Maintenance

AIR CLEANER

A properly cared for air cleaner ensures that only clean, filtered air is supplied through the carburetor into the engine. If the air is supplied directly without filtering, not only will dirt and dust from the air plug up carburetor passages causing the engine to run poorly, but also the dust that enters the engine will act like grinding compound wearing down the cylinder, piston, and rings. If the air cleaner element is damaged or too coarse, the result will be the same as though no element were used.

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

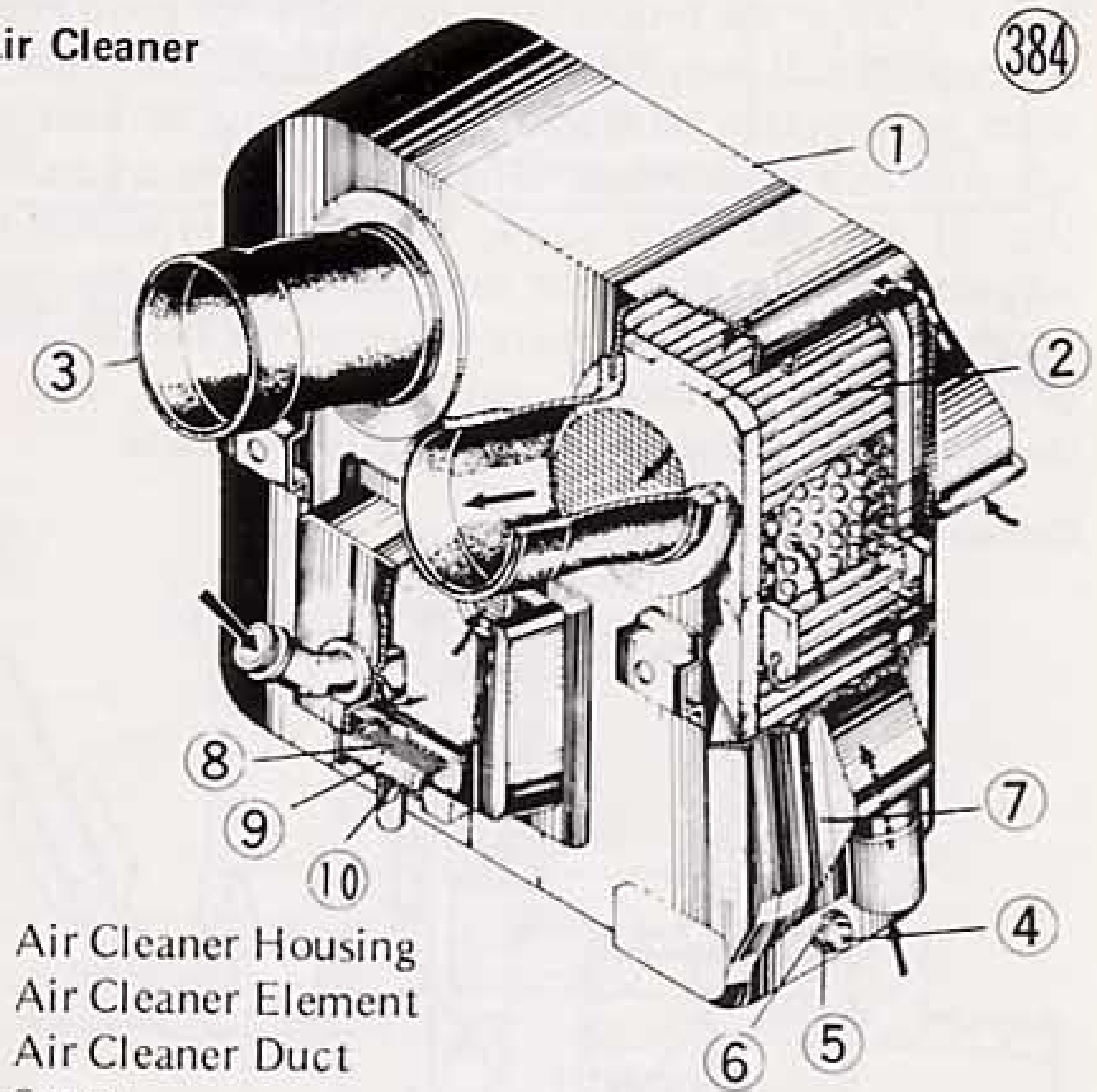
Cleaning and replacement

The air cleaner element must be cleaned periodically (Pg. 180).

Remove the air cleaner element (Pg. 27), clean it by swishing it around in a bath of a high flash point solvent of some kind, and then dry it from the inside using compressed air. Since this is a dry-type element, do not use kerosene or any fluid which would leave the element oily.

NOTE: Because of the danger of highly flammable liquids, do not use gasoline or low flash point solvents to clean the element.

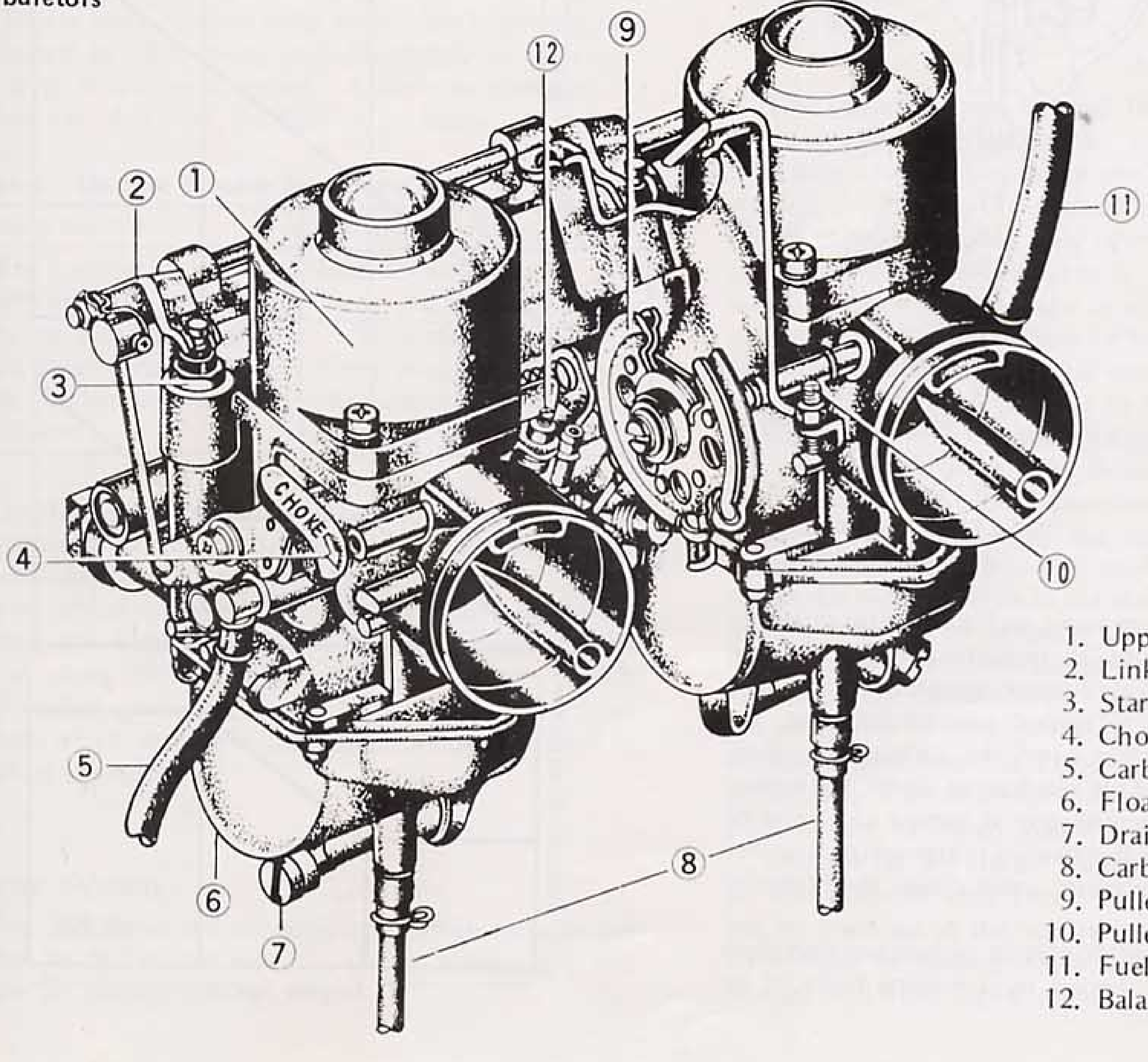
Air Cleaner



1. Air Cleaner Housing
2. Air Cleaner Element
3. Air Cleaner Duct
4. Screw
5. Lock Washer
6. Washer
7. Side Cover
8. Screen
9. Foam Rubber
10. Screen

Since repeated cleaning coarsens the element, replace it with a new one every 10,000 km or after it has been cleaned 5 times, whichever is sooner. Also, if there is a break in the element material or any other damage to the element, replace the element with a new one.

Carburetors

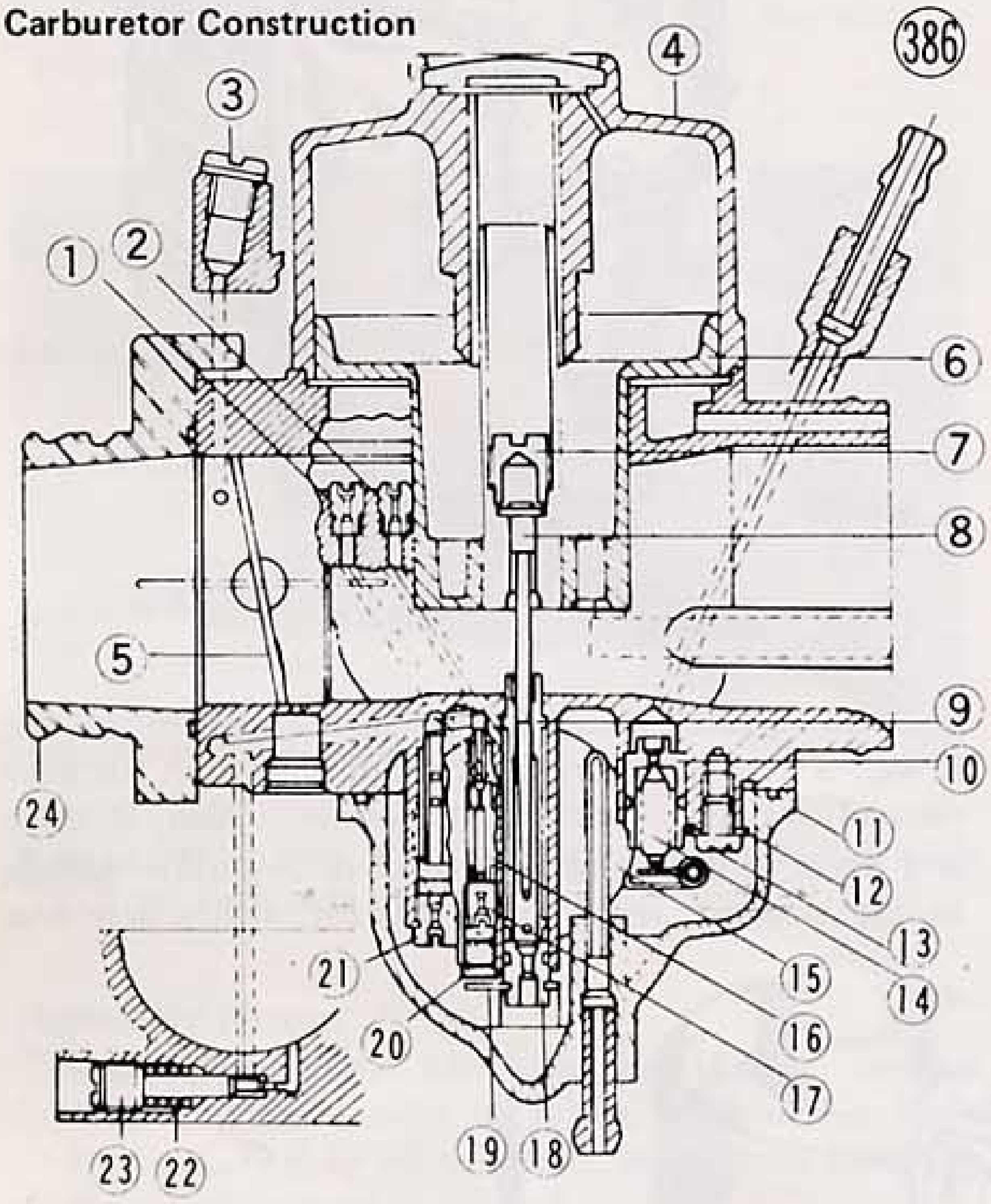


1. Upper Chamber
2. Linkage Mechanism
3. Starter Plunger Unit
4. Choke Lever
5. Carburetor Tube
6. Float Chamber
7. Drain Plug
8. Carburetor Tube
9. Pulley
10. Pulley Stop Screw
11. Fuel Hose
12. Balance Adjusting Screw

CARBURETORS

The carburetors perform the function of mixing the fuel and air in the proportions necessary for good engine performance at varying speeds and loads. In order for them to function satisfactorily, they must be kept well adjusted and maintained. The throttle cable adjustment (Pg. 9) and the pilot screw, idling, and synchronizing adjustments (Pg. 10) are covered in the Adjustment Section. The discussion here concerns the fundamentals of carburetor operation, special adjustments, and the checking and replacement of carburetor parts.

Carburetor Construction



1. Slow Air Jet
2. Main Air Jet
3. Vacuum Plug
4. Carburetor Cap
5. Batterfly Valve
6. Vacuum Piston
7. Screw
8. Jet Needle
9. Needle Jet
10. Float Valve Seat
11. Float Bowl
12. Retainer
13. Screw
14. Float Valve Needle
15. Float
16. Slow Jet
17. Pilot Jet
18. Main Jet
19. Jet Keeper
20. Pilot Passage Plug
21. Starter Jet
22. Spring
23. Pilot Screw
24. Mounting Plate

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

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

Another important principle is the Venturi Principle, which states that when an air passage narrows, moving air flows faster, exerting even less pressure. For example, at low speeds (0 ~ ¼ throttle) the vacuum piston is at its lowest position, forming what is called the "primary venturi". Since the engine intake requires less air at lower engine speeds, there would not be enough air flow speed for sufficient fuel to be forced up through the jets unless the passage (carburetor bore) above the jets is constricted. The low position of the vacuum piston constricts this passage so that there will be sufficient air flow speed for pressure difference to force the necessary amount of fuel up through the jets.

Thus, the amount of fuel passing through a jet depends both on the size of the jet (variable in case of the needle jet) and on the speed of the air flow over the jet. The speed of this air flow is in turn determined both by the

Venturi Principle

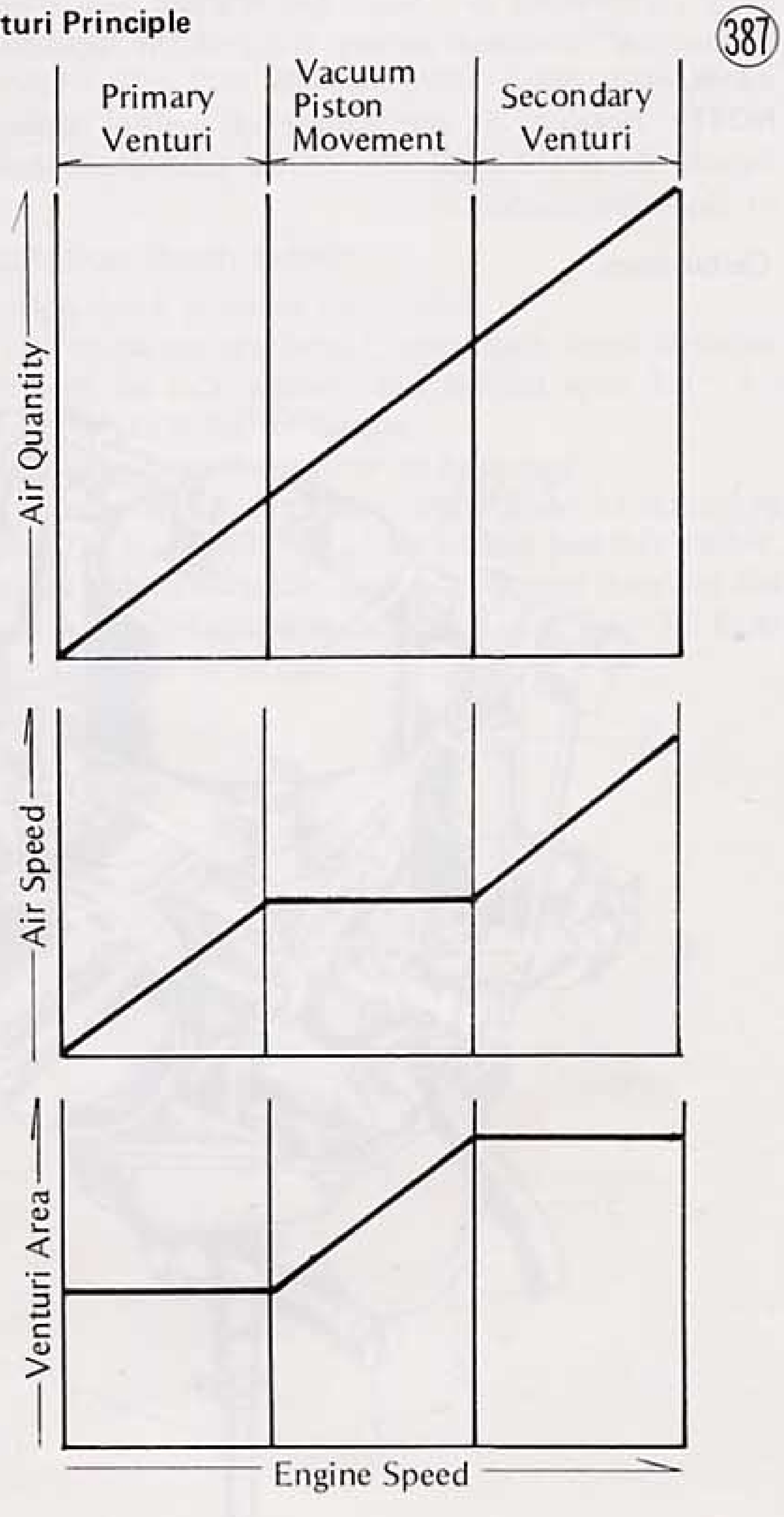


Table 3 Carburetor Specifications

Type	Main Jet	Main Air Jet	Slow Air Jet	Pilot Jet	Butterfly Valve Angle	Pilot Screw	Fuel Level
CVB36	130 (US model) 110 (European model)	40	90	35	10°30'	1⅝ ± ¼ turns out	33.5 mm

engine rpm and by the dimensions of the passage (variable by the vacuum piston) just above the jet. The size of the jet openings, the various dimensions of the air passages, and the engine rpm's are correlated through carburetor design so that, when properly adjusted, the carburetor meters (measures) the fuel and air in the correct proportions at different throttle openings.

The carburetor specifications (Table 3) have been chosen for best all around performance, and ordinarily will not require any change. However, sometimes an alteration may be desirable for improved performance under special conditions, and when proper mixture is not obtained after the carburetor has been properly adjusted and all parts cleaned and found to be functioning properly. For example, the quantity of air entering the carburetor bore is less at high altitude due to the lower atmospheric pressure. To obtain the proper carburetor fuel/air mixture, it may be necessary to exchange the main jet on each carburetor for one a size smaller. In particularly cold weather, the increased density of the air may necessitate a size larger main jet for each carburetor.

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

Table 4 Mixture Trouble Symptoms

Mixture too rich	Mixture too lean
Engine is sluggish	Engine overheats
Smoky exhaust	Runs better with choke lever pushed down
Runs less well when warm	Spark plug burned white
Spark plug fouled black	Running is unstable
Runs better without air cleaner	No power

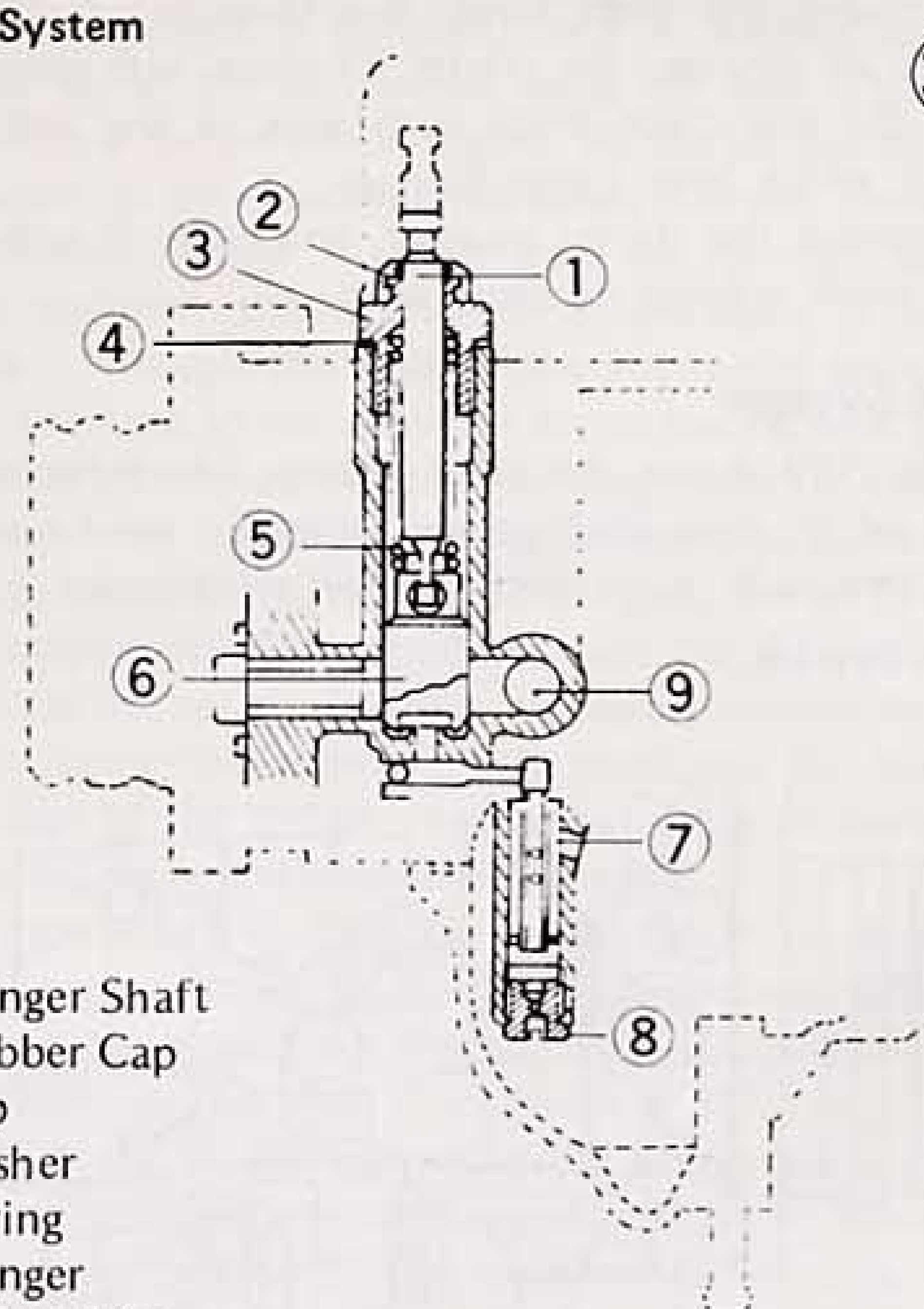
The following explanation of the functioning and maintenance of the carburetors covers the four main systems for fuel regulation and supply: the starter system, which supplies the necessary rich mixture for starting the engine; the pilot system, which supplies fuel at idling and low speeds; the main system, which supplies fuel at medium and high speeds; and the float system, which maintains the fuel at a constant level in the float chambers.

Starter System

Fig. 388 shows the starter system, which includes the starter jet ⑧, starter pipe ⑦, starter plunger ⑥ , and starter air passage ⑨.

Starter System

388



1. Plunger Shaft
2. Rubber Cap
3. Cap
4. Washer
5. Spring
6. Plunger
7. Starter Pipe
8. Starter Jet
9. Air Passage

The starter system is used for starting to provide the exceptionally rich fuel/air ratio that is necessary to enable easy starting when the engine is cold. When starting the engine, the throttle is left closed, and the starter plunger is pulled fully open by pushing down the choke lever. Since the butterfly valve is closed, a high intake vacuum (low pressure or suction) is developed at the engine side of the carburetor bore. The starter plunger, when raised, opens up the starter passage and an air passage so that they connect to the engine side of the carburetor bore. The intake vacuum from the engine as it is cranked over draws in air through this air passage and the fuel from the float chamber through the starter passage. Fuel metered by the starter jet mixes with a small amount of air drawn in through air bleed holes in the starter pipe as it rises in the starter fuel passage. This small amount of air prepares the fuel for better atomization once it reaches the plunger chamber (the area just below the raised plunger) where the fuel mixes with the air drawn in through the air passage. This mixture is then drawn into the carburetor bore where it, together with a small amount of mixture supplied by the pilot system, is drawn into the engine.

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

Cleaning

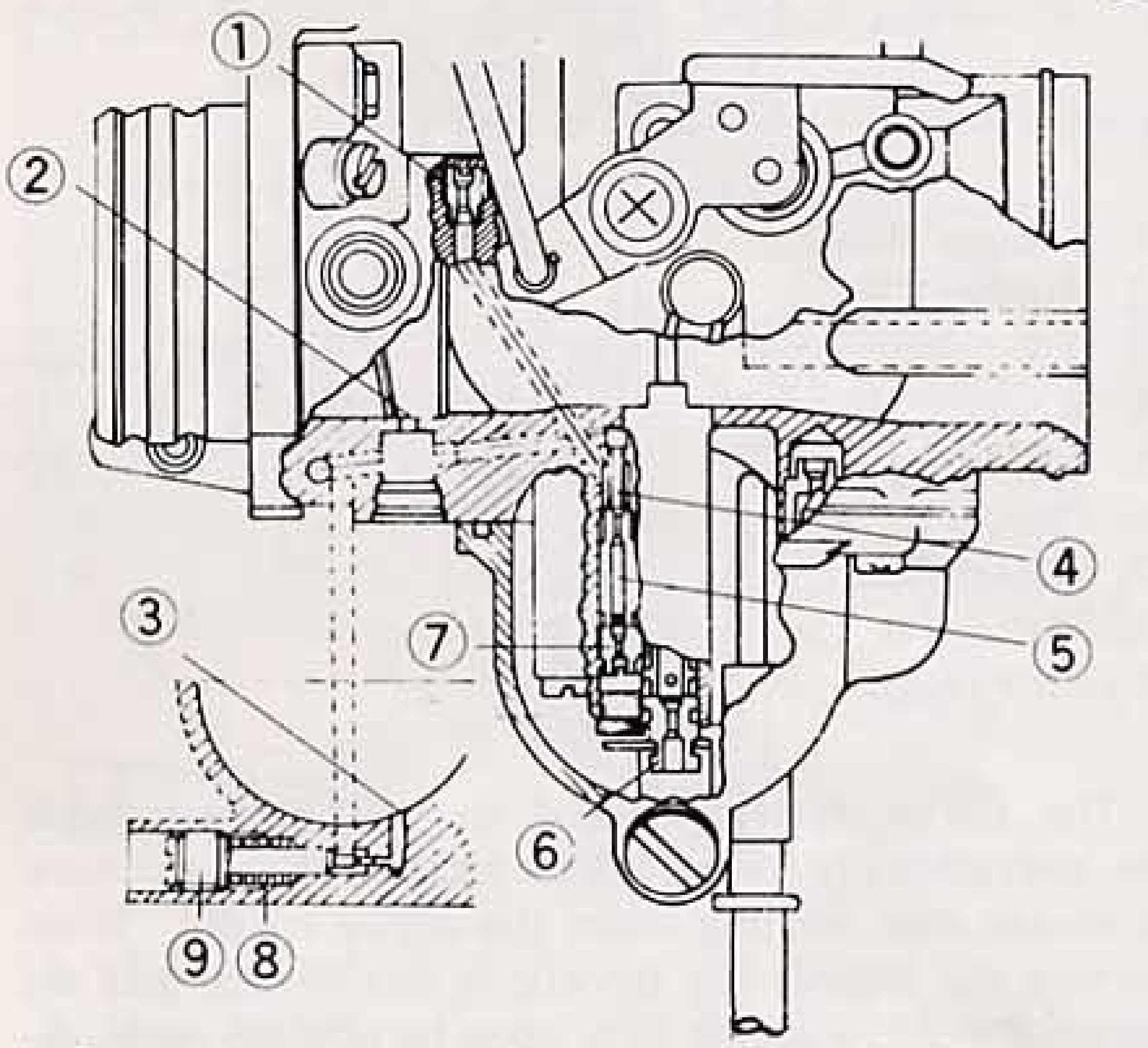
Remove the float bowl, and blow the starter pipe, starter air passage, the starter jet clean with compressed air. Do not clean them with wire or any other hard object which may cause damage.

Remove the starter plunger, and clean it with a high flash point solvent of some kind.

Pilot System

Fig. 389 shows the pilot system, which includes the pilot jet ⑦, slow jet ⑤, slow air jet ①, pilot passage ④, pilot bypass ②, pilot screw ⑨, and pilot outlet ③.

Pilot System (389)



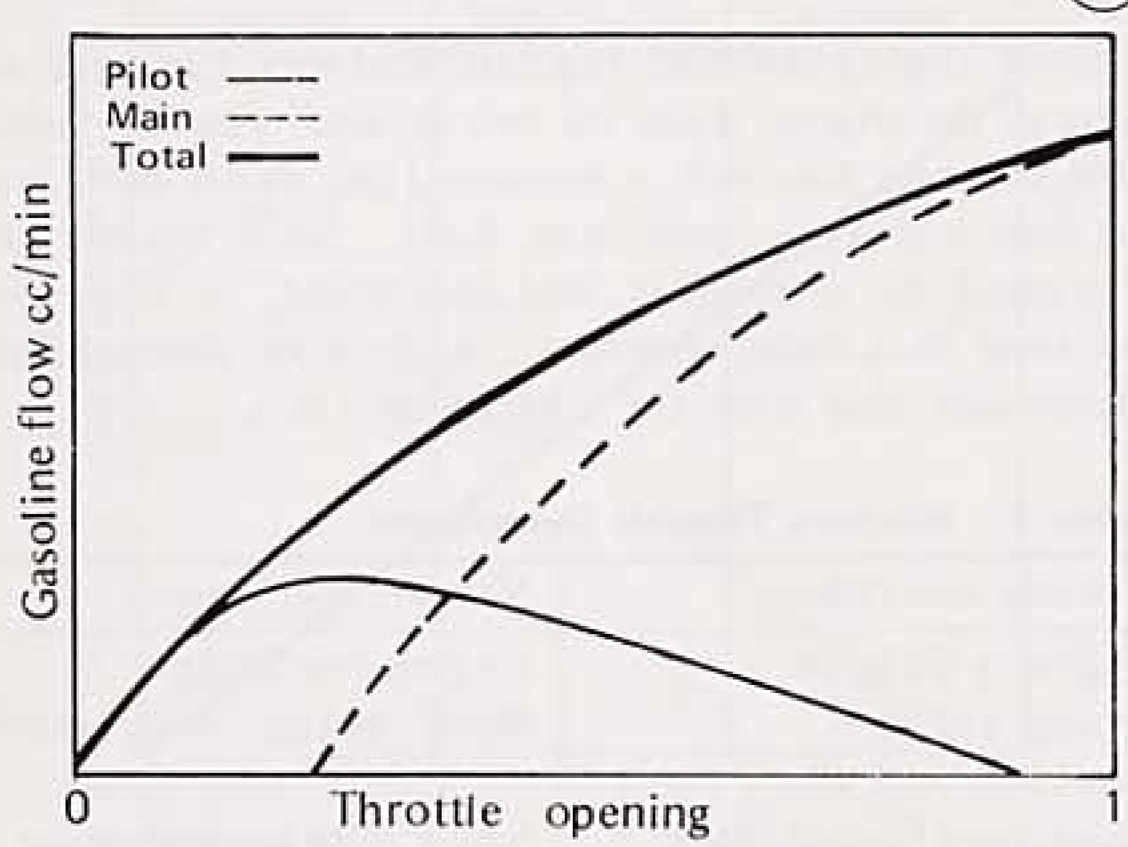
1. Slow Air Jet	4. Pilot Passage	7. Pilot Jet
2. Pilot Bypass	5. Slow Jet	8. Spring
3. Pilot Outlet	6. Main Jet	9. Pilot Screw

The pilot system determines the operation of the carburetor from 0 to ¼ throttle opening. At small throttle openings, almost no fuel is drawn through the main system due to insufficient air flow. Instead, the fuel is drawn through the main, pilot, and slow jets as a result of the low pressure (suction) brought about by the demand for air by the engine and the limited but relatively fast flow of air past the pilot outlet. The almost closed position of the butterfly valve restricts the carburetor bore air flow, preventing it from relieving the low pressure created by the engine around the pilot outlet while the Venturi effect (the narrower the air passage, the faster the flow of air) at the engine side of the butterfly valve further reduces the low pressure.

The supply of the fuel and air in the pilot system is shown in Fig. 391. At idling and slightly above, the fuel passes through the main jet, and is then metered at the pilot jet and at the slow jet, where the fuel mixes with air metered by the slow air jet. Then, the fuel passes through the pilot passage, where the pilot screw affects the flow, through the pilot outlet into the carburetor bore, and to the engine. As the butterfly valve turns a little more, the butterfly valve position extends the low pressure area to the pilot bypass, allowing fuel to bypass part of the pilot passage to go directly to the carburetor bore such that the supply of fuel increases sufficiently with engine need.

Fig. 390 shows throttle opening versus fuel flow for the main and pilot systems. If trouble occurs in the pilot system, not only are starting and low speed running affected, but the transition from pilot to main system is not smooth as the throttle is opened, causing a drop in engine efficiency. Pilot system trouble might be due to maladjustment; a dirty or loose pilot jet, slow jet, or slow air jet; or clogging of the main jet, pilot passage, pilot outlet, or pilot bypass.

Flow Characteristic (390)

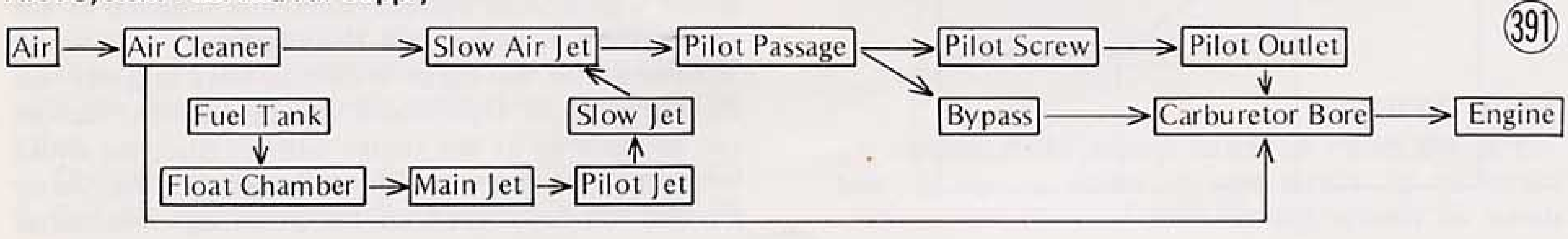


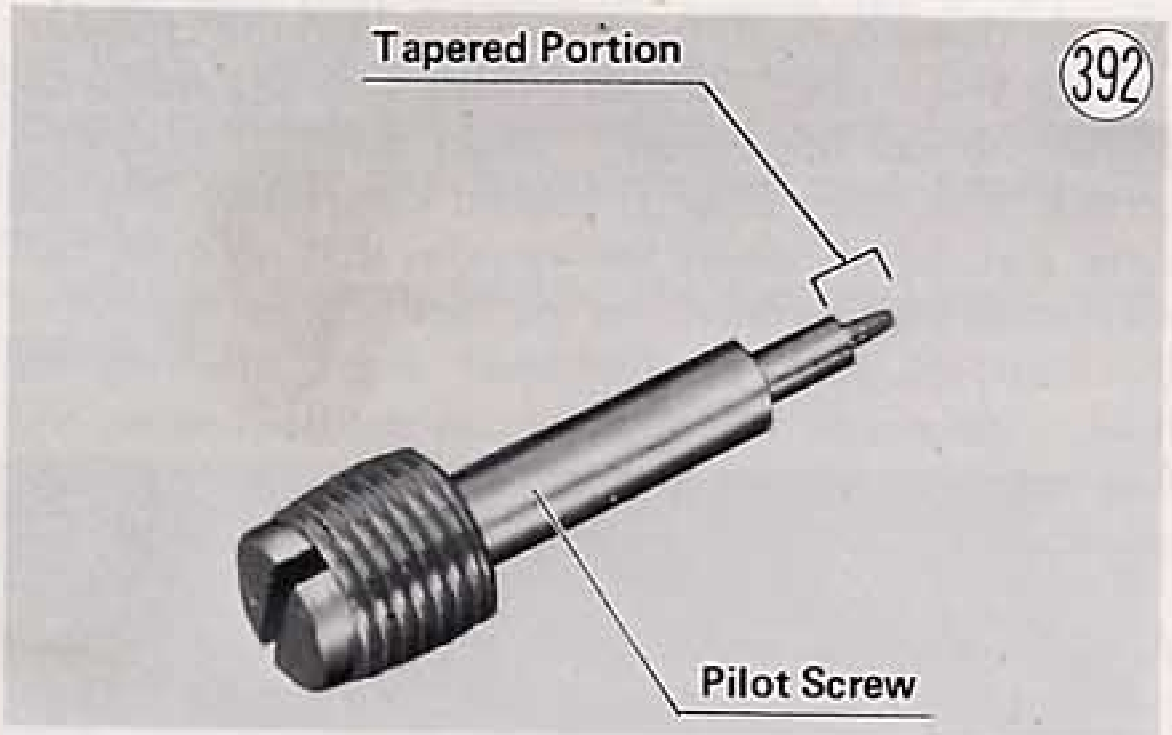
Cleaning and replacement

Wash the main jet, pilot jet, slow jet, and slow air jet with a high flash point solvent of some kind, and blow them clean with compressed air. Use compressed air to clean the pilot passage and slow air jet passage. Do not use wire for cleaning since any sharp instrument may cause damage.

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

Pilot System Fuel and Air Supply (391)



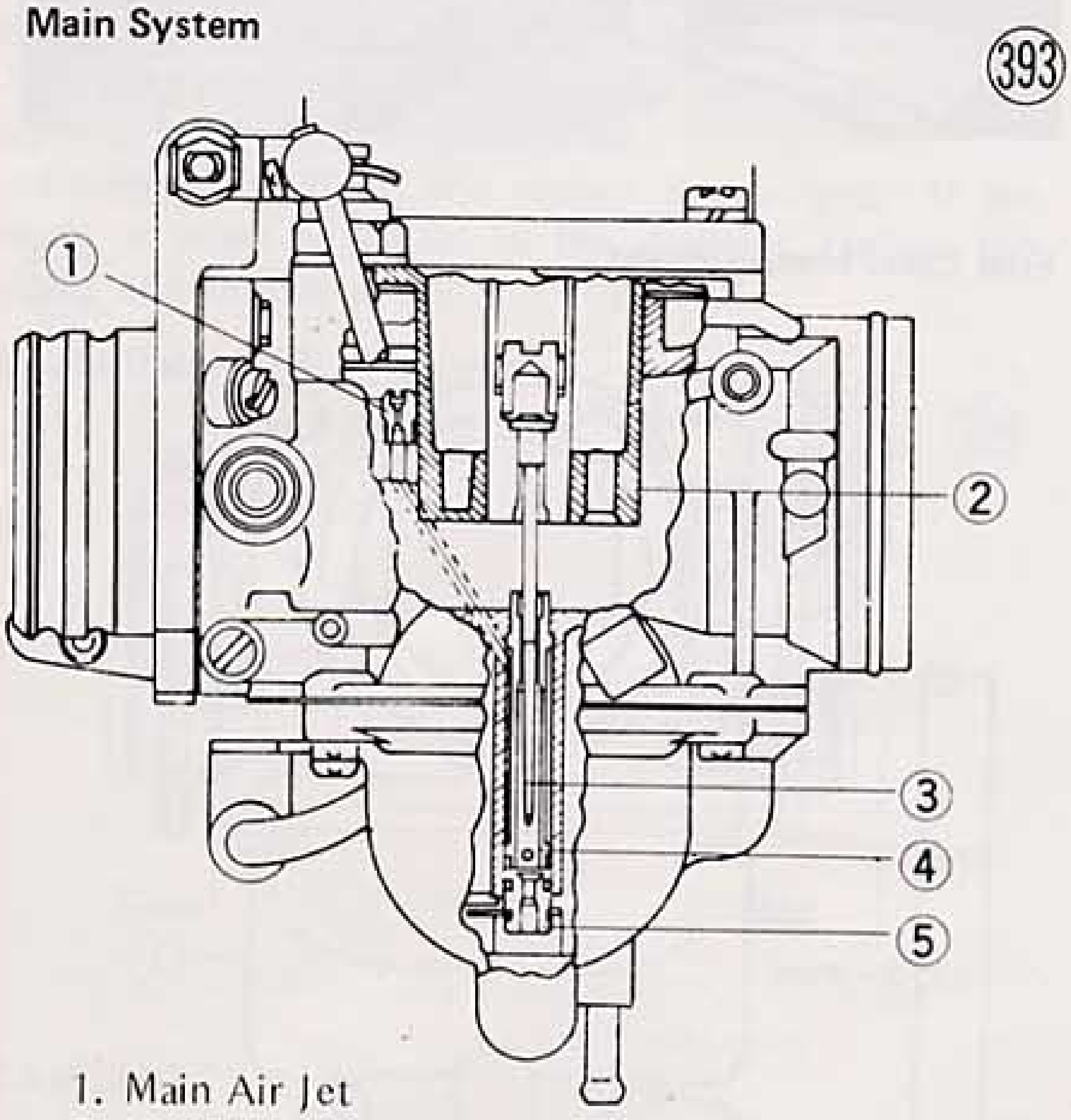


Main System

Fig. 393 shows the main system, which consists of the main jet ⑤, needle jet ④, jet needle ③, vacuum piston ②, and main air jet ①. Fig. 394 shows the supply of fuel and air in the main system.

From about ¼ throttle opening, the air flow past the jet needle outlet is sufficient to cause fuel to be drawn through the main system. The fuel passes through the main jet and then part of it goes through the pilot and slow jets as in the pilot system while the rest of it passes straight up through the space in the needle jet not blocked by the jet needle and into the carburetor bore, where it is atomized by the air flow to the engine.

