TOHATSU OUTBOARD MOTOR

M40D/M50D

SERVICE MANUAL

MAR 1991

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1 SPECIFICATIONS

Item			Model	M40D M / M50D M	M40D EFO / M50D EFO	M40D EPO / M50D EPO	M40D EPTO / M50D EPTO
Dimensions	Total length	mm		Approx. 1,107 (43.6 in.)		Approx. 630 (24.8 in.)	
	Total width	mm		Approx. 381 (15 in.)		Approx. 340	Approx. 355
	Total height	mm	S	Approx. 1,225 (48.2 in.)		Approx. 1,192 (46.9 in.)	
			L	Approx. 1,352 (53.2 in.)		Approx. 1,319 (51.9 in.)	
			XL	Approx. 1,479 (58.2 in.)		Approx. 1,446 (56.9 in.)	
	Transom height	mm	S	403 (15.87 in.)			
			L	530 (20.87 in.)			
			XL	657 (25.87 in.)			
Weight		kg	S	67.5 (148.8 lbs)	73.5 (162 lbs)	69 (152.1 lbs)	76 (167.5 lbs)
			L	69 (152.1 lbs)	75 (165.3 lbs)	70.5 (155.4 lbs)	77.5 (170.9 lbs)
			XL	70.5 (155.4 lbs)	76.5 (168.7 lbs)	72 (158.7 lbs)	79 (174.2 lbs)
Performance	Max. output kW (ps)		M40D	29.82 (40)/5,000 RPM			
			M50D	37.28 (50)/5,500 RPM			
	Full speed operation range		M40D	4,500—5,500 RPM			
			M50D	5,000—5,700 RPM			
	Fuel consumption at full throttle		M40D	Approx. 17 liters/hr. (4.49 gals./hr)			
			M50D	Approx. 21 liters/hr. (5.17 gals./hr)			
Engine	Number of cylinder			3			
	Bore & stroke	mm		68 × 64 (2.68 in. × 2.52 in.)			
	Displacement	cc		697 (42.53 in^3)			
	Lubrication			manual mixing in fuel tank	auto mixing		
	Fuel			Premium (super) gasoline with a pump posted octane rating of over 89 (research octane rating of 91)			
	Engine oil			Tohatsu 2-cycle Engine oil: SUPER GOLD			
	Engine oil mixing ratio			Breaking-in 25:1 After breaking-in 50;1	50:1 to 120:1		
	Oil tank			—	Integral tank (2 liters, 0.53 gals.)		
	Cooling system			Pressurized cooling (by rubber impeller)			
	Water temperature control			Thermostat (with pressure relief valve)			
	Intake system			Reed valve			
	Scavenging system			Schnürle 5 ports			
	Starting system			recoil hand starter	recoil hand starter and electric starter motor	electric starter motor (12 V 0.6 kW)	
	Battery				12V 70AH	12V 70AH	
	Ignition system			Pointless CD ignition type magneto			
	Ignition timing control system			Mechanical control			
	Firing order			1—2—3			
	Alternator			—	12V 11A (12V 130W)		
	Rectifier			—	Single phase full wave rectification with voltage regulator		
	Spark plugs		M40D	NGK B7HS-10 or CHAMPION L82C (gap 1 mm)			
			M50D	NGK B8HS-10 or CHAMPION L78C (gap 1 mm)			
	Number of carburetors			3			
	Engine rotation			Clockwise			
	Ignition timing		M40D	ATDC 3°—BTDC 18°			
			M50D	ATDC 3°—BTDC 24°			
	Trolling speed			650—700 RPM			

