SHOP MANUAL

MODEL M5A 5PS

INDEX

SPECIFICATIONS

Model :	M5A
Length overall :	Approximately 670 mm
Width overall :	〃 335 mm
Height overall :	〃 S Type : 1,015 mm
	UL Type : 1,165 mm
	Transam height : S Type : 410 mm (16 inch)
	UL Type : 570 mm (22 inch)
Weight :	S Type : 22.0 kg
	UL Type : 22.5 kg
Gear ratio :	14 : 25
Propeller (Dia. × Pitch) :	3 – blade × 188 mm × 157 mm (Standard type)
	2 – blade × 190 mm × 166 mm (Special order)
Maximum speed :	25 km/hr.
Fuel consumption :	2.3 littre/hr.
Fuel tank capacity :	3.0 littres (Separate 13 littres tank equippable.)
Operation :	Bar handle with throttle grip
Clutch :	Shift lever operation (Forward, neutral and reverse)
	Dog-clutch system
Engine type :	T52G
Cycle :	2 Cycles
Number of cylinder :	1
Bore × stroke :	52 mm × 43 mm
Piston displacement :	91 cc
Maximum output/revolution :	5 P.S./5,000 r.p.m.
Lublication :	Mixture (Gasoline : Oil = 25 : 1)
Cooling :	Compulsory Air and water cooling
Starting :	Automatic rewind starter or pulling cord
Ignition :	Flywheel magneto
Spark plug :	NGK B7HS
Lighting capacity :	12V 25W
Carburetor :	TK Carburetor, Type R14F-2F

FEATURES

1. As the engine is complete water-proof covered style, complete protection is made against water splash, immersion and rusting so that the full operation is possible even on the rough water.
2. The carburetor being equipped in the front besides being covered completely, the engine is completely protected from the water splash.
3. It is designed so as the magneto is completely protected from the water splash.
4. Since the lead valve is used, it gives more output at low revolution without the reverse flow of the fuel but with less fuel consumption. Besides, as the lead valve is made with stainless steel, it has the excellent anti-corrosion characteristic.
5. As it is designed so as the exhaustion is to be made into the water, there is less exhaustion noise.
6. As engine is cooled by the particularly designed method under Tohatsu's own patent which is air and water cooling system, the continuous operation is possible even at the high revolution.
7. In order to facilitate the operation, barhandle single lever system is employed besides, to minimize the vibration transmission, the rubber buffer is used.
8. Gear shift to forward, neutral and reverse can be done by clutch operation, which is the unique arrangement made for this class of outboard motor in Japan ever made by any maker. This enables the operator to handle the engine much more simply than before.

9. To enable the user in the wide range of the boats to which the outboard motor will be equipped, such two kinds of the transoms as S-Type and UL-Type which height are 410mm (16 inch) and 570mm (22 inch) respectively have been manufactured.
10. There are two kinds of propellers interchangeable provided for the proper use.
11. As the tilt stopper is automatic, operation is easy.
12. As hexa-degree tilt degrees is designed, the equipping angle to the boat is wider than before.
13. The operation is simply adjusted by the grip.
14. It is designed so as when necessary as option the lighting set and separate fuel tank can be equipped on demand of the user.
15. As the die-casting and metal moulds are employed generally in the production, finish of the painting is better than before besides it causes to promote beauty of its outer appearance and also anti-corrosion characteristics.

STRUCTURE

1. Power Head

Engine (T52 G) is of 2-cycle, single cylinder and compulsory air and water cooling system. On the upper end of crank shaft, cooling fan and flywheel magneto of one compound and rewind starter is equipped. On the lower end, drive shaft which is spline-connected conveys the revolution through clutch to propeller shaft. Crank case cannects with cylinder on one end and with intake manifold and carburetor on the other end.

While, the engine is covered with cylinder cover and the upper surface covered with the fuel tank which effects the tank and cover, thus the engine is covered style.

○ Cylinder head

Cylinder head is aluminium alloy and is the die cast which increases the anti-corrosion characteristics. The combution chamber is of ideal dome-shaped and is designed to increase the conbustion efficiency, and also, to cool the outerside by means of the cooling fan. Cylinder is set with 4 bolts with gasket between.

○ Cylinder

Cylinder is cast aluminium alloy designed half of crank case as one body with anti-corrosion characteristics. Special cast iron liner is inserted into cylinder by means of heat-treating. Outer surface is cooled with cooling fan.

○ Crank case

Crank case is alluminium alloy die casting with anti-corrosion characteristics consisting of the lower half, like cylinder. It is connected with cylinder by 6 bolts, namely 2 fitting bolts A, and 4 fitting bolts B which also fit Reed Value Seat & Intake Manifold together, after laying crank shaft between them and facing the surfaces at the position of 2 knocks.

Further, it is designed so as the fuel tank is placed on the upper part and the cylinder plate and crank case cover at the lower part which are bolted tightly.

○ Crank shaft

Three main parts, upper shaft (A) and lower shaft (D) and crank pin constitute a built-up crank shaft. Connecting rods are connected with upper and lower crank shafts at the time when crank pins are pressed-into crank shaft. Crank shaft upper and lower are set with main retainer (#6204-E_2 ball bearing) and further fitted oilseal B, and then are assembled with cylinder.

○ Piston and piston ring

Piston is of hardly expanding metal, aluminium alloy.

On the top is stamped arrow indicating exhaustion direction. Two pieces of piston ring, A and B, are inserted in the slits around the upper side. Piston is connected with connecting rod small end with piston pin so that piston can move floatingly.

Piston ring is of special cast iron and is felox treatment so that the same is of anti-defacement characteristics.

2. Lower unit

Lower unit consistes of steering bracket, drive shaft housing and gear case and each part is connectek by bolts.

○ Bracket

Two main parts are swivel bracket and stern bracket (anti-corrosion cast aluminium alloy). The swivel bracket which holds the drive shaft housing are devided into front (A) and rear (B) and they are connected with drive shaft housing by means of four bolts with linings between. This swivel bracket can be fitted with stern bracket left and stern bracket right between. Further, the outboard motor can be equipped with the boat by means of clamp screw attached to the stern bracket.

○ Drive shaft housing

It is made of anti-corrosion characteristic cast alluminium alloy designed the part of rudder as a one body. Its upper surface is the fitting surface of the engine and the lower surface, of the gear case. On the upper part of the left side, the bar handle is installed and, on the upper part of the right side, cratch lever. In the inner part, drive shaft, shift rod and cooling water pipe exist.

○ Gear case

Gear case is made of anti-corrosion characteristic cast alluminium alloy and, in the inner part, there are clutch mechanism, propeller shaft and the transmission mechanism inclusive bevel gear. Propeller shaft bearings and oil seal are pressed-in the gear case, and it is perfectly enclosed by gear case cap so as to prevent the lubrication oil to flow out.

Further, the upper part of the rear is the exhaustion hole and cooling water pipe is fitted with knock. In the middle part of it, there are holes, one for the drive shaft and another at the front for the clutch cam penetrating up to the gear case. In the drive shaft hole, two bushings are pressed in.

3. Transmission and clutch

The transmission is made in such a way as the drive shaft which is spline connected with a lower part of crank shaft, passes through the drive shaft housing, and is also spline-connected with bevel gear B in gear case.

Here bevel gear B gears into bevel gear A which is fitted with propeller shaft. Thus revolving force is turned by 90° and is conveyed to propeller shaft through clutch. Phosphorus-bronze bushing is pressed in bevel gear A.

The clutch mechanism shifts the propeller shaft forward and backward, by the motion of clutch cam, through the clutch push rod fitted in the propeller shaft, leting dog clutch transfers up-or downwards along propeller shaft so that the same sets in either big or small gear for forward or backward to rotate the propeller shaft. When it does not set in, it becomes the neutral. Dog clutch is splain-connected with propeller shaft. Operation of clutch is done by falling it forward and backward. Operation series is such as clutch lever—shift rod—cam shaft (on the end, clutch cam is set with pin).

Tips to the operator:

a) When changing from forward position to reverse position, try to set the clutch lever to the reverse when the boat looses the speed. The same care should be taken when changing from reverse to forward.

b) When it is reverse position, accelerate the carburetor throttle lever gradually and never accelerate the lever above 20° (approx. 25mm at the lever end, throttle approx. 1/4-1/3). While, never accelerate the engine revolution over approx. 3,500 r.p.m.

4. Fuel-flow system

The fuel oil is fed into the carburetor from the fuel tank equipped on the top of the engine through fuel cock pipe, then it becomes the suitable mixed gas then comes into the crank case through reed valve. The changing of fuel cock is done by lever in such manner as side—stop, lower—pass. There is preparation as option a separate tank which content is 13 litters for long rage operation.

5. Water cooling system

○ Regarding compulsory air cooling system:

The cooling by air of each part of engine is done by means of the fan fitted with the flywheel, along the lower part of the fuel tank, cylinder and cylinder head. The fuel tank works additionally as air cooling fan case and as the guide of the cooling air.

○ Cooling water system

The cooling water comes to the passage at the lower part of engine, by the propeller pressure, after passing through the cooling water pipe circulating the inner part of the drive shaft, then cools the lower part of cylinder where the cooling air is hard to pass, and then is exhausted into the water through the drive shaft after cooling the exhaust gas.

Further, a part of the cooling water is exhausted from the inspection hole at the lower

right side of cylinder, by which the circulating condition of the cooling water at the lower part of the cylinder is checked.

6. Lublication

○ Lubrication of each part of the engine

Being the mixed oil (Gasoline 25 : Oil 1), it is constantly fed in the crankcase together with the fuel so that the new oil is constantly supplied to each bearing and sliding part.

○ Lubrication of gear case

The gear oil is supplied to the gear case so that the same is supplied to the drive shaft, bearing for propeller shaft, and gears.
The quantity of oil supplied is approx. 80 cc.

7. Starting, stopping and speed control

○ Starting mechanism

The rewind starter is fitted on the fuel tank by means of the 3 bolts.

○ Stopping mechanism

The stop switch for the stopping of engine is enclosed with rubber cover and is placed on the front right side of the engine cover. The engine stops by pushing the stop-switch.

○ Speed control installation

The throttle grip is set on the handle and, by turning operation of the grip, the speed control is available.

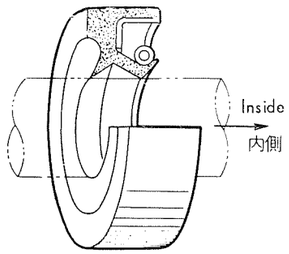
8. Electrical equipment

The ignition coil is installed in the flywheel magneto.

DISASSEMBLING & ASSEMBLING

Tips on disassembling and assembling of power-head & lower unit.

1. Before starting disassembling and assembling, prepare the ruled tools and equipments.
2. Before disassembling, check to see if there are corresponding marks on each part. If corresponding marks are not stamped on, mark the parts so that they can be reassembled correctly.
3. Temporarily fit the small parts, bolts, nuts, washers, etc. in their original position to prevent loosing them or mixing them up.
4. After disassembling, clean all parts, wash them with a certain cleaning oil or gasoline, check the damage or wear of them, and put them in order for re-assembling.
5. When re-assembling, check to see that the interlocking parts are properly fitted, the center of parts are correctly aligned, whether air leaks, that all moving parts are properly lubricated, all necessary parts are lubricated, all gaskets are properly placed and whether any gaskets are worn. Check the conditions of all the wires and pipes to see if they are all in order.
6. Be sure that the parts where many bolts and nuts are used (Cylinder head and crank case etc.) are evenly tightened. First turn on bolt slightly and alternately, then all bolts can be evenly tightened. Do not tighten the bolts on one side first and then fit the bolts on other side.
7. Use the indicated binding agent and screwlocks etc. without fail.
8. Check to see that the oil seals are in good condition. When reinstalling oil seals, be careful not to damage the lips which contact with a shaft and be sure not to take-off retaining ring. The spring side of the oil seal should be in proper position. (Drawing 1).



Drawing 1. Surface and reverse side of oil seal

Note 1: Followings are abbreviations for kinds of bolts, nuts, washers etc.

Abbreviation (Example)	Meaning
8×20, bolt	Dia. 8mm, Length 20mm, Hexagon bolt
8, nut	Dia. 8mm, Hexagon nut
6×10, + dome small	Dia. 6mm, Length 10mm + dome-shaped small screw
6×8, − round flat (RF.) small	Dia. 6mm, Length 8mm − round flat (RF) small screw
8, W.	8mm plate washer
8, S.W.	8mm spring washer
+ & − marks indicaie the slit shape of screw head. Dome, flat, dish etc. mean the shape of the screw head.	