Main System



1. Main Air Jet
2. Vacuum Piston
3. Jet Needle
4. Needle Jet
5. Main Jet

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

The lower part of the jet needle is tapered and extends down into the needle jet. It is fixed to the vacuum piston, and thus rises up in the needle jet as the vacuum piston rises. From the time the vacuum piston starts rising, from about ¼ throttle, until it reaches most of the way up in the carburetor bore, the fuel is metered primarily by the jet needle taper. As the jet needle rises, the needle to jet clearance increases, thereby increasing the amount of fuel that can pass up through the jet.

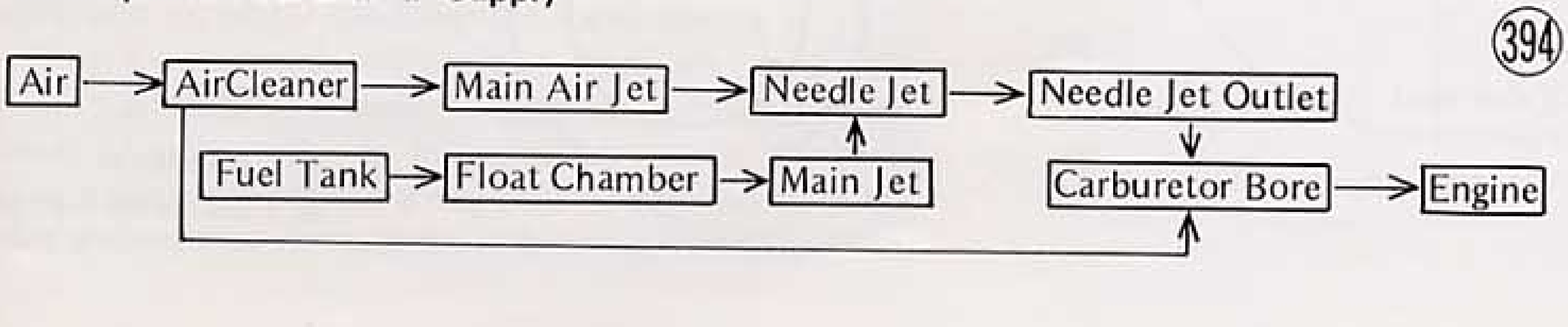
The vacuum piston rises only between ¼ and ¾ throttle. Through the hole in the bottom of the piston, the air pressure in the chamber above the vacuum piston is reduced by engine intake. Through another hole, the pressure of the incoming fuel/air mixture is transmitted to the piston. As engine speed increases, the air pressure in the upper chamber decreases, and the difference between the incoming fuel/air mixture pressure and the upper chamber air pressure will overcome the force of the weight of the piston, raising the piston to the extent corresponding to the pressure difference.

As shown in Fig. 387 the quantity of air drawn in by the engine intake is in direct proportion to engine rpm, and the speed of the air flow is constant while the vacuum piston rises from ¼ to ¾ throttle. Were the size of the air passage above the needle jet to change simultaneously with throttle movement rather than with engine intake (demand), the speed of the air flow in the air passage might even drop during a rapid increase in throttle due to the Venturi effect, causing a slight stall in acceleration. However, the vacuum piston-butterfly valve arrangement controls both the air and fuel supply at sudden throttle for smooth and immediate engine response.

At ¾ throttle the vacuum piston reaches its highest position, forming the "secondary venturi" to permit maximum engine output. At near full throttle openings, the cross-sectional area of the needle to jet clearance becomes greater than the cross-sectional area of the main jet. At these openings, the fuel drawn up into the carburetor bore is limited by the size of the main jet rather than the needle to jet clearance.

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

Main System Fuel and Air Supply



Cleaning and adjustment

Disassemble the carburetor, and wash the vacuum piston, main jet, needle jet, jet needle, main air jet, and air passage with a high flash point solvent of some kind, blowing them clean with compressed air. Do not use wire for cleaning since a sharp instrument may cause damage.

If the engine still exhibits symptoms of overly rich or lean carburetion after all maintenance and adjustments are correctly performed, the main jet may be replaced with a smaller or larger one. A smaller numbered jet gives a leaner mixture and a larger numbered jet a richer mixture. Many jets are available, but it is recommended that any change be limited to one jet size (10) difference from the standard jet.

Float System

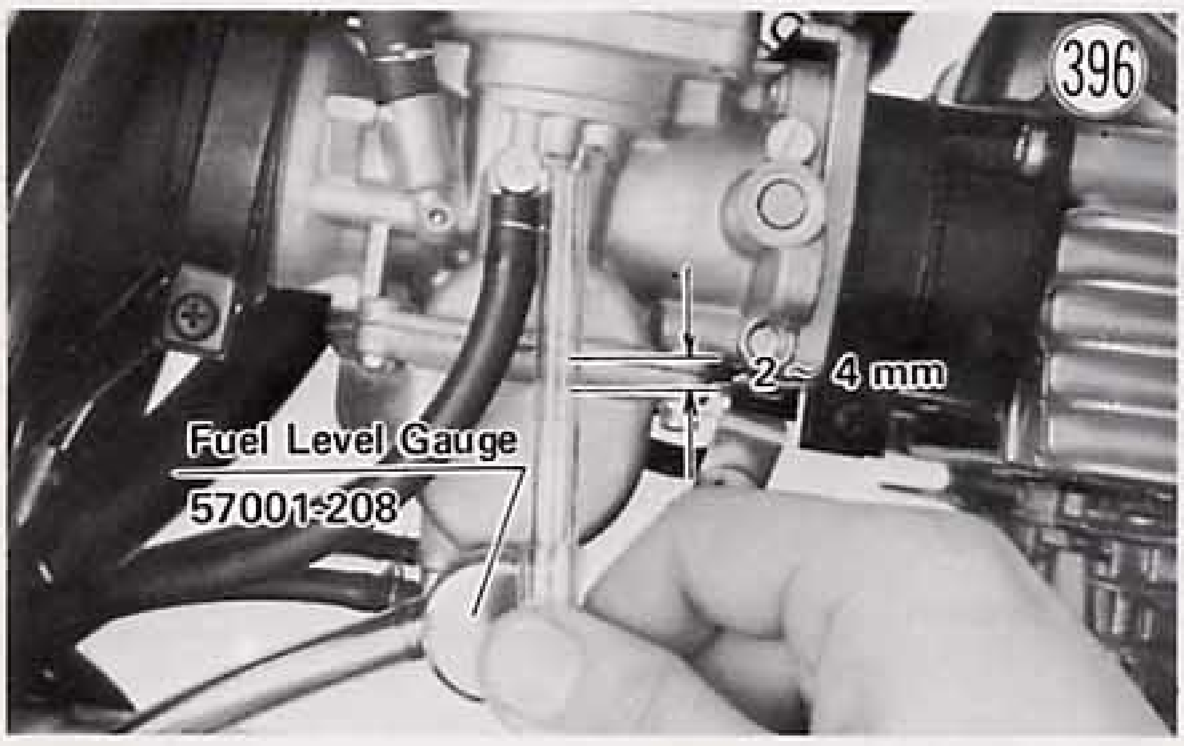
Fig. 395 shows the float system, which consists of the float 4 , float valve needle 3 , and float valve seat 1 .

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

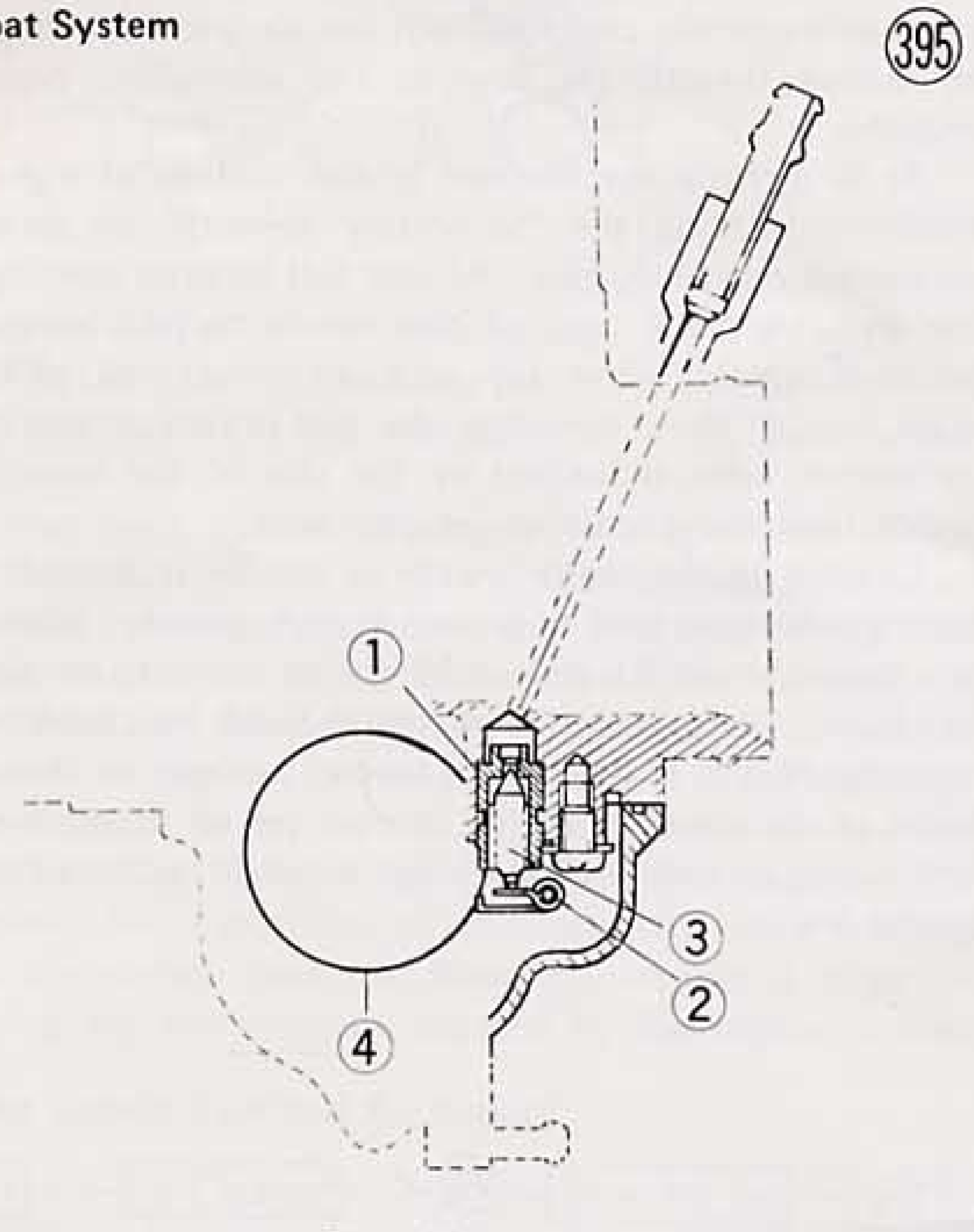
The fuel level is defined as the vertical distance from the center of the carburetor bore to the surface of the fuel in the float chamber. The fuel level is maintained at a constant value by the action of the float valve, which opens and closes according to the fuel level. As fuel flows through the float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

Fuel level measurement and adjustment

Turn the fuel tap off, and remove the drain plug from the bottom of the float bowl. Install the fuel level gauge (special tool). Hold the plastic tube against the carburetor body, and turn on the fuel tap. The fuel level in the plastic tube should come up to 2 ~ 4 mm below the edge of the carburetor body.

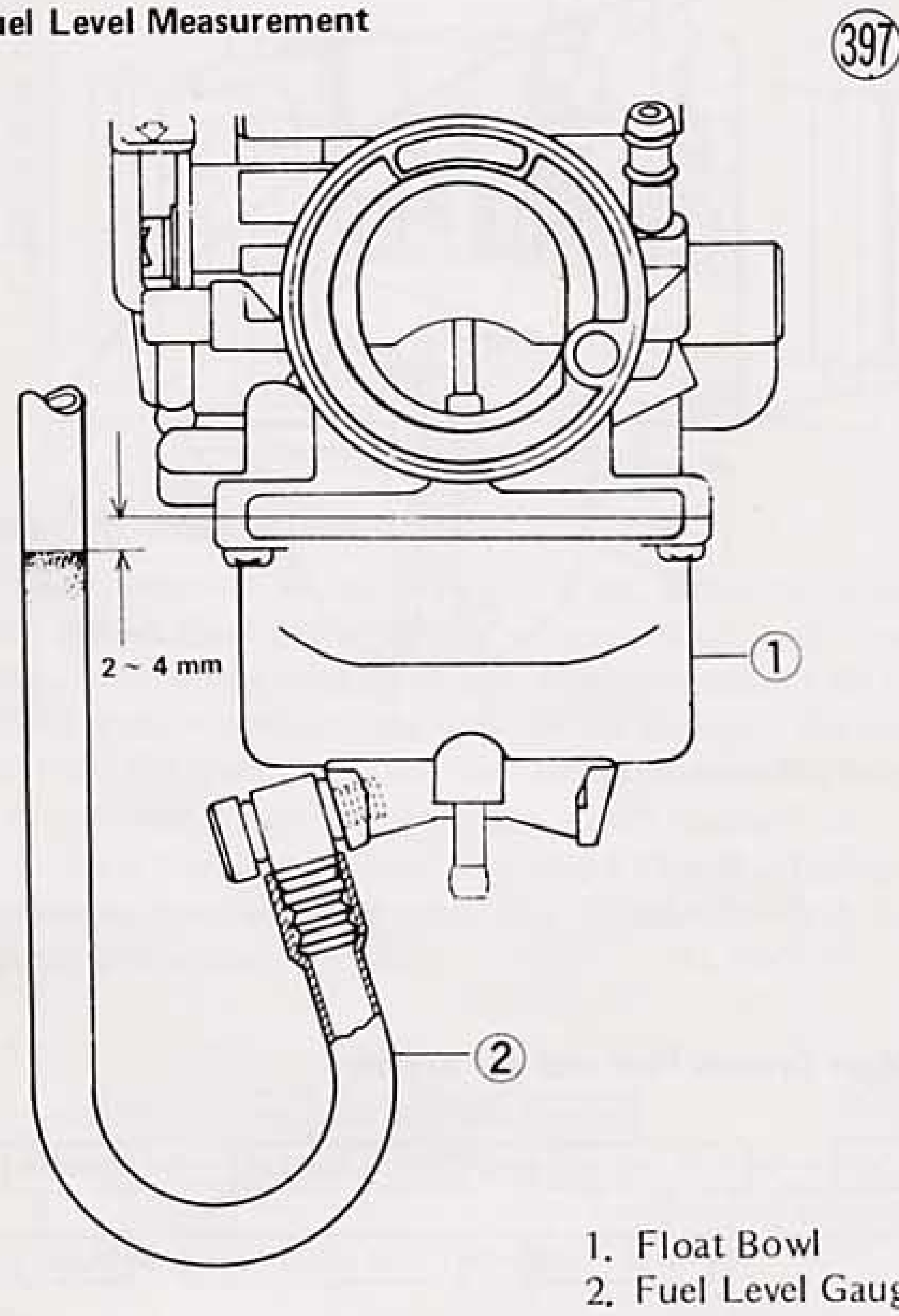


Float System



1. Float Valve Seat
2. Float Pin
3. Float Valve Needle
4. Float

Fuel Level Measurement

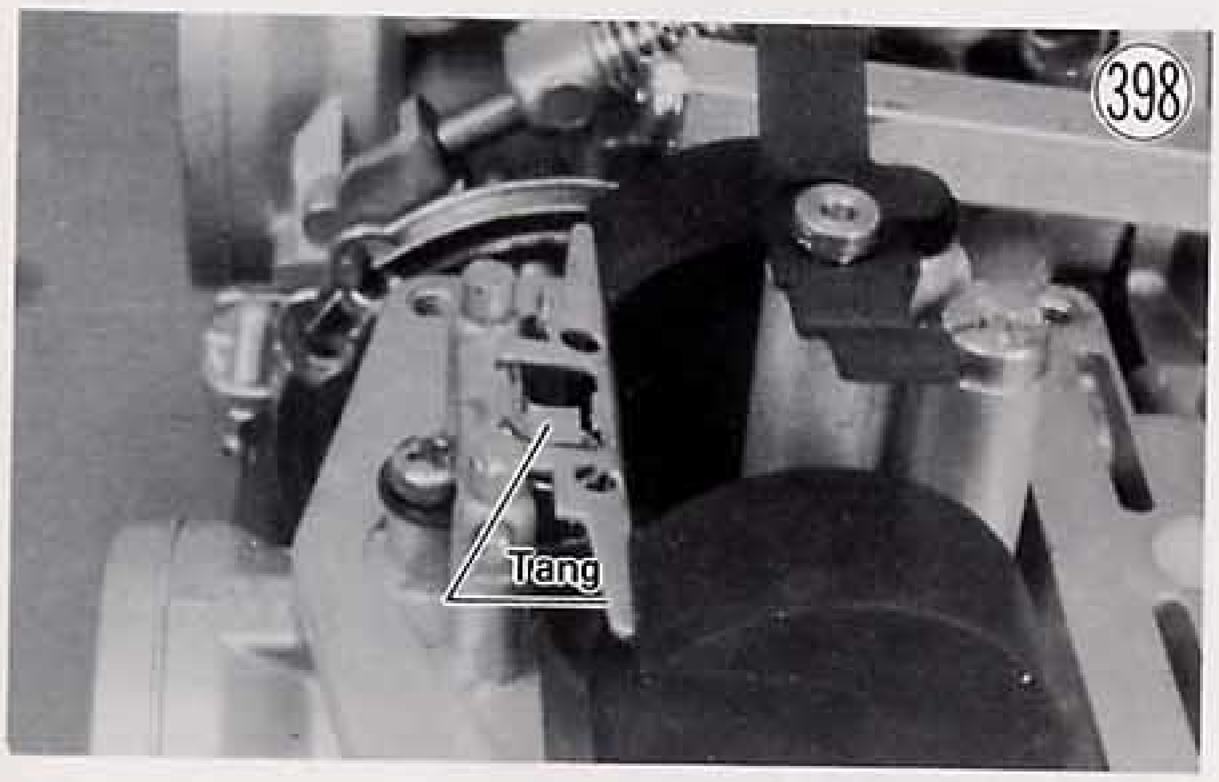


1. Float Bowl
2. Fuel Level Gauge

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

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

398



Cleaning and replacement

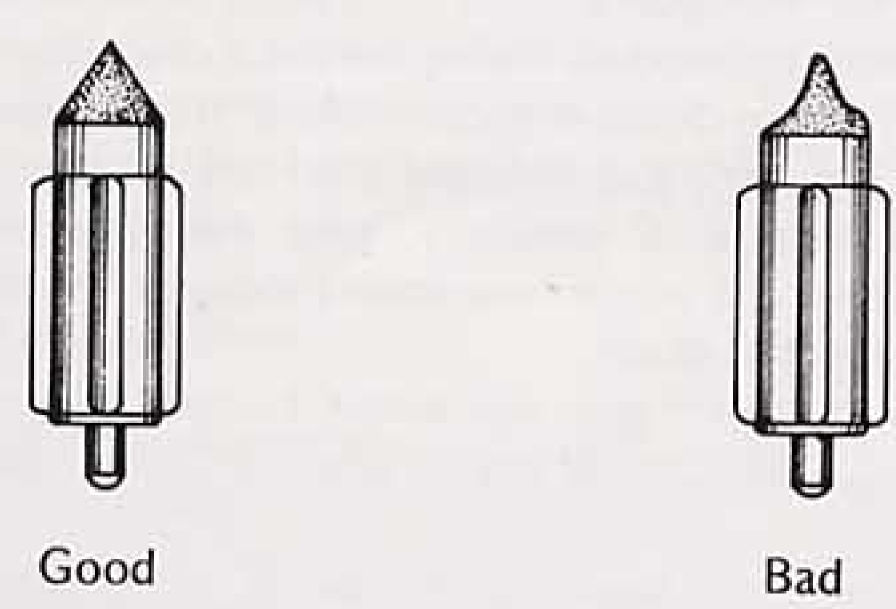
If dirt gets between the needle and seat, the float valve will not close and fuel will overflow. Overflow can also result if the needle and seat become overworn. If the needle sticks closed, no fuel will flow into the carburetor.

Take off the float bowl and float. Wash the bowl and float parts in a high flash point solvent of some kind. Use carburetor cleaner if necessary. Blow out the fuel overflow pipe with compressed air.

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

Needle Valve

399



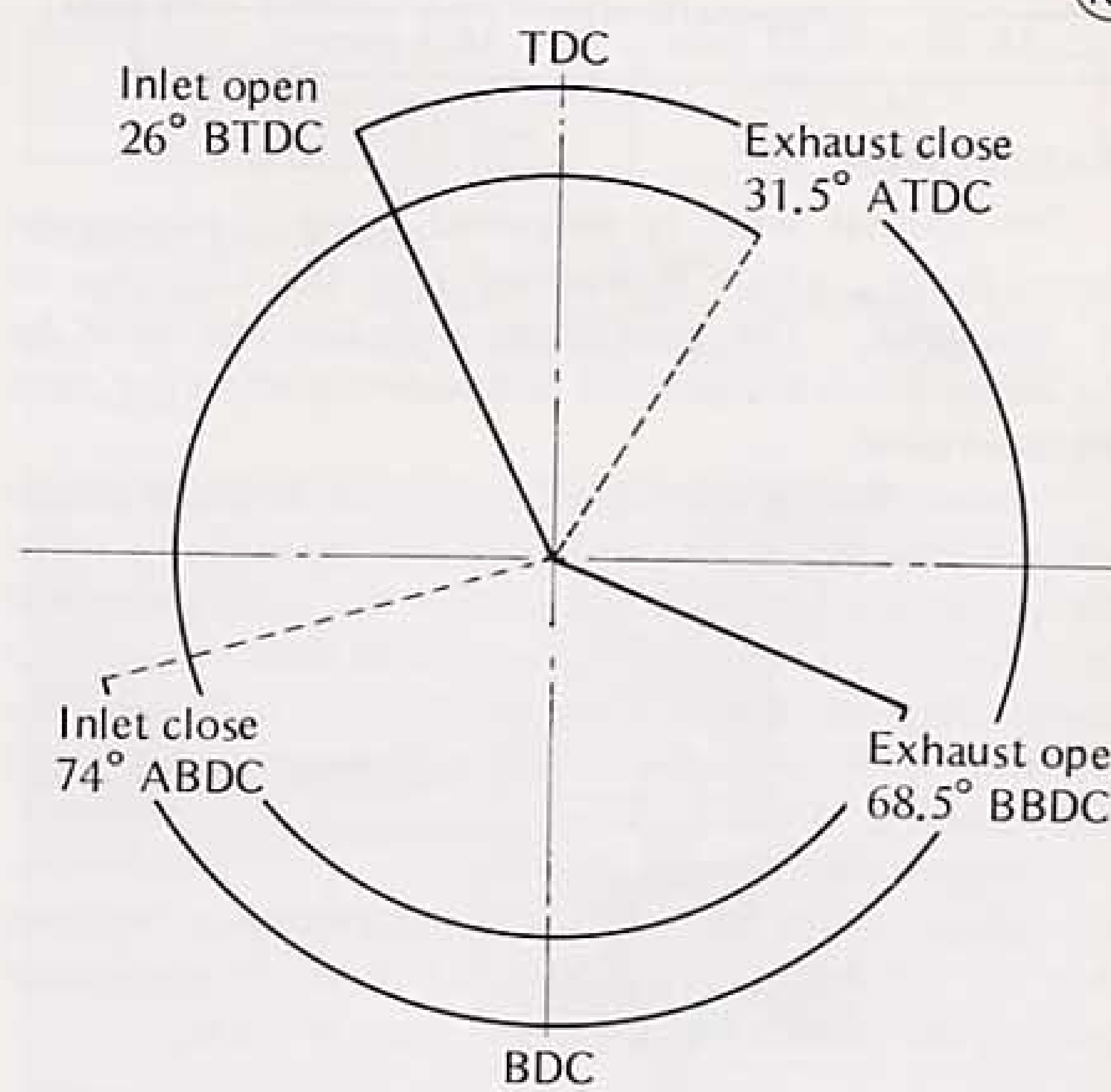
CAMSHAFT

The engine has an overhead camshaft (OHC) at the top of the cylinder head. The camshaft has four cams, two for the two inlet valves and two for the two exhaust valves. At the center of the camshaft is the camshaft sprocket. The sprocket is marked with arrows, which are referred to during camshaft installation for easily and correctly resetting the valve timing.

Engine rotation is transmitted from the crankshaft to the camshaft by a chain running on a sprocket at the center of each shaft. As the camshaft rotates, the cams move against the rocker arms, which open and close the inlet and exhaust valves at the proper intervals (Fig. 400).

Valve Timing

400



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

Cam wear

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

Cam Wear Measurement

401

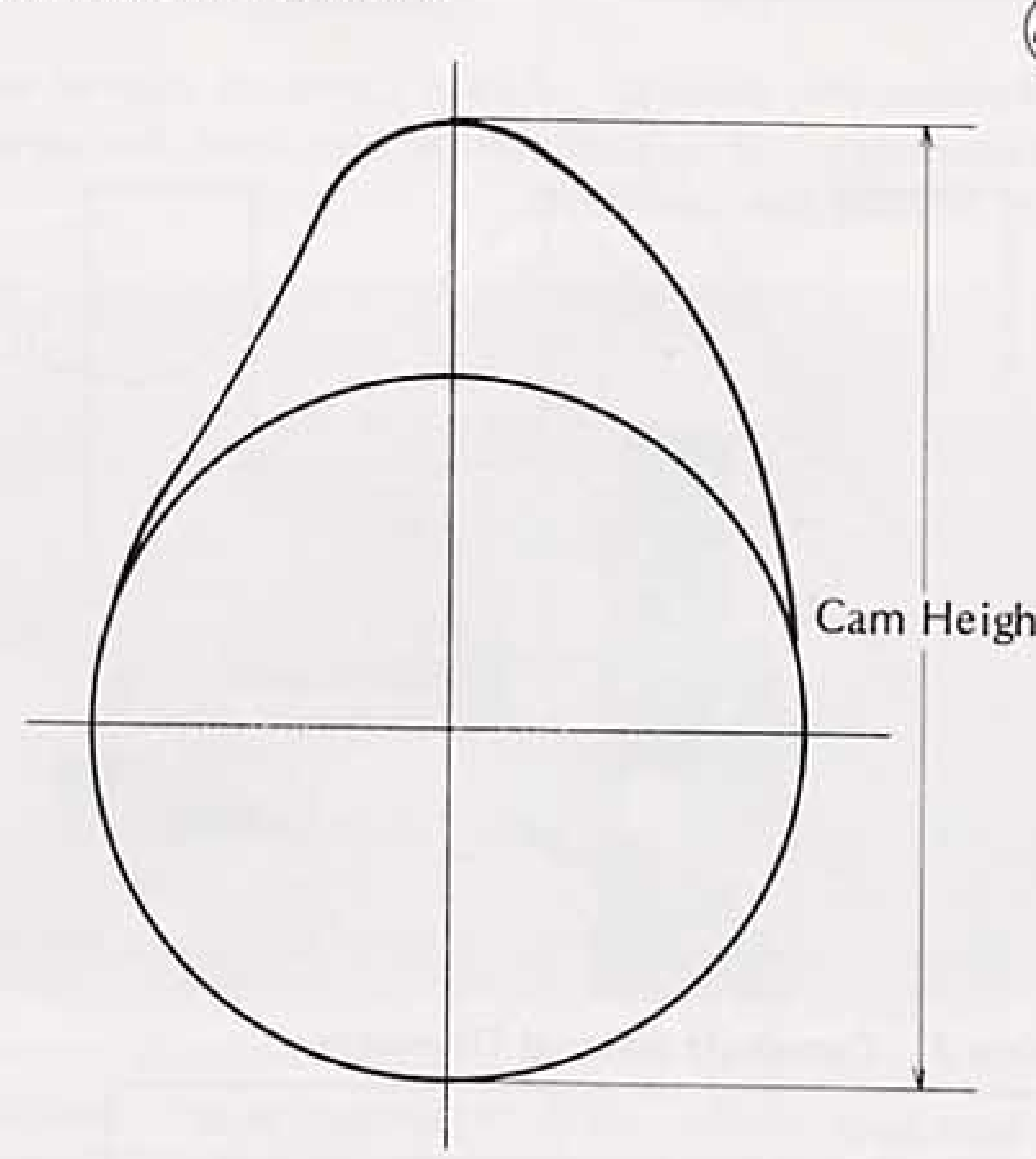


Table 5 Cam Height

Standard	Service Limit
38.39 ~ 38.47 mm	38.3 mm

Journal wear

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

Remove the cylinder head cover, cut strips of plastigauge to journal width, and place a strip on each journal parallel to the camshaft and so that the plastigauge will be compressed between the journal and the cylinder head cover. Replace the cylinder head cover, tightening the stud nuts in the correct sequence with the correct amount of torque (Pg. 35).

Remove the cylinder head cover, and measure the plastigauge width to determine the clearance between each journal and the cylinder head cover. If a clearance exceeds the service limit, replace the camshaft.

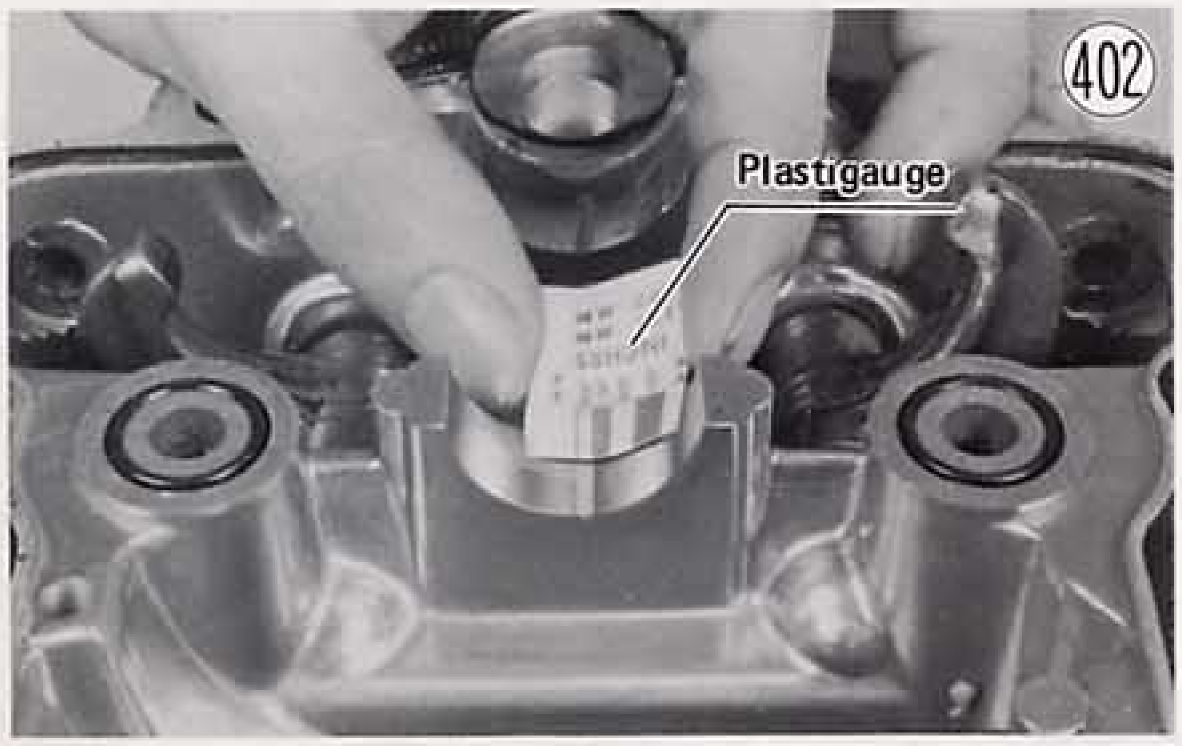


Table 6 Camshaft Journal/Cylinder Head Cover Clearance

Standard	Service Limit
0.043 ~ 0.101 mm	0.19 mm

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

***Table 7 Camshaft Journal Diameter**

Standard	Service Limit
27.94 ~ 27.96 mm	27.92 mm

Camshaft runout

Remove the camshaft, and take the sprocket off the shaft. Set the shaft in V blocks at the journals as shown in the figure. Measure the runout with a dial gauge set to where the sprocket is mounted on the shaft. If the runout exceeds the service limit, replace the camshaft.

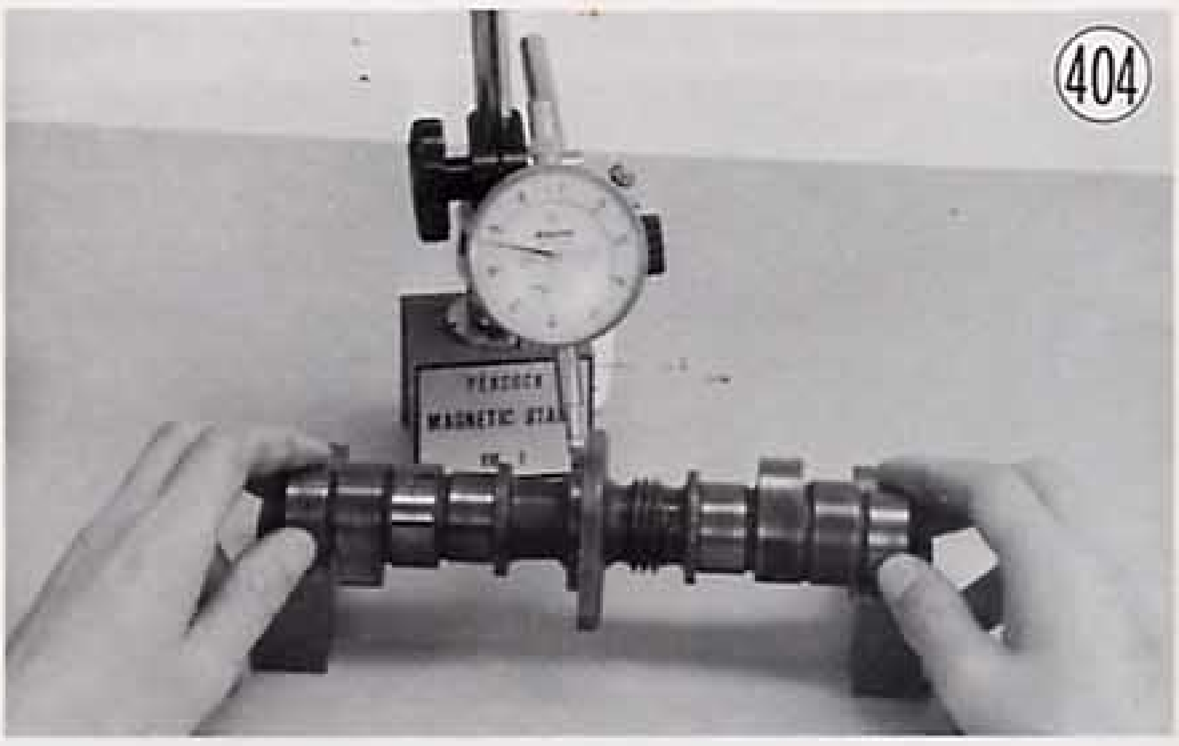


Table 8 Camshaft Runout

Standard	Service Limit
under 0.02 mm	0.1 mm

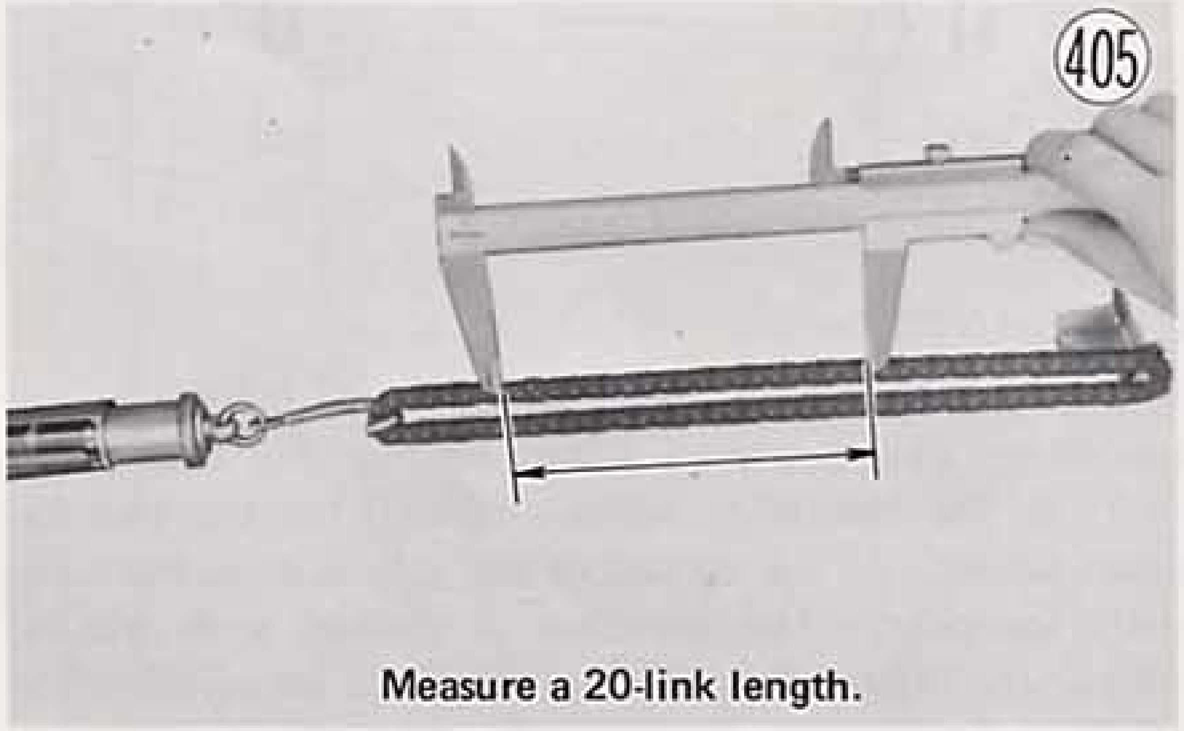
CAMSHAFT CHAIN, CHAIN GUIDES

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

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

Camshaft chain wear

Remove the camshaft chain, hold the chain taut with a force of about 5 kg in some manner such as the one shown in Fig. 405, and measure a 20-link length. Since the chain may wear unevenly, take measurements at several places. If any measurement exceeds the service limit, replace the chain.



Measure a 20-link length.

Table 9 Camshaft Chain Wear

Standard	Service Limit
160 mm	162.4 mm

Chain guide wear

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

Measure the thickness with a ruler. Replace if the wear has exceeded the service limit.

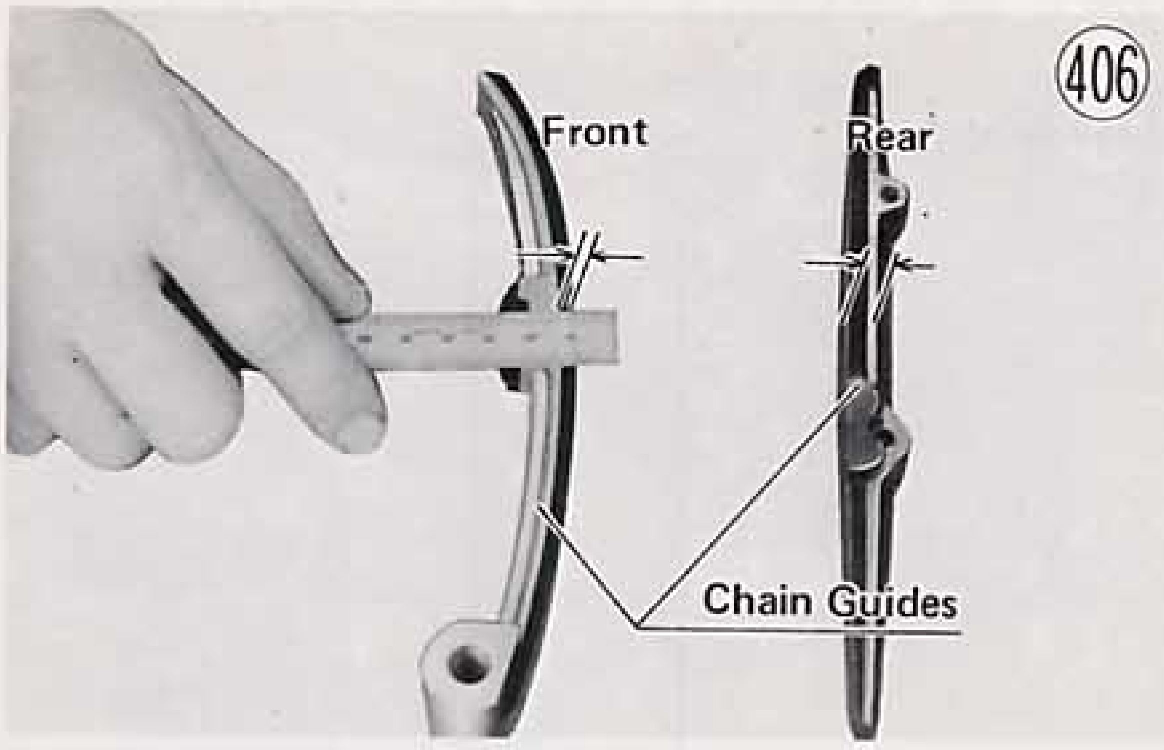


Table 10 Chain Guide Wear

	Standard	Service Limit
Front	3.3 mm	1.5 mm
Rear	4.5 mm	2 mm

ROCKER ARMS, SHAFTS

There are four rocker arms and shafts in the cylinder head cover. The two arms and shafts to the front control the two exhaust valves, while the two to the rear control the two inlet valves. The rocker arms are made of a special steel alloy for durability, and each arm surface which makes contact with the cam and the valve stem has been heat-treated to achieve superior surface hardness. An oil hole in each rocker arm enables oil to lubricate between the arm and shaft.

Excessive clearance between a rocker arm and shaft results in engine noise.

Rocker arm wear

Visually inspect where the cam and valve stem wear on each arm. If there is any damage or uneven wear, replace the arm.

Measure the inside diameter of each arm with a cylinder gauge. If it exceeds the service limit, replace the arm.