Item		Model	M40D M / M50D M	M40D EFO / M50D EFO	M40D EPO / M50D EPO	M40D EPTO / M50D EPTO
Lower unit	Number of trim stage (degree)		6 (4°—24°)			5 (8°—24°)
	Tilt up angle (degrees)		75°			
	Trim angle running in shallow water		33.5°			adjusting by Power Trim & Tilt
	Max. steering angle (degrees)		80°			70°
	Power trim and tilt		—			Manifold type single cylinder
	Shift system		Dog clutch (F—N—R)			
	Gear ratio		13:24			
	Exhaust system		Through the propeller hub			
	Transom board-recommended thickness		31—70 mm (1.22—2.75 in.)			
Other	Operation		Steering bar handle		Remote control	
	Fuel tank		22.7 liters (6 US gals.)			
	Standard propeller (no. of blades × diameter × pitch in inch)		S and L transom : C12.5 (3 × 11.3 × 11.5) XL transom : C12 (3 × 10.6 × 11.7) } (M40D)			
			S and L transom : C13.5 (3 × 11.0 × 12.4) XL transom : C12.5 (3 × 11.3 × 11.5) } (M50D)			
	Tachometer		—		poles selecting type with low oil level warning lamp	
	Trim meter		—			Standard equipment
	Remote control box		—		RC5B single lever	RC5A single lever
					with: * warning buzzer (low oil level) * neutral lock * neutral switch * safety switch * lever friction * terminal for accessory	
	Safety features		• High speed ESG (over-running prevention device) • Middle speed ESG (requires optional over heating sensor thermostat)			
			—	Low oil level warning lamp	Low oil level warning lamp and buzzer	
			—			PT/T assembly equipped with a shock absorber for when lowering the power unit. (outboard motor)

2 PRECAUTIONS DURING DISASSEMBLY AND RE-ASSEMBLY

① Secure the outboard motor to a work stand during repairs.
② Be careful not to damage the painted surfaces or the adjacent faces of the cylinders and crank cases, etc.
③ After disassembly, replace the packing, gaskets, "O" rings, oil seals, spring pins, split pins and carburetor locking plates.
Replace defective snap rings.
④ Always replace parts with genuine Tohatsu parts, and use Tohatsu gear oil.
⑤ Always use the proper special tools and follow the correct procedures.
⑥ Pay special attention to the marking on the parts when disassembling, and make simple identification marks on un-marked parts to make reassembly easier.
⑦ Clean disassembled parts and inspect for wear and damage.
⑧ When reassembling, pay careful attention to details such as the precise fitting parts, airtightness, obstruction of oil and grease supply holes, packing, wiring and piping.
For parts which require many nuts and bolts systematically tighten diagonally opposite nuts and bolts starting with large gauge bolts and ending with small gauge bolts. Work from the inside to the outside to ensure the bolts are tightened securely.
⑨ When inserting oil seals, be careful not to damage the lip and make sure the seals is in the proper direction.
Apply only specified grease to the lips.
⑩ When applying liquid packing material, be careful to use the proper thickness and quantity.
If the quantity is too great, the excess may overflow or seep into the case and cause adverse effects.
Read the directions carefully before using adhesives.

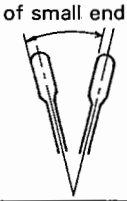
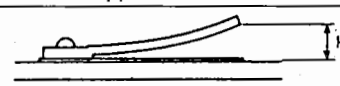
3 SERVICING DATA