Note 2: Figures in the picture and drawing indicate the part number.

9. All the bolts, nuts and screws used in the outboard motor type B9A, are ISO screws relud by the new JIS standard, and therefore, be careful not to mix up with the previous screws.

MAJOR DISASSEMBLING

1. ENGINE

A. Removing of engine parts

Order	Works	Part No. & Qty.	Tool	Note
1	Close the air vent valve of fuel tank cap & fuel cock.			See Photo 5
2	Unfix carburetor cover and separate carrying-handle.	5×12 ⊖ RF 2 5 SW 2 5W 2 5×13 RF 4 5 SW 4 5 W 4	⊖ Driver ⊖ Driver	Keep power head inclined 45° when removing carburetor cover
3	Remove handle	1277 1 8×45 bolt 2 8 SW 2	13 spanner	Do it after unfixing throttle wire and stop cord.
4	Unfix engin cover	1271 1 6×12 bolt 4 6 W 4	10 box spanner	1. Do it after unfixing plug cap & spark plug 2. When unfixing motor cover, keep clutch lever at forward position.

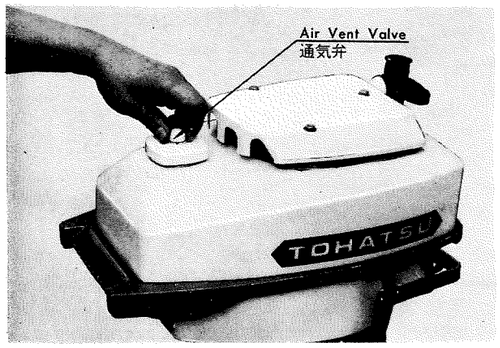


Photo 5. Closing air vent valve, Tank Cap.

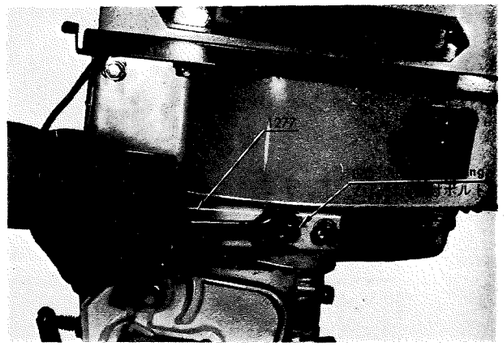


Photo 6. Unfixing steering handle
1277...Steering handle A

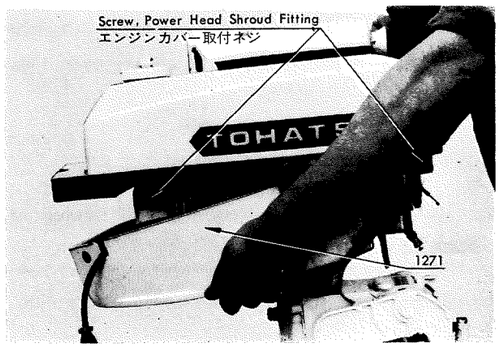


Photo 7. Unfixing motor cover
1271...motor cover

Order	Works	Parts & Q'ty	Tool	Note
5	Unfix the starter	1031 1 6 × 45 bolt 1 6 × 40 bolt 2 6 SW 3	10 box spanner	Photo 8
6	Unfix fuel tank	1301 1 630 ⊖ bolt 4 6 SW 4	⊖ Driver 10 box spanner	Do it after unfixing fuel pipe Photo 9 & 10
7	Unfix magneto nut, pulley bolt and starter pulley	1031−14 1 12 nut 1 6×12 ⊖ RF 1 6 SW 1	19 box spanner ⊖ driver	Starter pulley & magneto fly-wheel are jointly screwed. 12 nut is counter clockwise. Photo 11 & 12.
8	Unfix magneto flywheel	1121−1 1	Tool, flywheel pulling 19 box spanner	Photo 13

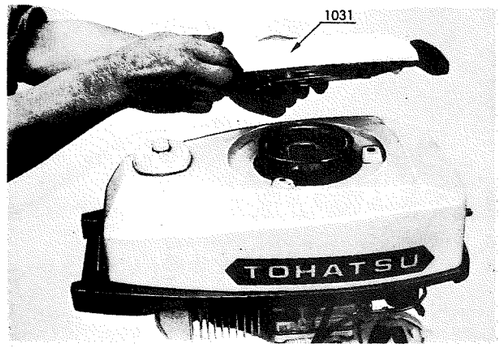


Photo 8 Unfixing starter
1031...Rewind starter

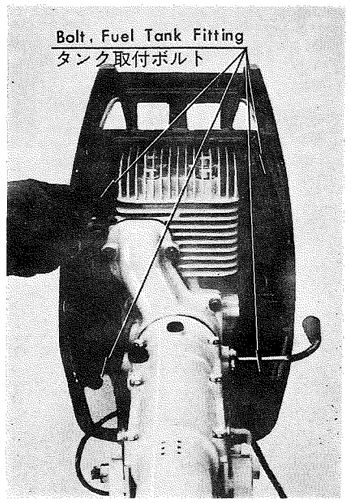


Photo 9. Unfixing bolt of fuel tank

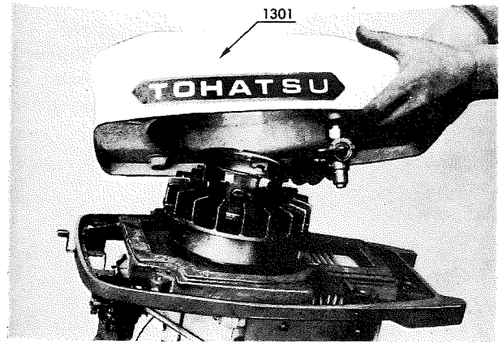


Photo 10. Unfixing fuel tank
1301...Fuel tank

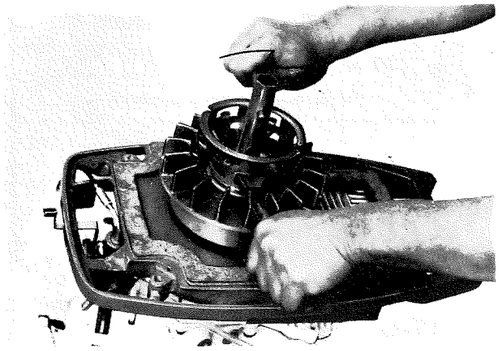


Photo 11. Unfixing nut, magneto fitting

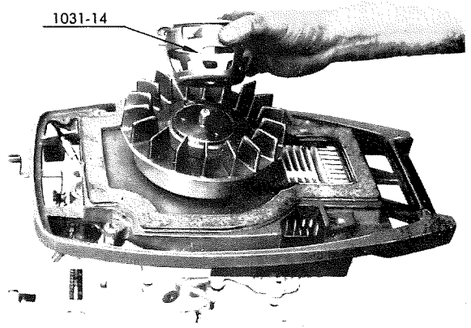
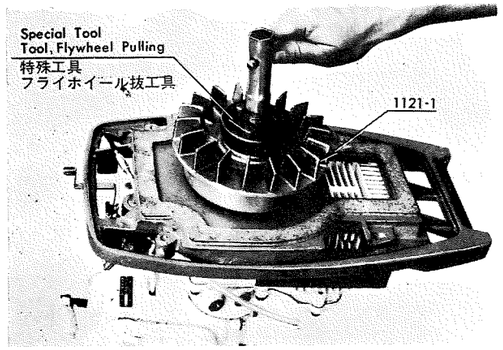


Photo 12. Unfixing starter pully
1031–14 Starter pulley



Photg 13. Tool, flywheel pulling
1121–1 Flywheel

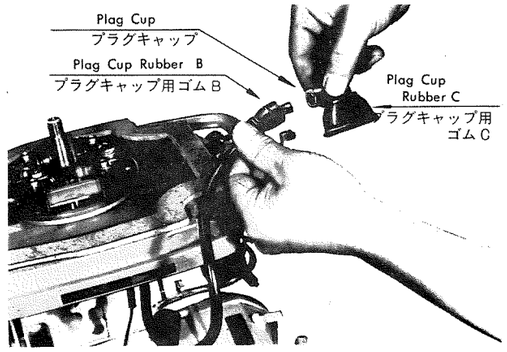


Photo 14. Unfixing plug cap, plug cap rubber B and C

Order	Works	Parts & Q'ty	Tool	Note
9	Unfix magneto base plate	5×12 ⊖ RD 2	⊖ Driver	Do it after unfixing plug cap & rubber C and B Photo 14 & 15
10	Unfix key and cam	Magneto 1 Cam 1		As it is marked R and L on the both faces. When assembling, it is required to bring R upward Photo 16
11	Unfix fuel tank stand	1305 1 6×16 ⊖ RF 6 6 SW 6	⊖ Driver	Photo 17
12	Unfix carburetor	1111 1 6×30 ⊖ bolt 1	⊖ Driver	Photo 18
13	Unfix engine body	6×25 ⊖ bolt 6 6 SW 6	⊖ Driver 10 spanner	Photo 19

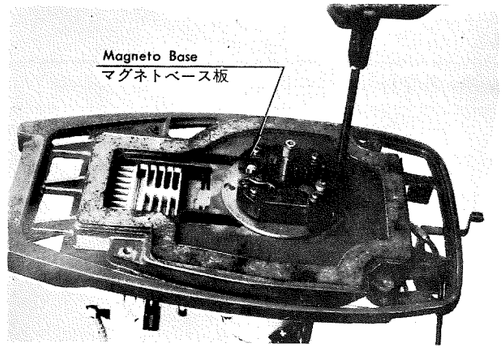


Photo 15. Unfixing magnets base plate

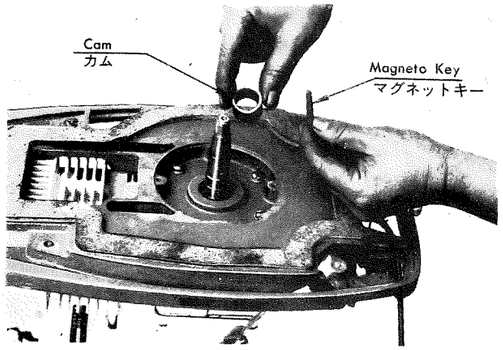


Photo 16. Unfixing magneto key and cam

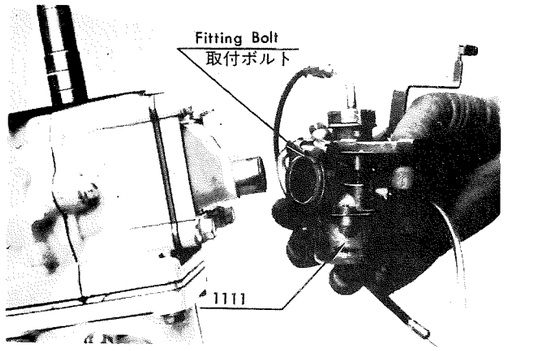


Photo 18. Unfixing carburetor
1111...carburetor

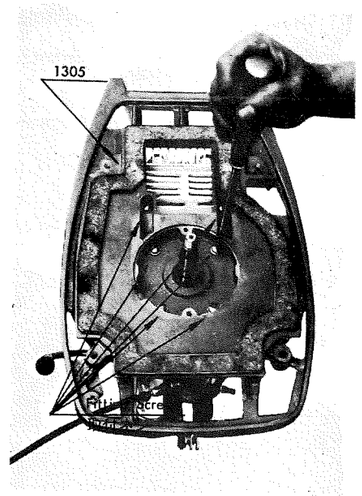


Photo 17. Unfixing fuel tank stand
1305...Fuel tank stand

Photo 19. Unfixing engine body

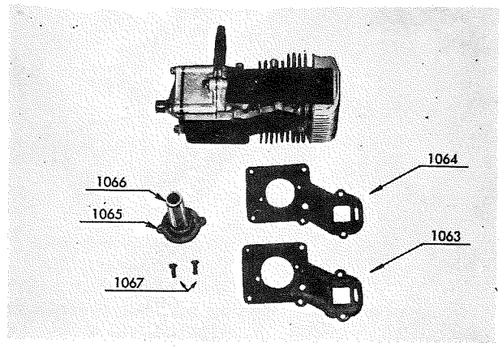


Photo 20. Engine body
1065=End cap assy, crank case
1066=Pipe, crank case end cap
1063=Cylinder plate
1064=Gasket, cylinder plate