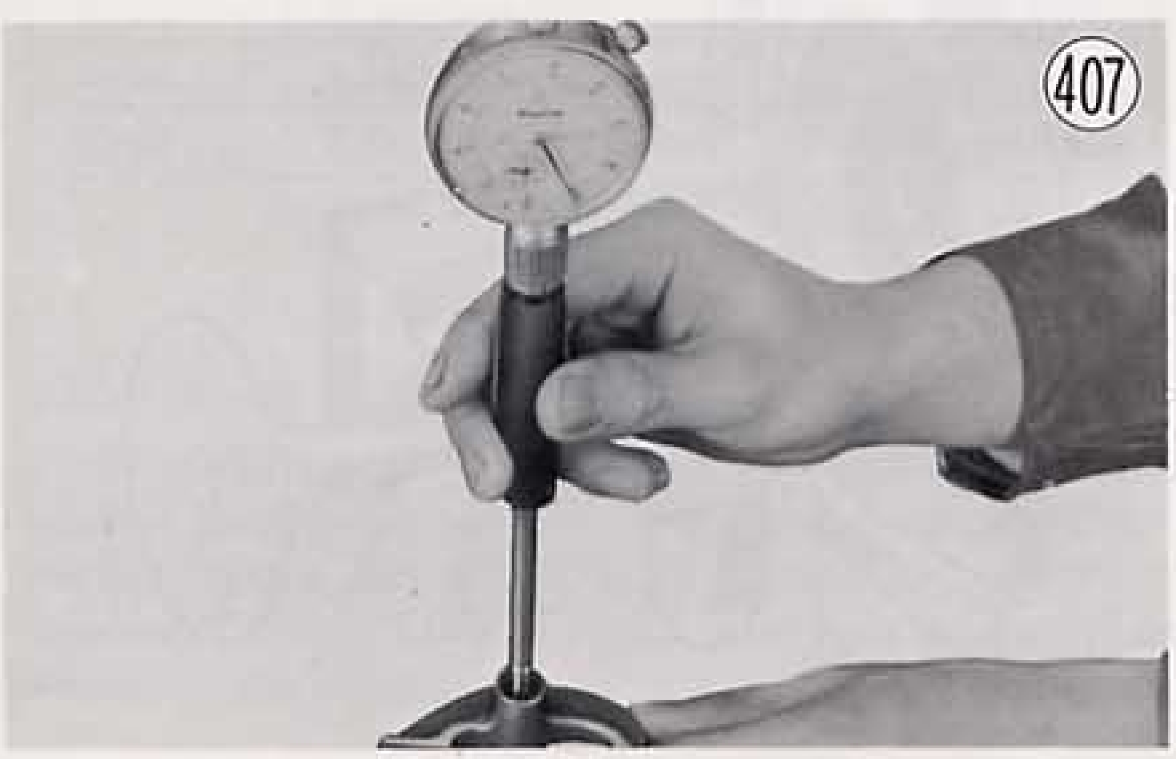


Table 11 Rocker Arm Inside Diameter

Standard	Service Limit
13.000~13.018 mm	13.05 mm

Rocker shaft wear

Measure the diameter of each shaft where the arm fits. If the diameter is less than the service limit, replace the shaft.

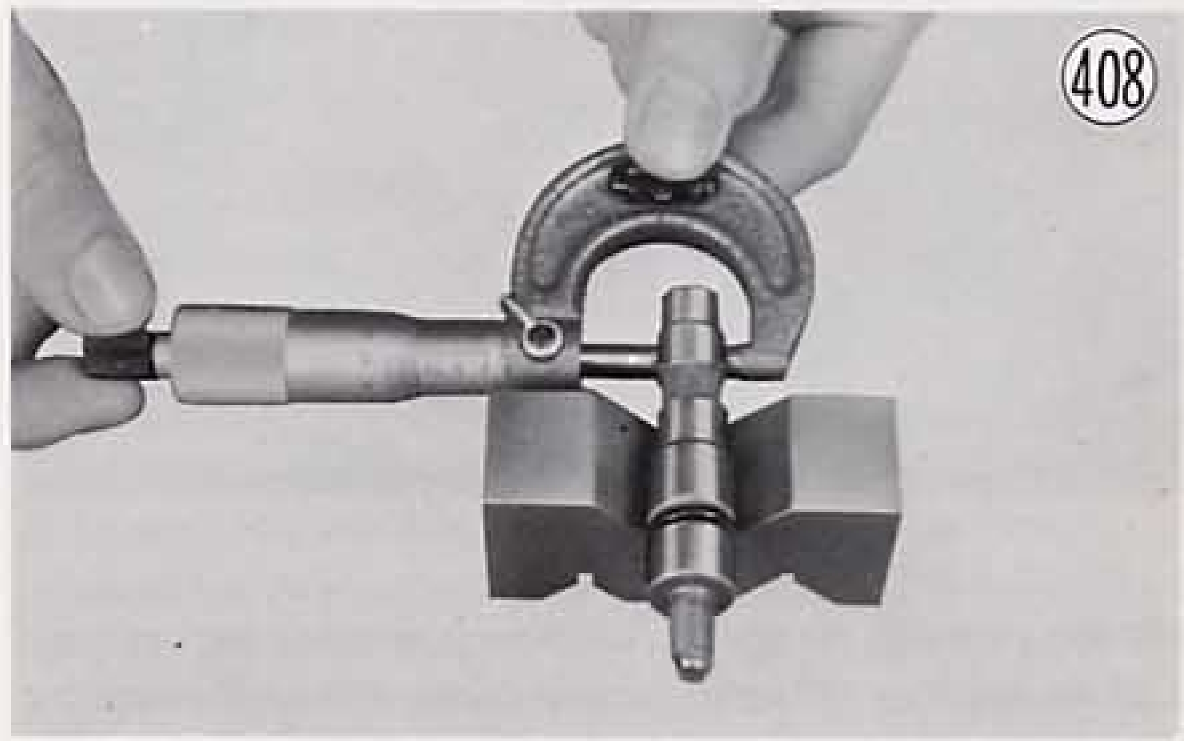


Table 12 Rocker Shaft Diameter

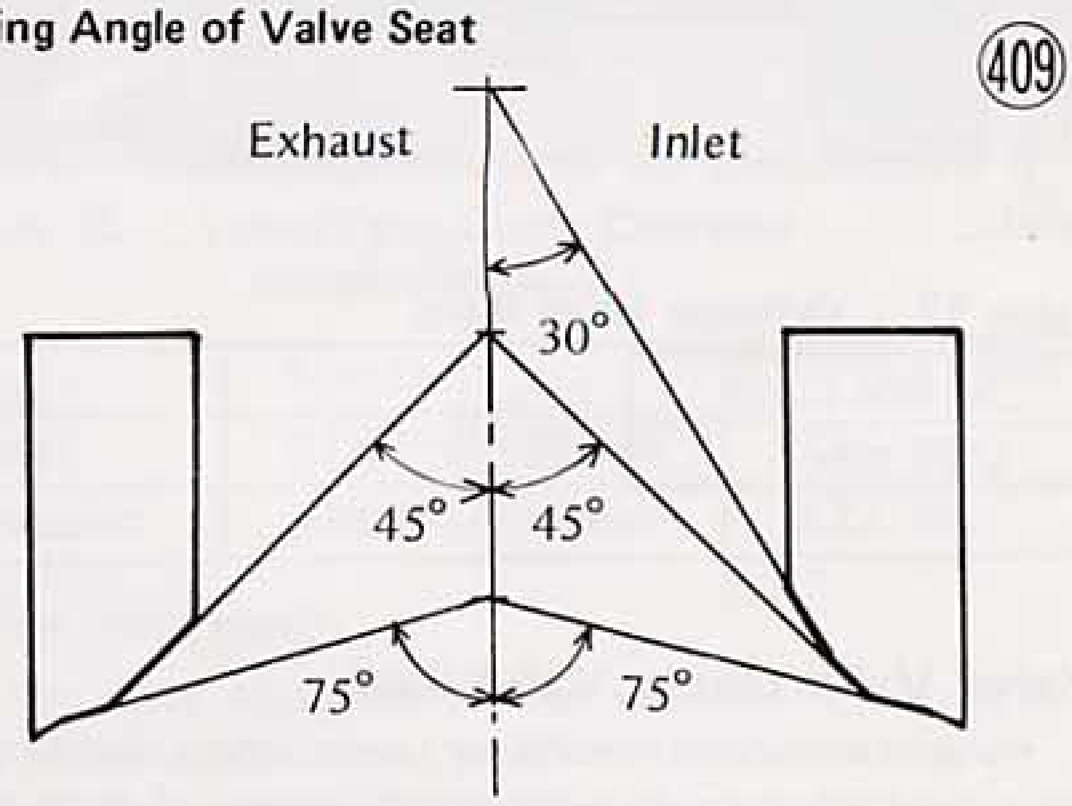
Standard	Service Limit
12.966~12.984 mm	12.94 mm

CYLINDER HEAD, VALVES

The valves, mounted in the cylinder head, are pushed open by the rocker arms and closed by the valve springs.

The valve guides and valve seats are pressed into the cylinder head. The valve seats are cut to the angles shown in Fig. 409 in order that the seats match the valve seating surfaces perfectly flush not only to prevent compression leakage but also to provide efficient heat transmission.

Cutting Angle of Valve Seat

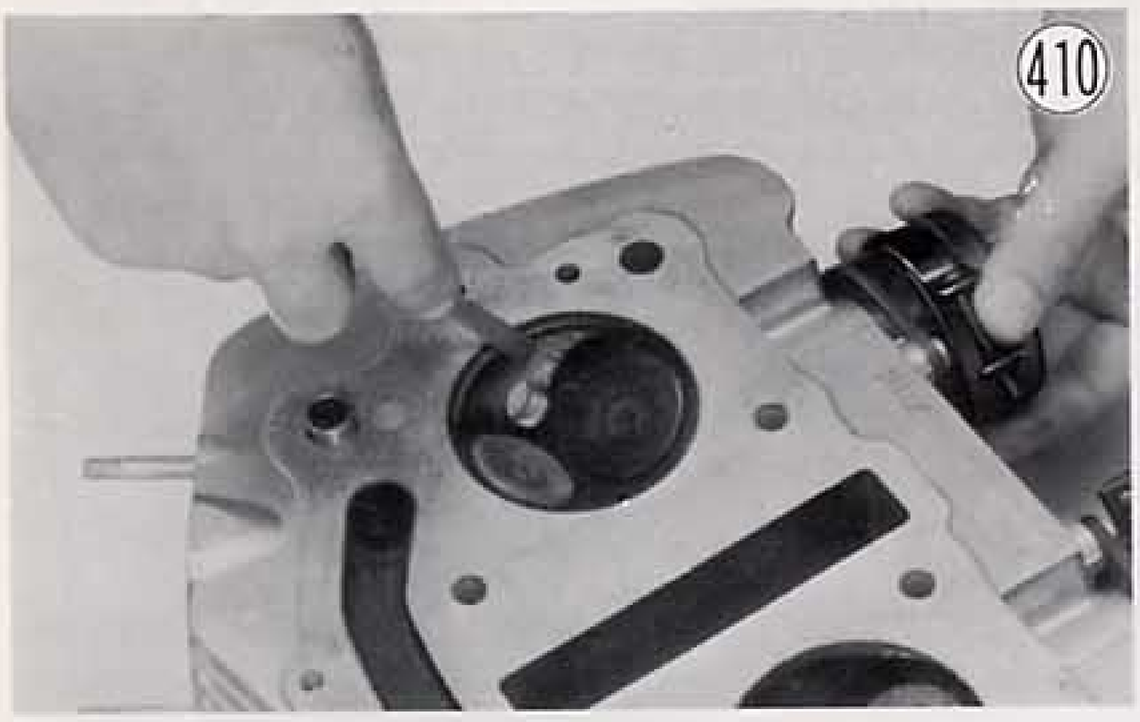


Cylinder Head

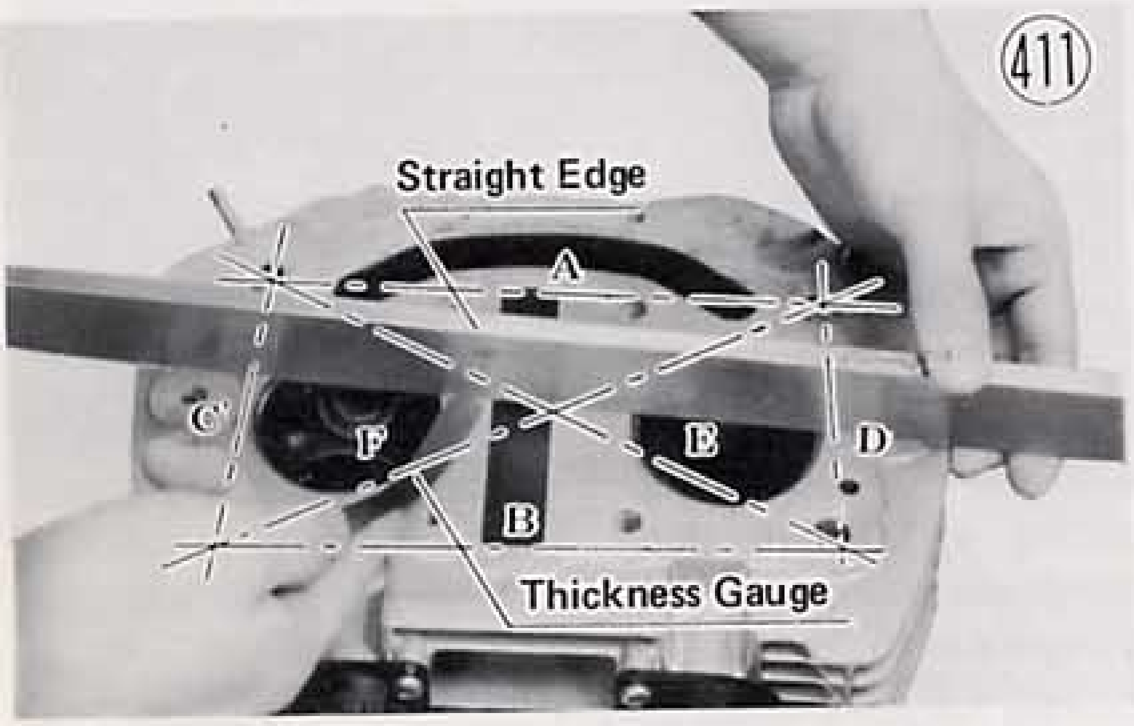
The cylinder head is made of aluminum alloy, used for its high heat conductivity, and is finned on the outside to aid dissipation of the heat generated in the combustion chambers. Carbon built up inside the combustion chambers interferes with heat dissipation and increases the compression ratio, which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

Cleaning and inspection

Remove the cylinder head (Pg. 35). Scrape out any carbon, and wash the head with a high flash point solvent of some kind.

410


Lay a straight edge across the lower surface of the head at several different points, and measure warp by inserting a thickness gauge between the straight edge and the head.

411


If warp exceeds the service limit, replace the cylinder head.

Table 13 Cylinder Head Warp

Service Limit
0.05 mm

Valve, Valve Guide, Valve Seat

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

In addition, valve and valve seat wear causes deeper valve seating and a decrease in valve clearance. Insufficient clearance upsets valve timing and may eventually prevent the valve from seating fully. So that the wear never progresses this far, adjust the valve clearance in accordance with the periodic maintenance chart (Pg. 180).

Valve inspection

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

Measure the thickness of the valve head using vernier calipers, and replace the valve together with its valve guide if the thickness is under the service limit.

Valve Shape

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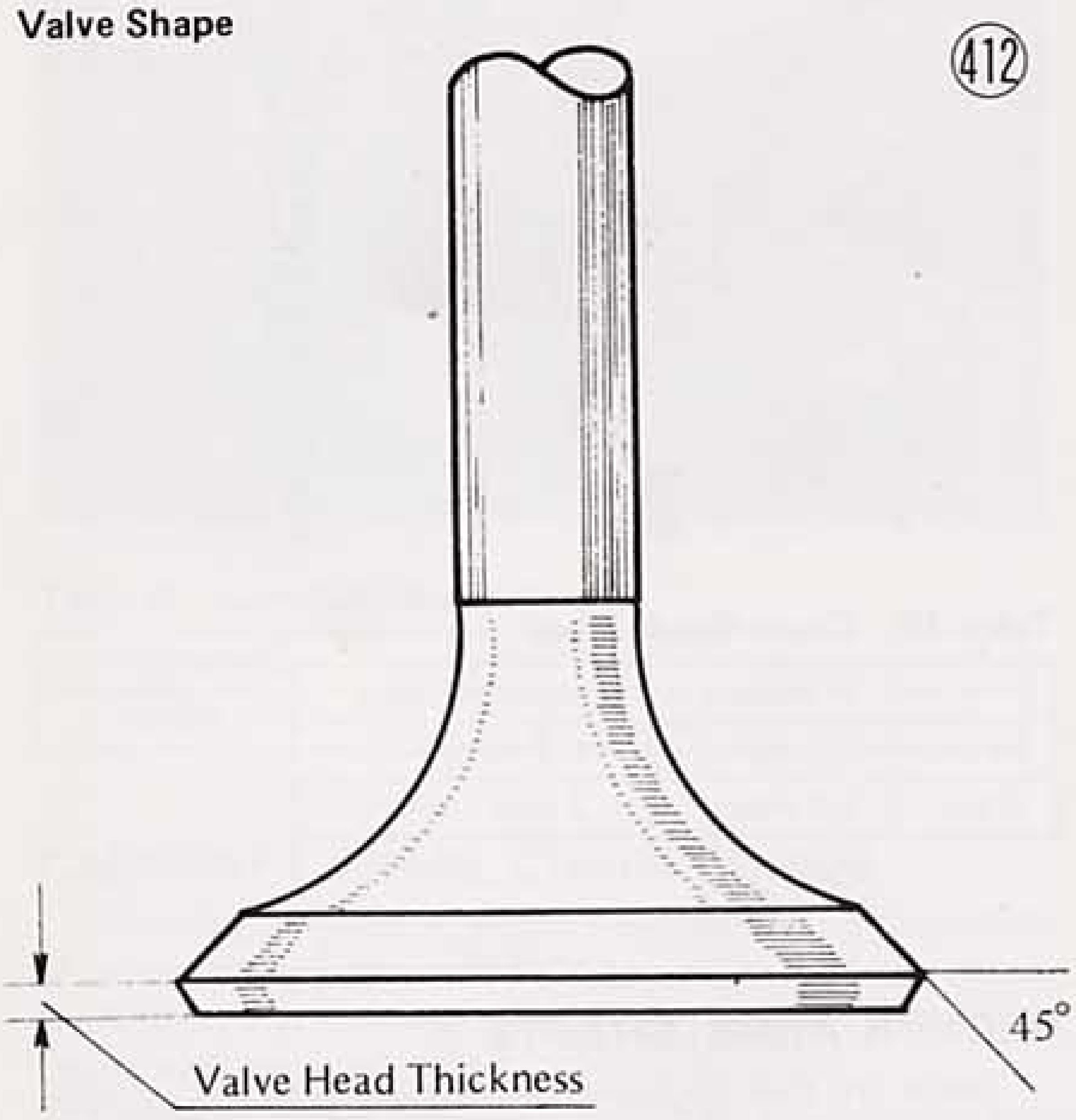
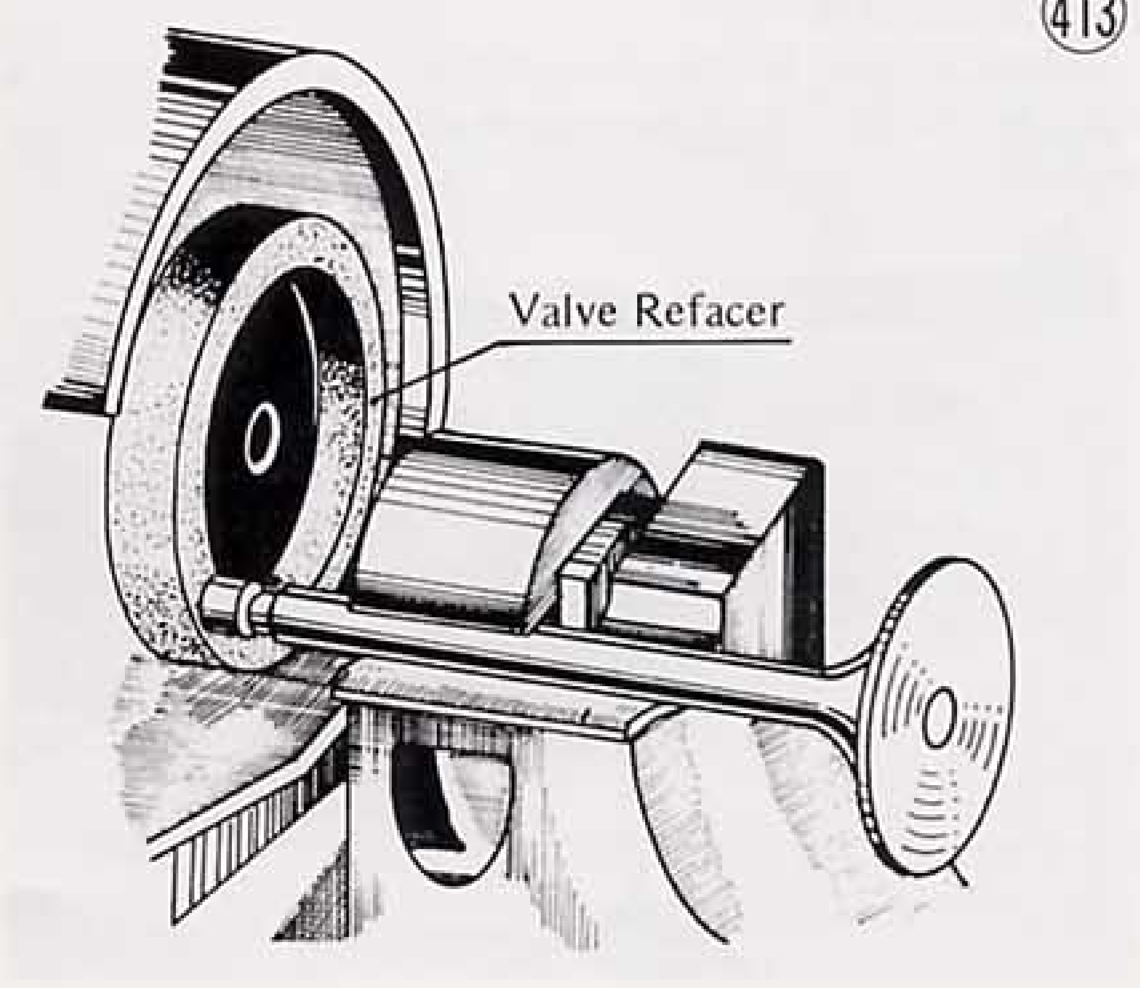


Table 14 Valve Head Thickness

Standard	Service Limit
0.75~1.25 mm	0.5 mm

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

Valve Stem Grinding

413


CAUTION: If the valve stem is ground down, be sure to leave at least 4.2 mm of stem end above the wide groove portion.

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

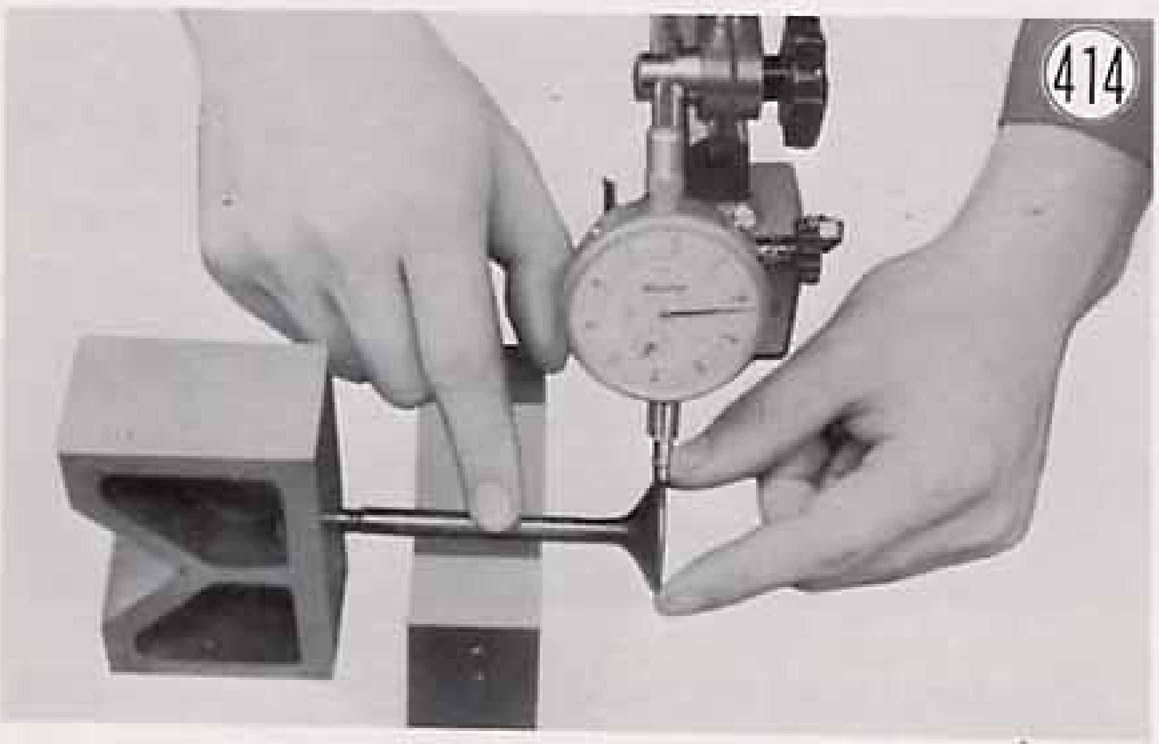


Table 15 Valve Stem Bend

Service Limit
0.05 mm

Measure the diameter of the valve stem with a micrometer. Since the stem wears unevenly, take measurements at four places up and down the stem, keeping the micrometer at right angles to the stem.

Replace the valve if the stem is worn to less than the service limit.

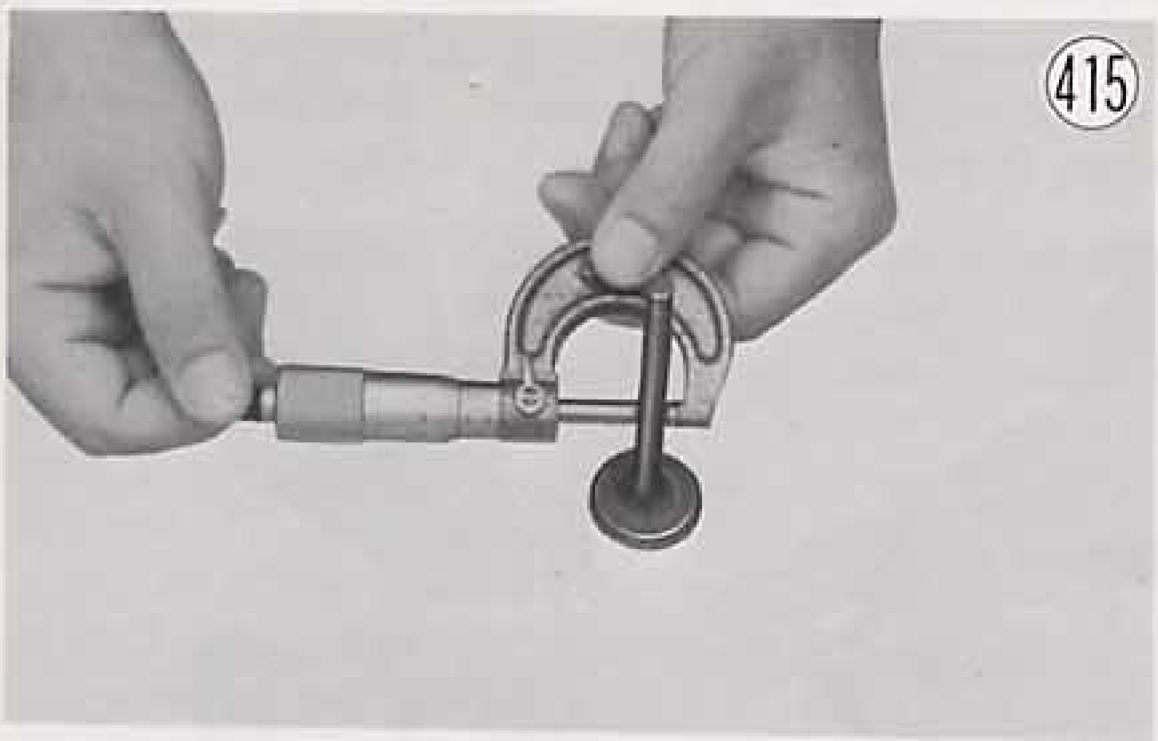


Table 16 Valve Stem Diameter

	Standard	Service Limit
Inlet	6.965 ~ 6.980 mm	6.90 mm
Exhaust	6.955 ~ 6.970 mm	6.89 mm

Valve guide inspection

Remove the valve, and measure the inside diameter of the valve guide using a small bore gauge and micrometer. Since the guide wears unevenly, measure the diameter at four places up and down the guide. If any measurement exceeds the service limit, replace the guide.

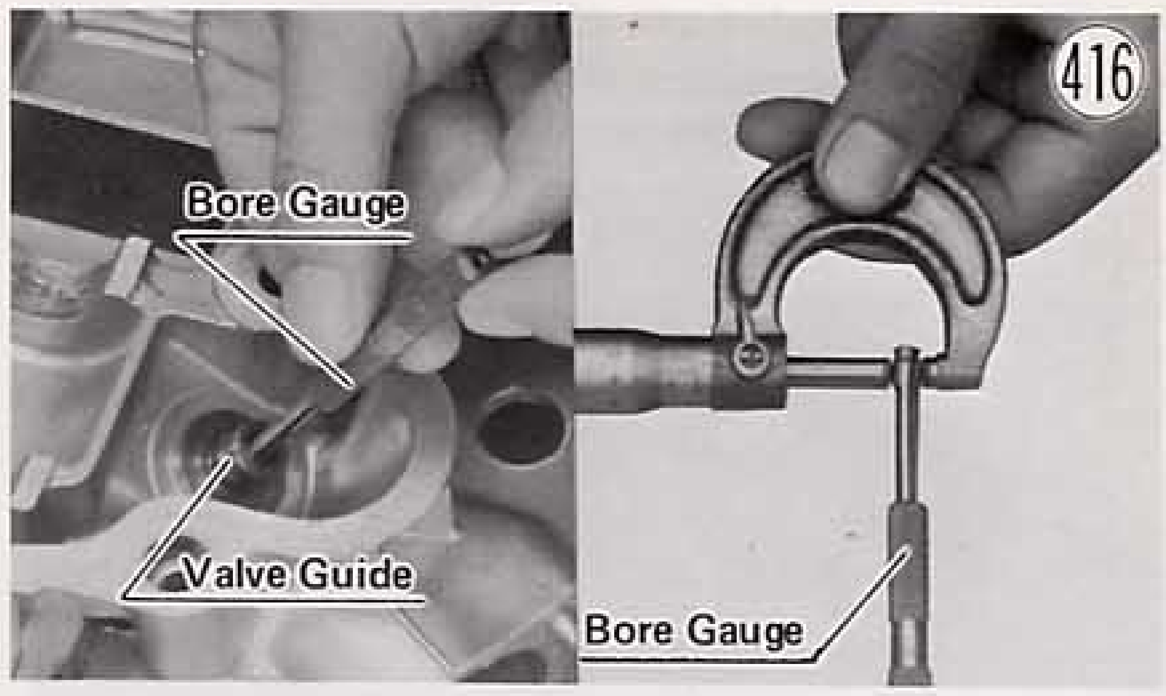


Table 17 Valve Guide Inside diameter

Standard	Service Limit
7.000~7.015 mm	7.08 mm

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method, as indicated below.

Insert a new valve into the guide and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface. Move the stem back and force to measure valve/valve guide clearance. Repeat the measurement in a direction at a right angle to the first.

If the reading exceeds the service limit, replace the guide.

NOTE: The readling is not actual valve/valve guide clearance because the measuring point is above the guide.

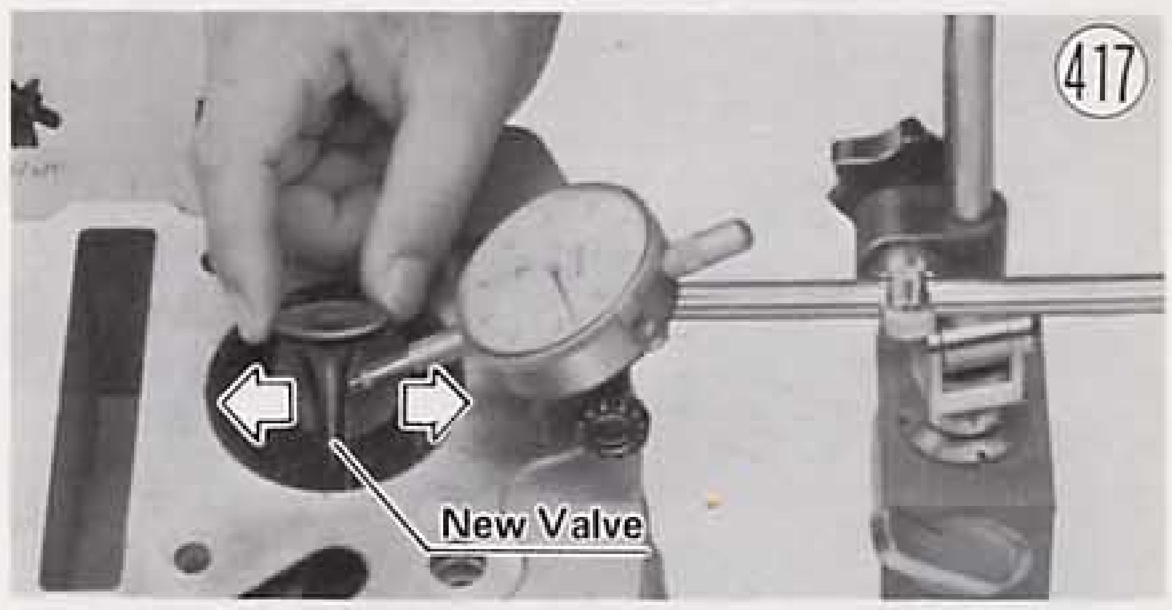


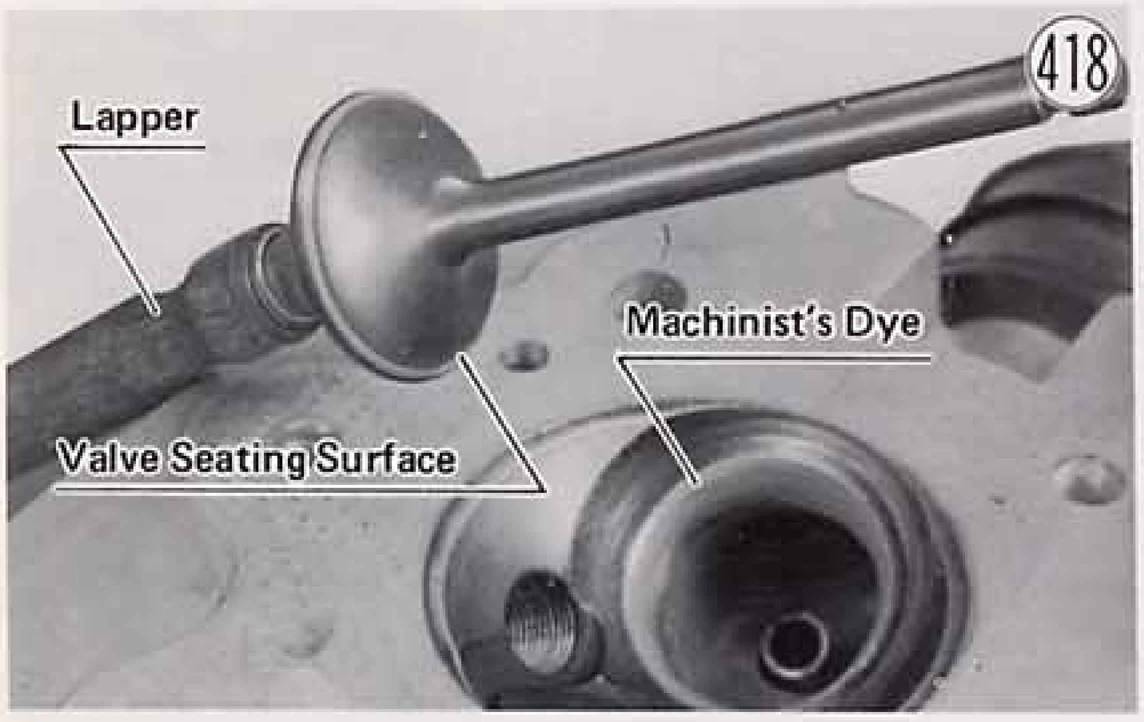
Table 18 Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Inlet	0.048~0.120 mm	0.24 mm
Exhaust	0.065~0.130 mm	0.22 mm

Valve seat repair

The valve must seat in the valve seat evenly around the circumference over a 0.5 ~ 1.0 mm wide area. If the seat is too wide, the seating pressure per square unit of area is reduced, possibly resulting in compression leakage and carbon accumulation on the seating surface. If the seating area is too narrow, heat conduction from the valve is reduced, and the valve will overheat and warp. Uneven seating or seat damage will cause compression leakage.

To determine whether or not the valve seat requires repair, first remove the valve, apply machinist's dye to the valve seat, and then use a lapper to tap the valve lightly into place. Remove the valve, and note where the dye adheres to the valve seating surface. The distribution of the dye on the seating surface gives an indication of seat condition.

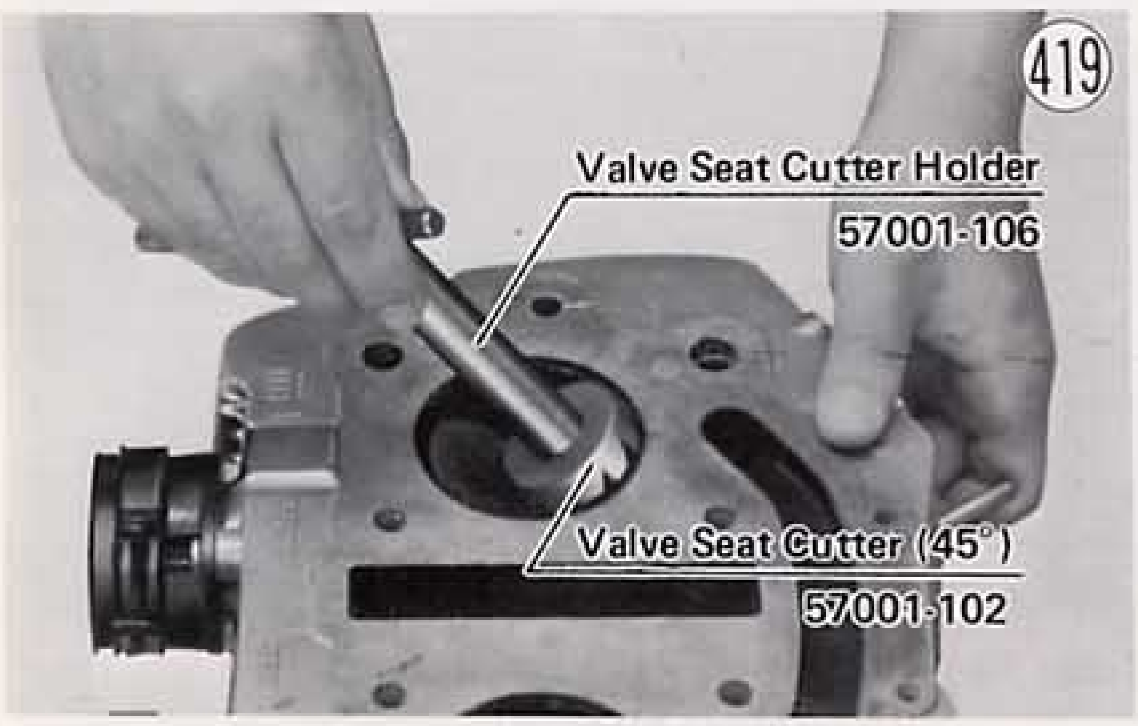


418

NOTE: The valve and valve guide must be in good condition before this check will give an accurate indication of valve seat condition.

A valve seat which requires repair is cut with a set of valve seat cutters. Four cutters are required for complete repair; one 30° (inlet valve seat only); one 45°; and two 75° cutters, one for the inlet and the other for the exhaust.

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

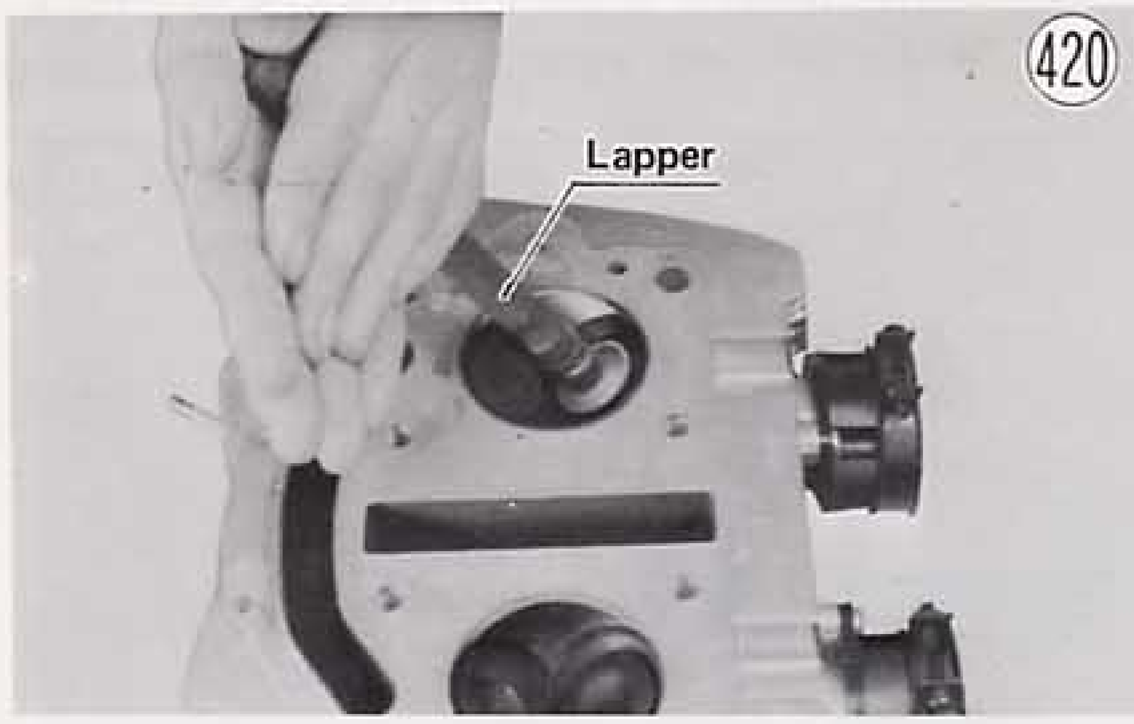


419

Next, use the 30° cutter (inlet valve seat only) to cut the surface inside the seating surface, and then use the 75° cutter to cut the outermost surface. Cut these two surfaces so that the seating surface will be 0.5 ~ 1.0 mm wide.