1. Standard Values

Part		Item	Standard Value, Type, Number, etc.	
Engine	Piston	Max. diameter (external diameter measured 12 mm above the lower edge of the piston skirt) Piston clearance	67.96 ± 0.01 mm (2.676 ± 0.0003937 in.) 0.03 to 0.07 mm (0.0018 to 0.00276 in.)	
	Piston ring	Ring gap top ring second ring	 0.22 to 0.37 mm (0.00866 to 0.0146 in.) 0.33 to 0.48 mm (0.013 to 0.0189 in.)	
	Crank shaft	Deflection	Within 0.05 mm (0.00199 in.) with both ends of crank shaft supported	
	Reed valve stopper	Lift height M40D M50D	6.5 to 6.7 mm (0.256 to 0.264 in.) 9.3 to 9.5 mm (0.366 to 0.374 in.)	
	Connecting rod	Gap between the connecting rod thrust washer and the crank web. (ie the freeplay at small end of connecting rod.)	0.28 to 0.65 mm (0.011 to 0.0256 in.)	
	Engine block	Compression (Measured at full throttle on a warm engine. All spark plugs should be removed during measurement.)	803.6 kPa (8.2 kg/cm², 116.63 P.S.I)	
Fuel	Carburetor		M40D	M50D
		Setting Mark	3C8	3E3
		Venturi Diameter	22 mm	26 mm
		Main jet (MJ)	#120	#130
		Main air jet (MAJ)	#210	#230
		Main nozzle	φ3.2 mm	φ4.0 mm
		Slow jet	#60	#74
		Slow air jet	#130	#130
		Pilot screw (turn counter-clockwise)	2-1/2±3/4	2-3/4±1/4
		Choke valve leak hole area	approx. 36 mm²	approx. 60 mm²
		Trolling speed	650 to 700 rpm	
Cooling system	Thermostat	Temperature at which the thermostat starts to open:	60°C	
		Temperature at which the thermostat opens fully	70°C	
Drive system	Bevel gear	Backlash between gear A and gear B	0.08 to 0.16 mm (dial gauge reading 0.31 to 0.62 mm)	
Electrical parts	Magneto	Ignition timing	ATDC 3°±1° ~ BTDC 18°±1°	ATDC 3°±1° ~ BTDC 24°±1°
		Spark performance at 500 rpm (measured with Tohatsu spark tester)	10 mm (0.394 in.) and over (at 500 r.p.m.)	
		Lighting coil output	12V 130W	
		Battery charging rate	3A and over at 1,500 rpm 9 to 11A at 5,500 rpm	
		Lighting coil resistance	0.32 to 0.48Ω (ohm)	
		Pulser coil resistance	161.5 to 220Ω (ohm)	
		Charge coil resistance	530 to 720Ω (ohm)	
	Ignition coil	Primary coil resistance Secondary coil resistance	0.179 to 0.242Ω (ohm) 2.72 to 3.68 kΩ (kilo-ohm)	
	CD unit	High speed ESG (cut-in-speed)	5,900 rpm	
		Low speed ESG (requires optional over heating thermostat)	3,500 rpm	
	Starter motor	Battery	12V 70AH to 12V 100AH	
		Output	12V 0.6 kW	
		Clutch	Over revolving clutch	
		Brush length (wear limit)	12.5 mm (9.5 mm)	
		Armature under cut (wear limit)	0.5 to 0.8 mm (0.2 mm)	
		Comutator outer dia. (wear limit)	30 mm (29 mm)	
	Rectifier	Conductivity	One-way	
	Fuse	Rating	20A	

Part		Item	Standard Value, Type, Number, etc.
Power trim & tilt	Pump assembly	Tilt-up side relief valve opening pressure	13,728.7 to 16,670.6 kPa (140 to 170 kg/cm²) (199.08 to 241.7 p.s.i)
		Tilt-down side relief valve opening pressure	1,961.2 to 3,334.1 kPa (20 to 34 kg/cm²) (28.44 to 48.35 psi)
		Spool check valve upper chamber opening pressure	235.3 kPa (2.4 kg/cm², 3.41 psi)
		Spool check valve lower chamber opening pressure	117.7 kPa (1.2 kg/cm², 1.71 psi)
		Oil capacity Recommended oil	550 cc, 18.6 pt. NIHON SEKIYU ATF DEXRON
	Tilt cylinder	Shock absorber valve opening pressure	3432 to 5.393 kPa (35 to 55 kg/cm²) (49.8 to 78.3 psi)
		Piston outer diameter Piston rod diameter Piston stroke	54 mm (2.13 in.) 16 mm (0.63 in.) 141 mm (5.55 in.)
	Motor	Time to tilt up or tilt down Voltage Output Rotation	60 seconds DC 12V 0.4 kW clockwise, counter-clockwise

