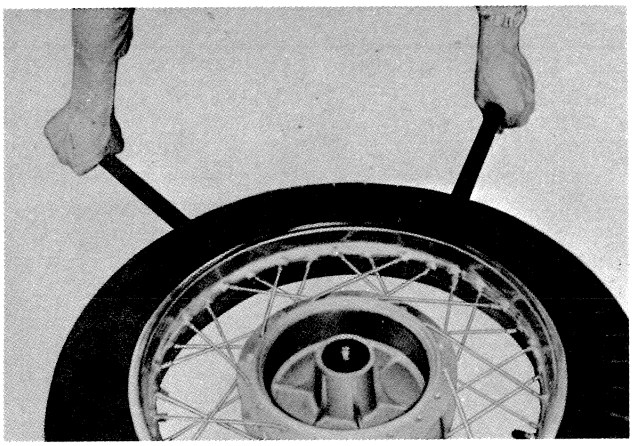
8) Lean the machine to the left and pull the rear wheel assembly back.

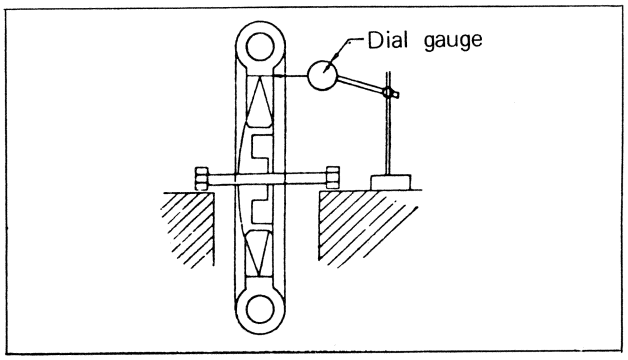


Disassembly and Assembly

a) Both sides of the single leading shoe unit are mounted on the brake plate. To remove the shoes, pull them out and away from the anchor pin and brake actuating cam.

b) Both wheel bearings are mounted in the hub. Their removal can be completed by following the removal procedures explained in the "Seals and Bearings" section, except that the rear wheel has two seals, one located outside each bearing.





Wheels

1) Tire and Tube Removal and Installation

a) Whether it is the front or rear tire to be changed, the procedure of tire and tube removal is identical. The explanation that follows is the proper method for both wheels.

b) Remove the valve cap, valve stem, and valve stem lock nut. Use two tire irons (with rounded edges) and begin to work the tire bead over the edge of the rim, starting opposite the tube stem. Take care to avoid pinching the tube. After one bead of the tire has been completely worked off the rim, slip the tube out. Be very careful not to damage the stem as it is pushed back out of the rim hole.

c) If the tire is to be completely removed, then work the tire off the same rim edge.

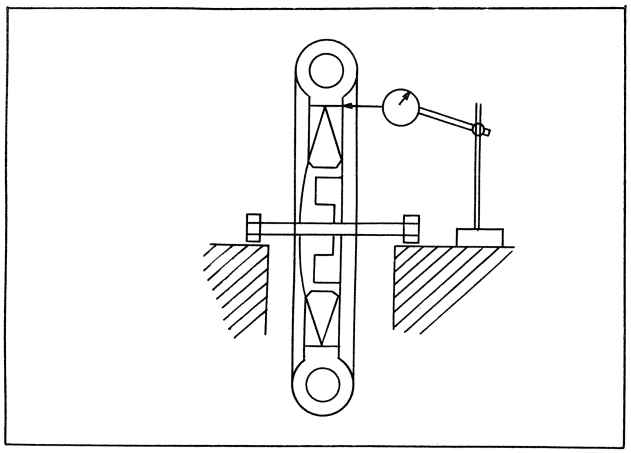
d) Installing the tire can be accomplished by reversing the disassembly procedure. The only difference in procedure would be to inflate the tube momentarily before both tire edges have been completely slipped onto the rim. This removes any creases that might exist. After the tire has been completely slipped onto the rim, check to make sure that the stem is squarely in the center of the hole in the rim. Then inflate the tube to 40(+) psi several times. Check for leaks, and set at prescribed pressure. Standard pressure:

F	R
1.6 kg/cm^2 (23 lbs/in^2)	2.0 kg/cm^2 (29 lbs/in^2)

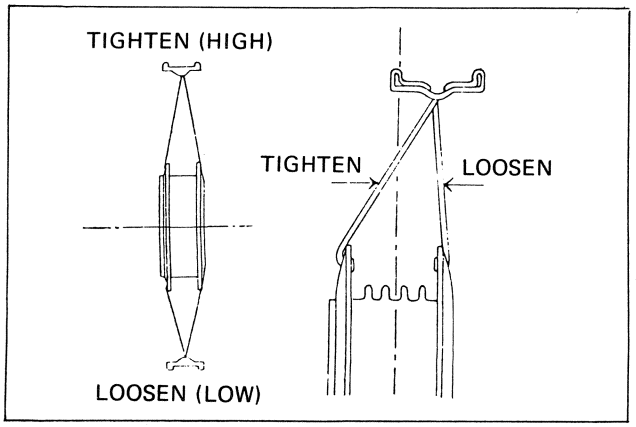
2) Rim and Spokes

a) A rim can develop warpage. It is due to (1) running the wheel into an object and bending the outer rim, or (2) one or more spokes loosening.

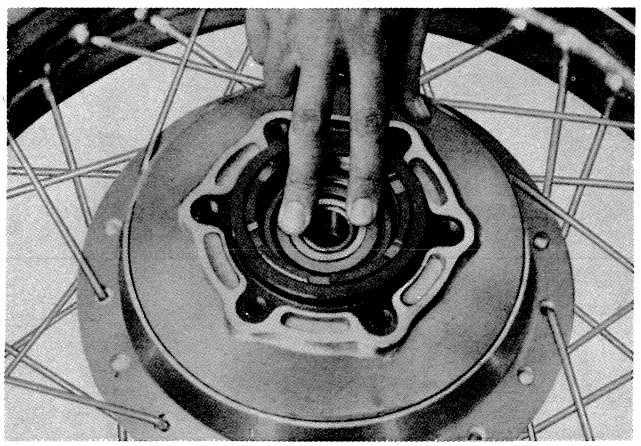
b) Check for warpage by mounting the wheel on a stand (or, if the wheel is attached to a motorcycle, it can be blocked up and held in place). Use some device to measure or detect movement then slowly spin the wheel and note the amount of rim "runout". It should not exceed 1/16".



c) If all the spokes are tight, and the rim shows no obvious signs of damage, and yet runout is still excessive, do the following.
1) If the runout is up and down, loosen the spokes opposite the high spot and tighten the spokes at the high spot.

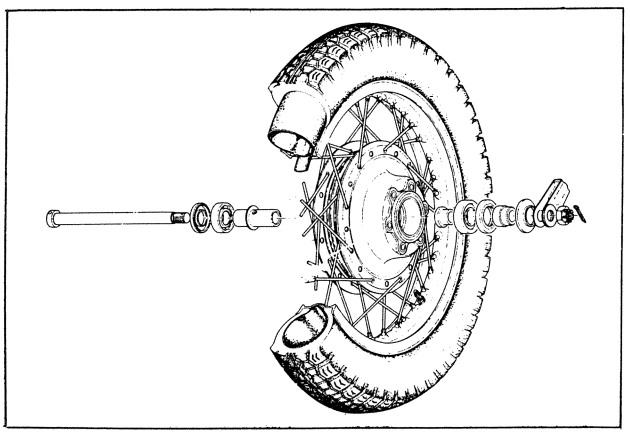


2) If the run out is sideways, loosen the spokes at the high spot, and tighten the spokes opposite the high spot.



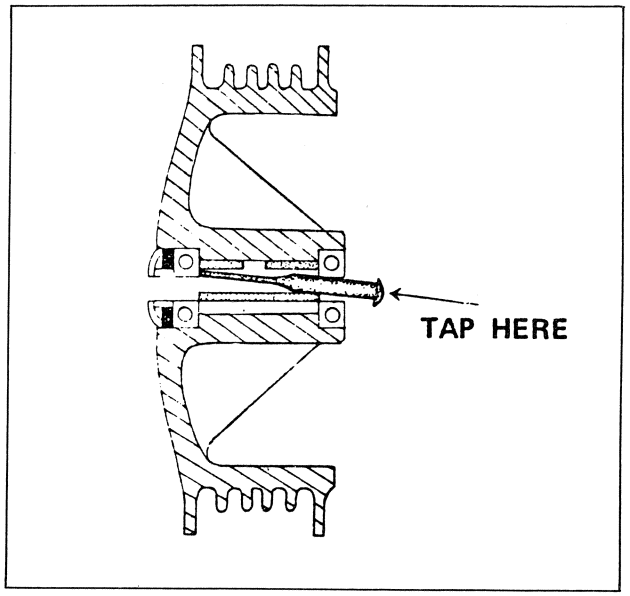
3) Seals and Bearings.
a) Wheel hub seals should be replaced every time they are pried out during repair, or if broken, cracked, or damaged in any way.

b) Check for smooth wheel bearing rotation. Dirt, rust spots, or any irregular surfaces will cause the bearing to hang up (will not spin smoothly). Remove the bearing, clean it, and check again. If the bearing still does not spin freely, replace it.

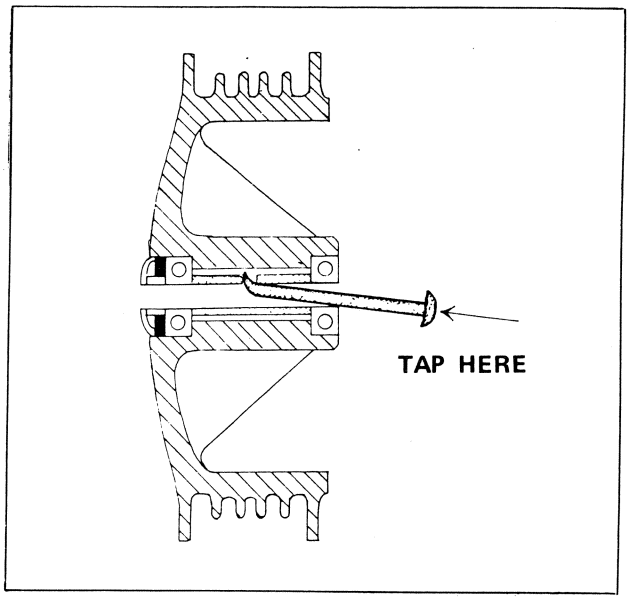


NOTE ON BEARING INSTALLATION: Be sure to grease the bearing before installation, using a quality bearing grease. In addition, during installation, protect the bearing to prevent dirt or contamiantion of any sort from entering the bearing.

c) The wheel hub houses both bearings, a spacer between the bearings, an outer seal, and a metal cap outside the seal. Removal of the outer bearings requires that the seal be pried out.

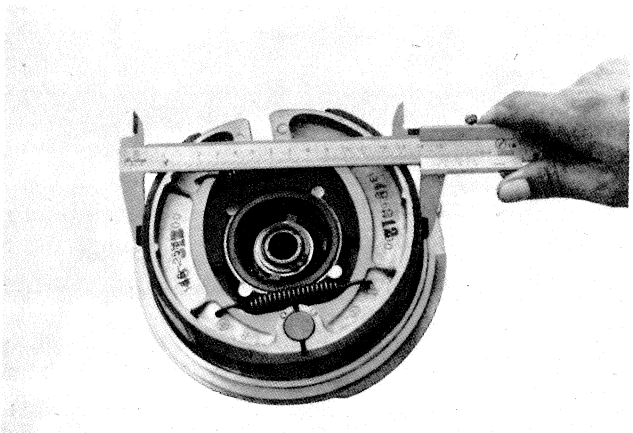


d) Drive the bearing out by pushing the spacer to one side (the spacer "floats" between the bearings) and tapping around the perimeter of the bearing inner race with a soft metal drift pin and hammer. Either or both bearings can be removed in this manner.



e) An alternative method of removing the bearings is to use a rod with a bent end. Insert the bent end into the hole drilled in the middle of the spacer and tap the other rod end with a hammer, driving the spacer (and bearing in front of it) out of the hub.

NOTE ON BEARING AND SEAL INSTALLATION: Be sure to use the special bearing installing tool which helps to prevent the bearing from going into the hub crooked and the seal from being bent during installation.



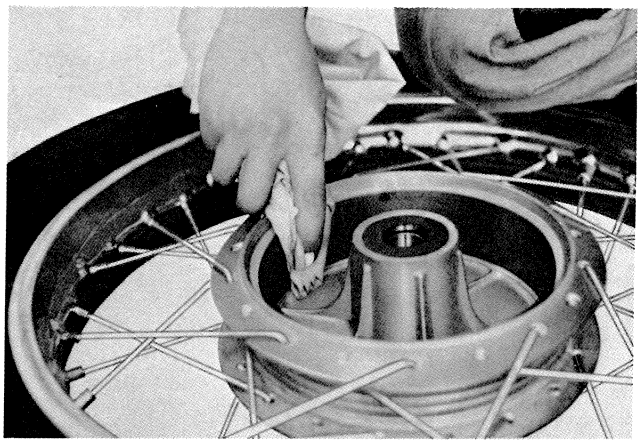
4) Brake Shoes

a) Use a vernier caliper to measure the outside diameter of the installed brake shoes and individual shoe linings. If either measurement proves any part of the brake unit to be excessively worn, replace both shoes with a new set.

	STD	Wear Limit
Shoe Outside Diameter	200mm (6.772")	196mm (6.612")
Lining Thickness	4mm (0.160")	2mm (0.080")

b) Check for brake shoe high spots that cause uneven contact with the brake drum. Remove these high spots with a file or emery cloth.

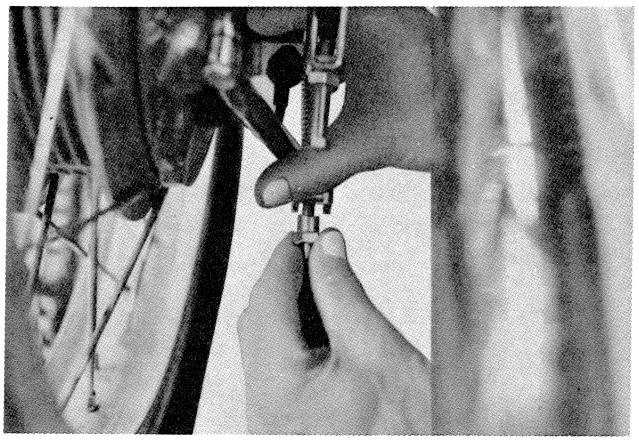
c) Friction heat can glaze the brake shoe surface. This causes less than maximum stopping efficiency. Use a file or rough emery cloth to evenly rough up the surface.



5) Brake Drum

a) Grease on the brake drum causes improper braking performance. Thoroughly clean the surface with a rag soaked in solvent if any grease is found on the drum.

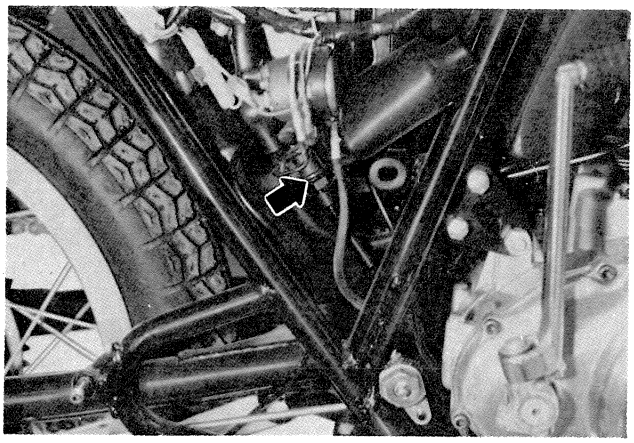
b) Any ridges or glazing that might exist on the brake drum surface can impair the operation. Use emery cloth to lightly sand out any ridges.

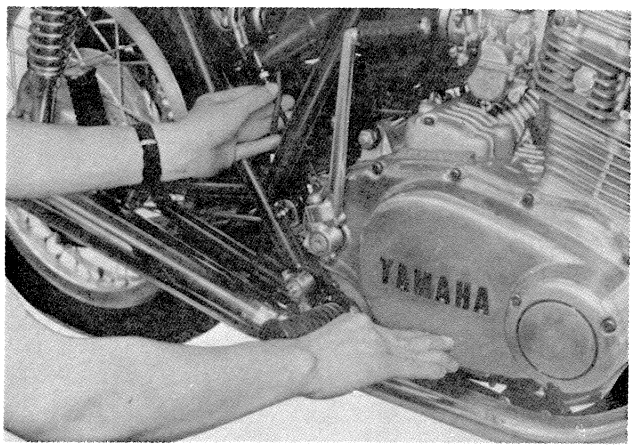


c) The single leading shoe rear brake is actuated by the right-side foot pedal. A rod connects the pedal to the brake. The adjustor is at the end of this rod. Spin the adjustor in or out, whichever direction is required to obtain approximately 1" (25mm) of pedal free play.

Note:

Rear brake adjustment should be checked any time the rear wheel is removed or the drive chain is adjusted.





Rear Stoplight Switch Adjustment

1) The rear brake stoplight switch mounts to the frame just behind the right-hand case cover. A rod connects the switch to the brake pedal.

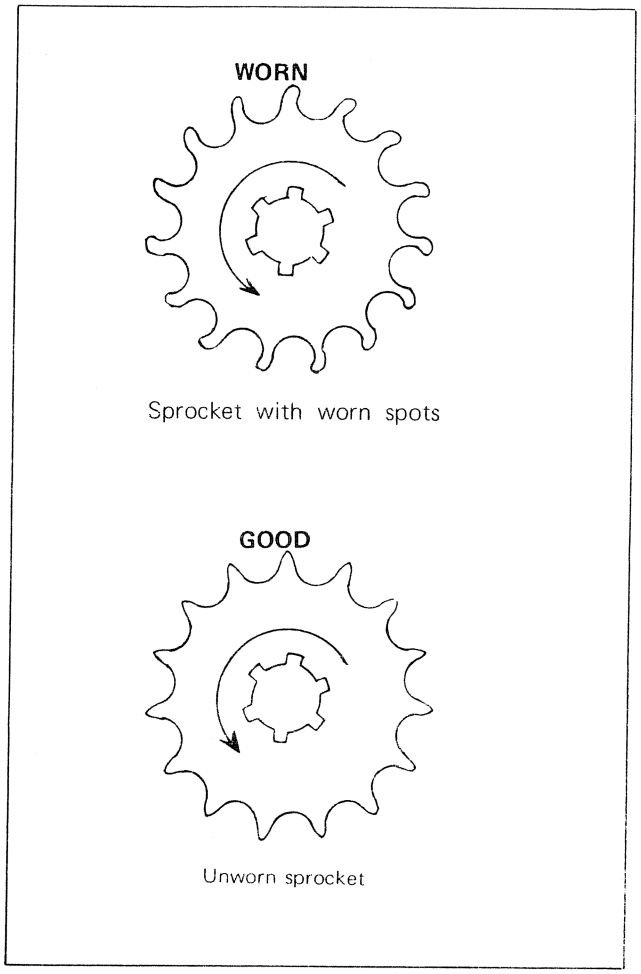
2) To make an adjustment, loosen one lock nut and spin the other nut. To raise the switch, loosen the bottom nut. To lower the switch, loosen the top nut.

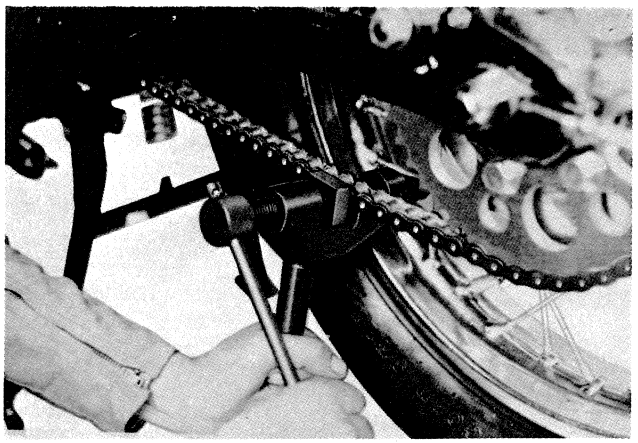
Note:

Check rear stoplight switch adjustment whenever the rear brake is adjusted or the rear wheel is moved.

NOTE ON INSTALLATION: Be sure that no lock tabs are cracked or broken and that they are all bent against the bolts.

3) Constant friction and force from the chain creates wear on the sprocket teeth. If wear has progressed to the extent shown in the illustration, replace the sprocket.



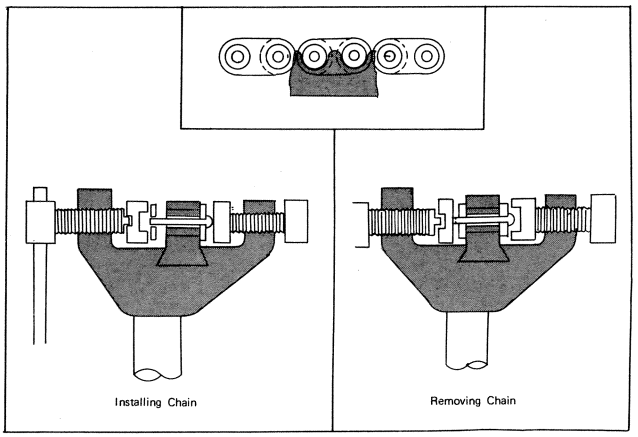


DRIVE CHAIN

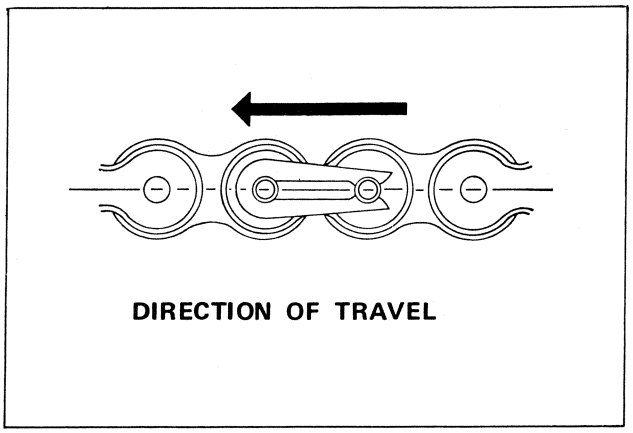
Disassembly

a) Removing Chain
Fit the special tool with an adapter for removing the chain. Then place the chain joint on the special tool and pull the chain apart by screwing in the pulling bolt.

b) Installing Chain
Joint the chain ends on the rear wheel sprocket, using a master joint. Place the chain joint on the sprocket where it is easier to use the special tool. Use the special tool, with a chain installing adapter, to caulk the new joint plate by screwing in the pulling bolt.