After cutting, lap the valve to properly match the valve and valve seat surfaces so that the valve will seat well. Start off with coarse lapping compound, and finish with fine compound.

Apply compound to the valve seat, and tap the valve lightly into place while rotating it with a lapper, repeating this until a smooth, matched surface is obtained.



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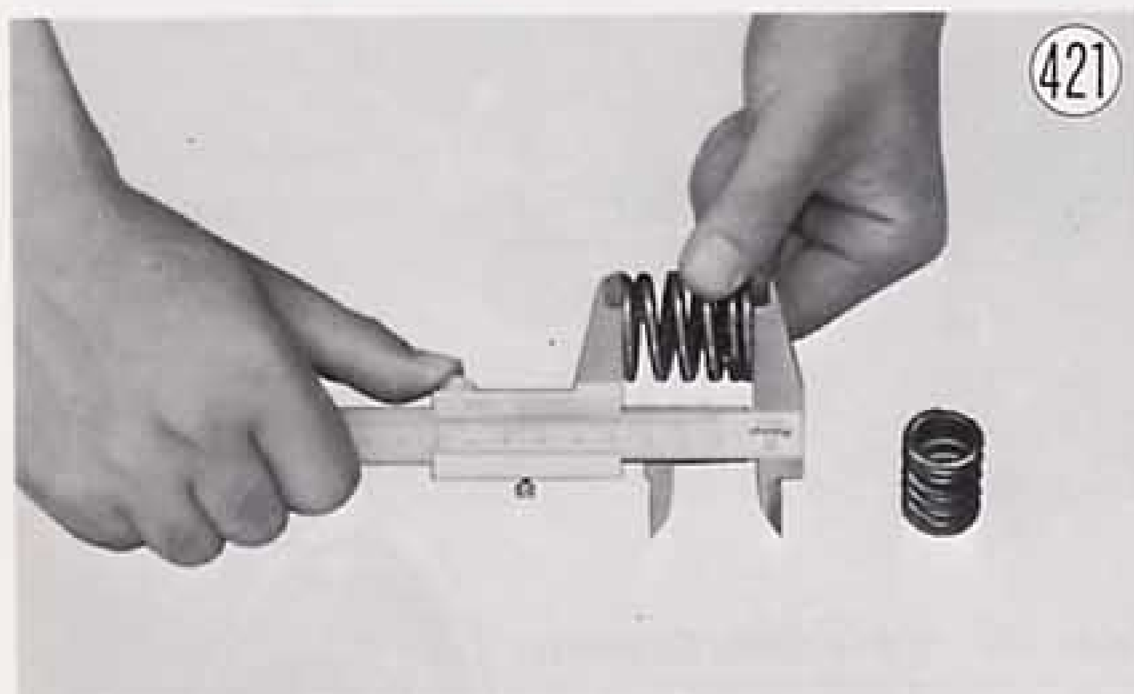
When lapping is completed and the valves are installed, check the valve clearance and adjust if necessary (Pg. 14).

Valve Springs

When the valve is not being pushed open by the rocker arm, valve springs press the valve against the seat to prevent compression leakage. An inner spring and an outer spring are used for each valve to prevent spring bounce at high speeds. If the springs weaken or break, compression leakage and valve noise will result, dropping engine power.

Inspection

Remove the springs, and check the free length of each spring with vernier calipers. Replace any spring which is shorter than the service limit.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Valve/Valve Seat Contact Area

422

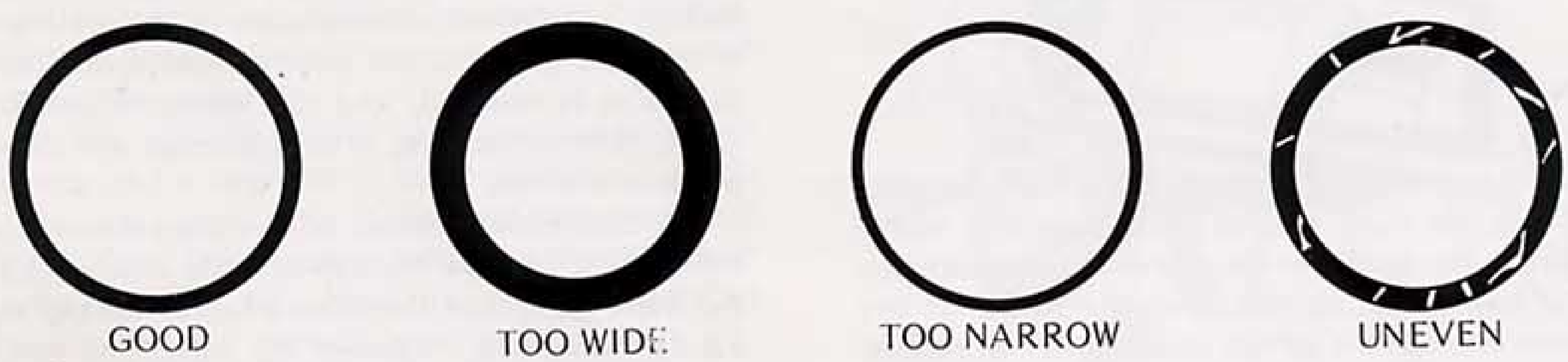


Table 19 Valve Spring Free Length

	Standard	Service Limit
Inner	32.4 mm	31.0 mm
Outer	37.3 mm	36.0 mm

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

Valve Spring Perpendicularity

423

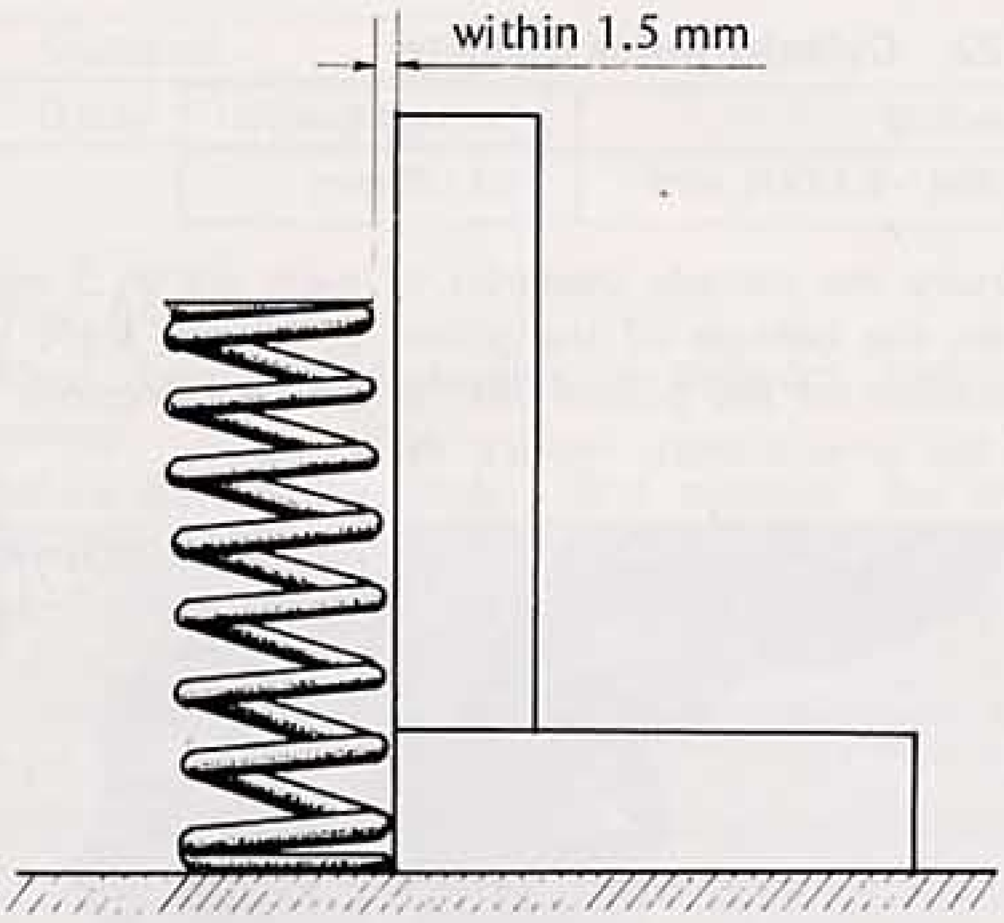


Table 20 Valve Spring Perpendicularity

	Standard	Service Limit
Inner	0.85 mm	1.5 mm
Outer	0.98 mm	1.5 mm

Oil Seals

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

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

CYLINDER BLOCK, PISTONS

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

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

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

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

Proper inspection and maintenance of the cylinder block and the pistons include checking the compression; removing carbon from the piston heads, piston ring grooves, and cylinder head exhaust ports; and checking for wear and proper clearance during top end overhaul. A worn cylinder, worn piston, or worn or stuck piston rings cause a loss of compression from gas blowby pass the rings since the rings will not form a satisfactory seal between the piston and the cylinder wall during compression. This gas blowby will result in difficult starting, power loss, excessive fuel consumption, contaminated engine oil, and possibly engine destruction. Oil leakage into the combustion chambers causes carbon to build up on top of the pistons, resulting in preignition, overheating, and detonation. A worn piston pin causes piston slap, which will result in accelerated piston and cylinder wear.

Engine problems may be caused not only by carbon deposits and wear or damage to the engine itself, but also by poor quality fuel or oil, improper oil, improper fuel/air mixture, improper supply of oil, or incorrect ignition timing. Whenever knocking, pinging, piston slap, or other abnormal engine noise is heard, the cause should be determined as soon as possible. Neglect of proper maintenance will result in reduced engine power and may lead to accelerated wear, overheating, detonation, piston seizure, and engine destruction.

Compression measurement

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

Before measuring compression, check that the cylinder head and cylinder head cover are tightened down with the correct torque (Pg. 38), and thoroughly warm up the engine so that engine oil between the pistons and cylinder walls will help seal compression as it does during normal running. While the engine is running, check that there is no gas leakage from around the cylinder head gasket.

Stop the engine, remove the spark plugs, and push the compression gauge (special tool) firmly into the spark plug hole for the cylinder in which the compression is to be measured such that there will be no leakage. Turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

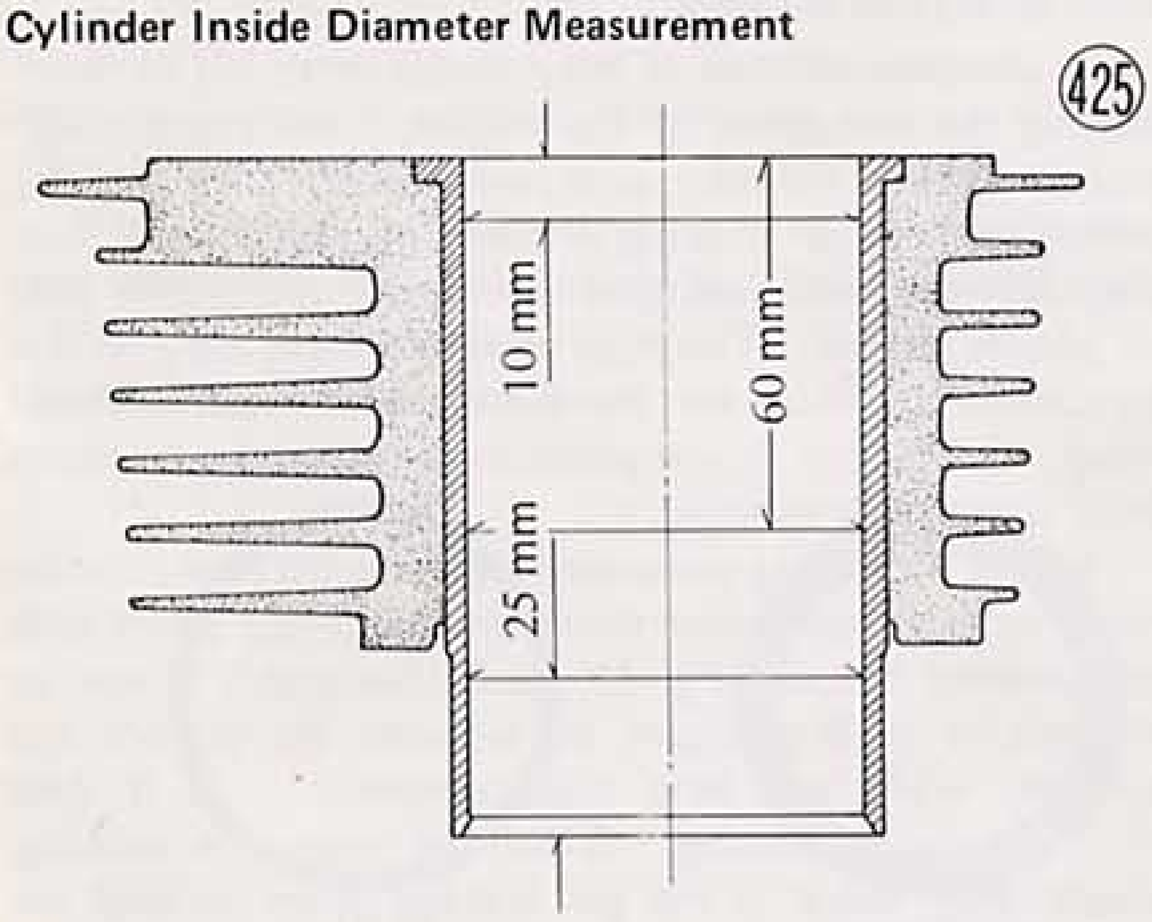
Table 21 Cylinder Compression

Standard	Service Limit
10~11 kg/cm^2 (142~156 psi)	7.5 kg/cm^2 (107 psi) and less than 1 kg/cm^2 (14 psi) difference between the cylinders.

Cylinder, piston wear

Since there is a difference in cylinder wear in different directions, take a side to side and a front to back measurement at each of the 3 locations (total of 6 measurements) shown in Fig. 425. If any of the cylinder inside diameter measurements exceeds the service limit, or if there is a difference of more than 0.05 mm between any two measurements, the cylinder will have to be bored to oversize and then honed. However, if the amount of boring necessary would make the inside diameter greater than 64.98 mm, the cylinder block must be replaced.

Cylinder Inside Diameter Measurement



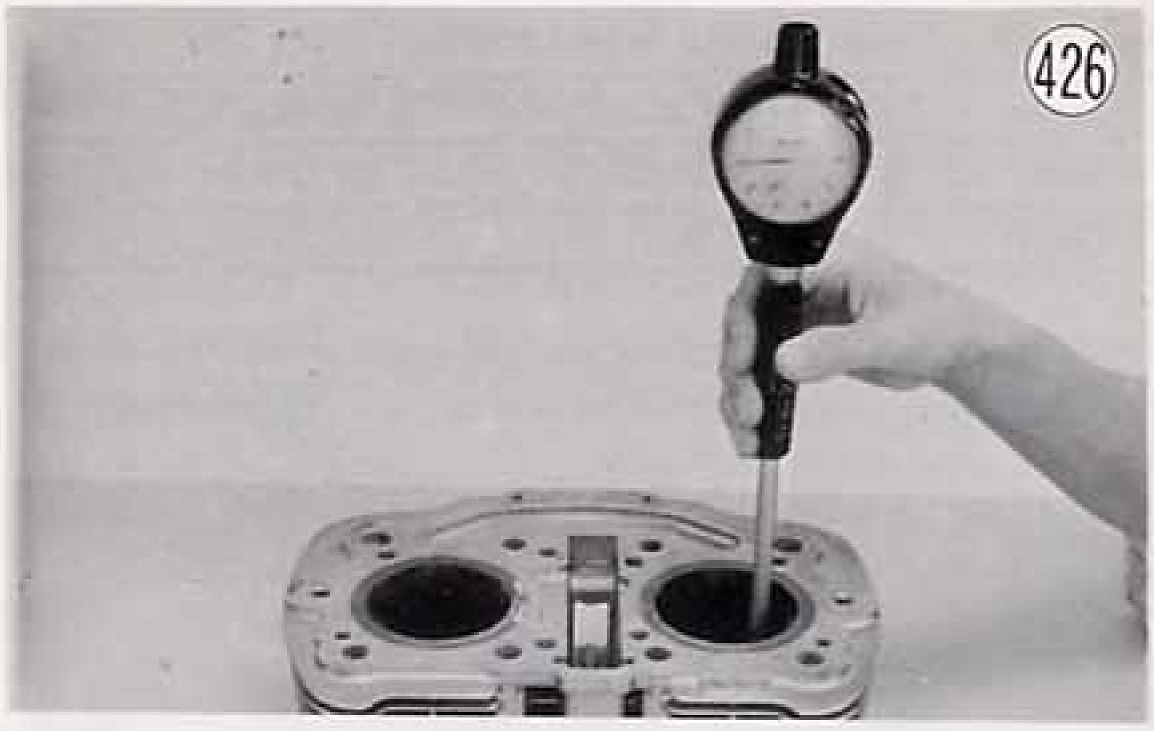
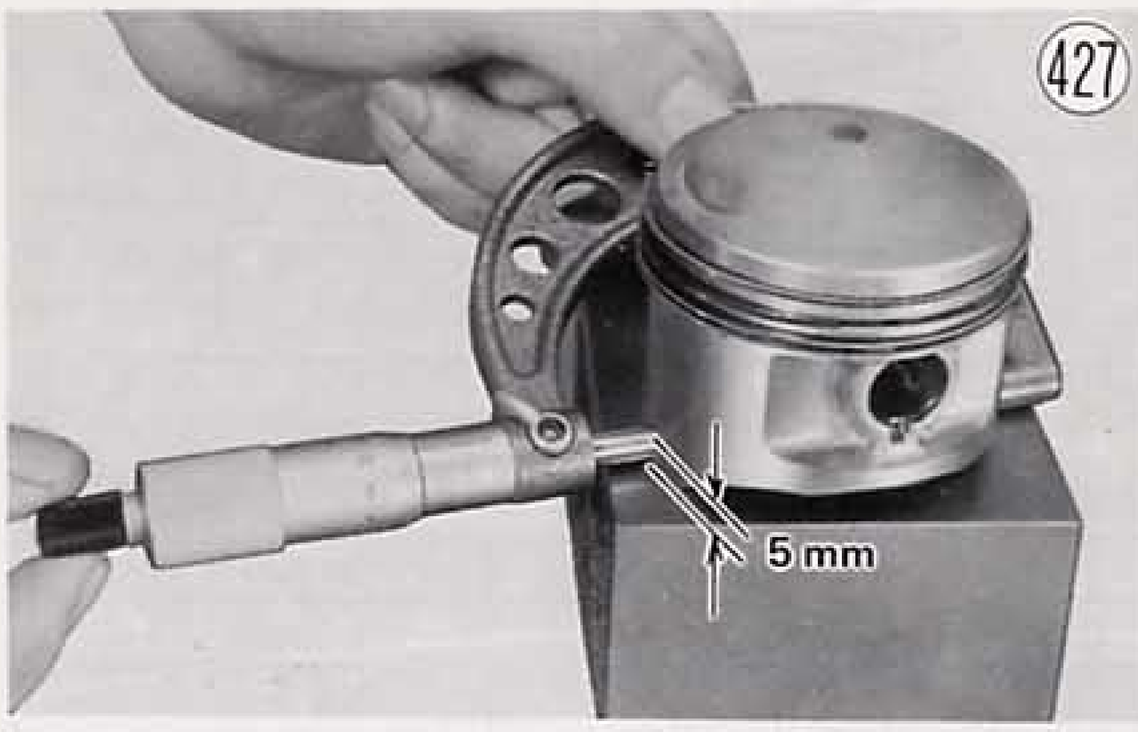


Table 22 Cylinder Inside Diameter

Standard	Service Limit
63.984~64.004 mm	64.08 mm

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



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

Table 23 Piston Diameter

Standard	Service Limit
63.94~63.96 mm	63.8 mm

Table 22 applies only to a cylinder that has not been bored to oversize, and Table 23 applies only to the standard size piston. In the case of a rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus 0.1 mm and the service limit for the piston is the oversize piston original diameter minus 0.15 mm. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.

NOTE: Whenever the piston or cylinder block has been replaced with a new one, the motorcycle must be broken in the same as with a new machine.

Piston/cylinder clearance

The piston to cylinder clearance is measured whenever a piston or the cylinder block is replaced for a new one, or whenever a cylinder is rebored and an oversize piston installed. The standard piston to cylinder clearance must be adhered to whenever the cylinder block is replaced or a cylinder rebored. However, if only a piston is replaced, the clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid piston seizure.

The most accurate way to find the piston clearance is by making separate piston and cylinder diameter measurements and then computing the difference between the two values. Measure the piston diameter as just described, and measure the cylinder diameter at the very bottom of the cylinder.

Table 24 Piston/Cylinder Clearance

Standard
0.034~0.054 mm

Boring, honing

When boring and honing a cylinder, note the following:

1. Before boring a cylinder, first measure the exact diameter of the oversize piston, and then, in accordance with the standard clearance given in Table 23, determine the diameter of the rebore.
2. Cylinder inside diameter must not vary more than 0.01 mm at any point.
3. There are two sizes of oversize pistons available: 0.5 mm and 1.0 mm. Oversize pistons require oversize rings.
4. Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.

Piston/cylinder seizure

Remove the cylinder block and pistons to check the damage. If there is only slight damage, the piston may be smoothed with #400 emery cloth, and any aluminum deposits removed from the cylinder with either #400 emery cloth or light honing. However, in most cases, the cylinder will have to be bored to oversize and honed, and an oversize piston installed.

Piston cleaning

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


428

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


429

Piston ring, piston ring groove wear

Visually inspect the piston rings and the piston ring grooves. If the rings are worn unevenly or damaged, they must be replaced. If the piston ring grooves are worn unevenly or damaged, the piston must be replaced and fitted with new rings.

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

Table 25 Piston Ring Thickness

	Standard	Service Limit
Top ring	1.460~1.475 mm	1.38 mm
Second ring	1.475~1.490 mm	1.40 mm
Oil ring	2.475~2.490 mm	2.40 mm

Table 26 Piston Ring Groove Width

	Standard	Service Limit
Top ring	1.50~1.52 mm	1.60 mm
Second ring	1.50~1.52 mm	1.60 mm
Oil ring	2.50~2.52 mm	2.60 mm

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

With the piston rings fitted into place on the piston, make several clearance measurements around the grooves using a thickness gauge.

Table 27 Piston Ring/Groove Clearance

	Standard	Service Limit
Top ring	0.025~0.060 mm	0.160 mm
Second ring Oil ring	0.010~0.045 mm	0.145 mm

Piston ring end gap

Place the piston ring being checked inside the cylinder using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low. Measure the gap between the ends of the ring with a thickness gauge. If the gap is wider than the service limit, the ring is overworn and must be replaced.

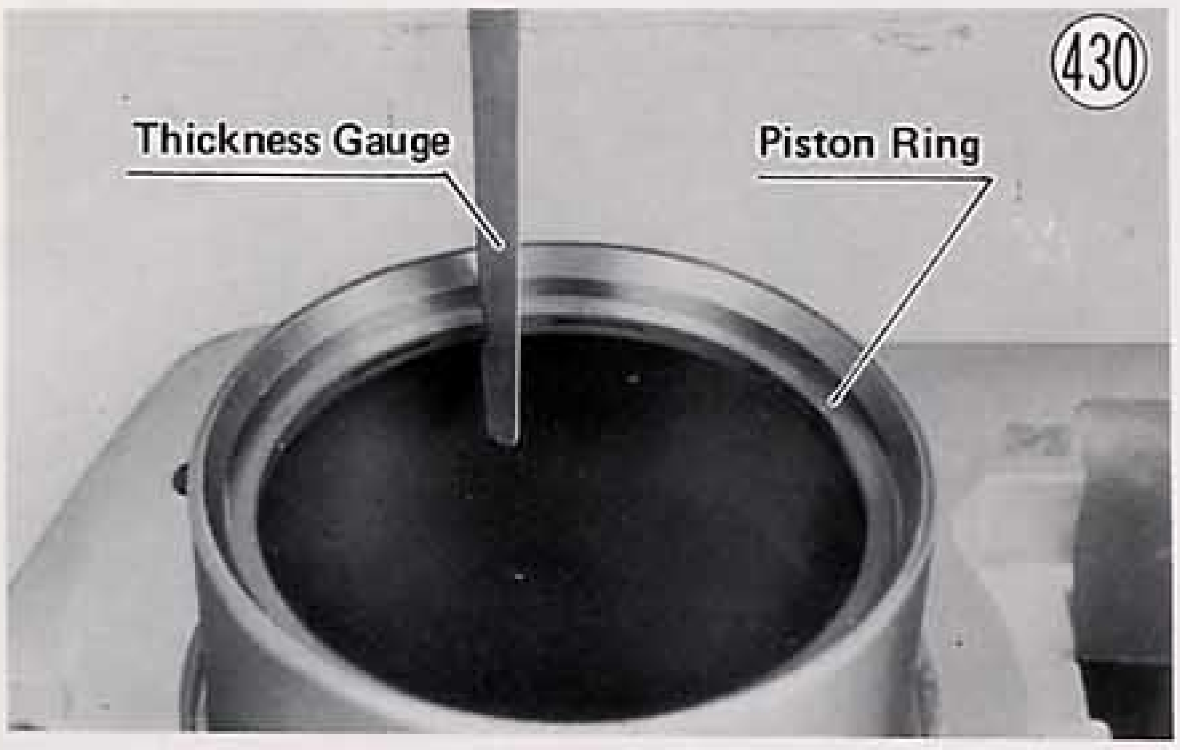


Table 28 Ring End Gap

Standard	Service Limit
0.2~0.4 mm	0.7 mm

Piston, piston pin, connecting rod wear

Measure the diameter of the piston pin with a micrometer, and measure the inside diameter of both piston pin holes in the piston. If the piston pin diameter is less than the service limit at any point, replace the piston pin. If either piston pin hole diameter exceeds the service limit, replace the piston.

Measure the inside diameter of the con-rod small end. If the diameter exceeds the service limit, replace the connecting rod.

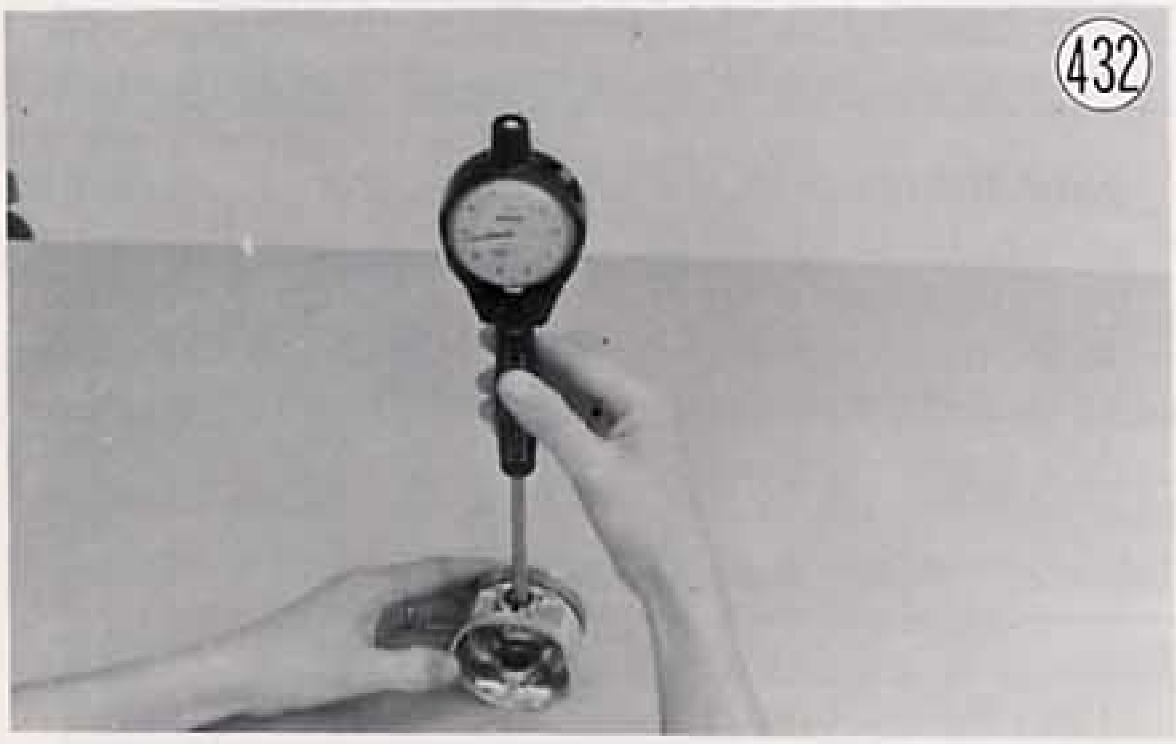


Table 30 Piston Pin, Piston Pin Hole, Small End Dia.

	Standard	Service Limit
Piston pin	14.994~15.000 mm	14.96 mm
Piston pin hole	15.004~15.011 mm	15.08 mm
Small end I.D.	15.003~15.014 mm	15.05 mm

NOTE: When a new piston or pin is used, also check that piston to pin clearance is 0.006 ~ 0.013 mm, and that pin to small end clearance is within 0.003 ~ 0.020 mm.

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

CRANKSHAFT, CONNECTING RODS

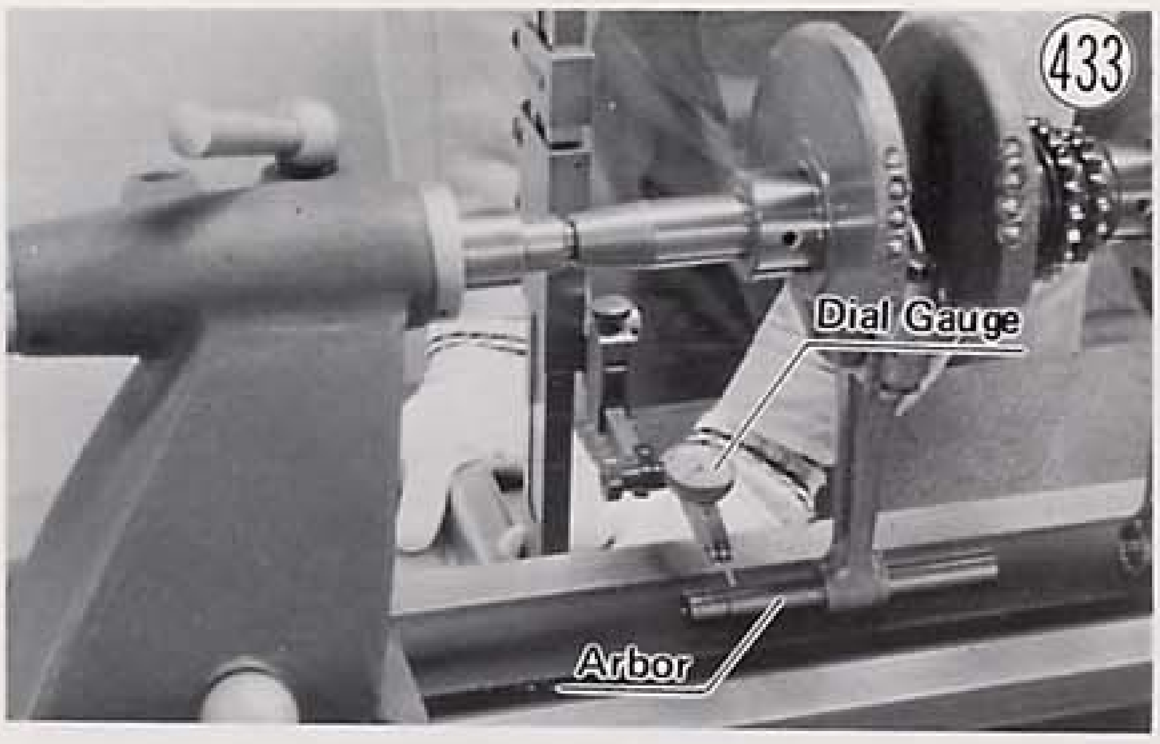
The crankshaft is the part that changes the reciprocating motion of the pistons into rotating motion, which is transmitted to the rear wheel when the clutch is engaged. The connecting rods are the parts that connect the pistons to the crankshaft. Crankshaft or connecting rod trouble, such as worn crankshaft journals or a bent connecting rod, will multiply the stress caused by the intermittent force on the pistons, and will result in not only rapid crankshaft bushing wear, but also noise, power loss, vibration, and a shortened egnine life. A defective crankshaft or connecting rod should always be detected at an early stage and then replaced immediately.

The following explanation concerns the most common crankshaft and connecting rod problems, giving the procedure for detecting damage and measuring wear and runout.

Connecting rod bend, twist

Set the crankshaft in a flywheel alignment jig or on **V** blocks on a surface plate. Select an arbor of the same diameter as the piston pin and of optional length, and insert it through the small end of the connecting rod.

Using a height gauge or dial gauge, measure the difference in the height of the rod above the surface plate over a 100 mm length to determine the amount the connecting rod is bent.



Using the arrangement shown in Fig. 434, measure the amount that the arbor varies from being parallel with the crankshaft over a 100 mm length of the arbor to determine the amount the connecting rod is twisted.

If either of these measurements exceeds the service limit, replace the connecting rod.

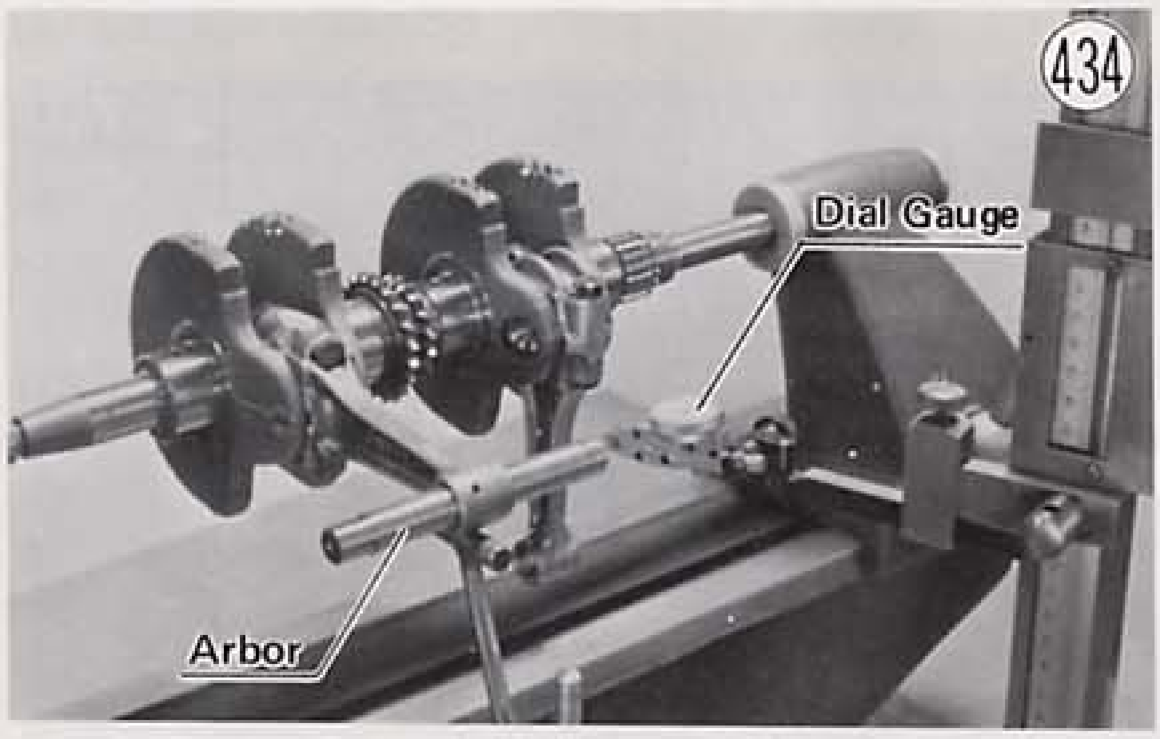


***Table 30 Connecting Rod Bend, Twist**

	Standard	Service Limit
Bend	under 0.10/100 mm	0.2 mm
Twist	under 0.15/100 mm	0.2 mm

Connecting rod bushing/journal wear

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

Remove the connecting rods, cut strips of plastigauge to bushing width, and place a strip on the connecting rod bushing half on each connecting rod parallel to the crankshaft and so that the plastigauge will be compressed between the bushing and the connecting rod journal. Replace the connecting rods, tightening the nuts with the specified torque (Pg. 71).

Remove the connecting rod, and measure the plastigauge width to determine the bushing/journal wear.

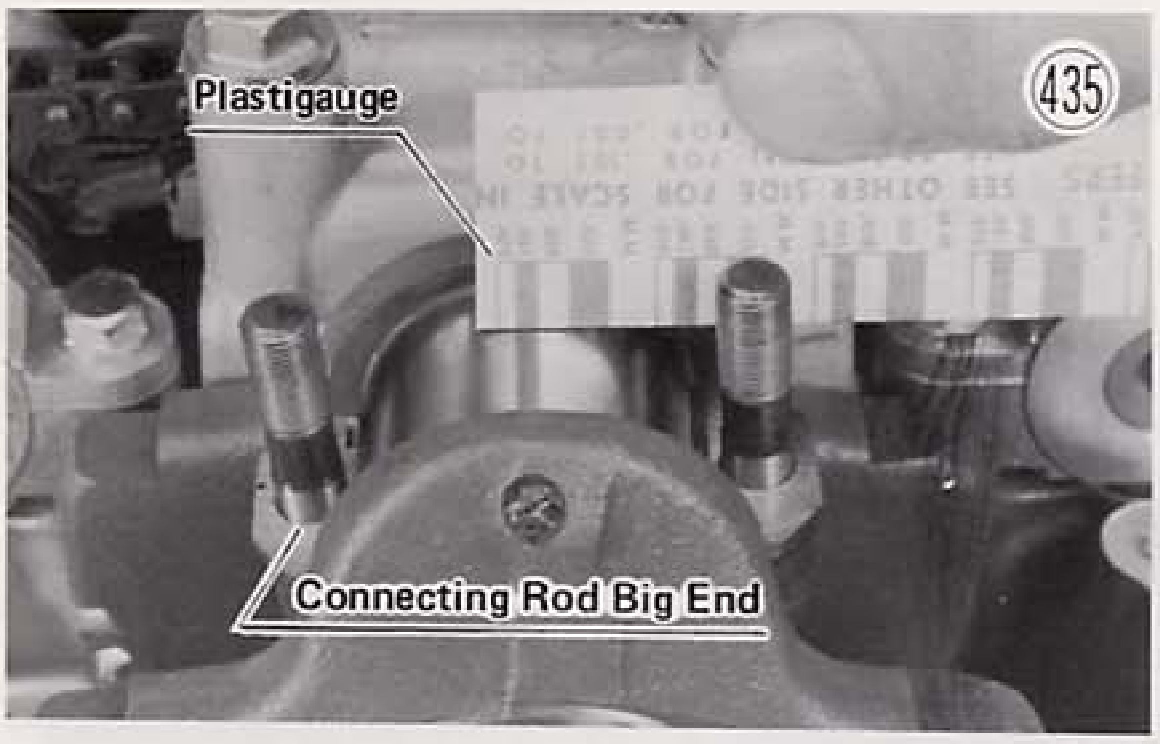


Table 32 Connecting Rod Bushing/Journal Clearance

Standard	Service Limit
0.041~0.071 mm	0.1 mm

If the clearance has gone beyond the service limit, replace the bushings as follows.

First measure with a micrometer the diameter of the crankshaft journals on which the connecting rod fit. Mark each flywheel in accordance with the journal diameter (Table 33).

NOTE: Any mark already on the flywheel should not be referred to during servicing.

Table 33 Connecting Rod Journal O.D./Connecting Rod I.D.

Marking	Journal	Connecting Rod
No mark	35.984~35.994 mm	39.000~39.010 mm
1	35.994~36.000 mm	39.010~39.016 mm

Table 34 Bushing Thickness

Color Coding	Thickness
Blue	1.485~1.490 mm
Black	1.480~1.485 mm
Brown	1.475~1.480 mm

Select the right bushing in accordance with the combination of the connecting rod and crankshaft coding (Table 1).

Connecting rod side clearance

Measure the side clearance of the connecting rod with a thickness gauge as shown. Replace the crankshaft and the connecting rod if the clearance exceeds the service limit.

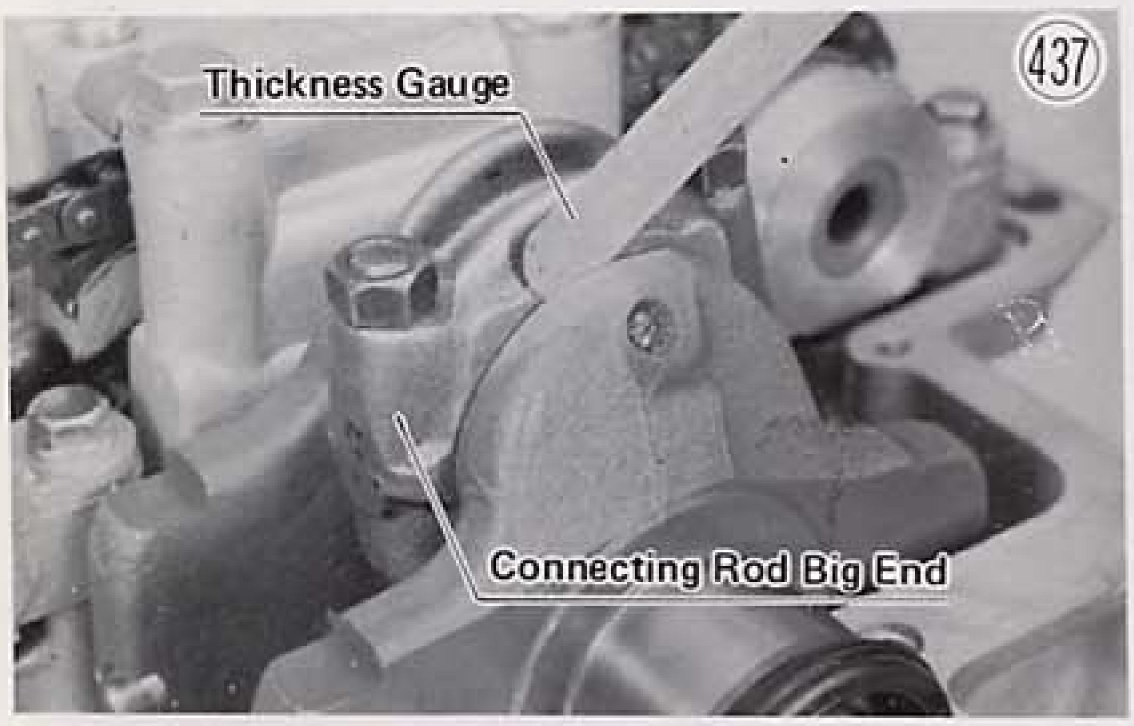


Table 35 Connecting Rod Big End Side Clearance

Standard	Service Limit
0.15~0.25 mm	0.45 mm

Crankshaft runout

Set the crankshaft in a flywheel alignment jig or on V blocks, and place a dial gauge to the points indicated. Turn the crankshaft slowly. The maximum difference in gauge readings is the crankshaft runout.

