TOHATSU OUTBOARD MOTOR

$M25C_2/M30A_3$

SERVICE MANUAL

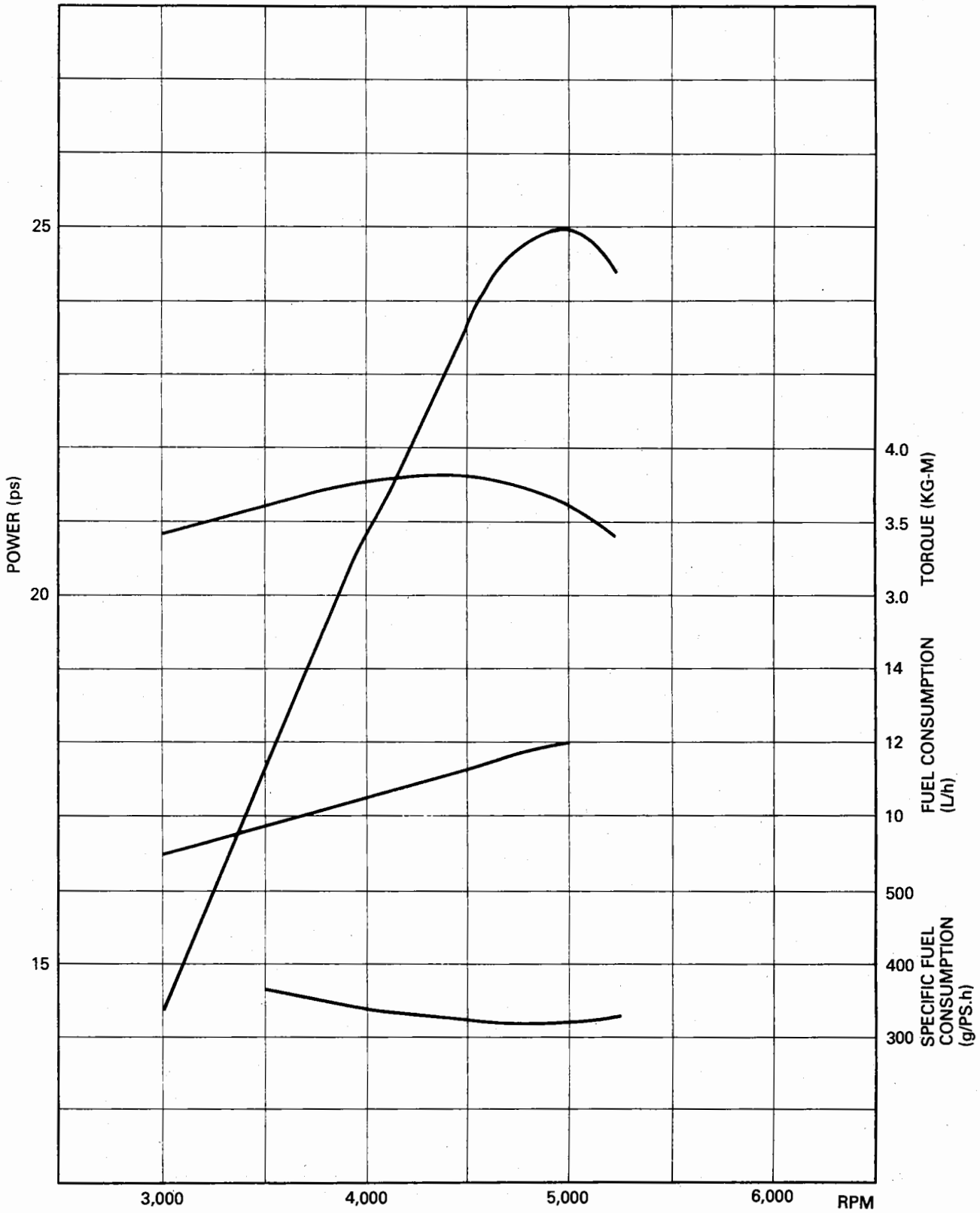
AUG 1988

CONTENTS

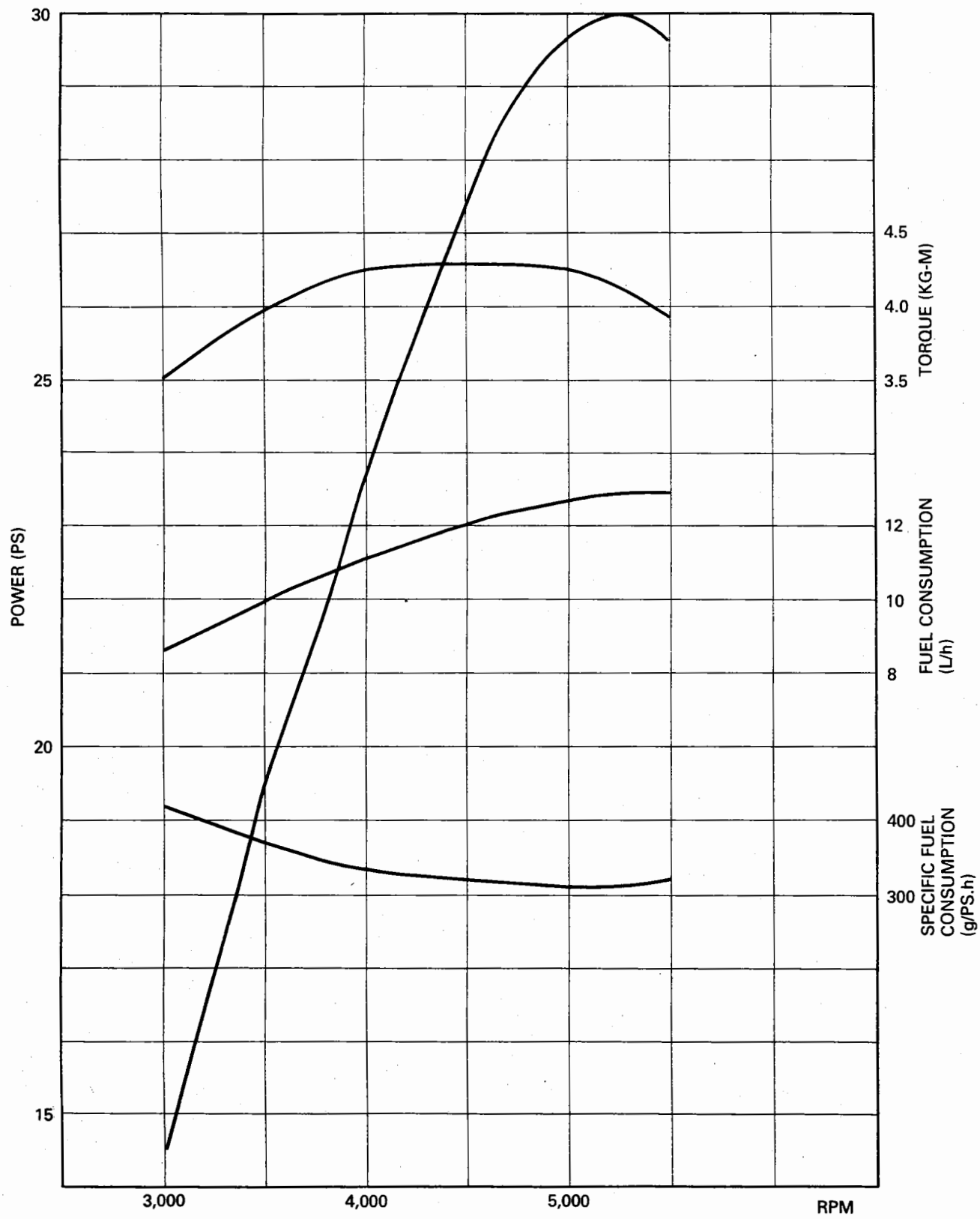
I. SPECIFICATIONS

Item		Model	$M25C_2$	$M30A_3$
Main dimensions	Overall length:	mm (in)	825 (32.48)	
	Overall width:	mm (in)	400 (15.75)	
	Overall height:	mm (in)	S: 1116 (43.94) L: 1243 (48.94) LL: 1319 (51.93) XL: 1370 (53.94)	
	Transom height:	mm (in)	S: 435 (17.13) L: 562 (22.13) LL: 638 (25.12) XL: 689 (27.13)	
	Weight:	Kg (lb)	S: 46 (101), L: 47 (104)	S: 48 (106), L: 49 (108)
Performance	Maximum output:	PS (HP)	25(24.6)	30(29.6)
	Maximum speed running range:	r.p.m.	4,800 – 5,500	
Engine	No. of cylinders:		2	
	Bore x stroke:	mm (in)	68 x 59 (2.68 x 2.32)	
	Displacement:	cm^3 (cu in)	429 (26.18)	
	Lubrication:		Gasoline oil mixture –50:1	
	Cooling method:		Water cooling (rotary rubber impeller) thermostat with relief valve	
	Starting:		Self recoil hand starter	
	Ignition timing:		$M25C_2$ ATDC2°–BTDC20°	
			$M30A_3$ ATDC2°–BTDC25°	
	Carburetor:		KEIHIN SEIKI made (Horizontal spindle type butter fly valve)	
	Rotating direction of engine:		Clockwise	
	Speed control:		Twist grip (Remote control: optional)	
Lower unit	Clutch:		Dog clutch, Forward, Neutral, Reverse	
	Gear reduction ratio:		12 : 23	
	Maximum tilt-up angle:	degree	75°	
	Tilt angle:	degree	2.5° – 275°	
	Tilt adjustment position:		6	
	Shallow-water cruising device:		Provided	
	Steering angle:	degree	80°	
	Permissible thickness of transom board:	mm (in)	40 – 60 (1.57 – 2.36)	
	Exhaust method:		Through hub exhaust	
	Fuel tank capacity:	ℓ (US gal, Imp gal)	24 (6-3/8, 5-1/4) Separate	
	Propeller (No. of blades x diameter x pitch):	mm (in)	S: : 3x9.5x12.9(3x242x327) L, LL: 3x9.6x11.5(3x243x292) XL: : 3x9.8x10.2(3x250x260)	S: 3x9.9x13.1(3x252x332) L, LL: 3x9.8x11.3(3x250x288) XL: 3x9.8x10.2(3x250x260)
Optional parts	Optional propeller (No. of blades x diameter x pitch)	in (mm)	3x9.6x13.4 (3x242x341) 3x9.8x 9.3 (3x249x236) 3x9.6x 8.7 (3x245x220)	3x9.9x14.2 (3x252x360) 3x9.8x 9.3 (3x249x236) 3x10.2x8.3 (3x260x210)
	Others:		1 Electric starters: 2 types (For commercial and general uses) 2 Remote controls (Single and twin) 3 Rectifier kit (For battery charging) 4 Safety switch (Normally provided for EP) 5 Tachometer 6 Remote steering controls 3 types: (Rope, ball post and drag link types) 7 Bar handle kit for two engines 8 Long bar handles (Resin) 9 Water pump for sandy locations 10 Medium length bar handle 11 Carburetor kit (with icing preventing measure) 12 Dog leg bar handle (For long bar handle use)	

M25C2 ENGINE PERFORMANCE



M30A3 ENGINE PERFORMANCE



II. FEATURES

1. Improved inlet port prevents water from entering engine housing. Stylistic appearance with small power head and sturdy lower unit.
2. Highly efficient engine, having a displacement of 430cc, employs a dual exhaust system with a long exhaust pipe thus ensuring stable power output.
3. New engines are provided with ignition timing advancing system interlocked with throttle, permitting steady slow running at low speed. This, together with devices to improve fuel combustion, results in tremendous improvement in trolling performance.
4. Vibration damping system eliminates excessive swinging of stem during low speed running. Vibration is greatly reduced at all engine speeds.
5. Plastic pump case, stainless steel bracket shaft, aluminum die cast carburetor, and two sacrificial anodes, including one newly installed on the engine block, drastically reduce corrosion.
6. Quieter running achieved by improved drive shaft housing and large size suction silencer. Quieter slow running obtained by improving idle port design.
7. Better bearing performance obtained through increasing bearing size and employing special bearing material.
8. Safety features include a neutral start mechanism which prevents serious accidents at the time of starting engine. A throttle-opening regulating mechanism also prevents damage to the main parts resulting from poor operation or careless handling. A link type throttle control system ensures further safety.
9. Engine support brackets have been increased in both size and strength to accomodate increased engine output, thus increasing dependability.
10. Thermostatic relief valve stabilizes engine temperature. Cooling water pressure surges on engine acceleration are avoided, thus eliminating water pressure troubles.
11. The large recoil starter is interchangeable with this model. This, together with a reduced engine compression ratio, makes starting easier.
12. Improvements of the bracket shaft and its fittings give better control and more accurate straight line cruising.
13. Reverse lock mechanism prevents faulty operation. Even if this mechanism is not returned to its original position at the time of tilt down it will automatically return to this position preventing sudden engine jump at the time of reversing.
14. Drag link remote steering control system allows remote control to be installed even in rubber boats.
15. 6-stage tilt adjustment and shallow water running device allows closer inshore running.
16. Simplified clutch mechanism solves the troublesome problems of link play and abrasion and provides light and smooth operation and increased durability.
17. Built-in 12V, 80W lighting generator provides current for night lighting and battery charging.
18. Six types of propellers suitable for heavy to light loads permit a choice for Japanese-style craft, pleasure boats, heavy and lightweight boats.
19. Special design of cutwater board and gear case ensures level cruising at all times.
20. Drive shaft housings are available for transom S and L types and are provided with built-in exhaust pipes. In addition, vertical rudder and gear case are integrated into one body for easier servicing.
21. Optional electric starters for both commercial and general use can also be supplied.
22. Other options include bar handle kit for twin mounting, long, extension, and special purpose handles (in which handles match direction of advance) to meet the diversified requirements of users.
23. The propeller boss exhaust system is employed to give a quieter and more diffused silencing effect. At the same time, a propeller diffusing ring increases gas exhausting efficiency. This exhaust system also increases power output. (M30A3) Six types of propellers are available.
24. A secondary water inlet is provided which will prevent engine overheating even if the main cooling water inlet is blocked with plastic sheeting and similar materials if they find their way into the cooling water circuit. (M30A3)
25. Better speed performance is achieved by redesigning the gear case and gearing and eliminating oil drag. (M30A3)

III. SERVICING AND ASSEMBLING

1. General precautions

When carrying out stripping, servicing and assembling pay due attention to the following precautions.

(1) When servicing the engine, secure it firmly to the work bench.

(2) When working on the engine, take care that painted surfaces inside and matching surfaces of the cylinders and crankcase are not damaged or scratched.

(3) Packings, gaskets, O-rings and split pins should be replaced with new items every time the engine is taken down. Deformed snap rings also require replacement.

(4) Always use TOHATSU genuine parts and TOHATSU outboard motor oil or oil recommended by TOHATSU.

(5) Only use the specified tools. Never work with other tools. Servicing must be carried out in a correct and accurate manner using the appropriate tools.

(6) When stripping any assembly, take special note of the match marks. If no match marks can be seen, it is advisable to make your own to prevent mistakes.

(7) Small parts, bolts, nuts and washers, once removed, should be temporarily returned to their original positions to prevent loss.

(8) All parts as they are taken down should be cleaned and washed with detergent oil or nonflammable solvent and checked for wear or damage carefully. This does not apply to rubber items, which can be damaged by solvents.

(9) When rebuilding, take note of the fitting of matching parts, packings, wiring and piping as well as greasing, cantering and sealing.
Bolts and nuts (e.g., cylinder head and crankcase) should be tightened progressively in a criss-cross pattern from the inner side. (Loosening should be carried out in the reverse order.)
When installing oil seals, take care not to scratch the oil seal lip. Make sure not to reverse its true position.
Be sure to pack the oil seal cavity with the specified grease. Be sure to apply the proper amount of liquid packing agent. If overfilled, it may overflow into the crankcase or elsewhere. Before using adhesives, read the directions carefully.
If any bolt or nut is hard to remove because of rust, spray with penetrating oil and wait more than five minutes for the oil to lubricate the threads. For service data, torque setting and correct application of sealing agents, adhesives and grease, please refer to the following sections of this manual.

Keys to symbols used in this manual.

H820	Hexagon bolt	Diameter	8mm (0.315 in.)	Length 20mm (0.787 in.)
Coarse 8	Hexagon nut	Diameter	8mm (0.315 in.)	
Stop 8 (3 types)	Hexagon nut (3 types)	Diameter	8mm (0.315 in.)	
W 6	Plain washer	Diameter	6mm (0.236 in.)	
SW 6	Spring washer	Diameter	6mm (0.236 in.)	
P620	Pan head screw	Diameter	6mm (0.236 in.)	Length 20mm (0.787 in.)

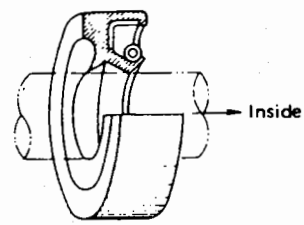


Fig. 1 Oil seal, front and back

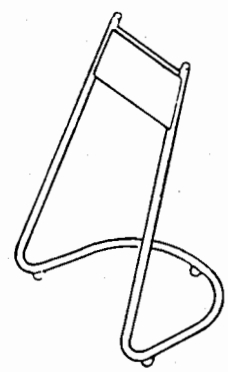


Fig. 2 Working stand

2. Servicing Data

Parts name	Item	Standard value ($M25C_2/M30A_3$)	Limit indicating adjustment or replacement
Piston	Outer diameter at piston crown	67.61~67.64mm (2.662~2.663in.)	
	Outer diameter at the point 15mm (0.59in.) from piston skirt. Measurement direction should follow the arrow mark on the piston crown.	67.92~67.94mm (2.674~2.675in.)	
	Clearance between cylinder (minimum clearance)	0.06~0.10mm (0.00236~0.00394in.)	over 0.21mm (0.00827in.)
	Piston pin hole diamater	17.001~17.007mm (0.6693~0.6695in.)	
	Piston ring groove width Top	2.04~2.06mm (0.0803~0.0811in.)	over 0.14mm (0.00551in.)
	Second	2.01~2.03mm (0.0791~0.0799in.)	over 0.11mm (0.00433in.)
Cylinder	Inner diameter	68.00~68.02mm (2.6771~2.6780in.)	over 68.09mm (2.260in.)
Piston pin	Clearance between piston pin hole	0.001~0.013mm (0.0000394~0.00051in.)	over 0.05mm (0.00197in.)
Connecting rod	Clearance between piston pin	0.0003~0.023mm (0.0000118~0.000906in.)	over 0.05mm (0.00197in.)
	Small end deviation from axis (axial direction)	1.0mm (0.0394in.) or less	over 2.0mm (0.0787in.)
	Big end deviation	0.3~0.5mm (0.0118~0.0196in.)	over 0.7mm (0.0276in.)
Crank shaft	Alignement	0.05mm (0.00197in.) or less	over 0.05mm (0.00197in.)
Compression of combustion chamber	To be measured at 500 r.p.m. on a warm engine.	686kPa (6.9bar, 7kg/cm^2, 100psi)	539kPa (5.39bar, 5.5kg/cm^2, 78psi) or less
Crank shaft oil seal	Inner diameter of upper oil seal	28.3~28.8mm (1.12~1.13in.)	Interface with shaft 0.5m (0.040in.) or less
	Inner diameter of lower oil seal	20.5~21.3mm (0.0807~0.893in.)	
Starter rope	Diameter	5mm (0.197in.)	
Ratchet guide B	Wire diameter (partial abrasion)	1.2mm (0.047in.)	1.0mm (0.020in.) or less
Carburetor	Main Jet #155 Main Air Jet #100 Slow Jet #85 Pilot Screw return 1-1/2±1/4 Main Nozzle #100		

	Part name	Item	Standard value	Limit indicating adjustment or replacement
Cooling system	Thermostat	Type Opening temperature Operating temperature (When fully opened) Lift when fully opened.	Wax type (with P.R.V.) 50.5mm ~ 53.5°C (1.99 in. ~ 128.3°F) 65°C (149°F) 3.0mm (0.118 in.)	
	Water pump	Construction Inner diameter of liner Height of liner (overall height including base plate) Outer diameter of impeller Height of impeller	Rotary rubber impeller type 39.9mm ~ 40.1mm (1.57 in. ~ 1.58 in.) 20.6mm ~ 20.8mm (0.811 in. ~ 0.819 in.) 43.7mm ~ 44.3mm (1.72 in. ~ 1.74 in.) 20.1mm ~ 20.3mm (0.791 in. ~ 0.799 in.)	Replace if the tip, side, or top is worn or cracked.
Electrical equipment	Magneto	Ignition timing (with throttle grip fully opened and warm engine)	B.T.D.C. 25°±2°/5500rpm A.T.D.C. 2° ±1°/1100rpm	
	Magneto base	Circumference of bearing portion of magneto coil plate	53.94mm ~ 53.97mm (2.124 in. ~ 2.125 in.)	53.90mm (2.12 in.) or less
	Magneto coil plate	Inner diameter of bearing portion of magneto stand	54.00mm ~ 54.03mm (2.126 in. ~ 2.127 in.)	Over 54.08mm (2.13 in.)
	Spark plug	Type NGK B7HS-10 (gap: 1.0) CHAMPION L-82C10 (gap: 1.0)	Spark gap 0.9mm ~ 1.0mm (0.035 in. ~ 0.039 in.)	Over 1.25mm (0.049 in.)
Power transmission	Clutch spring	Free height Mounting load/mounting height	77.5mm (3.051 in.) 4.9kg/60mm (11 lb/2.36 in.)	77.5mm (3.05 in.) or less
	Bevel gear	Backlash between bevel gears A and B	0.08mm ~ 0.13mm (0.03 in. ~ 0.005 in.)	Over 0.35mm (0.014 in.)
	Propeller shaft	Outer diameter of contacting surface of oil seal Deviation of propeller shaft Outer diameter of propeller shaft needle bearing portion Outer diameter of bevel gear A bearing portion	17.989 ~ 18.000 0.1mm (0.004 in.) or less 17.989mm ~ 18.000mm (0.708 in. ~ 0.709 in.) 16.985mm ~ 16.995mm (0.669 in. ~ 0.669 in.)	 Over 0.1mm (0.004 in.) 17.980mm (0.708 in.) or less 16.975mm (0.668 in.) or less
	Bevel gear C washer	Thickness	1.45mm ~ 1.50mm (0.057 in. ~ 0.059 in.)	1.35mm (0.053 in.) or less
	Drive shaft	Oil seal contacting surface Crossover tooth thickness (3), drive shaft spline (upper) Crossover tooth thickness (2), drive shaft spline (lower) Outer diameter of drive shaft needle bearing portion Deviation of drive shaft	17.00mm ~ 17.05mm (0.670 in. ~ 0.67 in.) 7.91mm ~ 7.96mm (0.311 in. ~ 0.313 in.) 4.95mm ~ 5.03mm (0.195 in. ~ 0.198 in.) 19.989mm ~ 20.000mm (0.787 in. ~ 0.787 in.) 0.3mm (0.012 in.) or less	 7.5mm (0.295 in.) or less 19.980mm (0.787 in.) or less Over 0.5mm (0.020 in.)

3. Relationship table between boat and propeller

Recommended table

M25C2	M30A3	Application	Applicable total weight (vessel + load)
8.5 (E-E)	8 (F)	For special heavy loads	Over 650 kg (1,433 lb)
9 (J)	9 (A)	For heavy loads	450 to 950 kg (992 to 2,095 lb)
10 (K)	10 (B)	Transom XL STD	350 to 650 kg (772 to 1,433 lb)
11.5 (F)	11 (C)	Transom L, LL STD	250 to 450 kg (551 to 992 lb)
13 (H)	13 (D)	Transom S STD	200 to 300 kg (441 to 662 lb)
13.5 (I)	14 (E)	For light loads	250 kg or less (551 lb)

4. Sealing agent, adhesive and lubricant locations

Part name \ Item	Three Bond 1322	Three Bond 1303B	Three Bond 1342	Bond G-17	Lock-Tite 572	Three Bond 1104	Three Bond 1107	Nippeco LT-2 (Cold service grease)	TOHATSU grease	Recommended engine oil	Recommended gear oil	Cup grease	Remarks
Engine													
Piston										O			Ring groove, outer circumference
Piston pin										O			External circle
Piston ring										O			
Cylinder liner										O			Internal wall
Upper main bearing										O			Bearing rotating portion
Center main bearing										O			Bearing rotating portion
Lower main bearing										O			
Small end bearing										O			
Big end bearing										O			
Cylinder, crank case matching surface						O							Do not apply excessively.
Labyrinth packing screw	O												Threaded portion
Oil seal Upper, crank shaft												O	Lip portion
Oil seal lower, crank shaft												O	Lip portion
Oil seal, drive shaft												O	Lip portion
"O" ring, magneto base										O			
"O" ring, crank case head										O			
Valve seat mounting screws	O												Threaded portion
Starter bracket mounting bolts		O											Threaded portion
Magneto base								O					Circumference of bearing portion

Part name \ Item	Three Bond 1322	Three Bond 1303B	Three Bond 1342	Bond G-17	Lock-Tite 572	Three Bond 1104	Three Bond 1107	Nippeco LT-2 (Cold service grease)	TOHATSU grease	Recommended engine oil	Recommended gear oil	Cup grease	Remarks
Guide plate								O					Sliding surface
Set ring								O					Sliding surface
Magneto cord clamp B mounting screws	O												Threaded portion
Starter shaft								O					Groove of ratchet guide B, outer circumference of bearing portion
Starter spring								O					
Ratchet shaft bush								O					
Starter shaft mounting nuts	O												Inner circumference of threaded portion
Carburetor								O					Sliding portion of lever
Air silencer mounting screws	O												Threaded portion
Throttle cam mounting screws	O												Threaded portion
Throttle cam bush									O				Sliding portion
Advancer arm									O				Sliding portion
Starter lock arm mounting screws	O												Threaded portion
Starter lock arm bush									O				Sliding portion
Throttle stop arm mounting screws	O												Threaded portion
Throttle stop arm bush									O				Sliding portion
Starter lock lever shaft									O				Sliding portion
Engine packing							O						Both faces
Ball joint B		O											Threaded portion (set ring, throttle shaft B)
Advancer arm shaft		O											Threaded portion

Lower unit

Water strainer plug			O										Pressed-in portion
Bevel gear B mounting nuts		O											Apply locking agent after degreasing threaded portion
Propeller shaft housing												O	Pilot portion
"O" ring, propeller shaft												O	
Oil seal, propeller shaft									O				Lip portion
Pump case lower												O	Pilot portion
Oil seal, pump case									O				Lip portion
"O" ring, pump case lower												O	
Propeller shaft housing mounting bolts									O				Threaded portion
Bolt, pump case			O										

Item / Part name	Three Bond 1322	Three Bond 1303B	Three Bond 1342	Bond G-17	Lock-Tite 572	Three Bond 1104	Three Bond 1107	Nippeco LT-2 (Cold service grease)	TOHATSU grease	Recommended engine oil	Recommended gear oil	Cup grease	Remarks
Seal rubber, pump case				O							O		G-17: Bonded portion, pump case Oil: Water tube inserted portion
Cam rod bush											O		Inner and outer "O" rings
Cam rod holder									O				Sliding portion
Gear case lubrication oil											O		$M25C_2$ & $M30A_3$: 250cc (1/2 US pt, 1/2 Imp pt)
Lower mounting rubber bolt									O				Fitting portion of mounting bracket
Bracket mounting bolts									O				Threaded portion
Bracket mounting bolt bush									O				
Clamp screws									O				Threaded portion
Bracket shaft									O				Sliding portion
Bracket shaft bush									O				Sliding portion
Thrust plate upper									O				Sliding portion
Thrust plate lower									O				Sliding portion
Oil seal, bracket shaft									O				Lip portion
Mounting bracket									O				Spline portion
Tilt stopper bush									O				
Friction spring, tilt stopper									O				
Set plate mounting bolt, tilt stopper		O											Threaded portion
Reverse lock arm shaft	O								O				Grease: Sliding portion Thread locking adhesive: Threaded portion
Reverse lock lever shaft	O								O				Grease: Sliding portion Thread locking adhesive: Threaded portion
Reverse lock guide plate mounting bolts	O								O				Grease: Sliding portion Thread locking adhesive: Threaded portion
Reverse lock guide bush									O				Sliding portion
Swivel bracket									O				Pack inside with grease.
Bracket mounting nut B		O							O				Threaded portion (Apply to bolt side.)
Twist grip									O				Sliding portion
Handle A mounting bolt collar									O				
Throttle shaft A bush									O				

Part name \ Item	Three Bond 1322	Three Bond 1303B	Three Bond 1342	Bond G-17	Lock-Tite 572	Three Bond 1104	Three Bond 1107	Nippeco LT-2 (Cold service grease)	TOHATSU grease	Recommended engine oil	Recommended gear oil	Cup grease	Remarks
Universal pinion									O				Sliding portion
Upper mounting rubber						O							Circumference
Lower mounting rubber						O							Circumference
Throttle shaft B collar									O				Sliding portion
Throttle shaft B supporter									O				Sliding portion
Shift lever shaft									O				Sliding portion
Oil seal, shift lever shaft									O				Lip portion
Shift lever shaft bush									O				
Lever stopper holder									O				Sliding portion
Shift lever stopper plate mounting screws	O												Threaded portion
Seal rubber, motor cover lower				O									Bonded portion
Choke rod									O				Sliding portion
Choke lever shaft		O							O				Thread locking adhesive: Threaded portion Grease: Sliding portion
Hook lever bush									O				
Hook lever sealing									O				Lip portion
Spacer, shift lever									O				Sliding portion
Drive shaft housing mounting bolts									O				Threaded portion
Gear case mounting bolts									O				Threaded portion
Water pipe lock plate mounting bolts									O				Threaded portion
Drive shaft												O	Spline on crank shaft side
Propeller rubber bush								O					Shaft portion
Starter solenoid bracket mounting screws		O											Threaded portion
Neutral switch plate mounting screw		O											Threaded portion
Drag link									O				Sliding portion
Drag link cable lock nuts									O				Sliding portion

5. Torque settings

Item	Screw diameter	Torque setting N·m (kg-m, ft-lb)
Magneto nut	16mm (0.630 in.)	118 ~ 137 (12 ~ 14, 87 ~ 101)
Bolt, cylinder head	8mm (0.315 in.)	24 ~ 25 (2.4 ~ 2.6, 17 ~ 19)
Bolt, crank case	8mm (0.315 in.)	24 ~ 25 (2.4 ~ 2.6, 17 ~ 19)
Nut, advancer arm	8mm (0.315 in.)	Adjustment
Bolt, starter bracket	8mm (0.315 in.)	24 ~ 25 (2.4 ~ 2.6, 17 ~ 19)
Spark plug	14mm (0.551 in.)	25 ~ 29 (2.5 ~ 3.0, 18 ~ 22)
Nut, bracket	7/8 inches	88 ~ 98 (9 ~ 10, 65 ~ 72)
Bolt, friction bracket	6mm (0.236 in.)	Adjustment
Nut, mounting rubber	10mm (0.394 in.)	24 ~ 25 (2.4 ~ 2.6, 17 ~ 19)
Reverse lock arm shaft	6mm (0.236 in.)	4.6 ~ 6.3 (0.47 ~ 0.64, 3.4 ~ 4.6)
Reverse lock lever shaft	6mm (0.236 in.)	4.6 ~ 6.3 (0.47 ~ 0.64, 3.4 ~ 4.6)
Nut, ball joint B	6mm (0.236 in.)	3 ~ 5 (0.3 ~ 0.5, 2.2 ~ 3.6)
Nut, friction handle adjustment	6mm (0.236 in.)	Adjustment
Nut, choke lever shaft	6mm (0.236 in.)	Adjustment
Nut, bevel gear B	10mm (0.344 in.)	24 ~ 25 (2.4 ~ 2.6, 17 ~ 19)
Nut, shift lever	10mm (0.394 in.)	25 ~ 29 (2.5 ~ 3.0, 18 ~ 22)
Others	3mm (0.118 in.) 4mm (0.157 in.) 5mm (0.197 in.) 6mm (0.236 in.) 8mm (0.315 in.) 10mm (0.394 in.)	0.6 ~ 0.8 (0.06 ~ 0.08, 0.4 ~ 0.6) 1.5 ~ 2.0 (0.15 ~ 0.20, 1.1 ~ 1.4) 2.5 ~ 3.4 (0.25 ~ 0.35, 1.8 ~ 2.5) 4.9 ~ 6.4 (0.50 ~ 0.65, 3.6 ~ 4.7) 11.3 ~ 15.2 (1.15 ~ 1.55, 8.3 ~ 11.2) 22.6 ~ 30.9(2.30 ~ 3.15, 16.6 ~ 22.8)

6. Service tools and measuring instruments

Measuring instruments

The following service and measuring instruments are required for servicing Tohatsu outboard motors.