2. DISASSEMBLING POWER-HEAD

Order	Works	Parts No. & Q'ty	Tool	Note
1	Unfix crank case end cap	1065 1 6×15 bolt 2	10 box spanner	Unfix cylinder plate and gasket simultaneously Photo 21
2	Unfix protect plate, fuel cock	1059 1 5×10 RF 2 5 SW 2	⊖ Driver	Photo 22
3	Unfix cylinder head	1051 1 8×40 bolt 4 8 W 4	13 box spanner	Photo 23
4	Unfix intake manifold	1081 1 6×75 bolt 4 6 SW 4 6 W 4	10 box spanner	Unfix simultaneously read valve assy and 2 gaskets Photo 24 Photo 25
5	Unfix crank case	6×30 bolt 2 6 SW 2 6 W 2	10 box spanner ⊖ driver	Photo 26

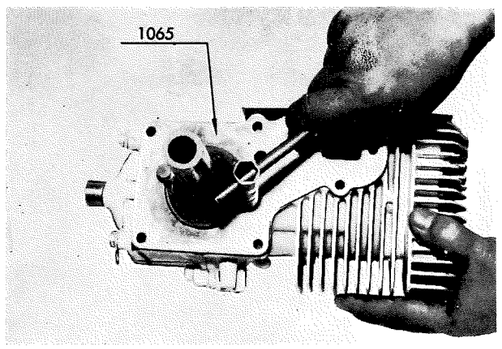


Photo 21. Unfixing crank case end cap
1051...Cylinder head

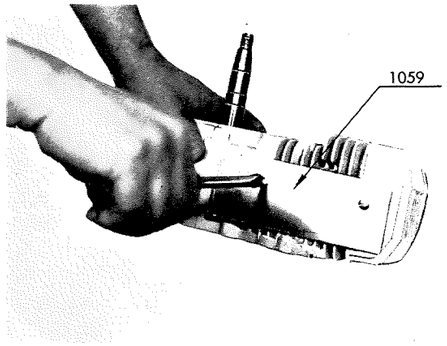


Photo 22. Unfixing protect plate, fuel cock
1059...Protect plate,fuel cock

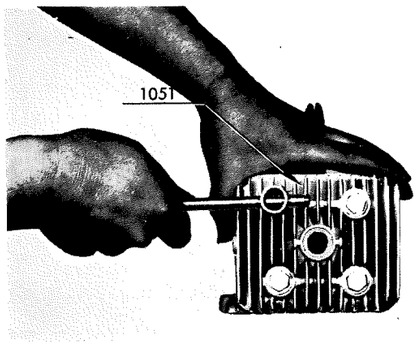


Photo 23. Unfixing cylinder head

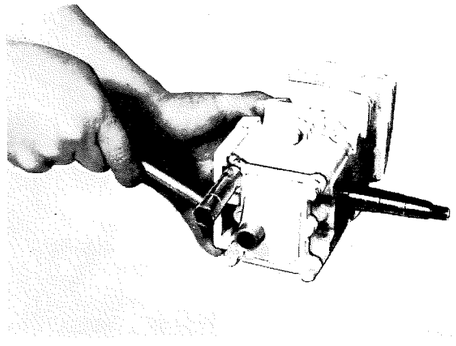


Photo 24. Unfixing read valve, intake manifold

Order	Works	Parts No. & Q'ty	Tool	Note
6	Unfix crank shaft ass'y	1009 1		Unfix as fitted with piston Photos 27 & 28
7	Unfix retainer of main bearing	1012 2		Unfix lock ring B of Oil seal Photo 29

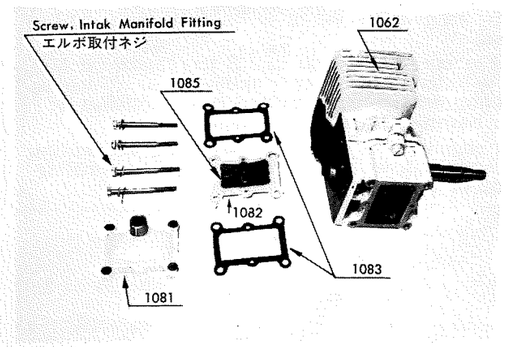


Photo 25. Intake manifold & Reed valve ass'y
1062...Cylinder & crank case ass'y
1081...Intake manifold
1082...Read valve seat
1083...Gasket, reed value seat
1085...Reed valve stopper

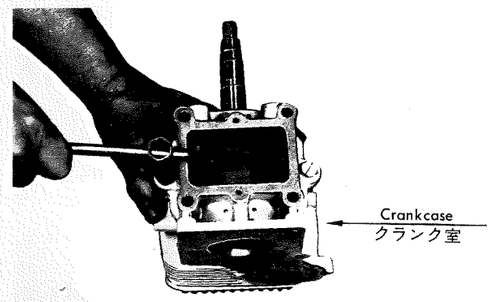


Photo 26. Unfixing crank case

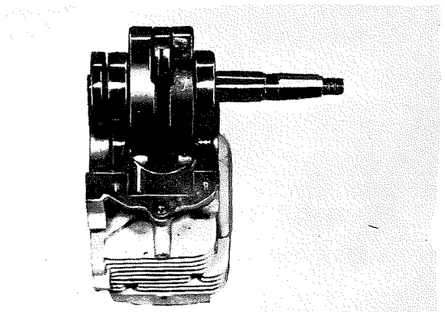


Photo 27. Unfixing crank shaft ass'y

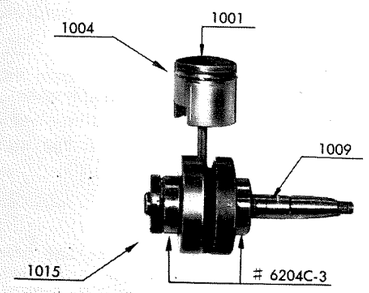


Photo 28. Piston & crank shaft assy
1009...Crank shaft ass'y
1015...Oil seal B
#6204C-3...Main bearing
1001...Piston STD
1004...Piston ring STD

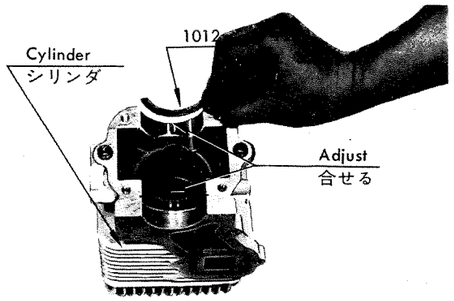


Photo 29. Unfixing retainer of main bearing
1012...Retainer, Main bearing

3. ASSEMBLING OF POWER HEAD

Assembling is done by the following reversedly orders of disassembling works. Tips on assembling works are as follows.

Order	Works	Note
1	Set the retainer of main shaft, to the groove	○ Set the cut part of the retainer to the oil hole of cylinder. Photo 29
2	Put crank shaft ass'y in crank case	○ Be careful not to misplace upper & lower part of crank shaft. Spline shaft should be at the same side as of exhaust hole. ○ Arrow mark at the top of piston should be at exhaust hole side. ○ Set the cut part of oil seal B to cylinder oil hole, and be careful not to set it upside-down. When assembling, take care not to hurt it with retainer of main bearing. Paste grease well. ○ Pour engine oil on the piston, piston ring and bearing. Be careful not to break piston ring when assembling. Photos 30 & 31.

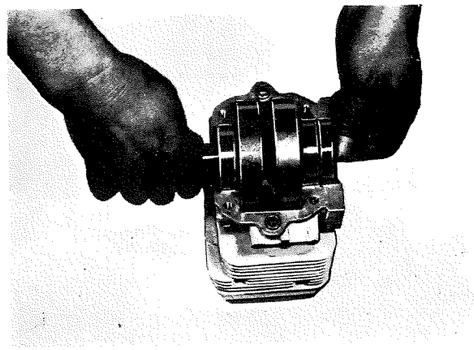


Photo 30. Assembling crankshaft ass'y.

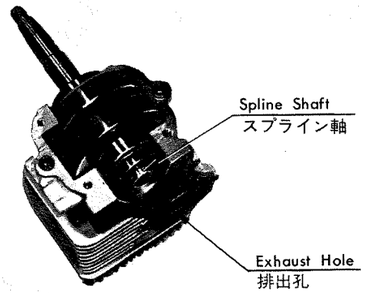


Photo 31. Completing assembling of crankshaft ass'y.

Order	Works	Note
3	Assemble crankcase	○ Apply liquid packing (Sealder Silver) on the combining surface ○ Decide position with two knocks. Four out of six bolts are to be jointly fitted with intake manifold. Photo 32
4	Assemble read valve and intake maniforld	○ Be careful to the surface and reverse of read valve. Reed valve should be at the side of crank case. ○ Place gasket on the both surfaces of valve sheet. ○ When fitting intake maniforld, jointly fit the holder of overflow pipe of carburetor. Photo 23
5	Assemble cylinder head.	○ Place gasket on the fitting surface. ○ When fitting the fuel cock protect-plate, the holes of its fitting screws at cylinder side and at cylinder-head side should be set to the opposite position.
6	Assemble fuel cock protect plate.	○ Be careful about the fitting position. Photo 22.
7	Assemble crank case end cap.	○ Jointly fit cylinder plate gasket. ○ Set the cut part of crank case end cap to check valve fuel hole.

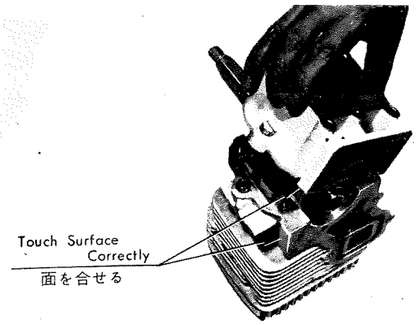


Photo 32. Assembling of crankcase.

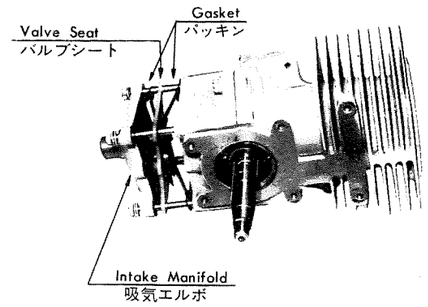


Photo 33. Assembling of read valve assy and intake manifold.

Tips to the assembling of engine parts :

○ Place gasket on the fitting surface of carburetor.
○ Be careful not to misplace in inserting cam (R up and L down), together with key.
○ Be careful at magneto base plate position. Assemble in such a way as contact breaker will face to cylinder. When assembling, keep the contact-point open, as slipper of contact breaker touches the cam.
○ Adjust the point gap after fitting base plate. (See the article of magneto; ignition timing.)
○ In assembling magneto flywheel and starter pulley, firstly set the position of flywheel with key then slightly knock with wooden hammer to fit the starter pulley temporarily with its bolt to the side of flywheel. Then fit the flywheel & starter pulley together firmly with its fitting nut (counter-clockwise screw). After that, finally fit the starter pulley with its fitting bolt.
○ When fitting fuel tank, be careful so as the tank lower surface and tank stand to be in the suitable clearance, and try to make a well-balanced fitting.
○ When starter is fitted, be careful so as the ratchet not to contact with the pulley.
○ When fitting motor cover, be careful not to hurt the high tension cord and fuel pipe.
○ When fiting handle, do not misplace the collar of steertng handle A.

2. GEAR CASE

A. Disassembling of gear case

Order	Works	Parts No. & Q'ty	Tool	Note
1	Separate shift rod, clutch lever.	1219 1 1215 1 4×16⊖ RF 1 4SW 1	⊖ Driver	When unfixed clutch lever, be careful not to loose the wave washer. Photos 34 & 35.
2	Unfix pin for cooling water pipe.	pin 1	Plier Hammer Punch	Photo 36.
3	Unfix gear case. (Unfix the bolt and pull it downward.)	1151 1 6×30 bolt 5	10 box spanner	Photos 37 & 38.