If the runout exceeds the service limit, replace the crankshaft.

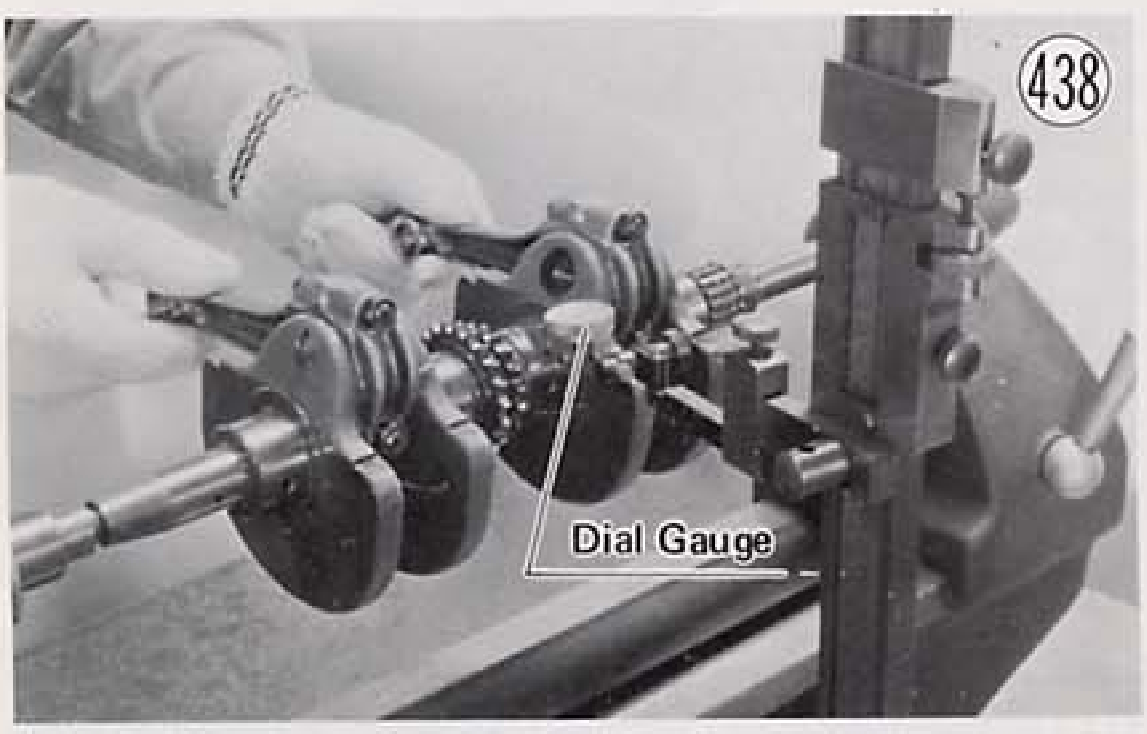


Table 36 Crankshaft Runout

Standard	Service Limit
under 0.02 mm	0.05 mm

Crankshaft bushing/journal wear

Remove the crankshaft, cut strips of plastigauge to bushing width, and place a strip on the half of each bushing parallel to the crankshaft and so that the plastigauge will be compressed between the bushing and the crankshaft journal. Install the crankshaft, crankshaft bushing cap, and the lower crankcase half in such a way that the crankshaft does not turn, tightening the bolts in the correct sequence with the specified amount of torque (Pgs. 59, 66).

Remove the crankshaft (making sure that the crankshaft does not turn at any time), and measure the plastigauge width to determine the bushing/journal wear. If either clearance exceeds the service limit, replace all eight bushing halves.

Table 37 Crankshaft Bushing/Journal Clearance

Standard	Service Limit
0.036~0.078 mm	0.11 mm

Measure the journals which wear on these bushings. If the micrometer reading is less than the service limit, replace the crankshaft.

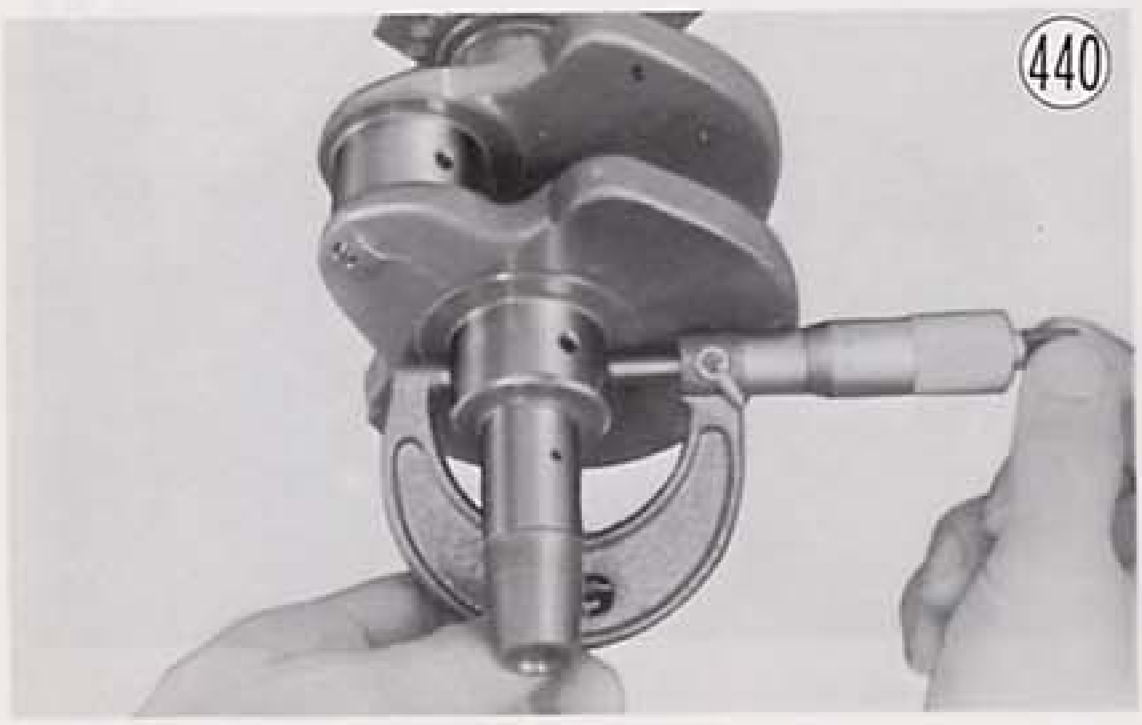


***Table 38 Crankshaft Journal (Not Con-Rod) Diameter**

Standard	Service Limit
35.984~36.000 mm	35.96 mm

Set the crankshaft back in place on the upper crankcase half. Replace the crankshaft bushing cap with the arrow pointing to the front, tightening the bolts in the correct sequence with the correct amount of torque (Pg. 66).

Measure the crankshaft thrust clearance with a thickness gauge as shown. Replace the crankshaft bushing cap and crankcase halves as a set if the clearance exceeds the service limit.

NOTES:

1. The reason that the bushing cap and the crankcase halves must be replaced together as a set, is that they are machined at the factory in the assembled state to ensure that the bushing cap will be aligned perfectly with the crankcase. A new bushing cap will **not** fit the old crankcase.
2. Measure the clearance between the crankshaft bushing cap and the center portion of the crankshaft flywheel, flowing the steps in Fig. 441.

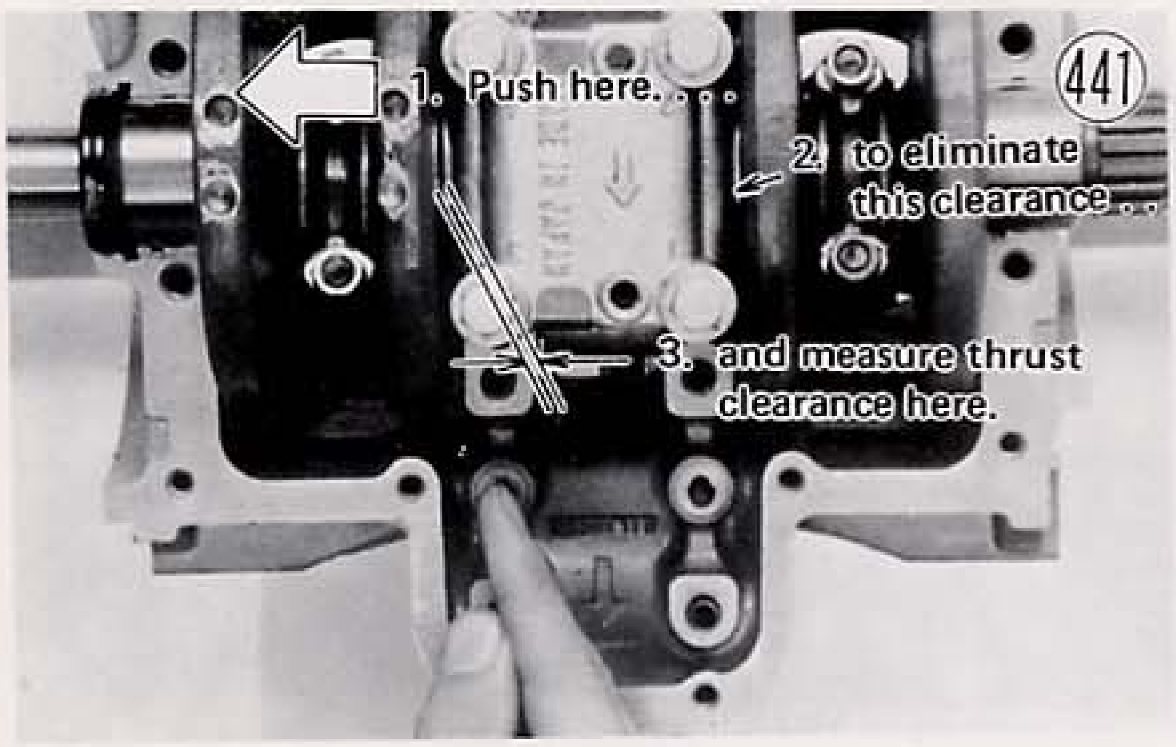


Table 39 Crankshaft Thrust Clearance

Standard	Service Limit
0.10~0.20 mm	0.45 mm

Oil passage cleaning

There is an oil passage running between the crankshaft journals on each side. Use compressed air to remove any foreign particles or residue that may have accummulated in these passages.

BALANCER MECHANISM

The balancer mechanism basically consists of two weights, which are chain-driven by the crankshaft. The following explanation covers how this mechanism reduce vibration.

The vibration on a 4-stroke, 2-cylinder engine is generally greater with larger engine displacement. This vibration is natural due to the mechanics of a reciprocating engine, but the proper addition of counterweights on the crankshaft can reduce this vibration. However, troublesome vibration remains unless some additional measure is taken.

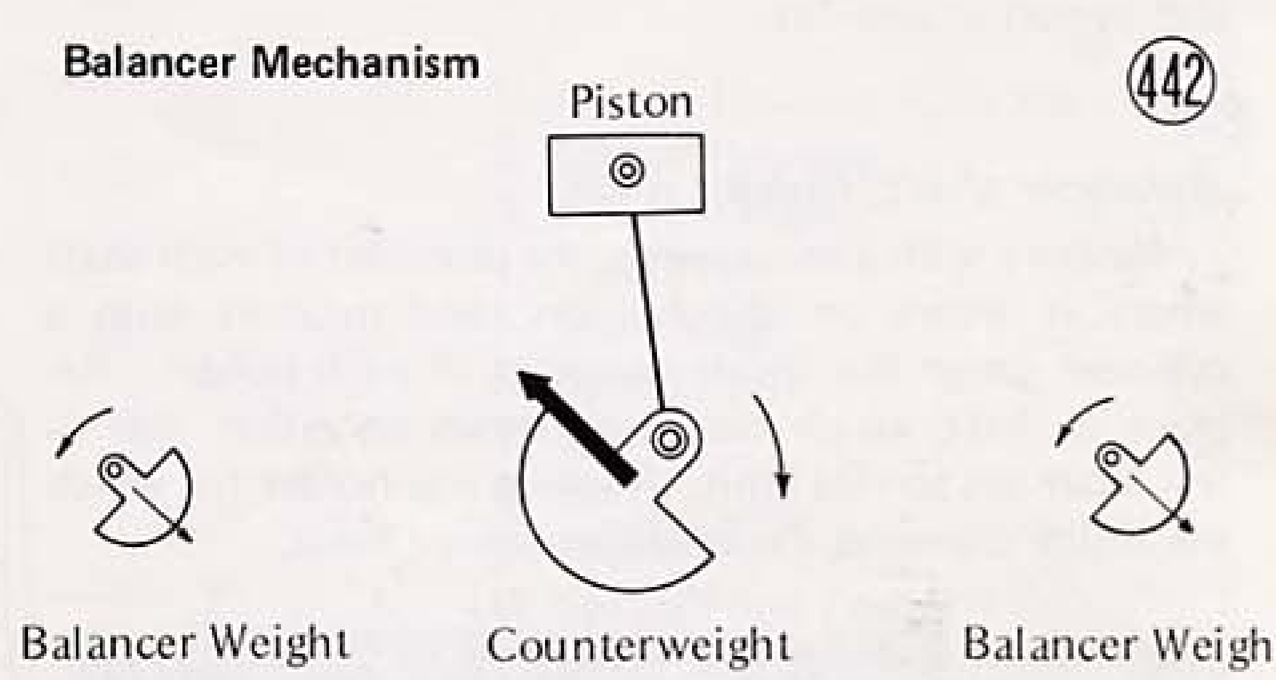
Fig. 443 shows the internal engine forces when the centrifugal force of the counterweights is one half the inertial force of the pistons. The arrows show the amount and direction of these forces.

As the crankshaft rotates clockwise, 1~5 in Fig. 443, one half of the inertial force of the pistons is negated by the vertical component of the centrifugal force of the counterweights. However, the horizontal component of the centrifugal force of the counterweights (brought about by having counterweights) is not negated by anything. The thick arrows indicate the resulting unbalanced force, which is the main cause of engine vibration.

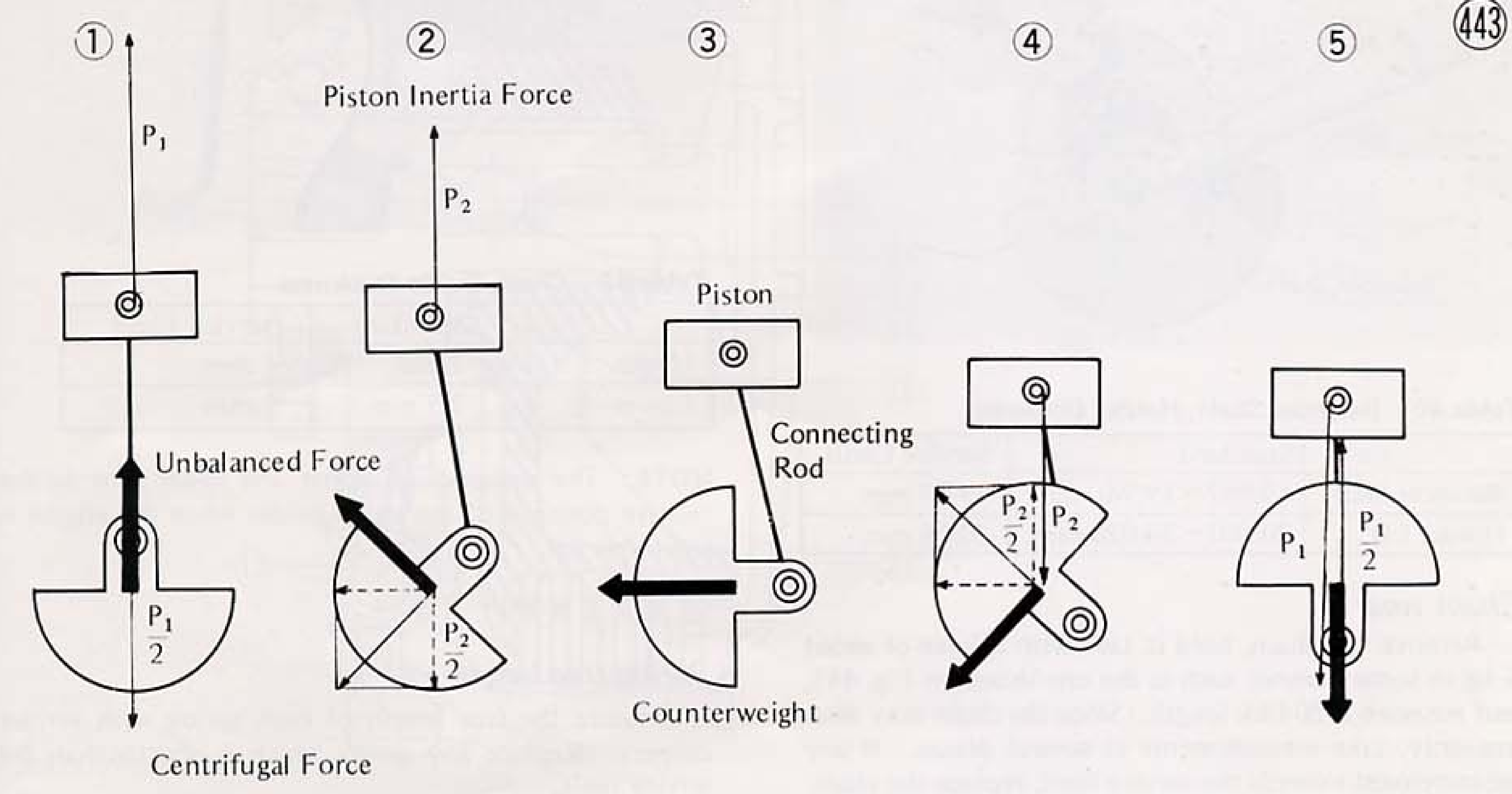
The balancer mechanism includes two balancing weights having one half the centrifugal force of the counterweights. A balancing weight is installed at an equal distance on both sides of the crankshaft for rotation by a chain in such a way that the weights rotate in the direction opposite to the crankshaft counterweights.

Fig. 442 shows how this mechanism works at one crankshaft position. The centrifugal force of the balancer weights exert a pull on the engine to the lower right as the arrows in the figure show. On the other hand,

Balancer Mechanism



Vibration Reduction with Crankshaft Counterweights only



the crankshaft counterweights are exerting a pull on the engine to the upper left. The centrifugal force due to the two balancer weights equals the unbalanced force which results when only the crankshaft counterweights are installed, but the forces cancel each other since the directions of these forces are opposite. With the forces cancelled, engine vibration is greatly reduced. At other crankshaft positions as well, these two forces are equal and opposing such that they cancel each other, keeping the system always in balance.

The balancer weights, turning at the same rpm as the crankshaft, are chain-driven by a sprocket which is part of the crankshaft. The balancer chain is an endless-type for maximum durability and wears very slowly due to its ample lubrication. The chain drives the weights through a sprocket on each side of the mechanism. Each sprocket has four springs, which are wedged between the sprocket and the weights to protect the sprocket and chain from the severe torque during the combustion stroke. In the center of each spring is a pin, which prevents damage to the spring from excessive compression.

If balancer mechanism trouble develops, such as excessive shaft or chain wear, not only are the bearings and crankcase parts affected but the resulting power loss and engine vibration may adversely affect performance and overall engine life.

Balancer shaft, holder wear

Measure with a micrometer the diameter of each shaft where it wears on the holders, and measure with a cylinder gauge the inside diameter of each holder. Replace a shaft which has worn down on either side to less than the service limit. Replace any holder for which the inside diameter exceeds the service limit.

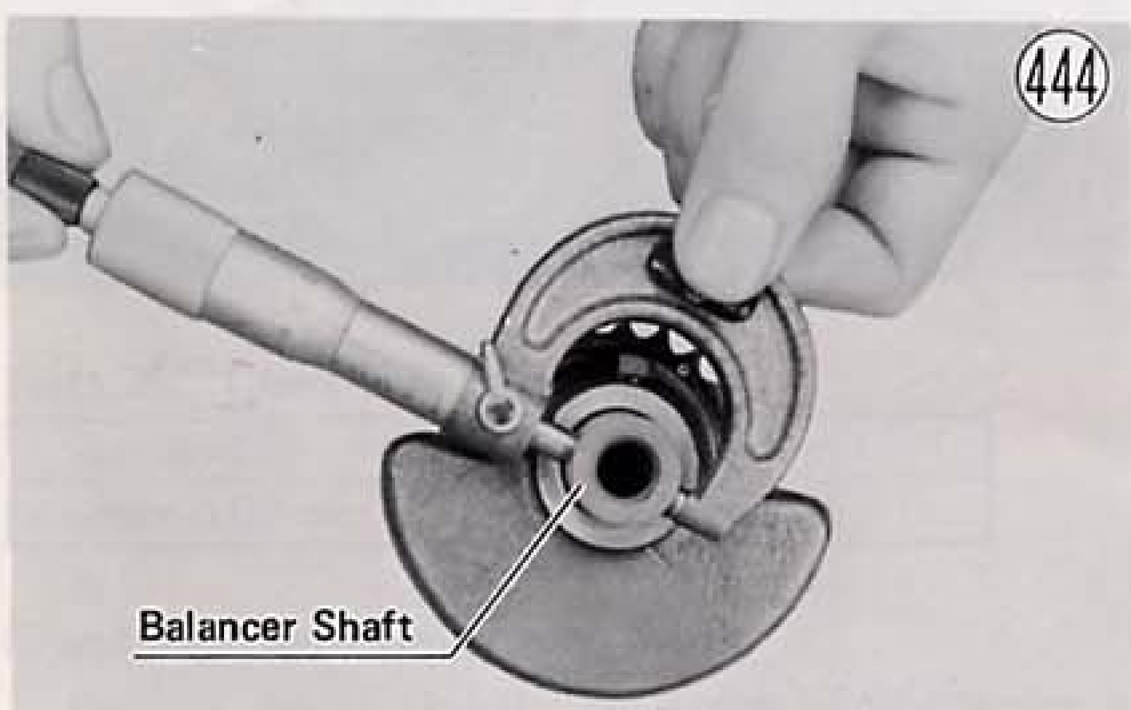
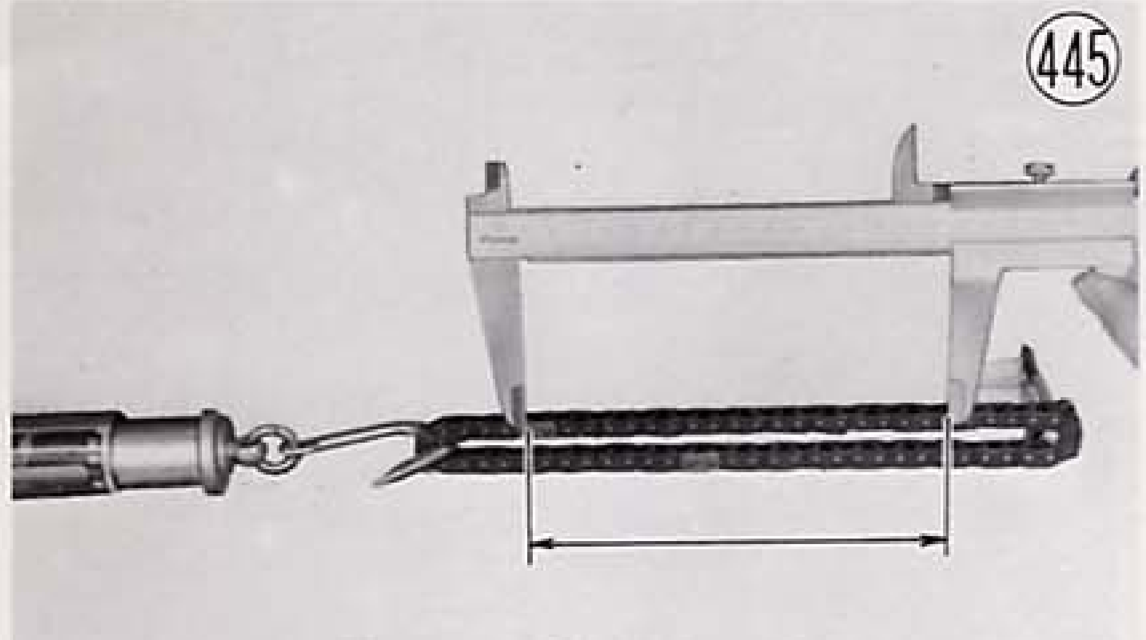


Table 40 Balancer Shaft, Holder Diameter

	Standard	Service Limit
Balancer Shaft	19.967~19.980 mm	19.93 mm
Holder I.D.	20.007~20.028 mm	20.08 mm

Chain wear

Remove the chain, hold it taut with a force of about 5 kg in some manner such as the one shown in Fig. 445, and measure a 20-link length. Since the chain may wear unevenly, take measurements at several places. If any measurement exceeds the service limit, replace the chain.



Measure a 20-link length.

Table 41 Balancer Chain Length

Standard	Service Limit
160 mm	162.4 mm

When replacing a chain for a new one, inspect all the sprockets. If either of the balancer mechanism sprockets is damaged or overly worn, replace it. If the crankshaft sprocket is damaged or overly worn, replace the crankshaft.

NOTE: If the crankshaft is replaced, select the right bushing in accordance with the combination of the connecting rod and the crankshaft marks (Pg. 71).

Chain guide wear

Visually inspect the rubber part of each chain guide. If it is worn down or damaged, replace the guide.

Measure the thickness with a ruler. If the wear has exceeded the service limit, replace the guide.

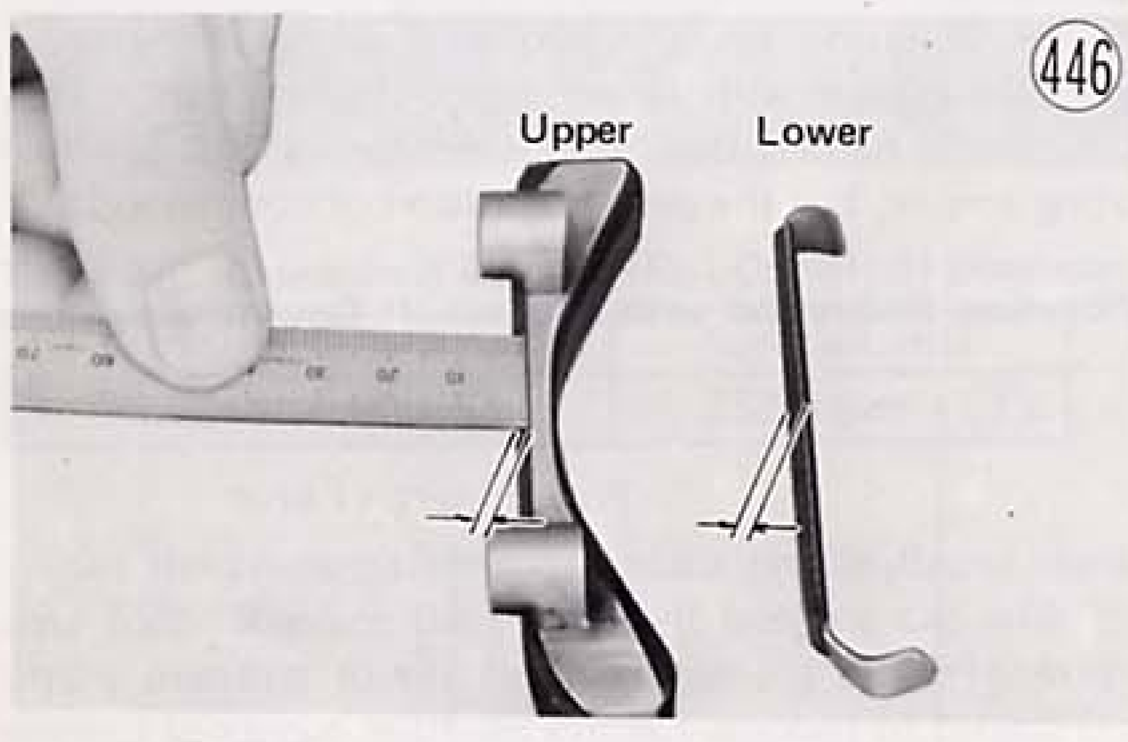


Table 42 Chain Guide Thickness

	Standard	Service Limit
Upper	2 mm	1 mm
Lower	2.5 mm	1 mm

NOTE: The designations upper and lower refer to the relative position of the chain guides when the engine is right side up.

Spring free length

Measure the free length of each spring with vernier calipers. Replace any spring which is shorter than the service limit.

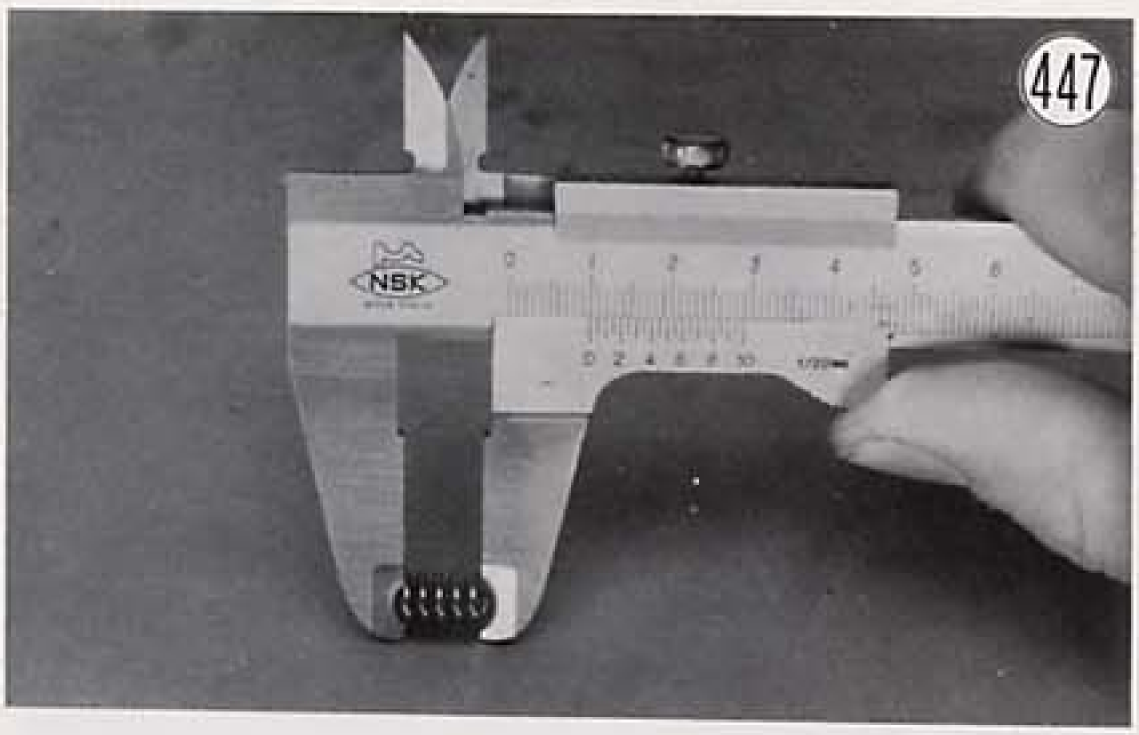


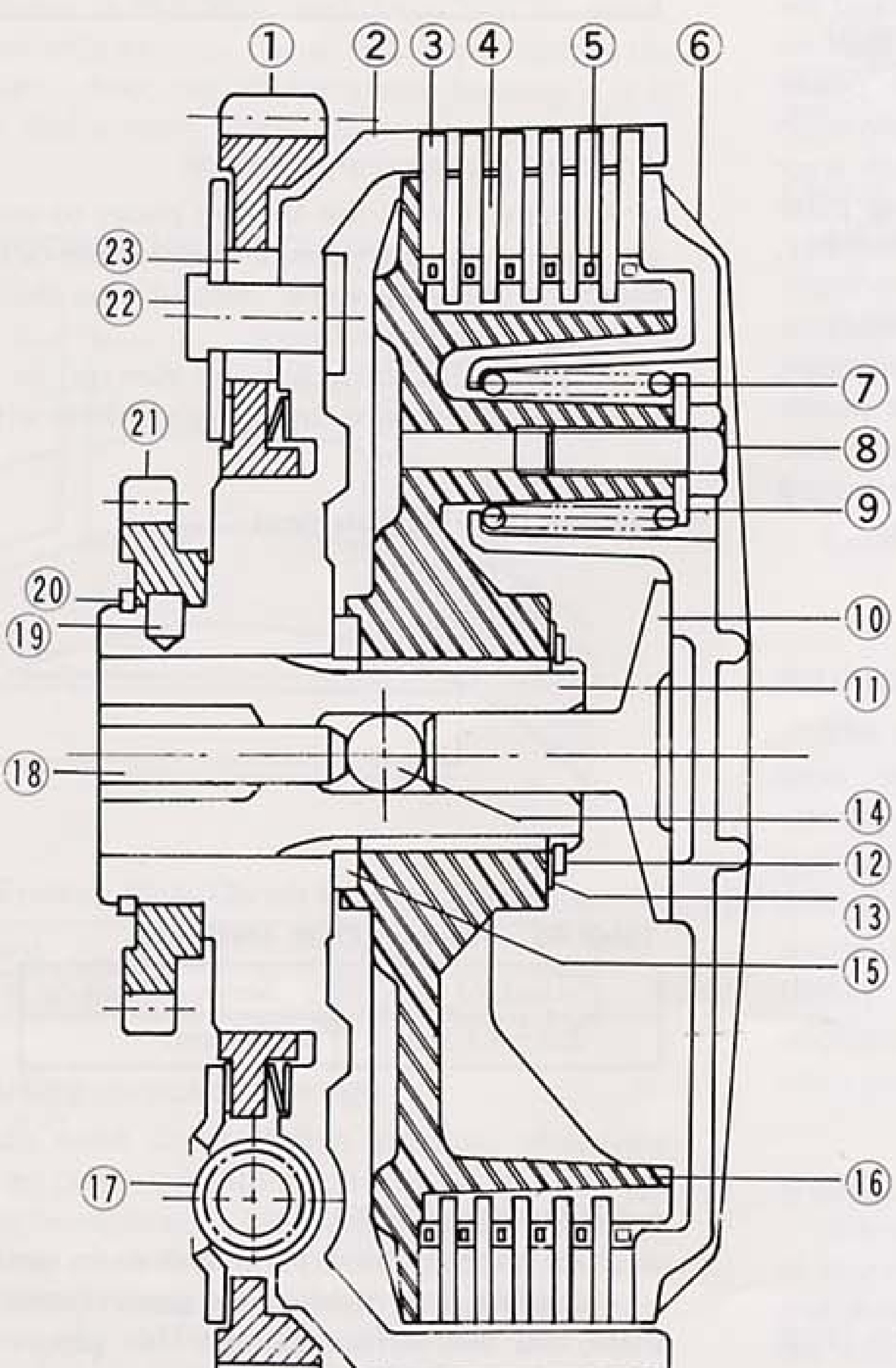
Table 43 Spring Free Length

Standard	Service Limit
9.8~10.4 mm	9 mm

CLUTCH

Fig. 449 shows the construction of the clutch, which is a wet, multi-plate type with 6 friction plates ③, 5 steel plates ④, and 6 steel rings ⑤. The friction plates are made of cork, used for its high coefficient of friction, bonded on a steel core, which provides durability and warp resistance. The clutch housing ② has a reduction sprocket on one side and contains springs to absorb shock from the drive train.

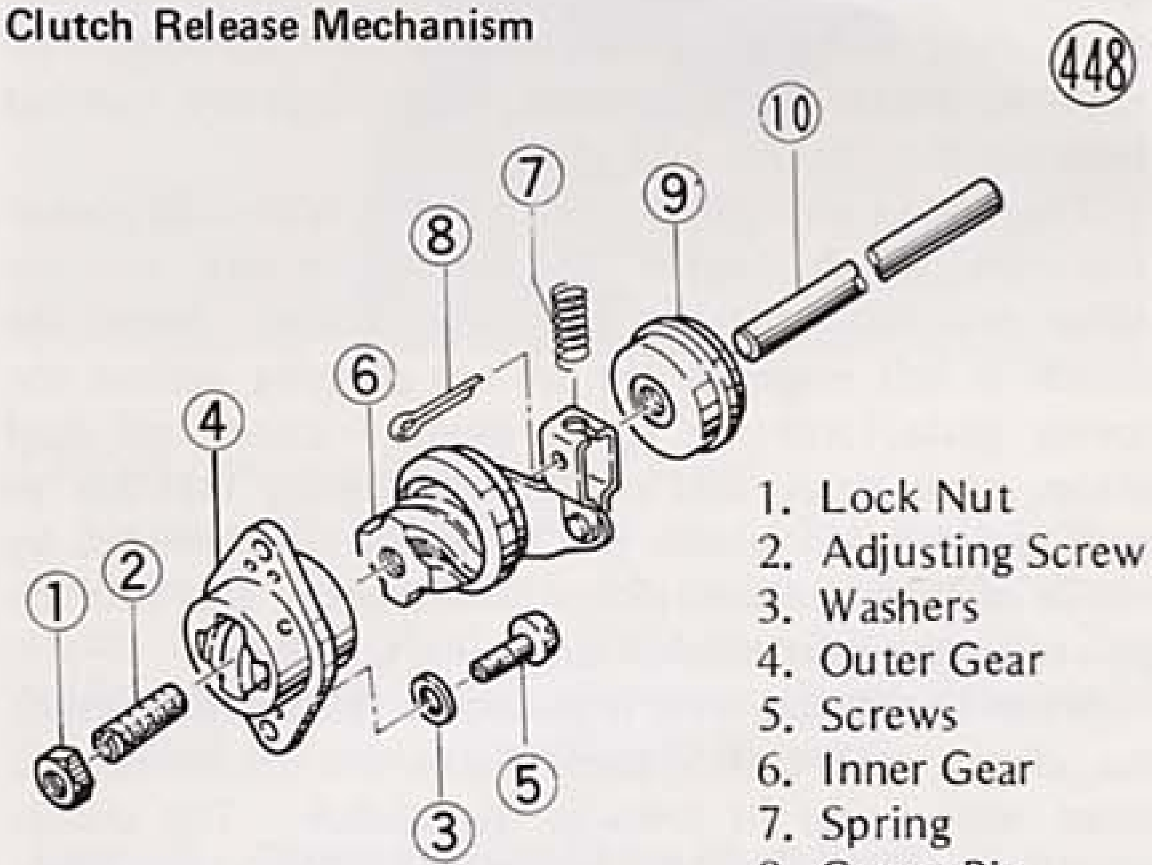
Clutch



1. Clutch Housing Sprocket
2. Clutch Housing
3. Friction Plate
4. Steel Plate
5. Steel Ring
6. Spring Plate
7. Spring
8. Bolt
9. Washer
10. Spring Plate Pusher
11. Drive Shaft
12. Circlip
13. Shim(s)
14. Steel Ball
15. Thrust Washer
16. Clutch Hub
17. Shock Damper Spring
18. Push Rod
19. Pin
20. Circlip
21. Oil Pump Drive Gear
22. Rivet
23. Collar

The clutch release mechanism is shown in Fig. 448. The clutch release outer worm gear is made of nylon and the inner one of steel. Assembled into the center of the release inner gear is the clutch adjusting screw, which pushes on the push rod and steel ball inside the drive shaft to release the clutch.

Clutch Release Mechanism



1. Lock Nut
2. Adjusting Screw
3. Washers
4. Outer Gear
5. Screws
6. Inner Gear
7. Spring
8. Cotter Pin
9. Oil Seal
10. Push Rod

The friction plates are connected to the clutch housing by tangs on the outer circumference of each plate, and, since the clutch housing is chain driven directly by a sprocket on the crankshaft, these plates are always turning any time the engine is running. The steel plates have a toothed inner circumference, which meshes with the splines in the clutch hub on the drive shaft so that the drive shaft and steel plates always turn together. To improve clutch disengagement, steels rings are inserted between the friction and steel plates.

One end of each clutch spring forces against its washer and bolt, which threads into the clutch hub, and the other end forces against the spring plate. When the clutch is left engaged, the springs pressing against the spring plate force the spring plate, friction and steel plates, steel rings, and clutch hub tightly together so that the friction plates will drive the steel plates by virtue of their mutual friction and thereby transmit the power to the transmission drive shaft.

When the clutch lever is pulled to release (disengage) the clutch, the clutch cable turns the clutch release inner worm gear in towards the clutch. The clutch adjusting screw, assembled inside the clutch release inner worm gear, then pushes the push rod, which through the steel ball and spring plate pusher pushes the spring plate. Since the spring plate moves the same distance that the inner worm gear moves and the clutch hub remains stationary, the springs are compressed and the spring pressure is taken off the clutch plates. Because the plates are no longer pressed together, the power transmission from the crankshaft to the transmission drive shaft is interrupted. However, as the clutch lever is released, the clutch springs return the spring plate and once again force the spring plate, plate assembly, and clutch hub tightly together.

A clutch that does not properly disengage will cause shifting difficulty and possible transmission damage. On the other hand, a slipping clutch will reduce power transmission efficiency and may overheat and burn out. A clutch that does not properly disengage may be caused by:

1. Excessive clutch lever play.
2. Clutch plates that are warped or too rough.
3. Uneven clutch spring tension.
4. Deteriorated engine oil.
5. Engine oil of too high a viscosity.
6. The clutch housing frozen on the drive shaft.
7. A defective clutch release mechanism.
8. Broken or missing steel rings.
9. An unevenly worn clutch hub or housing.

A slipping clutch may be caused by:

1. No clutch lever play.
2. Worn friction plates.
3. Weak clutch springs.
4. The clutch cable not sliding smoothly.
5. A defective clutch release mechanism.
6. An unevenly worn clutch hub or housing.

Clutch noise may be caused by:

1. Excessively worn primary chain and sprockets.
2. Damaged sprocket teeth.
3. Too much clearance between the friction plate tangs and the clutch housing.
4. Weak or damaged shock absorber spring(s).

Clutch spring tension

Clutch springs that have become weak will not return to their original length when disassembled from the clutch. Their condition can thereby be determined by measuring the free length with vernier calipers.