Be sure to use the special tools when noted as (use special tool). For the method refer to "How to use special tools".

(1) General tools

1.	Screwdriver	200mm (7.87 in.)
	Screwdriver	150mm (5.91 in.)
	Screwdriver	100mm (3.94 in.)
2.	Phillips screwdriver	200mm (7.87 in.)
	Phillips screwdriver	150mm (5.91 in.)
	Phillips screwdriver	100mm (3.94 in.)
3.	A set of open-end wrenches	6 sizes
4.	Box wrench	10mm x 13mm (0.394 in. x 0.512 in.)
	Box wrench	17mm x 21mm (0.669 in. x 0.827 in.)
	Box wrench	21mm x 23mm (0.827 in. x 0.906 in.)
5.	Adjustable wrench	300mm (11.811 in.)
6.	Pliers	
7.	Long-nose pliers	
8.	Clip pliers	
9.	T-handle socket wrench	10mm (0.394 in.)
	T-handle socket wrench	13mm (0.512 in.)
	T-handle socket wrench	17mm (0.669 in.)
10.	T-handle universal wrench	10mm (0.394 in.)
	T-handle universal wrench	13mm (0.512 in.)
11.	Resin-head hammer	
12.	Hammer	
13.	Allen key	8mm (0.315 in.)
	Allen key	10mm (0.394 in.)
14.	Spark plug wrench	21mm (0.827 in.)
15.	Spark plug wrench	21mm (0.827 in.)
16.	Torque wrench	49.0N·m (500kg-cm, 434 in-lb) 147.1N·m (1,500kg-cm, 1,302 in-lb)
17.	Socket wrench set	
18.	Piston ring tool	

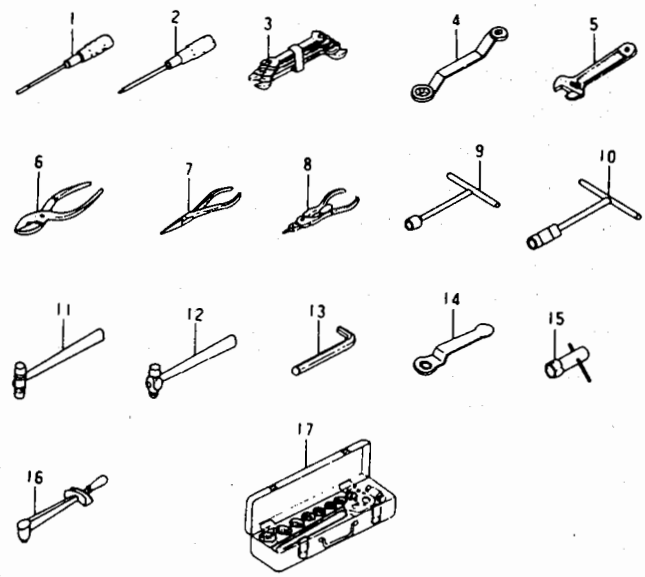


Fig. 3 General tools

(2) Compression gauge 0 to 1,373kPa (0 to 13.7 bar, 0 to 14kg/cm², 0 to 199 psi)

(3) Test propeller

M25C$_2$ & M30$_3$: 346-64111-5

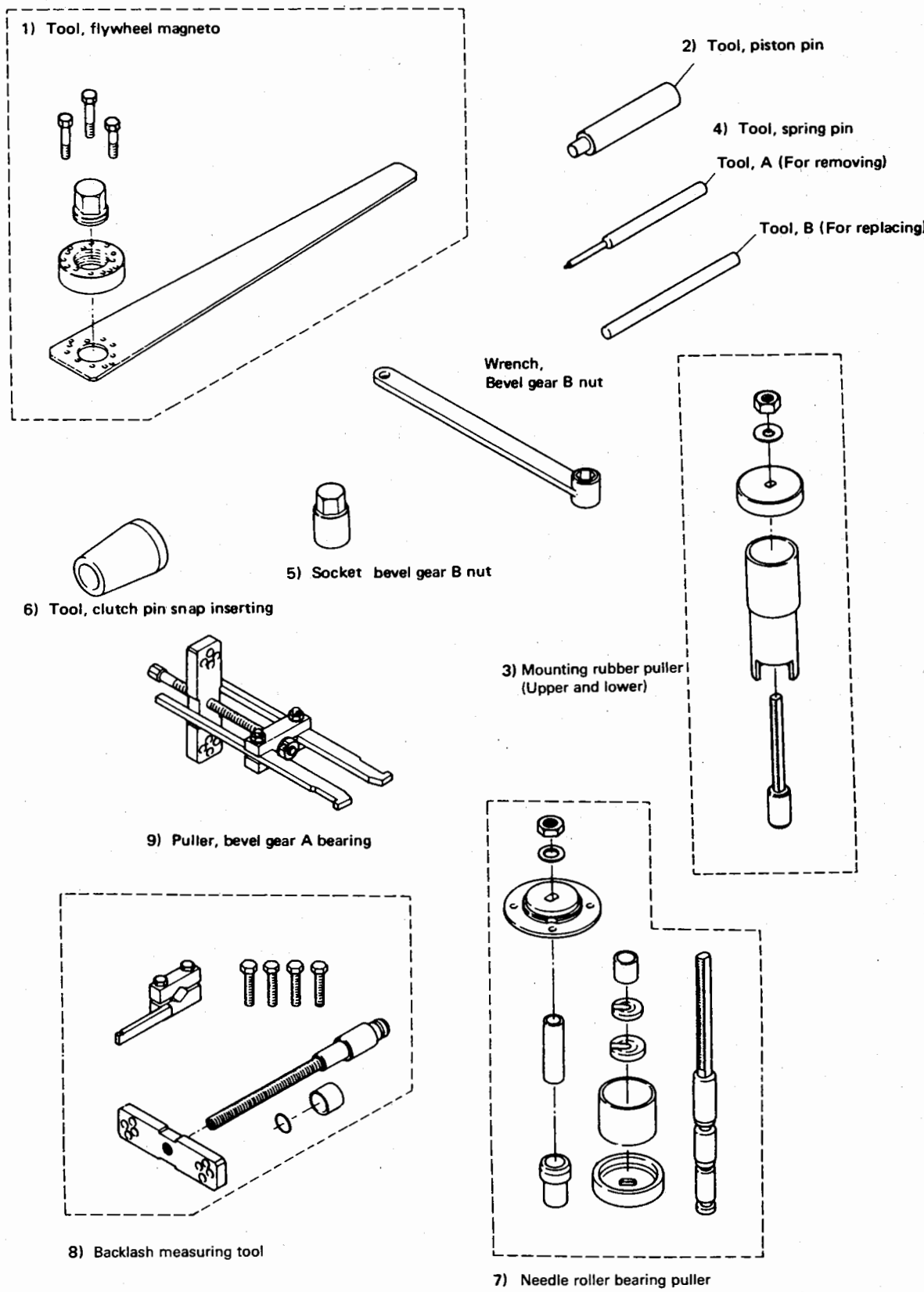
(4) Measuring instruments

The following instruments are available on the market:

Tachometer	600 to 6,000rpm
Universal tester	(Resistance x 1,000 10kΩ 30 to 300VAC, 30VDC, battery 3V or less)
Vernier calipers	(JIS B7507, M1 type vernier calipers 300mm (11.81 in.))
Micrometer	(JIS B7502, 0.01mm (0.0004 in.) scale, outside micrometer)
Cylinder gauge	(JIS B7515, 50mm to 100mm (1.97 in. to 3.94 in.) scale cylinder gauge)
Ring gauge	(JIS B7420, 68mm (2.67 in.)ϕ)
Dial indicator	(JIS B7503, 0.01mm (0.0004 in.) scale dial gauge)
Feeler gauge	(JIS B7524, 0.03mm to 0.3mm (0.001 in. to 0.012 in.) measurement)
V-blocks	(JIS B7540)
Surface plate	(JIS B7513, 500mm x 500mm (19.69 in. x 19.69 in.))

Dial indicator magnet base or dial indicator stand

Fig. 4 Special tools for stripping and assembling



7. How to use special tools for disassembling and assembling

(1) Tool, flywheel magneto

1. Stripping:

Fasten the tools (A) and (B) to the flywheel magneto with bolt (D) and remove the magneto nut (left hand thread) with socket wrench (Nominal size: 24).
Screw the tool (C) into the tool (B) and tighten (Nominal size: 24). Withdraw the flywheel magneto. (Tools (A) and (B) are normally tightened by means of three bolts.)

2. Reassembling

When replacing the flywheel magneto tighten the magneto washers and nuts after confirming that magneto key on the crank shaft is in position. Attach the tools (A) and (B) to the flywheel and then tighten the magneto nut to the rated torque with a torque wrench.
(Notes)

1. Degrease the tapered portions of crankshaft and magneto.
2. Supply oil to the threaded portion of the tools (B) and (C) as required.

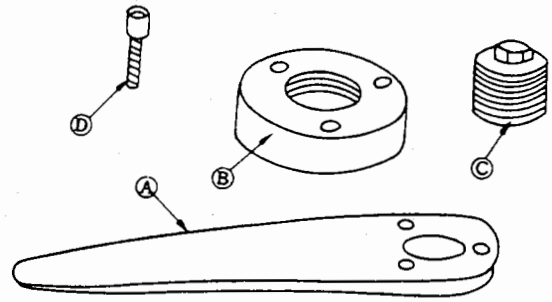


Fig. 5 Tool flywheel magneto

Tightening torque: 118 to 137N·m
(12 to 14kg-m, 87 to 101 ft-lb)

(2) Tool, piston pin

- Remove the piston pin clip and position the tip of the piston pin tool in the recess of the pin. To remove hit lightly on the end surface with a hammer in the direction of arrow. Make sure that the connecting rod is not bent during removal. (The tool can also be used for replacing the pin).

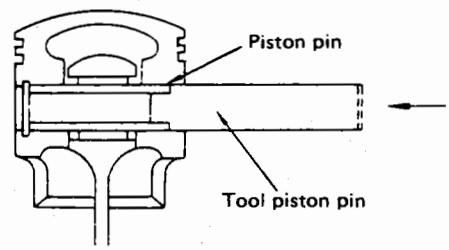


Fig. 6 Tool piston pin

(3) Mounting rubber puller (Upper and lower)

- Mounting rubber clip
- Screw the tool (B) into the mounting rubber bolt and fasten it together with pilot of the tool (D) so that the tool (A) is aligned with the mounting rubber, then tighten the nut (C).
- When removing the upper mounting rubber, be sure to apply the tool (A). Smaller diameter of the tool (A) is to be lead to the upper mounting rubber. When removing the lower mounting rubber, larger diameter of the tool (A) is to be lead to the lower mounting rubber.

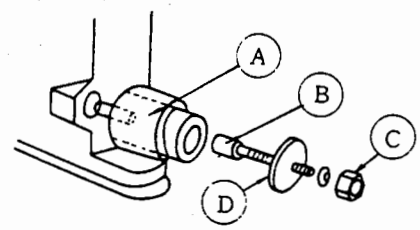


Fig. 7 Mounting rubber puller

(4) Tool, spring pin

1. When removing the spring pin from the shift lever shaft point, insert the tip of the spring pin extracting tool (A) in the spring pin hole and hit the end surface in the direction of the arrow lightly with a hammer. (This tool can also be used for extracting spring pins used in other parts).

2. When replacing the spring pin in the shift lever shaft joint, insert the spring pin in the hole of the spring pin tool B and place the tip of it in the hole for the spring pin in. Hit the end surface in the direction of the arrow lightly with a hammer. (This tool can be used for replacing the spring pins used in other parts.)
   (Note)
   Never use a used spring pin.

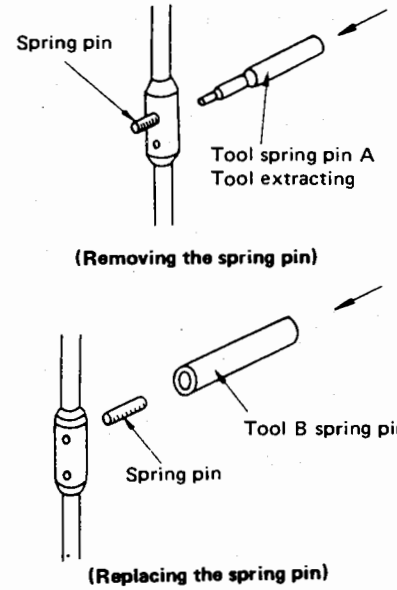


Fig. 8 Tool, spring pin

(5) Socket and wrench, bevel gear B nut

- Fix the bevel gear B nut inside the gear case by using tool (B) and tighten the tool (A) inserted in the spline on the engine side of the drive shaft by using the torque wrench at the specified torque setting.

(Note)
Be sure to apply the thread locking adhesive (Three Bond 1303-B) to the threaded portion of the drive shaft after degreasing. Apply sparingly.
Tightening torque: 24 to 25N·m
(2.4 to 2.6kg-m, 17 to 19 ft-lb)

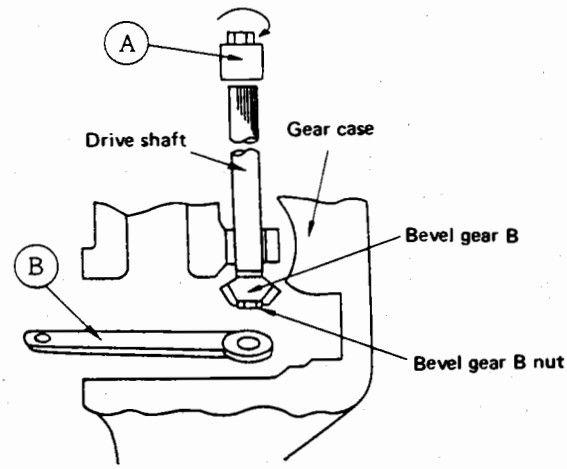


Fig. 9 Socket and wrench, bevel gear B nut

(6) Tool, clutch pin

- Install the clutch spring, clutch push rod, clutch and clutch pin in the propeller shaft and insert the tool (A) into the propeller shaft. Gradually expand the clutch pin snap along the tapered portion to insert in the groove of the clutch.

(Note)
Never use the used pin snap.

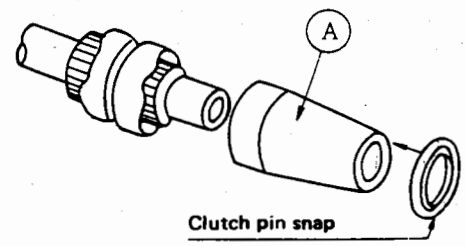


Fig. 10 Tool,clutch pin

(7) Puller,needle roller bearing

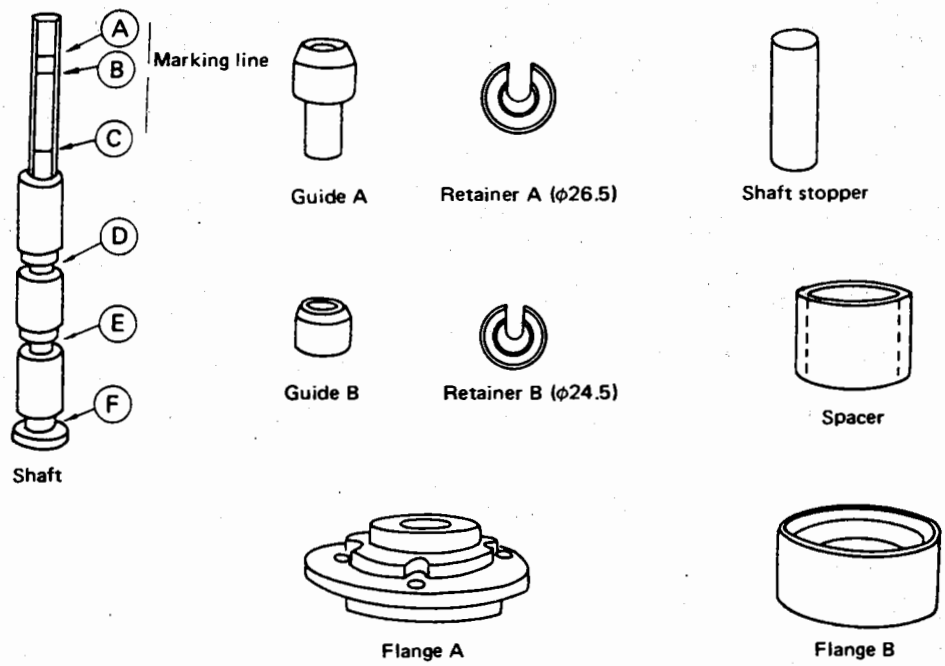


Fig. 11 Puller needle roller bearing

(7-1) Needle roller bearing of propeller shaft housing

1. When bearing is press fitted

Insert the retainer B (outer diameter: ϕ 24.5) into the groove (D) of the shaft and place the needle roller bearing and guide B on it. (The chamfered side of the guide B, the end of the needle bearing without markings and the V groove of the retainer B all face towards the thread side of the shaft).

Insert the needle roller bearing puller into the propeller shaft housing in the direction shown by the arrow in the diagram right. Secure flange B by means of the nut and washer until seated.

(The flange B is stepped and provided with 4 types of holes. Be sure to use a hole having a diameter of ϕ 70 which is linked with (G) portion as shown in the diagram right. Tightening is correct when the marking line (C), in the diagram above, can be seen above the nut and the nut is fully tightened. Be sure that the oil seal of the propeller shaft housing is removed.)

(Note)

Make sure that the retainer B is inserted home in the groove.

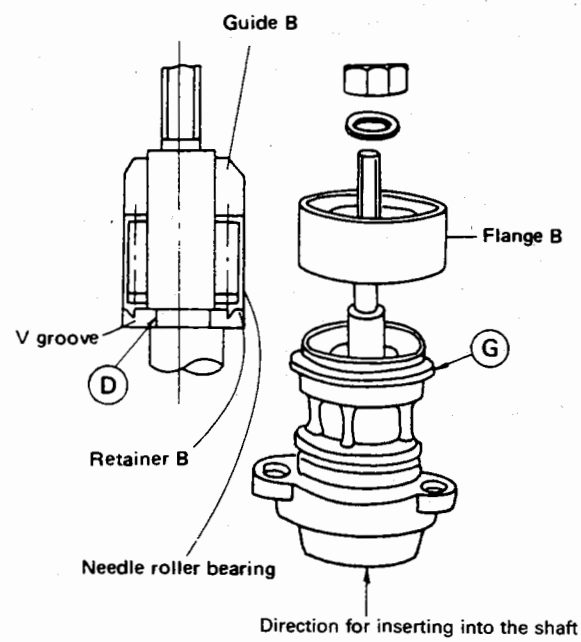


Fig. 12 Press fitting needle roller bearing

2. When bearing is to be pulled out

Insert the shaft into the propeller shaft housing from the direction of arrow as shown in the diagram with the retainer B only set to the groove (E). (Be sure to remove the oil seal of the propeller shaft housing in advance. Then set the spacer and flange B from above, as shown in the diagram, and tighten by means of the nut and washer until the needle roller, bearing comes out.

(The hole of the flange B should be used to inserted the spacer and pilot (ϕ 58). Take care that flange B and shaft are properly aligned.)

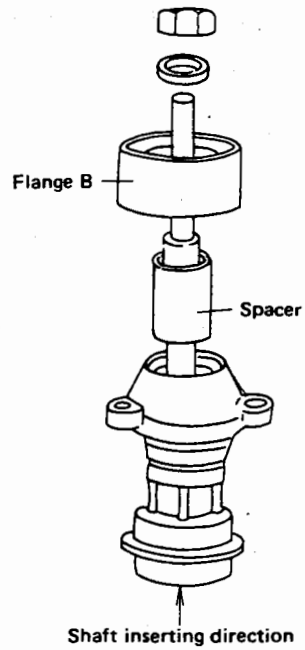


Fig. 13 Pulling out needle bearing

(7-2) Needle roller bearing of gear case

1. When bearing is press fitted

Insert the shaft into the gear case from the direction of arrow (A) and insert the guide A and needle roller bearing into the shaft from the direction of arrow (B). Then insert the retainer A (outer diameter: ϕ 26.5) into the groove (F). (In this case make sure to arrange so that the stepped side having larger diameter of the guide A, the side having neither figure nor letter on the end surface of the needle roller bearing and the surface with V groove of the retainer A face the threaded side of the shaft.)

Then insert the shaft stopper and flange A into the shaft in order from (A) side in the direction as shown in the diagram above and fasten the flange A using the tapped hole for pilot and pump case mounting bolt hole. And set the nut and washer and tighten them until the shaft does not move any more.

(Although the flange A is provided with many steps, make sure that the portion having an outer diameter of ϕ 44, linked with the hole for pump case holder, is used. The flange A normally coincides with three mounting holes for the gear case. Moreover, the shaft is provided with a marking line to guide tightening. Tightening is correct when the marking line (A) can be seen from above the nut and the nut does not turn any more.) Then loosen the nut and remove the retainer A and the tool can be dismantled.

2. When bearing is to be pulled out

Insert the shaft from the direction of arrow (A) and insert the retainer A into the groove (F) of the shaft from the direction of arrow (B). Then insert the flange A only into the shaft and fasten it in the same manner as in the case of press fitting. Moreover, set the nut and washer and tighten them until the needle roller bearing comes out.

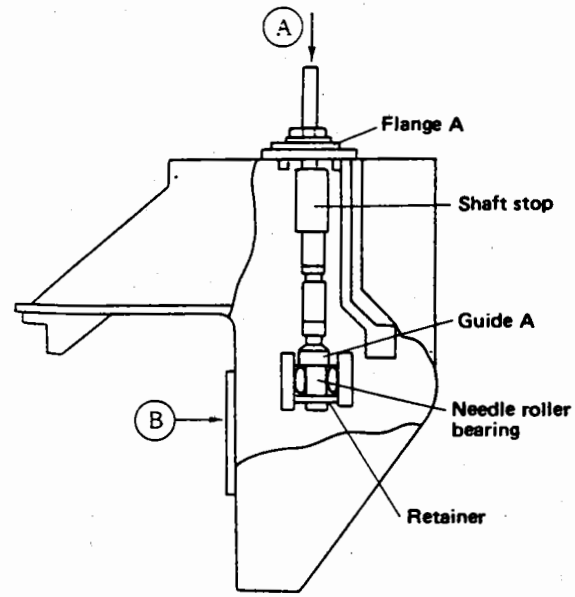


Fig. 14 Press fitting gear case needle bearing

(8) Measuring tool, backlash

- To measure the backlash between the bevel gears A and B, remove the propeller shaft housing, propeller shaft and bevel gear C from the gear case.

1. (Fig. 15) Install the "O" ring and collar in the groove at the tip of the shaft and screw the plate into the threaded portion of the shaft.

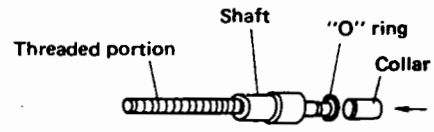


Fig. 15 Measuring tool, backlash

2. (Fig. 16) Fit the collar side of the shaft into the bearing portion of the bevel gear A and install the plate in the gear case. (In this case, when the plate is not adequately screwed into Ⓐ, it can not be istalled correctly since the shaft presses the bevel gear A. Therefore, tighten Ⓐ adequately.) Screw the shaft with a screwdriver applied to the slotted groove of the threaded end in order to fix the bevel gear A.

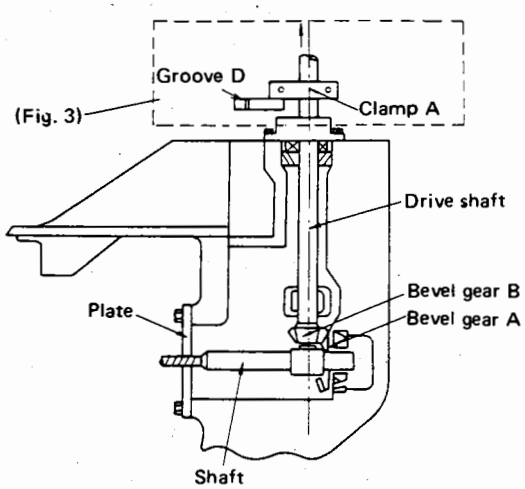


Fig. 16

3. (Fig. 16) Install the clamps A and B in the drive shaft. Turn the drive shaft while pulling it up in the direction of arrow and read the deflection at the groove D using a dial indicator.
When the reading of the dial gauge is between 0.33 and 0.54mm, the backlash is between 0.08mm and 0.13mm which is normal.

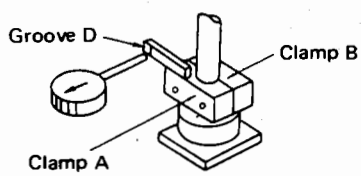


Fig. 17 The method of applying dial gauge

4. When measuring, take note of the following matters:
   1) Make sure that the shaft to fix the bevel gear A is adequately tightened so as not to turn more than the backlash when the drive shaft is lightly turned.
   2) When fixing the drive shaft bearing B, carry it out with the lower pump case only after removing the pump case. Moreover, install the clamps A and B in the location nearest to the lower pump case.
   3) Fix the gear case and dial gauge and read the dial gauge while turning the drive shaft while pulling it up. Measure while making sure that no play is experienced by other portions (play between the drive shaft and bearing, deflection of the drive shaft, etc.)

(9) Puller, bevel gear A bearing

- When removing the bevel gear A outer bearing apply the puller to the gear case and tighten the nut portion (Wrench: nominal 13). The plate is provided with a number of holes. Make sure to use them according to the pitch of holes for the propeller shaft housing mounting bolt of the gear case.
When installing the outer, adequately warm it up by using hot water before fitting.

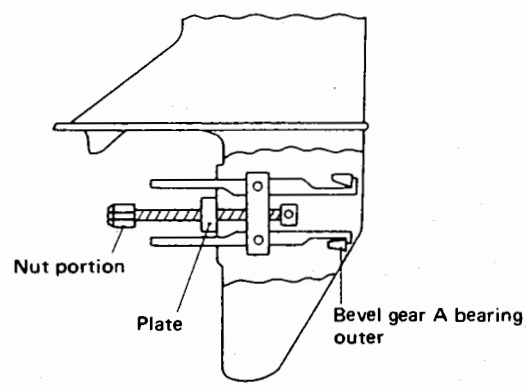


Fig. 18 Puller bevel gear A bearing

8. Removing power unit and auxiliary equipment

The inspection and maintenance of the main part of engine shall be performed after removing the power unit from the machine. However, the inspection and maintenance of the cylinder head and auxiliary equipment such as magneto, carburetor, fuel pump, fuel filter and recoil starter can be carried out without removing the power unit from the machine.