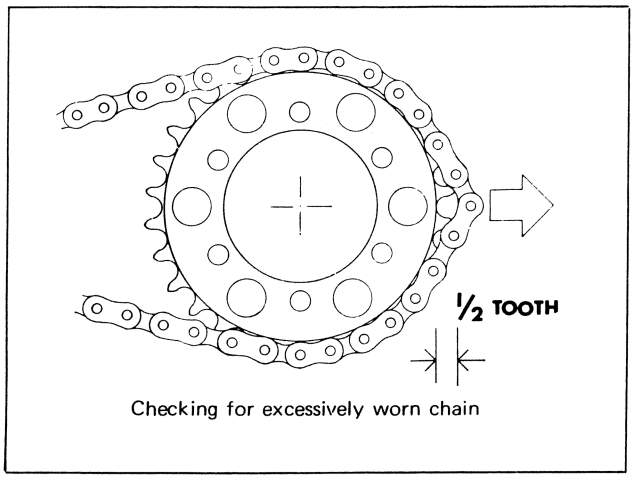
c) Whenever installing the chain, always install the master link retaining clip so that the rounded closed end faces the direction of travel.



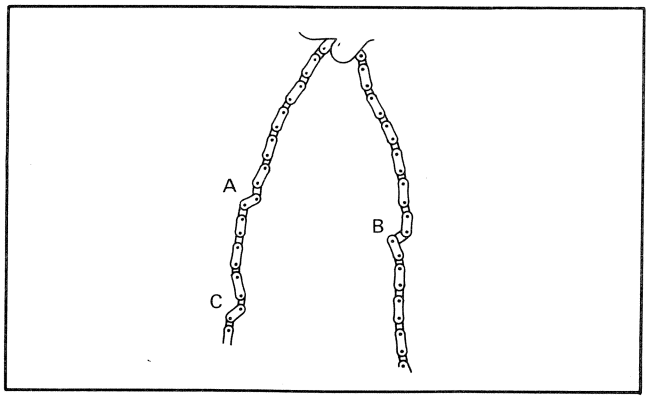
Inspection

Wear

a) With the chain still on the motorcycle, lift the chain away from the rear wheel sprocket. A chain is defective if it can be pulled away from the sprocket more than half the length of a link.



Checking for excessively worn chain

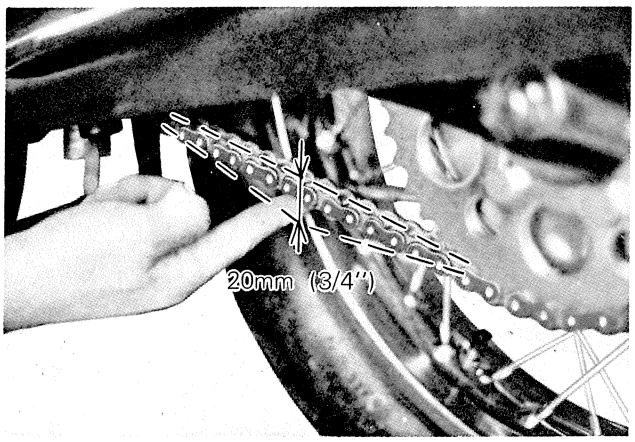


b) Check the chain for binding caused by dirt or rust. Hang the chain straight down and check all links for indications of binding (A, B & C in the picture). If soaking in a strong solvent does not remove the binding situation, then replace the chain.

Maintenance

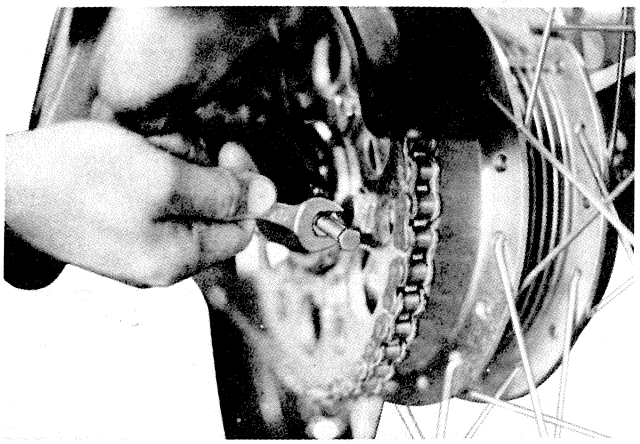
a) Lubrication. There are several pressure can lubricants available. Use a rag to wipe off any accumulation of dirt, then spray a liberal amount of lubricant on the chain at least every 200 miles.

b) Cleaning. The chain has to be periodically removed from the machine soaked in cleaning solvent.
Drain and dry the chain. Immediately after the chain has dried completely, lubricate to prevent any rust from forming.



Adjustment

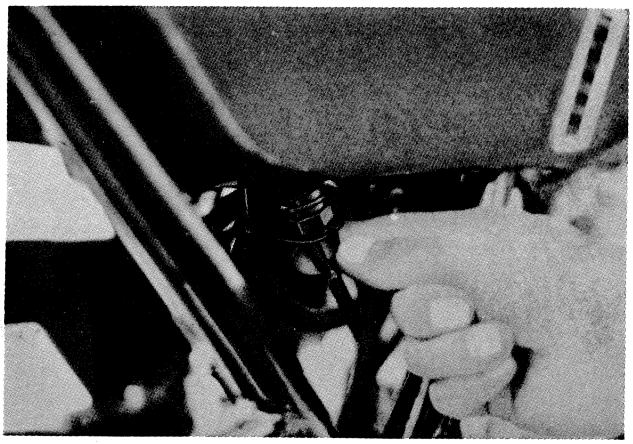
1) Proper drive chain up-and-down free play, with the rider in position and both wheels on the ground, should equal 20mm (3/4") when measured at the center of the lower section of chain. Follow these steps to obtain the correct free play.



2) Remove the cotter pin and loosen the rear wheel nut.

3) Loosen the chain adjusting bolt lock nut 2 on each side.

4) Rotate both adjusting bolt 3 to obtain the correct free play, and at the same time make sure that both ends of the axle are positioned evenly. This can be done by matching the marks on the sides of the swing arm 4 just above and to the rear of the rear wheel nuts.



5) After completing the adjustment, retighten all lock nuts.

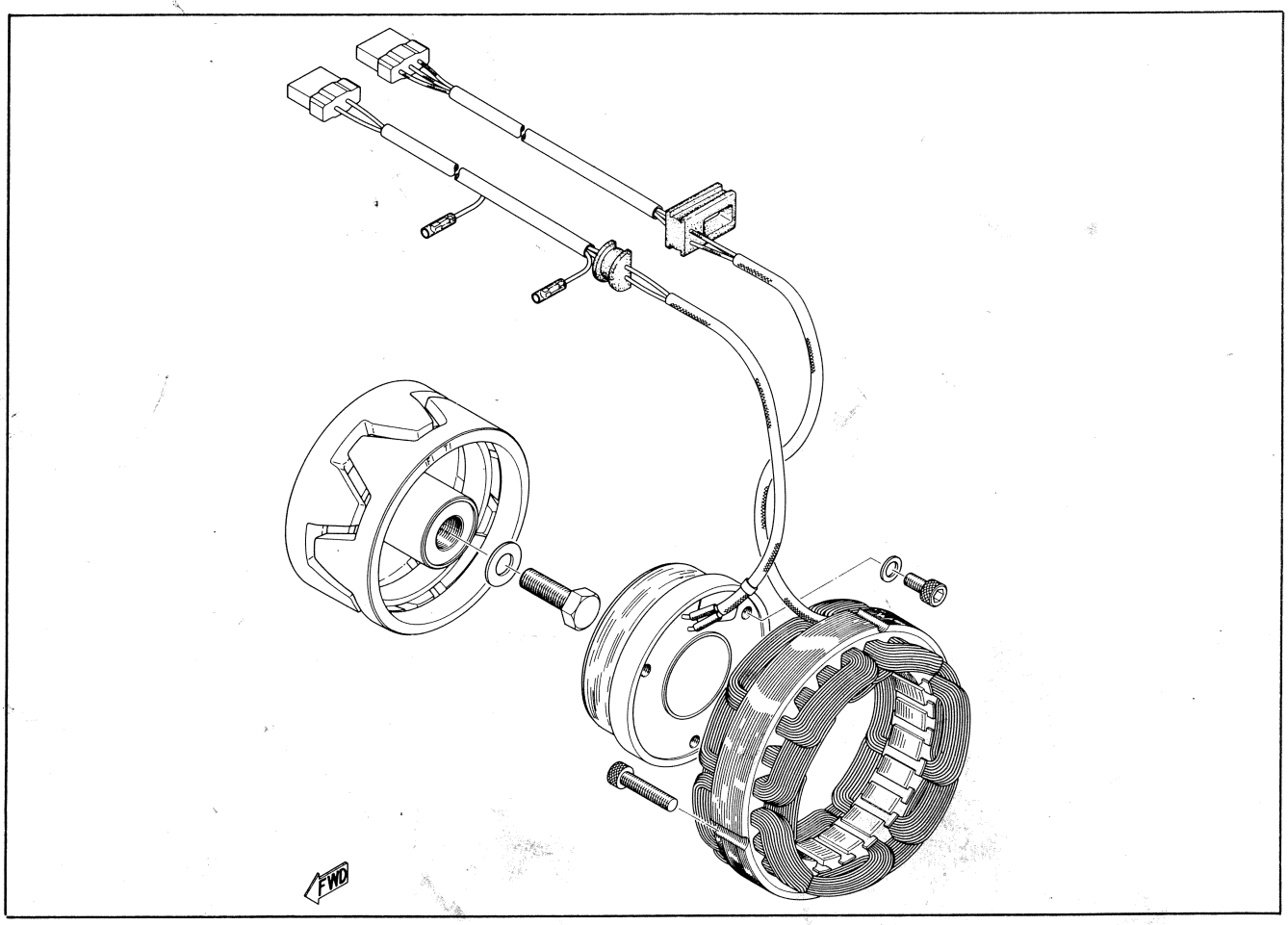
Tightening torque:	1	12.0 - 18.0 kg-m (90 - 135 ft-lbs)
	2	1.0 kg-m (90 in-lbs)

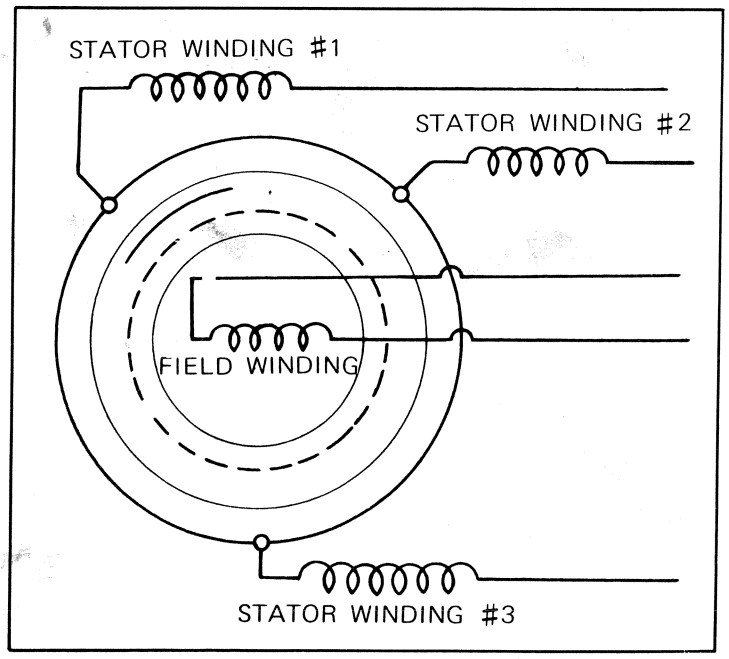
6) Finally, check for correct brake pedal and stoplight operation as they could have changed due to the chain adjustment.

A worn chain causes wear to both sprockets. If either sprocket is excessively worn, it can cause a new chain to wear out prematurely Strict attention should be paid to the condition of all three components, if any one is replaced. Possibly two or all three components might require replacement if wear is excessive.

4. ELECTRICAL EQUIPMENT

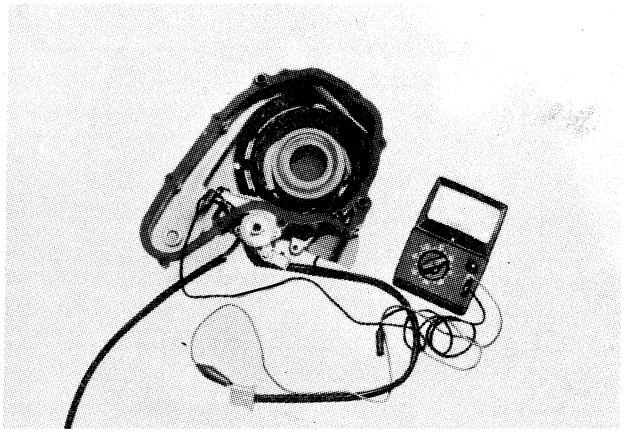
Unlike a conventional type alternator, the AC generator used in the TX500 has no brushes and slip rings, because the fixed coil does not rotate and is separated from the rotor. That is, it has no parts subject to wear. This AC generator is of a three-phase AC design and uses six silicon diodes for full-wave rectification.





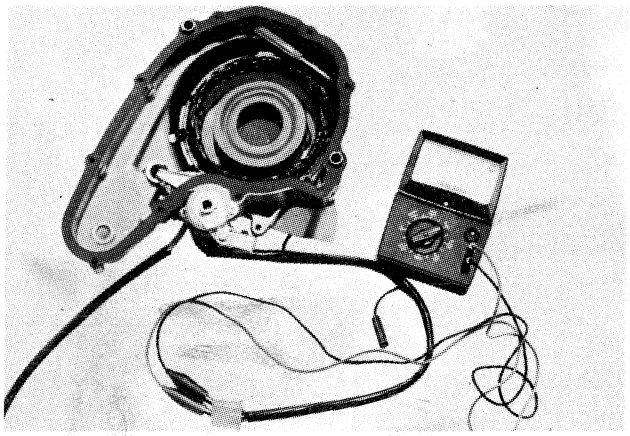
AC GENERATOR

The rotor is designed to interrupt the magnetic field created by the stationary field winding. Openings in the rotor are sinusoidal in shape and alternately make and break the magnetic field to the three stationary armature windings.

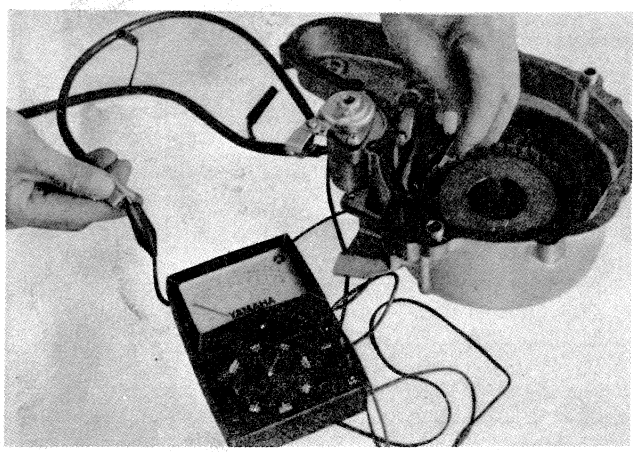


Inspection

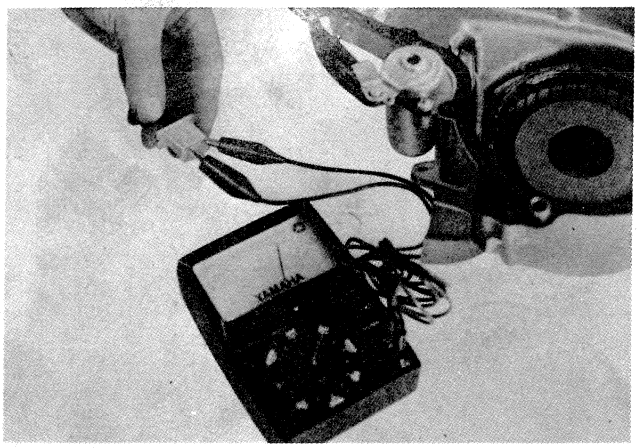
1) The field coil can be checked for insulation and wire breakage with an ohmmeter.
   If there is continuity between the lead wire and the core, the core is grounded.
   Look for broken insulation and lead wires touching the backing plate. If ground cannot be eliminated, field coil must be replaced.



If there is no continuity between the green and black lead wires, the coil is considered to be broken, and should be replaced. If the resistance across the field coil measures 4.04 Ω ± 10%/20 °C, it is considered to be in good condition.



2) The stator coil can also be checked for insulation and wire breakage with a tester.
   There are three stator coil terminals located in the 4-pin connector of the stator coil wiring harness. Measure the resistance between each of these terminals and the stator coil assembly core (there is no wire connected to the core; touch meter lead to bare metal of core). There should be infinite resistance (no continuity) between any stator coil terminal and the core itself. If there is continuity, the stator coil assembly is shorted and must be replaced.



3) Stator coil windings may be checked for continuity by measuring between any two of the three-terminals (white wires). This must be done for all three combinations (A-B, A-C, B-C). In each case the resistance should be 0.7 Ω ± 10%/20° C. The stator coil assembly should be replaced if any other resistance is obtained.

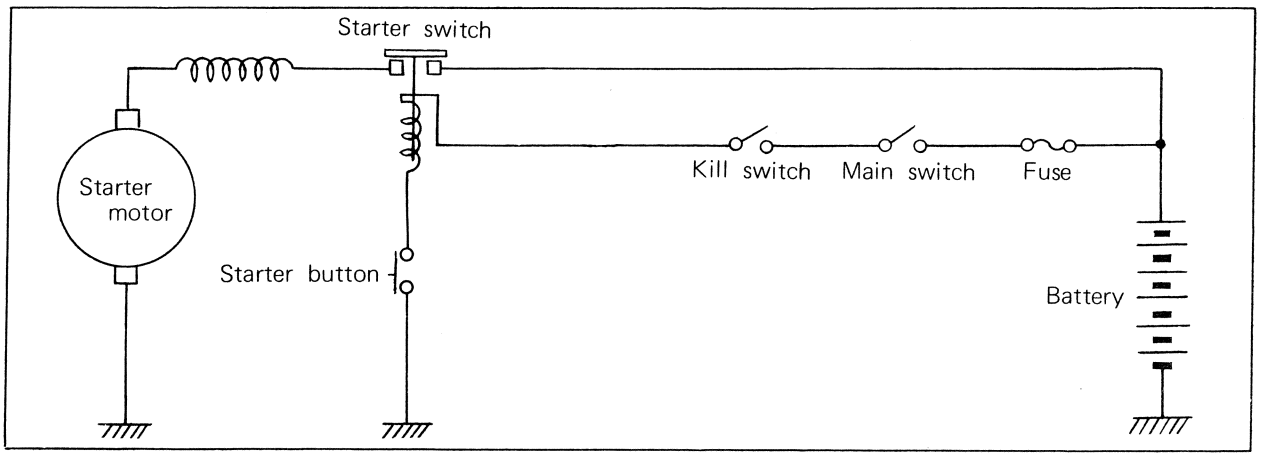
Handling Notes:

The AC generator is used in combination with silicon rectifiers, and therefore, it should be handled with the following special care.

1) Be careful not to connect the battery to the generator in the wrong polarity. Otherwise, the silicon diodes establish a short-circuit in the battery, thus allowing a large amount of current to flow through the diodes. This will ruin the silicon diodes and burn the wire harness.
2) Be sure to connect the terminals correctly.
3) Do not turn the engine at high speeds with the red wire circuit (of the silicon rectifier) disconnected. A high voltage will be generated and ruin the silicon rectifier.
4) During quick charging of the battery, the silicon rectifier must always be disconnected at the red wire.

STARTER MOTOR

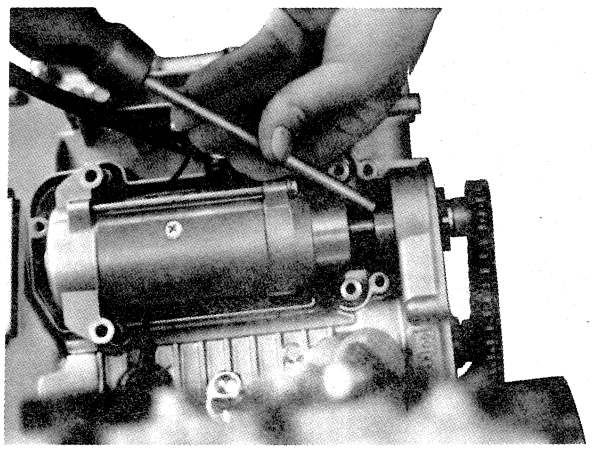
When the solenoid (starting motor switch) closes, a direct circuit from the battery to ground through the motor circuit is created. Resistance is extremely low in this circuit and consequently, a heavy current flow passes through the motor to ground causing the motor to turn.



Specifications

Note:
The following specifications should be refered to while disassembling and troubleshooting (explained in following chapters) is taking place.

COMPONENT	ITEM	MAINTENANCE STANDARDS	REMARKS
Motor			Mitsubishi MAD01-D
FIELDS	Resistance	0.01 ohm/20°C	
BRUSH	W x T x L	6 x 14 x 12.5 mm	
	Limit length	4.5 mm	
COMMUTATOR	Diameter	28.0 mm	
	Wear limit	26.0 mm	
	Mica undercut	0.7±0.1mm	
	Undercut limit	0.2 mm	
	Max. allow runout	0.15 mm	Out of roundness
BRUSH SPRING		650 gr pressure std.	(+10%, −25%)
STARTER SWITCH	Point gap	1.5 mm	
	Magnet windings	3.1 ohms ± 10%/20°C	
	Cut-in Voltage	8.0V or less	
	Cut out Voltage	3.0V or less	
MISCELLANEOUS ELECTRICAL			
STARTER MOTOR DRAW:		42A or less (12V)	No load
LOAD:		8.7V 100A (580 r.p.m.)	
CONSTRAINT:		4V 300A or less	

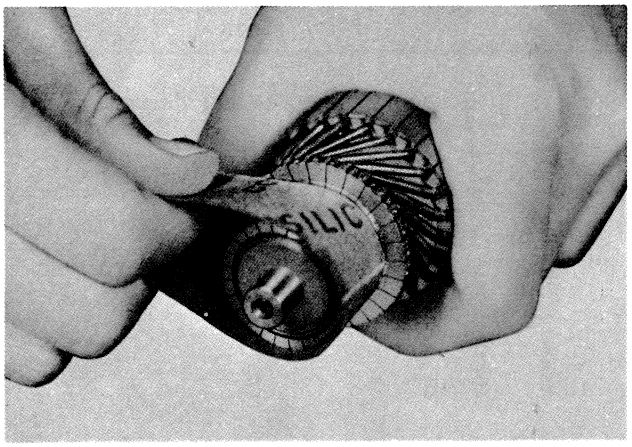


Disassembly

Starter motor

1) Remove the three cover installing bolts and the starter motor cover.

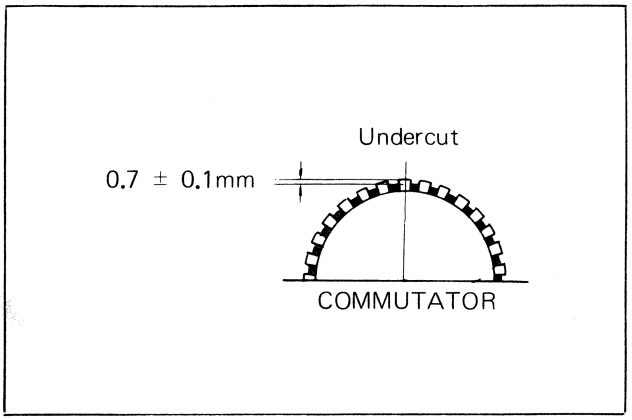
2) Remove the four motor mounting bolts and the holder. Remove the motor. (Refer to page 74).