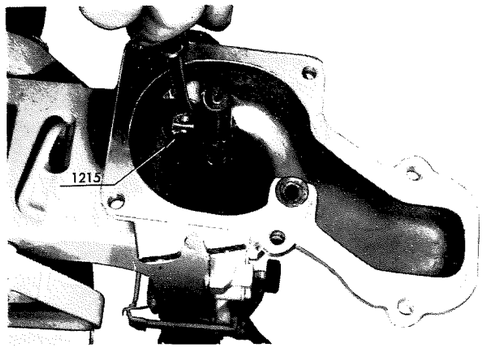


Photo 34. Separating clutch lever and rod.
1215...Shift rod

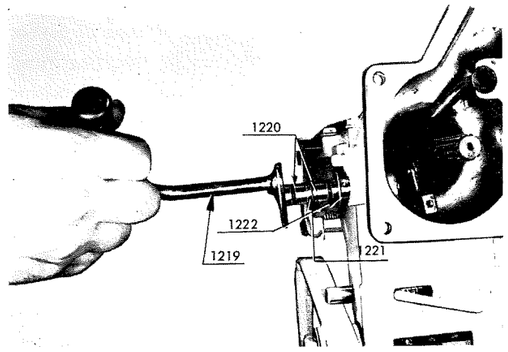


Photo 35. Unfixing clutch lever.
1220..."O" ring, shift lever
1222...Shim, shift lever
1219...Shift lever ass'y
1221...Wave washer, shift lever

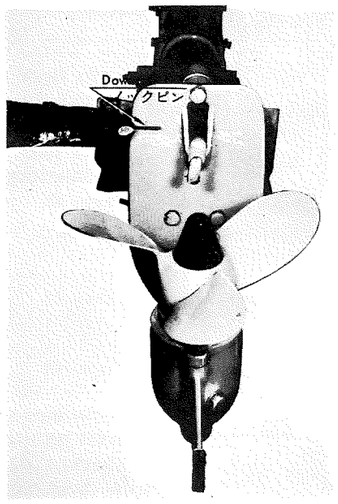


Photo 36. Unfixing pin for cooling water pipe.

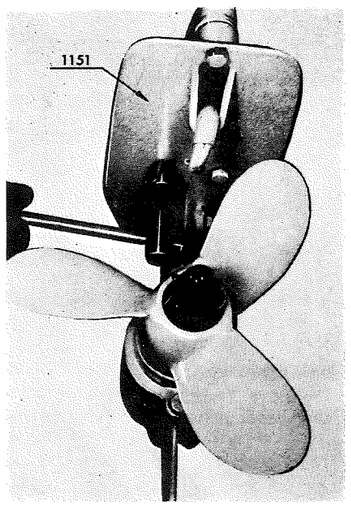


Photo 37. Ungxing bolt for gear case.
1151...Gear case ass'y

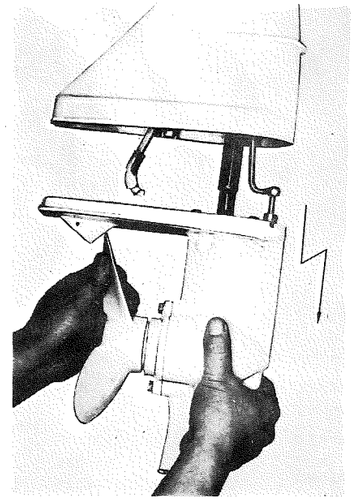


Photo 38. Pulling out of gear case.

B. Disassembling of gear case

Before starting the disassembling, be sure to drain gear oil from the draining hole.

Order	Works	Parts No. & Q'ty	Tool	Note
1	Unfix propeller	1187 1 Cotter pin 1 Nut 1 Shear pin 1	Plier 21 Spanner	Pull cotter pin, nut, and shear pin Photo 39
2	Unfix gear case	1159 1 6×18 bolt 2	10 box spanner	Do not unfix gear case cap in which propeller shaft oil seal and propeller shaft bearing are pressed in. Do not unfix "O" ring Photo 40

Order	Work	Parts No. & Q'ty	Tool	Note
3	Unfix propeller shaft	1182 1 1184 1 Bevel gear A 1 Washer, propeller shaft 1 Clutch 1 Clutch spring 1 1204 1		Unfix Bevel gear A, Washer for propeller shaft, clutch and clutch push rod simultaneously Photo 41
4	Unfix protect plate for oil seal	1157 1 6×10 ⊖RF 2	⊖ driver	Photo 42
5	Unfix drive shaft.	1192 1		Photo 43
6	Draw bevel gear A and B.	1181 Bevel gear A 1 Washer, Propeller shaft 1 1183 Bevel gear B		Sometimes shim for bevel gear A is attached, for which be careful. Photo 44

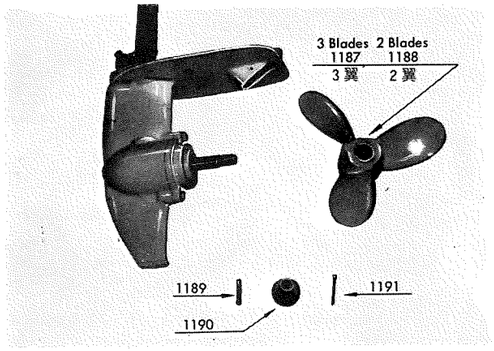


Photo 39. Unfixing propeller
1187...Propeller A (3 blade)
1188...Propeller B (2 blade)
1189...Shear pin
1190...Propeller nut
1191...Cotter pin, propeller nut

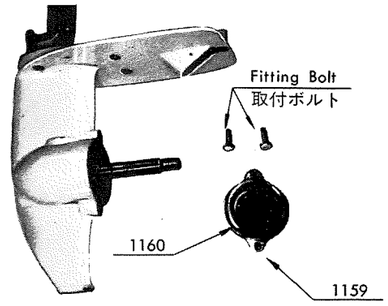


Photo 40. Unfixing gear case cap,
1159...Gear case cap
1160..."O" ring, gear cape cap

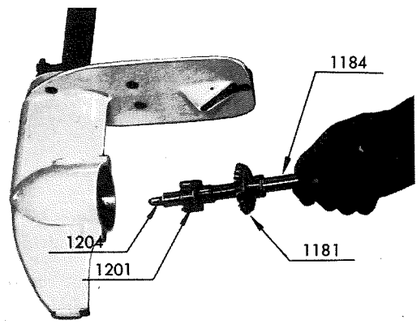


Photo 41. Unfixing propeller shaft
1184...Propeller shaft
1204...Push rod, Clutch
1201...Clutch
1181...Bevel gear A

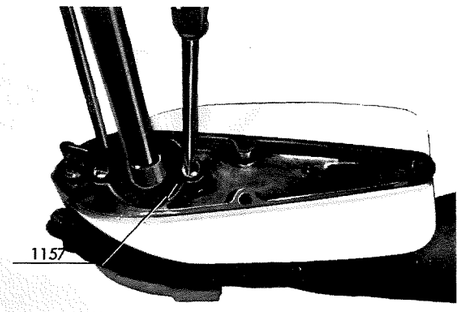


Photo 42. Unfixing Protect plate for oil seal
1157...Protect plate, drive shaft

C. Disassembling clutch

Order	Works	Parts No. & Q'ty	Tool	Note
1	Remove shift rod after unfixing cotter pin for connecting arm.	Cotter pin 1 Washer 1 pin 1 Shiftrod 1	Plier	Be careful not to loose the parts. Pooto 45
2	Pull out cam shaft lever assy.	Cam shaft lever assy 1 6 spcl ⊖ RF 1 Gasket 1 Bushing for cam shaft 1 Lock ring 1 "O" Ring 1	⊖ Driver	Pull out cam shaft lever together with the bushing, after unfixing cam shaft screw. Photos 46, 47 & 48

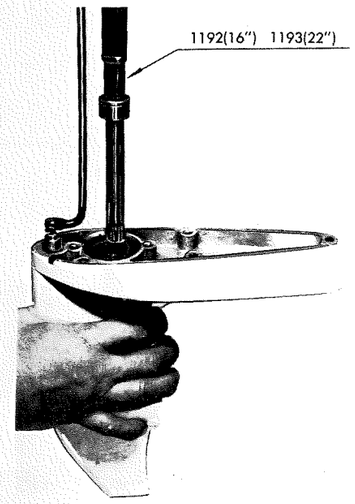


Photo 43. Pulling drive shaft

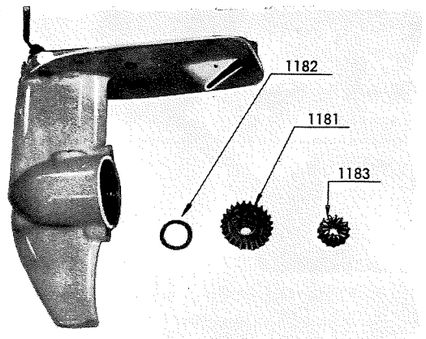


Photo 44. Pulling out Bevel gear A and B
1181...Bevel gear A
1183...Bevel gear B
1182...Shim, bevel gear A

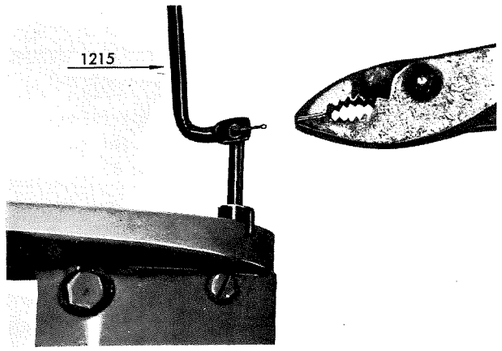


Photo 45. Pulling cotter pin for connecting arm

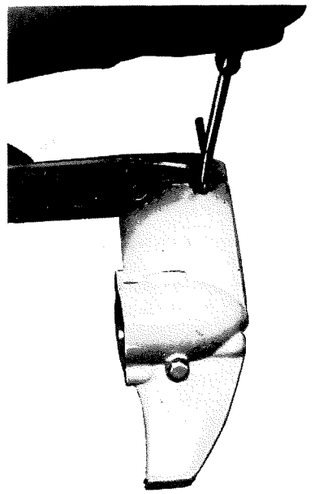


Photo 46. Unfixing cam shaft screw

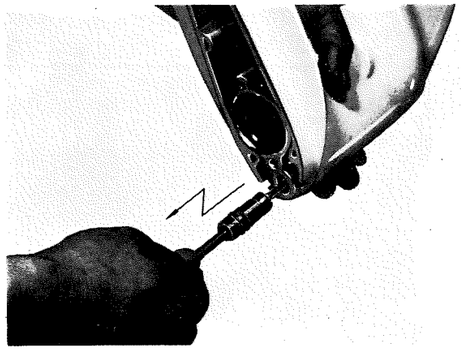


Photo 47. Pulling out cam shaft lever assy.

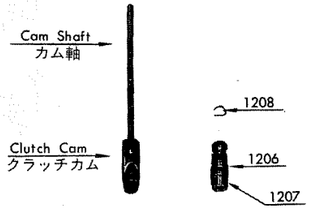


Photo 48. Cam shaft lever assy (Cam shaft and clutch cam are knocked together)

1207...Bushing, cam shaft
1206..." O " ring, cam shaft
1208...Lock ring, cam shaft bushing

D. Tips for assembling gear case and clutch mechanism

- ○ Tighten Stopper for cam shaft bushing: Tighten the stopper screw after inserting cam shaft bushing completely.
- ○ Assemble cam shaft lever and shift rod:
  Put the step-cut part of cam shaft lever upper, and put shift rod at the left side (seeing in front of gear case), then insert the pin, put the washer and pass-through cotter pin for connecting arm to bend it. (Photo 45)
- ○ Confirm the back lash of bevel gear.
- ○ Do not misplace the protect plate of oil seal.
- ○ Check the " O " ring for gear case cap.

3. DRIVE SHAFT HOUSING

A. Disassembling

Order	Work	Parts No. & Qty	Tools	Note
1	Unfix cooling water pipe	1167 1		Draw off the pipe down ward. (Photos 49 and 50)
2	Release drive shaft housing after unfixing fitting screw for swivel bracket.	1242 Swivel bracket 1 1163 Drive shaft housing 1 Reverse lock lever pin 2 6×30 bolt 6 6 S.W. 6	10 box spanner 10 spanner 10 box spanner	Release reverse lock lever pin first. Be careful not to loose thrust washer for swivel bracket and lining for drive shaft housing Photo 51, 52 and 53)
3	Disassemble stern bracket and swivel bracket.	1231 Stern bracket 2 Swivel bracket 1 10 nut 1 10 S.W. 1 10×155 bolt 1 Washer 4 1238 Tilt adjusting bar 1 Pin for above 1 6×10 ⊖ RD 2 Spacer plate 1	17 spanner Plier ⊖ Driver	Unfix fitting bolts for stern bracket, tilt adjusting bar, and spacer plate. (Photo 54 and 55)

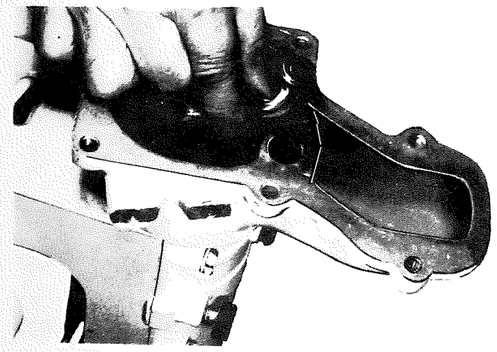


Photo 49. Unfixing cooling water pipe.