(1) Removing the power unit

1) Remove the choke rod.
2) Remove the ball joint cap on the starter lock arm side of the starter lock arm rod.
3) Take off the connection of the stop switch and C.D. unit. **(Fig. 19)**
   Stop switch cord (brown-black) (brown-black)
   C.D. ignition unit cord (Brown) (Black)

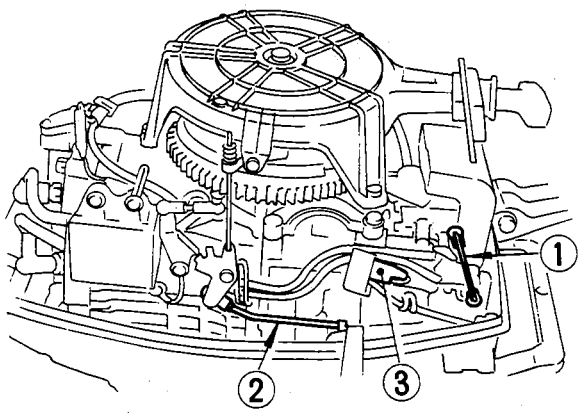


Fig. 19 The right (starboard) side of power unit

(1) Choke link rod
(2) Starter lock arm rod
(3) Stop switch connector

4) Remove the fuel pipe A (L = 140mm (5.51 in.)).
5) Remove the handle link rod. **(Fig. 20)**

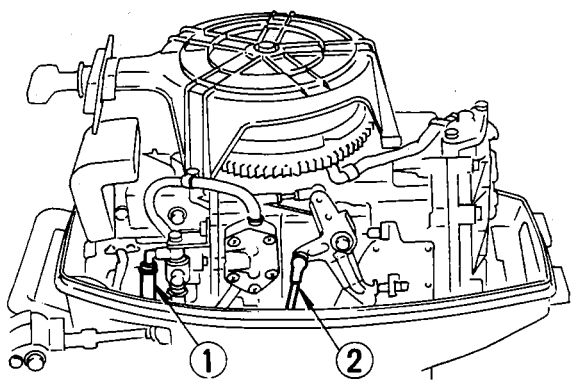


Fig. 20 The left (port) side of power unit

(1) Fuel pipe (A)
(2) Handle link rod

6) Remove the engine mounting bolts (H840-6) and remove the power unit pull it up. **(Fig. 21)**

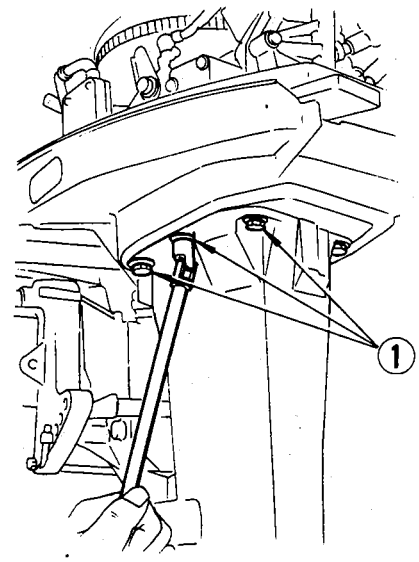


Fig. 21 Removing the engine

(1) Engine installing bolt

(2) Removing the auxiliary equipment

Auxiliary equipment including the recoil starter, carburetor, fuel pump, fuel filter, flywheel magneto, C.D. unit and thermostat are installed in the main part of

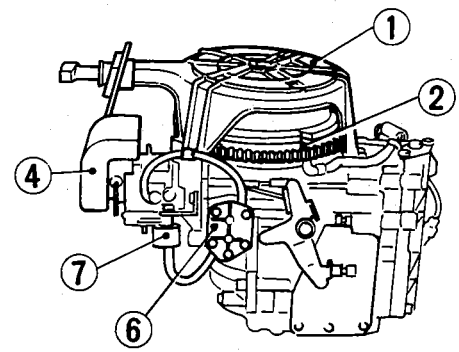


Fig. 22 The left (port) side of power unit

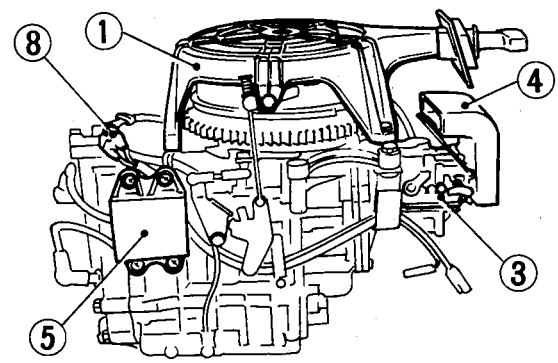


Fig. 23 The right (starboard) side of power unit

(1) Recoil starter
(2) Flywheel magneto
(3) Carburetor
(4) Air silencer
(5) C.D. unit
(6) Fuel pump
(7) Fuel filter
(8) Thermostat

(3) Removing the recoil starter

1) Take off the starter lock rod from the starter lock arm.
2) Remove the recoil starter bolts (H830-1, H625-2). Remove the recoil starter assembly while pulling up. (Fig. 24)

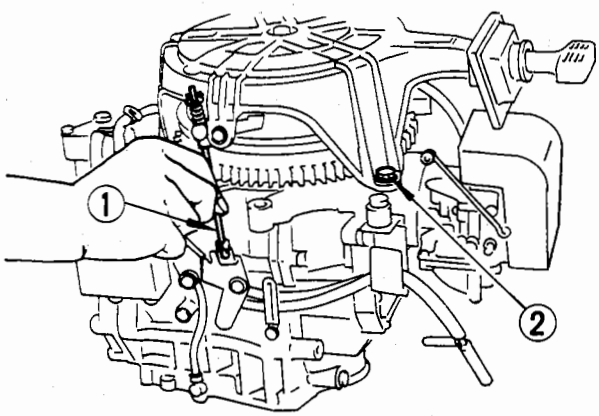


Fig. 24 Removing the recoil starter

(1) Starter lock rod
(2) Installing bolt (H625-1)

(4) Removing the air silencer and carburetor

1) Remove the air silencer mounting screws ((+)612-2). Remove the air silencer.
2) Remove the gasket.
3) Remove the fuel pipe C (L = 230mm (9.06 in.)).
4) Remove the caburetor mounting nuts. (Coarse 6-2) Remove the carburetor from the engine. (Fig. 25)

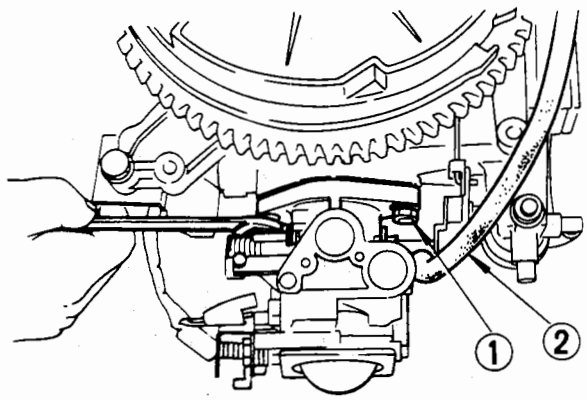
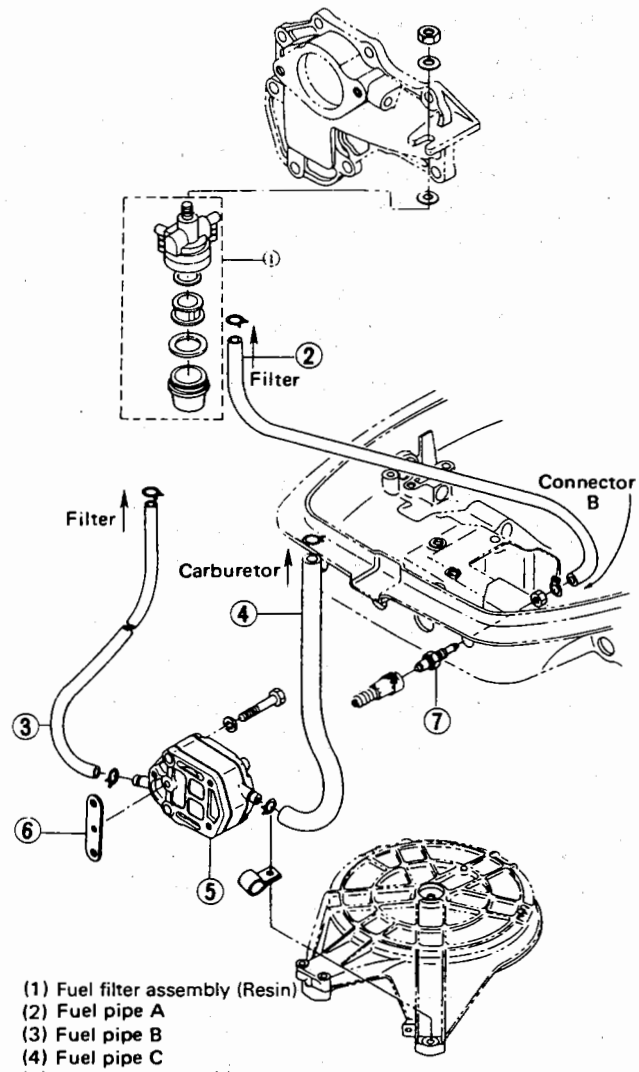


Fig. 25 Removing the carburetor

(1) Carburetor installing nut
(2) Fuel pipe C

(5) Removing the fuel pump

1) Remove the fuel pipe B (L = 120mm (4.72 in.)) from the fuel filter.
2) Remove the fuel pump mounting screws ((+) 640-2) in order to remove the fuel pump assembly.
3) Remove the fuel pump gasket.



(1) Fuel filter assembly (Resin)
(2) Fuel pipe A
(3) Fuel pipe B
(4) Fuel pipe C
(5) Fuel pump assembly
(6) Gasket
(7) Fuel connector B

Fig. 26 Fuel line

(6) Removing the fuel filter

1) Check that the fuel pipes A and B are removed.
2) Loosen the upper filter installing nut (coarse 8-1) in order to remove the fuel filter.

(7) Removing the flywheel magneto assembly

1) Take off the connection of the C.D. unit.
2) Remove the starter pulley. (Installing bolts: Coarse 620-3)
3) Install the flywheel magneto tools (special stripping tool) A and B in the flywheel with D (3) pieces and remove the magneto installing nut with 24mm wrench. (Nut: Left hand thread)
4) Then, screw the tool C into the center of the tool B and further tighten with a socket wrench and the flywheel will come off. (Fig. 27)

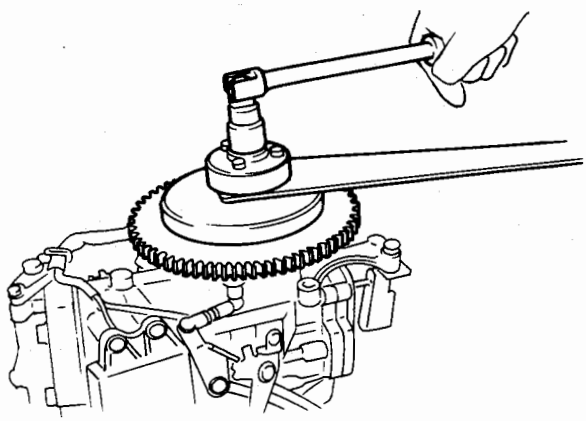


Fig. 27 Removing the flywheel (Using special stripping tool)

5) Remove the advancer link rod.
6) Remove the throttle stop arm rod.
7) Remove the magneto cord clamp B.
8) Remove the coil plate mounting screws ((+) 508-4) and remove the coil plate. (Fig. 28)

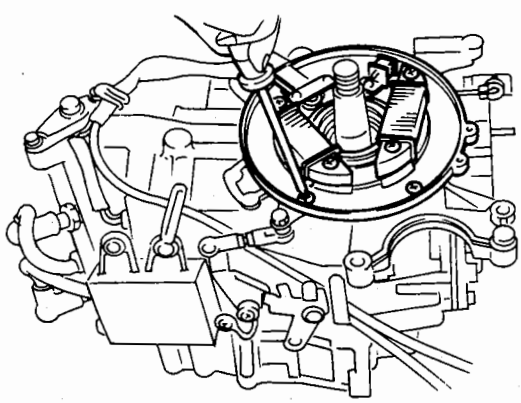


Fig. 28 Removing the coil plate

9) Remove the guide plate installing bolts (H620-4) and remove the guide plate and set ring (tightened together with the magneto base). (Fig. 29)

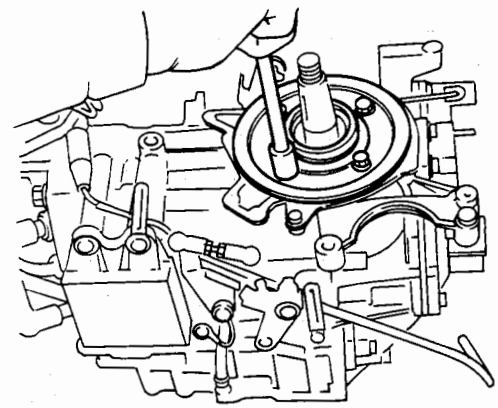


Fig. 29 Removing the guide plate

(8) Removing the C.D. unit

1) Remove the plug cap from the plug.
2) Take off the connection of the wiring cord (Coil plate, stop switch ground).
3) Remove the C.D. unit installing screws ((+) 630-4) so as to remove the unit.

(9) Removing the thermostat (Fig. 30)

1) Remove the thermostat cap installing bolts (H625-2) from the top of the cylinder head to remove the thermostat cap.
2) Remove the gasket.
3) Take out the thermostat.

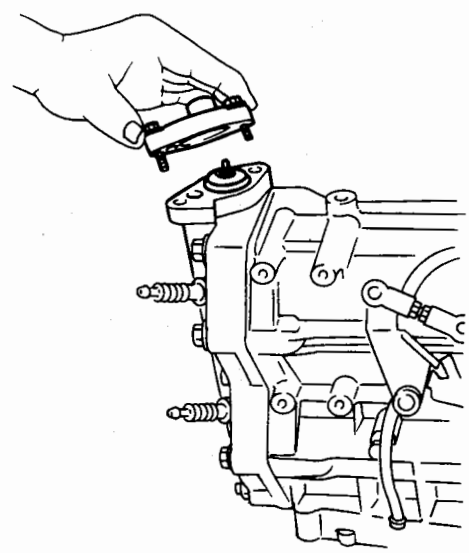


Fig. 30 Removing the thermostat

9. Disassembling the main part of the engine

(1) Cylinder head (Fig. 31)

1) Remove the cylinder head tightening bolts (H845-10 (T marking)) in order to remove the head.
2) Remove the gasket.
3) Check the engine anode for normality. (If worn away replace with new).

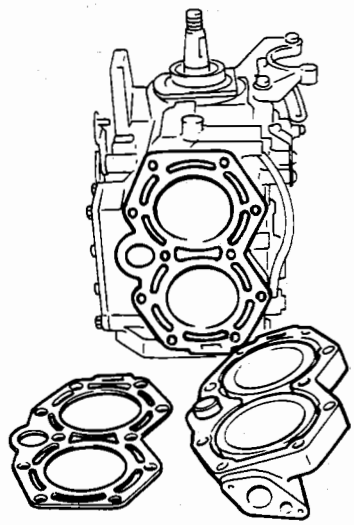


Fig. 31 Removing the cylinder head

(2) Exhaust cover (Fig. 32)

1) Remove the exhaust cover installing bolts (H518-9) in order to remove the cover.
2) Remove the gasket.

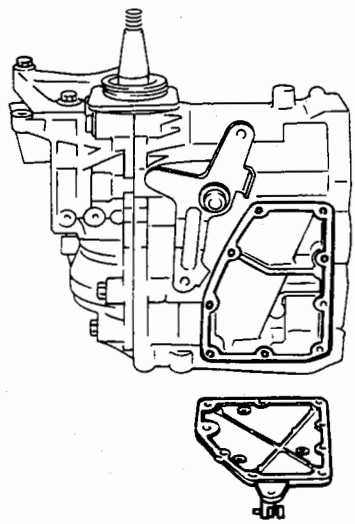


Fig. 32 Removing the exhaust cover

(3) Inlet manifold and reed valve (Fig. 33)

1) Remove the throttle link rod.
2) Remove the inlet manifold installing bolts (H625-9) in order to remove the inlet manifold.
3) Remove the gasket.
4) Remove the reed valve assembly installing screw ((+) 616-1) in order to remove the reed valve assembly.
5) Remove the gasket A.
6) Never strip the reed valve since it is choked after tightening. If defective, replace with new assembly.

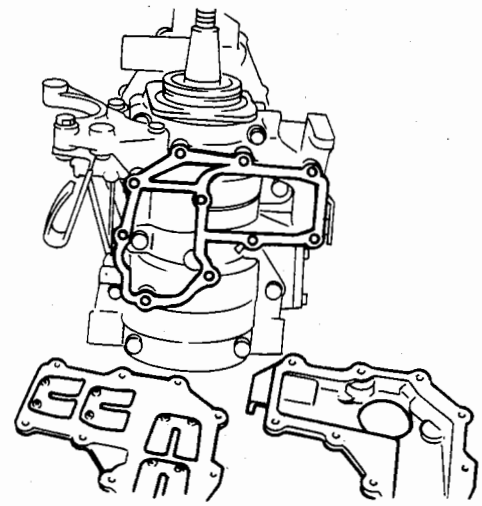


Fig. 33 Removing the inlet manifold and reed valve

(4) Cylinder crankcase

1) Remove the starter bracket.
2) Remove the crankcase head mounting bolts (H616-2).
3) Remove the labyrinth packing set bolt (H518-1) in the lower inlet port.
4) Remove the cylinder crankcase tightening bolts (H845-8, H840-2). (Fig. 34)

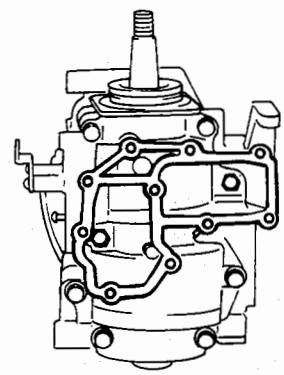


Fig. 34 Removing the crankcase tightening bolts

5) Strip the crankcase. (Fig. 35)
(Hitting the crankcase on the flange surface with a resin head hammer lightly will facilitate stripping.)

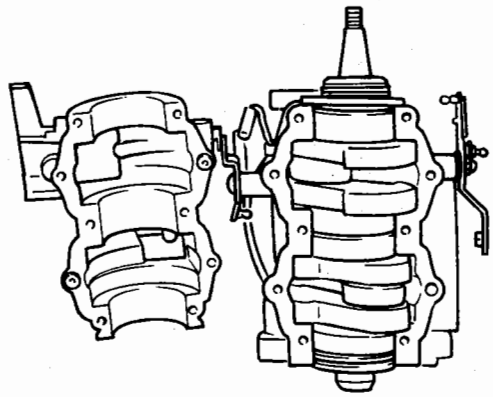


Fig. 35 Removing the crankcase

6) Remove the magneto base and crankcase head from the crankshaft.
("O" ring and oil seal are installed in each.)

(5) Crankcase and piston

1) Pull out the crankcase assembly from the crankcase.
2) Remove the piston pin clip.
3) Remove the piston from the connecting rod using a tool piston pin (Special stripping tool). (Fig. 36)
4) Remove the small end bearing.
5) Remove the piston ring.

(Note) It is difficult to strip and reassemble the crankshaft assembly. If defective due-to abrasion or deformation, replace with new crankshaft assembly.

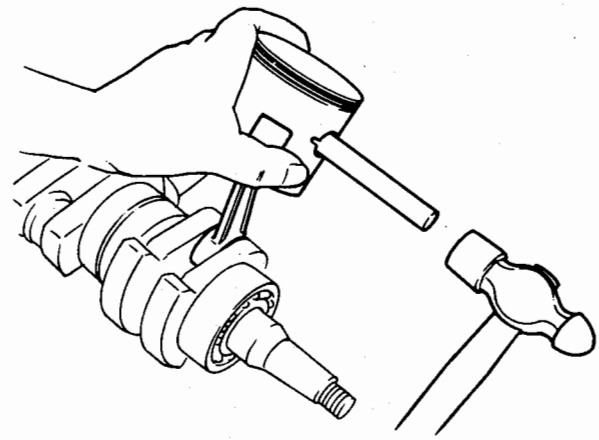


Fig. 36 Removing the piston

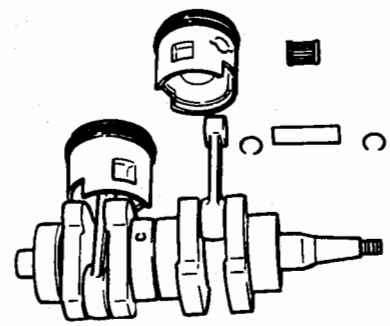
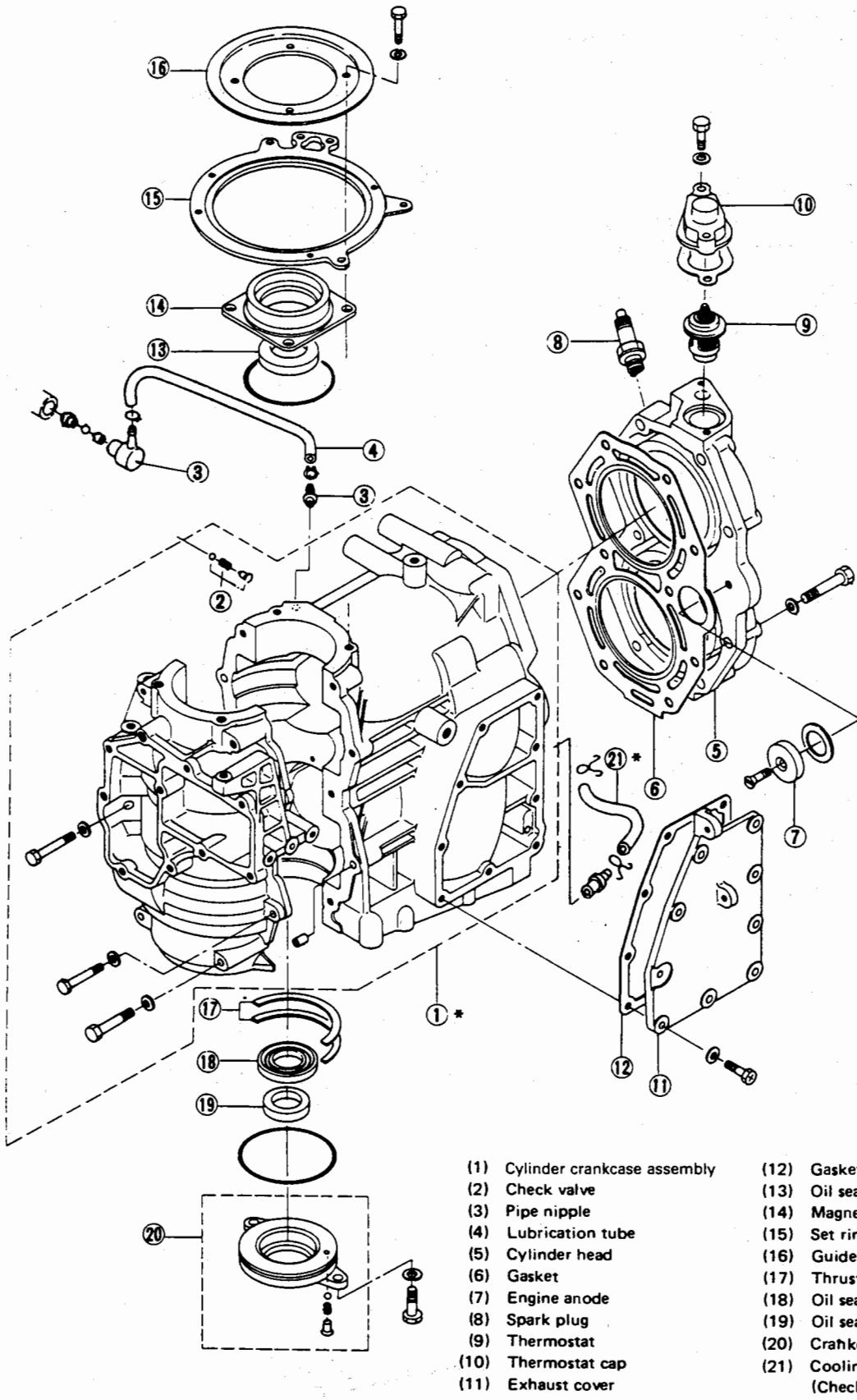
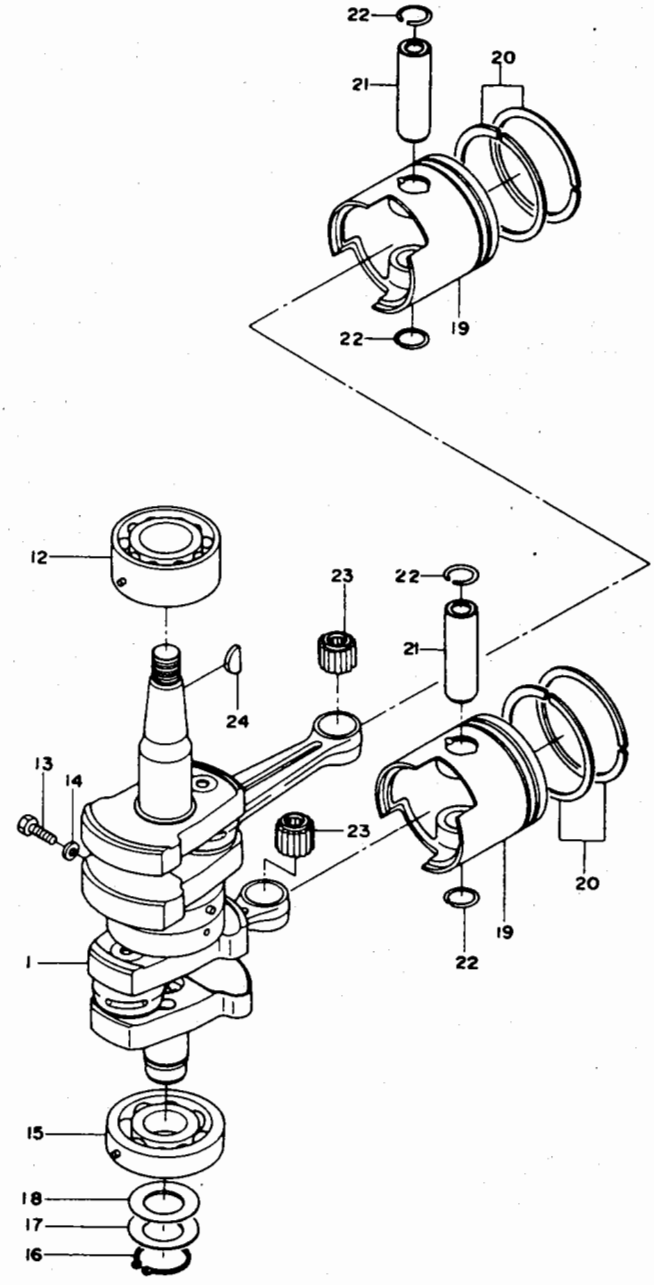


Fig. 37 Crankshaft and piston



(1) Cylinder crankcase assembly
(2) Check valve
(3) Pipe nipple
(4) Lubrication tube
(5) Cylinder head
(6) Gasket
(7) Engine anode
(8) Spark plug
(9) Thermostat
(10) Thermostat cap
(11) Exhaust cover
(12) Gasket
(13) Oil seal upper, crankshaft
(14) Magneto base
(15) Set ring
(16) Guide plate
(17) Thrust plate,crankshaft
(18) Oil seal lower
(19) Oil seal, drive shaft
(20) Crankcase head
(21) Cooling water pipe (Checking port)

Fig. 38 Cylinder crankcase assembly



(1)	Crankshaft assembly	(9)	Knock	(17)	Spacer
(2)	Crankshaft A	(10)	Connecting rod	(18)	Adjust shim
(3)	Crankshaft B	(11)	Big end bearing	(19)	Piston
(4)	Crankshaft C	(12)	Upper main bearing	(20)	Piston ring
(5)	Crankshaft D	(13)	Bolt	(21)	Piston pin
(6)	Crank pin	(14)	Spring washer	(22)	Clip
(7)	Center main bearing	(15)	Lower main bearing	(23)	Small end bearing
(8)	Labyrinth packing	(16)	Clip	(24)	Magneto key

Fig. 39 Piston, crankshaft

10. Inspection of parts

Refer to service data for correction and exchange standard

Part name	Inspection item	Action to be taken
Cylinder head	1) Adhesion of carbon on the inner wall of the combustion chamber	1) Remove by cleaning
	2) Distortion of the installation face	2) Apply No. 200 and above sand paper which is put on the surface plate.
	3) Corrosion of the abutting face of cylinder head	3) Correct or replace as required.
	4) Choke of the cooling water passage	4) Remove by cleaning
Cylinder	1) Adhesion of carbon around the exhaust port	1) Remove by cleaning.
	2) Deposit in the water jacket	2) Remove by cleaning.
	3) Extent of abrasion of the bore Measure the bore and gap against the piston with a cylinder gauge. (Fig. 40)	3) If above the limit exchange or carry out boring and finish with honing. • An over-sized piston is 0.5mm.
	4) Seizure	4) Use the over-sized piston after replacement or boring.
	5) Scar on the inner surface of cylinder	5) Correct if required. (No. 400 to 600 sand paper).
Piston	1) Adhesion of carbon on the piston head and ring groove	1) Remove by cleaning.
	2) Scar on the sliding surface	2) Correct if required. (No. 400 to 600 sand paper).
	3) Measurement of the gap between piston ring and ring groove (Fig. 41)	3) Replace if above the limit.
	4) Measurement of the bore diameter of the piston pin	4) Replace if above the limit.
	5) Outer diameter 17mm above the piston skirt (in the direction of exhaust arrow.) (Fig. 42)	5) Replace if above the limit.
Piston ring	1) Measurement of gap between piston ring ends (Fig. 43) In case the ring gauge is not available, carry out the measurement at the lower part of the cylinder bore where abrasion is relatively small.	1) Replace if above the limit.
	2) Measurement of width and thickness	2) Replace if above the limit.
Crankshaft	1) Deflection of the crankshaft (Main bearings at the both end of the crankshaft shall be supported by V blocks.)	1) Correct or replace if above the limit. Refer to Figs. 44, 45.
	2) Falling down of the connection rod	2) Replace if above the limit. Refer to Fig. 46.
	3) Side gap on the big end	3) Replace if above the limit.
Reed valve	1) Height of the valve stopper	1) Correct. Fig. 47.
	2) Cracks and breakage of the reed valve	2) Replace.
	3) Distortion of the valve seat surface	3) Replace.
Check valve	1) Operation	1) Replace with new ass'y if defective.
Thermostat	1. Opening and closing of the thermostat	1. Replace if required after testing.
	2. Wear or distortion of the spring	2. Replace.
Anode	1) Anode on the engine side	1) Replace when heavily abraded.
	2) Gearcase anode	

Opening and closing test for thermostat

1. Replace if the valve is opened, even slightly, at room temperature.
2. To check the valve opening temperature, immerse the thermostat into the water and raise the water temperature gradually.
3. To measure the valve opening lift degree, keep the temperature at approx. 65°C for 5 minutes, taking the delay in thermostat operation into consideration. (For the standard velue refer to the Service Data.)