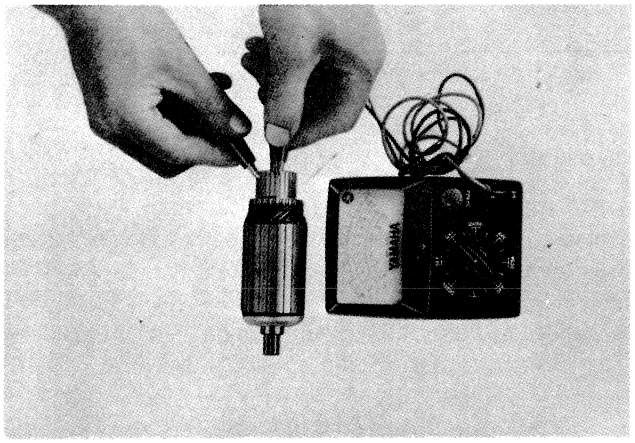
Servicing and troubleshooting

Armature

1) If the commutator surface is dirty, clean with #600 grip sandpaper as shown in the drawing at the left. After sanding, wash thoroughly with electrical contact cleaner and dry with high-pressure air stream.

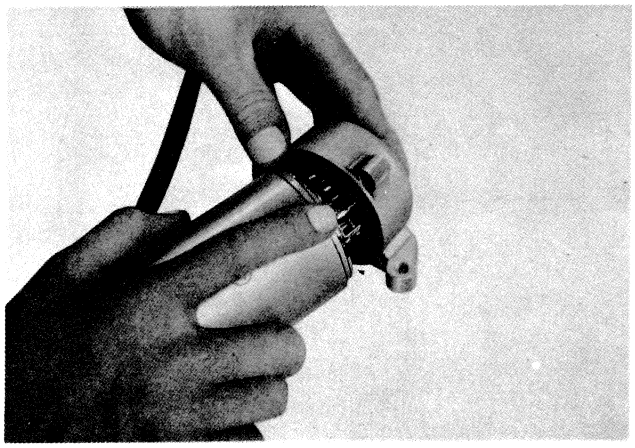


2) The mica insulation between commutator segments should be 0.7 ± 0.1mm below the segment level. If not, scrape to proper limits with appropriately shaped tool. (A hacksaw blade can be ground to fit.)

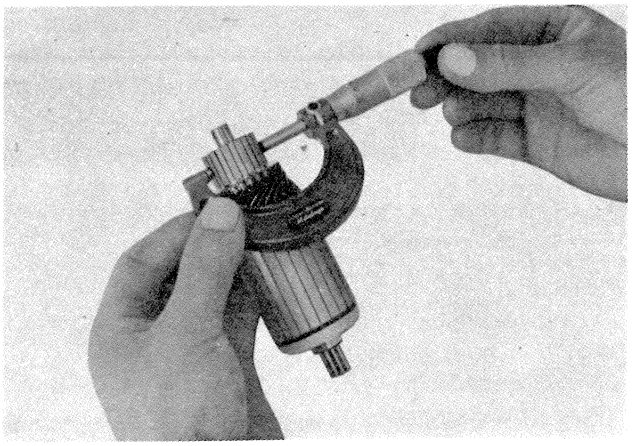


3) Each commutator segment should show zero ohm resistance to the others and at least three million ohms resistance to the core. If there is less than 3 meg ohms resistance to the core, or one of the segments is open, replace the armature.

In addition, the armature can be placed on a "growler" (testing device) and checked magnetically for internal shorts. Follow manufacturer's test recommendations.



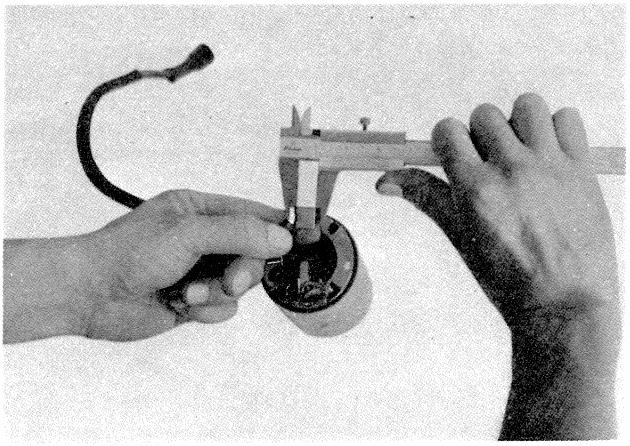
4) If the armature shows signs of having been in contact with the yoke windings, check the front and rear cover bearings.
Replace as necessary.



5) If the commutator surface shows heavy scoring it can be turned down on a lathe or commutator turning machine. Check the specification chart for minimum allowable commutator diameter. Recut the mica after turn down.

Note:

Should turning be required, check the condition of the cover bearings, armature electrical properties, starter amperage, draw and rpm and, finally, carbon brushes.

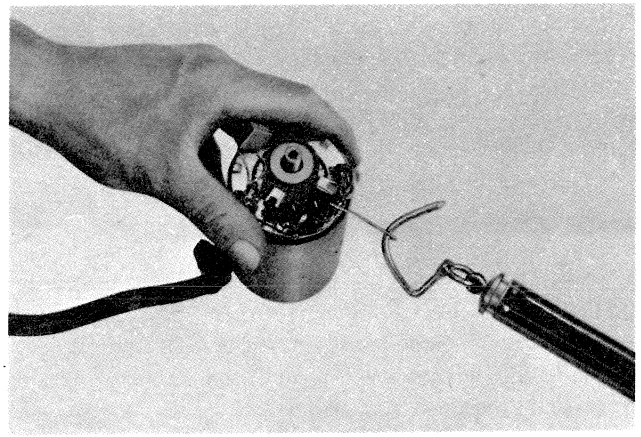


Carbon brushes

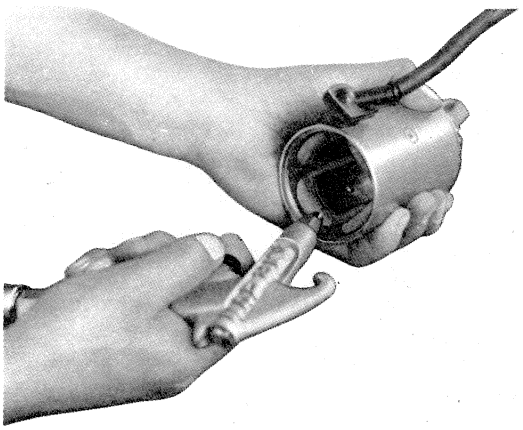
1) Check brush length and replace if at or near limits.
   Minimum length 4.5mm
   Standard length 12.5mm
2) Check brush spring pressure. Replace if over/under specs.
   Normal . . . . . 650 gr

Note:

Spring pressure is measured with a nominal length brush installed. Lift until spring starts to lift off brush and note reading on scale.



3) Clean the brush holders thoroughly. Use clean solvent, a soft-bristled brush, and dry with high-pressure air stream.



Yoke

1) If the yoke area is dirty, clean with clean solvent and dry with high-pressure air.

2) Yoke coil resistance is 0.01 ohms/20°C
   If coil resistance is more than 0.015 ohms or less than 0.005 ohms, replace it.

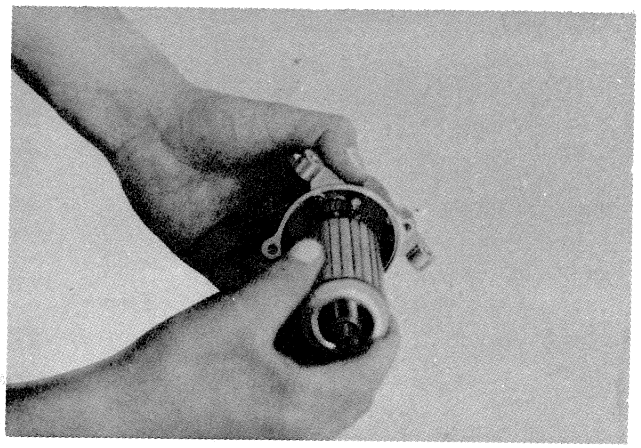
   If the yoke shows leakage to ground (resistance is less than 0.1 million ohms) replace it. (20°C)

Note:

Immediately after cleaning, the yoke may show some insulation leakage. Wait for it to thoroughly dry before checking or re-installing.

Covers

1) Check oil seals for hardening, cracking, and worn lips. Replace as necessary.



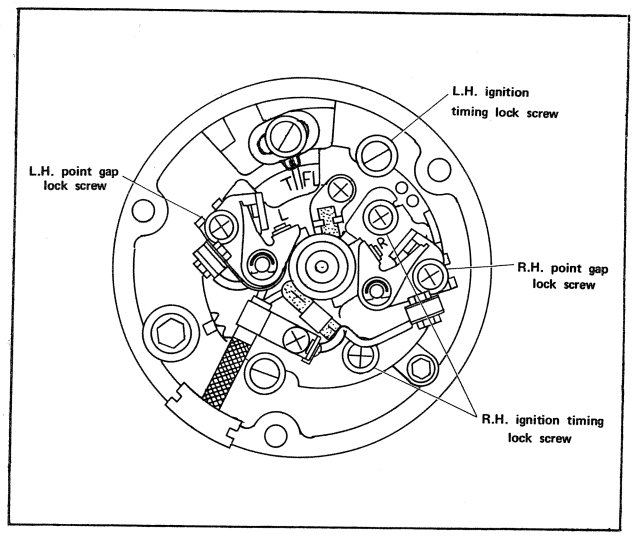
Note:

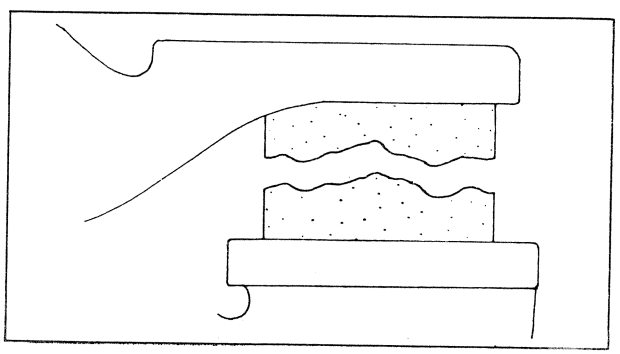
During reassembly, pre-lube the lips of all seals with "white" grease. (lithium soap base grease)

2) Clean the bearings thoroughly, lightly oil each and check for hard spots during rotation, cracked or broken balls and/or races, etc.
Replace as necessary.

Note:

During reassembly, all non-sealed bearings should be given a light coating of 20W or 30W "SE" (MS) Motor oil.





IGNITION BREAKER POINTS

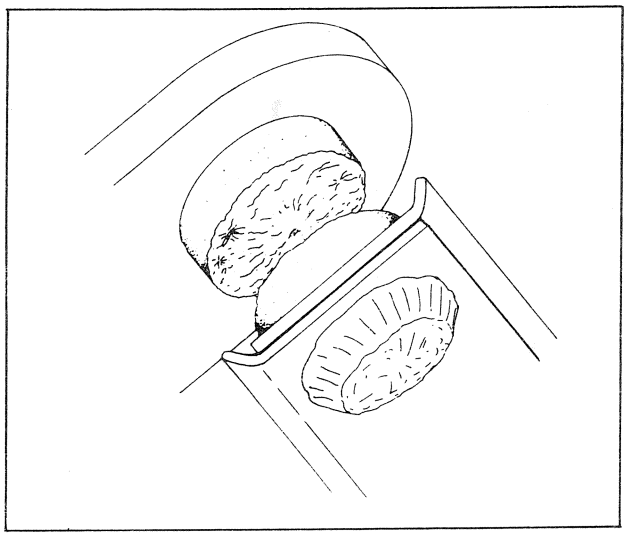
This unit is equipped with two independent sets of ignition points; one for each cylinder. They are both located in a single housing mounted on the front of the crankcase (R). The points act as circuit breakers for the ignition system. A point cam spins clockwise in the center of the ignition unit. A lobe on the cam controls the opening and closing of the points.
When the points are closed, current flows to the primary coil (which begins to build a magnetic field). At a precisely calculated point of crankshaft rotation, the cam forces the points apart, which stops current flow to the primary winding in the ignition coil. High voltage is then generated in the coil's secondary winding and causes a spark to jump the plug electrodes.

Inspection

Wear

a) The points gradually become burnt and pitted. This is normal wear. However, metal from one point might transfer to the other. If this metal build-up cannot be cleaned off with a point file, the points should be replaced.

b) Oil may gradually seep past the seal and coat the points or wiring. This will burn onto the points creating an insulating film. It must be cleaned off with ignition point cleaner.

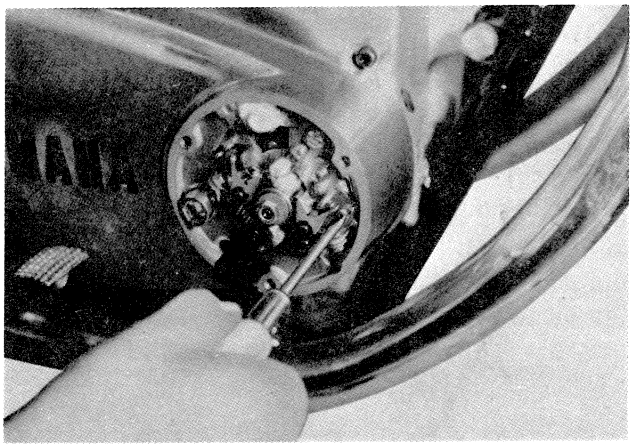


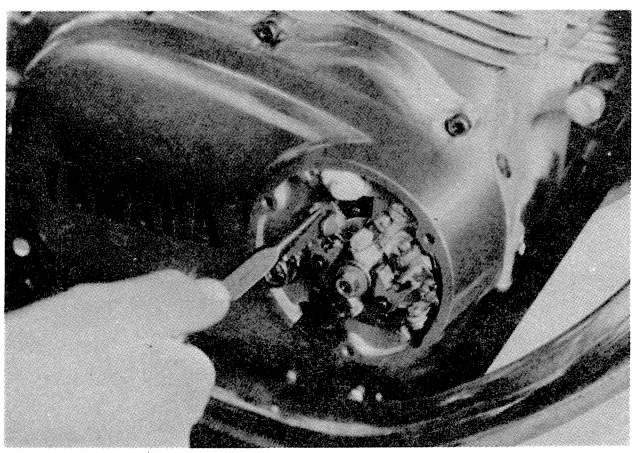
c) The fiber cam follower mounted on the pivoting point arm rubs against the cam Eventually this block wears down which results in a reduction of the point gap and retarded timing of the cylinder. The remedy is to re- gap the points and check the timing (timing should be checked any time the points are re-gapped.)

d) If a point return spring becomes weak or broken, the pivoting point will bounce. Timing will become erratic and ignition firing will be uneven. Measure spring tension by attaching a scale (measured in grams) to the pivoting point. It should take 650 - 850 g to cause the points to separate. (Use a point checker to measure the separation electrically).

CAUTION

The point shaft threads will be stripped if the engine is turned using the 10mm point cam retaining nut. Instead, remove the 10mm hex plug at the lower-left side of the housing and engage the crankshaft with a 10mm hex wrench.

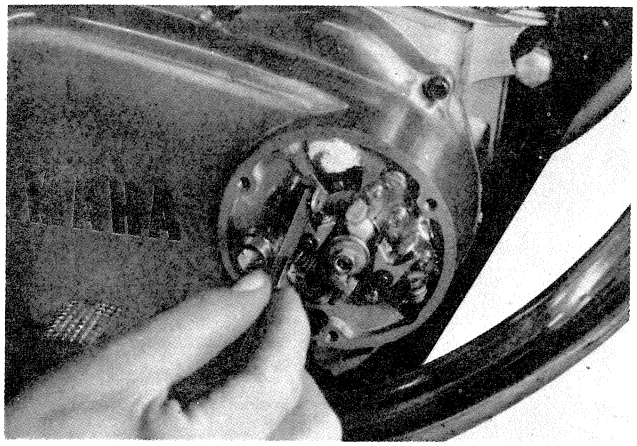


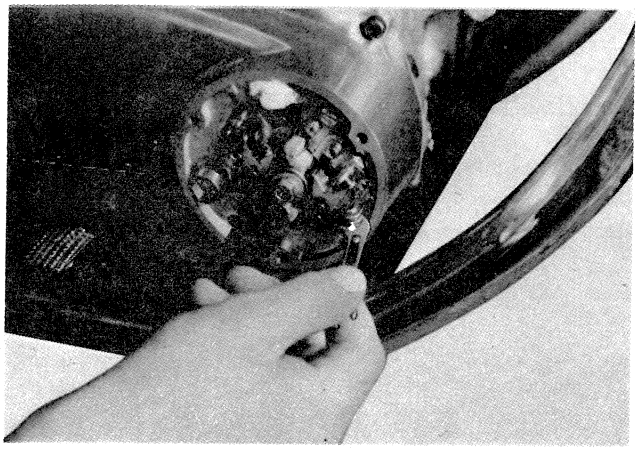


Repair

a) Point gap on each set of points must be set at 0.3 - 0.4 mm (0.012" - 0.016"). Constant electrical arcs across the points cause some metal to burn away, changing point gap. Clean and re-gap the points per recommendation. Check timing after re-gapping.

b) To clean the points, run a point file between the points until the gray deposits and pits have been removed. Spray the points with ignition point cleaner or lacquer thinner, then snap the points shut on a white business card (or paper of rough texture) and repeatedly pull the card through until no more carbon or metal particles come off on the card. (The card may be dipped in lacquer thinner or other cleaner to facilitate this procedure).





c) To gap the points, first rotate the engine until the ignition cam opens the points to their widest position. Slip a 0.4mm feeler gauge into the gap. It must be a tight slip fit. If an adjustment is necessary, loosen the point lock screw (1 or 2) as shown in the accompanying drawing, insert a screwdriver into the adjustment slots (3 or 4), and open or close the points until the feeler gauge indicates the correct gap. Retighten the lock screw and recheck the gap.

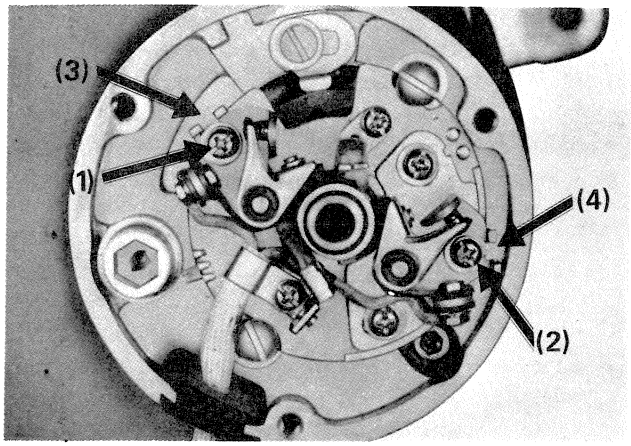
d) Next, rotate the camshaft until the second set of points opens to its widest point. Then perform the same steps described in the previous paragraph.

Note:

Add a few drops of light-weight oil onto the felt rubbing pad after each point adjustment to lubricate the point cam surface. Do not overoil.

Replacement

1) Unscrew the point wire securing screw. Completely remove the point lock screw. Lift the entire point assembly up off the point base plate.

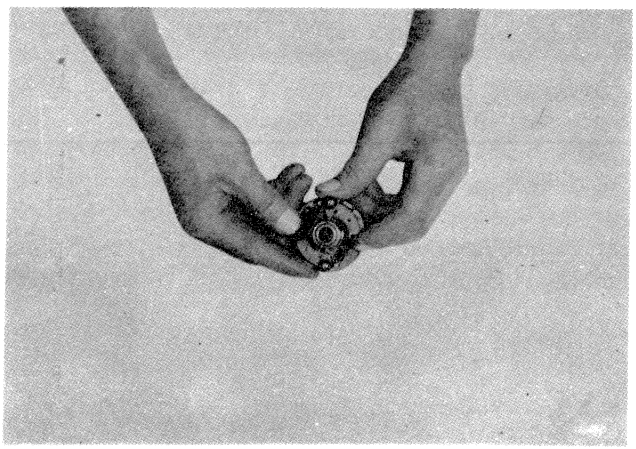


2) Locate the new set of points into position by slipping the point assembly locating pin into the appropriate locating hole in the base plate.

3) Insert and tighten the point lock screw. Finish this replacement by attaching the point wire to the stationary point and re-gapping the new point assemble.

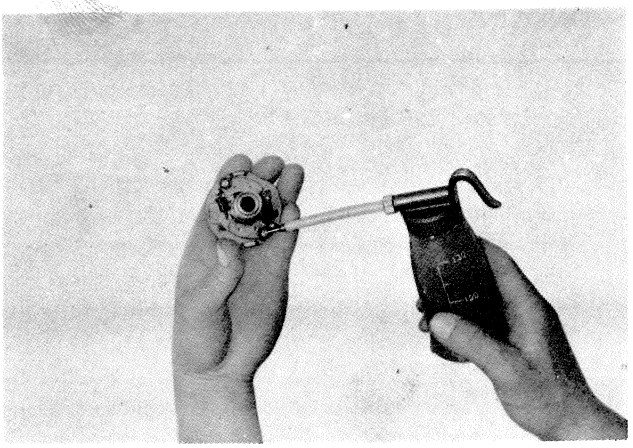
Note:

Point lead wire should not touch point base plate and should be insulated from the base plate by the insulator washers.