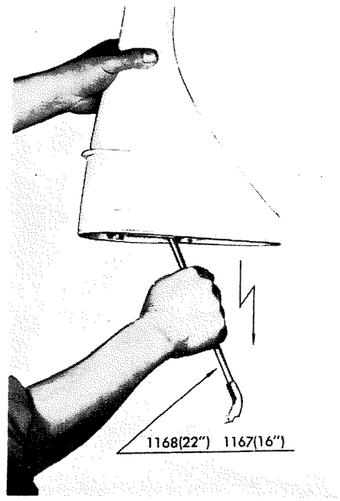


Photo 50. Pulling cooling water pipe.

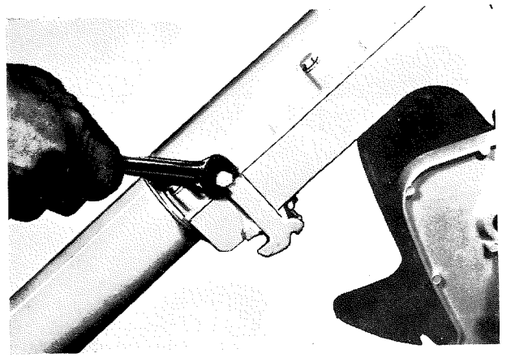


Photo 51. Unfixing reverse lock lever pin

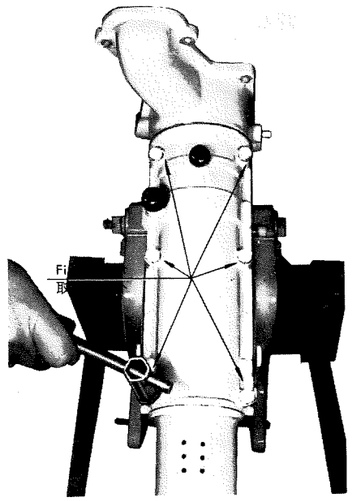


Photo 52. Unfixing fitting bolt for Drive Shaft housing

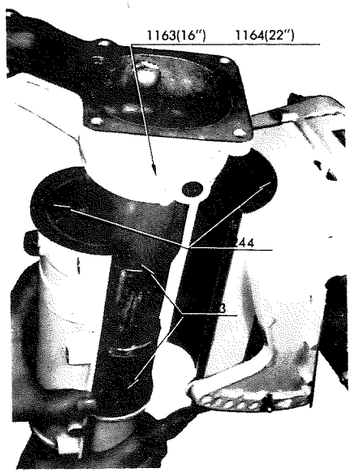


Photo 53. Releasing Drive Shaft Housing

1163 (1164) Drive Shaft assy, 16"· (22")
1243 Lining, drive shaft housing
1244 Thrust washer, swivel bracket

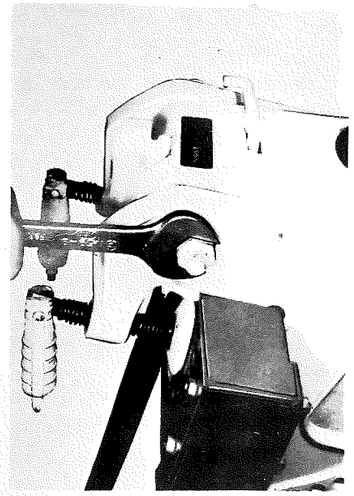


Photo 54. Unfixing nut, stern bracket

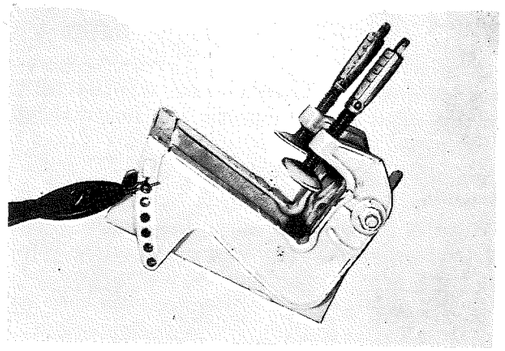


Photo 55. Unfixing tilt adjusting bar

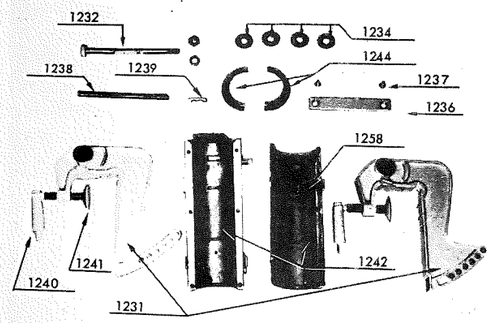


Photo 56. Bracket parts

1231 Stern bracket
1232 Bolt, stern bracket
1234 Washer, stern bracket
1236 Spacer plate
1237 Screw, spacer plate
1238 Tilt adjusting bar
1239 Pin, tilt adjusting bar
1240 Clamp screw ass'y
1241 Swivel plate
1242 Swivel bracket ass'y
1243 Lining, drive shaft housing
1244 Thrust washer, swivel bracket
1258 Adjusting plate

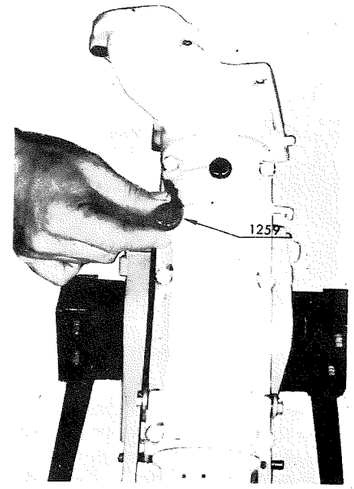


Photo 57. Loosen the adjusting plate screw

1259...Screw, adjusting plate

B. Tips for assembling

- ○ Paste the greese on the inner and outer surfaces of lining for drive shaft housing, and also thrust washer for swivel bracket.
- ○ Assemble drive shaft housing having loosened the adjusting plate screw, then adjust the condition of steering without fail.

REED VALVE

Reed valve is fitted between Intake Manifold and Crank case (with gasket at front and rear of the valve sheet). This is fitted together with Intake Manifold at the lower part of crank case with 4 long bolts.

1. Structure

Reed valve is made of stainless steel and has 3 fins each at right and left sides. It is fitted together with Valve Stopper made of stainless steel at the Valve Seat by means of 3 small screws. Besides, at the upper and lower parts of the Valve Seat there are holes in the purpose of supplying the oil to Oil Seal A and B of Main Shaft. There are same holes on the gasket. (See Figure 2)

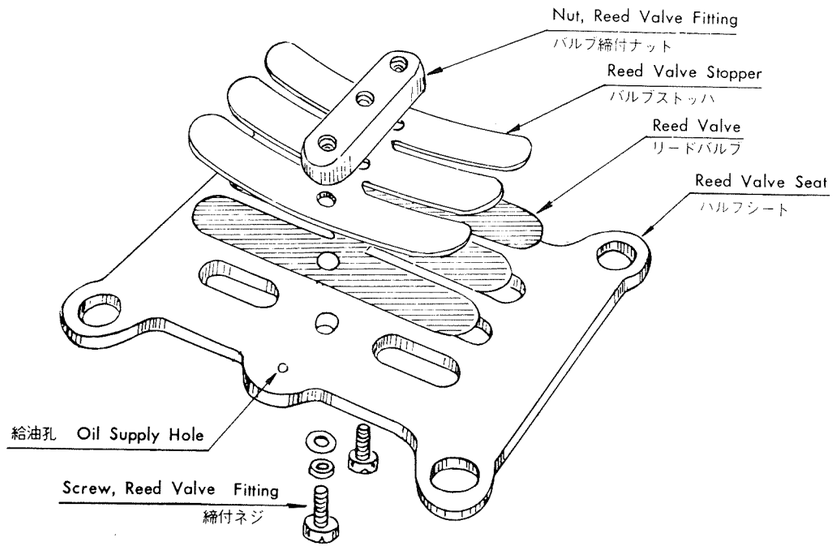


Figure 2. Structure of Reed Valve

2. Process and feature

When the inside of the crankcase is filled with negative pressure as according to the acceleration of the piston, Reed Valve is sucked up, then the sucking hole of Valve Seat open so that the fuel mixture is sucked in from the Carburetor. Then, when the piston is lowered by the shock of the blasting, the inside of the Crank Case is pressued and Reed Valve is pushed towards the Valve Seat so that they stick tightly so as the sucking hole is closed. The gaseous mixed oil pressed in the Crank Case is lead to the combustion chamber through exhaust hole. The engine continues its revolution, repeating such process.

Features of reed valve system.

a. Blowing back of the fuel mixture is prevented so that the fuel is economised.
b. As the fuel mixture couches directly with big end of connecting rod, lubrication and cooling efficiency of main part of the engine is far facilitated.
c. The selection of the fitting position of Carburetor can be made freely.

3. Disassembling

Disassembling is easily done by unscrewing 3 bolts which fits the Reed Valve.

4. Checking points

a. Damage of Reed Valve or dirt &/or substance fixed on the same, if any.
b. Clearance of the end of Valve Stopper should be: 5mm+0.2 (See Figure 3)

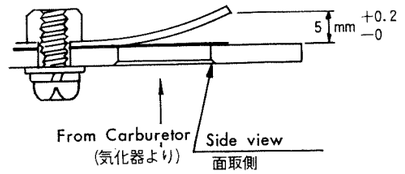


Figure 3. Clearance at the end of Valve Stopper

c. Clogging of oil supply holes on Reed Valve Seat, and on Valve Seat Gasket to Oil Seal A and B.

5. Tips to Assembling

a. Set the Reed Valve and center of sucking hole of the Seat then assemble by setting the Valve Stopper, paying attention to both right and left sides.
b. Be sure to have tightly screwed the bolts.
c. In case of fitting in the Crankcase, place the Valve to the side of Crank Case and insert the gasket in both sides.

CARBURETOR

In this outboard motor, the carburetor Type TKR-14F (Manufactured in TK Carburetor Co., Ltd.) is installed. (See Photo 58)

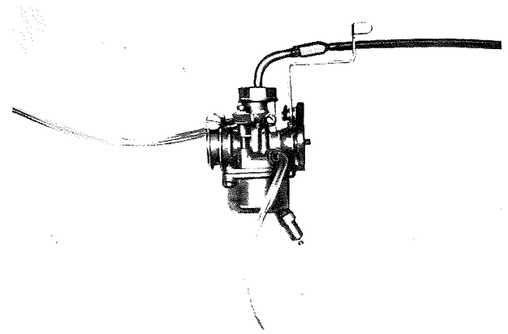


Photo 58. Carburetor Type TKR-14F

It is designed so as the carburetor is fitted to the engine through the intake manifold by means of the band to facilitate the unfixing. Intake side covered by carburetor cover, and right and left sides by engine cover, and it is perfect water and dust proof. The operation of Throttle Valve is to be done with the Single Lever through Throttle Wire. The operation of the Choke Valve is to be done with Choke Lever. The overflow operation of the starting of the engine is done in such a manner as pushing the Lever by finger inserted from a space of the engine cover.

Carburetor is an important device to meter and distribute an explosive fuel mixture and air to the engine, and its purpose is:

- ○ To supply suitable quantity of fuel mixture in accordance with the condition of the engine revolution
- ○ To produce the least possible fine grain of the fuel mixture as swiftly and accurately as possible.

1. Structure

The major component parts of the carburetor are devided roughly into the followings:-

- ○ Float chamber
- ○ Outlet and cutaway
- ○ Jet Needle and Main Jet

(1) Air intake hole
(2) Throttle valve
(3) Exhaustion hole of fuel mixture
(4) Needle jet
(5) Float chamber
(6) Main jet
(7) Needle jet holder
(8) Air jet
(9) Air breed
(10) Jet needle
(11) Throttle stop screw
(12) Valve spring
(13) Jet needle clip
(14) Cutaway
(15) Float
(16) Drain

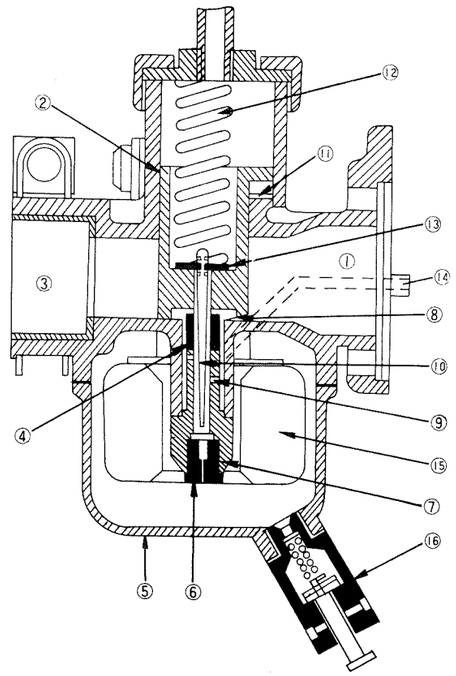


Figure 4. Structure and parts of Carburetor Type TKR-14F

○ Float chamber

The Float Chamber, comprising of Float, Float Valve, and Float Seat, serves to maintain the fuel at the prescribed level in order to make a proper fuel-air required for the engine operation.
When the fuel, flowing into the Float Chamber from the Fuel Tank through valve seat, reaches to the fixed level, the Float moves upward to push the Float Valve up into a close contact with Valve Seat to interrupt the flow of the fuel. When the fuel level goes down, and accordingly the Float moves down, the Float Valve is released from the Valve Seat and the fuel flows into the Chamber. The fuel can be kept at the prescribed level at all times by repeating such motion automatically.