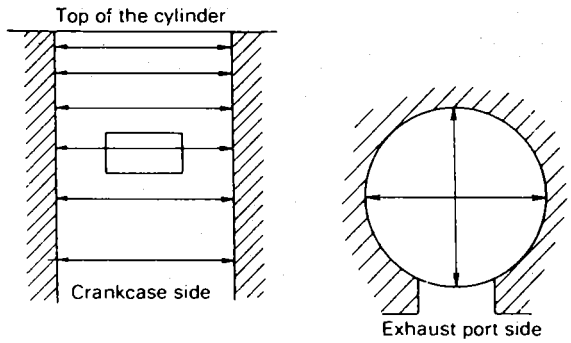


Fig. 40 Measuring point and direction of the cylinder bore

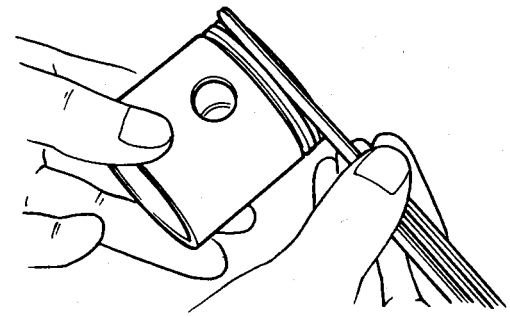


Fig. 41 Measuring the piston ring groove

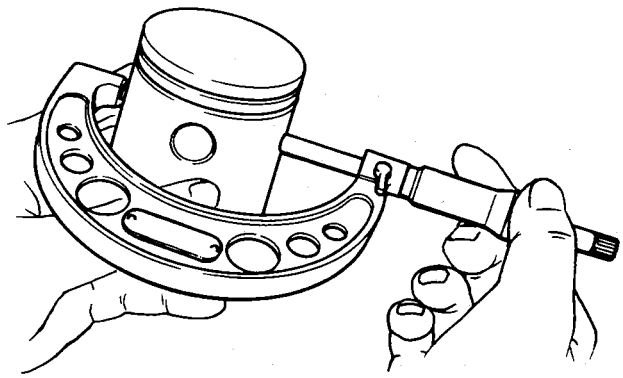


Fig. 42 Measuring the piston diameter

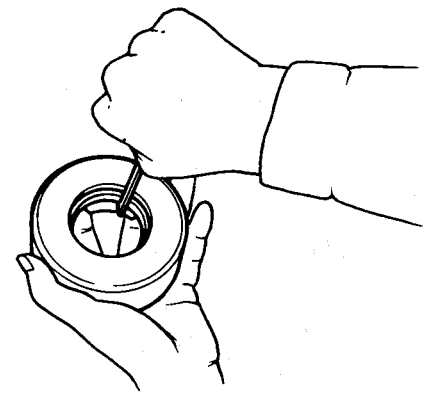


Fig. 43 Measuring the gap between the piston ring ends

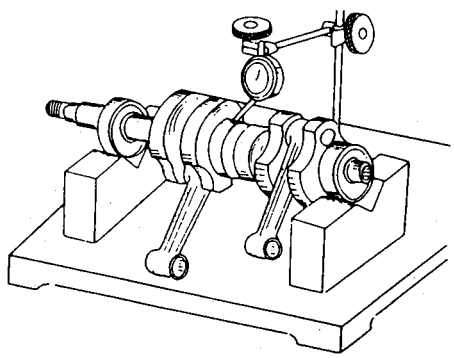


Fig. 44 Measuring the crankshaft deflection

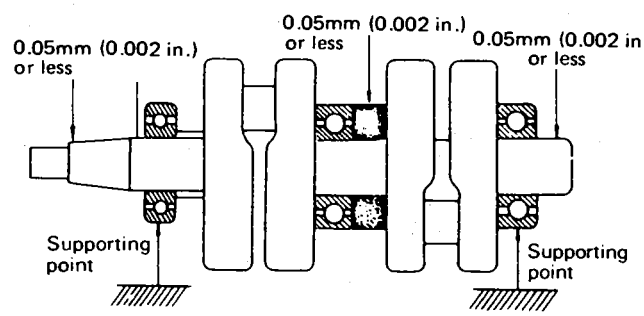


Fig. 45 Crankshaft deflection measuring points

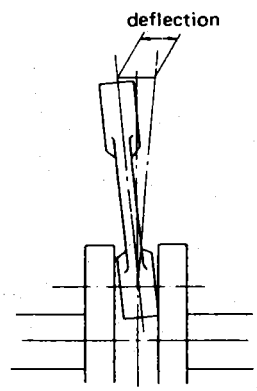


Fig. 46 Deflection of the connecting rod

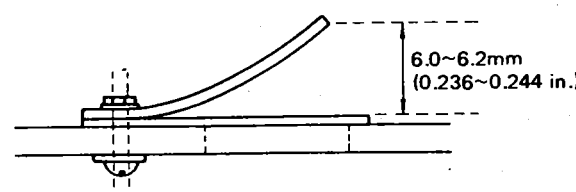


Fig. 47 Measuring the lift of the reed valve

11. Assembling engine

Assemble in the reverse order of stripping taking note of the following matters.

- Carry out safety measures by referring to paragraph 1 "General Precautions".
- Carry out inspections by referring to paragraph 2 "Service Data".
- Be sure to carry out sealing, bonding and lubrication by referring to paragraph 4 "Sealing, bonding and lubrication points".

(1) Installing piston

1) Install the small end bearing in the small end of the connecting rod. Tap the piston pin lightly into the piston, match with the rod, apply the piston pin tool (special stripping tool) and further tap lightly to insert it.
   (Note) Install the piston so that the crown mark ↑ points to the exhaust port side. (Fig. 48)

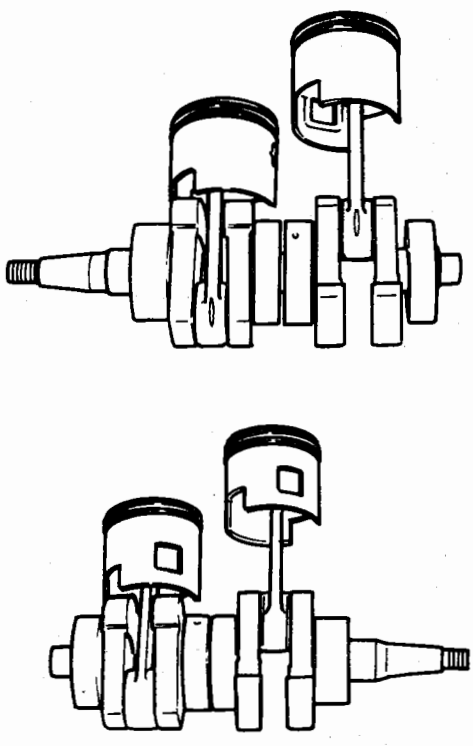


Fig. 48 Installing the piston

2) Insert the piston pin clip sufficiently into the piston pin hole groove which is in position.
   (Note) When reassembling be sure to use new piston pin clip.
3) Install the piston ring into the piston by setting it to the detent knock position on the piston.

(2) Crankshaft

1) The lower main bearing shall be positioned so that the side with knock is in the position as shown in the diagram right. (Fig. 27)
2) To press the lower main bearing into the crankshaft, push the inner race.
3) Be sure to apply oil to the sliding and rotating parts and grease to the labyrinth packing.

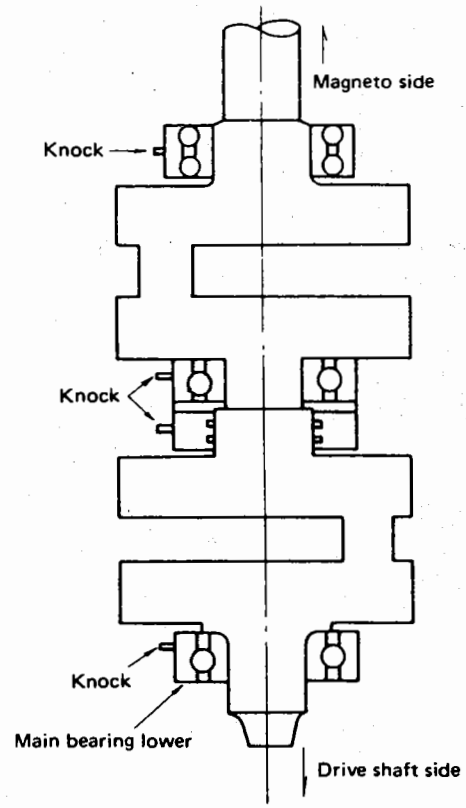


Fig. 49

(3) Installing the crankshaft assembly in the cylinder block

1) Be sure to insert the outer thrust plate correctly into the groove (on the drive shaft side) of the cylinder block. However, insert the inner one after having installed the crankshaft in the cylinder block. (Photo 23)

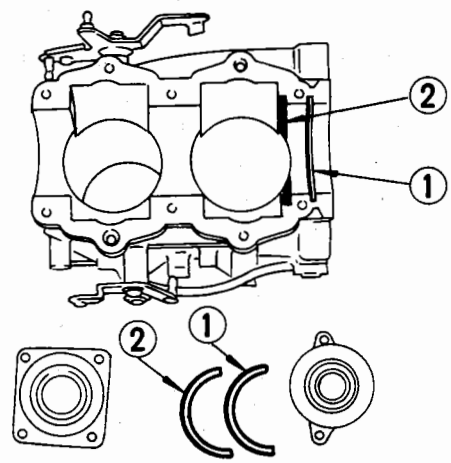


Fig. 50 Installing the thrust plate
(1) Outside
(2) Inside

2) Take care that the labyrinth knock and main bearing knock come into the specified hole or notch in the cylinder block.
3) When matching the matching surface of the cylinder and crankcase be sure to degrease and apply a sealing agent after confirming that there is no adhesion of foreign materials, burrs and deposits.
4) Use the screw locking adhesive (Three Bond 1322) for the labyrinth screw.
5) Use 2 types of crankcase installing bolts (H845-8 H840-2) and tighten to the specified torque at the correct positions. (Fig. 51)

Tightening torque 24 to 25N·m (2.4 to 2.6kg-m, 17 to 19 ft-lb)

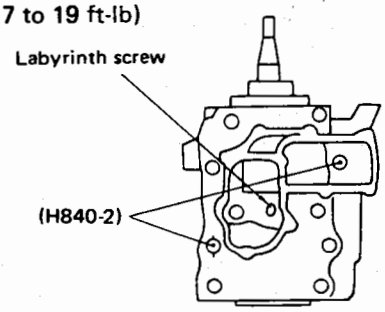


Fig. 51 Installing the crankcase installing bolt

(4) Assembling the crankcase head and magneto base

1) Fit the crankshaft upper oil seal to the magneto base, and the crankshaft lower oil seal and drive shaft oil seal to the crankcase head.
   - In the case of the crankshaft upper and lower oil seal, their lips should face this side against the fitting direction and in the case of drive shaft oil seal, its lip should face the other side.
   - When fitting, push the outer ring containing ring reinforcement in order not to damage the lip portion.
   - When fitted confirm that it does not fall.
   - Pack the lip portion with grease.
2) Insert the "O" ring into the crankcase head and magneto base, and apply recommended engine oil to it.

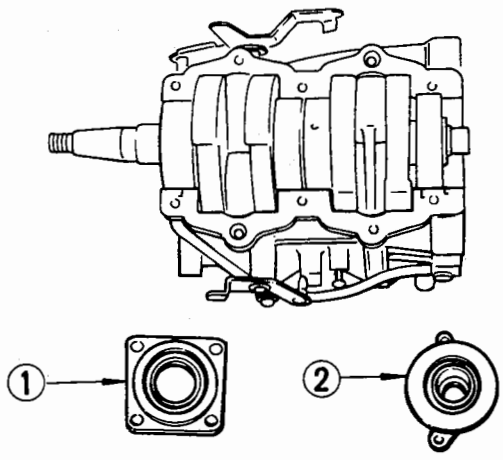


Fig. 52 Installing the magneto base and crankcase head

3) Install the crankcase head and magneto base in the cylinder and crankcase. (Fig. 52)
   - Take care that the crankshaft does not damage the oil seal lip.
   - The magneto base is tightened together with the guide plate. Do not fail to place the set ring.
4) Install the starter bracket. Apply a thread locking adhesive (Three Bond 1303B) to the tightening bolt and tighten it to the specified torque 24 to 25N·m (2.4 to 2.6kg-m, 17 to 19 ft-lb).

(5) Installing the cylinder head

1) The head of the tightening bolt is provided with "T" mark. Do not mix with the crankcase installing bolt.
2) Install together with the engine anode and rubber packing.
3) When tightening the cylinder head bolts carry out in the order as shown in the diagrams A or B with them divided into a few groups. (Fig. 53)
4) Carry out tightening after running in. Tightening torque 32 to 37N·m (3.3 to 3.8kg-m, 24 to 27 ft-lb).

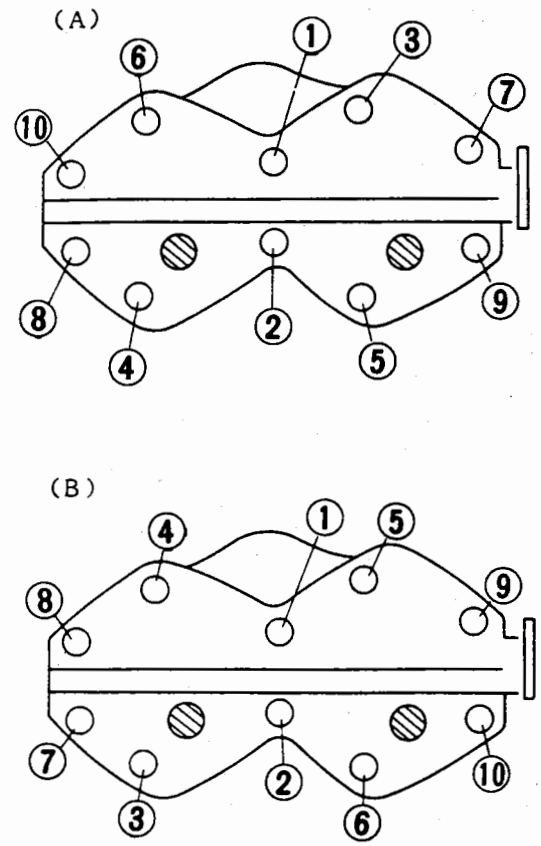


Fig. 53

(6) Reed valve seat

1) Check the reed valve and the lift (height of the tip of the reed valve stopper) for normality. Replace with new assembly if damaged or deformed.
2) Apply the thread locking adhesive to the valve seat installing screw ((+) 616-1) (Only one for the center), temporarily tighten and tighten with a screwdriver inserted into the hole of the carburetor installing flange after tightening the inlet manifold. (Fig. 54)

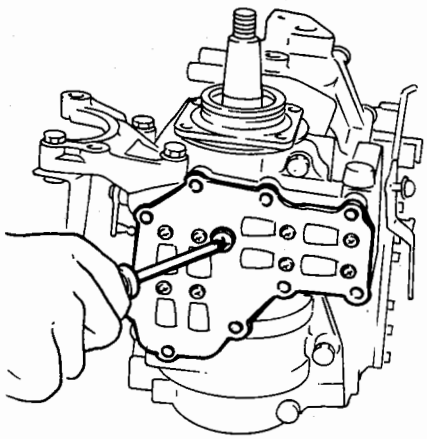


Fig. 54 Installing the reed valve assembly

(7) Installing the magneto

1) Install the coil plate assembly in the crankcase and install set ring with the guide plate inserted between them.
   - Apply grease to the sliding surface of the coil plate and set ring.
   - When the coil plate is operated after being mounted, the movement should be smooth.
2) Fix the magneto lead wire to the set ring by using the magneto cord clamp B.
3) When installing the flywheel cup, be sure to degrease the tapered portion of the crankshaft.
4) Tighten the magneto nut to the specified torque by (12 to 14kg-m) using the special tool.

(8) Wiring

1) Carry out wiring correctly by using clamps referring to the wiring circuit diagram.
2) Forcible bending and contact to the other parts should be avoided since these result in breakage or disconnection.
3) Make sure that all the connectors are taped (over 2.5 turns) and securely supported with connector holders.
4) Also make sure that the connector lead taking out portion is correctly sealed as specified.

(9) Fuel pipe and lubrication tube

1) Be sure to insert the nipple fully and clamp correctly (clip).
2) Avoid any forcible installation, bending or contact to other parts.

(10) Fuel filter

1) Confirm that there is neither water nor dust blockage.
   (Note) The plate washer is inserted in both above and below the installed part (inlet manifold).

(11) Air silencer

1) Be sure to apply a thread locking agent to the screw before installing this in the carburetor (Do not fail to install the air silencer gasket and make sure not to reverse its correct position.

(12) Throttle mechanism

1) Apply a thread locking adhesive to the ball joint B and tighten to the specified torque.
2) Apply a thread locking adhesive to the throttle cam installing screw (⊕616-1).
3) Apply grease to the sliding portion of the throttle cam advancer arm and apply oil to the ball joint portion.
4) Carry out adjustment in the following order. (Be sure to do this after the adjustment of the handle assembly has been completed.)
   a) Turn the handle grip to set to that the collar center of the carburetor throttle lever is on the "S" marking line.
   In this case adjust the length of the handle link rod so that the START match mark (⊔) of the handle grip comes to the embossed letter "START" position of the handle and fix by means of the ball joint installing nut. (R = Specified opening position for reversing) (Fig. 55)

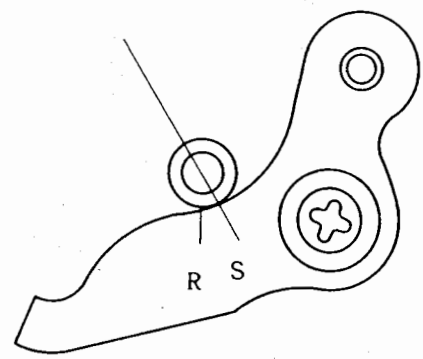
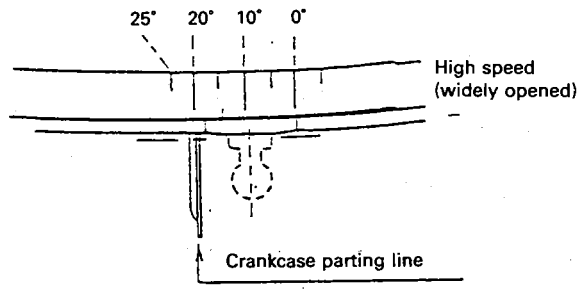


Fig. 55 Adjusting the throttle cam

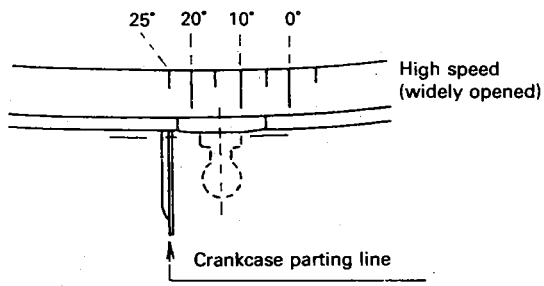
b) Ignition timing at carburetor throttle valve fully opened is:
$M25C_2$: BTDC 20°
$M30A_3$: BTDC 25°
Iginition timing at carburetor throttle valve fully closed is:
$M25C_2$: ATDC 2°
$M30A_3$: ATDC 2°

(Note)
With triangle mark on the coil plate shows that ignition timing is at Top Dead Center.
After adjusting ignition timing, adjust the advancer arm stoppers for min. and max. advanced sides.

Throttle fully opened
$M25C_2$: BTDC 20°



$M30A_3$: BTDC 25°



Throttle fully closed
$M25C_2$: ATDC 2°
$M30A_3$: ATDC 2°

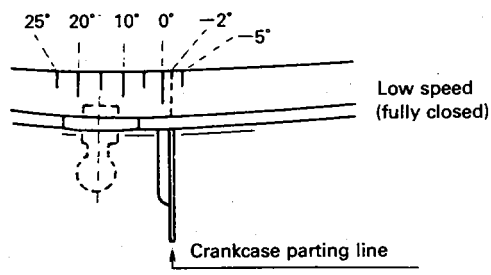
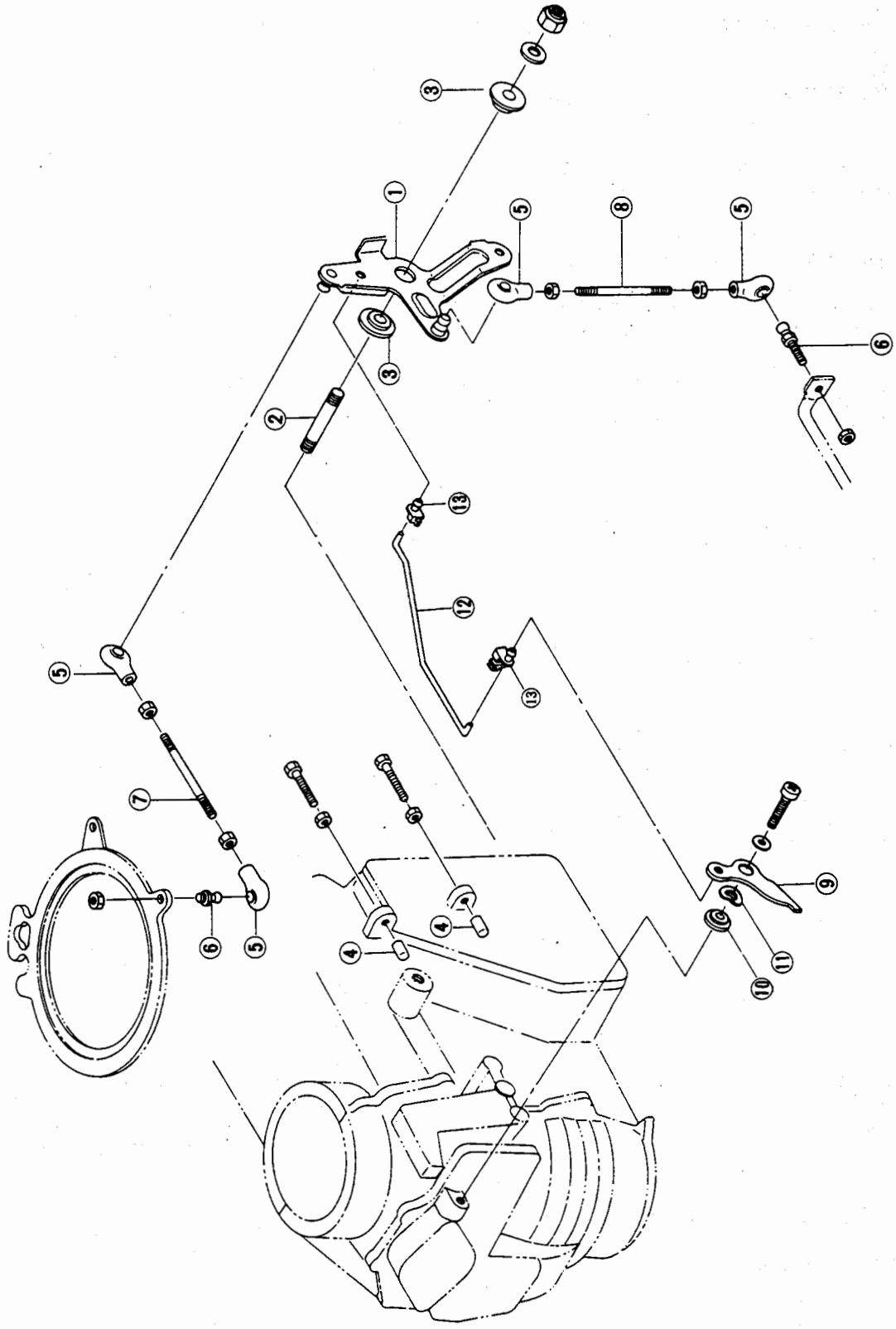
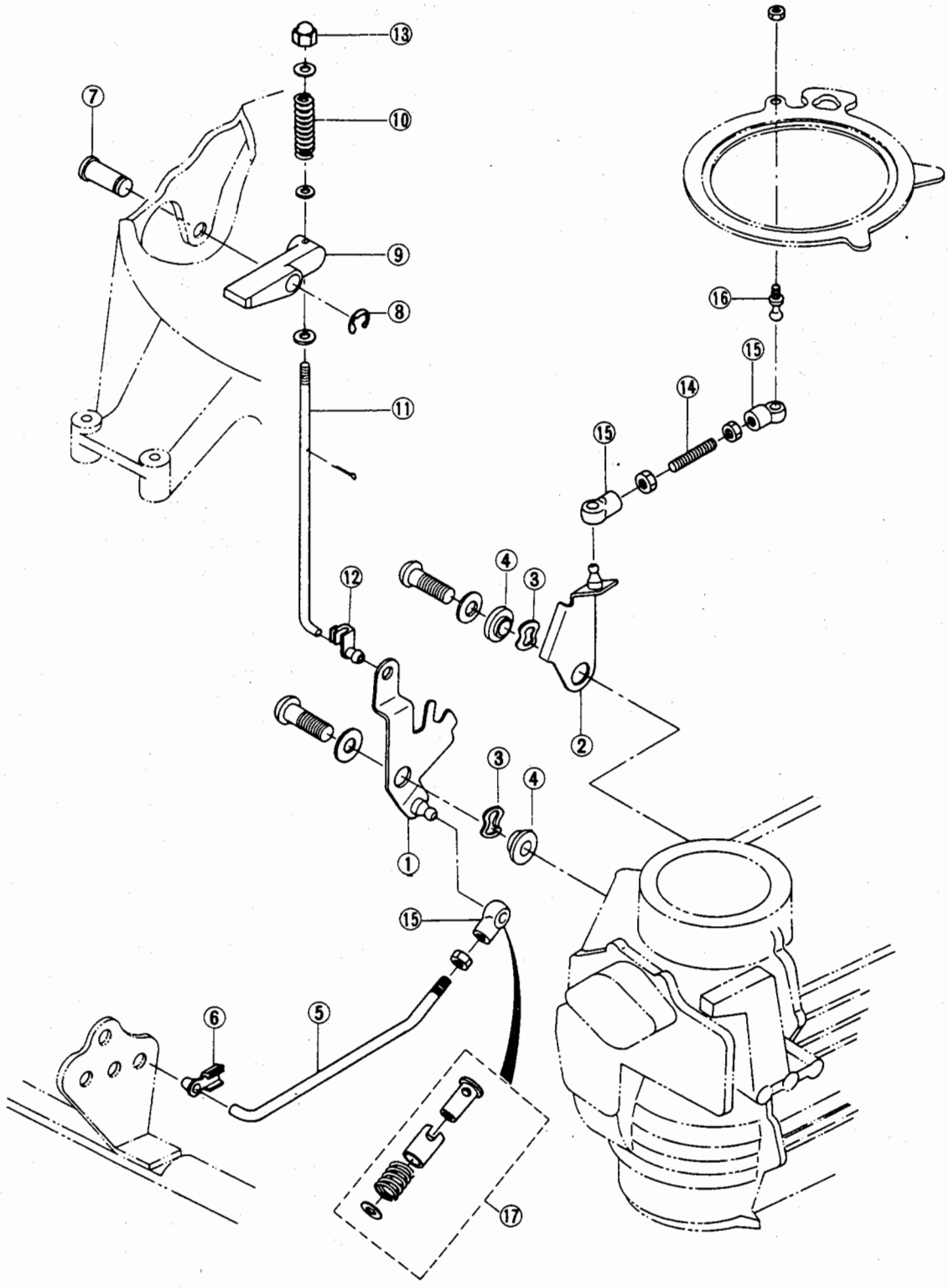


Fig. 56 Magneto coil plate ignition timing match mark



(1) Advancer arm
(2) Stud bolt
(3) Bush, advancer arm
(4) Cap, advancer arm stopper
(5) Cap, ball joint
(6) Ball joint B
(7) Advancer link rod
(8) Handle link rod
(9) Throttle cam
(10) Bush, throttle cam
(11) Wave washer
(12) Throttle link rod
(13) Snap, throttle link rod

Fig. 57 Magneto advancer mechanism



(1) Lock arm, starter
(2) Stop arm, throttle
(3) Wave washer
(4) Bush, starter lock arm
(5) Rod, starter lock arm
(6) Snap, starter lock arm rod
(7) Shaft, starter lock lever
(8) E ring, starter lock lever shaft
(9) Lever, starter lock
(10) Spring, starter lock
(11) Rod, starter lock
(12) Snap, starter lock rod
(13) Cap, starter lock lever
(14) Rod, throttle stop arm
(15) Cap, ball joint
(16) Ball joint B
(17) Ball joint cap (Temporary)

Fig. 58 Starter lock mechanism

12. Disassembling gear case

(Bevel gear, clutch and water pump mechanism)

(1) Removing the gear case

This can be carried out without removing the power unit.

1) Pull out the upper spring pin of the shift rod joint using the special tool. (Fig. 59)

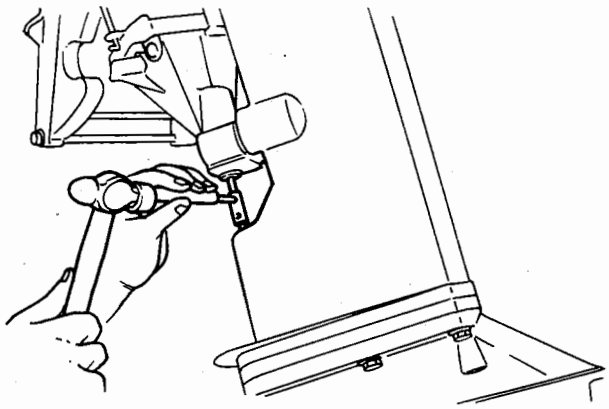


Fig. 59 Removing the spring pin

2) Remove the gear case bolt A ((+) H835-1) and pull out the gear case downwards.

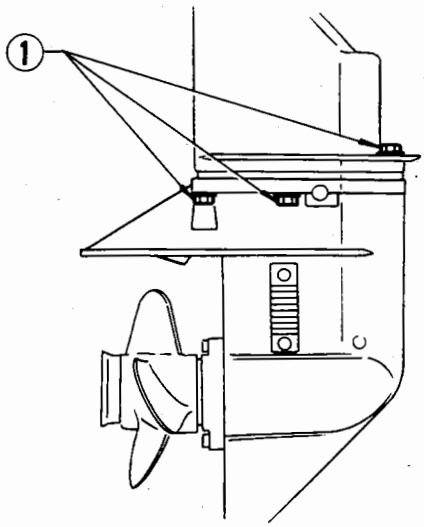


Fig. 60 Removing the gear case ($M25C_2$, $M30A_3$)
(1) Gear case installing bolts

(2) Water pump case

1) Remove the water pump case installing bolts (H652-4). (Fig. 62)
2) Pull out the water pump case upwards.
3) Pull out the pump impeller upwards.
4) Remove the pump impeller.
5) Pull out the lower pump case.
   - Since the pump case oil seal and "O" ring are installed handle carefully.

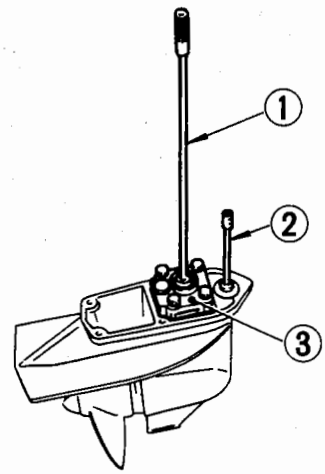


Fig. 61 Gear case assembly
(1) Drive shaft (3) Water pump case
(2) Shift rod

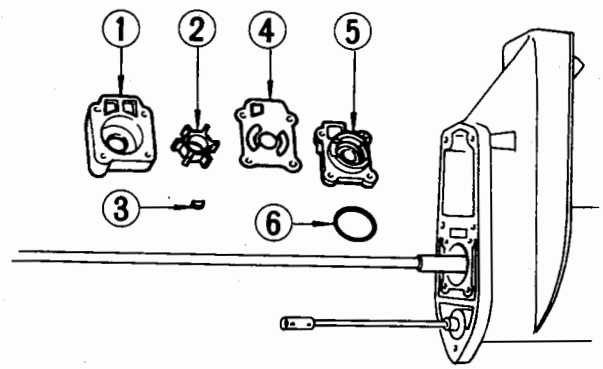


Fig. 62 Water pump component parts

(1) Water upper pump case	(4) Guide plate
(2) Pump impeller	(5) Water lower pump case
(3) Key	(6) "O" ring

- Be sure to drain the gear oil in advance, since it runs out when pulling out the lower pump case with the gear case held sidewise.
- Sub-water strainer

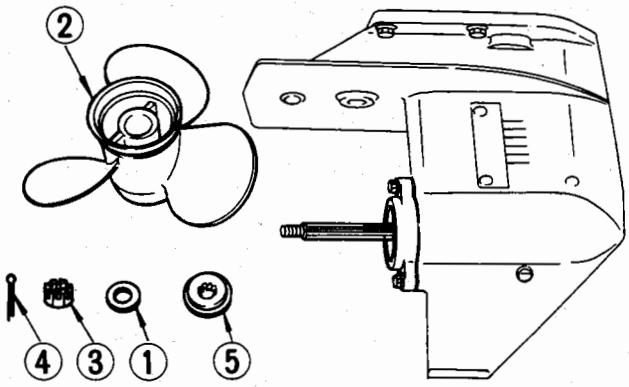


Fig. 65 Removing the propeller

1) Propeller washer 3) Nut 5) Thrust holder
2) Propeller 4) Split pin

(Note) In case the circumference of the shear pin hole of the propeller shaft is raised, the oil seal can be damaged when removing the propeller shaft housing. So be sure to correct.