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

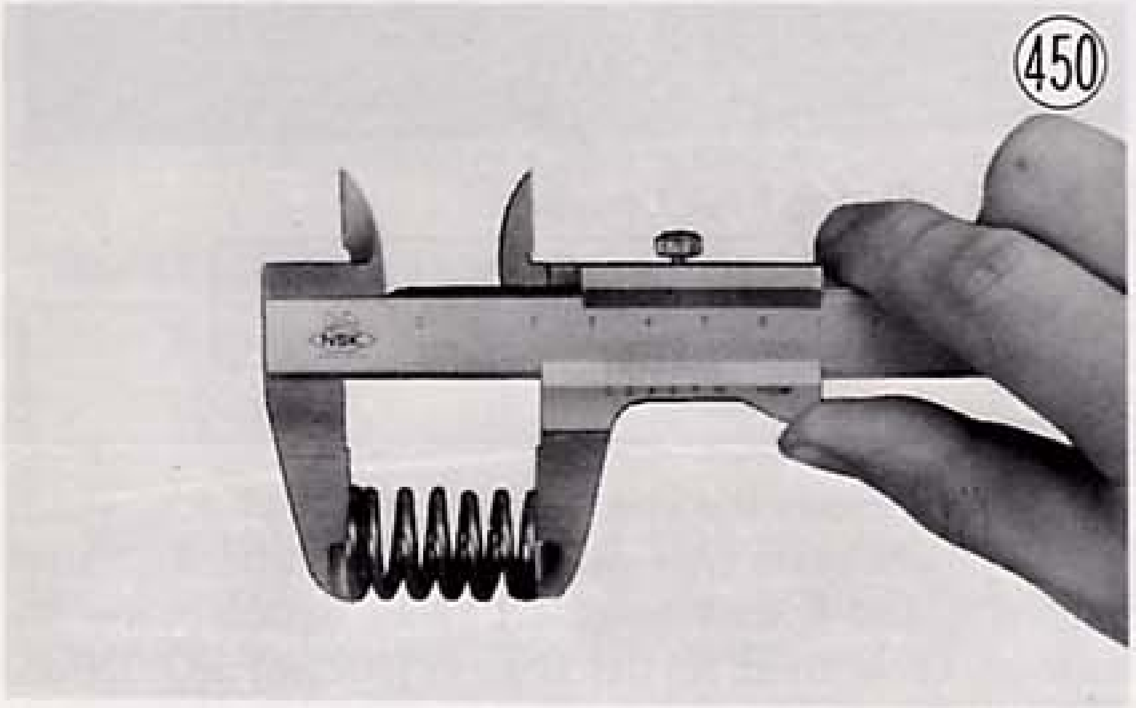

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Table 44 Clutch Spring Free Length

Standard	Service Limit
33.8 mm	32.3 mm

Friction plate wear, damage

Visually inspect the friction plates to see whether or not they show any signs of heat seizure or have become rough or unevenly worn. Measure the thickness of the plates with vernier calipers.

If any plates show signs of damage, or if they have worn past the service limit, replace them with new ones.

Friction Plate Measurement

451

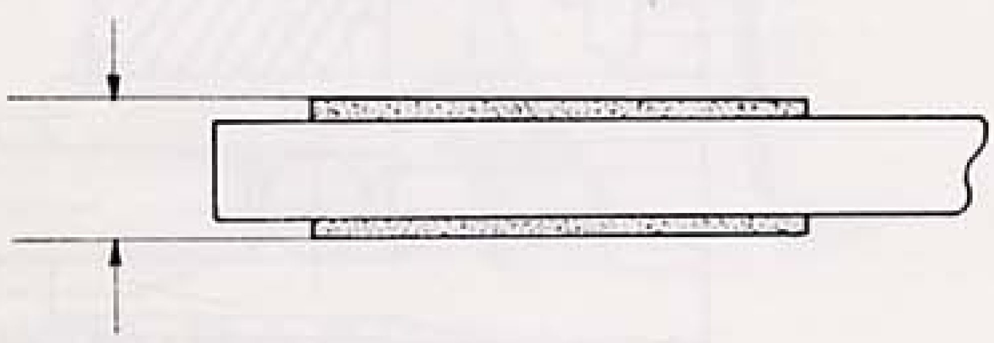


Table 45 Friction Plate Thickness

Standard	Service Limit
2.9~3.1 mm	2.5 mm

Clutch plate warp

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

Replace any plates warped over the service limit.

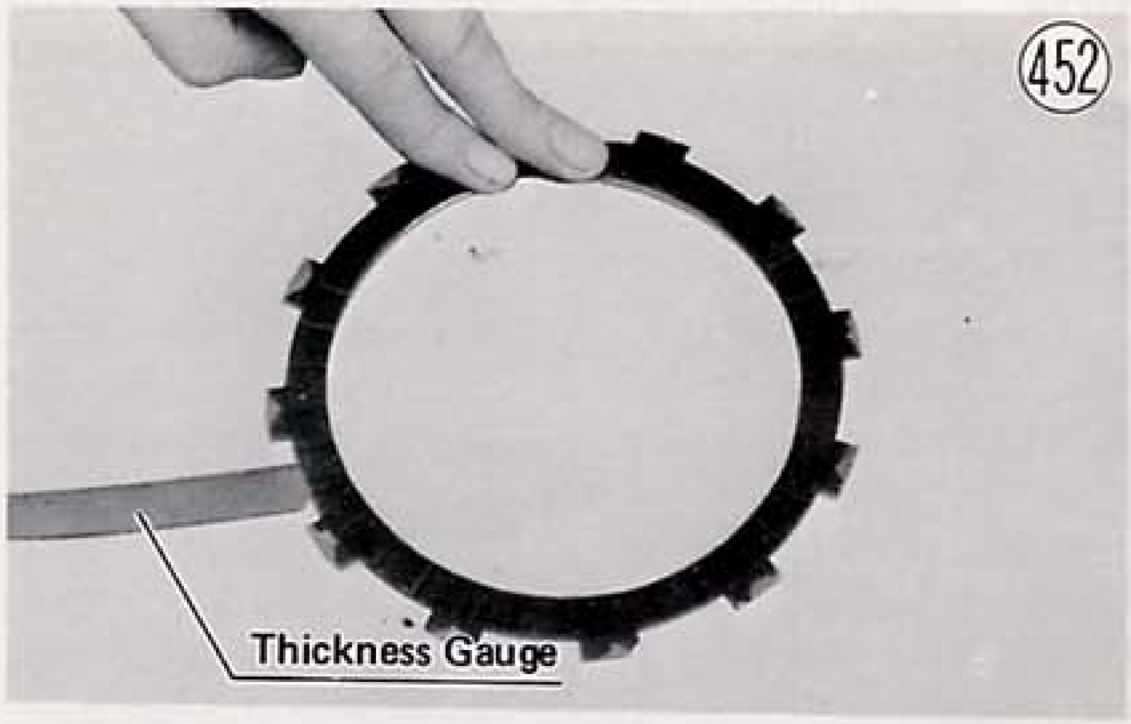


Table 46 Clutch Plate Warp

	Standard	Service Limit
Friction Plate	under 0.15 mm	0.30 mm
Steel Plate	under 0.20 mm	0.40 mm

Steel ring damage

Visually inspect the steel rings. Replace any which are bent, broken, or otherwise damaged.

Friction plate/clutch housing clearance

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

If the clearance exceeds the service limit, replace the friction plates. Also, replace the clutch housing if it is unevenly or badly worn where the friction plates wear against it.

Friction Plate/Clutch Housing Clearance

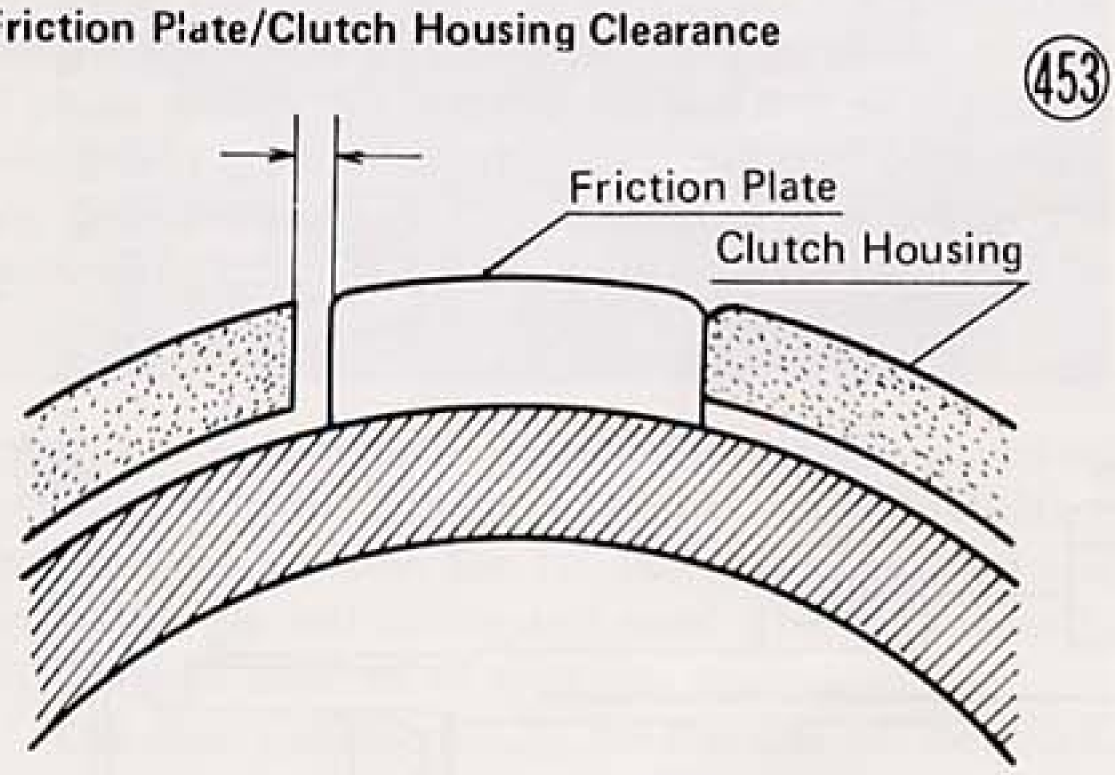
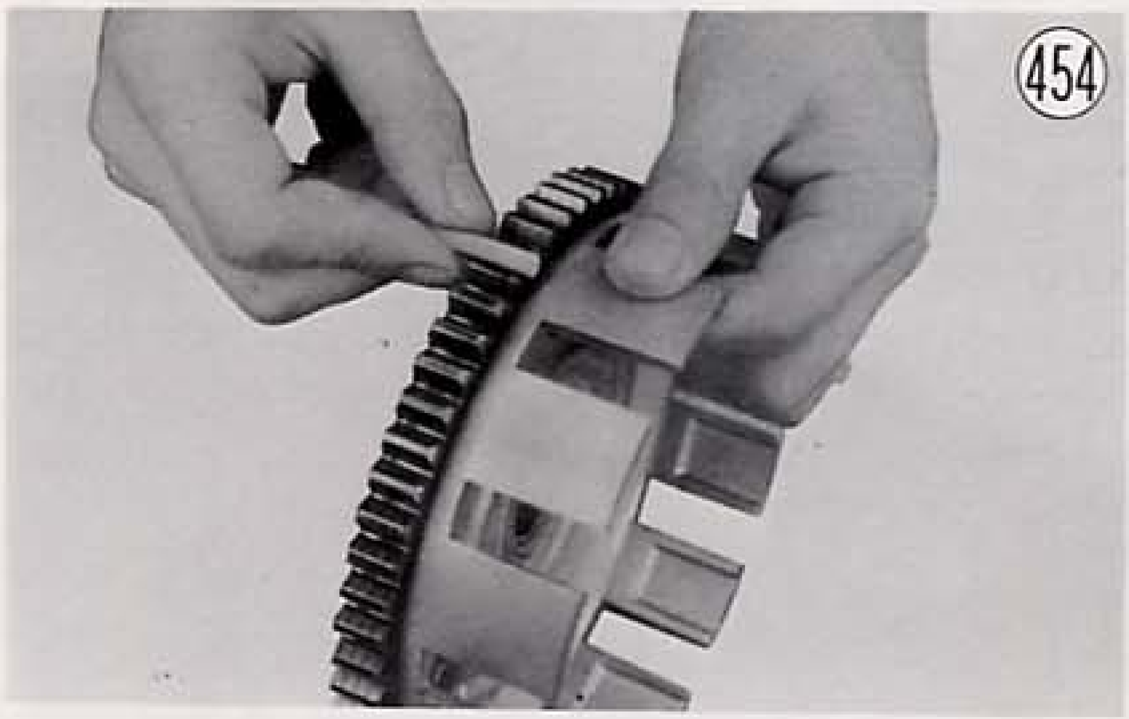


Table 47 Friction Plate/Clutch Housing Clearance

Standard	Service Limit
0.15~0.40 mm	0.60 mm

Clutch housing sprocket damage

Inspect the teeth on the clutch sprocket. Any light damage can be corrected with an oilstone, but the clutch housing must be replaced if the teeth are badly damaged. Damaged teeth on the clutch housing sprocket indicate that the primary chain, by which it is driven, may also be damaged. At the same time that the clutch housing sprocket is repaired or replaced, the primary chain should be inspected, and then replaced if necessary.



Clutch housing/drive shaft wear

Measure the diameter of the drive shaft with a micrometer, and measure the inside diameter of the clutch housing. Find the difference between the two readings to determine the clearance. Replace the clutch housing if the clearance exceeds the service limit.

Table 48 Clutch Housing/Drive Shaft Wear

Standard	Service Limit
0.020~0.062 mm	0.162 mm

Clutch hub damage

Inspect where the teeth on the steel plates wear against the splines of the clutch hub. If there are notches worn into the splines, replace the clutch hub.

Clutch release gear wear

Fit the outer and inner clutch release worm gears together, and push them back and forth in the direction of the shaft without turning them. If there is excessive play, replace them both. Also, replace them if either one is visibly damaged.

Lubrication

Lubricate the clutch release worm gears with grease.

PRIMARY CHAIN

The power transmission from the crankshaft to the drive shaft is chain-drive, utilizing a Hy-Vo (high velocity) chain. This Hy-Vo chain is a locker-joint type with a pin and locker construction. Some of the special features of the Hy-Vo chain are its capacity to transmit much power at high speed, its lack of susceptibility to heat seizure due to a construction which employs rolling rather than sliding friction, quiet operation even at high rpm, and low power loss.

Wear

A primary chain which has worn such that it is 1.4% or more longer than when new is no longer safe for use and should be replaced. Inspect the wear by measuring the chain slack, and replace the chain if it has worn past the service limit. The replacement chain must be the Tsubakimoto Hy-Vo 3/8P-5/8W, 74-link chain.

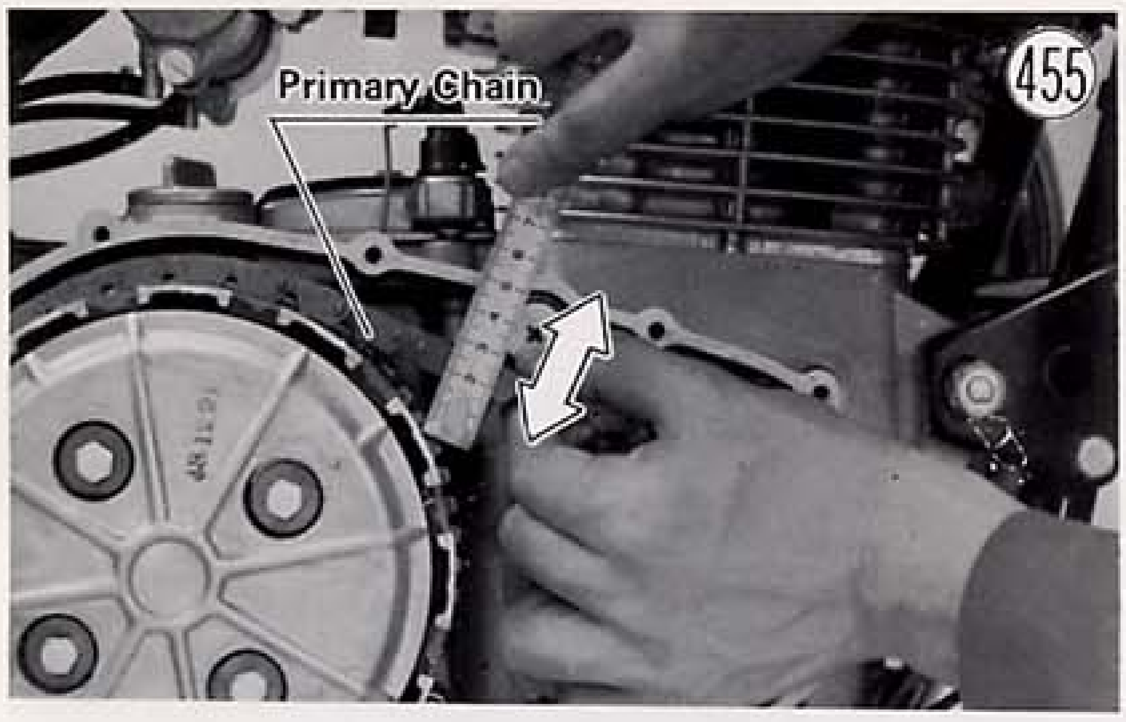


Table 49 Primary Chain Wear

Service Limit
20 mm

When a new chain is installed, check the chain guides, and replace with new ones if necessary.

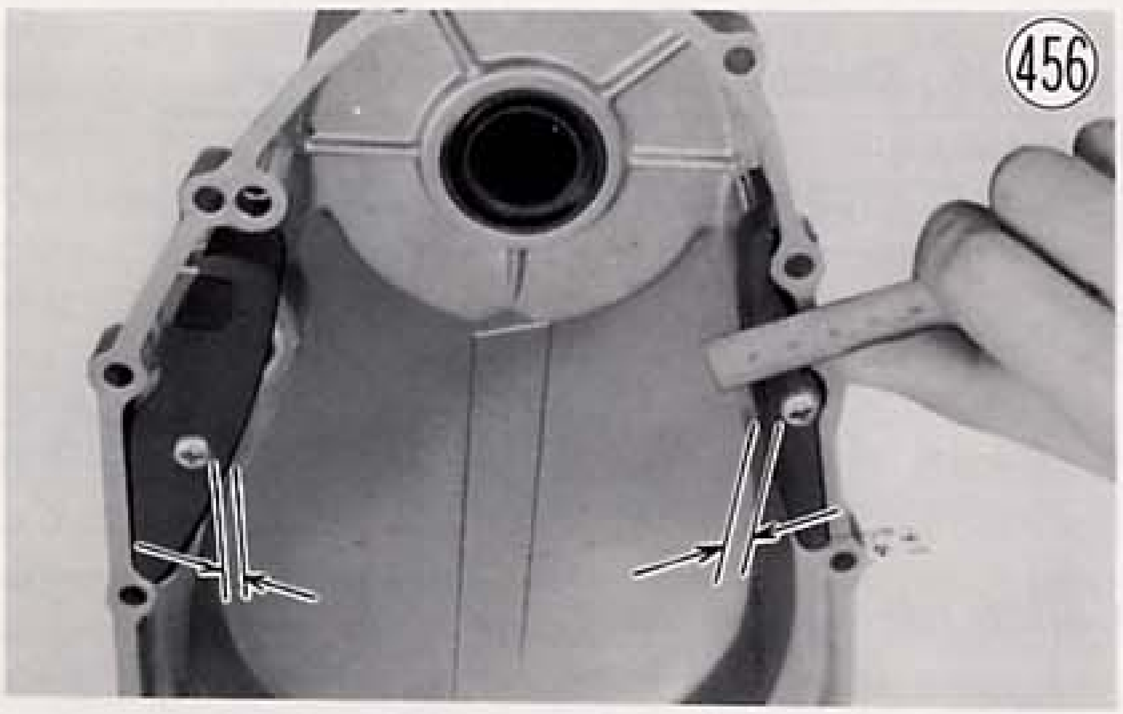


Table 50 Primary Chain Guide Thickness

Standard	Service Limit
7.5 mm	3.5 mm

NOTE: When installing new chain guides, apply a non-permanent locking agent to the chain guide screws, and replace the chain guides.

TRANSMISSION

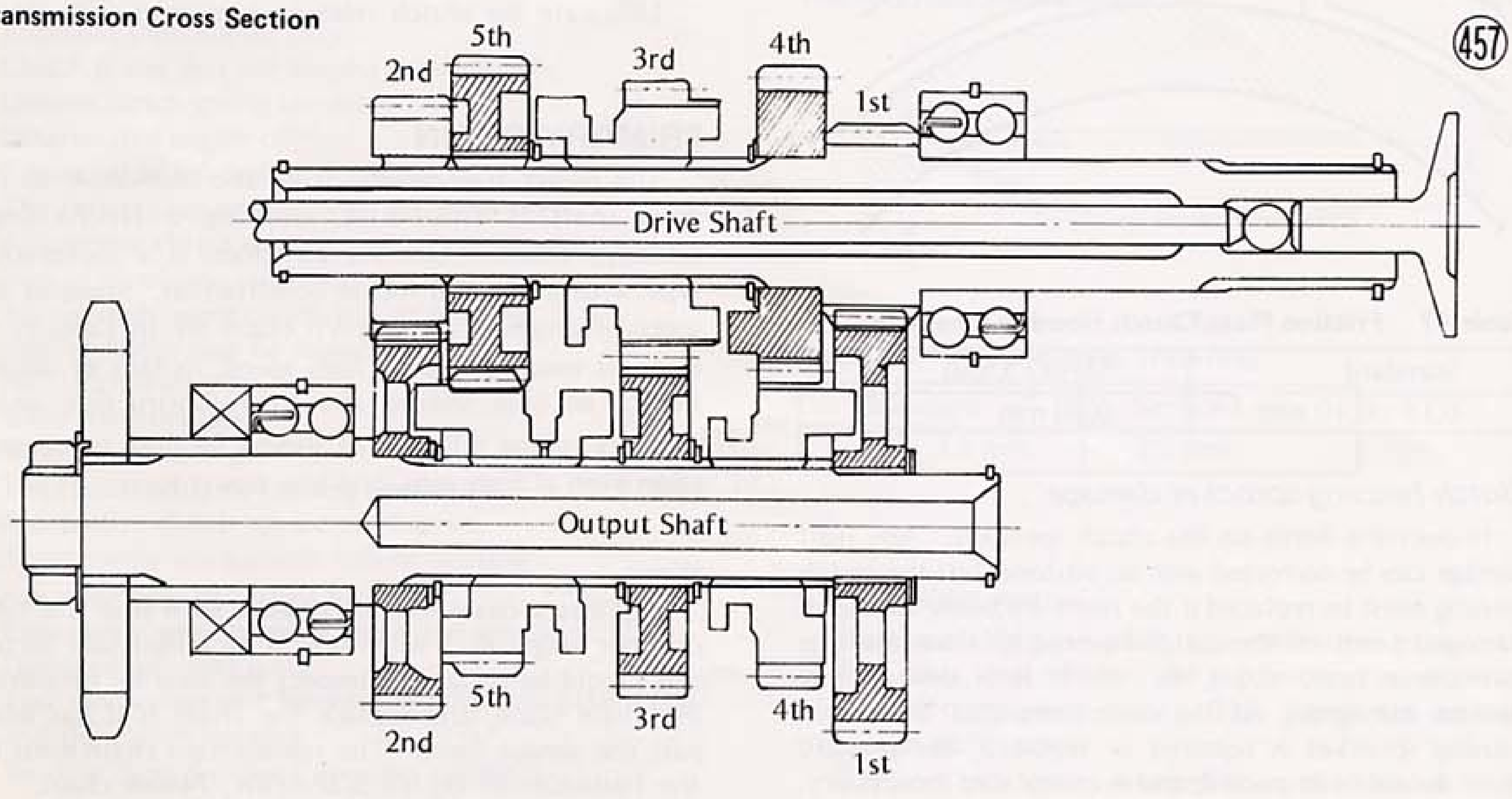
The transmission is a 5-speed, constant mesh, return shift type. Its cross section is shown in Fig. 457, and the external shift mechanism is shown in Fig. 465. For simplicity, the drive shaft gears in the following explanation are referred to as "D" (e.g., D1=drive shaft 1st gear) and the output shaft gears as "O".

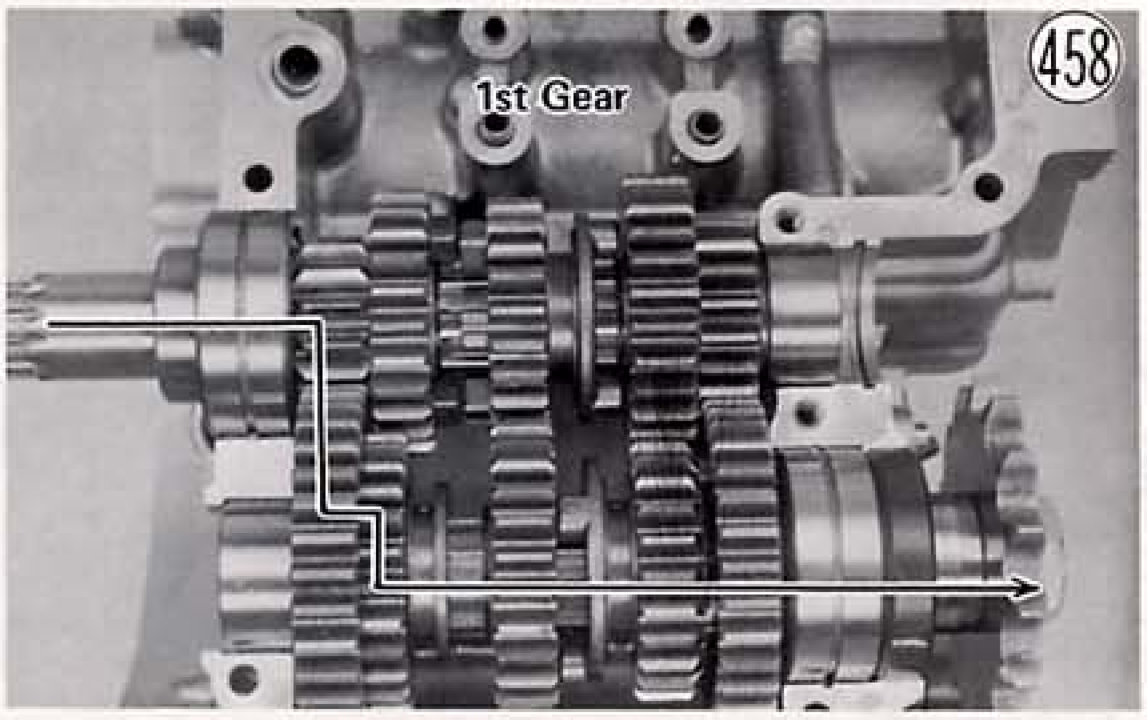
Gears D3, O4, and O5 are all splined to and thus rotate along with their shaft. During gear changes these gears are moved sidewise on their shaft by the 3 shift forks, one for each gear. Gears D4, D5, O1, O2, and O3 rotate free of shaft rotation, but cannot move sidewise. Gears D1 and D2 are part of shaft rotation and are unable to move sidewise.

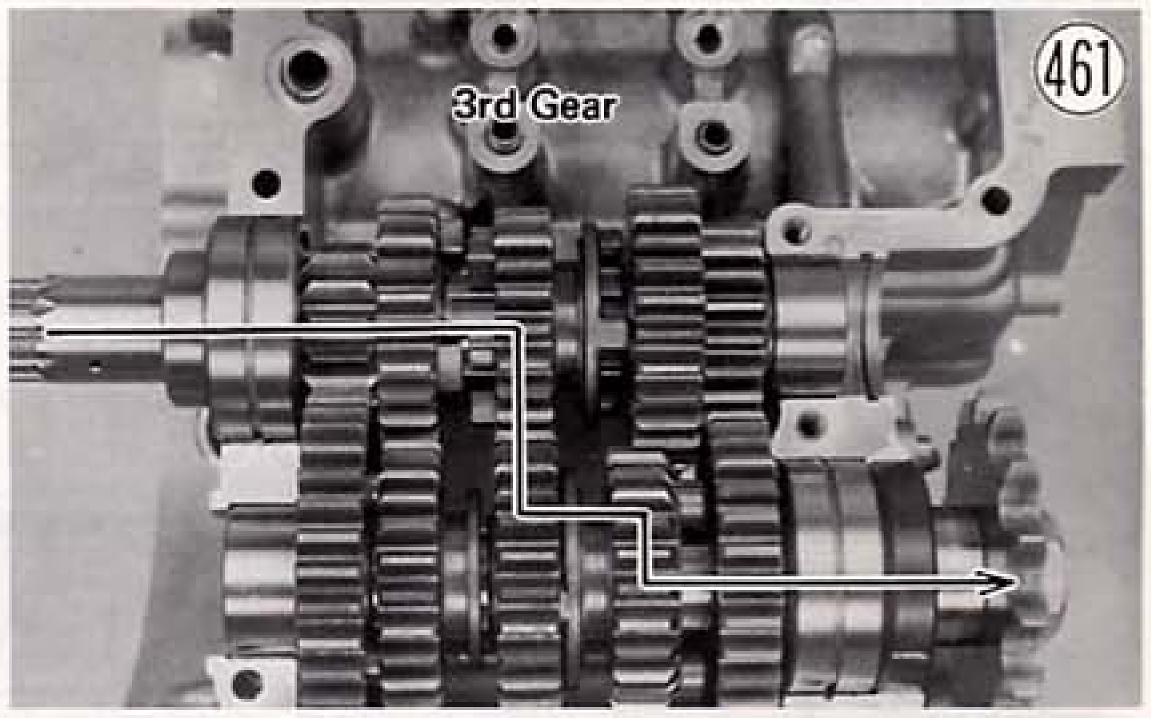
When the shift pedal ㉓ is raised or lowered, the shift shaft ㉒ turns, a pawl ㉕ on the external shift mechanism arm ㉖ catches on one of the shift drum pins ⑩, and the shift drum ⑦ turns. As the shift drum turns, the shift fork guide pins ㉗ (3), each riding in a groove in the shift drum, shift the position of one or another of the shift forks ⑥ ⑲ ⑳ in accordance with the winding of the grooves. The shift fork ears then determine the position of gears D3 ①, O4 ⑰, and/or O5 ⑱. Refer to Figs. 458 to 463 for the gear train for neutral and each of the 5 gears.

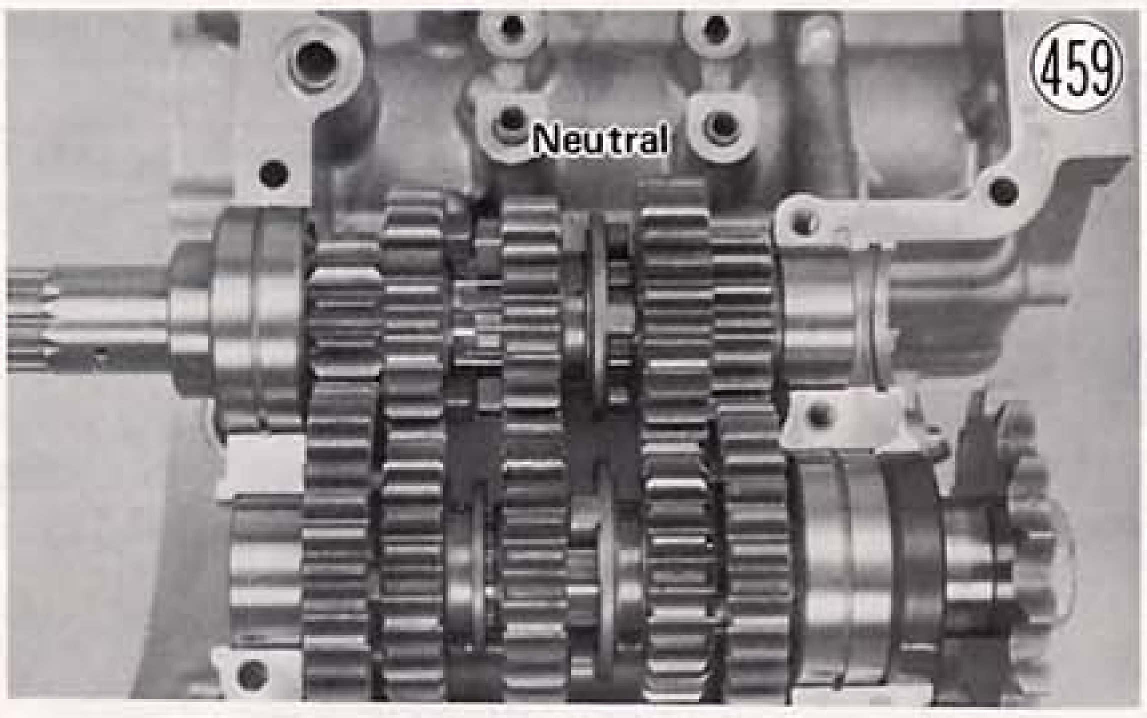
A spring ⑭ is fitted on the external shift mechanism to keep the shift arm pressed against the shift drum pins to ensure proper pawl and pin contact. When the shift pedal is released after shifting, the return spring ⑯, returns the pawl and shift pedal back to their original position. So that the transmission will remain where it was shifted, another spring, the shift drum positioning pin spring ④, pushes the shift drum positioning pin ③ into one of six positions on the shift drum operating

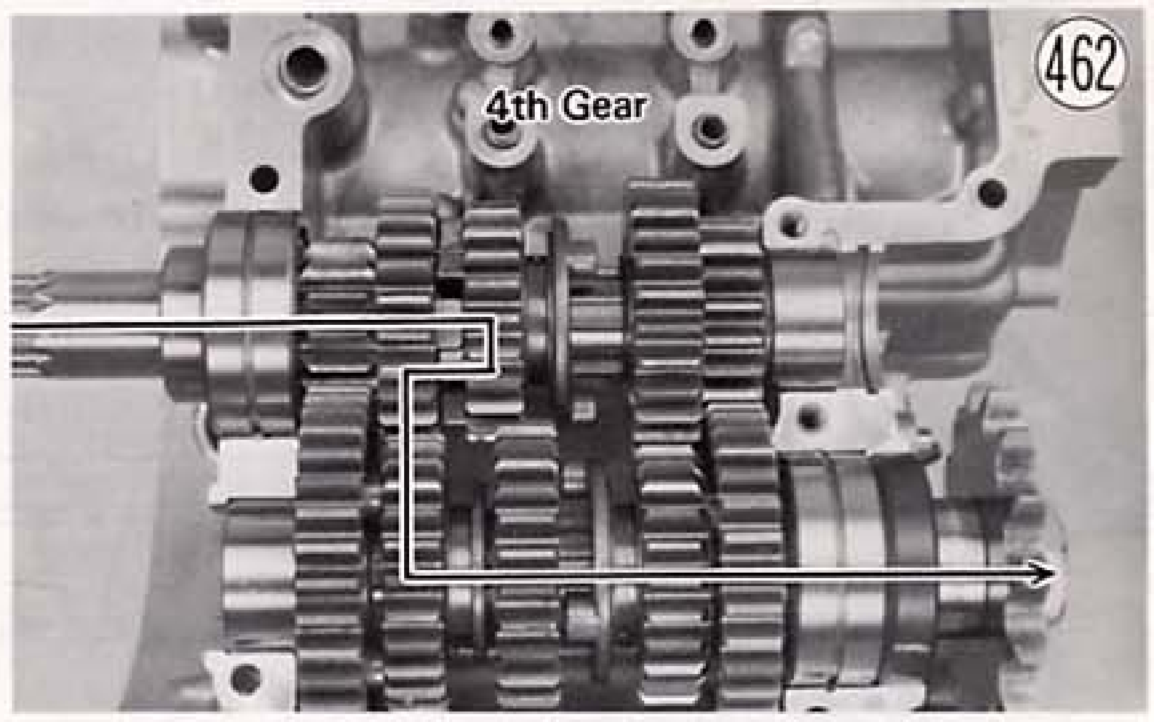
Transmission Cross Section

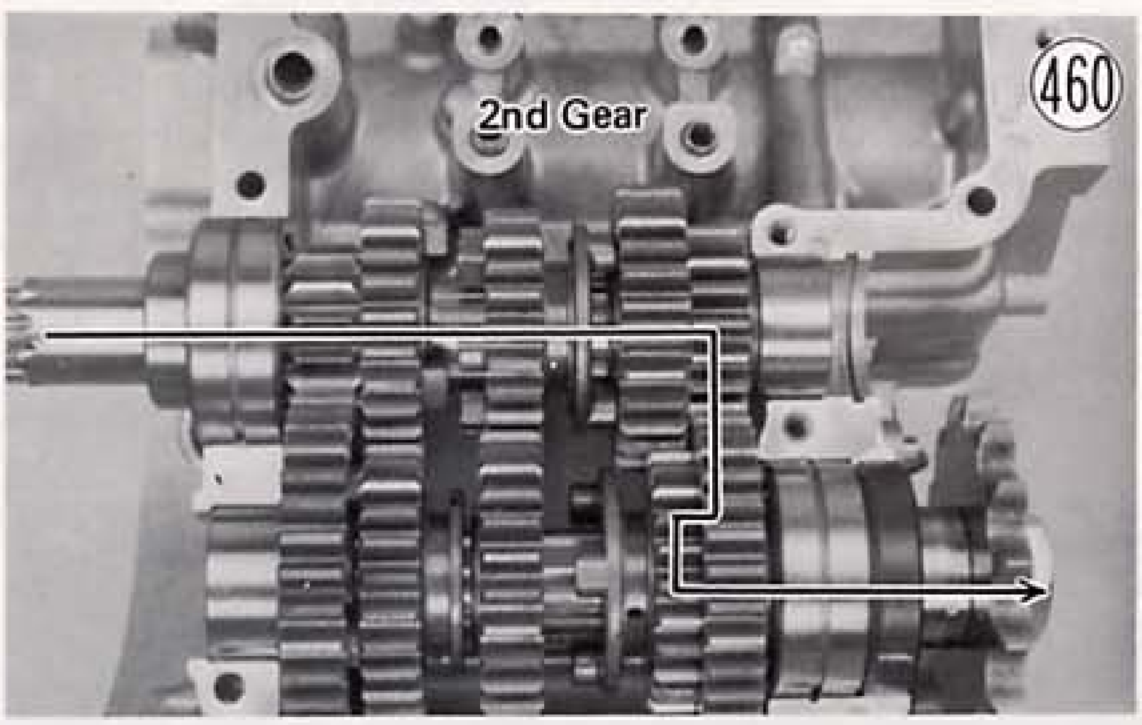












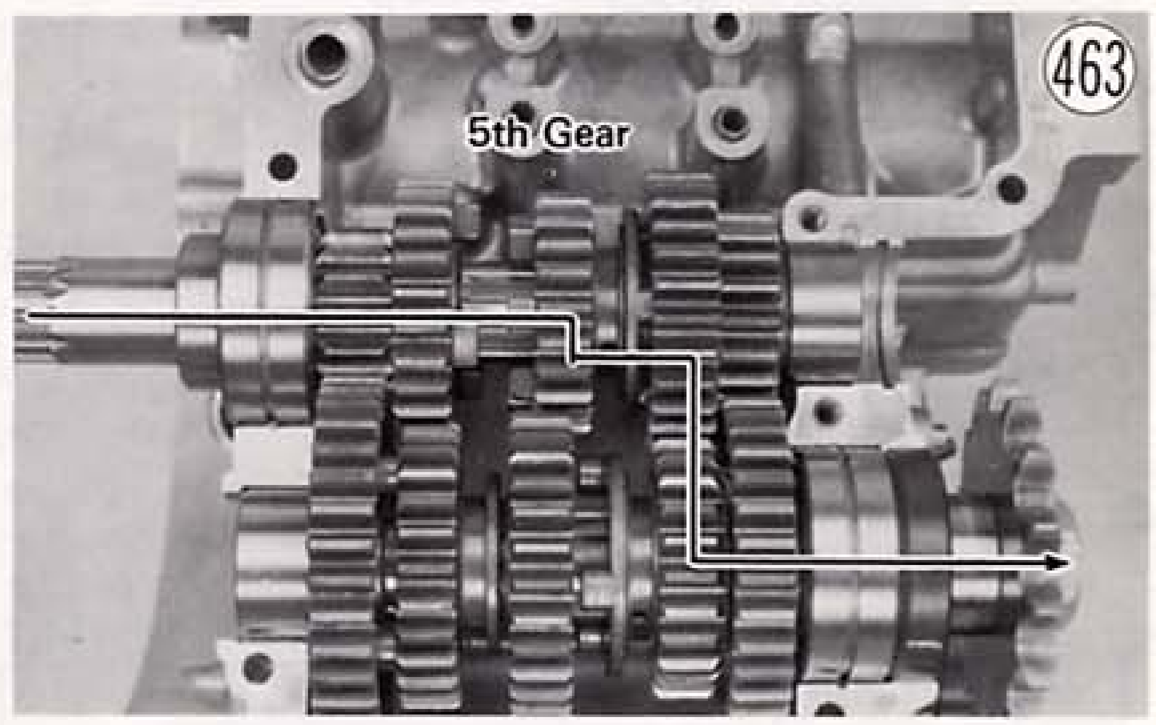


plate ⑤. Five of these positions are equally spaced and correspond to the 5 gears. The other position is halfway between the position for 1st and 2nd gears and corresponds to the half-stroke shift pedal movement from 1st or 2nd gear required to shift into neutral.

The return spring pin ⑮ on the side of the crankcase passes through a cutout on the shift mechanism. Each time that the shift pedal is operated, the pin limits the shift mechanism's range of movement, stopping the shift mechanism after the pawl on the shift mechanism arm has rotated the shift drum the proper amount for gear change. The return spring pin thus prevents the drum from being rotated too far.