2. Repair limits

Part	Repair Item	Repair Limit	Correction Procedure/Precision
Spark plugs	Plug gap	1.2 mm (0.0472 in.) or greater	0.9—1.0 mm (0.0354—0.0397 in.) Replace, if electrode wear is extreme.
Cylinder (cylinder head)	Adjacent faces of cylinder and cylinder head	When depth of scratches on or distortion of contacting surfaces is 0.03 mm (0.00118 in.) or greater.	Repair on a fraise or surface table with #240 to #400 emery paper so that no gas leaks.
	Scratch or wear of cylinder lining	When there are deep scratches or scuffing in the cylinder linings which cannot be repaired with #400 to #600 emery paper or when the difference between the maximum and minimum wear is 0.06 mm (0.000236 in.) or greater.	Re-bore or hone ±0.01 mm Pay attention to the ports chamfer. Re-chamfer if insufficient. Use oversized piston and piston ring after re-boring or honing.
Piston ring	Piston ring end gap	1 mm (0.0394 in.) or greater	Replace. Cylinder liner wear must be within service limit.
Connecting rod	Deflection of small end 	2 mm (0.0787 in.) or greater	Replace crank shaft assembly.
Crank shaft	Crank shaft deflection	0.05 mm (0.00197 in.) or greater with both ends supported	Less than 0.05 mm (0.00197 in.) with both ends supported
Reed valve stopper	Lift height (H)	 M40D: Other than H = 6.5 ~ 6.7m (0.256 ~ 0.264 in.) M50D: Other than H = 9.2 ~ 9.4m (0.362 ~ 0.370 in.)	M40D: Repair to H = 6.5 to 6.7 mm M50D: Repair to H = 9.3 to 9.5 mm Replace, if deformation is large.
Reed valve	Ineffective sealing, wear, damage	Excessive wear or damage of the valve seat surface.	Replace the entire set.
Pump impeller, liner, guide plate	Wear or cracking of lips	Wear, cracking or damage to the outer tip and surface of the lips.	Replace the entire set.
Oil seal	Irregular noise, damage	Wear, deterioration, damage of the lip or if the difference between the inner diameter and outer diameter of shaft at the lip becomes less than 0.5 mm (0.0197 in.).	Replace.
Engine block	Compression •Measure at full throttle after warming up engine. •Remove 3 spark plugs.	When the difference in compression between cylinders is extremely high.	Replace with over size piston after boring or honing or replace the block.
		When the compression is much higher than the standard value.	Remove carbon from the piston crown and cylinder head. Clean exhaust by-pass.
Propeller shaft	Damage to bearings	Shaft, wear at propeller thrust holder, is of 0.15 mm (0.0059 in.).	Replace.
	Oil seal in the propeller shaft housing	Wear, deterioration, damage of lip or if the difference between the inner diameter and outer diameter at lip becomes less than 0.5 mm (0.0197 in.).	Replace.