(4) Propeller shaft and clutch

1) Remove the oil plugs positioned both above and below the gear case in order to drain the gear oil.
2) Remove the propeller shaft housing mounting bolts (H825-2).
   (The bevel gear C is installed in the housing side.)
3) Pull out the propeller shaft.
   (The clutch, clutch spring and clutch push rod are installed in this order.) (Figs. 66, 67)
4) Remove the clutch snap pin and push the rod gently in order to pull out the clutch pin by using the tool spring pin (special tool).
5) Remove the clutch push rod and clutch spring from the propeller shaft.
   ●When the clutch is pulled out, the push rod and clutch spring will jump out. Take note of this.

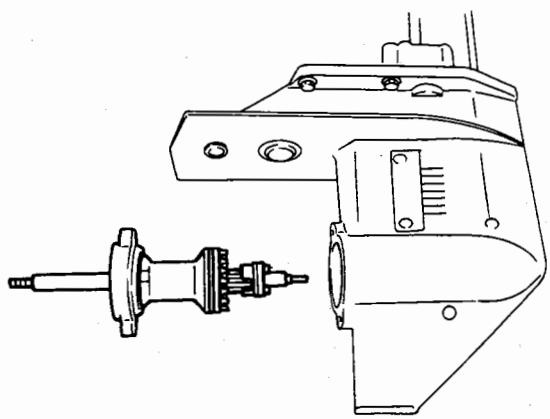


Fig. 67 Removing the propeller shaft

(5) Clutch cam and cam rod

1) Remove the cam rod bush stopper on the side of gear case.
2) Pull out upwards holding the shift rod joint portion.

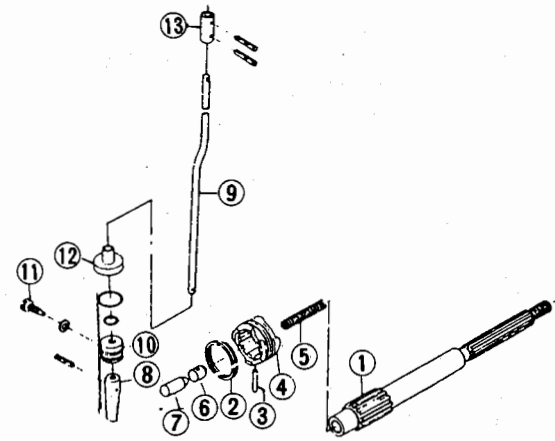


Fig. 68 Clutch component parts

(1) Properller shaft
(2) Clutch snap pin
(3) Clutch pin
(4) Clutch
(5) Clutch spring
(6) Push rod
(7) Clutch spring holder
(8) Cam
(9) Shift rod
(10) Cam rod bush
(11) Stopper
(12) Holder
(13) Joint

(6) Bevel gear and drive shaft

1) Insert the socket bevel gear B nut (special tool) into the spline portion on the engine side of the drive shaft and apply the wrench bevel gear B nut (special tool) to the bevel gear B nut inside the gear case. (Figs. 69, 70)

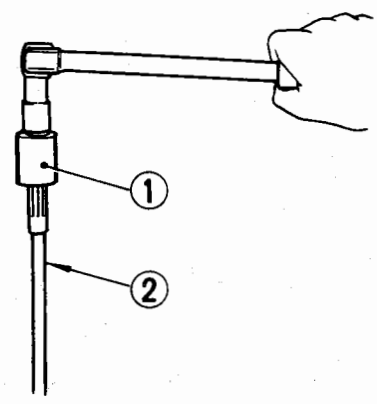


Fig. 69 Removing the bevel gear B

(1) Bevel gear B nut socket (special tool)
(2) Drive shaft

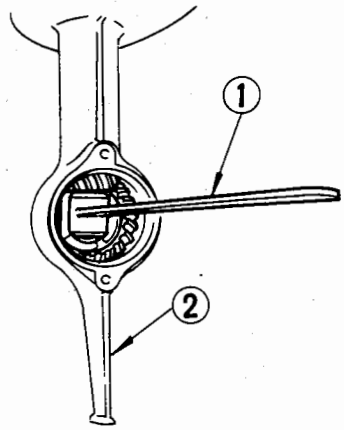


Fig. 70 Removing the bevel gear B

(1) Bevel gear B nut wrench (special tool)
(2) Gear case

2) Loosen the bevel gear B nut socket by means of a box wrench (nominal size 24) and remove the bevel gear B nut.
3) Remove the bevel gear B.
4) Tap lightly on the gear case flange face with a plastic hammer while holding the drive shaft, in order to pull out the drive shaft.
5) Tilt the gear case over in order to take out the bevel gear A.
6) When removing the bevel gear A outer bearing, be sure to use the puller for the bevel gear A outer bearing (special tool).
7) Remove the bevel gear C from the propeller shaft housing. (Figs. 71, 72)

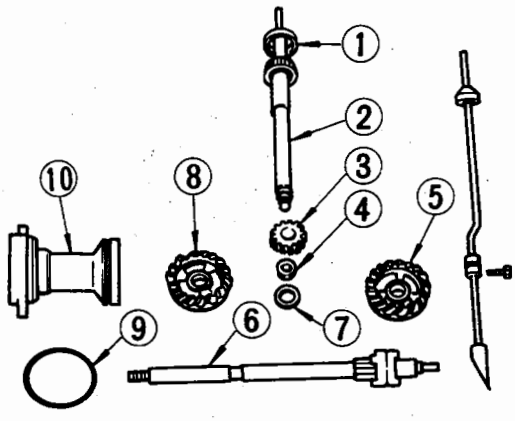


Fig. 72 Bevel gear component parts

Check item		
Bevel gears A, B, C and clutch	• Abrasion of the tips of the bevel gears A and C	Replace.
	• Abrasion of the tip of the clutch	Replace.
	• Rub of the teeth of the bevel gears A, B and C	Replace if required.
	• Abrasion of the bearing for bevel gears A and C	Replace if required.
Propeller shaft	• Clearance of clutch interfacing surface	Replace if required.
Drive shaft	• Drive shaft deflection	Correct or replace.
	• Spline abrasion	Replace if required.
Water pump	• Damage to the pump impeller	Replace.
	• Abrasion and distortion of the pump case liner	Replace.

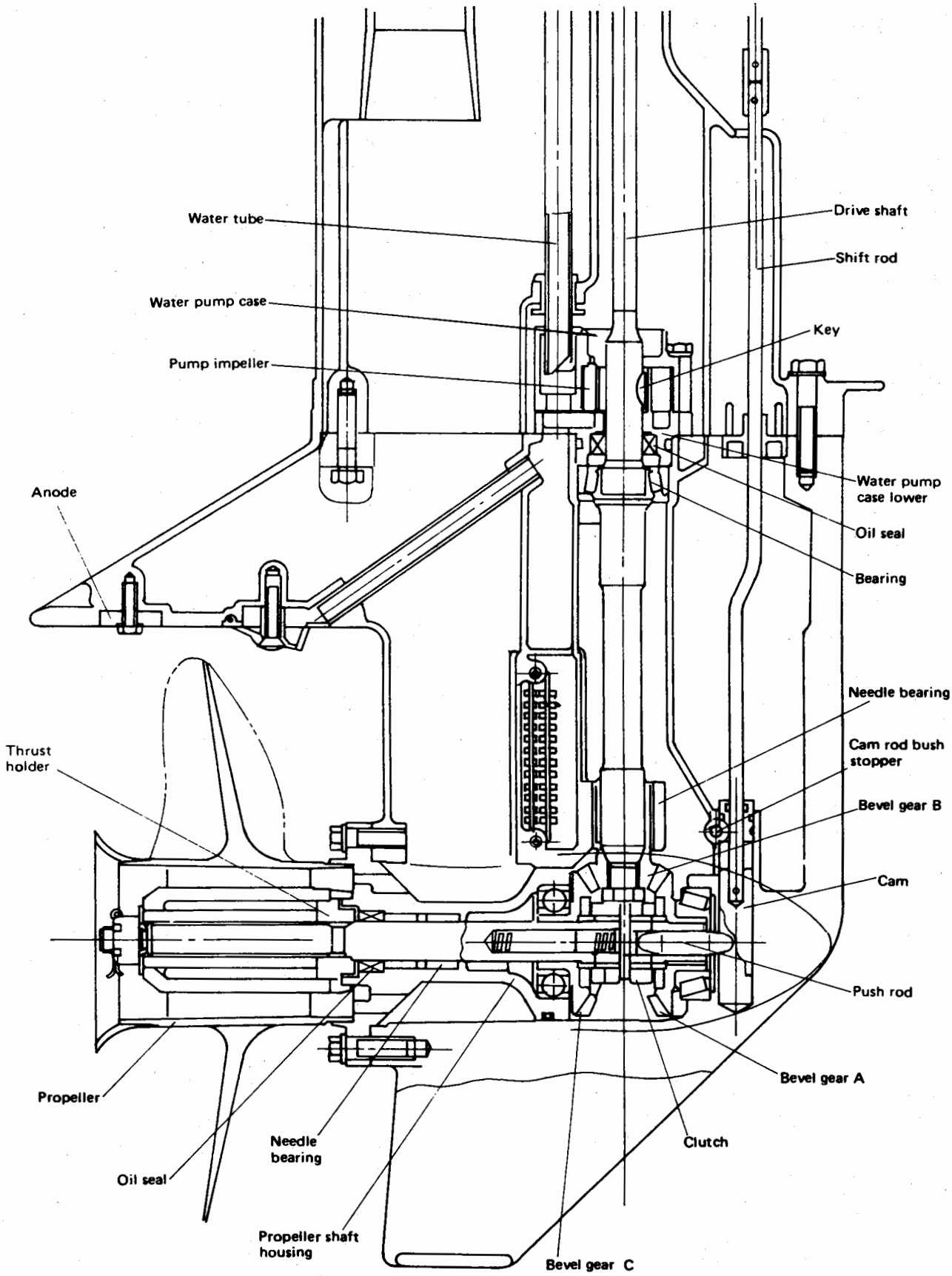


Fig. 74 Assembly drawing of gear case

13. Assembling gear case

Assemble in the reverse order of stripping taking note of the following matters.

(1) Bevel gear

1) When fittiing the bevel gear A inner bearing be sure not to push the retainer of the roller.
2) Make sure that the backlash of the bevel gears A and B is measured by means of the tool backlash measuring (special tool). (Fig. 75)

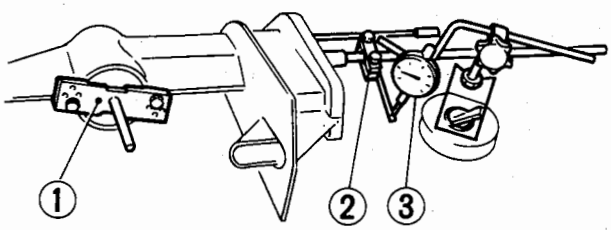


Fig. 75 Measuring the backlash

(1) Backlash tool plate (special tool)
(2) Clamp (special tool) (3) Dial gauge

Nominal value of backlash: 0.33mm to 0.54mm (0.013 in. to 0.021 in.)
Insert adjust shim between the lower pump case and drive shaft bearing B as required.

3) Apply a screw locking adhesive to the bevel gear B installing nut after fully degreasing its threaded portion (including the drive shaft threaded portion) and tighten to the specified torque.
   ●Be sure to use special tools when stripping and assembling.
4) Fit the needle bearings (ϕ20mmxϕ27mmx30mm (ϕ0.787 in. x ϕ1.06 in. x 1.18 in.) for the drive shaft into the gear case using the special tool or the equivalent.
   Gear oil: Approx. 250 cc (1/2 US pt, 1/2 Imp pt) (Be sure to use recommended gear oil).

(2) Clutch

1) Install the clutch and propeller shaft and confirm that they operate normally. The play must be minimized and the movement smooth.
2) The clutch pin must not be bent.
3) Pay due attention to the direction of the clutch. (Fig. 76) Take care that the side having a shallow groove is on the forward side. (Bevel gear A).

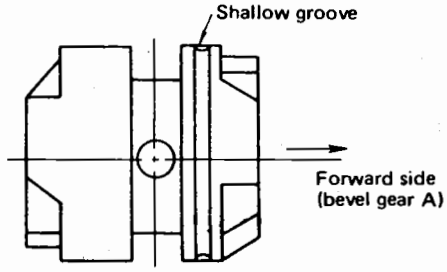


Fig. 76 Clutch

4) Install the clutch pin snap in the groove. Be sure to use a special tool for installing. Use new parts when reassembling.
5) Fit the spring pin to connect the clutch cam with the clutch cam rod so as not to project from the circumference of the clutch cam, using special tool.
6) Apply oil to the "O" ring portions both inside and outside the cam rod bush.
7) Make sure that the cam rod bush stopper is correctly fitted to the cam rod bush.
8) Be sure that the clutch cam smoothly operates both upwards and downwards when installed and operated.
9) Apply grease to the sliding surface of the cam rod holder.
10) Use new spring pins for the shift rod joint and expand the both ends after installation.

(3) Propeller shaft housing

1) When fitting the needle bearing for propeller shaft bearing, be sure to use a special tool in order not to damage either the cage or the roller.
2) When fitting the propeller shaft oil seal be sure to push the outer ring so as not to damage the lip.
3) When fitting the bevel gear C bearing be sure not to apply force to the inner but to the outer gear.
4) Apply grease to the propeller shaft oil seal lip portion.
5) Apply oil to the propeller shaft housing "O" ring portion and the pilot portion.
6) Apply grease to the propeller shaft housing mounting bolt.
7) Be sure to fit the oil seal protector.

(4) Water pump

1) Fit the water strainer to the gear case with the joint facing other side and be sure to apply a bonding agent to the water strainer plug before fitting.
2) When fitting the pump case oil seal to the lower pump case, be sure to apply pressure to the outer ring in order not to damage the lip.
3) Apply grease to the oil seal lip.
4) Install the pump impeller correctly in the keyway.
5) When installing the pump case liner in the case, be sure to fit the covex correctly.
6) Take care that the pump impeller turns in the same direction as the drive shaft (clockwise when viewed from the magneto side.) Never allow it to turn in the opposite direction. (Take note of this when measuring the backlash of the gear).
7) When inserting the water tube, be sure to apply oil to the inner circumference of the lower water pipe seal rubber. Take care that the tube is correctly connected and not trapped.
8) When tightening the pump case mounting bolts, first tighten *2 bolts.
   (Note) Use bolts having a large diameter. (Fig. 77)

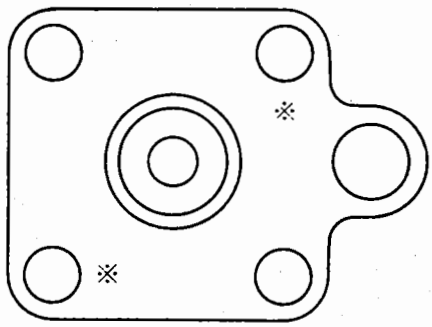


Fig. 77 Tightening the pump case

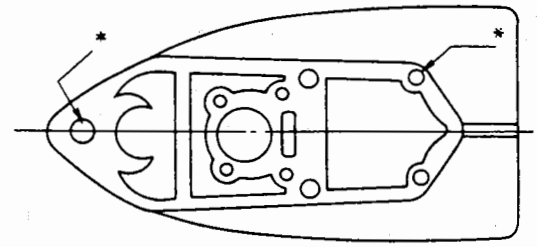


Fig. 78 Gear case

(5) Propeller

1) When installing the propeller shaft, be sure to apply grease to the inner circumference of the propeller rubber bush.
2) Make sure that the propeller washer is not deformed and that only genuine parts are used.

(6) Gear case assembly

1) When installing the drive shaft housing be sure to apply grease to the gear case mounting bolt.
First install * marked parts. (Fig. 78)

(7) Other precautions to be taken when assembling

1) Make sure that a drive shaft is fitted which has an outer diameter of 12.8mm (0.504 in.) at the torsion bar section.
2) The gear case capacities of $M25C_2$ and $M30A_3$ are 250cc (15.26 cu. in.).
Place the outboard motor in a vertical position and remove the upper and lower oil plugs. Pour oil in the lower hole until the oil appears at the upper plug hole.

(8) Standards for gear case and oil seal

Oil seal	Parts number	Standards
Propeller shaft oil seal	346-60111-0	18mm, 28mm, 8mm (0.71 in., 1.10 in., 0.31 in.)
Water pump case oil seal	346-65013-0	17mm, 30mm, 9mm (0.67 in., 1.18 in., 0.35 in.)

(9) Cooling water circulation system

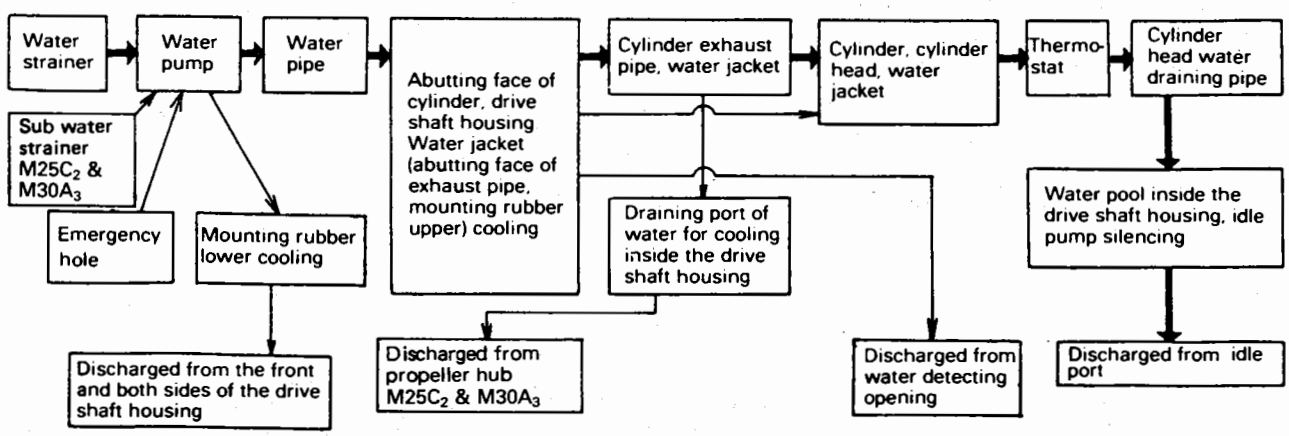
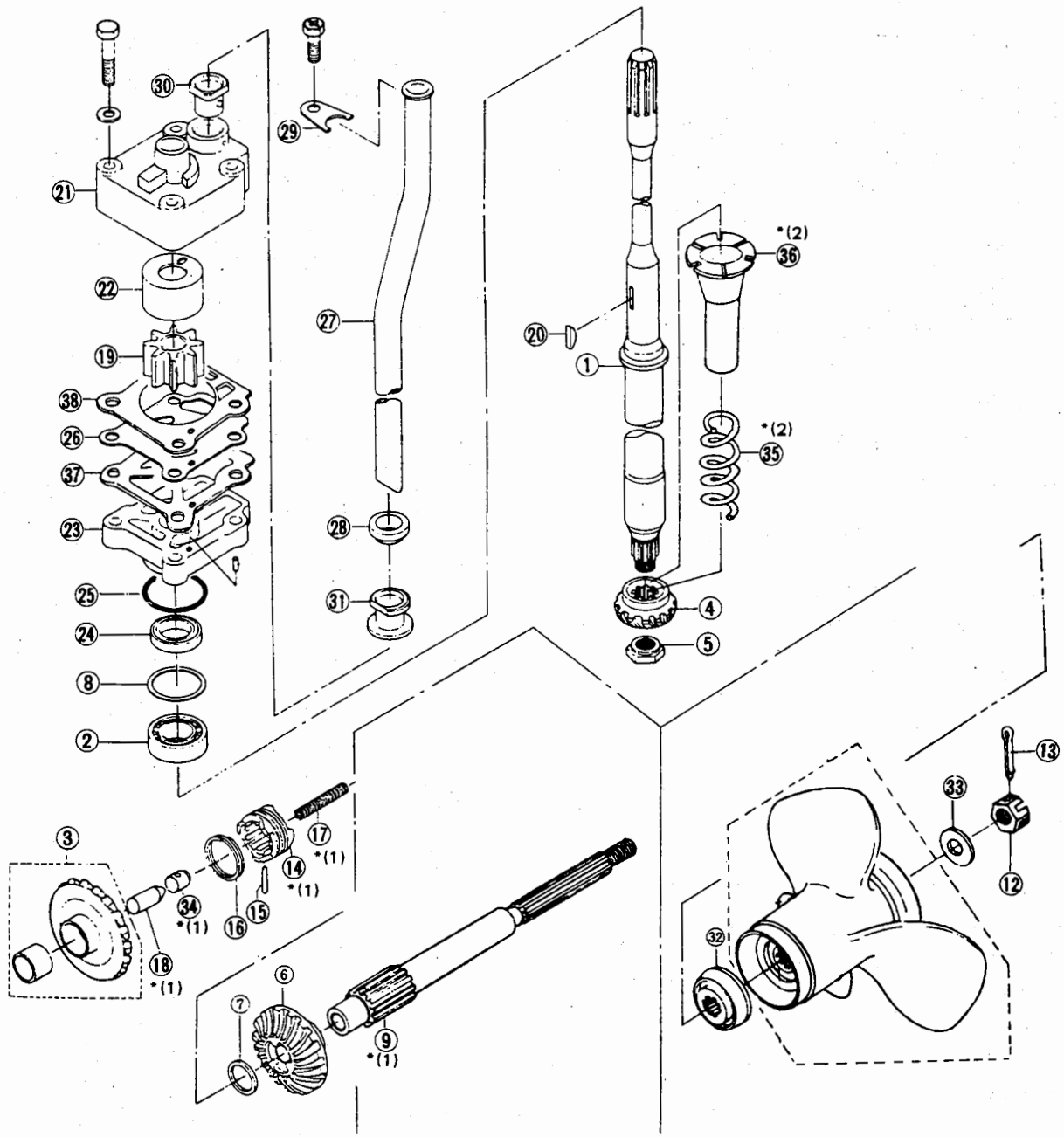
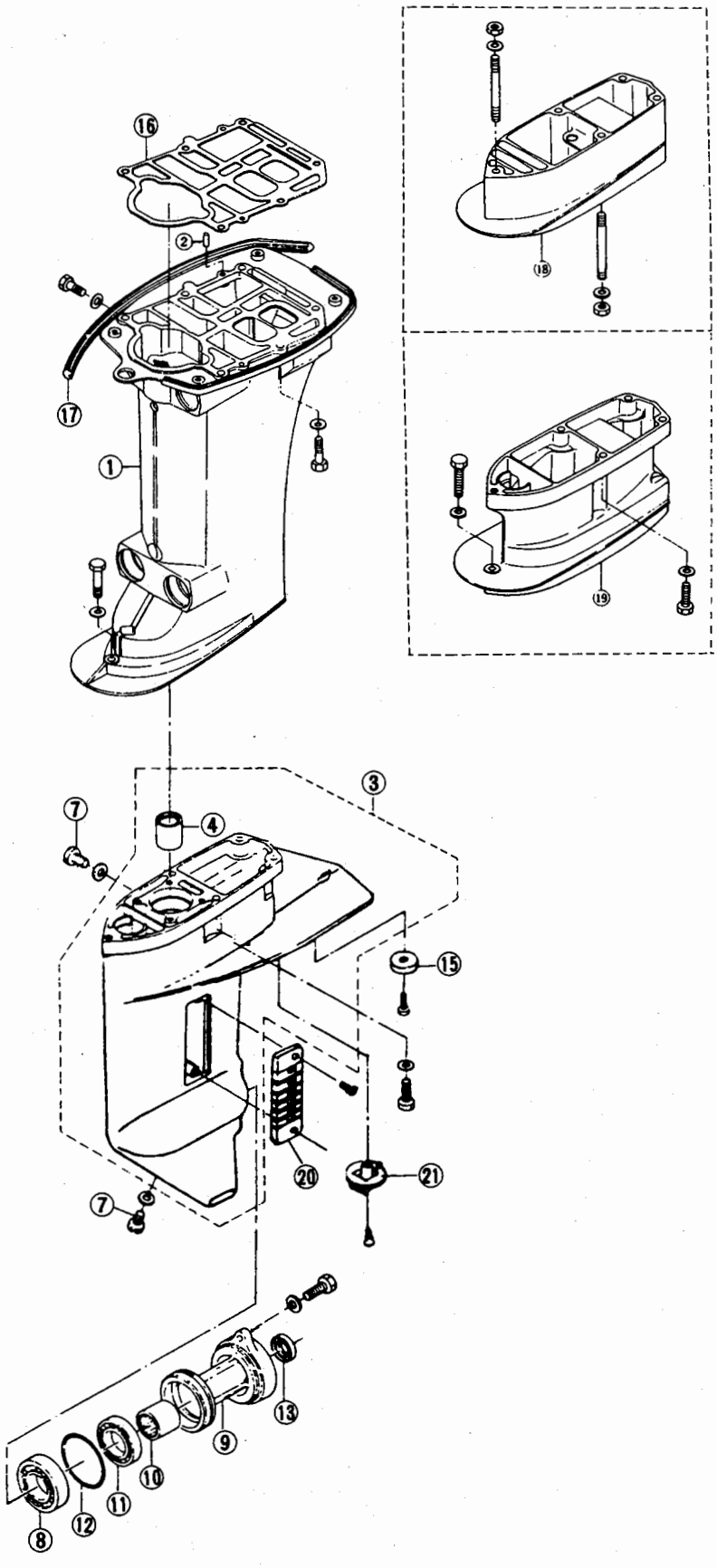


Fig. 79



1. Drive shaft
2. Ball bearing, drive shaft
3. Bevel gear A
4. Bevel gear B
5. Nut, bevel gear B
6. Bevel gear C
7. Washer
8. Shim, backlash adjust
9. Propeller shaft
10. Propeller
11. Shear pin
12. Propeller nut
13. Split pin
14. Clutch
15. Clutch pin
16. Snap, clutch pin
17. Clutch spring
18. Push rod, clutch
19. Impeller, water pump
20. Key, water pump impeller
21. Water pump case
22. Liner, water pump
23. Lower water pump case
24. Oil seal, water pump case
25. "O" ring, lower water pump case
26. Guide plate, water pump
27. Water pipe
28. Upper seal rubber, water pipe
29. Lock plate, water pipe
30. Lower seal rubber, water pipe
31. Lock rubber, water pipe
32. Propeller thrust holder
33. Propeller nut washer
34. Clutch spring holder
35. Drive shaft spring
36. Drive shaft pipe
37. Pump guide plate gasket
38. Pump case gasket

Fig. 80 Transmission and Water pump



1. Drive shaft housing
2. Engine knock
3. Gear case assembly
4. Needle bearing, gear case
5. Water strainer
6. Cover, water intake port
7. Oil plug
8. Bearing bevel gear A
9. Propeller shaft housing
10. Needle roller bearing housing
11. Ball bearing (#6205)
12. O ring
13. Oil seal, propeller shaft
14. Anode
15. Gasket, engine base
16. Seal rubber, lower motor cover
17. Extension housing (LL)
18. **Extension housing (XL)**
19. Water intake port cover
20. Sub water strainer

Fig. 81 Drive shaft housing and Gear case

14. Disassembling lower motor cover and drive shaft housing

(1) Lower motor cover

1) Remove the ball joint of the throttle shaft B.
2) Remove the throttle shaft supporter (both upper and lower).
3) Remove the lower motor cover mouting bolts (H630-4).
4) Raise the motor cover lower slightly, remove the shift rod from the shift rod lever and pull out the shift rod upwards.
5) To remove the lower motor cover pull out the throttle shaft B. (It can be removed without stripping the shift lever and its related parts.) (Figs. 82, 83)

(2) Drive shaft housing

1) Remove the nylon nuts (N10) from the mounting upper rubber and lower mounting rubber. (Fig. 84)
2) Pull out the shaft housing toward you.
3) Remove the water pipe lock plate so as to pull out the water pipe upwards.

(3) Mounting rubber (Upper and lower)

1) Remove the clip.
2) Pull out using a mounting rubber puller assembly (special tool).
   - When pulling out the upper be sure to use the side having a smaller diameter of the special tool. In the case of the lower the side having a larger diameter.

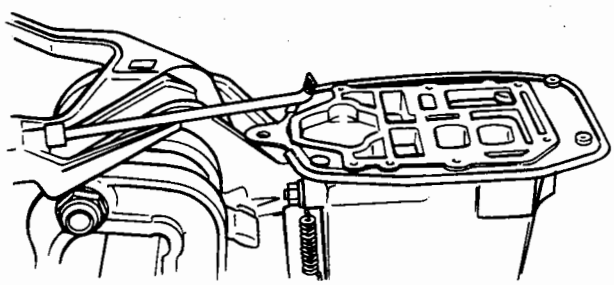


Fig. 82 Lower motor cover

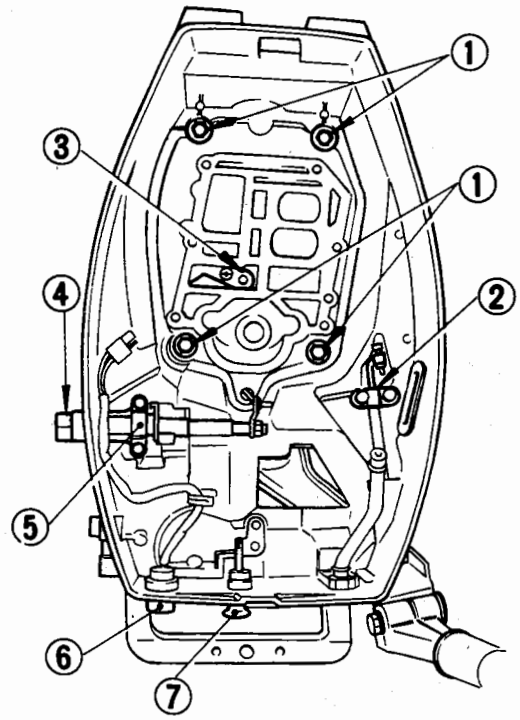


Fig. 83 Removing the lower motor cover

1. Bolt (H630-4)
2. Thrtottle shaft supporter
3. Water pipe
4. Shift lever
5. Shift lever stopper
6. Stop switch
7. Choke lever

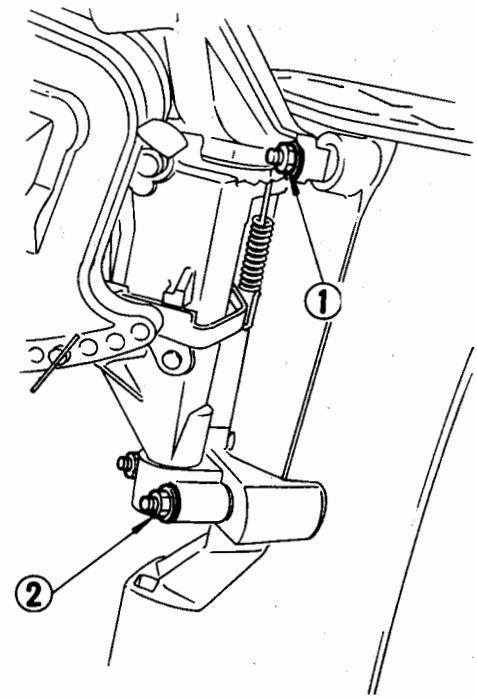


Fig. 84 Removing the mount rubber

1. Nylon nut for upper mounting rubber
2. Nylon nut for lower mounting rubber

15. Assembling motor cover lower and drive shaft housing

Assembling shall be carried out in the reverse order of stripping, paying due attention to the following matters.