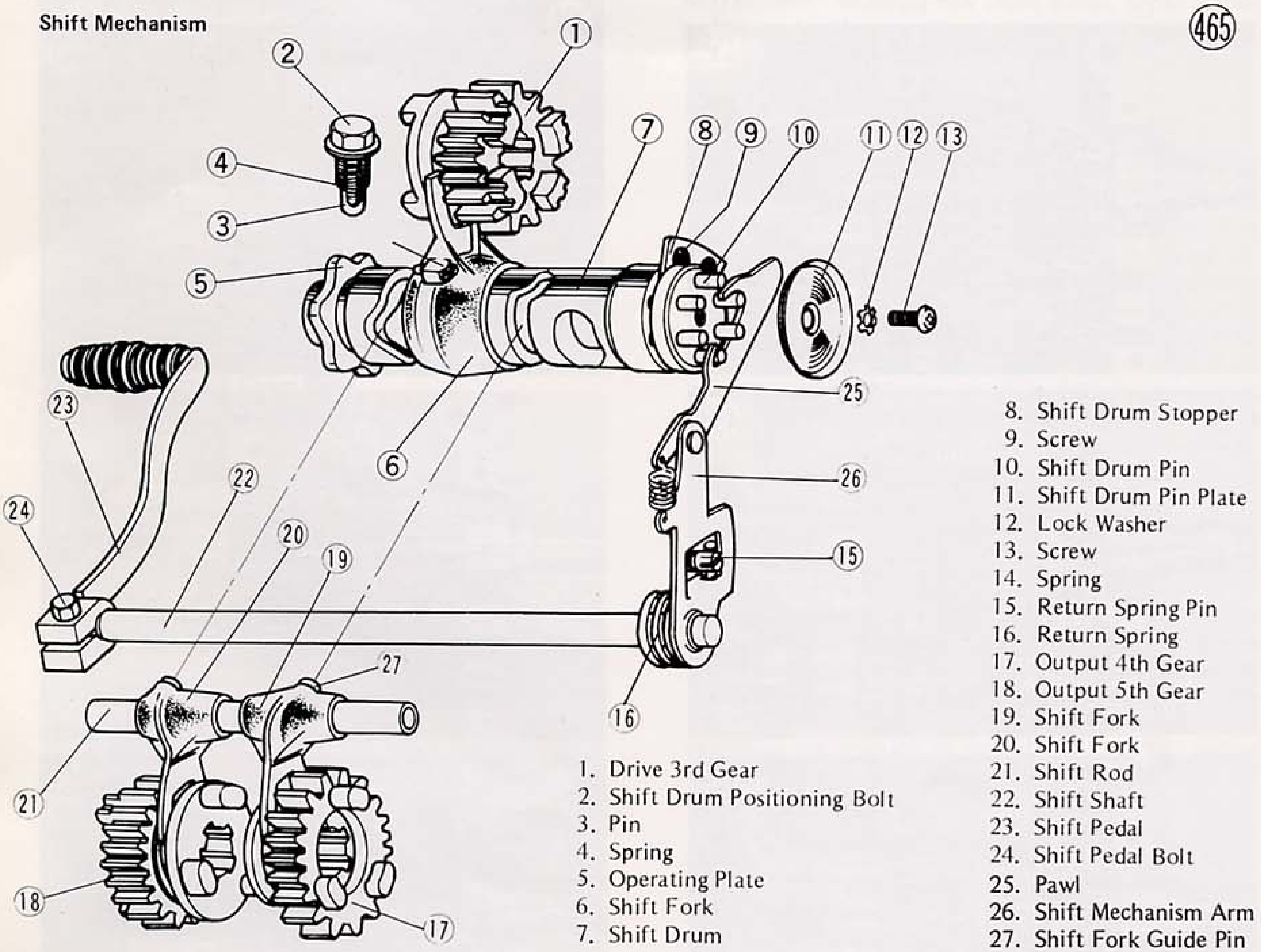
A neutral indicator light is provided so that the rider can readily determine whether or not the transmission is in neutral. The neutral indicator switch, installed in the crankcase near the starter motor, consists of a spring loaded pin which comes into contact with a nub on the side of the shift drum whenever the transmission is in neutral. When the shift drum has shifted the transmission into neutral, the neutral indicator switch pin touching this nub completes the neutral indicator light circuit, which turns the neutral indicator light on.

Transmission or external shift mechanism damage, causing the transmission to misshift, overshift, and/or jump out of gear, brings about more damage to the transmission and also overrev damage to the engine itself. An improperly functioning transmission or external shift mechanism may be caused by the following:

1. Loose return spring pin
2. Broken or weakened return spring or shift drum positioning pin spring
3. Broken or weakened shift pawl spring
4. Damaged shift mechanism arm
5. Loose shift drum stopper
6. Bent or worn shift fork(s)
7. Worn shift fork groove on gear D3, O4, and/or O5
8. Worn shift fork guide pin(s)
9. Worn shift drum groove(s)
10. Worn or damaged gear dogs, gear dog holes, and/or gear dog recesses
11. Improperly functioning clutch or clutch release
12. Improper assembly or missing parts

Transmission noise results from worn or damaged shafts, gear hubs or teeth, bearings, etc.

Shift Mechanism



1. Drive 3rd Gear
2. Shift Drum Positioning Bolt
3. Pin
4. Spring
5. Operating Plate
6. Shift Fork
7. Shift Drum
8. Shift Drum Stopper
9. Screw
10. Shift Drum Pin
11. Shift Drum Pin Plate
12. Lock Washer
13. Screw
14. Spring
15. Return Spring Pin
16. Return Spring
17. Output 4th Gear
18. Output 5th Gear
19. Shift Fork
20. Shift Fork
21. Shift Rod
22. Shift Shaft
23. Shift Pedal
24. Shift Pedal Bolt
25. Pawl
26. Shift Mechanism Arm
27. Shift Fork Guide Pin

External shift mechanism inspection

Inspect the shift pawl spring, shift pawls, and return spring. Replace any broken or otherwise damaged parts.

Measure the free length of the shift pawl spring. If it exceeds the service limit, replace it with a new one.

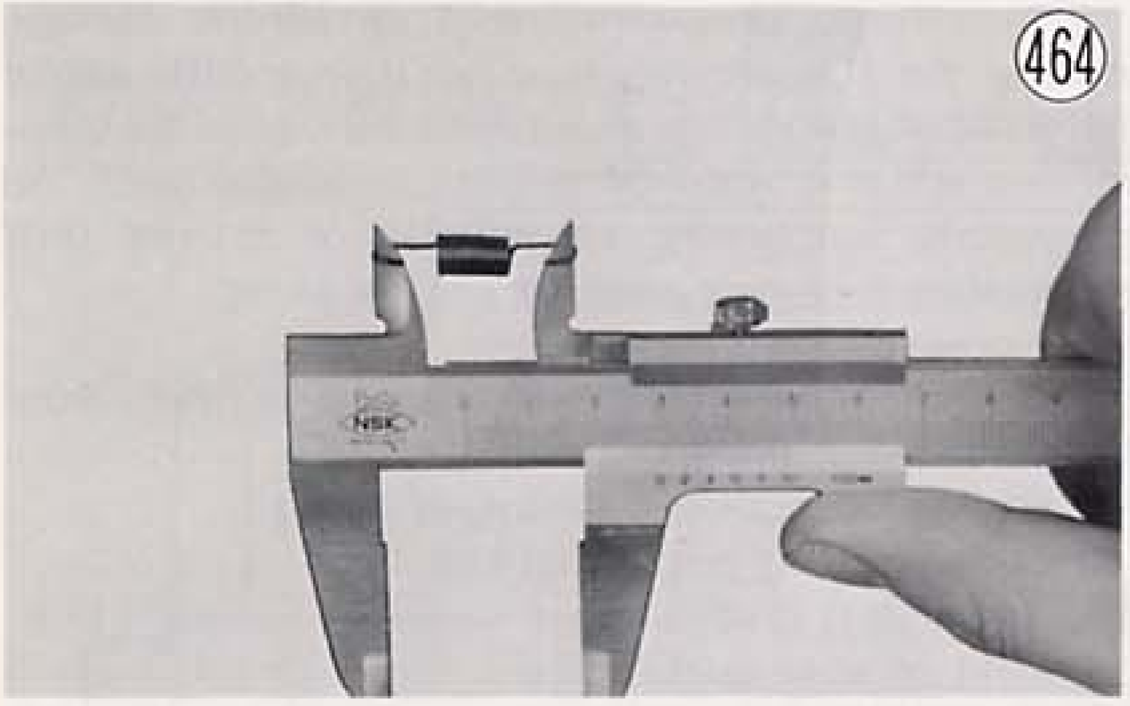
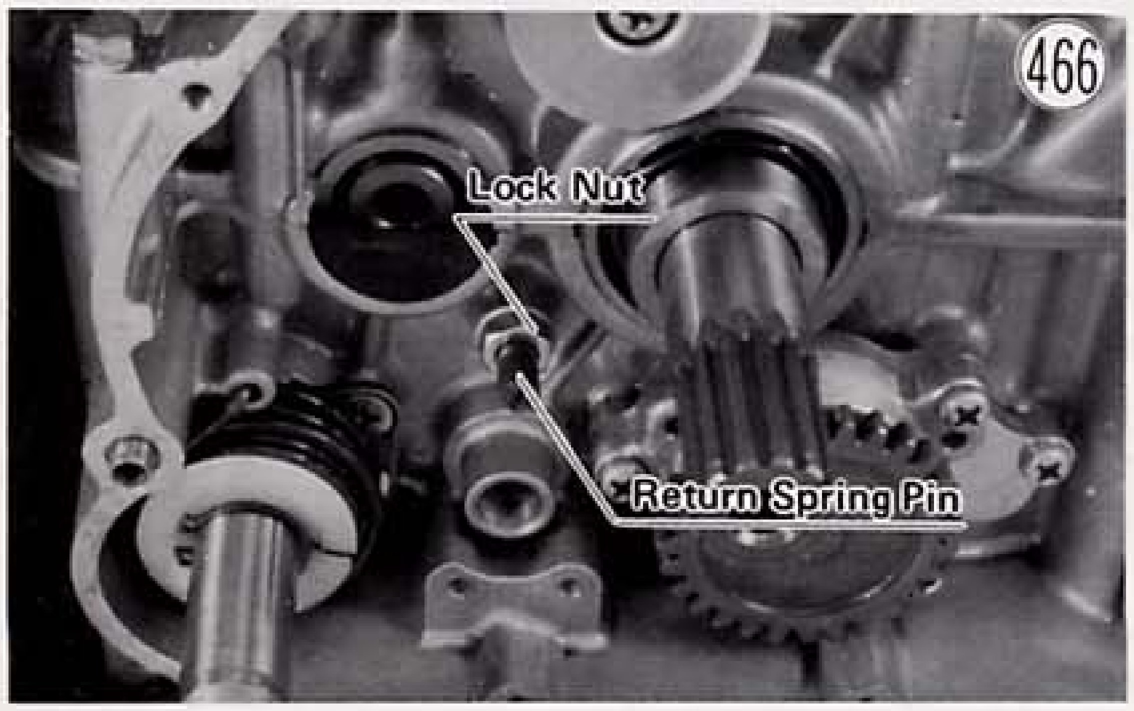


Table 51 Shift Pawl Spring Free Length

Standard	Service Limit
29.4 mm	31 mm

Check to see if the return spring pin is loose or not. If it is loose, remove it and apply a non-permanent locking agent to the threads. Then screw it back in tightening its lock nut.



Gear backlash

Split the crankcase. Leaving the transmission in place, measure the backlash between gears O1 and D1, O2 and D2, O3 and D3, O4 and D4, and O5 and D5. To measure the backlash, set a dial gauge against the teeth of one gear, and move the gear back and forth while holding the other gear steady. The difference between the highest and the lowest gauge reading is the amount of backlash. Replace both gears wherever the amount of backlash exceeds the service limit.

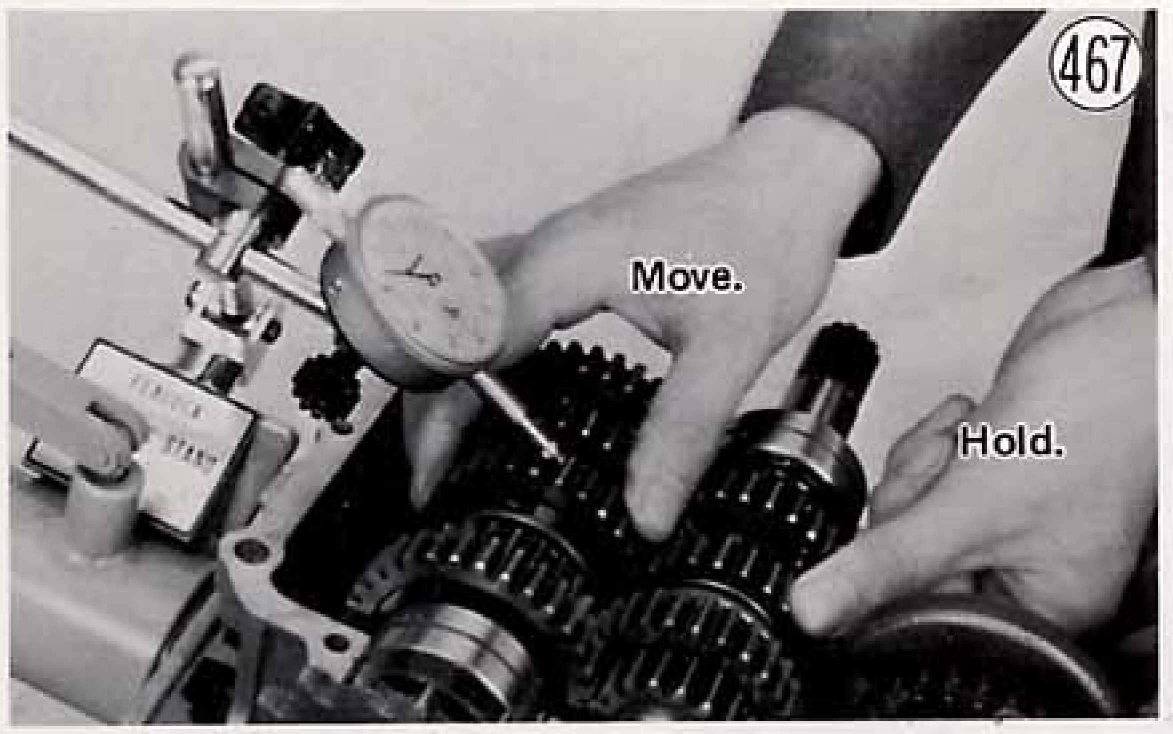


Table 52 Gear Backlash

Standard	Service Limit
0.06~0.23 mm	0.3 mm

Shift fork bending

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

Shift fork/gear groove wear

Measure the thickness of the ears of each shift fork, and measure the width of the shift fork groove on gears D3, O4, and O5. If the thickness of a shift fork ear is under the service limit, the shift fork must be replaced. If a gear shift fork groove is worn over the service limit, the gear must be replaced.

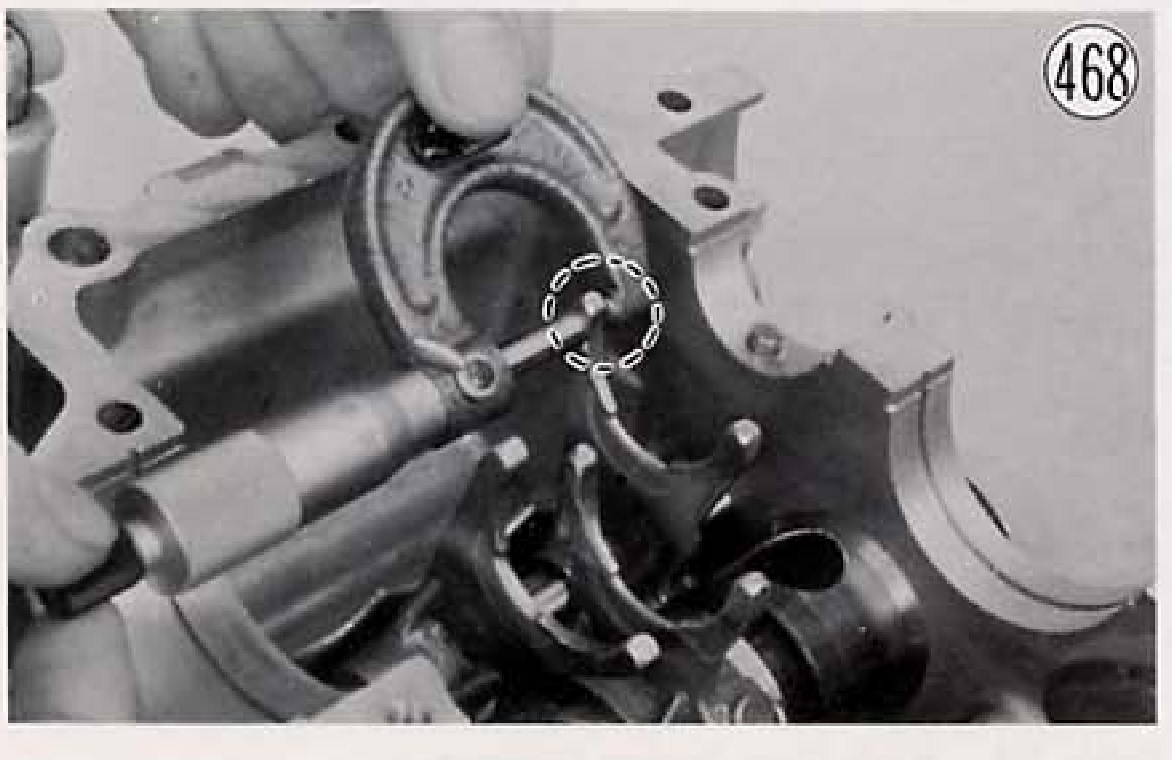


Table 53 Shift Fork Thickness

Standard	Service Limit
4.9~5.0 mm	4.7 mm

Table 54 Gear Shift Fork Groove Width

Standard	Service Limit
5.05~5.15 mm	5.25 mm

Shift fork guide pin/shift drum groove wear

Measure the diameter of each shift fork guide pin, and measure the width of each shift drum groove. Replace any shift fork on which the guide pin has worn past the service limit. If a shift drum groove is worn past the service limit, replace the shift drum.

Table 55 Shift Fork Guide Pin Diameter

	Standard	Service Limit
4th, 5th	7.9~8.0 mm	7.85 mm
3rd	7.985~8.000 mm	7.93 mm

Table 56 Shift Drum Groove Width

Standard	Service Limit
8.05~8.20 mm	8.25 mm

Shift fork guide pin/shift drum groove clearance

Measure the clearance between each shift fork guide pin and shift drum groove with a thickness gauge. Replace any shift fork with which the clearance exceeds the service limit.

Table 57 Shift Fork Guide Pin/Shift Drum Groove Clearance

	Standard	Service Limit
4th, 5th	0.05~0.30 mm	0.38 mm
3rd	0.05~0.22 mm	0.30 mm

Gear dog, gear dog hole, gear dog recess damage

Visually inspect the gear dogs, gear dog holes, and gear dog recesses. Replace any gears that have damaged or unevenly or excessively worn dogs, dog holes, or dog recesses.

Gear/shaft wear

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

Table 58 Gear/Shaft, Gear/Bush Clearance

	Standard	Service Limit
D4, D5, O2	0.020~0.062 mm	0.161 mm
O1	0.027~0.061 mm	
O3	0.027~0.069 mm	

Ball bearing wear, damage

Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than by measurement.

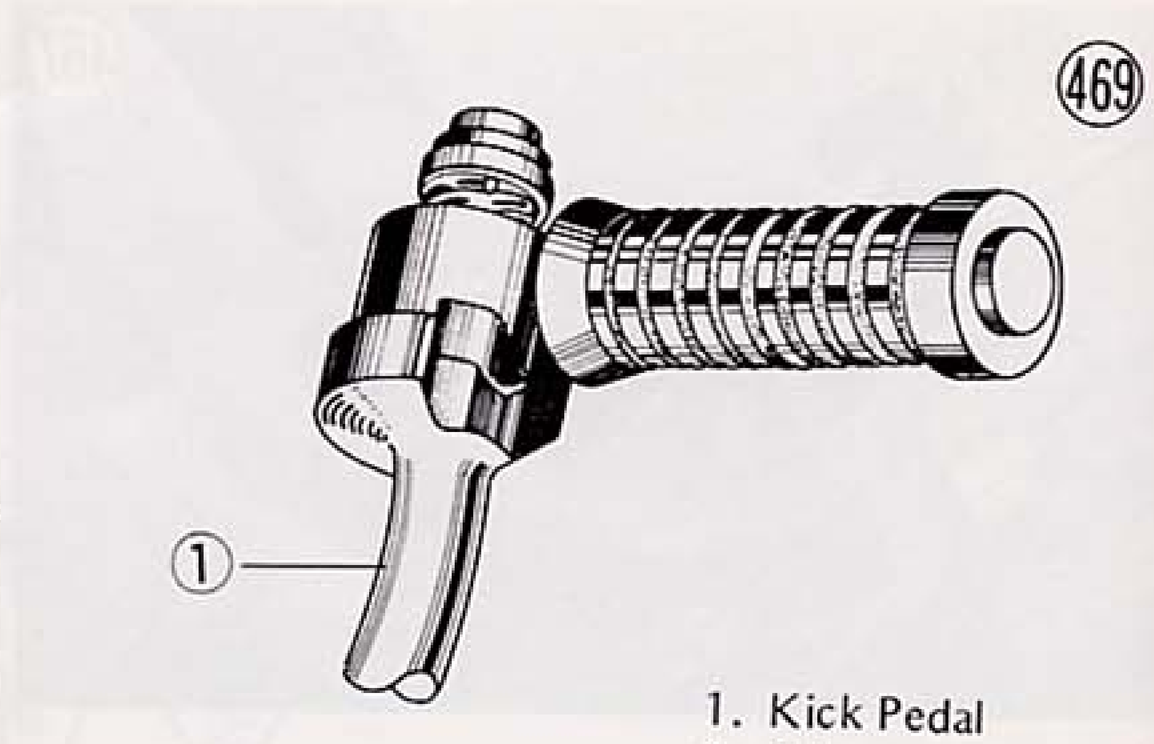
Clean each bearing in a high flash point solvent of some kind, dry it (do not spin it while it is dry), and oil it. Spin it by hand to check its condition. If it is noisy, does not spin smoothly, or has any rough spots, replace it.

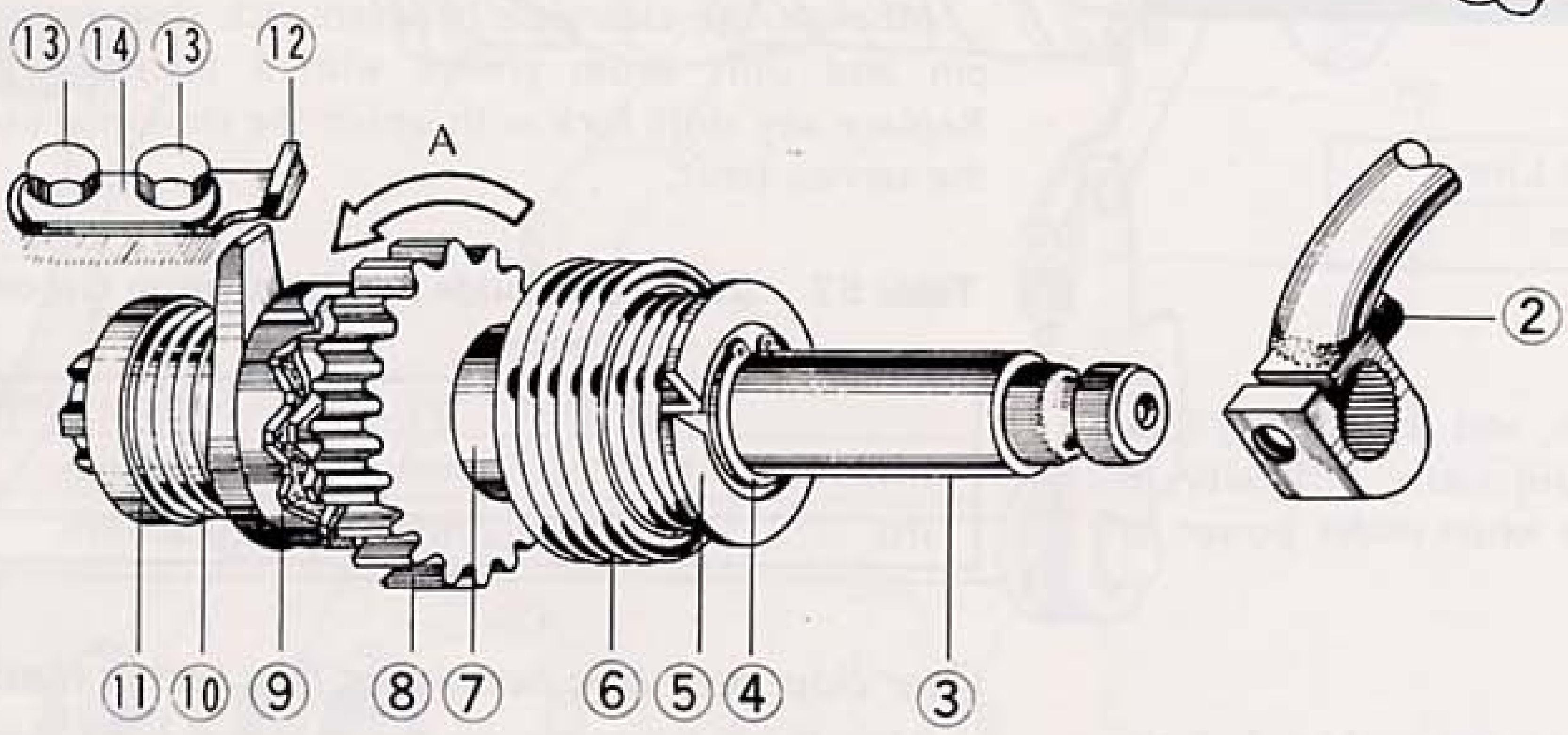
KICKSTARTER

Kickstarter construction is shown in Fig. 469. The kick gear is connected to the primary sprocket on the crankshaft through the output shaft 1st gear, drive shaft 1st gear, clutch housing sprocket, and primary chain.

The kick gear ⑧, constructed with a ratchet on one side, is always meshed with the output shaft 1st gear and turns freely anytime the output shaft is turning.

Kickstarter





1. Kick Pedal
2. Bolt
3. Kick Shaft
4. Circlip
5. Spring Guide
6. Kick Spring
7. Kick Shaft Collar
8. Kick Gear
9. Ratchet Gear
10. Spring
11. Spring Guide
12. Stopper
13. Stopper Bolts
14. Washer

The ratchet gear ⑨, mounted on the splined portion of the kick shaft ③, always turns with the kick shaft and can be moved sidewise on the shaft. A spring ⑩ presses on the ratchet gear in the direction of the kick gear, but, when the kick pedal ① is not being operated, an arm on the ratchet gear is caught on the stopper ⑫, which prevents the ratchet gear from meshing with the ratchet on the kick gear.

When the kick pedal is operated, the ratchet gear arm is freed from the stopper and the ratchet gear then meshes with the kick gear ratchet rotating the kick gear. The gear train of the kickstarter system then cranks the engine. As the engine starts, the primary sprocket through the gear train turns the kick gear. But, since the kick gear rotates in the direction of arrow "A" as shown in Fig. 469, the kick gear ratchet doesn't catch on the ratchet gear.

When the kick pedal is released, the kick shaft is turned by the return spring returning the kick pedal to its original position. At the same time the ratchet gear arm rides up on the stopper, breaking away from the kick gear. The kick gear now turns freely without hindrance.

If the kick pedal return spring weakens or breaks, the kick pedal will not return completely or at all, and the kick gear and ratchet gear will stay partially meshed, making noise while the engine is running. Kick mechanism noise may also result when the kick gear, collar, or kick shaft becomes worn.

If the ratchet gear or the ratchet on the kick gear is worn or damaged, the kick gear will slip, and it will not be possible to kickstart the engine.

Kick gear, shaft wear

Measure the inside diameter of the kick gear, and replace the gear if the diameter is over the service limit.

Visually inspect the ratchet portion of the kick gear. If there is any kind of damage, replace the kick gear.

Measure the kick shaft diameter at the kick gear, and replace it if it is under the service limit.

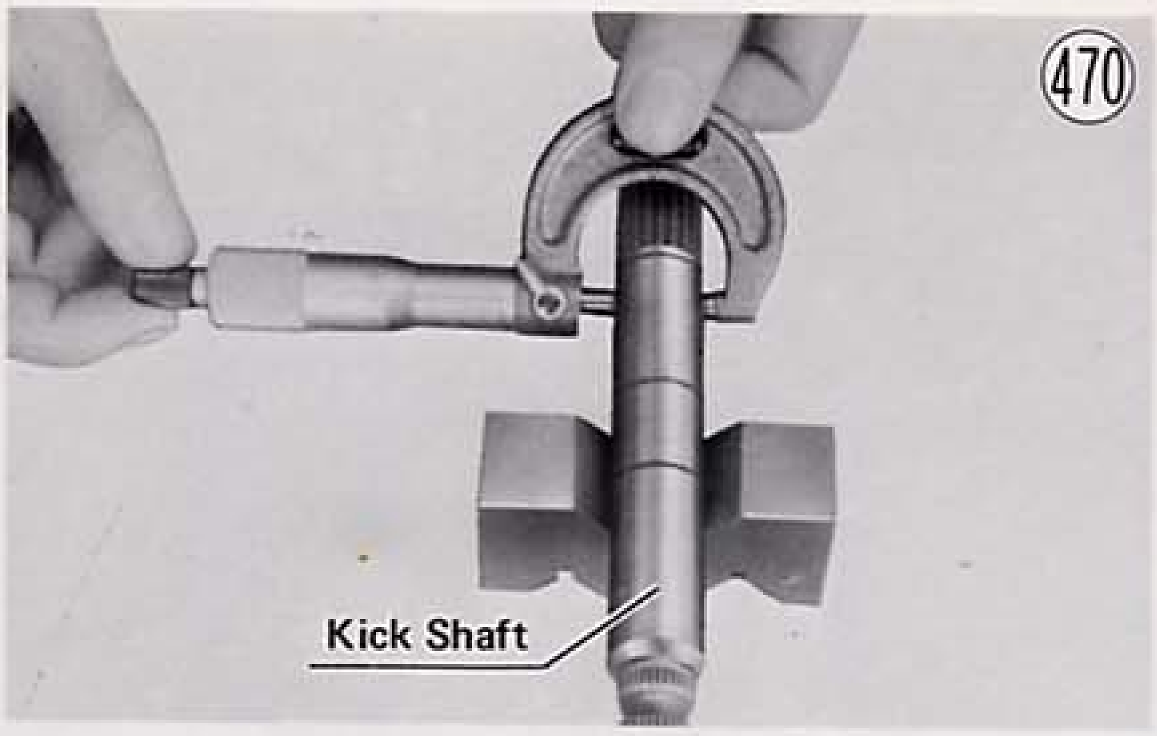


Table 59 Kick Gear Inside Diameter

Standard	Service Limit
20.000~20.021 mm	20.07 mm

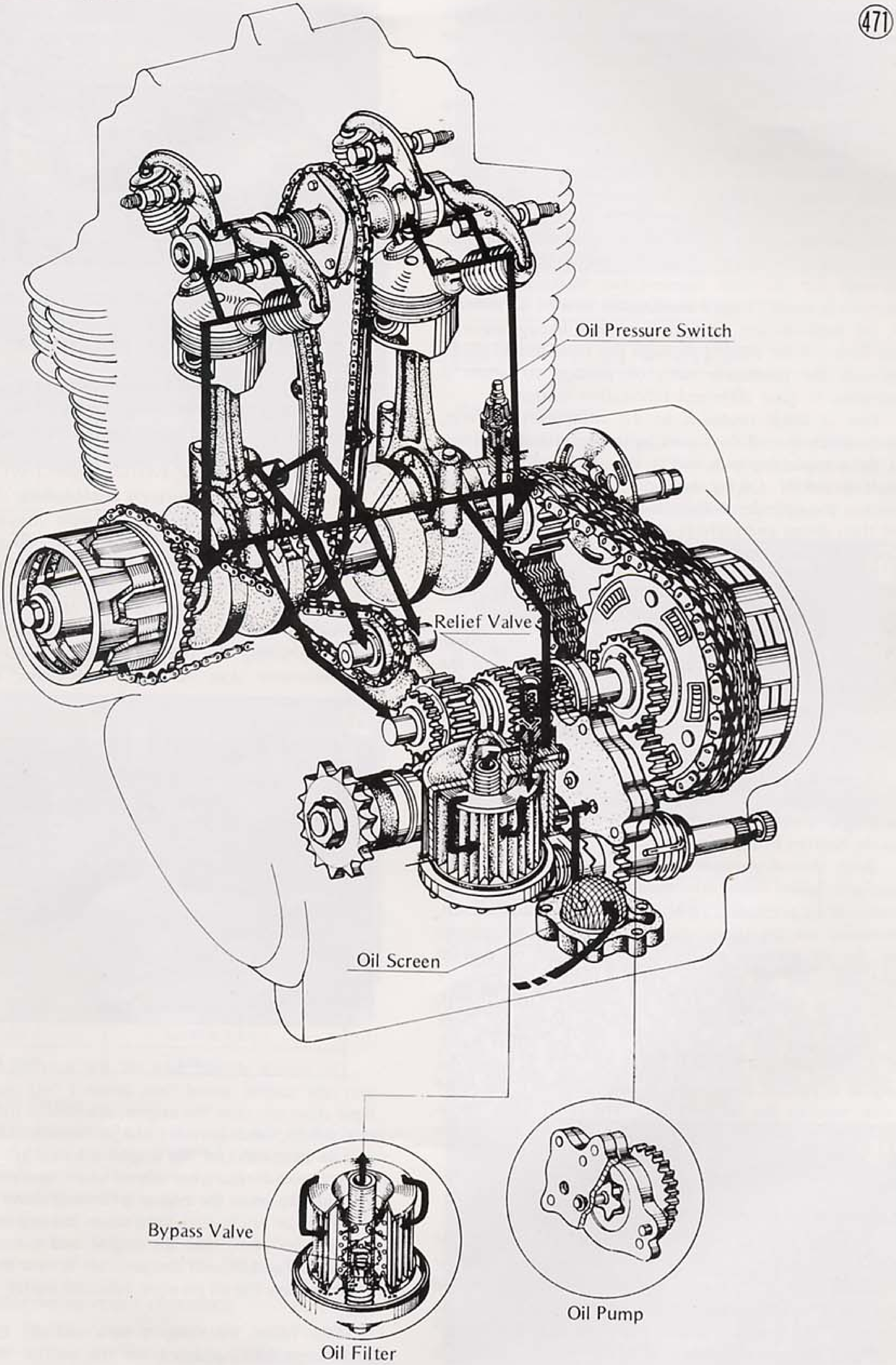
Table 60 Kick Shaft Diameter at Kick Gear

Standard	Service Limit
19.959~20.000 mm	19.93 mm

ENGINE LUBRICATION

The engine lubrication system includes the oil screen, engine oil pump, oil filter, oil pressure relief valve, and oil passages. An oil pressure indicator switch is provided to warn in case of insufficient oil pressure, and an oil breather keeps crankcase pressure variations to a minimum. The discussion here concerns how these parts

Engine Lubrication System



work together, how the oil reaches the various parts of the engine, and how to check the oil pressure. Details on the engine oil pump, oil filter, and oil breather are given in the sections (Pgs. 131 ~ 132) following engine lubrication.

Since the engine lubrication system is the wet sump type, there is always a supply of oil at the bottom of the engine in the crankcase. The oil is drawn through the wire screen into the oil pump as the pump rotors rotate, driven by a gear attached to the rear of the clutch housing. The screen removes any metal particles and other foreign matter of any size which could otherwise damage the oil pump. From the pump the oil passes through the oil filter element for filtration. If the element is badly clogged slowing the flow of oil through it, oil bypasses the element through a bypass valve in the filter. After passing through the filter the oil passes through the crankcase main oil passage to where it branches in four different lubrication routes.

One of these routes is to the crankshaft bearings, from which the oil then goes to the crankshaft journals at the con-rod big ends and to the starter motor crankshaft sprocket. Oil by the force of crankshaft rotation reaches the cylinder walls, pistons, and piston pins. The oil then drops and collects at the bottom of the crankcase to be used again.

Another route leads to the balancer mechanism shafts. After shaft lubrication the oil drops and collects at the bottom of the crankcase for recirculation.

A third route for the oil is through the oil passage at each end of the cylinder block up to the top of the cylinder head. The oil reaches the camshaft journals, camshaft cams, and valve guides. The oil then drops through the camshaft chain opening back to the bottom of the crankcase.

A fourth route for the oil is to the transmission through a passage existing at one of the drive shaft bearings. Following lubrication the oil drops back down to the bottom of the crankcase.

Both the oil pressure indicator switch and the oil pressure relief valve are important for maintaining a constant oil pressure. The oil pressure indicator switch, mounted on the upper part of the crankcase, checks on the oil pressure of the oil in the main oil passage and lights the oil pressure warning light if the pressure falls below a safe value. If the oil pressure is insufficient, the oil pump is overworn or malfunctioning or there is insufficient oil to the pump. On the other hand, if the oil pressure becomes excessive, such as when the engine is started (especially in cold weather), the relief valve reduces the oil pressure. The relief valve opens whenever a pressure of 5.2 kg/cm^2 (74 psi) presses on the valve spring.

Oil pressure measurement

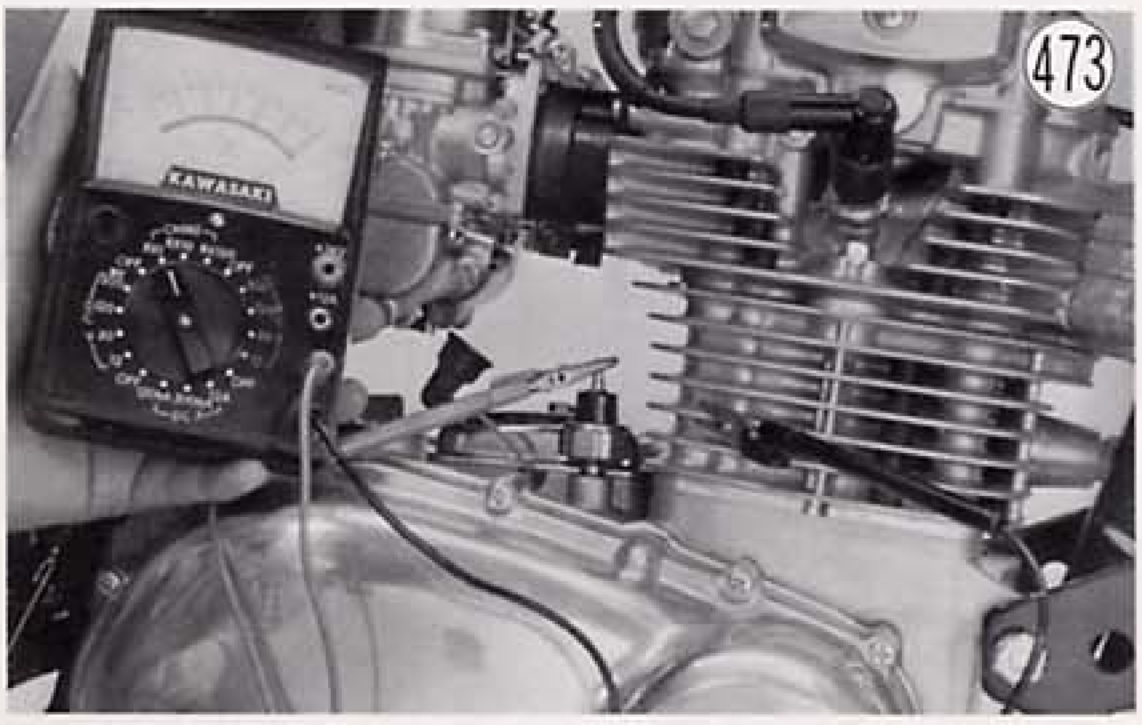
Remove the oil pressure indicator switch from the crankcase, and connect the oil pressure gauge adapter (special tool) in its place. Fit the indicator switch and the oil pressure gauge on the adapter, and start the engine. The standard pressure is more than 1.5 kg/cm^2 (21 psi) when the engine is at 4,000 rpm and the engine oil temperature is at approximately 80°C (176°F).

If the oil pressure is significantly below the standard pressure, inspect the engine oil pump (Pg. 131). If the pump is not at fault, inspect the rest of the lubrication system.

NOTES: 1. Apply a non-permanent locking agent to the switch threads before installing it back on the crankcase.
2. Warm up the engine before measuring the oil pressure.

Oil pressure indicator switch inspection

The switch should turn on the warning light whenever the ignition switch is on with the engine not running. If the light does not go on, disconnect the lead from the switch, and use an ohmmeter to check for continuity between the switch terminal and the switch body. A reading of zero ohms indicates that the switch is not at fault and the trouble is either defective wiring or a burned-out indicator bulb. If the ohmmeter does not read zero ohms, the switch is defective.



The switch should turn off the warning light whenever the engine speed rises above 1,500 rpm. If the light stays on, stop the engine, disconnect the lead from the switch, and connect the ohmmeter between the switch terminal and the engine (chassis ground). The meter should read zero ohms when the engine is off and infinity when the engine is running above 1,500 rpm. If the meter reads zero ohms when the engine is running above 1,500 rpm, stop the engine and measure the oil pressure (Pg. 130). If the pressure is near the standard value, replace the oil pressure indicator switch with a new one.

NOTE: When installing a new switch, use a non-permanent locking agent on the switch threads and tighten it with the specified torque (Pg. 183).

Relief valve wear

Measure the diameter of the valve piston and the inside diameter of the valve body. Subtract the valve piston diameter from the valve body inside diameter to determine the amount of valve wear. If the clearance exceeds the service limit, replace the valve piston. If the piston and the inside wall of the valve body are scratched, replace the relief valve.

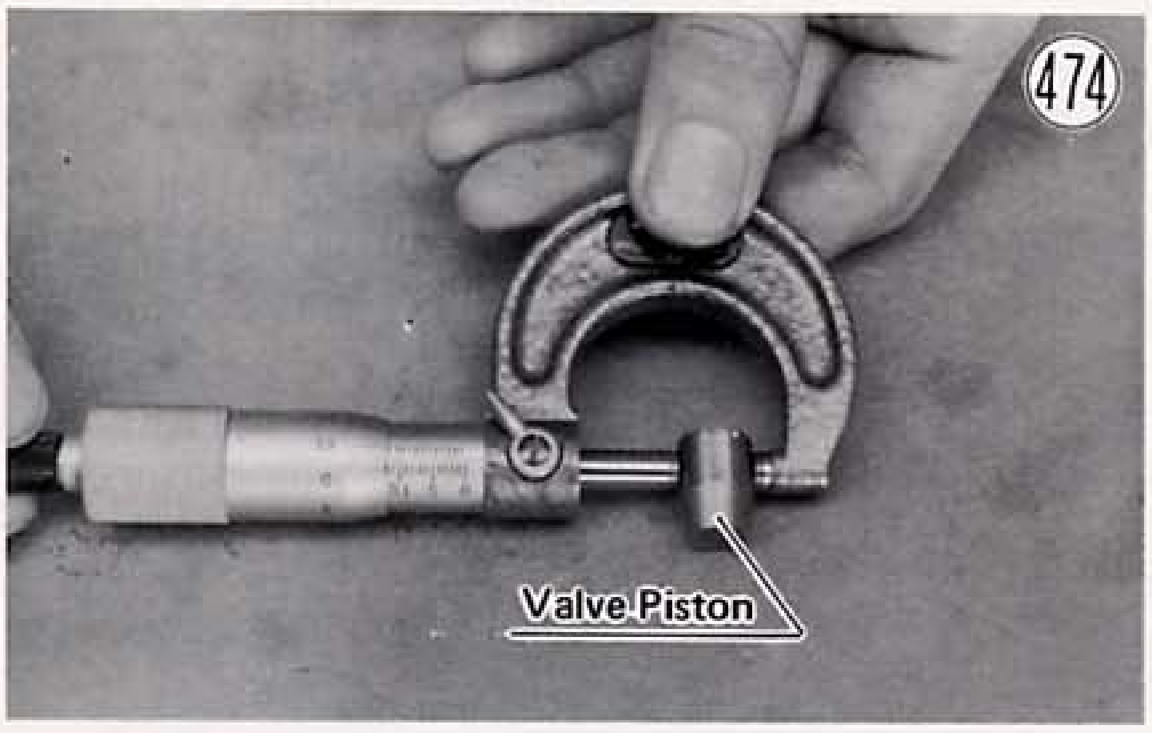


Table 61 Relief Valve Wear

Standard	Service Limit
0.020~0.103 mm	0.13 mm

Relief valve spring tension

Measure the valve spring free length with vernier calipers. If the length is less than the service limit, replace the spring.