4 PERIODIC INSPECTION

Item	Inspection point	Initial 10 hours or 2 weeks	Initial 30 hours or 1 month	Initial 50 hours or 3 months	Initial 100 hours or 6 months	Remarks
1. Checking torque	• Cylinder head bolts • Cylinder head cover bolts • Exhaust cover bolts • Carburetor setting nuts • Intake manifold bolts • Crank case bolts • Oil pump setting screw • Magneto nut • Starter motor installation bolts • Drive shaft housing bolts • Gear case bolts • Propeller shaft housing bolts • Propeller nut • Lower mounting rubber bolt	○	○			Refer to torque table. (page 27)
2. Gear oil	• Check for water and foreign matter when changing or adding gear oil. • Check gear case when water, foreign matter or abnormality in supplying oil is found.	○ change	○ add			Change: every 200 hours or once a year before long term storage Check: after long term storage
3. Spark plug	• Check plug gap. • Remove dirt and carbon deposits.	○	○			M40D: NGK B7HS-10 CHAMPION L82C (gap 1 mm) M50D: NGK B8HS-10 CHAMPION L78C (gap 1 mm)
4. Fuel system	• Discharge water and clean the: fuel tank, fuel pipes, fuel filter, fuel connector, fuel pump. • Check for fuel leakage, air in the system and damaged pipe clips, etc.	○	○			Fuel pipes must be replaced every two years.
5. Carburetor	• Remove all dust and water. Clean with a non-flamable cleaner using compressed air. • Check float valve for wear.				○	Replace worn float valves with one from a carburetor repair kit.
6. Grease	• Propeller shaft • Bracket bolts • Steering shaft • Manual tilt system • Drag link • Sliding portion of the steering handle • Sliding portion of the manual clutch • Gear shift link • Throttle link • Carburetors • Ball joints caps • Starter motor pin • Hook lever in lower motor cover			○		Refer to "Sealing agents, Adhesive and Lubricants." (page 12 ~ 14)
7. Compression	• Check with compression gauge.			○		Check at full throttle on a warm engine.
8. Water filter	• Check the water filter for deposits.	○				

Item	Inspection point	Initial 10 hours or 2 weeks	Initial 30 hours or 1 month	Initial 50 hours or 3 months	Initial 100 hours or 6 months	Remarks
9. Cooling system	• Remove deposits and dirt from the: water pump, impeller, water pipe, cylinder, cylinder head, head cover, thermostat, exhaust cover, engine base and exhaust pipe.				○	Replace worn or damaged parts with parts from a water pump repair kit.
10. Carbon deposits	• Cylinder head • Piston crown • Piston ring groove • Exhaust gas passages (including exhaust by-pass) • Inner exhaust cover • Engine base • Exhaust pipe					Check every 200 hours. Do not score the cylinder head, piston crown or ring grooves when cleaning.
11. Wiring	• Loosen connections • Frayed or severed wires • Damaged insulation	○			○	
12. Ignition timing, throttle link	• M40D: ATDC 3° ± 1° ~ BTDC 18° ± 1° M50D: ATDC 3° ± 1° ~ BTDC 24° ± 1° • Loosen ball joint caps and locking nuts. • Bent link rods. • Loosen rod snap	○	○			Change with new if looseness in ball joint cap and rod snap.
13. Throttle wire	• Loosen wire				○	
14. Trolling speed adjustment	• Check trolling speed with the tachometer (to be checked on a warm engine).	○	○			
15. Lubrication system	• Clean the oil tank, oil pipe, filter and check valve to remove dirt and water. • Check for oil leakage and damage and unproper clipping.	○			○	Change the check valve in every two years.
16. Anode: trim tab, cylinder head, power trim & tilt	• Check for corrosion and wear. Replace if the anode is worn by 1/3 or more.	Every time before use			○	Change anodes every year.
17. Cooling system check	• Check the condition of the discharged water through the inspection port. • Inspect the water intake port vinyl (water filter) for deposits of dirt and foreign particles.	Every time before use				
18. Steering handle	• Check the throttle for ease of movement, free play and correct installation.	Every time before use				
19. Manual Clutch	• Check for ease of operation, free play, correct installation and functioning of forward, neutral and reverse.	Every time before use				
20. Reverse lock	• Check operation and for correct installation.	Every time before use				
21. Starter lock	• Inspect for flaws and damage.	Every time before use				
22. Remote control box	• Check operation of key switch, safety switch, accelerator lever, control valve and buzzer.	Every time before use				

Item	Inspection point	Initial 10 hours or 2 weeks	Initial 30 hours or 1 month	Initial 50 hours or 3 months	Initial 100 hours or 6 months	Remarks
23. Drag link	• Check for loose nuts and bolts, free play and re-grease.	Every time before use				
24. Engine mounting bolts	• Check for loose nuts and bolts.	Every time before use				