(1) Mounting rubbers (upper and lower)

1) Confirm that the damper plate and mount rubber are neither damaged nor distorted.
2) Install the clip correctly in the groove of the drive shaft housing after having inserted the mount rubber.
3) Confirm that the washer is neither damaged nor distorted.
4) When installing the drive shaft housing, confirm that the mount rubbers (upper and lower) are normal.
   Tighten mounting rubber nut (nylon nut M10) to the specified torque of 24 to 25N·m (2.4 to 22.6kg-m, 17 to 19 ft-lb).
5) The axial clearance at the outer cylinder portion of the mounting rubber is 0.4mm (0.016 in.) or less. (Shim to adjust.)

(2) Motor cover lower

1) When fitting the lower motor cover, take care that the lower motor cover does not protrude.
2) Be sure to apply grease to the hook lever bush and hook lever seal ring's lip portion.
   ●Choke
   1) The M6 nylon nut for the choke linkage must be adjusted so that the choke lever operates smoothly, yet be firm enough so that the lever does not move by itself under the influence of engine vibration.
   2) Apply grease to the sliding surface of the choke rod and choke lever.

(3) Shift lever

1) Apply grease to the sliding surfaces of the shift lever shaft, shift lever shaft oil seal, lever shaft bush, lever stopper holder and shift lever spacer.
2) Apply a thread locking adhesive to the shift lever stopper plate bolts (H512-2).
3) Tighten the shift lever installing nut (N10 nylon)) to the specified torque [25 to 29N·m (2.5 to 3.0kg-m, 18 to 22 ft-lb)].
4) When installing the shift rod joint spring pin, be sure to use the special tool.
5) Adjustment of clutch
   Place the shift lever at the F-N-R positions and turn the propeller manually in order to confirm that the clutch operation is normal. And locate the "N" position between F and R and set the shift lever at this position. Then, adjust the position of the lever stopper holder (slotted hole, shim) so that the center of the ball of the lever stopper holder coincides with the center of the hole of "N" of the lever stopper plate. Then tighten with bolt. Then confirm that the clutch operation at F, N and R positions is correct.
6) Be sure that the clearance between the shift lever stopper plate and the lever stopper holder is between 0.5mm (0.020 in.) and 1.0mm (0.039 in.). Take care that the plate does not fall.

Installing the mount rubber upper

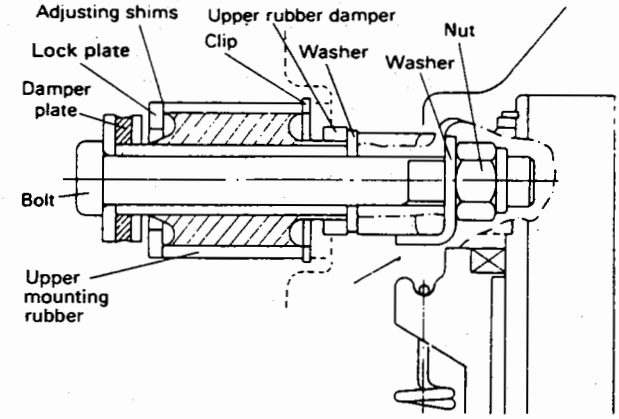


Fig. 85 Installing the upper mounting rubber

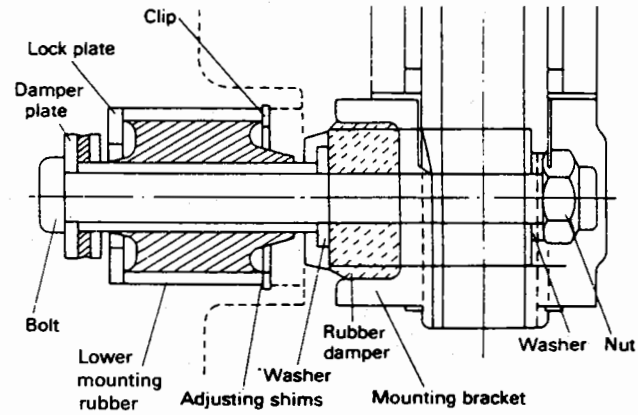


Fig. 86 Installing the lower mounting rubber

16. Disassembling handle, steering and bracket

Assemble in the reverse order of stripping. Please pay attention to the following points.

(1) Handle

1) Please apply grease for TOHATSU outboard motor use before assembling sliding parts such as the grip throttle shaft bush, universal pinion and throttle supporter. (Fig. 89)
2) The method of fitting throttle shaft A and the throttle grip is shown in the Fig. 87.
3) When attaching the throttle shaft B to the universal pinion, please refer to the Fig. 88.

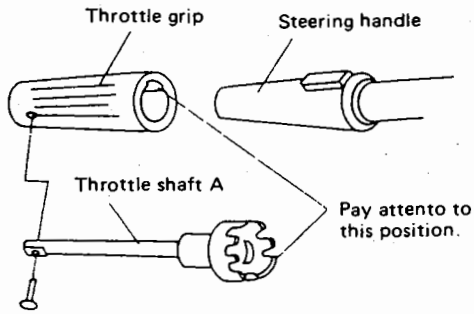


Fig. 87 Assembling the throttle shaft A

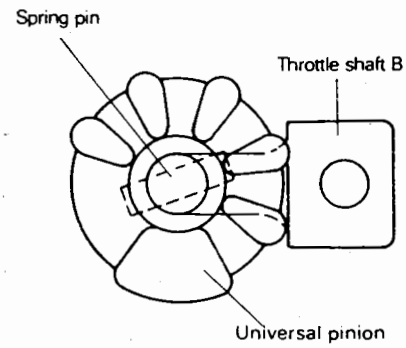


Fig. 88 Attaching the throttle shaft B to universal pinion

4) When connecting the throttle shaft A to the throttle shaft B ensure the correct engagement of the universal pinion.
5) Set an appropriate clearance between the handle A and the steering bracket by adjusting the handle friction adjusting nut. The setting is approximately correct when the handle does not fall down under its own weight when raised to the upper position.

(2) Steering shaft assembly

1) Draw out the mount bracket downwards after removing the mount bracket lower and grip.
2) Pull out the steering shaft assembly upwards.

(3) Stern bracket

1) Remove the reverse lock guide plate installing bolt.
2) Remove the thrust rod.
3) Remove the distance piece installing nut.
4) Remove the bracket installing nut and bolt.

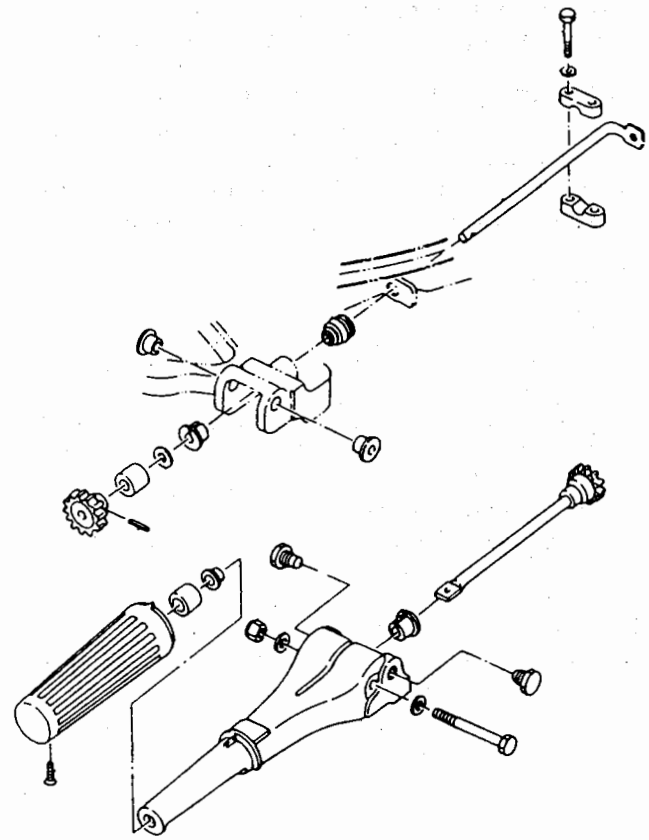


Fig. 89 Handle parts

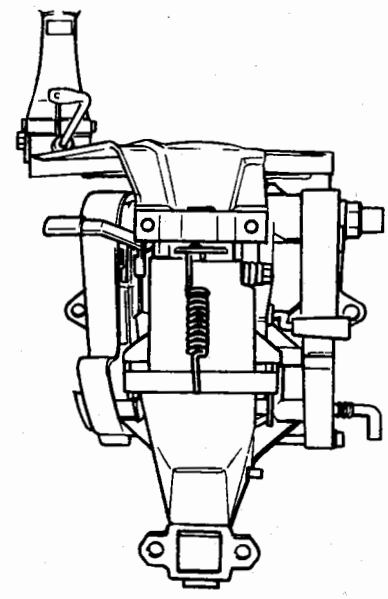


Fig. 90 Steering assembly

(4) Reverse lock mechanism

1) Remove the tilt stopper mounting bolt and remove the tilt stopper.
2) Remove the reverse spring.
3) Remove the reverse lock rod and remove the reverse lock.
4) Remove the reverse lock arm shaft and remove the reverse lock arm.

17. Assembling handle, steering and bracket

Assemble in the reverse order of stripping paying attention to the following matters.

(1) Handle

1) Install the universal pinion and the spring pin for the throttle shaft B collar making sure to use a special tool.
2) Use new spring pin for the universal pinion. Be sure to prevent falling out using both ends after installing.
3) The diagram below shows the relation between the throttle shaft B and the universal pinion, and relation between the throttle shaft B and the throttle shaft B collar.

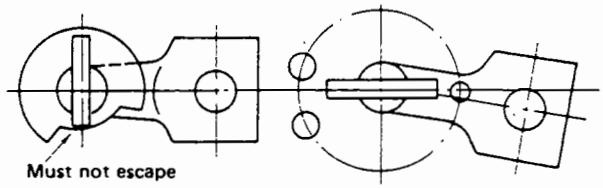


Fig. 91 (Throttle shaft B—throttle shaft B collar) (Throttle shaft B—universal pinion)

4) The method of assembling the universal pinion, grip screw and throttle shaft B is as shown in the diagram below. (Fig. 92)

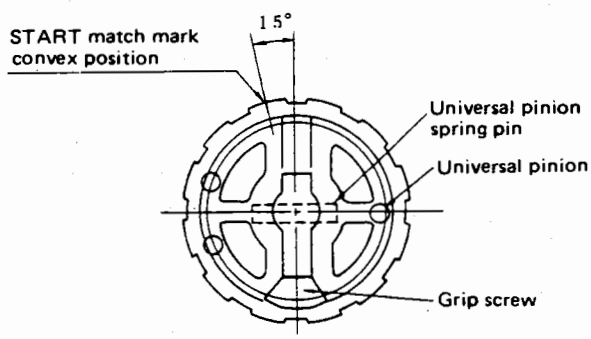


Fig. 92

Join the throttle shafts A and B so that the universal pinions are in mesh with the bent portion of the throttle shaft B at its approximate level position (6°30′ downwards) with the grip match mark (convex) set at start position.

Apply grease to the sliding surfaces of the handle grip, meshing and sliding portions of the handle A bolt collar, throttle shaft A bush and universal pinion, and sliding portion of the throttle shaft B supporter.

Be sure to arrange the handle A and the steering bracket so that there is no play between them and they do not fall down under gravitation, and an appropriate tightening force is obtained when the handle is held up through adjusting of the handle friction adjust nut.

5) Other matters

Apply grease to the drive shaft and engine side splines.

(2) Bracket

1) Fit the bracket shaft oil seal in the direction as shown in the diagram below. (Fig. 93) Be sure not to damage the lip portion in this case.

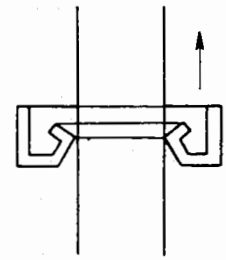


Fig. 93 Installing the oil seal

2) Apply grease to the bracket shaft, bracket shaft bush upper and lower thrust plates, oil seal, bracket bolt bush, bracket bolt threaded portion and clamp screw. Especially pack the swival bracket with grease.
3) Apply No. 572 Screw locking Adhesive to the fitting portion of the mounting rubber installing bolt (lower) and the mounting bracket before assembling.
4) When installing the mounting bracket apply grease to the splines.
5) Install the tilt stopper, set plate mounting bolt, reverse lock arm shaft, reverse lock lever shaft, reverse lock guide plate mounting bolt and bracket nut B after applying the screw locking adhesive to their threaded portions.
6) Apply grease to the sliding portions of the tilt stopper bush, friction spring and reverse lock arm shaft, and also the sliding portions of the reverse lock lever shaft, guide plate mounting bolt and guide bush.
7) Tighten the bracket to torque of **88 to 98N·m (9 to 10kg-m, 65 to 72 ft-lb)**.
8) Install the reverse lock lever grip in a manner as shown in the diagram below. (Fig. 94)

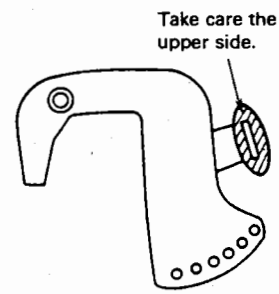


Fig. 94

9) Adjust the bracket friction bolt so that steering can be carried out smoothly and a straight advance can be made even when you let go of the handle. (Fig. 95)

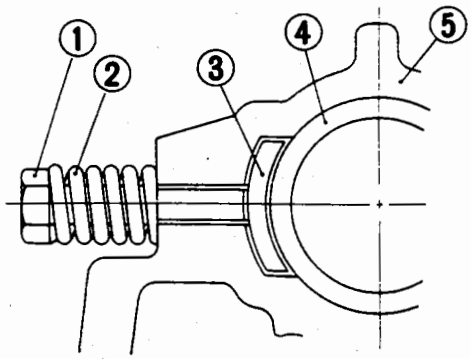


Fig. 95 Installing the friction bolt

(1) Bolt (H630)
(2) Spring
(3) Friction plate, bracket
(4) Steering shaft
(5) Swivel bracket

10) Install the reverse lock lever grip stopper as follows. (Fig. 96)

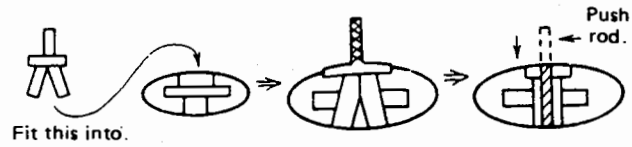
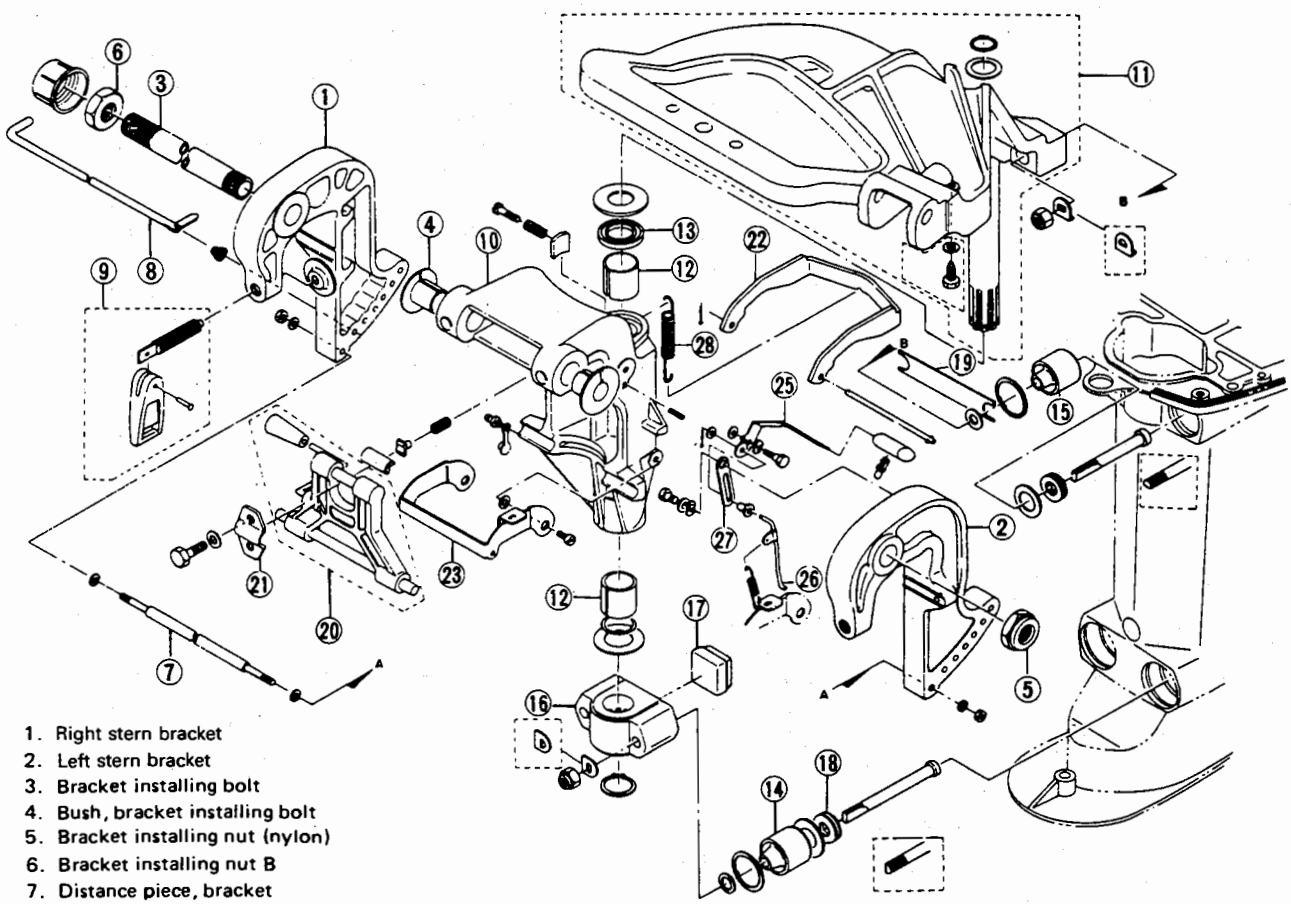


Fig. 96



1. Right stern bracket
2. Left stern bracket
3. Bracket installing bolt
4. Bush, bracket installing bolt
5. Bracket installing nut (nylon)
6. Bracket installing nut B
7. Distance piece, bracket
8. Thrust rod
9. Clamp screw assembly
10. Swivel bracket
11. Steering shaft assembly
12. Bush, bracket shaft
13. Oil seal, bracket shaft
14. Lower mounting rubber
15. Upper mounting rubber
16. Mounting bracket
17. Lower damper
18. Damper plate
19. Upper damper rubber
20. Tilt stopper
21. Set plate, tilt stopper
22. Reverse lock
23. Reverse lock arm
24. Rod, reverse lock
25. Lever, reverse lock
26. Link, reverse lock
27. Guide plate, reverse lock
28. Spring, reverse lock

Fig. 97 Bracket reverse lock

18. Disassembling and assembling auxiliary equipment

(1) Recoil starter

The recoil starter provided for this machine is an automatic recoil starter which rewinds starter rope automatically using the reaction force of the power spring.
When the starter handle is pulled the ratchet comes out and then it is fitted in the starter pulley to rotate the crank shaft and start the engine.
When the engine starts rotating or the rope is rewound this fitting is automatically disconnected.
Moreover, the starter lock mechanism is installed in order to interlock with the shift lever. Therefore, starting is not possible since the starter is locked unless the clutch is thrown into neutral position.

• Stripping

1) Remove the starter lock lever snap ring in order to remove the starter lock rod assembly. (Fig. 98-(1))
2) Remove the rope from the starter handle, hold the starter case and the reel, and slowly turn the reel in order to loosen the recoil starter spring.
3) Remove the ratchet stopper (E ring) in order to remove both the ratchet guides A and B together from the starter shaft.
4) Loosen the nut located at the center of the starter shaft and then the installing bolt (H830) in order to remove the starter shaft (Photo 44-(3)).
5) Remove with the rope wound round the reel, taking care that the starter spring inside it is not disconnected.

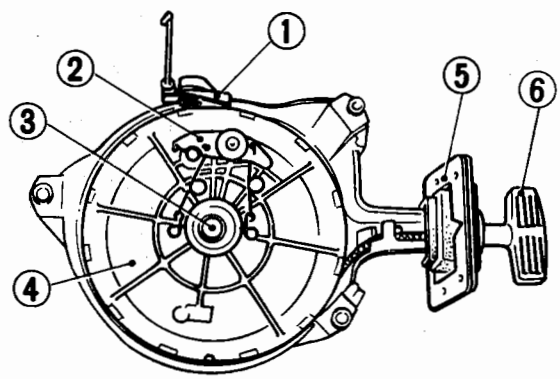


Fig. 98 Assembling the recoil starter

(1) Starter lock rod
(2) Ratchet
(3) Starter shaft
(4) Reel
(5) Starter seal plate
(6) Starter handle

• Assembling

Assemble in the reverse order of stripping, paying due attention to the following matters.

1) Install the ratchet guide B, making sure that the installing direction (back) is correct.
2) Take care that the winding direction is correct (clockwise when viewed from outside).
3) Be sure to apply grease to the starter shaft, ratchet, ratchet bush, ratchet guides A and B, and starter spring.
4) When installing the starter shaft installing nut, make sure to apply a screw locking agent.
5) The ratchet must operate in the direction of ↑ mark. (Apply grease.) (Fig. 99)

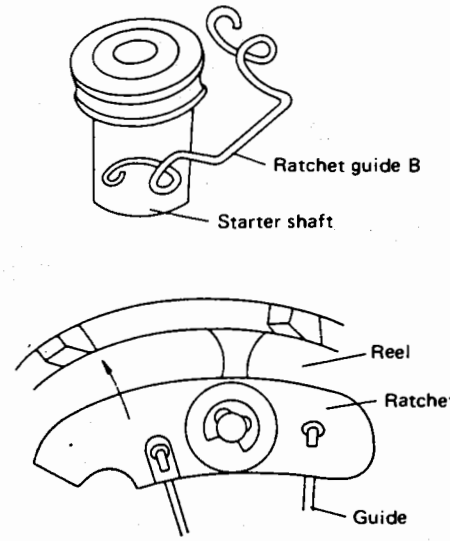
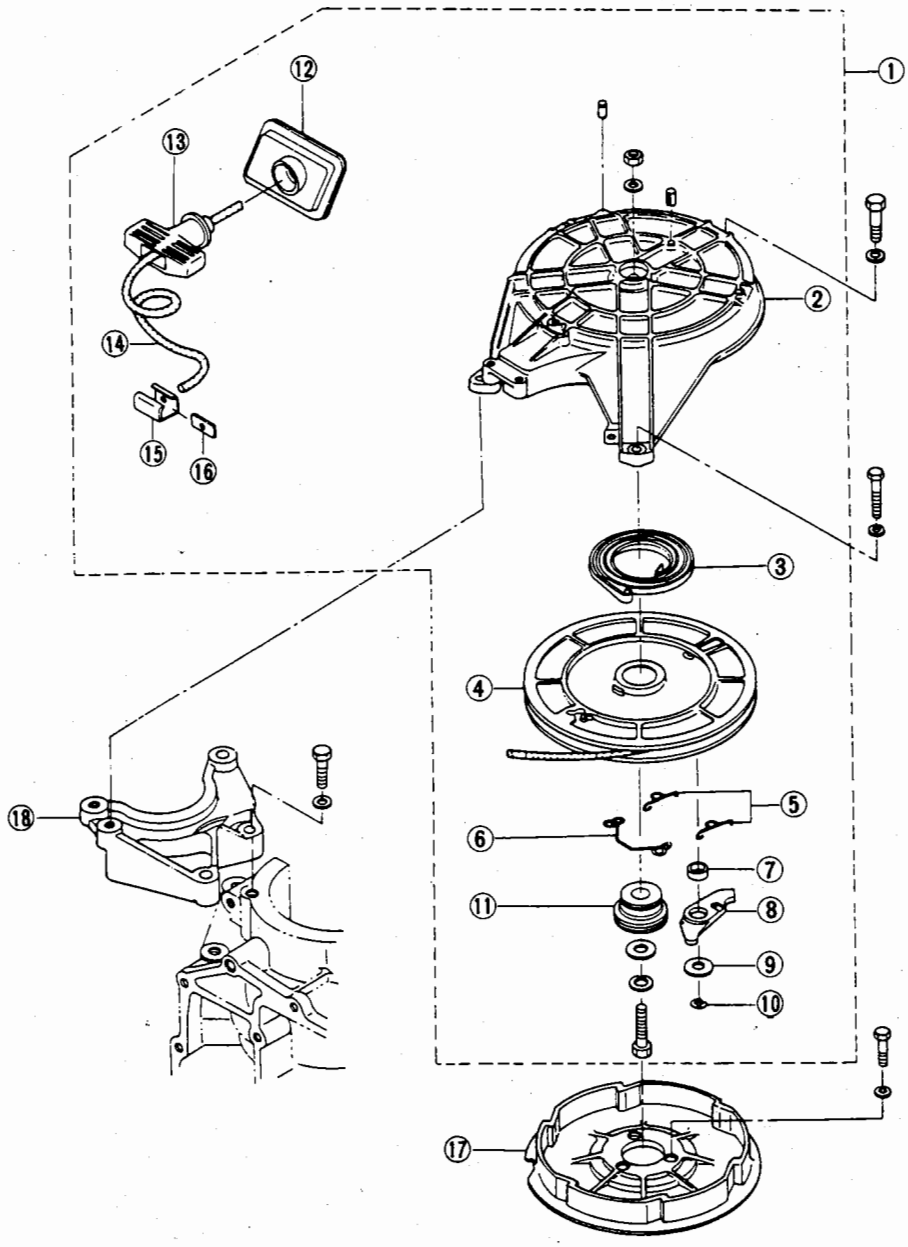


Fig. 99

6) The pre-load of the starter spring shall be set according to the following procedures.
   a) Wind the starter rope round the reel thoroughly to the end.
   b) Take care that the returning force of the starter spring is not large enough to rotate the reel.
   c) Hold the edge of the rope, turn the reel 3 turns and fix the rope to the starter handle.
7) Installing the starter lock lever should be done by the following procedure (See Fig. 58). Starter lock mechanism on page 35 in the recoil starter assembly adjusts by means of the knot (grip end) in the starter rope so that the tip of the starter lock lever is fitted in the convex portion of the reel.
8) Take care that the starter lock lever correctly is not thrown in its neutral position.
9) Insert the rod snap (See Fig. 58 Starter lock mechanism on page 35) corrrectly in order not to come off starter lock Rod.



1. Recoil starter assembly
2. Starter case
3. Starter spring
4. Reel
5. Ratchet guide A
6. Ratchet guide B
7. Bush, ratchet
8. Ratchet
9. Washer A, ratchet
10. E ring
11. Starter shaft
12. Seal plate
13. Starter handle
14. Starter rope
15. Rope anchor
16. Plate, rope anchor
17. Starter pulley
18. Starter bracket

Fig. 100 Recoil starter mechanism

(2) Fuel pump

1) The fuel pump of this motor is installed in the side of the crank case with 2 pan head machine screws with a packing. This pump is a diaphragm type in which the fuel is fed taking advantage of crankcase pressure. The principle is as shown in the Fig. 101.

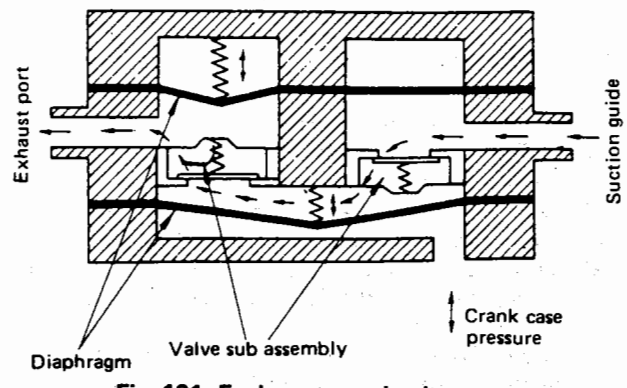


Fig. 101 Fuel pump mechanism

2) Inspection

Inspection item	Action to be taken
1. Tension and damage of the diaphragm, distortion of the mounting hole	Replace as required.
2. Damage to the packing, gas leakage	Replace as required
3. Water pool inside the filter and fouling	Drain the cup of water, remove dust.