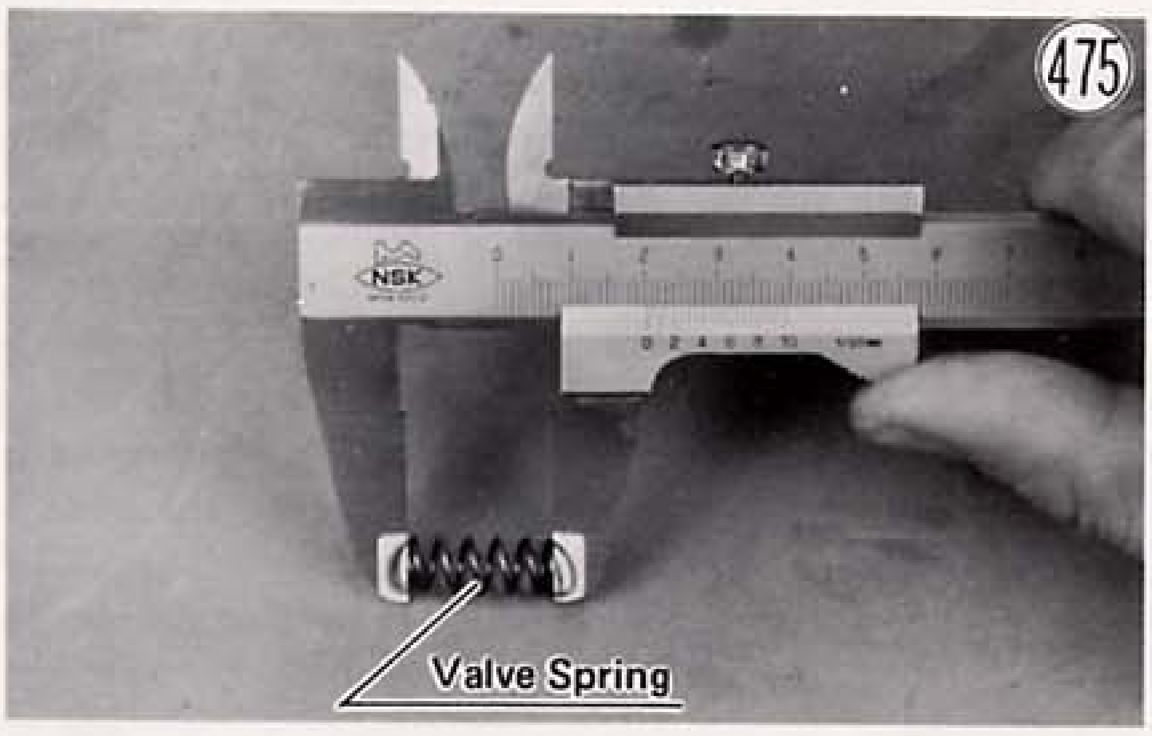


Table 62 Valve Spring Free Length

Standard	Service Limit
20.6 mm	19 mm

Engine Oil Pump

The oil pump, installed in the right side of the lower crankcase half, is a simple trochoid type with an outer and an inner rotor. The gear on the pump is driven in direct proportion to engine rpm by a gear attached to the rear of the clutch housing.

If the oil pump becomes worn, it may no longer be able to supply oil to lubricate the engine adequately.

Outer rotor/inner rotor clearance

Measure the clearance between the outer rotor and inner rotor with a thickness gauge. If the clearance exceeds the service limit, replace the rotors.

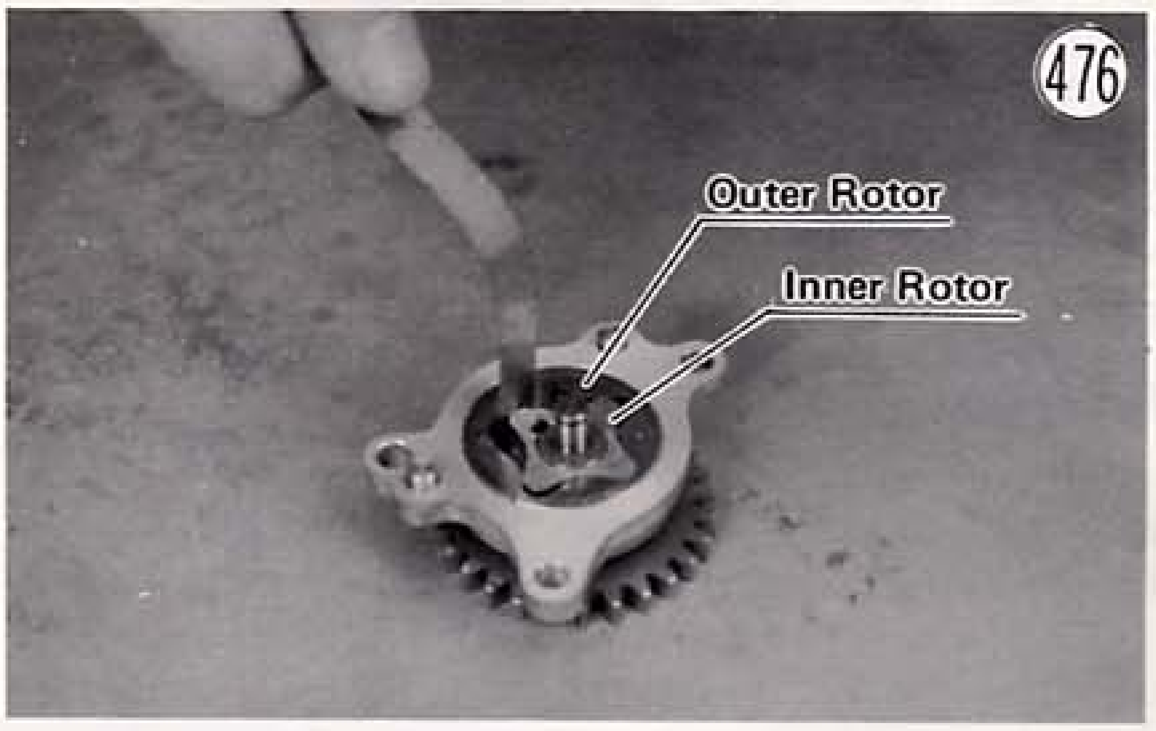


Table 63 Outer Rotor/Inner Rotor Clearance

Standard	Service Limit
0.025~0.115 mm	0.21 mm

Rotor side wear

Lay a straight edge on the oil pump body, and measure the clearance between the straight edge and the rotors with a thickness gauge. If the clearance exceeds the service limit, replace the rotors.

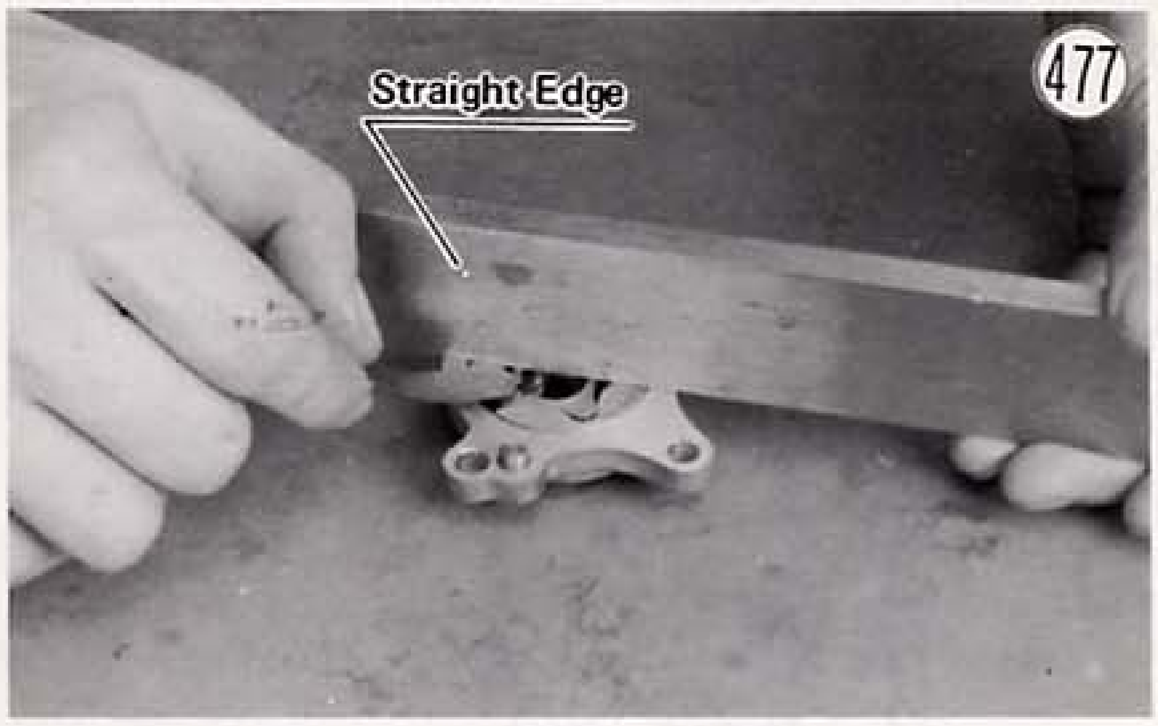


Table 64 Rotor Side Wear

Standard	Service Limit
0.03~0.09 mm	0.15 mm

Outer rotor/pump body clearance

Measure the clearance between the outer rotor and the pump body with a thickness gauge. If the clearance exceeds the service limit, replace either the pump body or the outer rotor depending on which is excessively worn. The standard inside diameter for the pump body and outside diameter for the outer rotor are 40.66 ~ 40.69 mm and 40.53 ~ 40.56 mm.

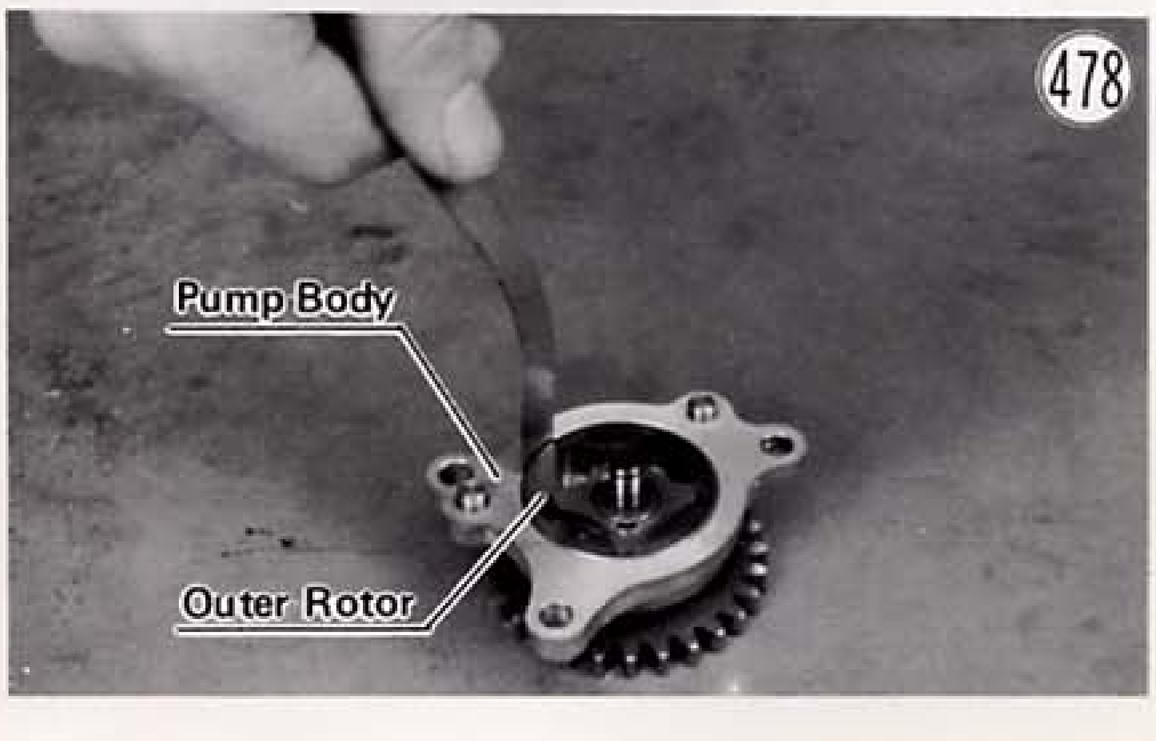


Table 65 Outer Rotor/Pump Body Clearance

Standard	Service Limit
0.10~0.15 mm	0.25 mm

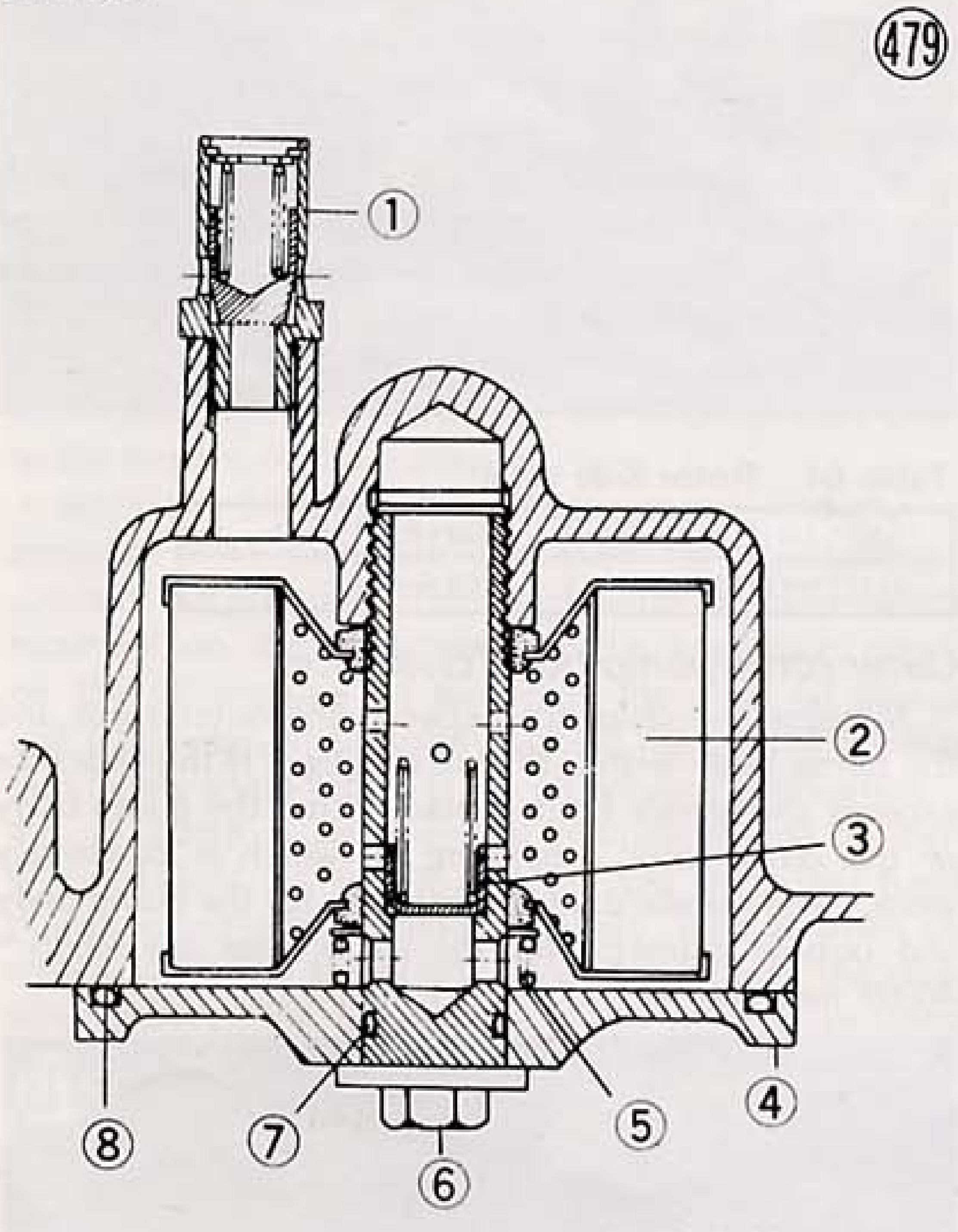
Oil Filter

The oil filter, located in the lower part of the crankcase, cleanses the oil from the oil pump by filtration before the oil is used for lubrication.

As the filter element becomes dirty and clogged, its filtering effect is impaired. If it becomes so clogged that it seriously impedes oil flow, a pressure bypass valve in the center of the oil filter bolt opens so that sufficient oil will still reach the parts of the engine needing lubrication. When the filter becomes clogged such that the oil pressure difference between the inlet and outlet for the filter reaches 1.3 ~ 1.7 kg/cm² (18 ~ 24 psi), the oil on the inlet side pushing on the valve spring opens the valve, allowing oil to flow to the main oil passage bypassing filtration.

Since any metal particles or other foreign matter in the oil reaching the crankshaft and transmission accelerates wear and shortens engine life, the oil filter should never be neglected.

Oil Filter



1. Relief Valve
2. Filter Element
3. Bypass Valve
4. Filter Base
5. Spring
6. Filter Bolt
7. O Ring
8. O Ring

Replace the filter element in accordance with the periodic maintenance chart (Pg. 180) since it quickly becomes clogged with metal filings from the engine and transmission breaking in. Subsequently, replace the element at every other oil change. When the filter **is removed for element replacement, wash the rest of the filter parts in a high flash point solvent of some kind and check the condition of the O ring. If the O ring is worn or deteriorated, replace it to avoid oil leakage.**

Oil Breather

The oil breather is located on the top of the cylinder head cover. The underside of the breather opens to the crankcase, while the upper part connects through the breather hose to the air cleaner. Its function is to minimize crankcase pressure variations caused by crankshaft and piston movement and to recycle blowby gas.

Gas blowby is the combustion chamber gas escaping past the rings into the crankcase. A small amount is unavoidable, but gas blowby increases as cylinder wall and piston ring wear progresses. If not efficiently removed, blowby gas will seriously contaminate the engine oil.

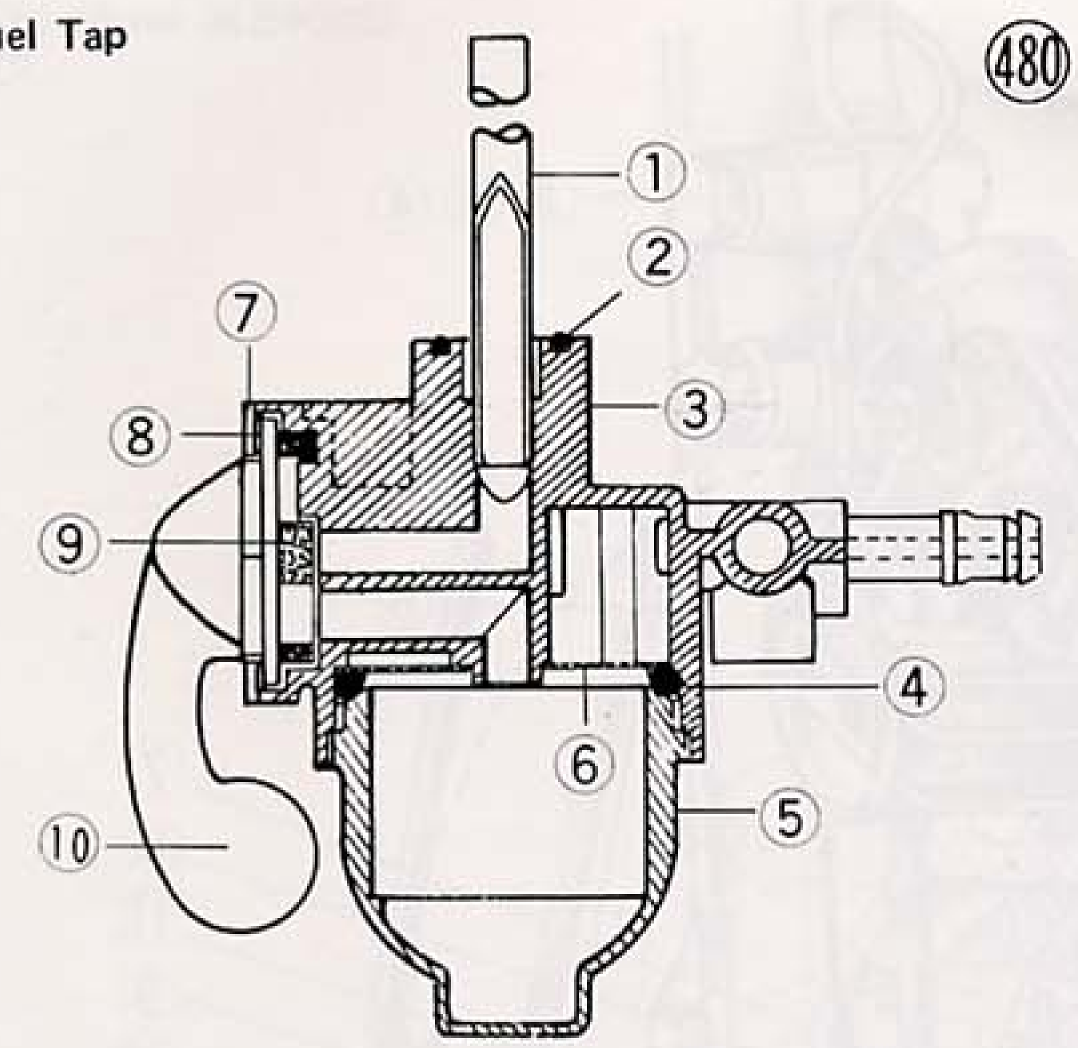
Recycling blowby gas means more efficient combustion, but the oil mist resulting from transmission gear movement must first be removed. The mixture of blowby gas and oil mist passes through a maze in the breather, which separates most of the oil from the gas. The oil which is separated from the gas returns to the bottom of the crankcase passing by the tachometer gear and camshaft chain. The gas together with a little oil is drawn through the breather hose into the air cleaner case. Here the remaining oil separates and passes through a hose to the outside, and the gas is drawn through the air cleaner element and carburetors into the engine again for combustion.

FUEL TANK

The fuel tank capacity is 14 liters, 3 liters of which form the reserve supply. A cap is attached to the top of the tank, and a fuel tap to the bottom at one side. An air vent is provided in the cap so that, when the tap is turned on, low pressure, which would hinder or prevent fuel flow to the carburetor, will not develop in the tank.

Fuel tap construction is shown in Fig. 480. The fuel tap has three positions: stop, on, and reserve. With the tap in the stop position, no fuel will flow through the tap; with the tap in the on position, fuel flows through the tap by way of the main pipe until only the reserve supply is left in the tank; with the tap in the reserve position, fuel flows through the tap from the bottom of the tank. The fuel tap contains a strainer and a sediment cup to filter out dirt and collect water.

Fuel Tap



1. Main Pipe
2. O Ring
3. Body
4. O Ring
5. Sediment Cup
6. Strainer
7. Plate
8. Wave Washer
9. Valve Gasket
10. Lever

Inspection and cleaning

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

Examine the air vent in the cap to see if it is obstructed. Use compressed air to clear an obstructed vent.

Periodically inspect and clean the fuel tap strainer and the sediment cup, using a high flash point solvent of some kind and a fine brush on the strainer. If the strainer is damaged, it must be replaced. If the sediment cup contains much water or dirt, the fuel tank and the carburetors may also need to be cleaned.

To clean out the fuel tank, disconnect the fuel hose, remove the fuel tap, and flush out the tank with a high flash point solvent of some kind.

To drain the carburetor float bowls, remove the plug at the bottom of each carburetor. For thorough cleaning, remove and disassemble the carburetors (Pgs. 28 ~ 30).

WHEELS

Wheel construction is shown in Figs. 482 and 483. The following sections, Pgs. 133 ~ 138, cover the tires, rim and spokes, axle, grease seals, and wheel bearings. For the brakes, see Pgs. 140 ~ 148.

TIRES

The tires are designed to provide good traction and power transmission during acceleration and braking even under bad surface conditions when they are inflated to the correct pressure and not overloaded. The maximum recommended load in addition to vehicle weight is 140 kg .

If the tires are inflated to too high a pressure, riding becomes rough, the center portion of the tread wears quickly, and the tires are easily damaged.

If inflation pressure is too low, the shoulder portions wear quickly, the cord suffers damage, fuel consumption is high, and handling is poor. In addition, heat builds up at high speeds, and tire life is greatly shortened.

To ensure safe handling and stability, use only the recommended standard tires for replacement, inflating them to the standard pressure. However, for continuous high speed travel, increase the tire pressure from 0.2~0.4 kg/cm² (3 ~ 6 psi) in order to minimize heat buildup. Also, a certain variation from the standard pressure may be desired depending on road surface conditions (rain, ice, rough surface, etc.).

Table 66 Tires, Air Pressure (measured when cold)

	Air Pressure		Size	Make, Type
Front	1.75 kg/cm² (25 psi)		3.25S-18 4PR	Yokohama Y984C
Rear	Up to 97.5 kg	2.0 kg/cm² (28 psi)	3.50S-18 4PR	Yokohama Y987A
	Over 97.5 kg	2.5 kg/cm² (36 psi)		

Tire wear, damage

Tires must not be used until they are bald, or if they are cut or otherwise damaged. As the tire tread wears down, the tire becomes more susceptible to puncture and failure. 90% of tire failures occur during the last 10% of tire life.

Visually inspect the tire for cracks and cuts, replacing the tire in case of bad damage. Remove any imbedded stones or other foreign particles from the tread. Swelling or high spots indicate internal damage, requiring tire replacement unless the damage to the fabric is very minor.

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

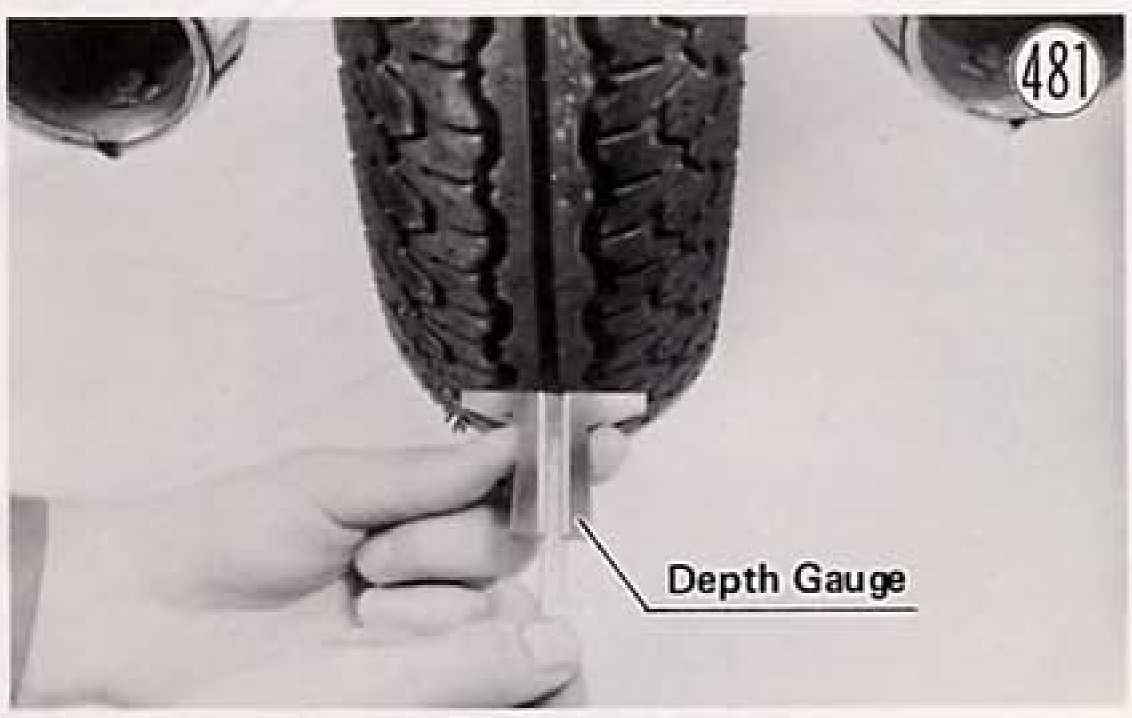
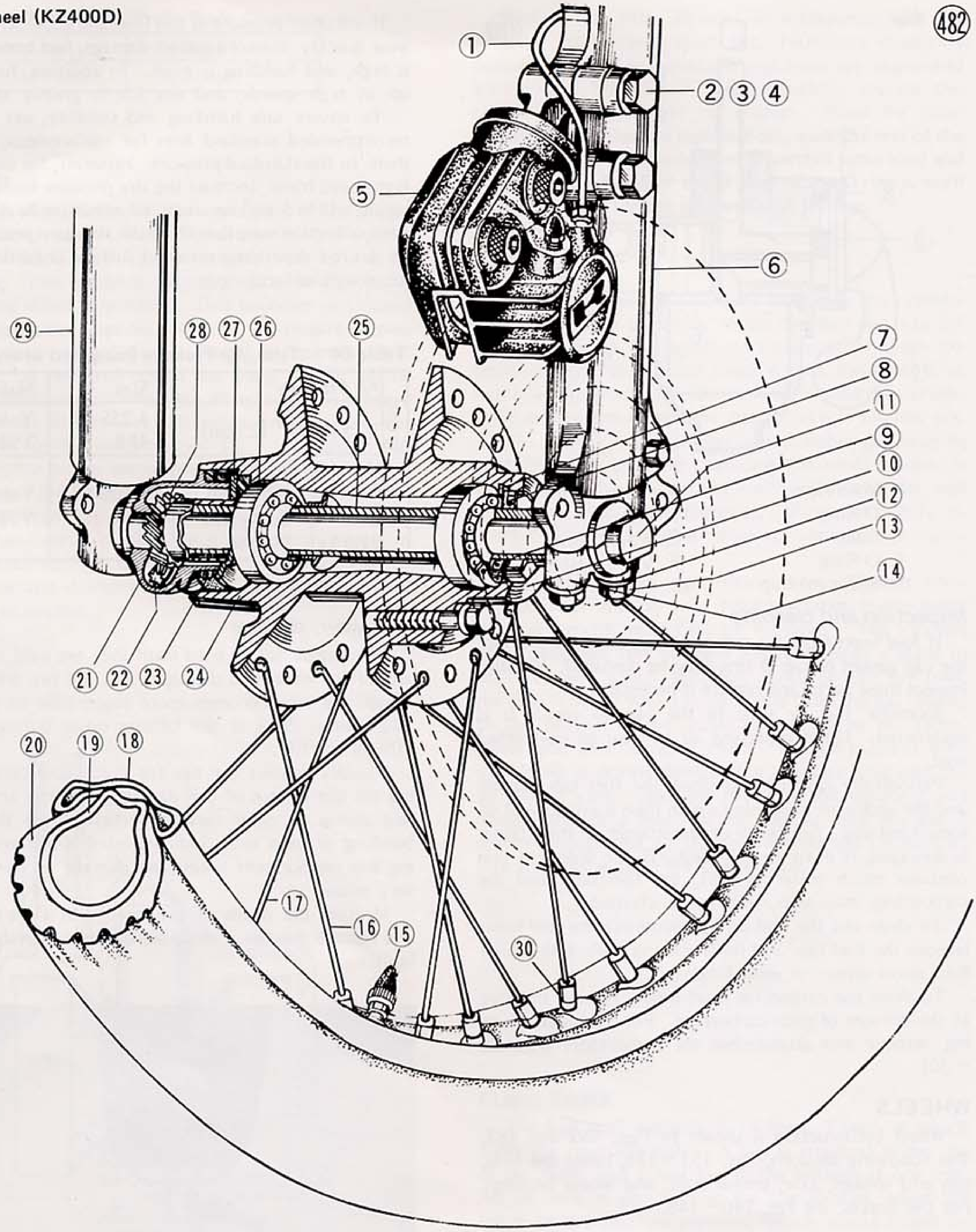


Table 67 Tire Tread Depth

	Standard	Service Limit	
		Normal speed	over 130 kph
Front	4.4 mm	1 mm	1 mm
Rear	6.3 mm	2 mm	3 mm

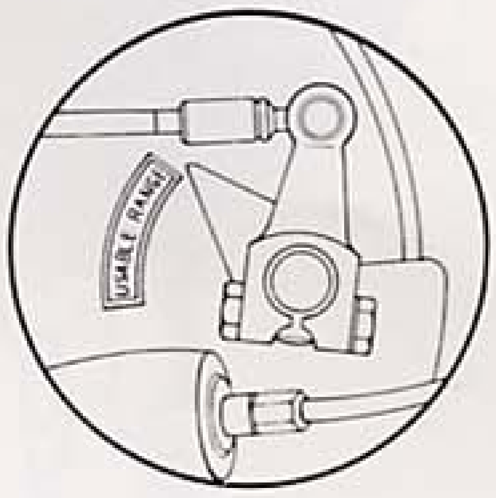
Front Wheel (KZ400D)

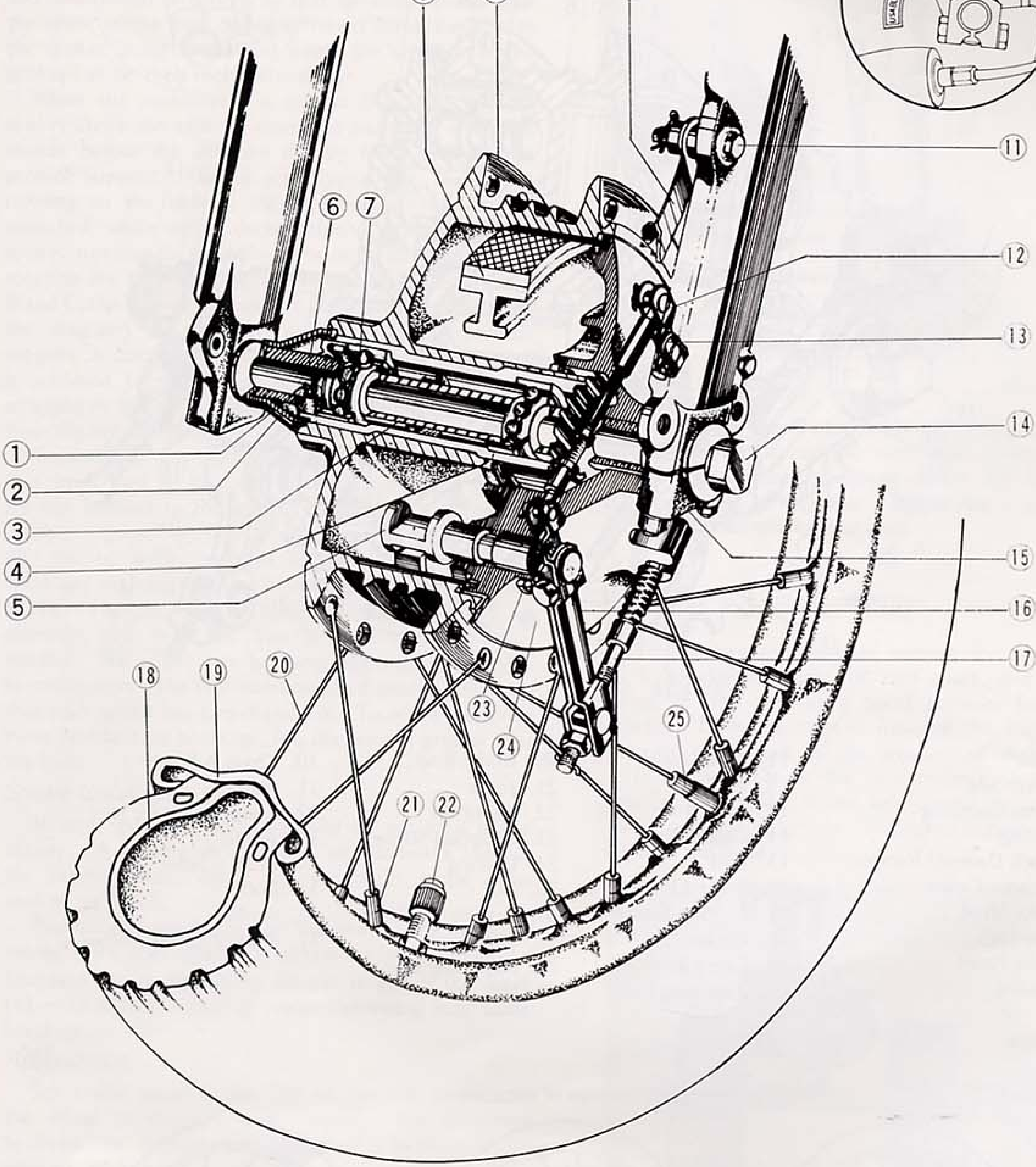


1. Brake Pipe
2. Bolt
3. Lock Washer
4. Washer
5. Caliper
6. Left Front Shock Absorber
7. Circlip
8. Grease Seal
9. Circlip
10. Cap
11. Axle
12. Lock Washer
13. Nut
14. Axle Clamp
15. Valve Stem
16. Inner Spoke
17. Outer Spoke
18. Rim
19. Tube
20. Tire
21. Speedometer Gear Housing
22. Speedometer Pinion
23. Grease Seal
24. Front Hub
25. Distance Collar
26. Bearing
27. Gear Drive
28. Speedometer Gear
29. Right Front Shock Absorber
30. Nipple

Front Wheel (KZ400S)

Brake Lining Wear Indicator (483)

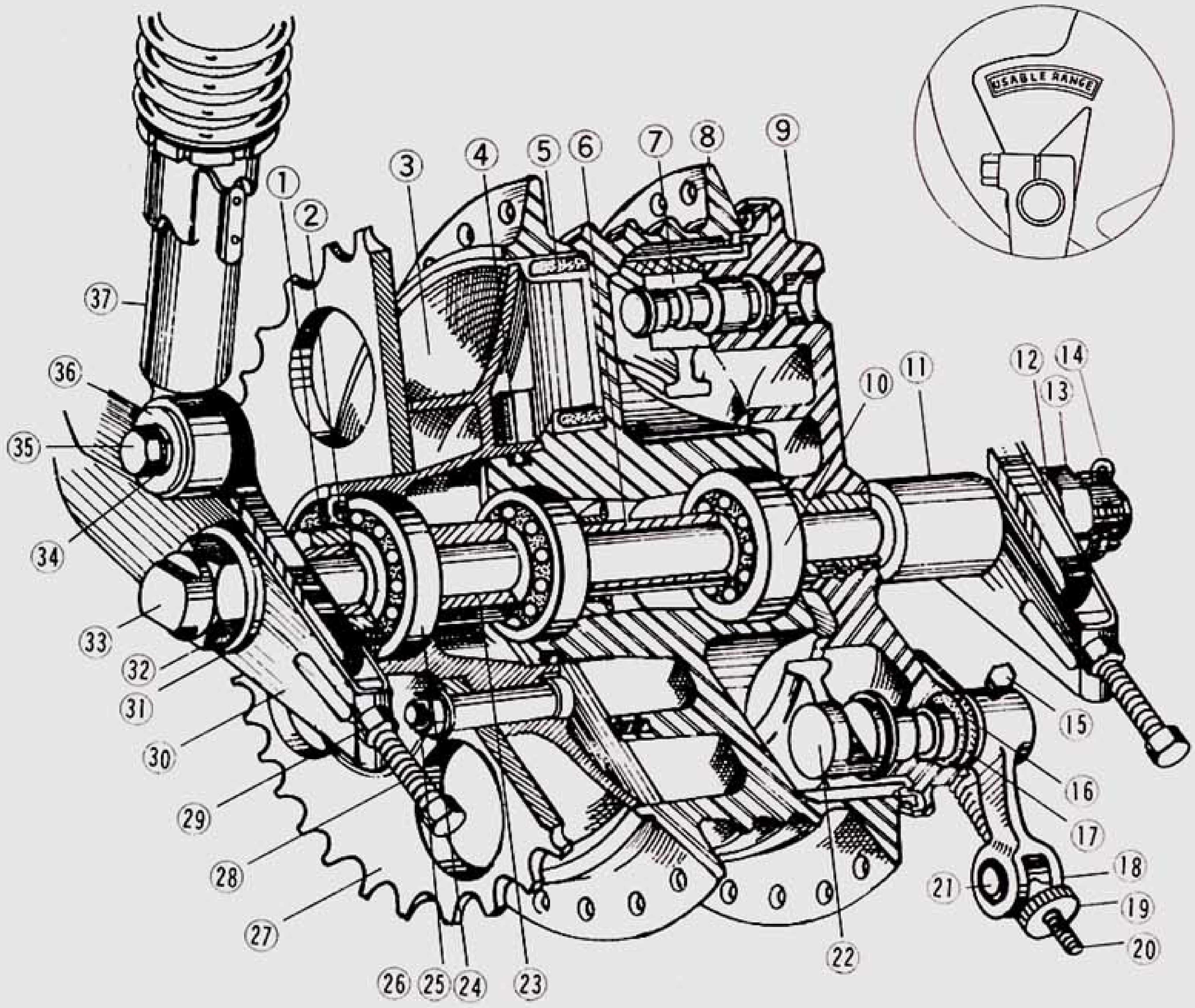




1. Cap
2. Grease Seal
3. Collar
4. Grease Seal
5. Brake Cam Shaft
6. Collar
7. Ball Bearing
8. Brake Shoe
9. Front Hub
10. Torque Link
11. Torque Link Bolt
12. Secondary Brake Cam Lever
13. Connecting Rod
14. Axle
15. Axle Clamp
16. Primary Brake Cam Lever
17. Brake Cable
18. Tube
19. Rim
20. Spoke
21. Nipple
22. Valve Stem
23. Return Spring
24. Brake Panel
25. Balance Weight

Rear Wheel

Brake Lining Wear Indicator (484)



1. Collar
2. Grease Seal
3. Wheel Coupling
4. O Ring
5. Shock Damper Rubber
6. Distance Collar
7. Brake Shoe
8. Rear Hub
9. Brake Panel
10. Bearing
11. Axle Sleeve
12. Washer
13. Axle Nut
14. Cotter Pin
15. Bolt
16. Brake Lining Wear Indicator
17. Gasket
18. Cam Lever
19. Adjusting Nut
20. Brake Rod
21. Joint
22. Camshaft
23. Coupling Sleeve
24. Bearing
25. Nut
26. Double Washer
27. Sprocket
28. Adjusting Bolt
29. Nut
30. Chain Adjuster
31. Washer
32. Coupling Sleeve Nut
33. Axle
34. Lock Washer
35. Bolt
36. Washer
37. Rear Shock Absorber

Spoke Force

(485)