Power trim & tilt

Item	Inspection point	Initial 10 hours or 2 weeks	Initial 30 hours or 1 month	Initial 50 hours or 3 months	Initial 100 hours or 6 months	Remarks
1. Oil leakage	• Check visually. • For small leaks operate the PT/T assembly and check for oil floating on the water. • Loosen oil plug.	○		○		Oil leakage must be checked for when taking delivery, every 200 hours and before every season.
2. Lower cylinder pin	• Check torque.					Check the torque when taking delivery, every 200 hours and before every season.
3. Piston rod alignment Upper - cylinder alignment	• Visual inspection					At time of delivery. Every 200 hours or every season. After an accident.
4. • Oil level • Recommended oil • Bleeding air	• The oil level should reach the oil plug hole when the engine is tilted up with the piston rods fully extended. • When the oil level is low and oil is added be sure to bleed the air and recheck the oil level. • As troubleshooting CH 12 • As troubleshooting CH 11 • See pages 55.					At time of delivery. Every 10 hours or every month. Every 50 hours or every 3 months. Every 200 hours or every season.
5. Manual valve operation	• Open the manual valve and manually move the motor up and down.					At time of delivery. Every 200 hours or every season.
6. Power trim and tilt	• Check the trim and tilt for functioning in shallow water.					Before use.
7. Power trim and tilt grease of upper cylinder pin	• Use Tohatsu grease					Every 50 hours or every 3 months

5 SEALING AGENTS ADHESIVES AND LUBRICANTS

Item \ Sealing Agents Adhesives Lubricants	1342 3M	1373B 3M	G17 3M	1741 3M	1104I 3M	Insulating grease	Low temperature standing grease	Tohatsu grease	Cup grease	Tohatsu engine oil	Tohatsu gear oil	Silicon-oil compound	Automatic transmission fluid	Remarks
Piston										○				Ring groove, piston pin hole, outer of piston
Piston pin										○				Outer surface
Piston rings										○				
Cylinder linings										○				Inner wall
Small end bearings										○				Rotating part
Big end bearings										○				Rotating part
Main bearings										○				Rotating part
Big end bearing washer										○				
Labyrinth seal O-ring							○							
Upper main bearing oil seal							○							Lip
Crank case head "O"-ring										○				
Crank shaft lower oil seal							○							Lip
Drive shaft oil seal							○							Lip
Oil pump drive gear										○				
Oil pump driven gear										○				
Adjacent faces of the cylinder and crank case					○									Take care to apply the correct thickness of grease.
Guide plate							○							Sliding part
Set ring		*○					○							Sliding part *Threaded portion of ball joint
Spark plug cap												○		Spark plug socket high tension cord
Advancer arm							○							Sliding part
Throttle cam							○							Sliding part
Shift arm							○							Sliding part
Ball joint cap							○							Sliding part
Cable joint (for clutch arm)								○						Sliding part
Over heating sensor												○		**
Starter motor						○①		○②						
Starter solenoid						○								Two terminals
Power trim & tilt solenoid switch						○								Six terminals
Starter case							○							
Bushing							○							
Starter spring							○							
Friction plate							○							
Friction spring							○							
Starter reel fitting bolt	○													
Steering handle grip								○						
Steering handle bushing A								○						