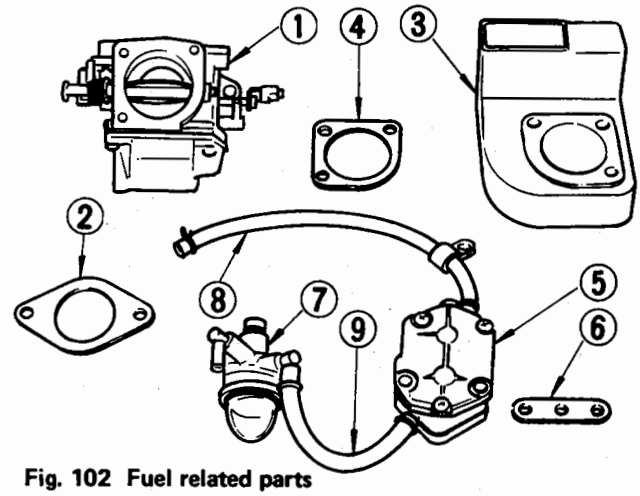
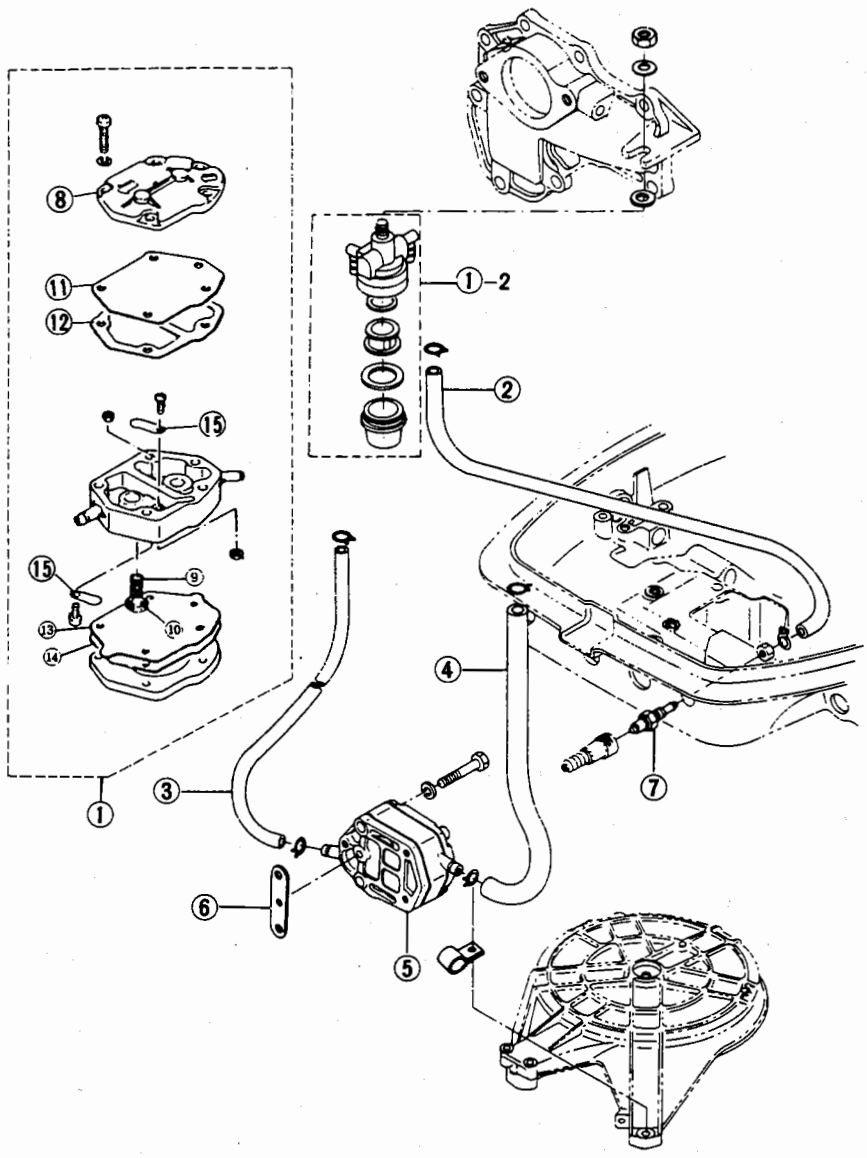


Fig. 102 Fuel related parts

1. Carburetor
2. Gasket
3. Air silencer
4. Gasket
5. Fuel pump
6. Gasket
7. Fuel filter
8. Fuel pipe C
9. Fuel pipe B



1. Fuel pump assembly
1-2. Fuel filter assembly (resin)
2. Fuel pipe A
3. Fuel pipe B
4. Fuel pipe C
5. Fuel pump assembly
6. Gasket
7. Fuel connector B
8. Pump cover
9. Diaphragm spring
10. Guide plate
11. Diaphragm
12. Gasket B
13. Diaphragm B
14. Gasket A
15. Check valve

Fig. 103

(3) Carburetor

The carburetor (KEIHINSEIKI horizontal shaft butterfly valve type) is installed in the engine to the inlet manifold. The throttle operation is inter-linked with the ignition timing by the operation of either the twist grip or the remote control lever.

The choke valve (butterfly valve) is either opened or closed through the choke lever by operating the choke rod (closed when pulled) located on the left side of the front of the lower engine cover.

Outline of the construction

The flow of the fuel and air is divided into the pilot system and the main system.

1) Pilot system (See Fig. 104)

This system consists of the slow jet (S.J.), slow air jet (S.A.J.), pilot outlet (P.O.), bypass (B.P.) and adjusting screw. When the opening of the throttle valve is small, the fuel is measured at the slow jet (S.J.) after passing through the passage (A) and mixed at the passage (B) with the air measured at the slow air jet (S.A.J.) which is then jetted out from the bypass (B.P.) or the pilot outlet and supplied to the engine.

In idling, the air is also taken in from the bypass (B.P.) and the mixture is mainly jetted out from the pilot outlet (P.O.). However, as the throttle valve is opened, the negative pressure applied to the pilot system increases, thus allowing the mixture to be also jetted out from the bypass (B.P.).

When the throttle is further opened, the quantity of air increases and consequently the pressure drop increases, thus allowing the fuel to be taken in from the main jet (M.J.) which is then jetted out from the main nozzle.

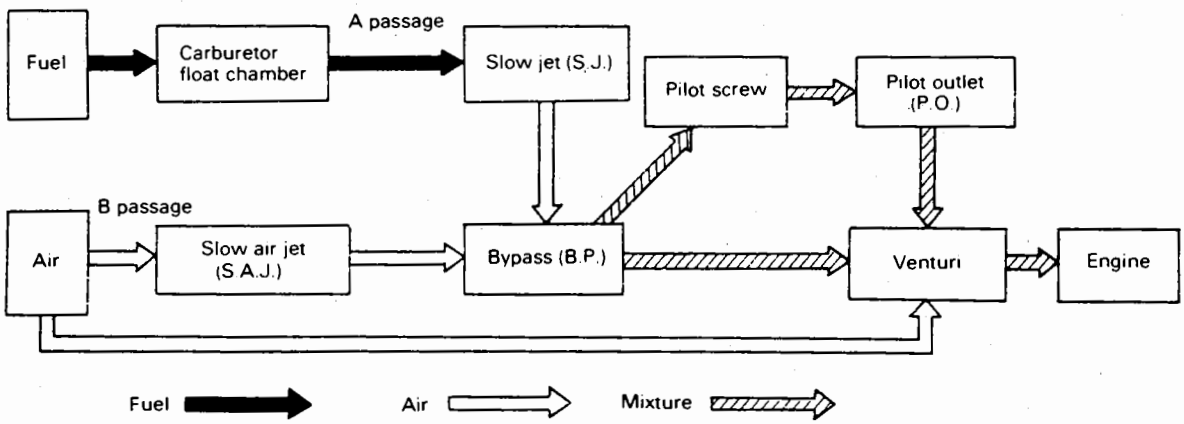


Fig. 104

2) Main system (See Fig. 105)

This system consists of the main jet (M.J.), main nozzle (M.N.) and main air jet (M.A.J.).

When the opening of the throttle valve increases, the pilot system almost stops operating. When the throttle valve is widely opened, the quantity of the air increases and the flow rate of the air increases at the venturi portion, thus causing the pressure drop at the tip of the main nozzle (M.N.) to increase, which allows the fuel to be taken in and the quantity of the fuel jetted out to increase.

The fuel is measured at the main jet (M.J.), the high pressure air is taken in from the main air jet (M.A.J.) provided at the air inlet port of the carburetor and introduced in the bleed hole provided at the main nozzle (M.N.), where it is mixed with the fuel measured at the main jet (M.J.) and then an appropriate mixture is jetted out from the tip of the main nozzle (M.N.) and mixed with the main air before being fed to the engine.

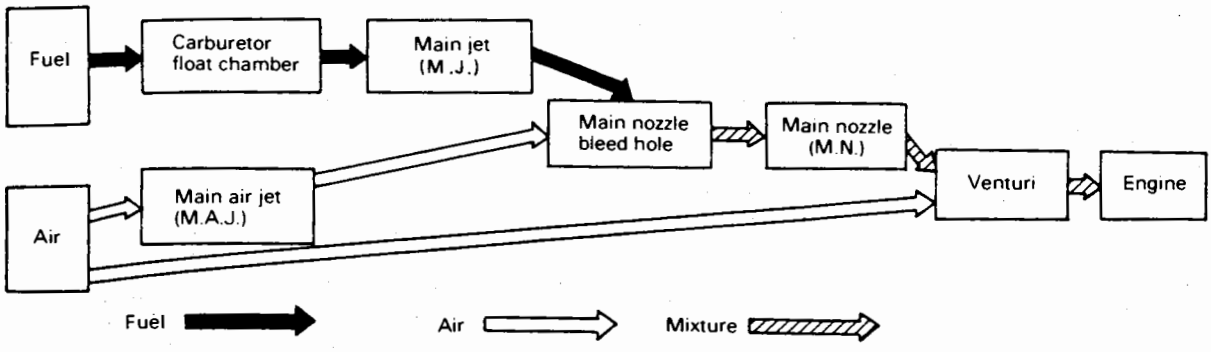


Fig. 105

3) Float

This consists of the float, float valve, special clip and valve seat and it is designed to maintain the float chamber level at a constant, obtaining an air-fuel mixture suitable for the engine. When the fuel poured into the float chamber through the valve seat reaches a certain level the float is raised, which pushes the needle valve upwards. The raised float valve is pressed tightly to the valve seat which cuts fuel flow. As the fuel is consumed the float chamber level is lowered and the lowered float subsequently causes lowering of the needle valve, where, parting from the valve seat the fuel is poured into the float chamber over again. The float chamber level is kept constrant by repeating this procedure automatically.

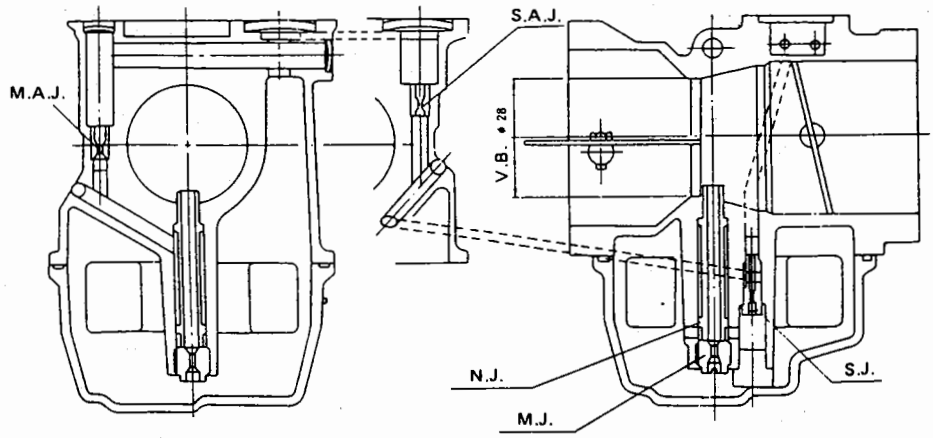
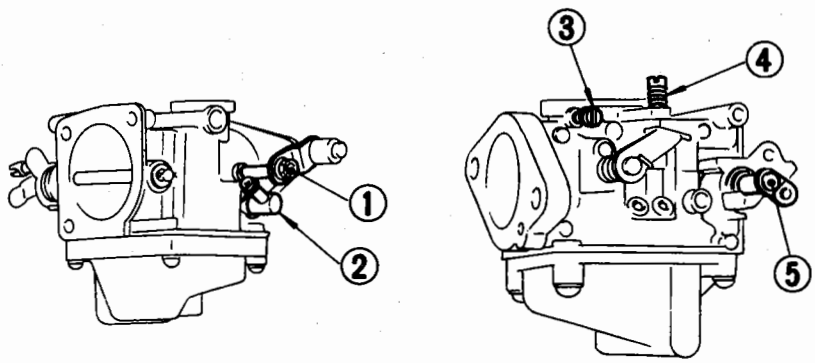


Fig. 106 Sectional drawing

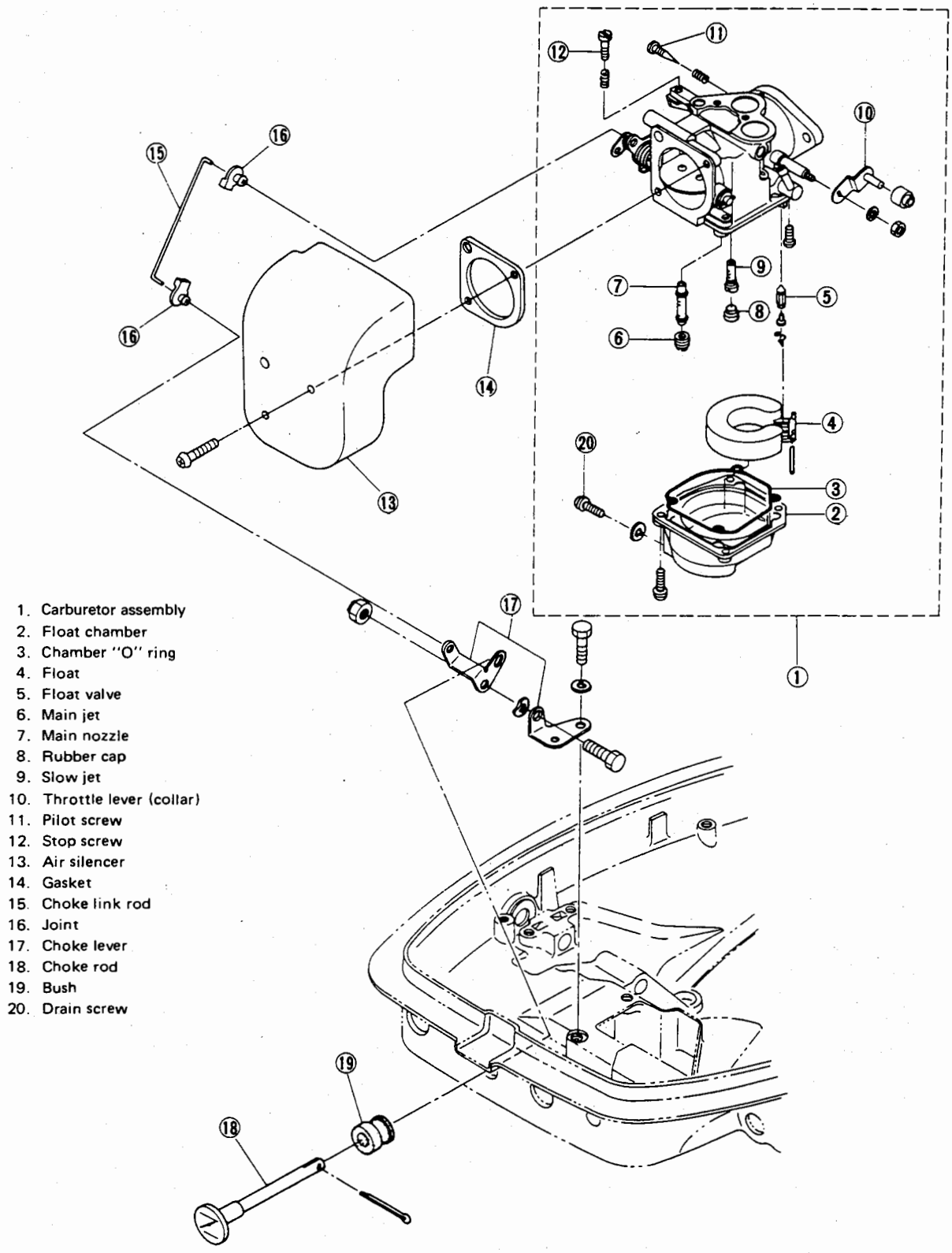


1. Throttle valve shaft
2. Fuel joint
3. Pilot screw
4. Throttle stop screw
5. Choke valve shaft

Fig. 107 Names of carburetor parts

4) Checking each part

Check item	Action to be taken
1. **Oil leakage from the fuel pipe joint portion**	●Replace pipe.
2. **Clearance on the throttle valve shaft and the choke valve shaft**	●Replace if required.
3. **Idling rpm** ● **Adjust after warm up.** **Clutch off 1100 to 1200rpm** **Clutch in 900 to 950rpm**	●Tighten the pilot screw lightly. While observing the rpm on the tachometer, operate the throttle and stop screw in order to obtain the specified rpm. To adjust the pilot screw in order to come to the best position where the rpm is the highest within the range of +-1/4, turn and again set the throttle stop screw at the specified rpm. ●Replace if the tip of the pilot screw is worn away.



1. Carburetor assembly
2. Float chamber
3. Chamber "O" ring
4. Float
5. Float valve
6. Main jet
7. Main nozzle
8. Rubber cap
9. Slow jet
10. Throttle lever (collar)
11. Pilot screw
12. Stop screw
13. Air silencer
14. Gasket
15. Choke link rod
16. Joint
17. Choke lever
18. Choke rod
19. Bush
20. Drain screw

Fig. 108 Carburetor

(4) Electrical equipment

1) Component parts
The component parts are as follows:

Classification	Parts names	Type/standards	Remarks
Ignition	Flywheel magneto C.D. unit Spark plug	(4-pole) AC 05014 E Y 05800 NGK B7 HS-10 (gap 1.0) CHAMPION L82C (gap, 1.0mm) (0.039 in.)	Twice/a rotation simultaneously Plug gap 0.9mm to 1.0mm (0.035 in. to 0.039 in.)
Switch	Stop switch		Waterproof type
Lighting		12V 80W	

Outline

The ignition secondary voltage generating system for the C.D. magneto differs from that for the conventional magneto, which uses a contact breaker (point). In this system, the charging current generated at the magneto is first stored in the capacitor inside the C.D. unit and then the electro energy in the capacitor is applied to the primary winding of the ignition coil by means of the signal voltage of the magneto, synchronized with the ignition timing in order to generate a high voltage in the secondary coil. Therefore, since the electric switch (thyristor SCR) operated by the signal voltage is installed in the unit, highly efficient stable ignition secondary sparks can be generated.

The C.D. magneto mainly consists of the flywheel provided with the magneto steel and pole piece, the coil plate equipped with various types of coils and the C.D. unit which houses the coil plate, capacitor SCR, ignition coil and diode.

Flywheel

(1) Construction

This is a steel arm type flywheel formed by using a steel plate inside of which a ferrite magneto and pole pieces are fixed securely, using screws and a bonding agent. 4 magnetic poles are installed in a radial manner when viewed from the center of the flywheel. The boss riveted to the center of the flywheel is provided with a key way which is used to determine the installing position in the crankshaft. Moreover, the flywheel surfaces are painted to prevent rust.

(2) Inspection and maintenance

There are no special parts requiring maintenance. However, be sure to degrease the boss tapered portion before reinstalling in the crankshaft so that it will be free of oil or foreign materials. Note that *the flywheel tightening torque is "118 to 137N-m (12.0 to 14.0kg-m, 87 to 101 ft-lb)".*

Coil plate

(1) Construction

The coil plate is a die-cast plate made of aluminum alloy in which the exciter coil to charge the capacitor and the trigger coil to generate signals at the ignition time are installed.

The lighting coil is capable of lighting the electric lamp of 12V80W directly. However, when the electric starter motor is installed, this will be used as a coil for charging the battery. Moreover, 7 linear marks on the circumference of the coil plate (Fig. 31) are the reference marks to set the ignition timing which are marked every 5°.

(2) Inspection and maintenance

1) Checking coils
The wiring diagram of the C.D. unit for inspection is as follows (Fig. 109).

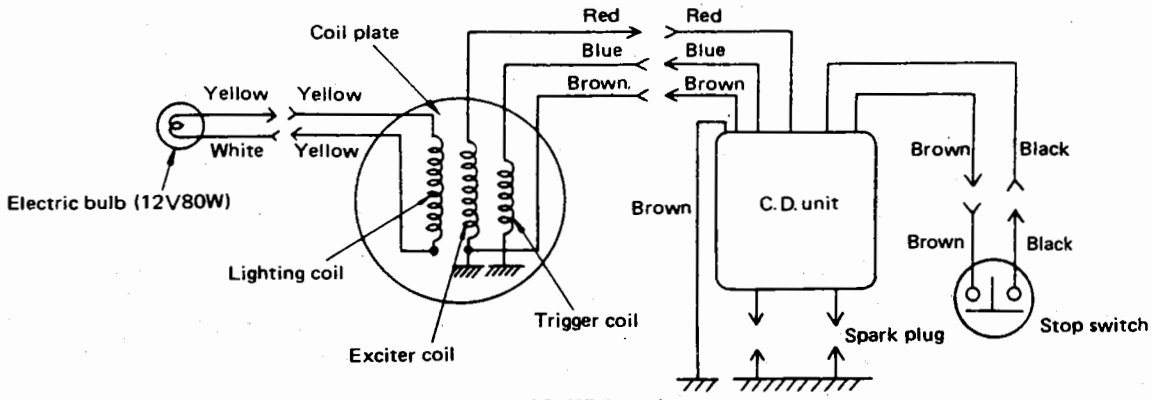


Fig. 109 Wiring diagram

First, take off the 3-pole coupler which connects the coil plate with the C.D. unit and measure the resistance between the lead wires of coils of the coil plate using an appropriate tester in order to judge the capability of each coil.
When the resistance values drastically differ from those specified below, the coil is judged to be defective.

Reference value of resistance

Exciter coil	290Ω	(Between red lead wire and coil plate)
Trigger coil	20Ω	(Between blue lead wire and coil plate)
Lighting coil	0.34Ω	(Between yellow and yellow lead wires)

Precautions to be taken

There is general variation of ±15% to ±20% in the resistance values for even normal coils, resulting from differences in diameters of coil windings.

When measuring the coil resistance be sure to check the coil lead wire and the inside of the coil for disconnection.

When checking, first connect the tester to each of the lead wires, and then apply light tension to the coil lead wire manually by a light twisting force from the fingers to the outlet of the lead wire and coil winding portion. At that time, if the indication of the resistance value changes, it is judged that a disconnection has occured.

2) Checking the ignition timing

The ignition position is set by the signal voltage of flywheel magneto. Once set, the ignition position remains unchanged regardless of the service period of the C.D. magneto since there are no consumable parts in the unit.

Therefore, the ignition timing is normal if the match ($M25C_2$; BTDC20°, $M30A_3$; BTDC25°) of the magneto coil plate is matching to the abutting face of the cylinder and crank case when the handle grip is fully opened (the carburetor throttle is widely opened).

The correct ignition timing in this case is obtained approximately 5 minutes after warming up, and with the engine running at 5000 to 5500 rpm.

3) C.D. unit

(1) Construction

The C.D. unit is housed in a black resin case in which the diode, the capacitor, the thyristor, the Zenor diode are installed on a single circuit board, which is then enclosed together with the ignition coil and packed with resin to improve the water and vibration resistance.

(2) Inspection and maintenance

1) When checking the C.D. unit, measure the resistance value using the circuit tester for radio having a battery of 3V rating or less. Note that when measuring using a megger or instrument having a bettery for its supply, the C.D. unit can be damaged. A large number of capacitors and diodes are installed in the C.D. unit. Their resistance are measured in the course of measuring of lead wires.

When measuring the resistance of the capacitor, the pointer of the tester is once deflected to a great extent and soon recovered. In the case of a normal diode, the resistance values are changed greatly by connecting the tester terminals inversely (changing the polarity of the terminal) or changing the resistance switching range. The inspection is carried out taking advantage of this. The table below indicates the conditions where the resistance between the lead wires of the C.D. unit is measured using a tester for radio. Unless all these items are satisfied, the C.D. unit is judged to be faulty. Moreover, note that the resistance switching ranges are measured at the largest spot.

since the indication of the resistance values vary by model of the testers.

Table 1

	Connection of tester terminal and identifiaciton of lead wire	Tester (+) Terminal			
		Brown	Red	Blue	Black
Tester (−) Terminal	Brown		Insulated	Insulated	Insulated
	Red	The pointer deflects slightly then recovers.			Short circuit
	Blue	300Ω to 1000Ω	Insulated		Insulated
	Black	The pointer deflects slightly then recovers.	Short circuit	Insulated	

Explanation of the description in the table above

The pointer once deflected recovers soon (small): This is, as has been explained, one of the attributes of the capacitor. "Small" in parentheses indicates the extent of deflection as is shown in the above table. This occurs when the capacitor subjected to measurement is already charged by the tester during the preceding measurement. Therefore, in this case connect reverse the tester terminal and keep for 2 minutes before repeating the measurement.

4) Ignition coil

(1) Construction

Two ignition coils are installed in the case of the C.D.unit. Two primary coils of the two ignition coils are connected in series. The lead wire of one of them is connected with the thyrister and that of the other with the ground wire.

Moreover, the beginning of the winding of each secondary coil is connected to the end of the winding of each primary coil and the end of the winding of the secondary coil is connected with the high-tension cord which is taken out of the case of the C.D. unit. This ignition coil is for C.D. ignition unit use with high generating voltage. Therefore it is constructed to prevent damage to the high tension cord or insulation breakdown by covering the high tension cord with a rubber tube with high dielectric voltage value.

(2) Inspection and maintenance

To check, measure the resistance value using a curcuit tester for radio. First, take out the connection (3-pole coupler) of the C.D. unit and the coil plate and also remove the high tension lead wire from the spark plug.

When measuring the resistance value of the secondary coil, measure at the terminal on the brown wire side of the 3-pole coupler and between the two high tension wire terminals.

When the measured values largely differ from the following values, it is judged that the ignition coil is faulty.

Although the ignition coil is constructed in order to prevent direct measurement of the resistance value of the primary coil, when the resistance value of the secondary coil meets the reference value for maintenance, the two primary coils are not disconnected.

Resistance value of the secondary coil

2500Ω (2.5kΩ)

Brown lead wire – Between terminals of the primary high tension wires

Brown lead wire – Between terminals of the secondary high tension wires

(Reference: 5.0kΩ between terminals of the primary and secondary high tension wires)

5) Stop switch

Inspection and maintenance

Precautions to be taken

The deterioration of the insulation between the constracts of the stop switch exerts a bad influence on the ignition performance and especially on the performance at the time of starting.

When measuring the insulation resistance between the constracts of the stop switch, take out the connection (2-pole coupler) of the C.D. unit and the stop switch and measure the resistance between the two poles of the coupler on the switch side. However, when measuring with a tester, the value should be over 2MΩ when measured at the maximum spot in the resistance switching range, and when measured with 500V megger, it should be over 1MΩ.

When the value is less than the specified, clean the inside of the switch case after removing the switch to strip. Check the waterproof cover for cracks due to secure distortion. Replace with new if required.

6) Checking the connection and the contact part:

The connection point between the magneto and the C.D. unit uses a double- or tripple-coupler. A vinyl tape is wound around the coupler over 2.5 turns in order to prevent poor contact or slippage due to the vibration of the engine and clamping is carried out for the lead wires to prevent troubles occuring at the coupler portion. However, be sure to check the mounting bolt for the C.D. unit for looseness.

7) Precautions to be taken for handling the C.D. magneto

(1) Neither disconnect nor short circuit the wiring for the C.D. unit while running. Otherwise the C.D. unit can be damaged.

(2) Never change the installing position of the parts of the C.D. magneto. Since they are installed in locations where the thermal and oscillating conditions are optimum, changes in mounting position shoud be avoided.

(3) Do not touch the spark plug or the high tension cord with hands during operation of the engine, since the C.D. magneto exhibits a high performance both in the secondary voltage and current.

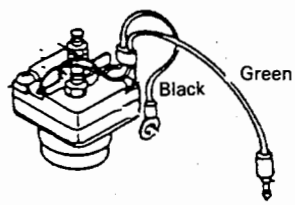
(4) When checking the spark plug for normality, be sure to contact both plugs with the engine portion. If one only is contacted, the C.D. unit can be damaged.

(5) When measuring the compression pressure, measure as indicated in paragraph (4) or carry out after removing the tripple coupler.