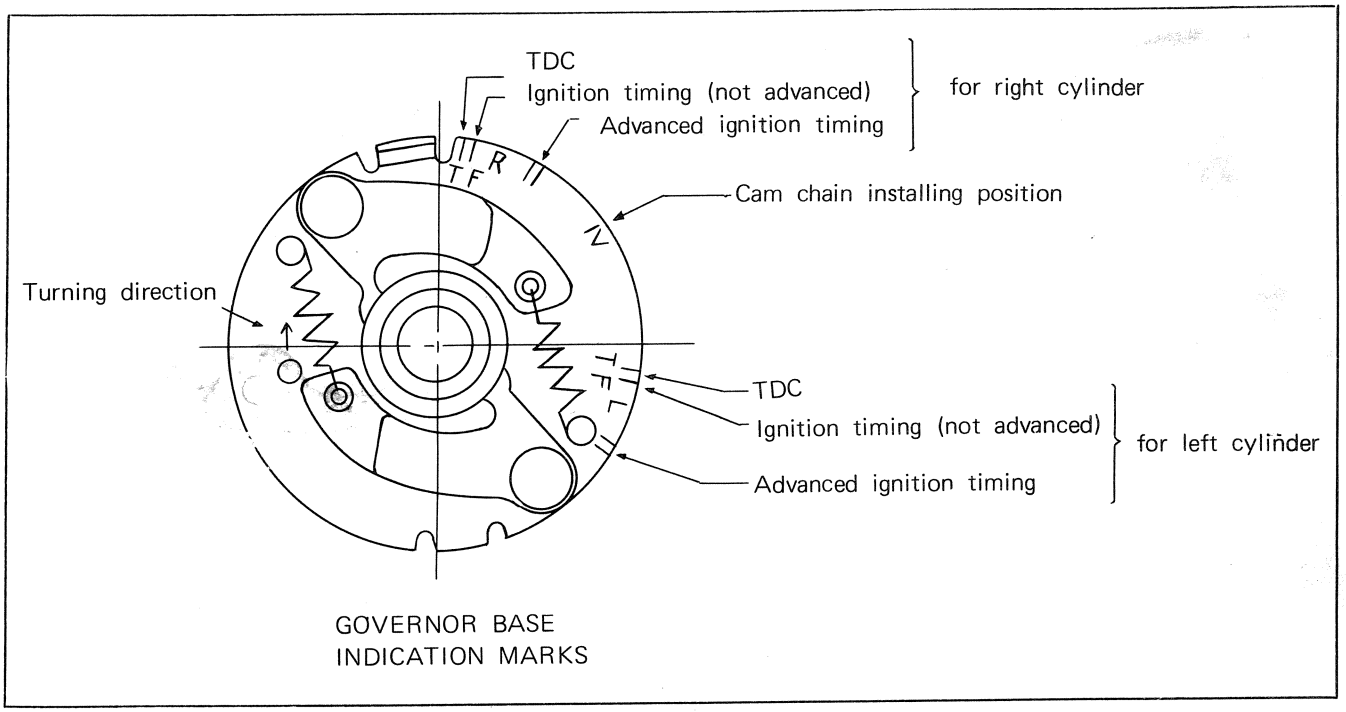
ADVANCE ASSEMBLY

1)The governor is attached to the breaker gear shaft. Two centrifugal weights pivot on pins. Each weight has a small extension that fits into the disk notch. As engine rpm increases, both weights begin to swing out on their pivot pins due to centrifugal force acting on the rotating unit. The weights continue to swing outward as rpm's increase until the weights are stopped by fixed stopper pins. As these weights pivot, the extensions in the disk notches cause the disk to rotate. Since the disk is directly attached to the point cam rod, the ignition point cam also rotates, which causes ignition timing to advance.

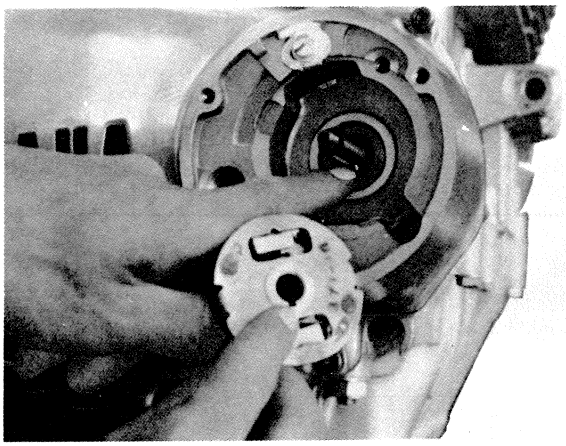


2) Both weights must pivot smoothly or ignition advance will not occur at the proper rpm, nor will it advance to its fullest extent. On occasion, light-weight grease must be applied to the weight pivot pins.

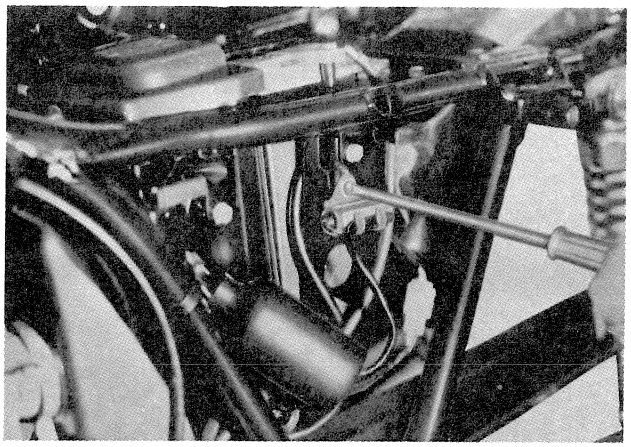
3) The advance unit mechanically changes ignition firing from 5° BTDC at low rpm to 40° ± 3° BTDC at high rpm (full advance). The ignition point cam is attached to the timing shaft.



GOVERNOR BASE
INDICATION MARKS



4) The point cam is not integral with the assembly. During installation, align the mark on the cam with the pin on the assembly shaft. If reversed, ignition timing will be reversed.

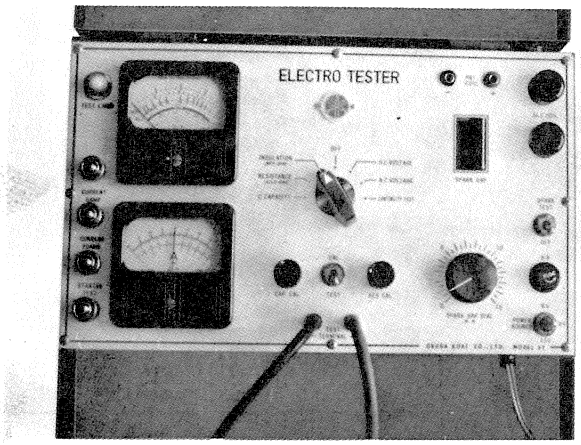


CONDENSER

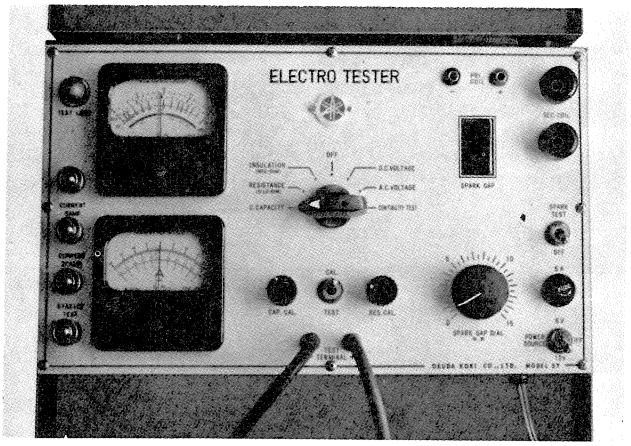
1. Two ignition condensers are located on the battery box. They are mounted as a single assembly and must be replaced as a set in the event of failure.

2. The condensers serve as a storage device to decrease arcing across the ignition points. Should one fail there could be either no spark or severe point pitting due to arcing. In the event of severe arcing there is also the possibility that the strength of the ignition spark may be decreased.

3. To test the condition of either condenser, pull the male/female connection apart.

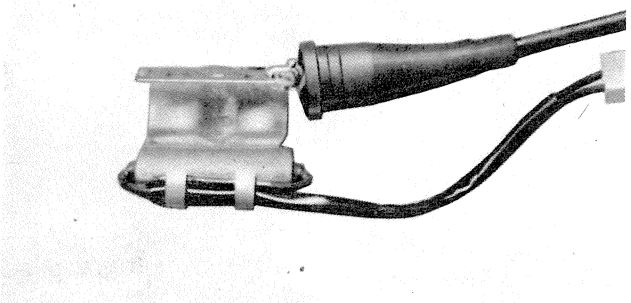


4. Set electro-tester function switch to "insulation" and connect the Black (Neg) lead to the condenser case, Red (Pos) lead to the wire running from the center of condenser. There will be a momentary flow of current and then the condenser should show at least 5+ million ohms resistance between the positive terminal and ground.

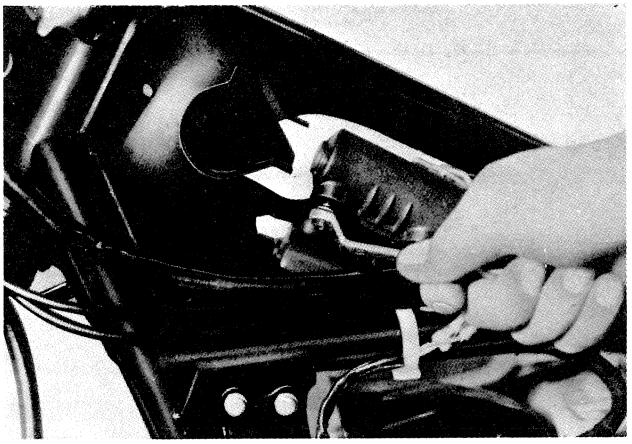


5. Next, hook up an electrotester to the condenser. (Leads in the same position). Turn the main function switch to "C.CAPACITY" and the calibration switch to "CAL".

6. Turn the "CAP CAL" knob until the meter needle points to 0.20uf on the red meter scale for "Capacitance".

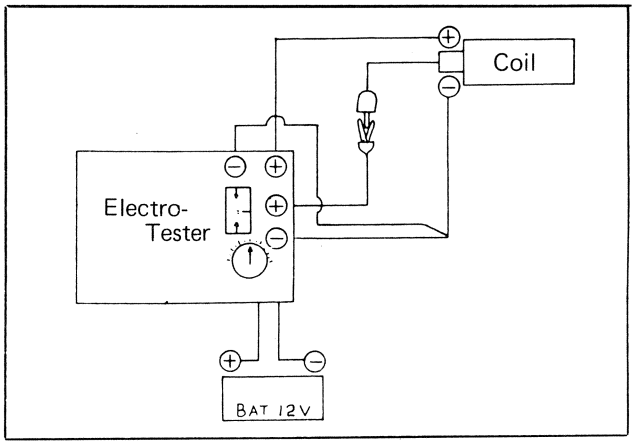


7. Turn the Calibration switch to "TEST". The needle should stay in approximately the same position. If it moves very far into the red, replace the condenser assembly.



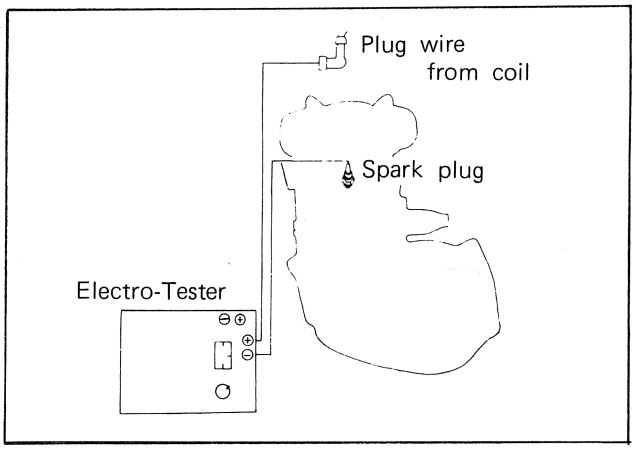
IGNITION COIL

1. Location
   The ignition coils are mounted on a bracket directly in back of the steering head. They cannot be removed until the gas tank is removed.

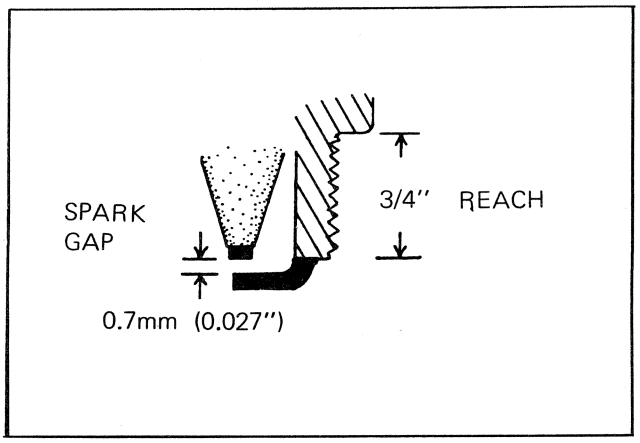


2. The ignition coils can be checked on the machine. It is not necessary to remove either the coil or the gas tank unless the coil is defective and needs replacing.

3. Static Test:
   Follow the diagram at left to check the coil. Leave the ignition key off and block the points open with a piece of paper. The coil should show at least 7mm spark gap. (Instruction for setting up the Electrotester can be found on the Electrotester cover.)



4. Dynamic Test:
   Follow the diagram at left for setting it up. Set the spark gap on the Electrotester to zero. Turn the ignition on and start the machine. Rev the machine to 2~3,000 rpm (or the rpm you wish to test at) and begin opening the tester's spark gap. When the engine begins to misfire, close the spark gap until it runs smoothly again. Spark gap should be at least 7mm.



SPARK PLUGS

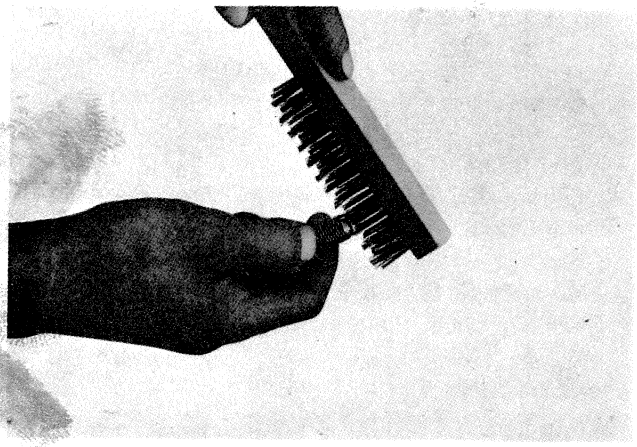
1. Standard spark plug is an NGK D-8ES which is a 12mm, 3/4" reach, fairly cold plug.
   Specific Tightening Torque: 130 - 170 in-lbs.
   (1.5 - 2.0 kg-m)

2. Under normal conditions the spark plug should show no deposits on the porcelain insulator around the center electrode. The porcelain should be a light to medium tan color. After 2,000 - 4,000 miles fuel deposits will begin to build up on the plug. Fuel deposits are easily cleaned off but as this is the period for a tune-up it is advisable to replace the spark plug.

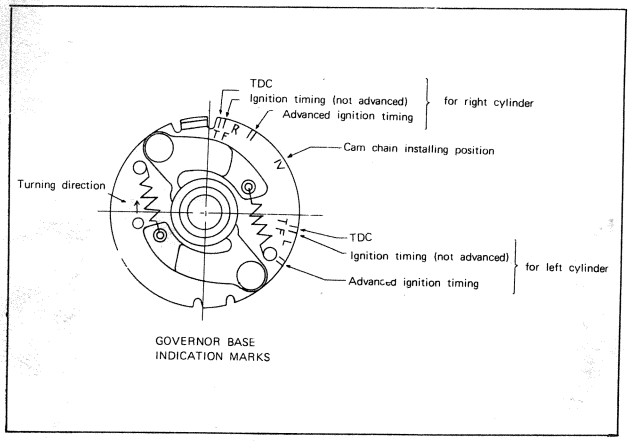
3. If one or both plugs are wet, black, and/or heavily sooted, this is an indication that temperatures within the combustion chamber are too low. Check with the rider as to his habits. The plug is designed to give best performance during moderate to medium-high speed cruising.

4. If one or both plugs are white, blistered, and/or the electrode has melted away, this is an indication of excessive combustion chamber temperature.

5. Under normal circumstances it is best to tune carburetion to achieve a correct spark plug reading.



6. Servicing
   Clean the electrodes of carbon and adjust the electrodes gap to 0.027" (0.7mm). Be sure to use the specified plug when replacing.

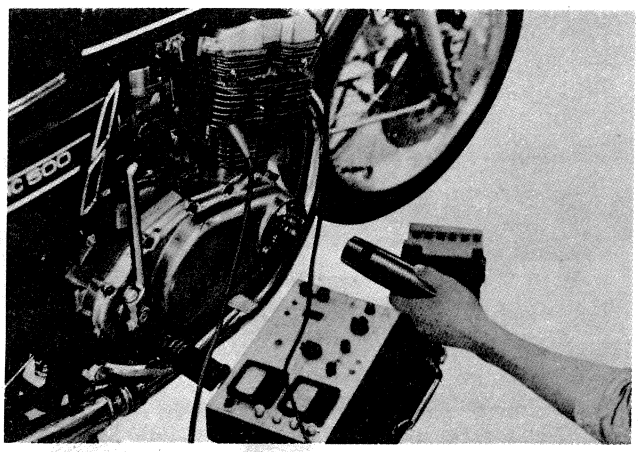


GOVERNOR BASE INDICATION MARKS

SETTING IGNITION TIMING

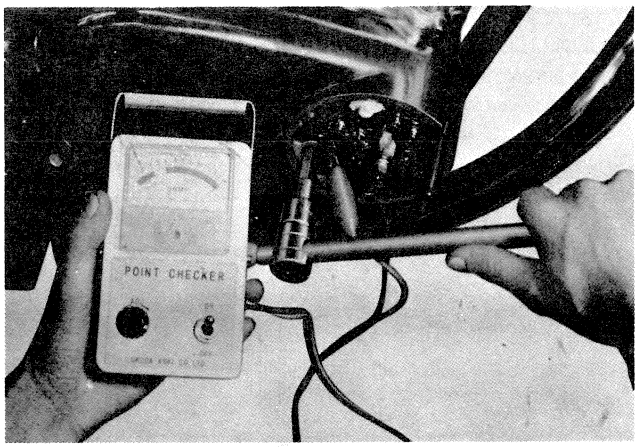
Ignition timing is checked by observing the position of the timing marks on the governor base in relation to the timing plate on the crankcase cover (R).

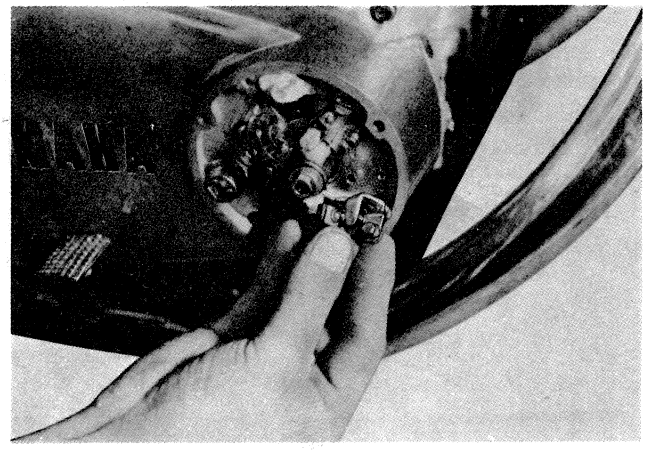
The timing plate is attached to the crankcase cover (R), and the governor base has four timing marks, respectively, for both right and left cylinders. In addition, it has one more mark "V" which is used when the cam chain (timing chain) is installed.
The first one of the four marks is "T" indicating top dead center for the piston.
The second mark is "F" indicating the ignition timing (that is, firing position) before advance takes place (5° BTDC). The space between the two marks after "F" indicates the advanced ignition timing position. If the ignition is timed to this position at 2,000 rpm, the ignition timing is correct. (40° ± 3° BTDC)

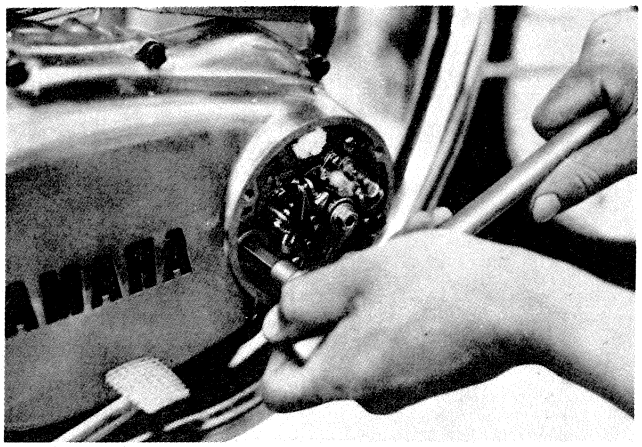


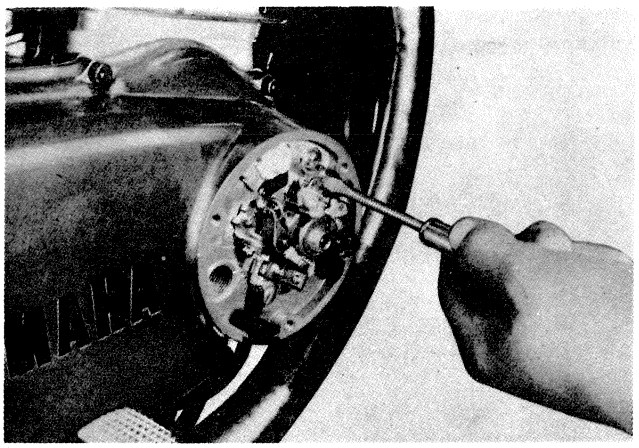
Note

Before adjusting ignition timing, "F" mark on governor base must be aligned with timing plate by turning crankshaft. For this adjustment, the point checker can be used, but for advanced ignition timing adjustment, a timing light must be used.









Note

Each point gap should be checked first, and adjusted, if necessary. Then proceed with the timing adjustment. Refer to page 147.

1. Check the point checker for full scale deflection (Infinity to Zero resistance), then hook the black lead to a good ground; the red lead to the orange point wire (left cylinder).

Caution:

Ignition timing for each cylinder is set separately. However, it is absolutely necessary that the left cylinder points are timed BEFORE the right cylinder points. The left cylinder points are mounted directly to the ignition point base plate. The right cylinder points, however, mount on a separate plate that is, in turn, mounted to the large ignition base plate. If the right cylinder points are timed first, they will shift out of position when the base plate is pivoted to time the left cylinder points.

The letter "L" (for left cylinder) is stamped next to one set of points, the letter "R" (for right cylinder) is stamped next to other set. This indicates which of points fires which cylinder.

2. Rotate the crankshaft in the direction of running rotation (clockwise when viewed from the right side) until the left-hand set of points just start to open, as indicated by the point checker.

3. Check the governor timing mark position in relation to ignition timing. If left-hand breaker points open and close with correct timing, timing plate is considered to be aligned with "F" mark. If not aligned, re-adjustment is needed.

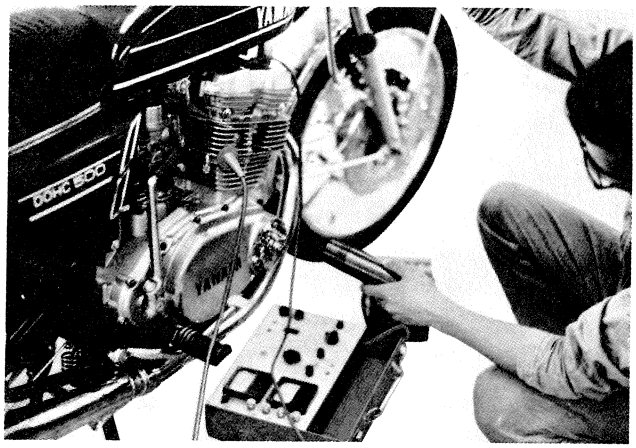
4. With the timing marks lined up correctly, loosen both base plate lock screws. Pivot the entire plate until the right cylinder points just start to open, (as indicated by the point checker).

5. Tighten down both lock screws and check the timing again to make sure the base plate has not moved.

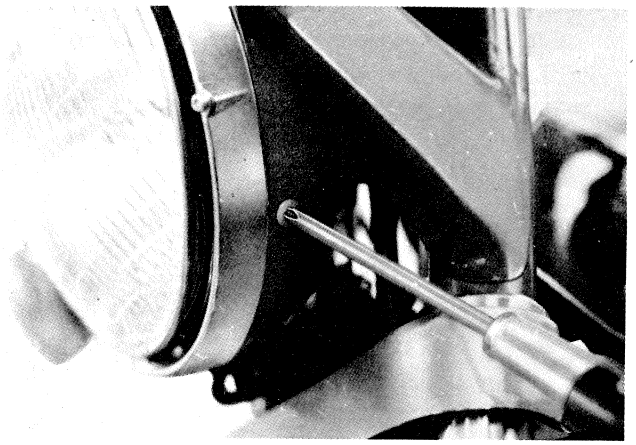
6. To set right cylinder timing, repeat steps 1 thru 4, except to switch the point checker probe from the orange wire to the gray wire. The right cylinder points are held in place on the base plate by two different lock screws. Loosen both lock screws as shown in the accompanying figure and make the necessary adjustments.