** Fill between sensor and cylinder.

① On terminals ② Thinly on pinion

Item \ Sealing Agents Adhesives Lubricants	1342 3M	1373B 3M	G17 3M	1741 3M	1104I 3M	Insulating grease	Low temperature standing grease	Tohatsu grease	Cup grease	Tohatsu engine oil	Tohatsu gear oil	Silicon-oil compound	Automatic transmission fluid	Remarks
Steering handle bushing B								○						
Steering handle fitting washer								○						
Steering handle fitting wave washer								○						
Throttle shaft bushing								○						
Shift lever shaft bushing								○						
Seal ring								○						
Wave washer								○						
Shift lever stopper								○						
Manual choke lever								○						Sliding portion
B gear nut	○													Apply to the threaded portion after degreasing.
Propeller shaft housing								○						Inserted portion
Ditto "O"-ring								○						
Propeller shaft oil seal														Lip
Propeller shaft								○						Spline
Propeller stopper								○						Tapered portion
Propeller thrust holder								○						Inserted portion
Lower water pump case								○						Inseted portion
Lower water pump case O-ring								○						
Lower water pump case oil seal								○						Lip
Pump case fitting bolt								○						Bolt shaft
Water tube								○						Upper part
Water tube upper seal rubber											○			Inner
Water tube lower seal rubber			○③								○④			
Water tube guide rubber								○						Outer and inner
Pump case								○						Apply it thinly to the inner portion (inside).
Engine base sealing rubber				○										
Exhaust housing grommet			○ or ○											Fitting portion
Splash cover fitting bolt								○						Bolt shaft
Splash cover grommet				○										To be adhered to the splash plate
Trim tab fitting bolt								○						
Drive shaft							○							Engine side splined portion
Cam rod bushing									○					Surface
Cam rod O-ring 2.4—5.9											○			
Cam rod O-ring 3.5—21.7									○					
Cam rod stopper bolt									○					Bolt shaft
Gear oil											○			Approx. 500 cc, 1.06 pt.
Gear case bolt									○					Bolt shaft
Extension housing bolt									○					Bolt shaft