8) Starter motor

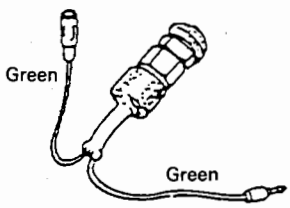
No or weak rotation	1) Malfunction of the starter solenoid switch 2) Loose or corroded battery terminals 3) Excessive or weak battery 4) Faulty contact of the main switch 5) Faulty connection of the starter terminal 6) Worn brush 7) Trouble of the starter solenoid 8) Malfunction of field coil or armature coil 9) Faulty conduction of ground lead wire 10) Trouble of the neutral switch
Starter motor works but pinion does not engage with the ring gear	1) Worn teeth blade of pinion 2) Malfunction of over running clutch
Starter motor does not stop	1) Malfunction of main switch

9) Starter solenoid



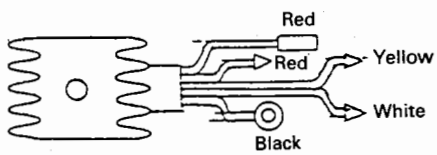
Resistance between lead wires
Green — Black 3.4 Ω

10) Neutral switch (EF type)



Switch Position	Conduction
Released condition	No
Pushed in	Yes

11) Rectifier



		Tester positive lead wire (+)			
		Black	Red	Yellow	White
Tester negative lead wire (−)	Black		conductive	conductive	conductive
	Red	no conductive		no conductive	no conductive
	Yellow	no conductive	conductive		no conductive
	White	no conductive	conductive	no conductive	

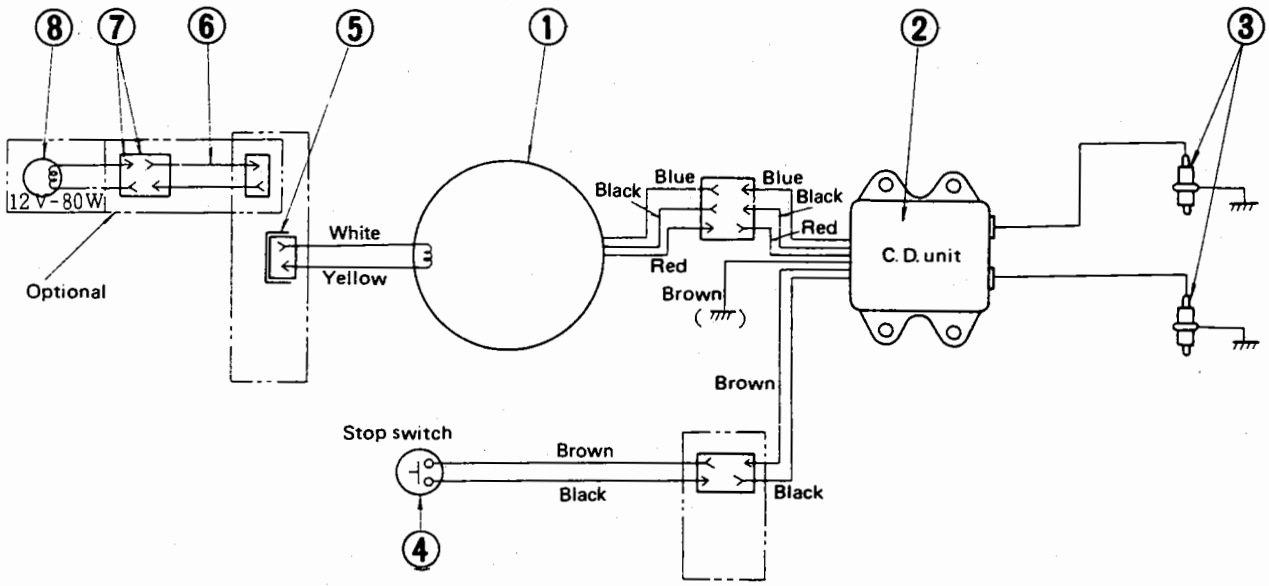
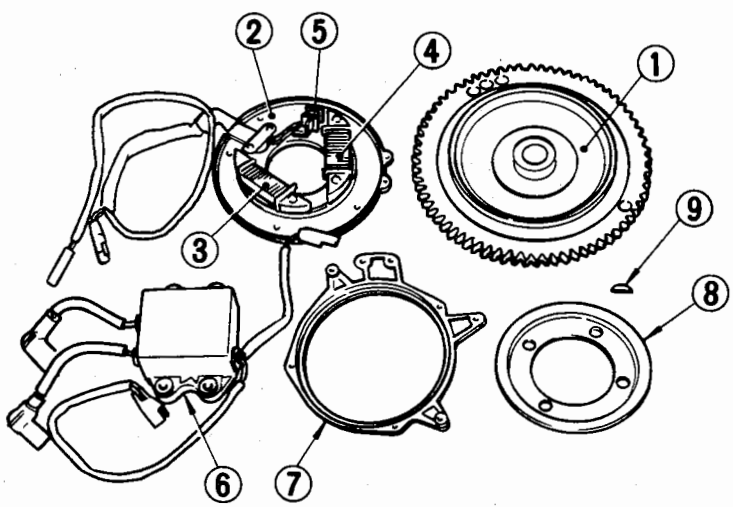


Fig. 110 Wiring diagram (STD type)

Number	Name	Remarks
1.	Flywheel magneto	AC5014
2.	C.D.unit	EY05800
3.	Spark plug	NGK B7HS-10 or CHAMPION L-82C (gap 1.0mm) (0.039 in.)
4.	Stop switch	For S.T.D.
5.	Blind cover for coupler	Not necessary when fitting 6, 7 and 8.
6.	Receptacle assembly	Optional
7.	Plug in main body Terminal holder	Optional
8.	Bulb	Except for part, commercially available 12V 80W electric bulb



1. Flywheel (Starting gear)
2. Coil plate
3. Exciter coil
4. Lighting coil
5. Trigger coil
6. C.D. unit
7. Set ring
8. Guide plate
9. Magneto key

Fig. 111 C.D. magneto

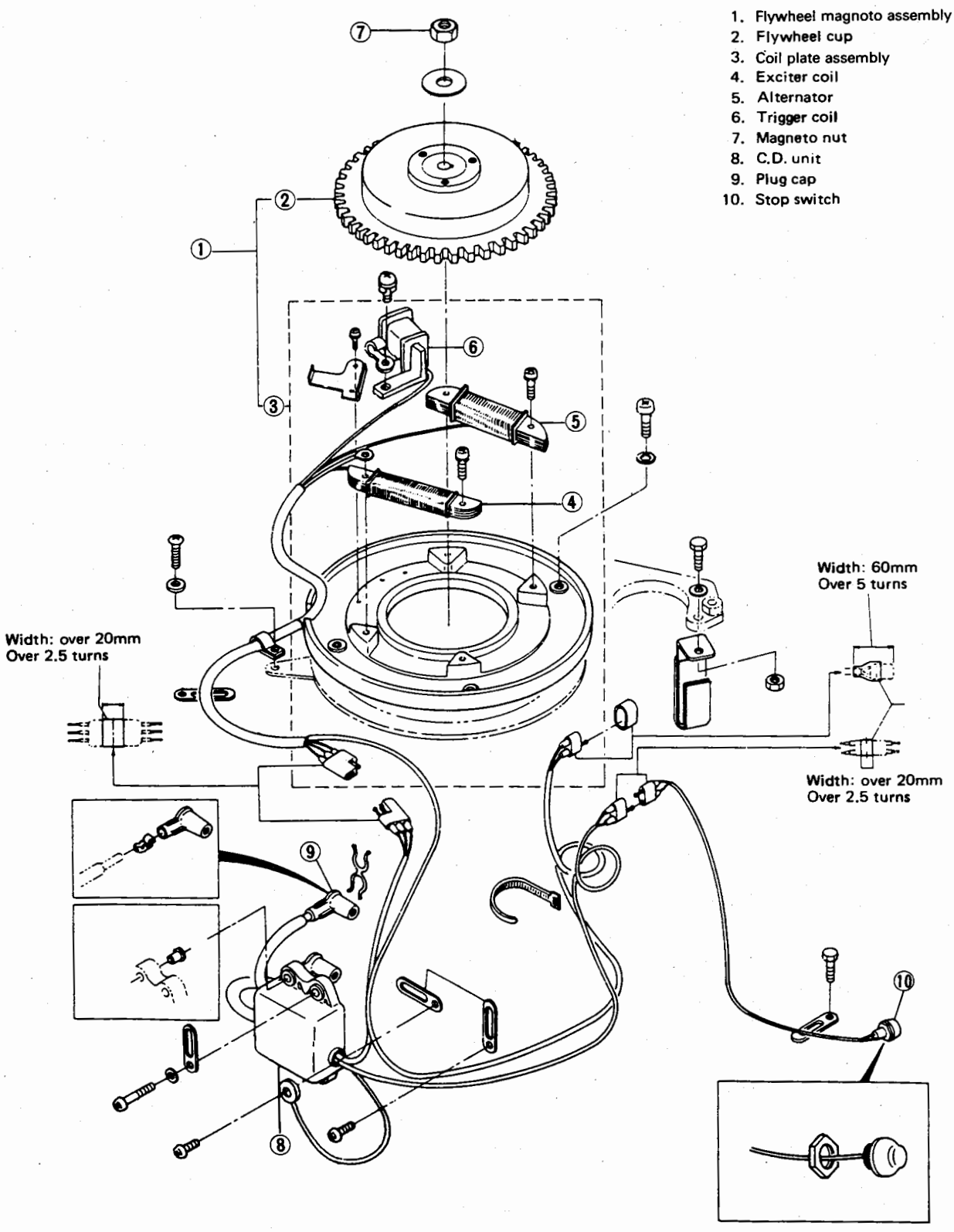


Fig. 112 Magneto

(5) Propeller

The propeller has a great influence on the performance of the boat. TOHATSU can supply a variety of types to suit any purposes.

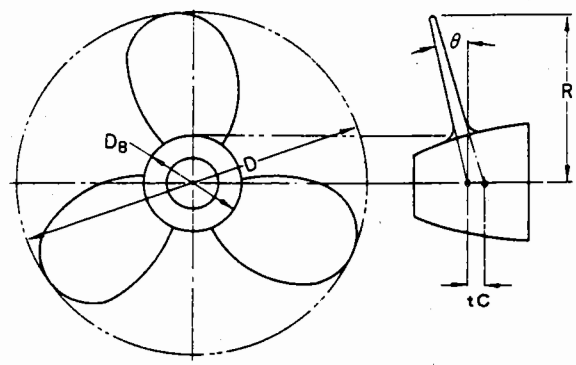
○Selecting the propeller

In order that the engine power can be effectively used to propell the vessel, it is necessary to select a propeller best suited to the purpose for which the boat will be used.

Therefore, it is important that the propeller is selected so that the engine rpm remains within the recommended range and it is used most effectively. Otherwise, the speed of the boat decreases. When the engine rpm exceeds the range, increase in the vibration sounds or damage to the parts including cavitation can be expected. On the other hand when it does not reach the range, overloads and damage to the parts can also be expected.

Consequently the propellers are available in 6 types.

Recommended rpm range: 4800 to 5500 rpm



D: Diameter — θ: Rake
Pitch ratio: H/D — R: Radius
tC: Imaginary thickness on center line
Boss ratio: D_B/D — D_B: Boss diameter
Blades thickness ratio (B.T.R.): rC/D
H: Pitch — Z: No. of blades

Fig. 113 Particulars of propeller

(6) Inspection and maintenance after general assembling

Check the following items after assembling the engine and the lower unit.

○Items to be checked before carrying out a trial run

- Piping conditions of the fuel system
- The state of electric wiring, connection and clamping
- Clutch adjustment
- The operation of the reverse lock

○The items to be checked after trial run

Start the engine and carry out idling and then check the following items.

- Fuel leakage from the abutting face of the crankcase
- Fuel leakage from the installing surface of the inlet manifold
- Cooling water leakage from the abutting face of the cylinder head
- Cooling water leakage from the installing surface of the engine
- Cooling water leakage from the installing surface of the exhaust cover
- Abnormal sound
- Idling rpm and stability (clutch in 900 to 950 rpm)
- Discharging of the cooling water (The cooling water should be discharged from the water detecting opening and discharge port.)

○Tightening after trial run

Tighten to the specified torque (referring to the Tightening torque table).

○Breaking-in .

When the piston, piston ring, piston pin, crankshaft, cylinder and bevel gear bearing have been replaced with new be sure to carry out a breaking in order to normalize the movemnent of the sliding portion of each part.

Precautions to be taken

- Gasoline/recommended oil mixture 20:1 (when engine parts replaced)
- Breaking-in period: 10hrs
- Engine rpm (Do not open the grip fully first. Carry out at low and medium speeds in advance.)

○Water tank simulating running condition and test propeller (murine)

When carrying out trial runs on land it is necessary to operate the test propeller for absorbing power in the water tank in order to apply an appropriate load to the engine.

1) Purpose of application of the test propeller

This test propeller is used for the following purpose.

a. For adjustment and checking of the outboard motors after servicing

2) About the water tank to which the test propeller is applied.
   a. Be sure to secure the minimum dimensions for the water tank. (Fig. 114)

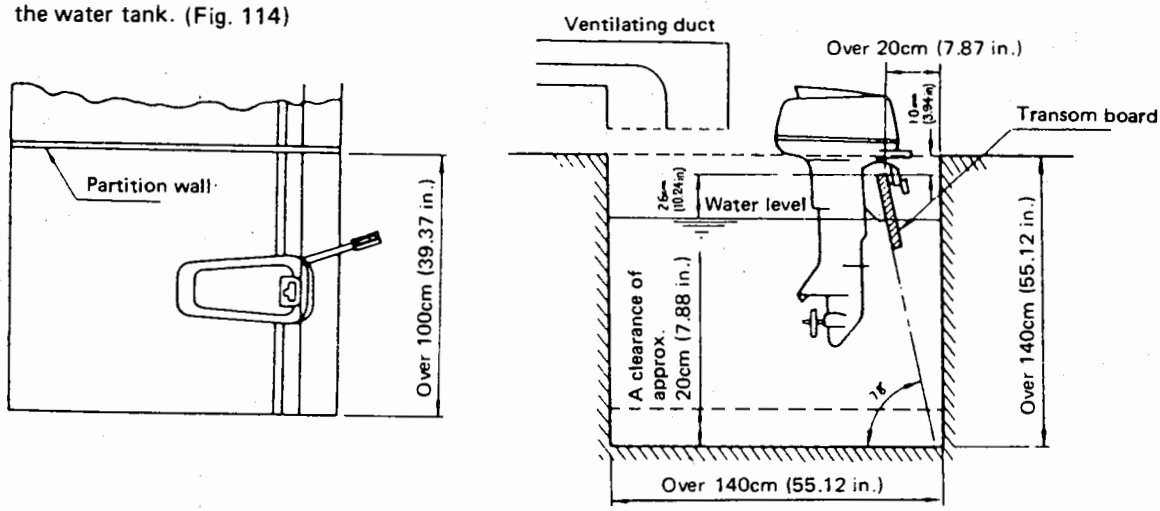
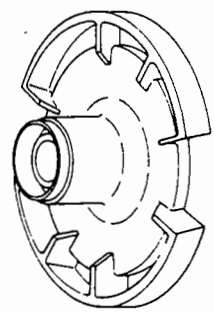


Fig. 114 Dimensions of the tank and installing position

   b. Even when installing 2 or more motors in a water tank, make sure that a partition wall is fixed so that the minimum dimensions can be ensured for at least one of them.
   c. When the water tank is used continuously, overheating of engine will occur due to the temperature rise of the water in the tank. Consequently, take care that the water temperature in the tank does not exceed 25°C (77°F). It is recommended that either a cooling system or an overflow device of water flow is installed.
   d. Do not use used unclean water. Otherwise the carbon in the water adheres to the inner walls of the cooling system, thus reducing the cooling performance.
   e. When using the tank continuously, the exhaust fumes remain round the carburetor which are then taken in the motor through the carburetor, thus preventing the normal rotation. Therefore be sure to install a device to forcibly exhale the fumes.
   f. The height of the tank should be relatively high as shown in the diagram.

3) Adjusting and checking operation of outboard motors after servicing
   a. When the engine rpm exceeds 5500 rpm, regardless of the length of the transom with the handle grip fully opened under the conditions of the water tank specified in paragraph 2, the high rotation of the engine is correctly adjusted. However, the 5500 rpm is specified under the standard air temperature and pressure (20°C (68°F) 760mmHg humidity 65%). Therefore, the values vary according to the conditions. Use an accurate tachometer for measuring rpm.
   b. When adjusting the engine idling, carry out with the clutch thrown in at its neutral postition. This is because the water level of the tank is constant, regardless of the length of the transom and whether the resistances of the test propeller and the propeller differ with each other.

4) Precautions to be taken
   a. Be sure not to operate with the grip fully opened within a short time.
   b. The test propeller is a type of measuring instrument. It should be stored and handled carefully. (Fig. 115)
   c. Be sure not to carry out rapid acceleration or deceleration.



Outer diameter: φ223mm (8.78 in.)
Width: 14.5mm (0.571 in.)

(For M25C$_2$, M30A$_3$)

Fig. 115 Test propeller

19. Periodical check

It is recommended that the user make periodical inspections of items with * mark added in the remarks column.

Check item	Maintenance frequency	Item and action to be taken	Remarks
Correct tightening of nuts and bolts	New engine after 10 hrs.	Cylinder head, exhaust cover, carburetor inlet manifold, crankcase, recoil starter drive shaft housing, mounting rubber, gear case, propeller shaft housing	Refer to "Tightening torque" table.
Gear oil	New engine. Replace after 10 hrs. Fill up the shortage in every 50 hrs run. Change oil in every 200 hrs run and also when new season starts after prolonged winter storing.	Fill up the shortage or change as described on the left. Check propeller shaft oil seal for cracks, abrasion or water performance.	Recommended gear oil GL5 #80, $M25C_2$ and $M30A_3$ about 250cc (1/2 US pt, 1/2 Imp pt)
*Spark plug	In every 50 hrs.	Correct, clean or replace when gap widens between poles due to abrasion, or carbon build up.	NGK B 7HS 10 CHAMPION L82YC gap: 0.9mm to 1.0mm (0.035 in. to 0.039 in.)
*Fuel system	In every 50 hrs.	Clean and check for damage to the fuel tank, fuel pipe, fuel filter, fuel pump, carburator float chamber.	Remove dust and water. Fuel leakage. Drawing in of air.
*Grease up	In every 50 hrs.	Propeller shaft, shift lever shaft, hook lever shaft, choke lever shaft, choke link mechanism, shift lever stopper plate, throttle shaft, handle, grip, bracket shaft, bracket bolt, clamp screw, tilt stopper, reverse lock mechanism, throttle link mechanism, starter lock mechanism, recoil starter, carburetor	
Compression pressure	In every 100 hrs.	Take a compression check. (after warm up)	Standard 686kPa (6.86 bar, 7.0kg/cm², 100 psi)/500rpm
Cooling water passage	In every 100 hrs.	Remove water and dust from the passage of the pump, water pipe, cylinder, cylinder head.	Overheating due to the shortage of the quantity of cooling water
Carburetor	In every 100 hrs.	Strip, remove dust and clean with air and nonflammable solvent.	Abnormal running at all speed range
Removing carbon	In every 200 hrs. or 1 year	Remove carbon from the combustion chamber, exhaust passage, piston head.	Available in using the recommended oil
*Anode	In every use	Check for corrosion and abrasion.	Replace if required.
*Propeller	In every use	Correct or replace, if required.	
Starter rope	Before cruising	Check for abrasion or damage.	
*Checking cooling water	During operation	Discharging of cooling water from the water detecting opening and discharge port, build up of plastic materials or dust in the water strainer.	Remove
*Clutch operation	In every use	Check for correct clutch play and engagement	
*Reverse lock operation	In every use	Check for correct lock.	
*Handle	In every use	Check steering and throttle operation for normality.	
*Electrical wirings	Every 100 hours	Check wirings for loose connection broken wire, damaged portion.	
Ignition timing	Every 100 hours	When throttle is fully closed. When throttle is widely opened.	
Throttle link mechanism	Every 100 hours	Check ball joint cap and rod for looseness, deformation and bend.	
*Engine mounting bolt	Every operation	Loose bolt and nut, leakage from holes.	

Symptom / Probable cause	Engine does not start	Engine starts but stops soon afterward	Engine idling is not stable	Acceleration is poor	Engine speed is abnormally high	Engine speed is abnormally low	Boat speed does not increase	Engine overheats
Outboard motor is out of fuel	O	O						
Fuel lines are not properly connected	O	O	O	O		O	O	O
Air is sucked into fuel line	O	O	O	O		O	O	O
Fuel hose is twisted	O	O	O	O		O	O	O
Air vent is open	O	O	O	O		O	O	O
Fuel filter, fuel pump or carburetor is clogged	O	O	O	O		O	O	O
Engine oil is of poor quality			O	O		O	O	O
Fuel is of poor quality	O		O	O		O	O	O
Mixture ratio of fuel oil is high			O	O		O	O	
Mixture ratio of fuel oil is low						O	O	O
Excessive fuel is sucked in	O			O				
Carburetor is not properly adjusted	O	O	O	O		O	O	O
Recirculation pipe is broken	O	O	O	O			O	O
Spark plug of different specifications is used		O	O	O		O	O	O
Spark plug is fouled	O	O	O	O		O	O	
Spark plug is faulty	O	O	O	O		O	O	
Insufficient amount of cooling water is supplied						O	O	O
Thermostat does not operate properly			O					O
Caviation occurs				O	O		O	O
Improper propeller is selected				O	O	O	O	O
Propeller is broken or damaged				O	O	O	O	O
Thrust rod is not properly positioned				O	O		O	
Cargo is loaded in improper position				O	O	O	O	
Transom height is not proper				O	O	O	O	O
Stop switch is short-circuited	O					O	O	
Throttle link is not properly adjusted	O		O	O		O	O	
Ignition timing is not properly adjusted	O	O	O	O		O	O	O
Battery is discharged or fuse is blown	O							

IV. REMOTE CONTROLS

Single Remote Control Model is an easy-to-operate and reliable single lever system.

(1) Single Remote Control Fitting Part Assembly is provided in kit form, with remote control box. Prepare the appropriate remote control cable to the hull by measuring the remote control installing lenghth and the length required for the operation of engine.

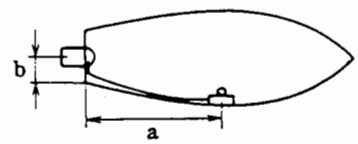


Fig. 116 (a + b)

- The reference for measurement of remote control cable

(2) Check the number of parts for the kit in advance before installing the remote control. (Fig. 121)

(3) Hull side (Driver's side)

1) Install the control box on the right side of the driver. (Fig. 117)
2) Securely install with wood screws in positions where the control lever can be easily operated. (Fig. 118)
3) Fix the remote control cable to the hull with as little bending as possible.

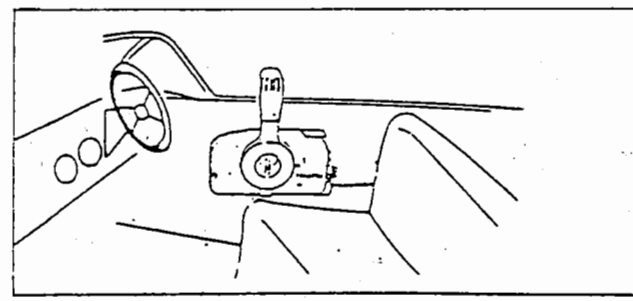
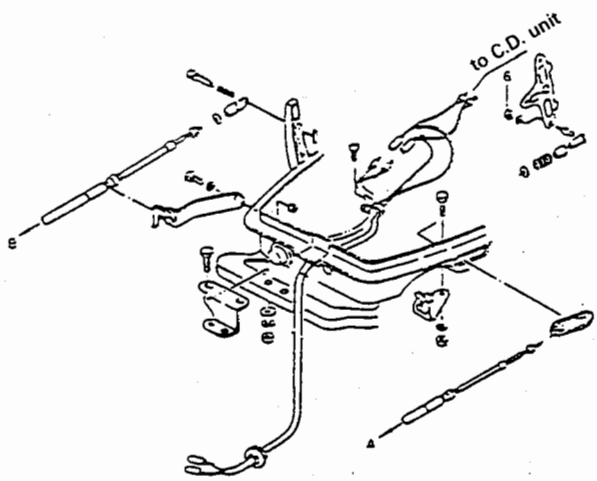
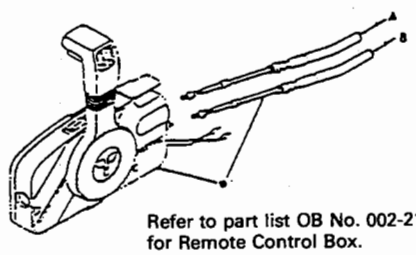


Fig. 118 Installing the remote control box and cable

OPTIONAL PARTS (1) REMOTE CONTROL





Refer to part list OB No. 002-21024-0 for Remote Control Box.

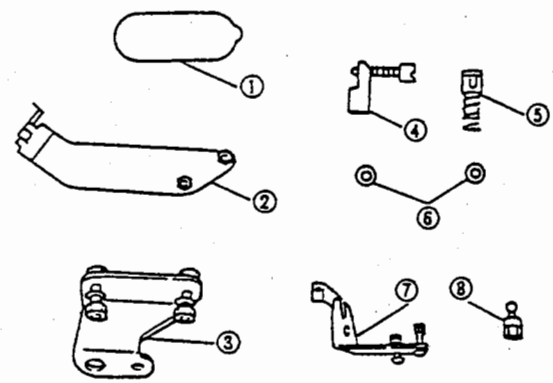
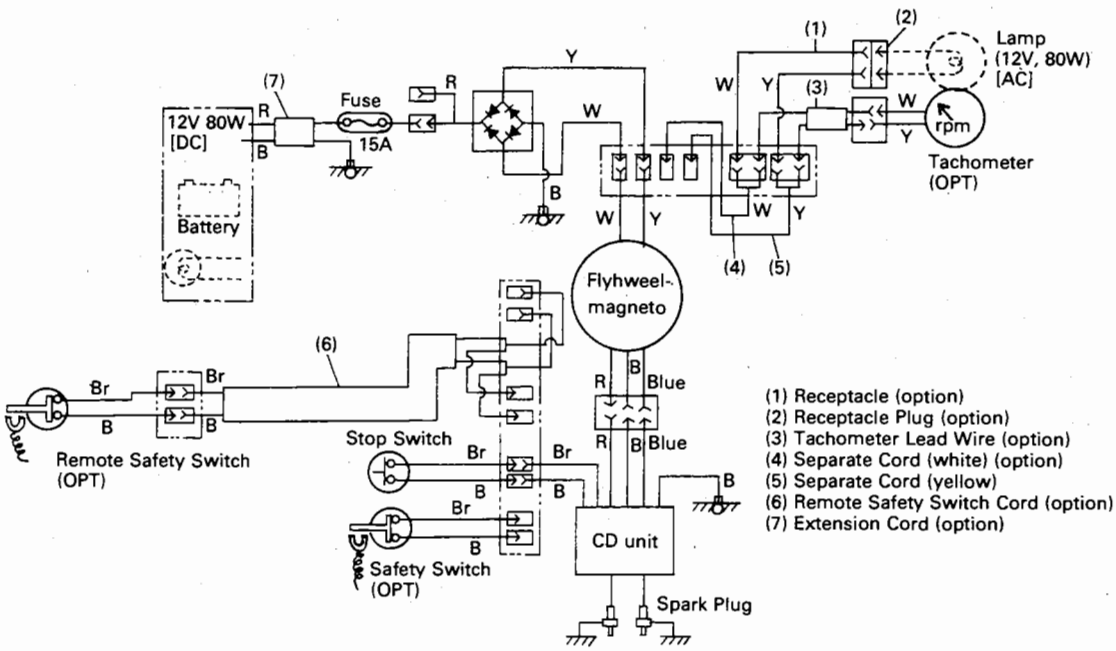


Fig. 117
Attaching parts on engine side

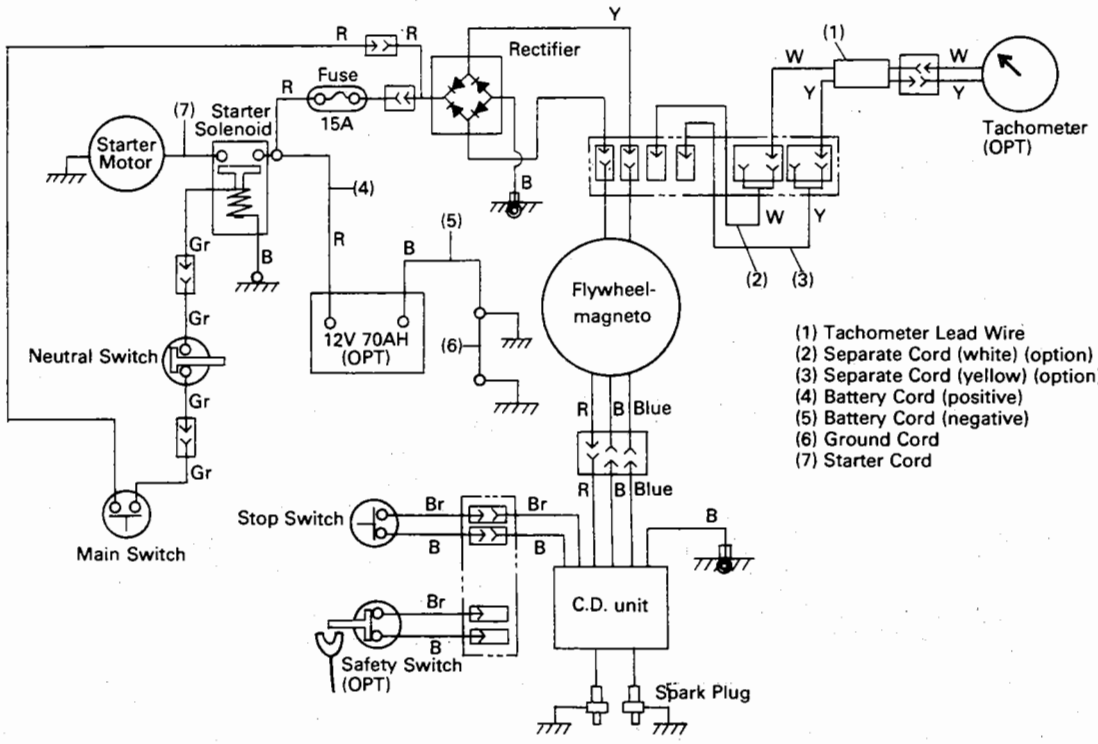
(1) Cable grommer on throttle side
(2) Clutch cable clip assembly
(3) Steering hook
(4) Sleeve B guide assembly
(5)Ball holder assembly
(6) Washer
(7) Throttle cable clip assembly
(8) Ball joint assembly

V. WIRING DIAGRAM

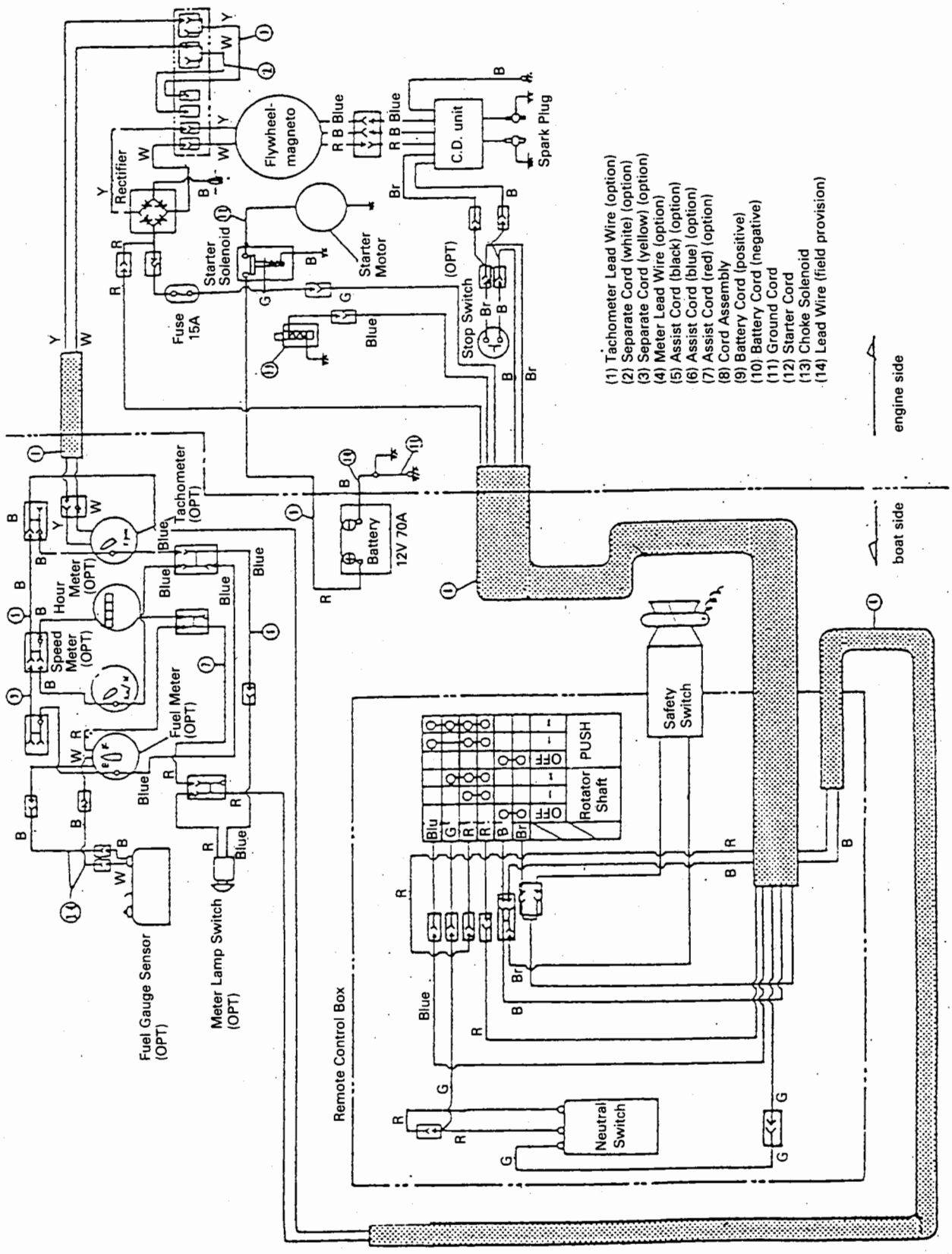
$M25C_2$ / $M30A_3$



$M25C_2$ EF / $M30A_3$ EF



M25C$_2$ EP / M30A$_3$ EP



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