○ Outlet and Cutaway

This part is operated when the engine is running at low to ordinary speed; namely it serves to aid smooth shifting from the low speed jet to the main nozzle when no negative pressure can act upon the main nozzle due to the little opening Throttle Valve. At low engine speed, Throttle Valve is almost closed and very little air-fuel mixture is fed. Therefore, the air enters from the Air Bleed, after mixed with gasoline metered by Pilot Jet, is jetted out through Pilot Outlet. Further open Throttle Valve, and Cutaway made under Valve acts upon the negative pressure added to the top end of the Needle Jet, effecting flow velocity and atomatization in the venturi. Provided this is small, the negative pressure increases, enriching the fuel-air mixture.

○ Needle Jet and Main Jet

These jets are utilized at ordinary travelling speed other than the low speed. As the Throttle Valve is opened further, Cutaway effect becomes weaker and gasoline metered by Main Jet is mixed with air coming in through the air bleed. The mixture of gasoline and air is jetted out through the gap between Needle Jet and Jet Needle while being adjusted of its mixing ratio by Jet Needle Tapper. The Needle Jet is provided with a small hole called Air Bleed, through which the air is sucked into to be mixed with gasoline inside the Needle Jet for better atomatization efficiency.

2. Caution for handling

- ○ To tighten the Intake Manifold firmly.
- ○ Any dirt in the fuel or air passage will possibly result in improper gasoline-air mixing ratio and earlier worn parts. Therefore, special caution is required.
- ○ Never use the wire or any other similar obstacle to clean the small hole of Main Jet, Pilot Jet and Pilot Outlet in disassembly and cleaning in order to prevent given damage to it.
- ○ Replace worn parts with the genuin parts to prevent the fall down of engine efficiency.
- ○ The use of the compressed air and gasoline is preferable to clean the interior of the Carburetor.
- ○ In disassebling the Float Chamber, be careful not to loose the Float Valve.
- ○ In setting the Float, never force to do. As it is very apt to mistake the order in assembling, it is preferable to look beforehand well, before disassembling, the conditions of float hanger metal (soldered wire) and Arm. After setting, pay attention to the followings:
  - ○ Be sure that the both ends of hanger metal are inserted into the Arm.
  - ○ Be sure that both Float and Arm jointly work and the Float Valve works smoothly up until it perfectly contacts with Valve Seat.

3. Adjusting of each part

The trouble of the Carburetor is generally caused by the rich or lean fuel mixture, and it presents the following phenomenon:-

In case of rich condition	In case of lean condition
○ Rotation feels heavy and is intermittent and some times engine does not accelerate. ○ Spark plug is liable to get wet and dirty, black in colour. ○ When the Choke Valve is closed during operation, engine works in worse condition.	○ Rotation is not smooth. ○ Engine is overheated (Spark Plug is heated and white in colour). ○ When the Choke Valve is closed during operation, rotation is accelerated and the condition is better.

In consider of the above phenomenon, complete examination is done in the manufacturers and, as the suitable setting for this engine is done, it is unnecessary to adjust the other parts except the idling and jet needle.

The above phenomenon is seen due to the following causes, and is such case, disassemble and check the engine. (See caution for handling mentioned above.)

Cause to be rich	Cause to be lean
○ Defacement of each part (Main jet and jet neele)	○ Clogged fuel supply mechanism with dirt (Small holes on Cock, Main Jet and Float etc.)
○ Too high Oil surface (Poor condition of Float Valve and its defacement and bent Arm)	○ Too low oil surface (Poor condition of Float Valve)
○ Clogged air bleed with dirt etc.	○ Air leakage of Carburetor caused by poor setting
○ Careless handling (Open Choke Valve)	

a) Adjustment of idling (Opening of throttle valve, 1/8 or under)
Adjust engine revolution by screwing/unscrewing the throttle-stop-screw, after closing the throttle valve fully by closing the single lever. Idling speed (clutch-in) is 1400–1600 r.p.m.
When screw-in the throttle-stop-screw, the engine revolution increrses, and screw-out, decreases.

b) Adjustment of Jet Needle (Opening of throttle 1/4–3/4) Adjust the clearance between the Needle Jet by raising or lowering the position of Jet Needle Clip fitted to the Throttle Valve. When it is rich, raise it and, when lean, lower it. (Such adjustment is scarcely necessary.)

4. Setting

Arrange setting in pursuance of the following criterion :–

Part	Condition
Main Jet	# 94
Needle Jet	2.095ϕ – 0.6ϕ×2
Jet Needle	R–2/3 degree
Throttle Valve Cut	1.0mm
Outlet	0.4ϕ
Oil surface (From Venturi center)	17.5mm

ELECTRICAL EQUIPMENTS

This outboard motor is provided with Kokusan Denki Flywheel Magneto Type HP06 (magneto steel turning outside; ignition coil provided separately) by way of standard type of power generator. The magneto system (a.c.) is also utilized for ignition.

The parts for the lighting are prepared as option.

1. Principal component parts

a)	Ignition exciter coil (with high tention cord)	1 pc.
b)	Condenser	1 〃
c)	Contact Breaker	1 〃
d)	Spark plug (NGK–B7H)	1 〃
e)	Stop switch	1 〃
f)	Flywheel (with cooling fan)	1 〃

2. Parts for special order

a) Lighting coil
b) Consent for lighting

3. Circuit diagram

As shown in Figure 5.

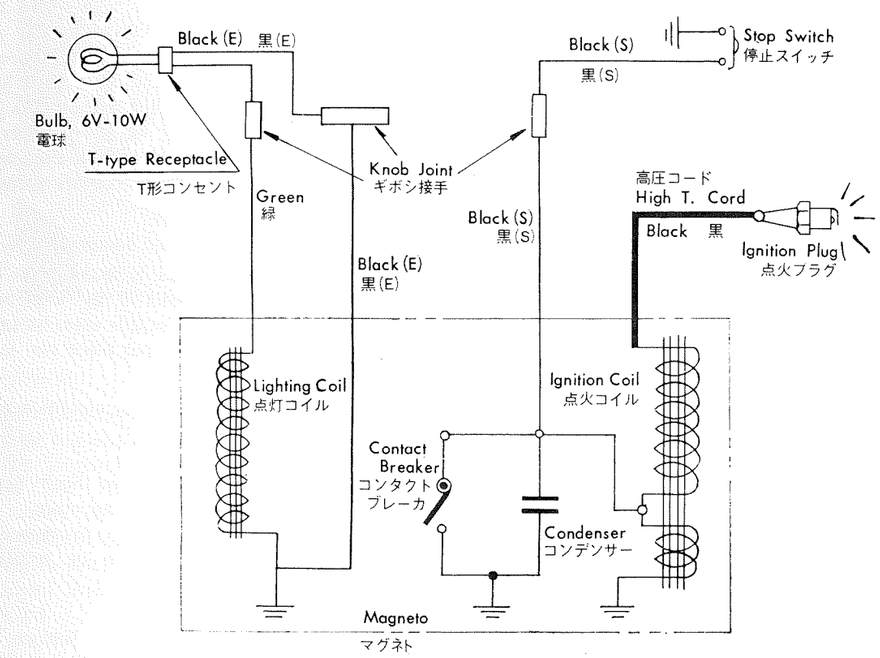


Figure 5. "Seaswallow" circuit diagram

4. Ignition

It is the important element of the engine as to give the engine the power to rotate by the explosion occurs when the compressed mixture in the cylinder is ignited by electric spark.

1. Spark plug

The spark plug is of such design that a tremendous electric voltage (approx. 10KV) produced by the Ignition coil jumps the gas between electrodes, and ignites the compressed mixture in the cylinder. It has been installed in the Cylinder Head with its electrodes exposed in the combustion chamber.

Construction

The construction of Spark Plug is as shown in Fgure 6. The standard gap size between the center and side electrode is 0.6–0.7mm.

Check and maintenance

The electrodes which are worn due to electric discharge or covered with carbon soot and oil may possibly cause defective ignition, resulting in failure in engine start, decreased output, unsatisfactory engine performance etc. and therefore, disassemble at times to check it. (Use the box spanner.)

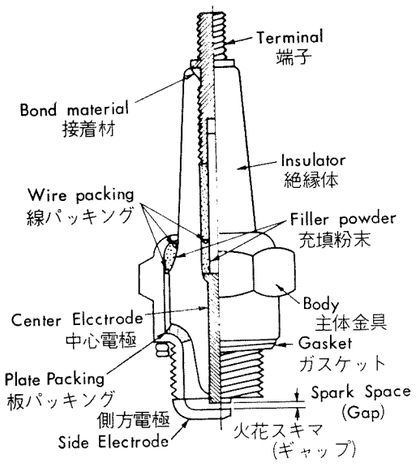


Figure 6. Structure of Spark Plug

a) Wash off all dirt deposits such as carbon and oil. (The use of a plug cleaner to clean the plug is most desirable. If it is unavailable, use a brush or wire to clean even the innermost part.)

b) Adjust the Spark Gap. (Its adjustment is made by bending the side electrode.)

Note: If the Spark plug is overheated or showing black in colour, it means unsuitable fuel mixture (rich or lean). In this case, check to trace the cause of trouble. If no trouble can be traced in its look, replace with the new one of the suitable standard.

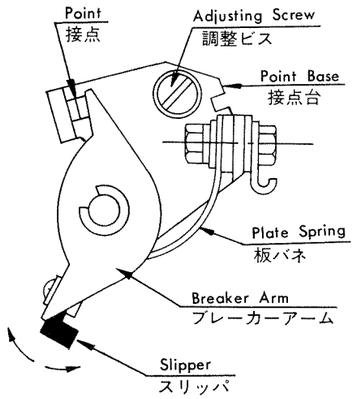


Figure 7. Contact Breaker

○ Adjustment of the ignition timing

The base plate for this type is fitted with 2 pieces of dish bolts, and only by setting the contact surface, the adjustment of the ignition timing is made.

Ignition timing adjustment is to be done in such a manner as rotating the Crank Shaft clockwise quietly (Top Dead Center side) and the clearance adjustment is to be done prior to the setting of the Flywheel. Use (−) driver to loosen the contact point adjusting bolts (Fig. 7) at the contact surface and adjust the clearance as shifting the contact base, and also, as setting the clearance with the clearance guage so as, when the clearance becomes 0.35± 0.5, the bolts are tightened.

2. *Contact Breaker*

Contact Breaker is the device to pass and intermit the electric current by opening and closing the contacting face. It is fitted on the magneto base.

○ Structure and efficiency

As shown in Figure 7, the Contact Breaker is composed of Point Base, Breaker Arm, Plate Spring etc. The Breaker Arm, made of steel plate, is fitted with tangsten point on its one end and the bakelite slipper on its other end. It is operated in such a way as when the cam installed in the crank shaft rotates as contacting with the slipper, the breaker arm swings to continue the opening and closing motion of the contact point.

○ Check and maintenance

Check to see the dirt and defacement mainly.

a) If the contact surface is found to be dirty with dirt or oil, clean it by wipping off with clean paper. In this case, be careful not to leave any paper piece etc. on the contact surface.

b) Watch the following heat condition at the contact surface.