CAUTION

The point shaft threads will be stripped if the engine is turned using the 10mm point cam retaining nut. Instead, remove the 10mm hex plug at the lower-left side of the housing and engage the crankshaft with a 10mm hex wrench.



7. Start the engine, set speed to 2,000 rpm and set the timing light as illustrated. If ignition occurs between the two marks for advanced ignition, the ignition is correctly timed. If not, readjust the contact breaker position, and check the timing plate position.



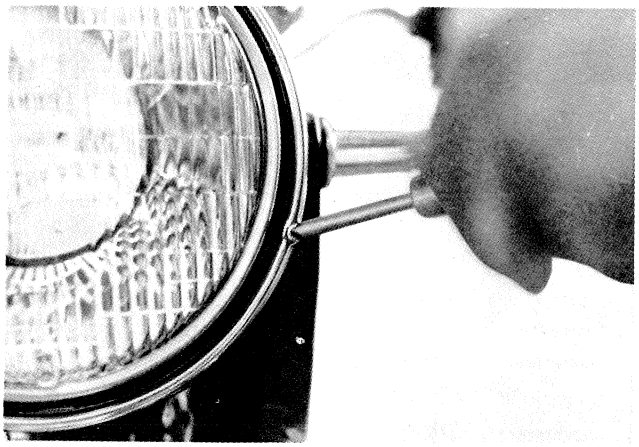
LIGHTING CIRCUIT

1. Headlight

a) The headlight is a semi-sealed unit with a non-replaceable filament. If the headlight burns out, replace the entire headlight bulb unit.

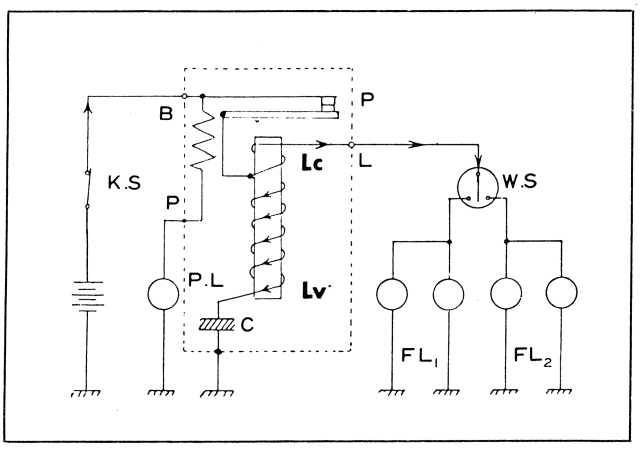
b) Replacement:

Remove screws "A", "B" and "C" ("C" is the side adjustment screw). Unhook spring "D" and pull the defective unit out of its shell. Slip a new unit into position and install parts "A", "B", and "C".



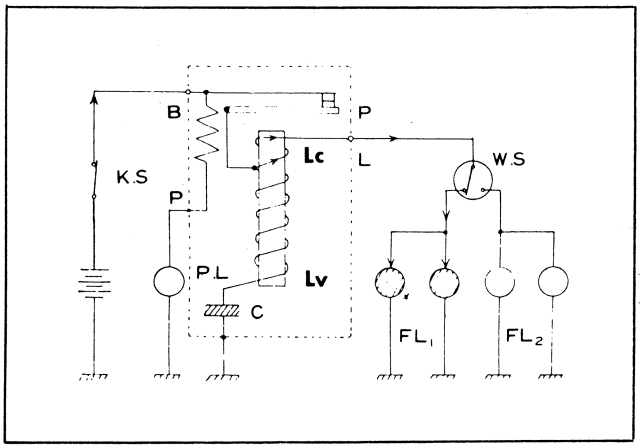
c) Adjustment:

Screw "C" controls side-to-side headlight movement. Screw it in or out until the headlight beam is centered.

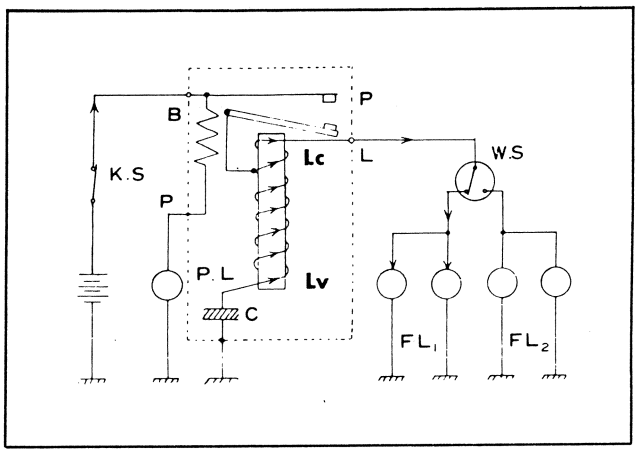


2. Turn Signals

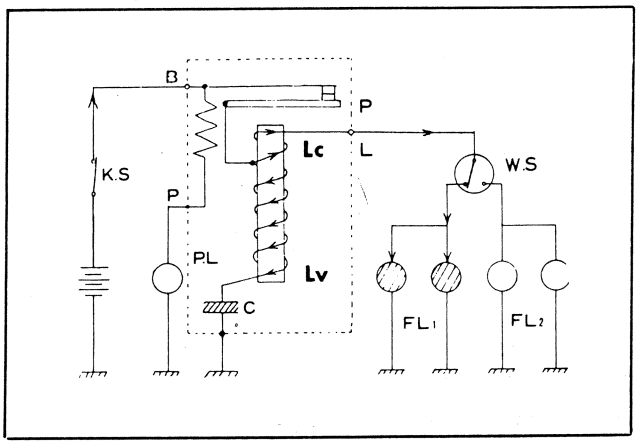
a) Voltage flows from battery to the relay condenser. The condenser becomes fully charged (including wire to flasher switch) and all voltage flow stops in the relay).



b) When the relay switch is activated, voltage flows from the battery through the "Lc" winding and causes the flasher to light.



c) At the same time that voltage lights the flasher, the "Lc" winding around the metal core creates an electromagnet that pulls the contact points apart. Voltage flow stops and the flasher lights go out. Magnetism to hold the points apart is momentarily maintained because the stored electrical charge in the condenser discharges back through "Lv" and "Lc" winding. The stored condenser amperage, however, is not sufficient to light the flasher lights (due to their being a high resistance load), so both flasher lights do not light again.



As soon as the condenser becomes sufficiently discharged, magnetism ceases and the point spring pulls one point into the other. Voltage once again flows to the flasher lights, causing them to light. At the same time some voltage charges the condenser. The process continues to repeat itself until the switch is turned off.

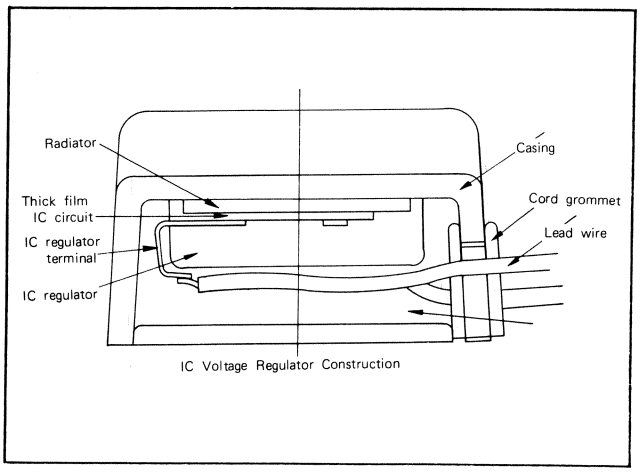
d) Improper Operation

d-1) No flasher action at all:
Check for a broken or shorted wire in the turn signal circuit.

d-2) Too slow or too fast flasher action:
A burned out flasher bulb will slow the flasher action. Check the condition of all flasher bulbs. If flashing action is too slow, and all bulbs are good, the flasher relay (condenser inside) is defective. Replace the relay.

Note

A bulb of incorrect watt rating will also affect flasher speed - doublecheck all bulbs for correct voltage and/or wattage.



IC Voltage Regulator Construction

IC Voltage Regulator

Yamaha has adopted an IC voltage regulator in the TX500 which is the first of its kind in the motorcycle field. This IC voltage regulator is designed to eliminate the following inherent disadvantages of a conventional contact-type voltage regulator-fluctuations in voltage due to mechanical vibrations, burning or wear on contact surfaces due to interrupted current.

There are two types of IC voltage regulators available, hybrid IC and semi-conductor IC. In the TX500, the hybrid IC type is used, and it is made up of an aluminum circuit board with condensers and resistors printed or vaporbonded to it. The whole circuit is constructed by micromanipulation and processing of a single block or chip of semiconductor. (In a transistor, the chip is sealed in, and the three electrodes extend outside the container.) To protect the circuit, it is insulated by silicone rubber and put in an aluminum case for better heat dissipation. Therefore, the hybrid IC voltage regulator cannot be disassembled, and no adjustment is required. We shall discuss how to check the condition of the hybrid IC voltage regulator.

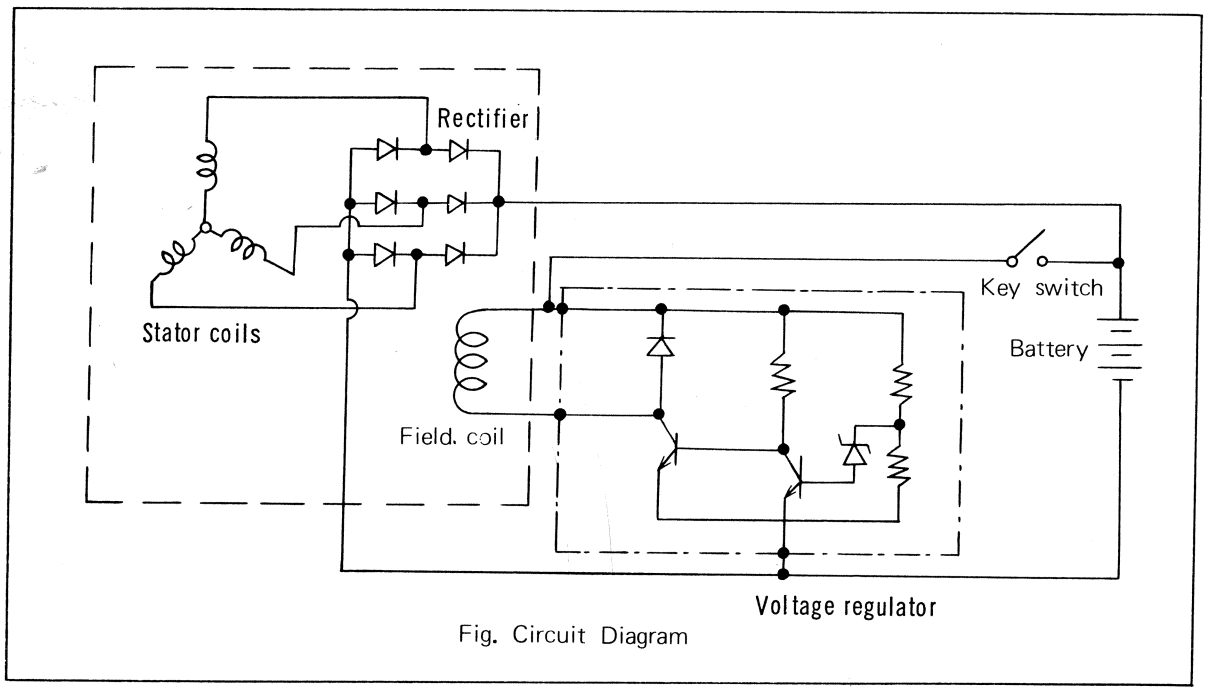
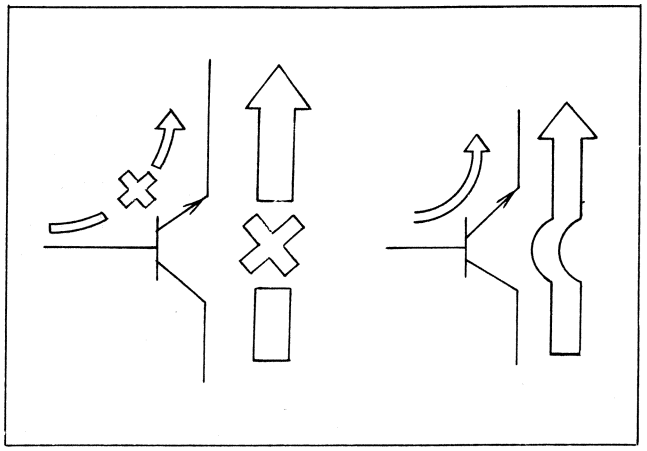


Fig. Circuit Diagram

Functions of the IC Voltage Regulator

The functions of the voltage regulator is to regulate the voltage of the current flowing to the field coil by interrupting the current by menas of an ON–OFF control system. We will consider here the functions of a transistor, diode, and a Zener diode used in the IC voltage regulator as well as those of the IC voltage regulator itself.



Theory of a Transistor (Tr)

As shown below, when current flows from the base of a transistor to the emitter (this current is called base current), a large amount of current flows from the collector to the emitter (this current is called collector current).

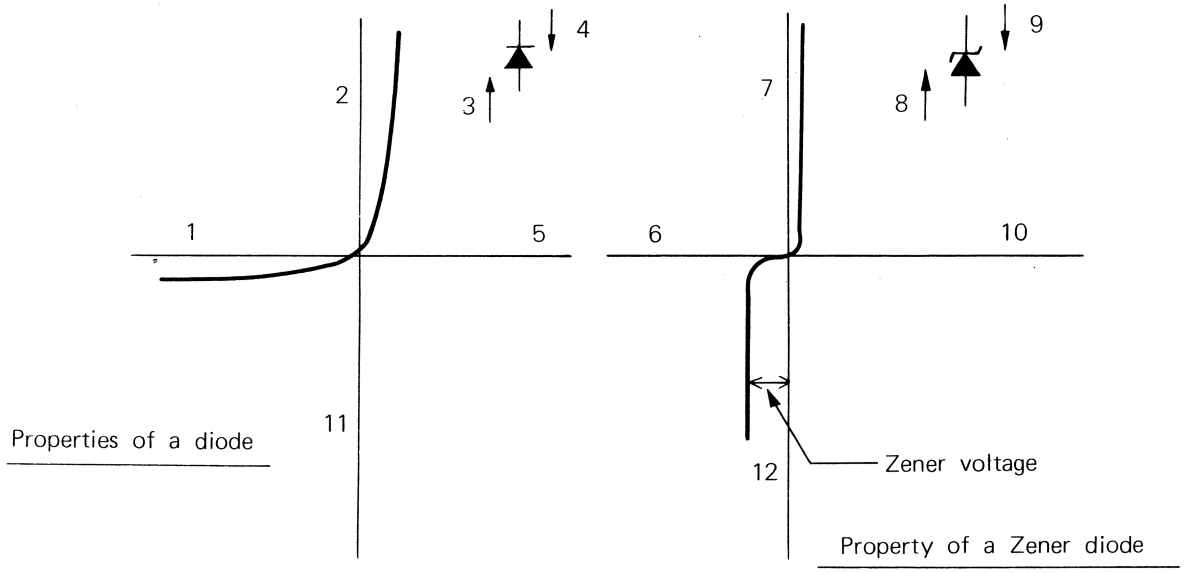
On the contrary, when there is no current from the base to the emitter, no current flows from the collector to the emitter. In other words, only when the base voltage is about 0.7 volts higher than the emitter voltage, does current flow.

Theory of the Zener Diode (ZD)

Like a standard diode, the Zener diode allows current to flow in the forward direction, but when a voltage in the reverse direction is applied, it shows different properties.

As illustrated below, when a voltage in the reverse direction is applied, the insulating properties of the Zener diode breakdown, thus allowing the current to pass across it.

The IC voltage regulator uses the properties of the Zener diode. It detects whether the voltage is higher or lower than the voltage setting, by which the voltage across the battery terminal can be regulated.



1. Voltage in the reverse direction
2. Current in the forward direction
3. Forward direction
4. Reverse direction
5. Voltage in the forward direction
6. Voltage in the reverse direction
7. Current in the forward direction
8. Forward direction
9. Reverse direction
10. Voltage in the forward direction
11. Current in the reverse direction
12. Current in the reverse direction

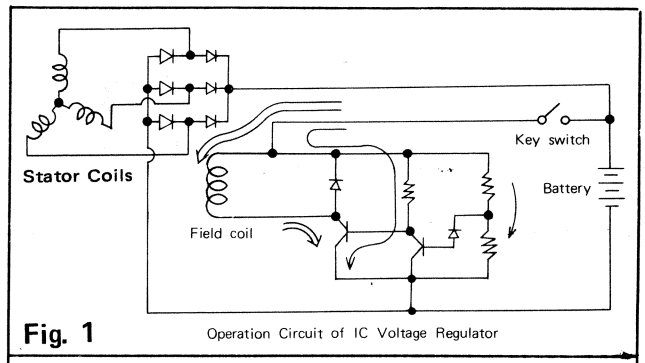


Fig. 1 Operation Circuit of IC Voltage Regulator

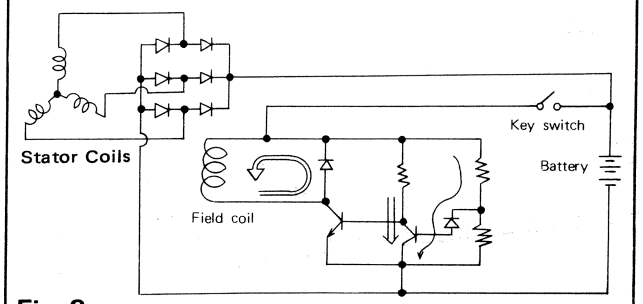
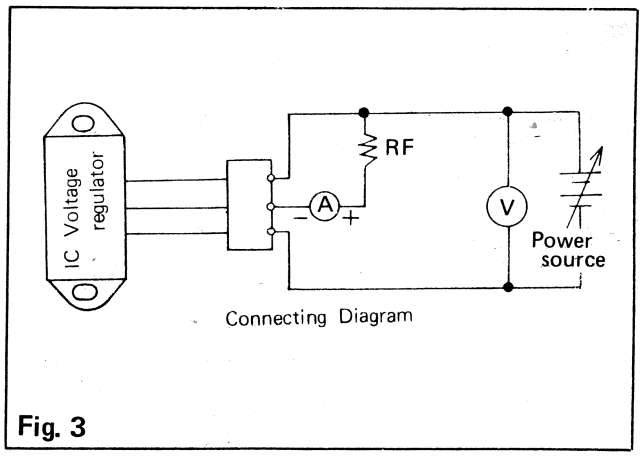


Fig. 2 Operation Circuit of IC Voltage Regulator



Connecting Diagram

Fig. 3

Theory of the IC Voltage Regulator

Figs. 1 and 2 show the function of the IC voltage regulator circuit.

Diagram shows how the circuit functions when the battery voltage is low. In this case, current flows to the base of Tr1 and further to the field coil, thus causing the output voltage of the generator to rise. As the generator voltage rises, the generator begins to charge the battery, and as a result, the battery voltage increases.

As the battery voltage increases, the voltage across the Zener diode reaches the Zener Voltage. As a result, as seen in Fig. 2, current flows through the Zener diode to the base of Tr2, thus making Tr2 conductive. As the collector-emitter voltage of Tr2 (the base-emitter voltage of Tr1) drops, Tr1 becomes nonconducting, and the generator rotor coil current decreases.

When Tr1 changes from the conductive condition to the nonconducting condition, the current flowing to the generator field coil continues to flow through diode D. To sum up, transistor Tr1 repeats the ON–OFF operation 50 to 200 times per second, and thus the IC voltage regulator maintains the constant voltage of the battery.

Inspection

This IC voltage regulator is sealed in a molded resin, and therefore, it is impossible to inspect or replace its inner parts. But it can be checked in the following manner and, if faulty, it should be replaced with a new one.

a. Checking the IC voltage regulator (removed from the generator) using a constant voltage power source.

RF (Resistor)	100 ohms, 5 watts
V (Voltmeter)	30V, rating 0.5
A (Ammeter)	1 amp., rating 0.5
Power source	0-30 volts, variable maximum current 1 amp.

Checking Method

In the circuit shown in Fig. 3, when the power source voltage is slowly increased, the current flowing to resistor RF also increases accordingly. But when the power source voltage is increased further, the current flowing to RF suddenly decreases below 3 mA. This increased voltage is the regulated voltage of the IC voltage regulator.

If no current flows to RF when the power source voltage is below the specified regulated voltage, or if the ammeter reads more than 3 mA when the power source voltage is over that specified, the IC voltage regulator is faulty. It should be replaced with a new one.

Caution

Connect the resistor, voltmeter, ammeter and battery, in that order.

Do not reverse the battery connections.

b. Checking the IC voltage regulator (being connected to the generator) by using a battery alone.
   1) Use a fully-charged battery.
   2) Start the engine, and increase the engine speed to more than 2,000 rpm. Measure the battery voltage after starting the power generation.
      If the voltmeter readings are 14.5 ± 0.3 volts, the IC voltage regulator is in good condition. If within the range of 13.5 to 15 volts, the IC voltage regulator should be checked according to the procedure on page 158. But if the voltmeter readings are below 13.5 volts or over 15.0 volts, the IC voltage regulator should be replaced.

Note

If the test is performed with a battery not fully charged, the voltmeter readings will be about 13 volts. That is, correct measurements are impossible.

Operational Notes

1. Never disconnect the battery wire while the generator is in operation. If this is done, a high voltage is generated between the generator output terminals, thus damaging the semi-conductors.

2. Keep the battery wire connected while measuring the regulated voltage without removing the IC voltage regulator. For this test, use a fully-charged battery. If the battery is disconnected, the regulated voltage will be higher.
   If the battery is not fully charged, the battery voltage will not reach the specified regulated voltage. Therefore, make sure the battery is in a fully charged condition.

3. Do not use a high-voltage insulation resistance tester such as a megger.
   If a high voltage is applied to the regulator's terminal, the regulator will be damaged.

5. TROUBLE SHOOTING

A. No start or difficult to start

1. Ignition System

Possible Causes	Inspection and Repair
1. Carbon-fouled or worn out spark plug.	Clean or replace plug.
2. Gap incorrect or bridged.	Gap to 0.7mm
3. Contact breaker point burned up or worn-out.	Clean or change points.
4. Point gap incorrect.	Set point gap (0.3 - 0.4 mm)
5. Ignition timing out of adjustment.	Set ignition timing.
6. Ignition coil failed.	Use electro-tester to measure primary and secondary winding resistance. Also make a standard coil test.
7. Condenser shorted out.	Use electro-tester to check capacity and insulation.
8. Brown or red ignition wires broken or shorted.	Turn on main switch. Use horn and stoplight. No operation means possible broken wire.
9. Main switch defective.	Check main switch.
10. Blown fuse.	Replace.
11. Battery discharged or defective.	Check specific gravity of each cell with hydrometer.

2. Fuel System

Possible Causes	Inspection and Repair
1. No gass.	Disconnect fuel line at carburetor, turn fuel petcock, on, check for fuel flow.
2. Tank cap vent hole plugged.	
3. Petcock defective.	
4. Fuel line plugged.	
5. Carburetor not level.	
6. Carb equalizer tube has hole or loose connection.	

3 Compression-Cylinder Compression Measure Shows Low Pressure

Possible Causes	Inspection and Repair
1. Lack of valve clearance; valve held open.	Adjust valve.
2. Valve timing incorrect.	Camshaft improperly installed or cam chain loose.
3. Cylinder head gasket broken.	Check for combustion gasses blowing out past gasket.
4. Valve seat defective.	See Valve Seat Repair Section.
5. Piston rings(s) defective.	Too much smoke while riding motorcycle. Especially blue
6. Cylinder tapered or out of round.	smoke indicating oil burning. See individual wear sections
7. Valve guide(s) worn out.	for inspection methods.
8. Guide seals bad.	

B. Poor idle and/or low speed performance

1. Ignition System

Possible Causes	Inspection and Repair
1. Spark plug fouled or incorrect gap.	Clean and gap, or replace if necessary.
2. Contact points bad.	Clean and gap, or replace if necessary.
3. Incorrect ignition timing.	Reset timing.
4. Weak spark.	Check ignition coil and condenser.
5. Partially discharged or defective battery.	Weak horn and lights-check fluid level; recharge;

2. Fuel System

Possible Causes	Inspection and Repair
1. Tank cap vent plugged.	Clean or repair as necessary.
2. Fuel petcock plugged.	
3. Carburetor slow speed system inoperative.	
4. Pilot screw out of adjustment or plugged.	
5. Carburetor float level incorrect.	
6. Starter levers on.	
7. Air leak.	Manifold equalizer tube cracked, or rubber carburetor manifold cracked.
8. Carburetor not level.	
9. Equalizer tube has hole or loose connection.	

3. Compression System

Possible Causes	Inspection and Repair
1. Incorrect valve clearance.	
2. Valve timing (camshaft) incorrect.	
3. Valve seat leakage.	
4. Valve guide worn.	

C. Poor mid-range and high speed performance

1. Ignition System

Possible Causes	Inspection and Repair
1. Spark plug incorrect	Clean and gap to 0.7mm or change plug if necessary.
2. Advance (or spring) defective.	Advance not able to turn, governor weight not pivoting. Check for correct "retard" to full advance" position.
3. Ignition timing off	
4. Points set too close	Re-gap to 0.3 - 0.4 mm.
5. Condenser defective.	Check using electro-tester.
6. Spark plug caps dirty.	Check for carbon tracking.

2. Fuel System

Possible Causes	Inspection and Repair
1. Butterfly valve not opening completely or not in synchronization.	Make corrective adjustment.
2. Dirty air filter element.	Clean with high pressure air.
3. Carburetor float level incorrect.	Measure and change if required.
4. Incorrect main jet size.	Remove jet and check stamped size.
5. Incorrect jet needle clip location.	Check position of clip in needle.
6. Cracked and leaking vacuum diaphragm.	Remove air cleaner and observe vacuum piston operation while running engine.
7. Carburetor not level.	Level carburetors.
8. Choke half on.	Check chokes.

3. Compression System

Possible Causes	Inspection and Repair
1. Weak or broken valve spring.	Make valve spring tests, replace if weak.
2. Valve timing (camshaft) incorrect.	Check cam chain tension.
3. Broken piston rings.	Compression abnormal. Replace.
4. Valve springs upside down.	Install properly.

D. Engine overheating

1. Ignition

Possible Causes	Inspection and Repair
1. Ignition timing too advanced or retarded.	Check timing.
2. Malfunctioning governor.	Check action of governor rod and pivot weights.
3. Too hot spark plug heat range.	Check heat range/electrode insulator color.

2. Fuel System

Possible Causes	Inspection and Repair
1. Too lean air-fuel mixture.	Any jet plugged or too small. Air leak in carburetion intake system.
2. Bad gasoline.	Listen for detonation: check for unusual deposits on spark plug.

3. Oil System

Possible Causes	Inspection and Repair
1. Oil level too low.	Check and refill.
2. Oil too thin.	Improper weight or too contaminated-change oil.
3. Oil pump defective.	Loosen oil delivery line to head and check for oil flow.
4. Oil passage plugged.	Disassemble engine; pour solvent or direct air through oil passages.

4. Too Much Blue Exhaust Smoke

Possible Causes	Inspection and Repair
1. Too much engine oil.	Check oil level and drain some if necessary.
2. Breather plugged up.	Check and clean if necessary.
3. Cylinder and/or piston rings worn.	Make necessary measurements and replace as necessary.
4. Worn or cracked valve guide.	Make necessary measurements and replace as necessary.
5. Cracked valve guide seals.	Make necessary inspection and replace as necessary.

6. CONVERSION TABLES

Millimeters to Inches

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0		0.0039	0.0079	0.0018	0.0157	0.0197	0.0236	0.0276	0.0315	0.0354
1	0.0394	0.0433	0.0472	0.0512	0.0551	0.0591	0.0630	0.0669	0.7099	0.0748
2	0.0787	0.0827	0.0866	0.0906	0.0945	0.0984	0.1024	0.1063	0.1102	0.1142
3	0.1181	0.1200	0.1260	0.1299	0.1339	0.1378	0.1417	0.1457	0.1496	0.1535
4	0.1575	0.1614	0.1654	0.1693	0.1732	0.1772	0.1811	0.1850	0.1890	0.1929
5	0.1969	0.2000	0.2047	0.2087	0.2126	0.2165	0.2205	0.2244	0.2283	0.2323
6	0.2362	0.2402	0.2441	0.2480	0.2520	0.2559	0.2598	0.2638	0.2677	0.2717
7	0.2756	0.2795	0.2835	0.2874	0.2913	0.2953	0.2992	0.3031	0.3071	0.3110
8	0.3150	0.3189	0.3228	0.3268	0.3307	0.3346	0.3386	0.3425	0.3465	0.3504
9	0.3542	0.3583	0.4016	0.3661	0.3701	0.3740	0.3780	0.3819	0.3858	0.3898
10	0.3937	0.3976	0.4016	0.4055	0.4094	0.4134	0.4173	0.4213	0.4252	0.4291

0.01mm=0.004 0.03mm=0.0012 0.05mm=0.0020 0.07mm=0.0028 0.09mm=0.0035
0.02mm=0.008 0.04mm=0.0016 0.06mm=0.0024 0.08mm=0.0031 0.10mm=0.0039

Inches to Millimeters

	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0		0.254	0.508	0.762	1.016	1.270	1.524	1.778	2.032	2.286
0.1	2.540	2.794	3.048	3.302	3.556	3.810	4.064	4.318	4.572	4.826
0.2	5.080	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
0.3	7.620	7.874	8.128	8.382	8.636	8.890	9.144	9.398	9.652	9.906
0.4	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
0.5	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
0.6	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
0.7	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
0.8	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
0.9	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146
1.0	25.400	25.654	25.908	26.162	26.416	26.670	26.924	27.178	27.432	27.686

0.001"=0.0254mm 0.003"=0.0762mm 0.005"=0.1270mm 0.007"=0.1778mm 0.009"=0.2286mm
0.002"=0.0508mm 0.004"=0.1016mm 0.006"=0.1524mm 0.008"=0.2032mm 0.010"=0.2540mm

Metric to Inch System

	KNOWN	MULTIPLIER (Rounded off)	RESULT
TORQUE	m-kg	7.233	ft-lbs
	m-kg	86.80	in-lbs
	cm-kg	0.0723	ft-lbs
	cm-kg	0.8680	in-lbs
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 (U.S. liq.)
	cc (cm^3)	0.06102	cu. in.
	l (liter)	2.1134	pt (U.S. liq.)
	l (liter)	1.057	qt (U.S. liq.)
	l (liter)	0.2642	gal (U.S. 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 (Rounded off)	RESULT
TORQUE	ft-lbs	0.13826	m-kg
	in-lbs	0.01152	m-kg
	ft-lbs	13.831	cm-kg
	in-lbs	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 (U.S. liq.)	29.57	cc (cm^3)
	cu. in.	16.387	cc (cm^3)
	pt (U.S. liq.)	0.4732	l (liter)
	qt (U.S. liq.)	0.9461	l (liter
	gal (U.S. liq.)	3.785	l (liter)
MISC.	lb/in	0.017855	kg/mm
	psi (lb/in^2)	0.07031	kg/cm^2
	Fahrenheit(°F)	5/9(°F -32)	Centigrade(°C)

DEFINITION OF TERMS:

m-kg = Meter-kilograms: Usually torque.
g = Gram(s).
kg = Kilogram(s): 1,000 grams.
km = Kilometer(s).
l = Liter(s).
km/l = Kilometer(s) per liter: Mileage.
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.

7. TORQUE SPECIFICATIONS

Torque specifications call for dry, clean threads. Components such as the cylinder or cylinder head should be at room temperature prior to torquing. A cylinder head or any other item with several fasteners should be torqued down in a cross-hatch pattern is successive stages until torque specifications is reached. The method is similar to installing an automobile wheel and will avoid warping the component.

See following pages.

Standard I.S.O. Pitch Threads

A (NUT)	B (BOLT)	TORQUE SPECIFICATION kg-m	Ft-lbs	In-lbs
10mm	6mm	1.0	7.2	85
13mm	8mm	2.0	15	175
14mm	8mm	2.0	15	175
17mm	10mm	3.5–4.0	25–29	300–350
19mm	12mm	4.0–4.5	29–33	350–400
22mm	14mm	4.5–5.0	33–36	400–440
26mm	17mm	5.8–7.0	42–50	500–600
27mm	18mm	5.8–7.0	42–50	500–600
30mm	20mm	7.0–8.3	50–60	600–700
SPARK PLUG (14mm)		2.7–2.9	19–21	230–250
(12mm)		1.5–2.0	11–15	130–175

Tightening Torque for Engine and Frame Parts

ENGINE SECTION

* : Use LOCK-TITE
: Use MOLYBDENUM Oil

Parts to tightened	Parts name	Q'ty	Tightening torque
Valve clearance adjustment	6-mm lock nut	8	1.2 – 1.5 kg-m
Camshaft cap tightening	6-mm nut	12	0.8 – 1.0 kg-m
"	6-mm stud bolt *	12	0.8 – 1.0 kg-m
Cylinder head tightening	10-mm nut	8	3.0 – 3.4 kg-m 25-26 FT
"	6-mm bolt	11	1.0 – 1.2 kg-m 85 in
"	8-mm bolt	3	2.1 – 2.5 kg-m 20
"	10-mm stud bolt *	8	1.5 – 2.0 kg-m
Connecting rod	8-mm lock nut	4	3.5 – 4.0 kg-m
Crankshaft oil hole	1/8" taper plug	2	3.7 – 4.0 kg-m (caulking)
Oil warning switch	1/8" taper *	1	2.0 – 2.3 kg-m
Oil filter	22-mm oil cleaner ass'y	1	2.0 – 2.3 kg-m
Strainer housing	6-mm pan-head screw	4	0.8 – 1.0 kg-m
Delivery pipe	10-mm banjo bolt	2	2.0 – 2.2 kg-m
Drain plug	30-mm	1	3.5 – 4.0 kg-m
	14-mm	1	3.5 – 4.0 kg-m
Pump cover	6-mm allen screw	3	0.7 – 0.9 kg-m
Strainer cover	6-mm allen screw	11	0.7 – 0.9 kg-m
Kick crank	8-mm bolt	1	1.5 – 2.5 kg-m
A C generator, rotor	10-mm bolt	1	3.0 – 3.5 kg-m
" , stator coil	6-mm allen screw	3	0.7 – 0.9 kg-m
" , field coil	6-mm allen screw	3	0.8 – 1.0 kg-m
Clutch spring	6-mm cross recess hexagon screw	6	0.8 – 1.0 kg-m
Clutch boss tightening	18-mm lock nut	1	7.5 – 8.0 kg-m
Change stopper screw	8-mm stopper screw	1	1.2 – 2.0 kg-m
Change adjusting screw	6-mm adjusting screw	1	0.8 – 1.0 kg-m
Neutral switch	5-mm flat-head screw	3	0.25 – 0.45 kg-m
Change pedal	6-mm bolt	1	0.8 – 1.2 kg-m
Drive sprocket	18-mm lock nut	1	2.5 – 4.5 kg-m
Crankcase tightening	10-mm stud bolt	6	1st. 1.0 2nd. 2.0 Final 3.5 kg-m
"	6-mm bolt	14	1st. 0.5 Final 1.0 kg-m
Primary drive gear	10-mm bolt	1	3.5 – 4.0 kg-m
Spark plug	18-mm Hex.	2	1.5 – 2.0 kg-m
Primary gear	6-mm nut *	1	0.8 – 1.0 kg-m

Section	Parts to tighten	Tightening torque
Frame	Front wheel shaft and nut	7.00 -- 10.00 kg-m
	Front fender and fender stay (F) (R)	0.60 – 0.95 kg-m
	Fender stay (F) (R) and front forks	0.60 – 0.95 kg-m
	Front fender center stay and front forks	0.80 – 1.25 kg-m
	Handle crown and inner tube	0.80 – 1.25 kg-m
	Handle crown and steering shaft (M8)	0.80 – 1.25 kg-m
	Handle crown and steering shaft (M16)	6.00 – 9.00 kg-m
	Handle crown and handle upper holder	1.80 – 2.50 kg-m
	Front flasher and headlight	0.80 – 1.25 kg-m
	Master cylinder and brake hose 1	1.50 – 2.00 kg-m
	Brake hose 1 and brake pipe 3	1.30 – 1.80 kg-m
	Brake pipe 3 and joint	1.30 – 1.80 kg-m
	Brake hose 2 and joint	1.50 – 2.00 kg-m
	Brake hose 2 and brake pipe 1	1.30 – 1.80 kg-m
	Brake pipe 2 and caliper	1.30 – 1.80 kg-m
	Caliper (L) and caliper (R)	7.50 – 9.50 kg-m
	Caliper (L) and caliper bleed screw	0.60 – 0.90 kg-m
	Caliper (R) and front fork outer tube	4.00 – 5.00 kg-m
	Disc to disc bracket	0.80 – 1.00 kg-m
	Disc bracket and hub	1.70 – 2.20 kg-m
	Stop switch and joint	1.50 – 2.00 kg-m
	Engine mounting nut (front upper side)	2.70 – 3.40 kg-m
	" (front lower side)	2.70 – 3.40 kg-m
	" (rear upper side)	2.70 – 3.40 kg-m
	" (rear lower side)	5.00 – 7.00 kg-m
	Engine front bracket and frame	1.40 – 2.20 kg-m
	Engine rear bracket and frame	1.40 – 2.20 kg-m
	Battery box stay to frame	0.60 – 0.45 kg-m
	Pivot shaft and frame	5.00 – 8.00 kg-m
	Rear wheel shaft and rear arm	12.00– 18.00 kg-m
	Rear fender and frame (M6)	0.60 – 0.95 kg-m
	" (M16)	0.80 – 1.25 kg-m
	Tension bar and brake plate	1.40 – 2.20 kg-m
	Tension bar and rear arm	1.40 – 2.20 kg-m
	Muffler and frame	0.8 – 1.25 kg-m
	Muffler stay and frame	1.30 – 2.10 kg-m
	Handle crown and meter bracket	1.80 – 2.50 kg-m
	Meter bracket and meter cover	0.20 – 0.30 kg-m
	Rear arm and rear end arm	0.80 – 1.25 kg-m
	Rear stay and frame	0.60 – 0.95 kg-m
	Rear flasher light and stay	0.80 – 1.25 kg-m
	Axle holder and front forks	0.80 – 1.25 kg-m
	Cleaner box and frame	0.60 – 0.95 kg-m
	Frame and rear cushion	2.30 – 3.70 kg-m
	Rear arm and rear cushion	2.30 – 3.70 kg-m

TX500 - TX500A

PERTINENT PARTS and SERVICE BULLETINS

Note

THE FOLLOWING INFORMATION MUST BE USED AS A GUIDE ONLY TO INDICATE THE DIRECTION TAKEN BY VARIOUS MODIFICATIONS. IT IS INCLUDED ONLY AS AN AID TO SERVICING THE SERIES AND, SHOULD A QUESTION ARISE REGARDING A CERTAIN PART, THE MECHANIC SHOULD REFER TO AN UP-TO-DATE MODEL PARTS BOOK, SERVICE OR PARTS NEWS BULLETIN, OR THE MANUFACTURER.

MOTORCYCLE PARTS NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 11/9/73

NUMBER **400**
PAGE 2 of 2

TX500/500A — PARTS LIST, Additions and Corrections (cont.)

2-35
NOTE: Add one (1) washer under bolts as follows:

No. 7 - 6 places
No. 8 - 4 places
No. 9 - 1 place

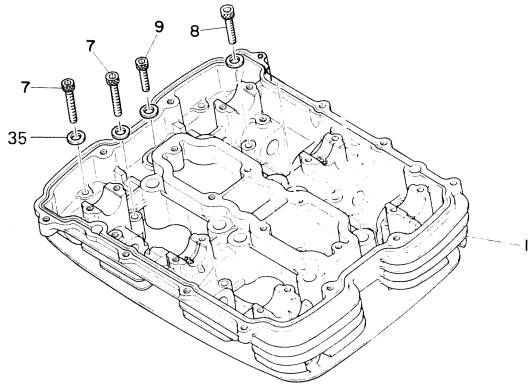


Figure 1 (See Figure 2 - TX500 Parts List)

37-31
37-23
NOTE: New parts are interchangeable as a set only.

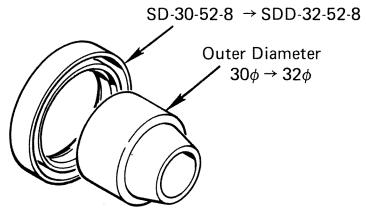


Figure 2 (Rear Wheel Oil Seal & Shaft Collar)

PLEASE UPDATE YOUR PARTS LIST TODAY

† † † † †

MOTORCYCLE PARTS NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 10/15/73

NUMBER **407**
PAGE

TX500/TX500A — PARTS LIST, Valve, Guide, Bushing and Oil Seal Change

The valve guide bushings (intake and exhaust) and the valve stem oil seals have been redesigned to improve their oil retaining capabilities. Valve stem oil seals have been added to exhaust valves. See drawings below.

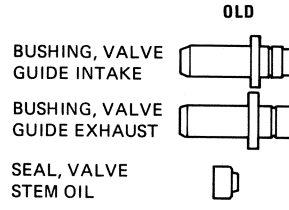


Figure 1

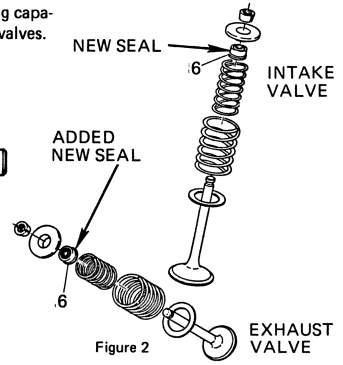


Figure 2

PARTS ORDERING

Page No.	Ref. No.	Old Parts No.	New Parts No.	Parts Name	Qty	Price	Interchangeable
4	2 - 4	371-11133-10	371-11133-11	Bushing, valve guide intake	4		Yes, as a set
4	2 - 5	371-11134-10	371-11134-11	Bushing, valve guide exhaust	4		
8	3 - 6	371-12119-00	371-12119-01	Seal, valve	4→8		

AFFECTED MACHINES

TX500: E/N 011042~
TX500A: E/N 100101~ (All)

SALE OF PARTS

1. Bushings: When old type is out of stock, only the new type will be sold. Both types are available now.
2. Oil Seals: Both old and new types are available now. Old type will continue to be sold.

PLEASE UPDATE YOUR PARTS LISTS

† † † †

MOTORCYCLE PARTS NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 6/7/73

NUMBER 380
PAGE 1 of 2

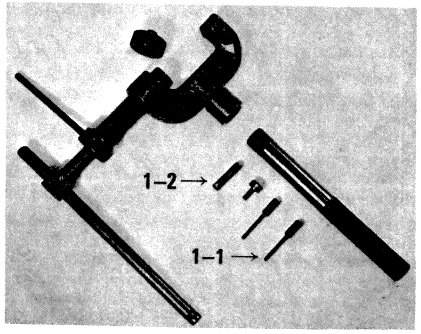
TX500 — SPECIAL TOOLS

Please add the following information to your 1972 Special Tools Catalog.

ITEM	PART NUMBER	DESCRIPTION	QTY.	"N" PRICE	REMARKS
1.	908-90011-12-00	CAM CHAIN CUTTER ASSY.	1		
1-1	908-90011-13-00	. PIN, Cutter	2		Price each
1-2	908-90011-24-00	. PIN, Caulking	1		
2.	908-90011-14-00	VALVE SEAT CUTTER ASSY.	1		
2-1	908-90011-16-00	. CUTTER, Intake, Flat	1		
2-2	908-90011-33-00	. CUTTER, In (10°), Ex (25°)	1		
2-3	908-90011-18-00	. CUTTER, In/Ex, 45°	1		
2-4	908-90011-19-00	. CUTTER, Exhaust, Flat	1		
2-5	908-90011-21-00	. PILOT, Cutter	1		
2-6	908-90030-49-00	. ATTACHMENT, Pilot	1		
3.	908-90011-23-00	WRENCH, Hex, 10mm	1		
4.	908-90011-26-00	DIAL GAUGE STAND ASSY.	1		Includes tip extension
5.	908-90011-27-00	WRENCH, Clutch Adjust	1		
6.	908-90011-29-00	SETTER, Valve Guide	1		
7.	908-90011-22-00	DRIFT PUNCH, Guide Removal	1		5.25mm ϕ
8.	908-90030-48-00	VACUUM GAUGE ASSY., (-76cmHg)	1		Two gauges in set

NOTE: There is no TX500 Special Tool Kit. All tools must be ordered individually or as assemblies.

NOTE: The Cam Chain Cutter Assembly, see illustration, has a tool storage compartment in the handle. The assembly comes with one extra cutter pin, Ref. 1-1.



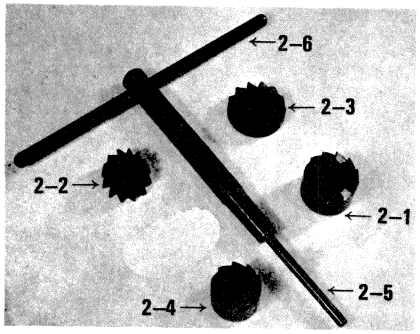
REF. NO. 1

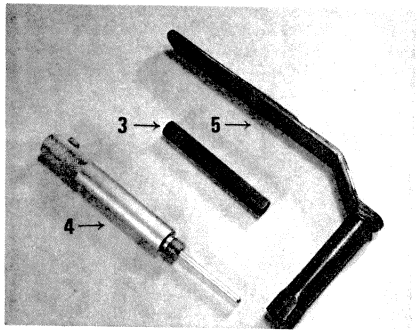
MOTORCYCLE PARTS NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 6/7/73

NUMBER 380
PAGE 2 of 2

TX500 — SPECIAL TOOLS (cont.)