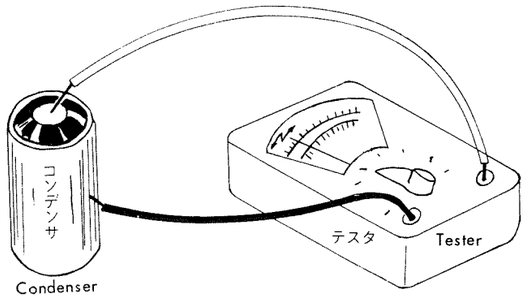
If...Normal

If black...Oil deposit burnt (Such kind of trouble occurs most often)

If blue...High heat (High resistence due to rough surface or trouble in condensor)

Note:

a) When polishing the Contact Surface, use a clean point file or smooth sand paper and, after polishing, wipe the surface without fail with clean paper.



b) Polish the Contact Surface so as the both surfaces exactly contact.

c) Adjustment of the clearance at the contact surface should be done after confirming the smooth condition of the surface.

d) To supply oil to the cam, paste little quantity of magneto grease (Maruzen Oil-Swallow M20) on the felt fitted on the base plate (every approx. 100 hours).

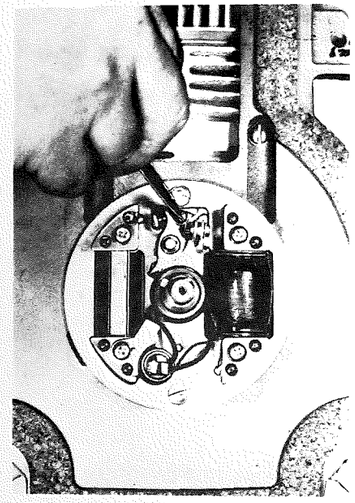


Photo 59. Adjusting the Point Gap

3. *Condenser*

The Conderser serves to prevent the damage caused by burning of the contacting points, and also, the lowering of the high voltage of the Ignition Coil. Provided this part has a trouble, there occurs an arc (blue flame) between the points, resulting a damaged contact. In addition, it comes to work inefficiently, i.e, cannot break the current instantly, and the secondary voltage is lowered.

○ Checking

Release the circuit and loosen the Condenser and then check with the tester, as shown in Figure 8. If the needle moves and return instantly, is shows to be in good order but, if the needle does not move or does not return, it shows that it is imperfect.

If the insulation resistance is measured by using a megger and if it is over 5 MΩ, it is in good order. While, in another method, if it is charged by the megger and if a bluish white spark fles when the plus pole of the Condenser and the case is short, it shows to be perfect.

4. *Ignition Exciter Coil*

The Ignition Exciter Coil is consisted of coil of primary winding of big wire and another of secondary winding of small wire, and, by intermitting the voltage which is generated by the primary coil instantly with the Contact Breaker, high voltage (approx. 10,000 V) is generated in the secondary coil, which is transmitted to the Spark Plug through the high tension cord.

○ Checking

Remove the Flywheel, insert an insulation (thick paper or other) between the points as shown in Figure 9, then check it by using the battery. The checking is to be done in such a manner as shown in the Figure; keep clearance of 5-6mm between the end of high tension cord and the mounting base, earthen the (−) side of the battery on the mounting base and contaet the (+) side of the battery quickly with the pole of the Condenser. In this case, intensity of the spark can be seen between the top end of the cord and the mounting base. If the spark is strong, the coil is in perfect condition, but, on the contrary, if the spark is weak or does not fly, the coil is defective. (Renew the defective coil.)

4. Lighting set

The voltage generated in the coil which is located on the magneto base plate in the opposite side of the Ignition Exciter Coil, is transmitted to the T Type Consent fitted on the Fuel Tank through a joint.

Checking

Whether the coil is cut or not is checked by testing through the continuity tester, as shown in Fig. 10. To see its performance, turn the engine and measure the voltage produced, as shown in Fig. 11. If the voltage is around the curve shown in Fig. 11, it is perfect. The coil is defective in either case of the voltage excessively high or low.

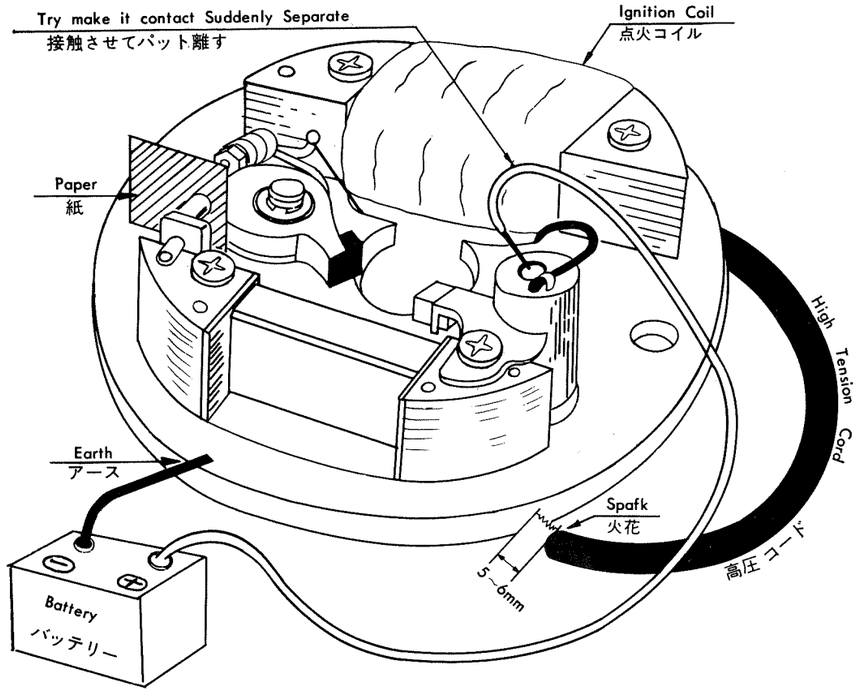


Figure 9. Checking of Ignition Coil

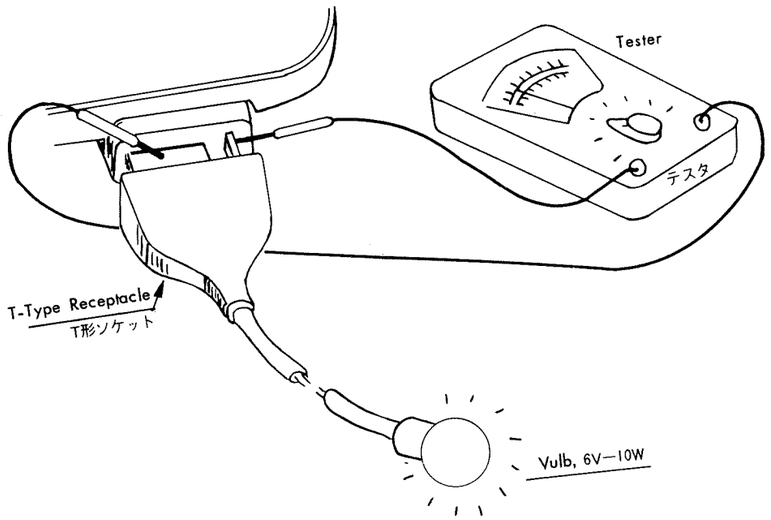


Figure 10. Testing of voltage for lighting coil

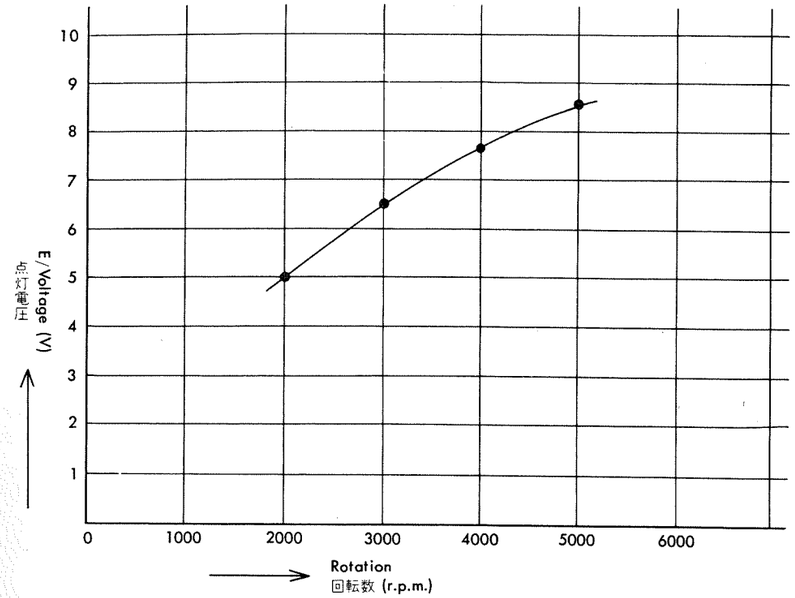


Figure 11. Characteristic of voltage for lighting set

STARTER

The starter system of this type is the rewind starter which makes the starter wire rewind automatically by spring power. The Starter is enclosed in the Starter Case and fitted with 3 (−) flat small screws on the top of the Fuel Tank.

One fitting bolt is 6×45 and another two is 6×40. The longer one is to be at the side of the pulling of the rope.

When the Starter Cord is pulled with rapid motion, 3 Ratchets inside the Starter projects to engage with the square hole the starter pulley fitted on the Flywheel so that the Crank Shaft is rotated. When the engine gets into rotation or Starter Coil is wound, the engagement of the ratchet is automatically released and the Starter and the Engine become unrelated. (See Photo 60, showing the entire parts of the Starter.)

1. Disassembling

a) Unscrew 3 screws and remove from the Fuel Tank.

b) Pull the starter rope slightly and put it in the cut part of the reel then release the spring tension quietly. Reel rotates clockwise when seen from the fitting surface.

c) Remove Lock Ring, Washer, and Holding Plate, then the Ratchet.

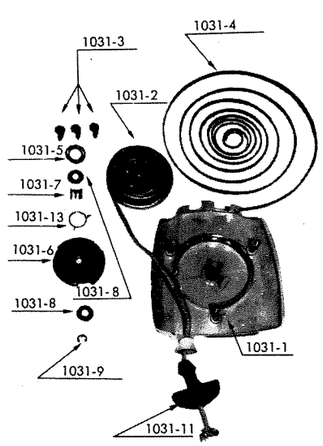


Photo 60. Starter parts assy.

1031- 1 Starter Case
1031- 2 Starter cam
1031- 3 Ratchet
1031- 4 Starter Spring
1031- 5 Oil felt
1031- 6 Holding plate
1031- 7 Spring
1031- 8 Washer
1031- 9 Lock Ring
1031-11 Starter Handle
1031-13 Return Spring

d) Remove Return Spring, Spring and then Reel (fitted with cam). In case of removing the Reel, hold up the reel slightly to insert the finger then loosen it from the Starter Case in such manner as to be trying to insert the end of the spring into the reel, so that the reel is taken out as it is containing the spring.

2. Tip to assembling

The assembling is done in the reverse work of the disassembling.

a) When setting the Spring, firstly fit the outer end to the fitting portion of the Reel and wind it counter-clockwise.

b) Wind the Rope clockwise (seen from the spring side) (reverse of the spring winding direction), then pass the rope through the hole on the Starter Case, and then fit on the Starter Handle.

c) Fit the Ratchet, paying attention not to misplace.

d) The adjustment of the spring tension is to be done after completing the setting, by putting the rope in the cut part of the Reel and rotating counter-clockwise.

e) If the metalic noise is heard when the Starter Assy is completed and the engine is started, loosen the fitting bolt to change the position of the Starter little by little until such noise cannot be heard, before the bolt is fitted firmly.

f) The parts which the oil is to be supplied are Shaft, Ratchet and Spring.

3. Tip to change the Starter Rope

The Starter Rope is to be changed in the following manner.

a) Remove the Reel, following to the manner in disassembling.

b) Pass the end of Starter Rope through the starter rope pulling hole of Reel then tie up the end.
After the above process, do it in pursuance of the assembling manner.

PROPELLER

The duty of Propeller is to give propulsion to the boat.