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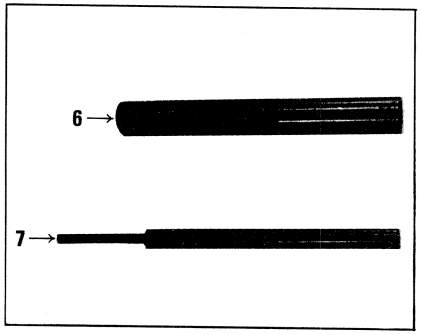

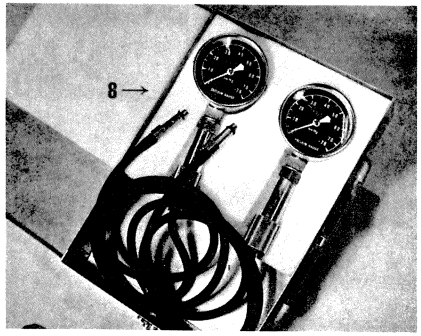

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MOTORCYCLE PARTS NEWS

NUMBER 408

PAGE 1 of 1

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 12/31/73

TX500 — TENSIONER ASSEMBLY, Modification

The camshaft chain tensioner has been redesigned. The mounting bolt diameter has been decreased from 8mm to 7mm. A smaller washer and nut will be required to secure the new tensioner.

PARTS ORDERING

REF. NO.	OLD PART NO.	NEW PART NO.	PART NAME	QTY.	REMARKS
5-17	371-12210-01-00	371-12210-02-00	TENSIONER ASSY.	1	Interchangeable as a set only
5-18	92903-08200-00	90201-07384-00	WASHER	1	
5-19	90176-08011-00	90176-07012-00	NUT, crown	1	

AFFECTED MACHINES

Factory changed to new type (02) tensioner on TX500 E/N 371-006277 ~

SALE OF PARTS

1. Tensioner Assembly: As soon as old type runs out of stock, the new type will be put on sale.
2. Washer and Nut: Both types will be sold.

PLEASE BRING YOUR PARTS LISTS UP-TO-DATE!

† † † †

MOTORCYCLE SERVICE NEWS

NUMBER 299

PAGE 1 of 1

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 9/14/72

ALL 1973's — ENGINE/FRAME NUMBERS

For identification purposes, the factory has released the following list of engine (frame) numbers. On most production models, the engine and frame numbers are identical. Production commenced with the numbers listed.

MODEL	I.B.M. PARTS I.D. NO.	DISPLACEMENT (CUBIC CENT.) ACTUAL	ADVERTISED	ENGINE/FRAME PREFIX & STARTING NUMBER	PREDOMINANT COLOR
		- STREET -			
RD60	388	55	60	388-000101	Butterfly Blue
RD250	361	247	250	352-100101	Butterfly Blue
RD350	360	347	350	351-100101	Brandy Red
TX500	371	498	500	371-000101	Baja Brown
TX650	366	653	650	S650-200101	Metal Flake Blue
TX750	341	743	750	341-000101	Metal Flake Gold
		- ENDURO -			
GT1	393	73	80	393-000101	Competition Yellow
LT3	305	97	100	LT2-035101	Grape
AT3	316	123	125	AT1-200101	Bahia Blue
CT3	314	171	175	CT1-100101	Gold Dust
DT3	311	246	250	DT1F-135101	Competition Green
RT3	308	351	360	RT1-125101	Baja Brown
		- MOTOCROSS -			
GTMX	367	73	80	367-000101	Silver
LTMX	335	97	100	LT2-105101	Silver Dust (Green stripe)
ATMX	318	123	125	AT1-325101	Silver Dust (Orange stripe)
MX250	364	246	250	364-000101	Silver Dust (Yellow stripe)
MX360	365	351	360	365-000101	Silver Dust (Red stripe)
SC500	363	498	500	363-000101	Silver Dust (Black stripe)
		- ROAD RACERS -			
TA125	400	123	125	FRAME: 400-990101 ENGINE: AS3-990101	White tank, Red Front Fender
TA250	329	247	250	FRAME: TD3-990101 ENGINE: DS7-990101	White tank, Red Front Fender
TZ350	383	347	350	FRAME: 383-990101 ENGINE: R5-991001	White tank, Red Front Fender

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 5-29-73

NUMBER 320
PAGE 1 of 1

TX500 — VALVE CLEARANCE, Special Set-up Instructions

PROBLEM

Initial TX500 engines utilized *cast-in* valve seats. The Factory has since changed to *pressed-in* seats. During the change-over, a small percentage of units do not have fully seated valve seats.

During the first 500 miles, these seats will settle by themselves. However, as they do, valve clearance will decrease causing poor performance and/or no idling.

CURE

During initial servicing, set valve clearances on affected machines as follows:

IN – 0.3mm (0.012")
EX – 0.4mm (0.016")
Cold Engine

At 500 miles, check and reset to standard clearance.

IN – 0.15mm (0.006")
EX – 0.20mm (0.008")
Cold Engine

AFFECTED MACHINES

TX500 ENGINE NUMBERS 007287 ~ 008776

NOTE: *Prior* to above engine numbers, valve seats are cast-in.
After above engine number, seats are properly installed.

WARRANTY

There will be *no* Warranty Allowance for this procedure.

† † † †

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 7/3/73

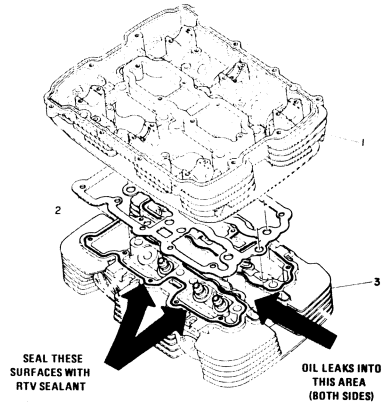
NUMBER 323
PAGE 1 of 1

TX500 — OIL LEAK, Camshaft Case

During servicing, check for oil residue around spark plug area of cylinder head. Leakage may be caused by poor seal between camshaft case and cylinder head. If leakage exists, check carefully to determine exact point where leak occurs.

Remove cylinder head cover, camshaft case and head cover gaskets one and two. Camshaft removal is not necessary. However, cam shain must be disassembled. Clean all mating surfaces thoroughly. Apply RTV silicon sealant in cylinder head seal groove (see illustration). Do not apply excessive amount. Allow for set up time (until "tacky").

Reassemble using new gaskets throughout. Torque camshaft case and cylinder head cover securing bolts thoroughly in a "cross-hatch" pattern.



WARRANTY

FAILURE CODE: 21 JOB CODE: 1400 HOURS: 3.6

One claim per machine.

† † † †

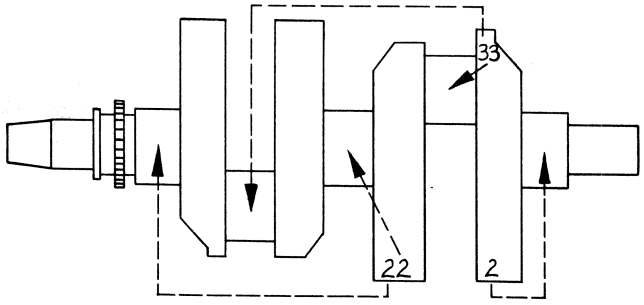
MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 8/13/73

NUMBER 349
PAGE 1 of 1

TX500 — CRANKSHAFT AND ROD JOURNALS, Size Code Location

Main bearing and rod bearing journal sizes are identified by code numbers stamped on the webs. Code number locations, and applicable journals, are shown below.



NOTE:

For additional information regarding size codes, see Motorcycle Service News Bulletin Number 302, pages 3~4.

† † † †

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 10/5/73

NUMBER 378
PAGE 1 of 1

ALL 1974 MODELS — ENGINE/FRAME NUMBERS

For identification purposes, the factory has released the following list of engine (frame) numbers. On most production models, the engine and frame numbers are identical. Production started with the numbers listed.

	MODEL	DISPLACEMENT (CUBIC CENT.) ACTUAL	I.B.M. PARTS I.D. NO.	ENGINE/FRAME PREFIX & STARTING NUMBER	PREDOMINANT COLOR
STREET	RD60A	55	388	388-003101	Ivy Green
	RD200A	195	397	397-010101	Marine Blue
	RD250A	247	361	352-200101	Amber Brown
	RD350A	347	360	351-200101	Ruby Red
	TX500A	498	371	371-100101	Bird Blue
	TX650A	653	447	447-000101	Cinnamon Brown
ENDURO	GT80A	73	393	393-100101	Brilliant Red
	DT100A	97	437	437-000101	Desert Gold
	DT125A	123	444	444-000101	Brandy Red
	DT175A	171	443	443-000101	Yale Blue
	DT250A	246	438	450-000101	Virginia Gold
	DT360A	351	446	446-000101	Geneva Green
MOTOCROSS	GTMXA	73	367	367-100101	Competition Yellow
	MX100A	97	427	427-000101	Competition Yellow
	MX125A	123	402	402-000101	Competition Yellow
	MX175A	171	455	455-000101	Competition Yellow
	MX250A	246	364	364-020101	Competition Yellow
	MX360A	351	365	365-020101	Competition Yellow
	SC500A	498	363	363-020101	Competition Yellow
	YZ80A	73	462	462-000101	Silver Dust
	YZ125A	123	453	453-000101	Silver Dust
	YZ250A	246	431	431-000101	Silver Dust
	YZ360A	351	432	432-000101	Silver Dust
TRIALS	TY80A	73	451	451-000101	Competition Yellow/White
	TY250A	246	434	434-000101	Competition Yellow/Toba Pearl
ROAD RACER	TA125A	125	400	ENGINE: AS3-990101 FRAME: 400-990101	Cinquasia Red/White
	TZ250A	247	430	ENGINE: DS7-991101 FRAME: 430-991101	Cinquasia Red/White
	TZ350A	347	383	ENGINE: R5-991001 FRAME: 383-991001	Cinquasia Red/White
	TZ750A	695	409	409-000101	Cinquasia Red/White

MOTORCYCLE SERVICE NEWS

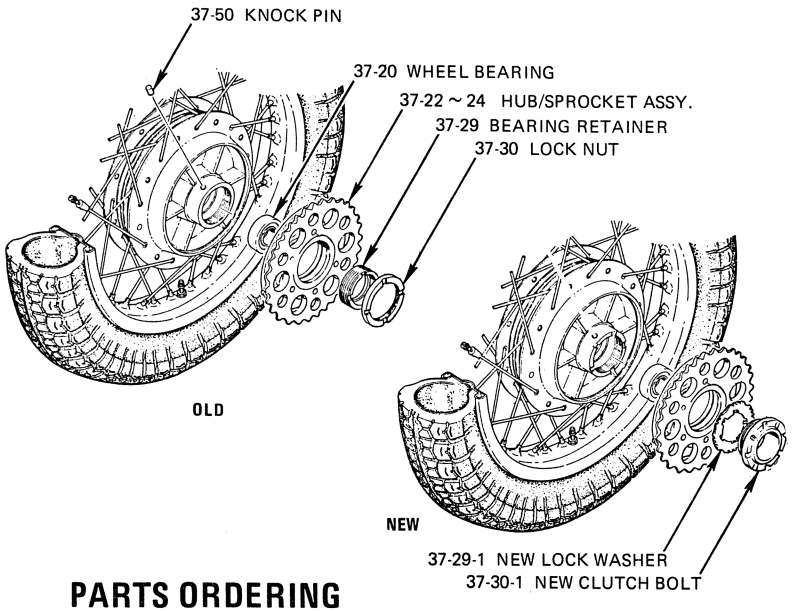
YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 11/13/73

NUMBER 382

PAGE 1 of 3

TX500/500A — REAR WHEEL HUB, Design Change

The left-hand rear wheel bearing on above units is held in place by a threaded bearing retainer. The retainer is secured by a cold-rolled steel knock pin. The pin must be removed prior to retainer removal. Drilling the pin out requires a tungsten-carbide drill bit. This procedure requires wheel disassembly and machine shop facilities. Due to this, the factory is discontinuing the old style (-00) hub in favor of one using a lock washer to secure the retainer. The hubs and associated hardware are not interchangeable. See illustrations below. R & R procedure for both hubs is given on Page 2.



PARTS ORDERING

Reference numbers 37-29 ~ 30 and 37-29-1, 37-30-1 are interchangeable as set only with hub due to change from L.H. to R.H. thread. See PNB No. 400 for additional details.

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 11/13/73

NUMBER 382

PAGE 2 of 3

TX500/500A — REAR WHEEL HUB, Design Change (cont.)

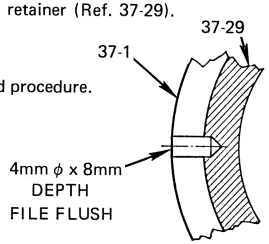
OLD STYLE HUB – DISASSEMBLY PROCEDURE

1. Remove rear wheel assembly.
2. Using drift punch or other suitable tool, remove lock nut (Ref. 37-30).

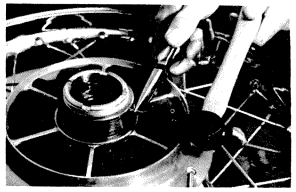
   CAUTION: *Lock nut has left-hand thread.*
3. Remove hub clutch assembly and sprocket, complete (Ref. 37-22 ~ 24).
4. Using a 4mm (No. 50) tungsten carbide drill bit, carefully drill knock pin out.

   NOTE: *Drill to maximum of 8mm (0.315").*
5. Using drift punch or other suitable tool, remove bearing retainer (Ref. 37-29).

   CAUTION: *Bearing retainer has left-hand thread.*



6. Left-hand wheel bearing can now be removed. Use standard procedure.
7. With new bearing properly installed, install bearing retainer. Tighten thoroughly.
8. If old knock pin hole ovalled out during pin removal, drill new hole 90 ~ 180° away. Drill hole 8mm (0.315") deep.
9. Drive in spring pin (P/N 916-09400-18-00) until it bottoms. Cut off excess and file flush with hub surface in order to aid hub clutch assembly.



10. Install hub clutch assembly and lock nut.

    LOCK NUT TORQUE:
    10Kg-m (72 ft-lb/870 in-lb)
11. After lock nut is installed, stake threads.

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 11/13/73

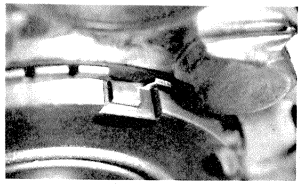
NUMBER 382
PAGE 3 of 3

NEW STYLE HUB – DISASSEMBLY PROCEDURE

1. Remove rear wheel assembly.
2. Bend down lock washer tabs.
3. Using a drift punch or other suitable tool, remove clutch bolt and lock washer.

   NOTE: *Clutch bolt has right-hand thread.*
4. Remove hub clutch assembly and sprocket, complete (Ref. 37-22~24).
5. Using standard procedure, remove left-hand wheel bearing.
6. With new bearing properly installed, install clutch bolt lock washer taking care to see that washer indents are properly aligned with hub indents.
7. Install clutch bolt (right-hand thread) and tighten thoroughly.

   CLUTCH BOLT TORQUE:
   10Kg-m (72 ft-lb/870 in-lb)



8. With clutch bolt installed, bend two or more lock washer tabs into clutch bolt spanner notches.

AFFECTED MACHINES

TX500	(all)	Have old (-00) rear hub.
TX500A	E/N 371-100101 ~ 107394	Have old (-00) rear hub.
TX500A	E/N 371-107395 ~	Have new (-01) rear hub.

WARRANTY

If bearing replacement is required during the Warranty period, use:

PROBLEM CODE: (None) JOB CODE: 6012 HOURS: 0.8
*0.8 "Extra Labor"

*NOTE: Add 0.8 hours "Extra Labor" if old (-00) type hub is being repaired.

† † †

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 10/22/73

NUMBER 386
PAGE 1 of 1

The chart below shows standard settings for above models. Alternate parts for machines requiring personalization are shown in the list following the chart.

CARBURETOR *(MFG) (TYPE) I.D. NUMBER)*	Keihin CV32 37162
MAIN JET	No. 125 (U.S. = No. 120)
NEEDLE JET	3.8φ
JET NEEDLE/CLIP POSITION	302002 (non-adjustable)
CUT AWAY	11°
PILOT JET	No. 50 Slow Jet: No. 50
AIR JET	No. 60 Slow Air Jet: No. 110
STARTER JET	No. 45 Starter Air Jet: 1.0φ
AIR SCREW *(TURNS OUT)*	(Pilot Mixture Screw - 1 ± ¼ turn)
FLOAT LEVEL	22 ± 1mm

ALTERNATE PARTS

PART NUMBER	DESCRIPTION	REMARKS
MAIN JET		
371-14943-29-00	MAIN JET, 110	Leanest, for high altitude
371-14943-30-00	MAIN JET, 115	Lean, for high altitude
371-14943-31-00	MAIN JET, 120	Recommended for sea level use
371-14943-32-00	MAIN JET, 125	STD, Slightly rich for sea level
JET NEEDLE		
371-14916-61-00	JET NEEDLE	STD, (502002) Non-adjustable
371-14916-62-00	JET NEEDLE	LEAN, for mid-range surging problem

NOTE:

Current test reports indicate a No. 120 Main Jet with the lean (371-62) needle as a good starting point for sea level use.

† † † † †

MOTORCYCLE SERVICE NEWS

YAMAHA INTERNATIONAL CORPORATION
BUENA PARK, CALIFORNIA 90620
DATE 12/31/73

NUMBER 396
PAGE 1 of 1

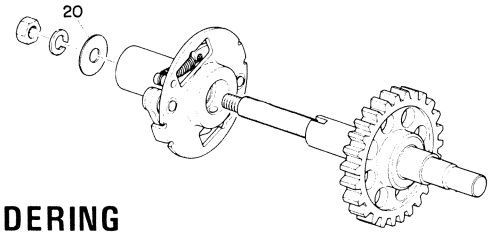
TX500/500A GOVERNOR ASSEMBLY SPECIAL WASHER, Design Change

The special washer (Ref. No. 20, below) may warp, allowing the securing nut to loosen. This can cause the governor assembly or positioning pin to break.

A new heat-treated washer *plate* has been designed to take the place of the special washer. It has more strength and will supply better support for the governor assembly.

WHENEVER A TX500 IS IN FOR TUNE-UP, THE SPECIAL WASHER SHOULD BE REPLACED WITH THE WASHER PLATE.

GOVERNOR SECURING NUT TORQUE: 0.8 ~ 1.2kg-m (70 ~ 105 in-lb)



PARTS ORDERING

REF. NO.	PART NUMBER	DESCRIPTION	REMARKS
8-20	256-21615-00-00	WASHER, Special	Delete
8-20	902-01064-12-00	WASHER, Plate	Add to Parts List

NOTE: The Special Washer is zinc coated and has the appearance of aluminum. The Washer Plate is heat-treated and dark in color.

AFFECTED MACHINES

TX500	371-000101 ~ 013127	Have special washer. Must be replaced.
TX500	371-013128 ~	Have new washer plate.
TX500A	371-100101 ~	All have new washer plate.

WARRANTY

Due to the minimal time involved, there will be no Warranty Allowance.

† † † †

TECHNICAL BULLETIN

TX500

M4-002

CRANKCASE COVER, Modification

The crankcase cover has been redesigned to provide threaded screw holes for better securing of the generator cover. The generator cover has also been redesigned to provide two holes for mounting with 4mm screws.

PARTS ORDERING

REF. NO.	OLD PART NO.	NEW PART NO.	DESCRIPTION	QTY.	REMARKS
19-1	371-15411-00-00	371-15411-01-00	COVER, crankcase left 1	1	Change as a set
19-8	371-15415-00-00	371-15415-01-00	COVER, generator	1	Change as a set
19-17	----------	98603-04008-00	SCREW, panhead	2	Added

AFFECTED MACHINES

Factory changed to new (01) type covers on late production TX500. Engine numbers not available at this time.

SALE OF PARTS

1. Crankcase Cover: Both old and new types will be sold.
2. Generator Cover: Both old and new types will be sold.

PLEASE BRING YOUR PARTS LIST UP-TO-DATE!

† † † †

TECHNICAL BULLETIN

ALL MODELS M4-008

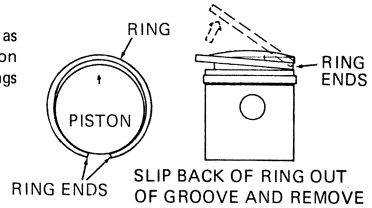
PISTON RING HANDLING

M4-008

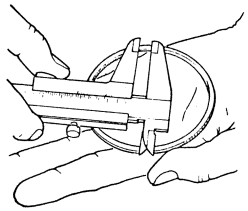
Recent changes in piston ring material require considerable care in handling and troubleshooting. Use following procedure.

NOTE: See appropriate Service Manual for four-stroke oil ring handling and troubleshooting procedures.

1. Using your thumb nails, spread ring ends only as far as necessary for back of ring to clear piston crown. If ring ends are opened excessively, rings will be deformed.

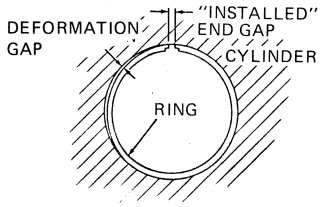


2. Using vernier calipers, measure ring end gap in "free" position. Replace as required.



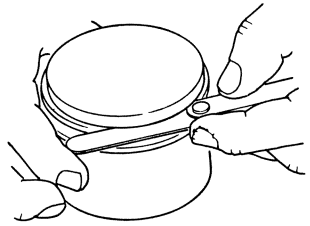
3. Using piston crown to keep ring at right angle to cylinder bore, insert ring into cylinder. Measure end gap in "installed" position. Replace as required.

4. With ring still in position in cylinder, hold cylinder towards light. Check for full seating of ring against cylinder wall. If ring not fully seated, check cylinder for out-of-round. Repair cylinder and/or replace ring as required.



5. Service piston, ring expanders (if fitted), ring grooves, and wrist pin hole as required per established procedure for carbon removal, etc.

6. Install piston rings, reversing Step 1. Again take care that ring ends are not spread too far. Such action will cause ring deformation.



6. With rings installed, check ring groove clearance. Replace piston and/or rings as required.

NOTE: The primary concern in handling rings is to make sure the rings are not deformed during removal or installation. "Free" end gap measurement (Step 2) and checking for full seating (Step 4) are the best methods to check for possible ring deformation. Any deformed ring (out-of round) should be immediately replaced.

† † † †

 1/25/74

TECHNICAL BULLETIN

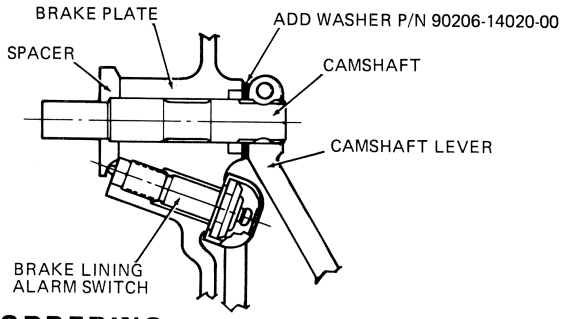
TX500A/TX650A/TX750

M4-005

REAR BRAKE CAMSHAFT, Addition of washer

Excessive lateral movement of rear brake camshaft may cause premature operation of the brake lining alarm switch and indicator lamp.

To prevent this a wave washer should be added between the brake shoe plate and the camshaft lever. See drawing below.



PARTS ORDERING

Please make the following addition to your TX500/TX500A, TX650A, and TX750 Parts Lists.

TX500/500A

PAGE	REF. NO.	NEW PART NO.	DESCRIPTION	QTY.	REMARKS
120	37-50	90206-14020-00	WASHER, wave	1	Addition (TX500A only)

TX650A

106	35-46	90206-14020-00	WASHER, wave	1	Addition

TX750

124	38-44	90206-14020-00	WASHER, wave	1	Addition

AFFECTED MACHINES

TX500A: F/N ~ 371-117805 – machines need washer.
F/N 371-116706 – washer installed by factory.

TX650A: All machines have washer installed by factory.

TX750: All machines need washer.

† † † †

 1/14/74

TECHNICAL BULLETIN

TX500/500A

M4-014

RETORQUE CYLINDER HEAD

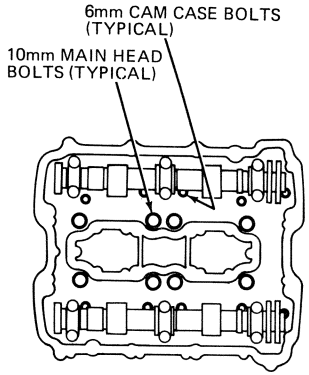
During 250 mile service check on TX500 and TX500A units, while head cover is removed for valve setting, we recommend retorquing the cylinder head bolts and ten (10) cam case bolts. If this is done on all units, the head will remain sealed and oil seepage will be greatly reduced.

PROCEDURE

CAUTION: *If all bolts are not torqued in proper sequence, cam case bolts will become loose.*

1. Torque the eight (8) main head bolts in a crisscross pattern.

HEAD BOLT TORQUE (10mm):	4.0 kg-m 30 ft-lbs. 360 in-lbs.



2. Torque the single 8mm head bolt (not shown in drawing) on the righthand side of engine.

HEAD BOLT TORQUE (8mm):	2.3 kg-m 17.5 ft-lbs. 210 in-lbs.

3. Torque the ten (10) 6mm cam case screws in a crisscross pattern.

CAM CASE BOLT TORQUE (6mm):	1.2 kg-m 9.0 ft-lbs. 110 in-lbs.

WARRANTY

There will be no warranty coverage for this procedure.

NOTE: *Check Service News Bulletin No. 323 for additional information on TX500 top end oil leakage.*

† † † †

 2/5/74

TECHNICAL BULLETIN

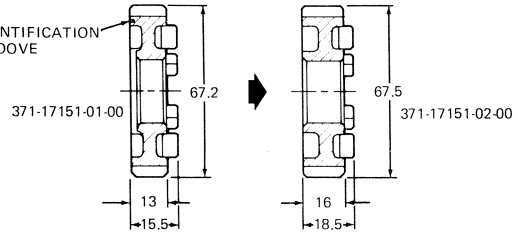
MOTORCYCLE
M4-019

TX500/500A
TRANSMISSION GEARS DESIGN CHANGES

Some of the transmission gears have been redesigned to provide additional strength.

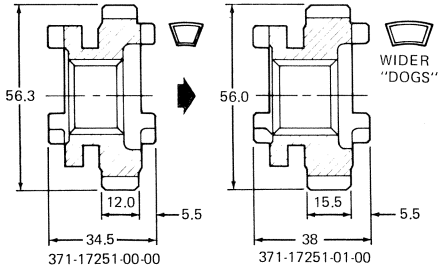
FIFTH PINION GEAR:

1. Overall width is 3mm wider.
2. Teeth are 3mm wider.
3. Diameter is 0.3mm greater.



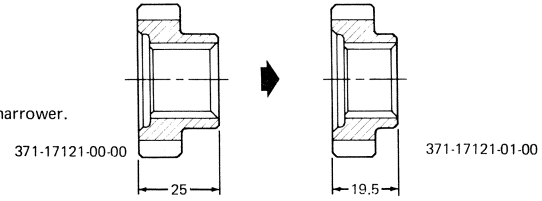
FIFTH WHEEL GEAR:

1. Overall width is 3.5mm wider.
2. Teeth are 3.5mm wider.
3. Diameter is 0.3mm smaller.
4. Engagement "dogs" are wider.



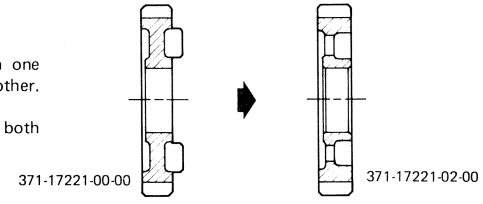
SECOND PINION GEAR:

1. Overall width is 5.5mm narrower.



SECOND WHEEL GEAR:

1. Old type (-00) had slots on one side and "dogs" on the other.
2. New type (-02) has slots on both sides.



 4/8/74

M4-019

PARTS ORDERING

REF. NO.	OLD PART NO.	NEW PART NO.	DESCRIPTION	PRICE	REMARKS
14-7	371-17151-01-00	----------	GEAR, 5th pinion		E/N: ~100197
	----------	371-17151-02-00			E/N: 100198 ~ *
14-8	371-17121-00-00	----------	GEAR, 2nd pinion		E/N: ~100197
	----------	371-17121-01-00			E/N: 100198 ~ *
14-16	371-17221-00-00	----------	GEAR, 2nd wheel		E/N: ~100197
	----------	371-17221-02-00			E/N: 100198 ~ *
14-19	371-17251-00-00	----------	GEAR, 5th wheel		E/N: ~100197
	----------	371-17251-01-00			E/N: 100198 ~ *

* New type gears must be installed as a set.

AFFECTED MACHINES

TX500A: E/N 100198 ~ have new type gears.
E/N 100101 ~ 100197 have old type gears. New type may be installed as a set (4 gears) only.

TX500: All machines have old type gears. New type may be installed as a set (4 gears) only.

SALE OF PARTS

Both old and new type gears are now stocked. Old type will continue to be stocked.

PLEASE BRING YOUR PARTS LIST UP-TO-DATE!

† † † †

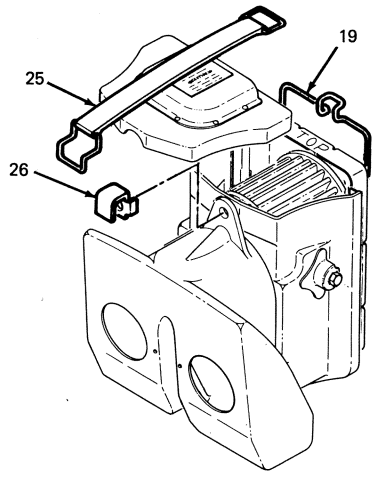
TX500A

M4-018

AIR CLEANER, MODIFICATION

TECHNICAL BULLETIN

Air cleaner case caps on early TX500A machines are a push-on fit and may come off because of vibration, etc. The factory has redesigned the case cap and added a rubber strap (HOLDER) and stay to secure the case cap. See drawing.



AFFECTED MACHINES

TX500A: E/N 371-106154 ~ Have new type case cap.

PARTS ORDERING

REF. NO.	OLD PART NO.	NEW PART NO.	DESCRIPTION	PRICE
21-19	371-14422-01-00	371-14422-02-00	CAP, case 2	
21-25	----------	371-14459-00-00	HOLDER	
21-26	----------	371-14498-00-00	STAY	

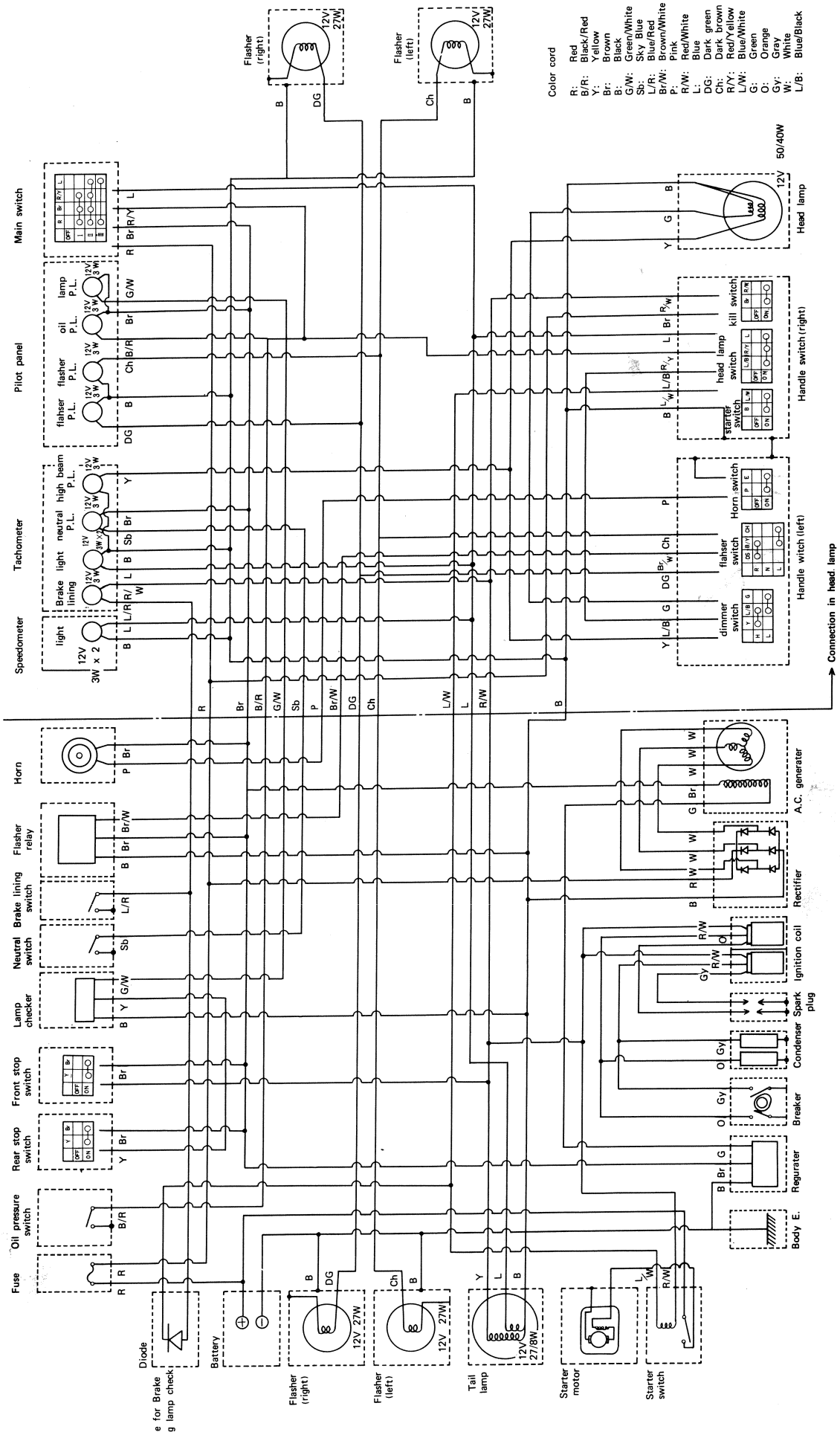
NOTE: *Only the new type case cap is available.*

PLEASE BRING YOUR PARTS LISTS UP-TO-DATE!

† † † †

 3/25/74

9. Wiring diagram (U.S.A.)



YAMAHA

CONSUMER INFORMATION

1974 MODEL TX500A
1973 MODEL TX500

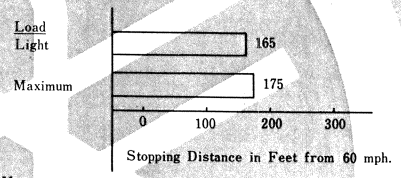
NOTICE

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.

A. Fully Operational Service Brake

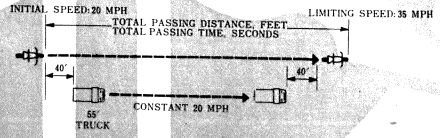


Stopping Distance in Feet from 60 mph.

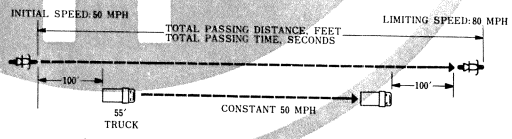
ACCELERATION AND PASSING ABILITY

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. The high-speed pass assumes an initial speed of 50 mph and a limiting speed of 80 mph.

LOW SPEED PASS



HIGH SPEED PASS



SUMMARY

Low-speed pass..... 340 feet; 6.7 seconds.
High-speed pass..... 910 feet; 8.5 seconds.

YAMAHA MOTOR CO.,LTD. LIT-11653-71-00
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YAMAHA

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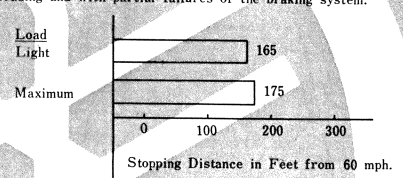
STOPPING DISTANCE

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.

A. Fully Operational Service Brake

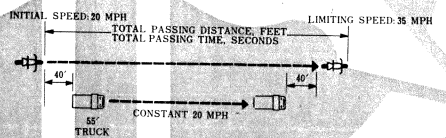


Stopping Distance in Feet from 60 mph.

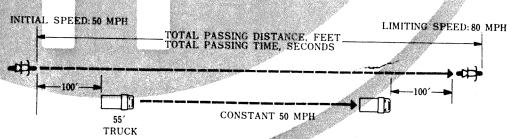
ACCELERATION AND PASSING ABILITY

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. The high-speed pass assumes an initial speed of 50 mph and a limiting speed of 80 mph.

LOW SPEED PASS



HIGH SPEED PASS



SUMMARY

Low-speed pass..... 340 feet; 6.7 seconds.
High-speed pass..... 910 feet; 8.5 seconds.

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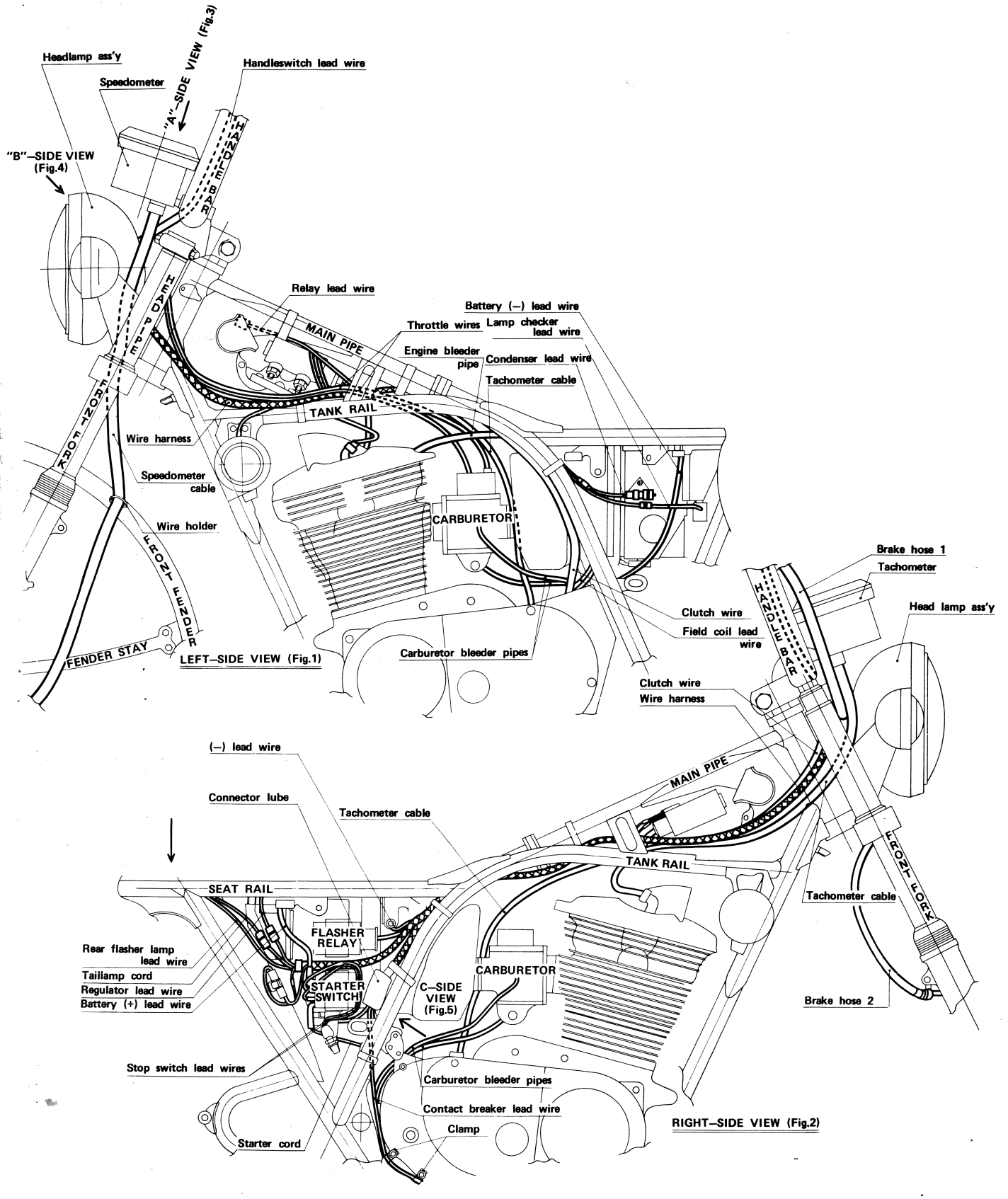
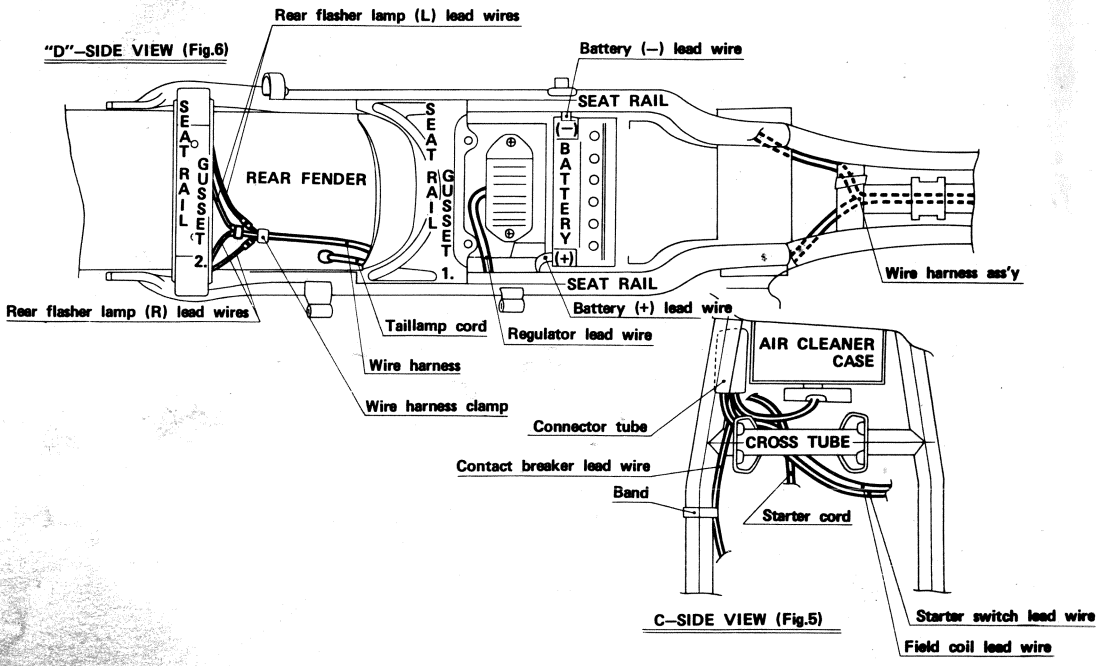
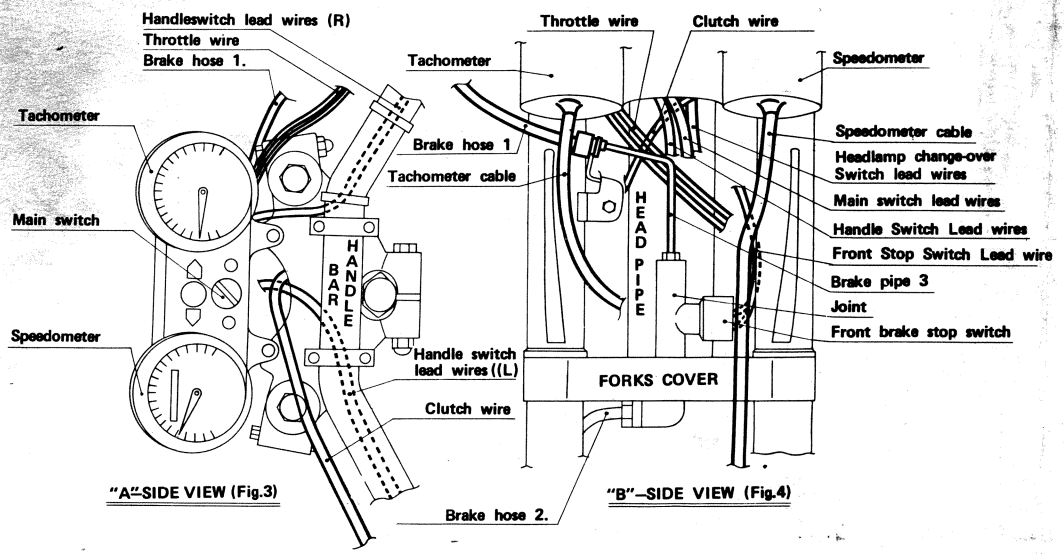
11. CABLE ROUTING DIAGRAMS




"D"–SIDE VIEW (Fig.6)
Rear flasher lamp (L) lead wires
Battery (–) lead wire
SEAT RAIL
SEAT RAIL GUSSET 2.
REAR FENDER
SEAT RAIL GUSSET 1.
BATTERY
(–)
(+)
SEAT RAIL
Wire harness ass'y
Rear flasher lamp (R) lead wires
Taillamp cord
Regulator lead wire
Battery (+) lead wire
Wire harness
Wire harness clamp
AIR CLEANER CASE
Connector tube
CROSS TUBE
Contact breaker lead wire
Band
Starter cord
C–SIDE VIEW (Fig.5)
Starter switch lead wire
Field coil lead wire


Handleswitch lead wires (R)
Throttle wire
Brake hose 1.
Tachometer
Tachometer
Main switch
Speedometer
BAR HANDLE
Brake hose 1
Tachometer cable
Handle switch lead wires ((L)
Clutch wire
Brake hose 2.
"A"–SIDE VIEW (Fig.3)
Throttle wire
Clutch wire
Tachometer
Speedometer
HEAD PIPE
Speedometer cable
Headlamp change-over Switch lead wires
Main switch lead wires
Handle Switch Lead wires
Front Stop Switch Lead wire
Brake pipe 3
Joint
Front brake stop switch
FORKS COVER
"B"–SIDE VIEW (Fig.4)