1. Particulars of Propeller

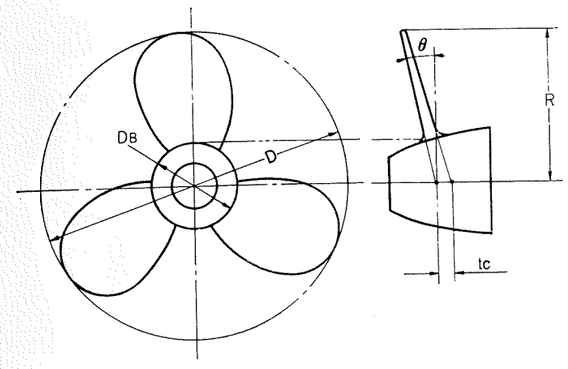


Figure 12. Particular of Propeller

D=Diameter
R=Radius
DB=Boss diamer
H=Pitch
θ=Angle of rake
tc=Imaginary thickness of blade on centerline
Z=Number of blades

Pitch ratio = H/D
Boss ratio = DB/D
Rake = 0
(B. R.T.) = tc/D

2. Kinds of Propellers engaged in this outboard motor

Member of blades (Z)	Outside Dia (D)	Pitch (H)	Pitch Ratio (H/D)	Purpose for usage
3	188mm	157mm	0.835	Operation in normal condition
2	190mm	166mm	0.874	Operation where considerable sea weads exist or in case the boat is light in weight

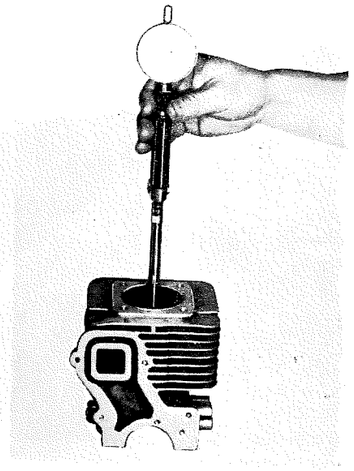
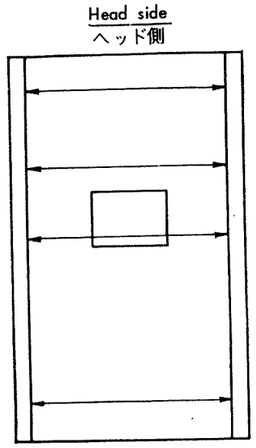


Photo 61. Measuring the Cylinder



13 Figure

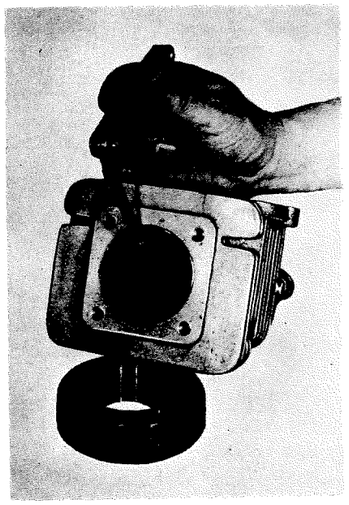


Photo 62. Checking Piston Ring Gap

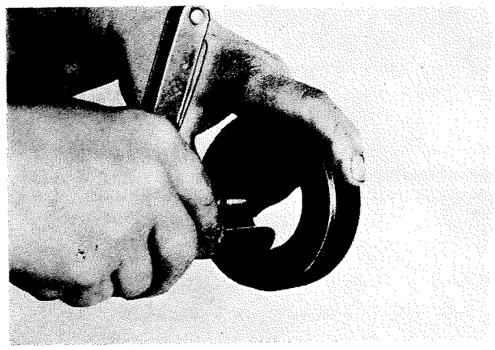


Photo 63. Setting of Piston Ring by means of standard guage

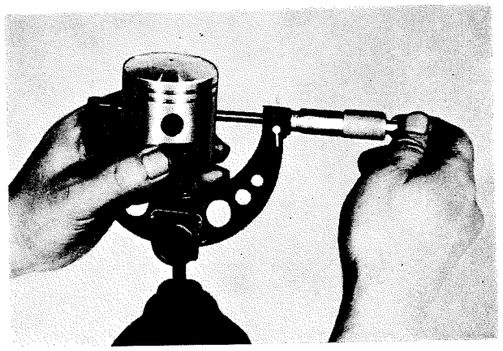


Photo 64. Measuring of Piston Ring defacement

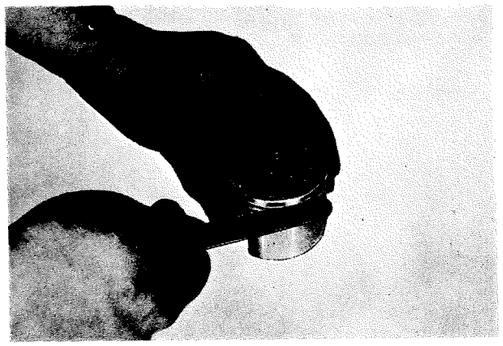


Photo 65. Measuring of Piston Ring slid

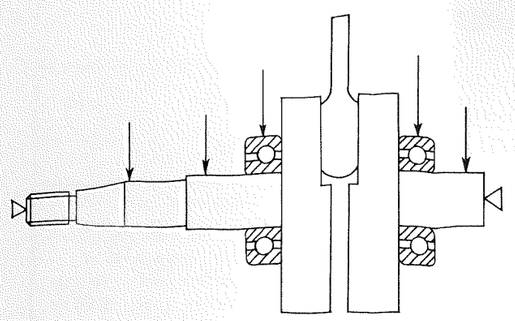


Figure 14. Checking rolling of Crank Shaft

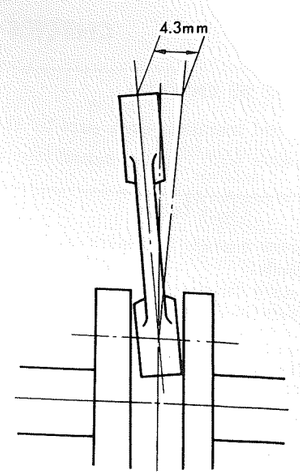


Figure 15. Checking rolling of small end, Connecting Rod

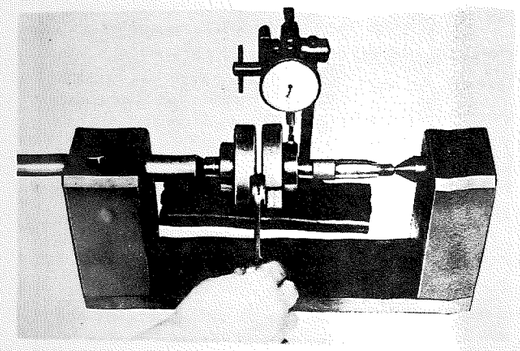


Photo 66. Checking rolling of Crank Shaft

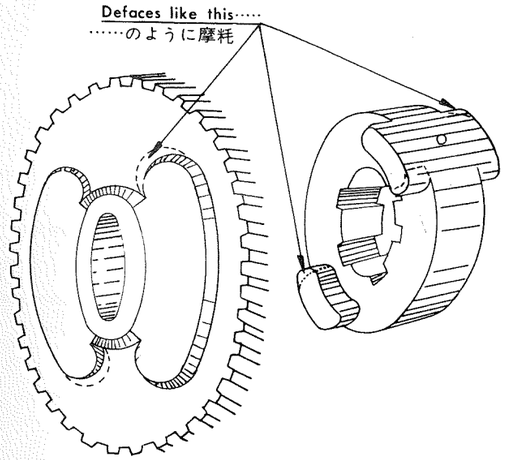


Figure 16. Checking of defacement at claw metal, Clutch

CHECKS AND MAINTENANCE

1. ITEMS TO BE CHECKED

Check and maintain each part by the following procedure.
(For items with (*), see dimensions given in the table of Maintenance Standard.)

Division	Check Points	Remedies	Remarks
Cylinder head	1. Carbon deposits in combustion chamber. 2. Warped mounting surface 3. Blown-out cylinder head gasket	Clean and remove carbon Correct warped surface Correct cylinder head gasket if blownout slightly. Replace if blown-out heavily.	○ Judge (1) and (3) with eye ○ Measure (2) by using scale or surface or surface plate. To correct, use abrasive paper (#200 or so) placed on surface table.
Cylinder	1. Flaw and trace of seizure in cylinder walls. 2. Wear of cylinder bore (*)	Correct or replace if necessary Rebore or replace	○ Judge (1) with eye ○ Use dial gauge to measure cylinder bore at 4 points on either side, upper and lower, and front and rear and right and left (8 points in all) as illustrated. (Photo 61) (Fig. 13)
Piston	1. Corbon deposits on piston head and in piston ring grooves. 2. Worn and damaged piston (*) 3. Clearance between cylinder and piston. (*) 4. Piston ring-groove clearance (*) 5. Gas between piston ring ends (*) 6. Clearance from piston pin (*)	Clean and remove carbon Replace if necessary 〃 Replace if necessary 〃 〃	○ Judge (1) with eye ○ Measure (2) by using micrometer, and (4) and (5) by thickness gauge (Photos 62, 63, 64, & 65) ○ Piston head, which is exposed directly to tremendous heat caused by combustion of air-fuel mixture, is smaller in diameter than skirt, which is the largest in diameter. ○ For clearance between piston and cylinder wall, measure at 6mm lower point from second ring groove and at lower parts of cylinder.
Crankshaft	1. Crankshaft distortion (*) 2. Wear in bearing (*) 3. Wear in crank pin (*) 4. Flaw in crankshaft (*)	Replace crankshaft if necessary 〃 〃 Replace crankshaft	○ Measure (1) with center rest and dial gauge Photo (66) (Fig. 14) ○ Measure (3) by using micrometer ○ Judge (4) with eys
Connecting rod	1. Distortion of small end (*) 2. Clearance between big end and crankshaft (*) 3. Wear of small end bush and pin (*) 4. Wear of big end (*)	Replace if necessary 〃 〃 〃	○ Measure (1) at (Fig. 15)
Crankcase	1. Flaw and stain of each joint surface 2. Breakage of each oil seal lip	Correct surface or replace crankshaft Replace crankcase if necessary	○ Judge (1) and (2) with eye
Clutch	1. Permanent set of clutch spring (*) 2. Wear of bevel gear pawl 3. Wear of clutch pawl 4. Wear of clutch and clutch spline	Replace if necessery 〃 〃 〃	○ Judg (2) and (3) at corners with eye (Fig. 16)
Others	1. Wear of power transmission shaft coupling 2. Wear of small bevel gear 3. Wear of propeller shaft 4. Wear of propeller shaft bearing 5. Breakage of oil seal for propeller shaft 6. Breakage of propeller	Replace if necessary 〃 〃 〃 〃 〃	

2. MAINTENANCE STANDARD

Parts	Item to be adjusted		Standard value	Repair limit	Remedy	Remarks
	Cylinder compressive force.	kg/cm²	6			When starter is operating. (At full-throttle of carburetor)
	Fuel consumption	l/h	2.3			
Cylinder	Cylinder bore	mm	52~52.01	Over 0.05	Bore cylinder	Difference in wear in each part.
	Oversize	mm	+0.5, +1.0		walls	At 0.5mm intervals 2 types
Cylinder head	Mounting surface distortion				Correct mounting surface.	Use abrasive paper (over #200) placed on surface plate.
	Tightening torque	kg-m	2.0~2.2			
	Spark plug tightening torque	kg-m	3.0~3.5			
	Gasket thickness	mm	2.0			
Piston	Piston head diameter	mm	51.78~51.81		Replace.	
	Maximum diameter (upper end of skirt)	mm	51.91~51.93			
	Minimum clearance between piston and cylinder	mm	0.07~0.10	Over 0.20	〃	Replace if clearance is excessively large.
	Pin hole diameter	mm	13.993~14.004		〃	
	Oversize	mm	+0.5, +1.0		〃	At 0.5mm intervals 2 types
Piston ring	Thickness (+)	mm	2.1~2.3			
	Tensile strength	kg	0.66~1.02			Tangential tensile strength
	Gap between piston ring ends	mm	0.15~0.35	Under 0.8mm	Replace.	Insert standard gauge
	Gap between piston ring and groove	mm	0.03~0.07	Over 1.0mm	〃	Insert thickness gauge
	Oversize	mm	+0.5, +1.0	Over 0.1mm	〃	At 0.5mm intervals 2 types
Piston pin	Outside diameter	mm	13.994~14.000			
	Clearance between piston pin and piston	mm	0.007 0.010	Over 0.05mm	Replace.	
Connecting rod	Inside dia. of small end	mm	18.003~18.013		Replace.	
	Distortion of small end	mm	0.8	Over 1.6mm	〃	
	Crankshaft side clearance	mm	0.16~0.32	Over 0.5mm	〃	See "Limit to Small End Distortion".
Crankshaft	Crankpin O. D.	mm	17.194~17.200	Over 0.05mm	Replace.	
	R & L main shafts O. D.	mm	20.002~20.011		〃	
	Main shaft bearing, axial play	mm		Over 0.4mm	〃	
	Main shaft bearing, radial play	mm		Over 0.05mm	〃	Distortion of bearing section supporting both ends of crankshaft.
	Main shaft, max. distortion	mm	Within 0.03mm	〃	Correct.	
Clutch spring	Free length	mm	51	Under 49mm	Replace.	
	Load	kg	2.0			When installed
	Installation length	mm	40.5			
Spark plug	Type					NGK B7HS
	Spark plug gap size	mm	0.6~0.7		Correct.	3000 r.p.m.
Reverse lock	α Angle	° ′	84°±30′	±1°	Correct.	

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