③ To be applied to pump case ④ Inner face

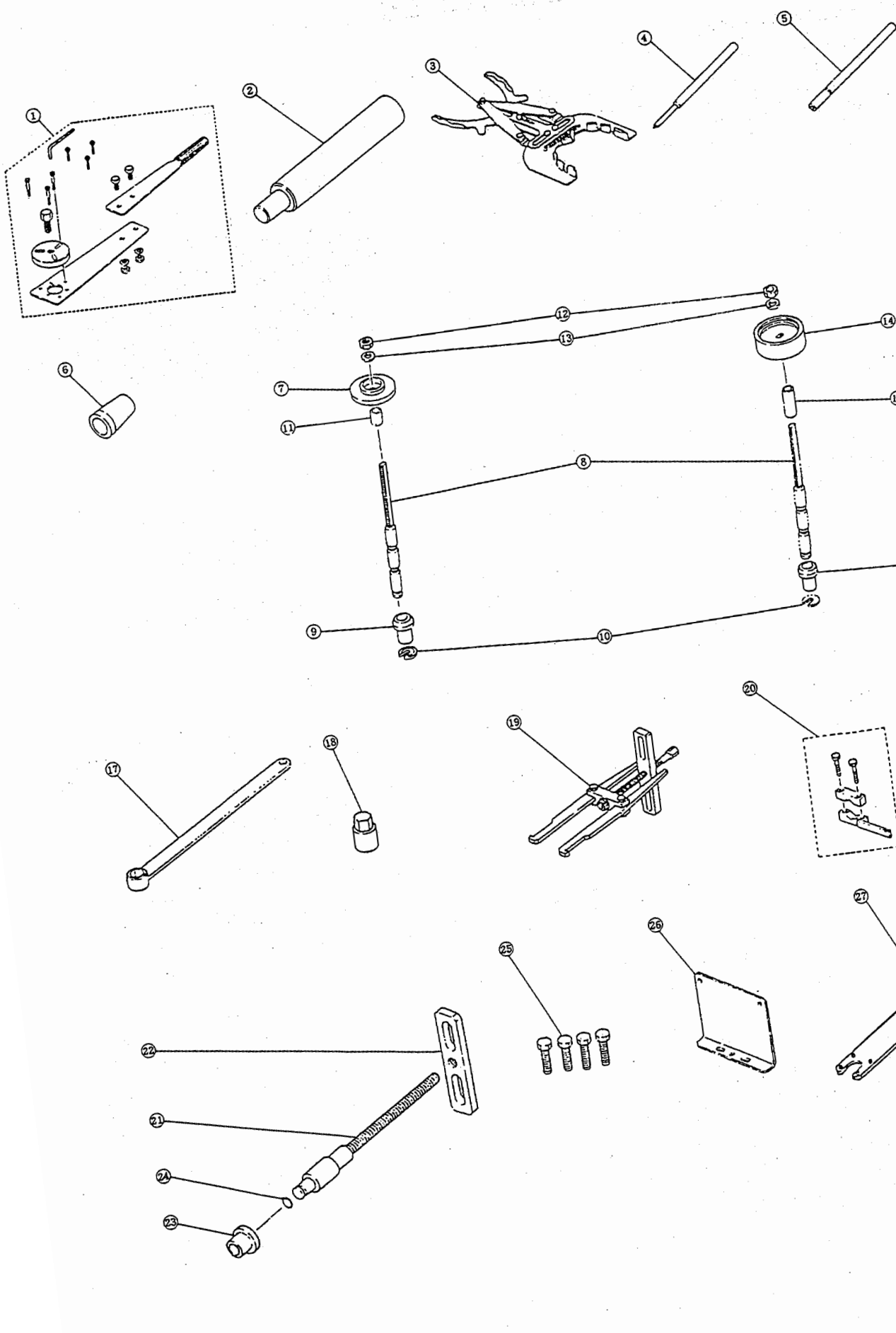
Item \ Sealing Agents Adhesives Lubricants	1342 3M	1373B 3M	G17 3M	1741 3M	1104I 3M	Insulating grease	Low temperature standing grease	Tohatsu grease	Cup grease	Tohatsu engine oil	Tohatsu gear oil	Silicon-oil compound	Automatic transmission fluid	Remarks
Propeller shaft housing bolt									○					Bolt shaft
Bracket bolt								○						Grease through the grease nipple, apply to the inner surface.
Bracket bolt cap								○						Inner surface
Stern bracket washer								○						Both faces
Swivel bracket								○						Grease through the grease nipple.
Steering shaft								○						Sliding part
Steering shaft bushing								○						Sliding part
Steering shaft sealing								○						
Thrust plate								○						Sliding part
Upper mounting bolt	○													Apply to the thread.
Mounting bracket								○						Spline
Tilt stopper								○						Sliding part
Filler lid hinge								○						Sliding part
Hook lever								○						Sliding part
Hook lever bushing								○						Sliding part
Hook lever seal ring								○						Sliding part
Upper motor cover seal rubber				○										Apply to adjacent surfaces.
Filler lid seal rubber				○										
Power trim and tilt upper cylinder pin								○						
Power trim and tilt lower cylinder pin								○						sliding part
Power trim and tilt assembling bolt								○						
Power trim and tilt sensor cam fitting bolt	○													Shaft of bolt
Tilt stopper knob of Power Trim and Tilt			○											
Power trim and tilt oil													○	Specified oil
Drag link										○				Sliding part
Remote control box										○				Sliding part
Tilt stopper knob				○										
Pump assembly O-ring										○				
Relief valves O-rings										○				
Spool valve and back-up ring										○				Outer surface of spool
Manual valve O-ring										○				
Cylinder O-ring, back-up ring, piston										○				
Piston rod assembly O-ring and buck-up ring										○				

Item		Initial torque			Final torque		
		N — m	kg — m	lb — ft	N — m	kg — m	lb — ft
Engine unit	Cylinder head bolt M8	②11.76 to 14.7	②1.2 to 1.5	②8.68 to 10.85	③23.5 to 25.5	③2.4 to 2.6	③17.35 to 18.8
	Cylinder head bolt M6	①1.96 to 2.94	①0.2 to 0.3	①1.45 to 2.17	④4.61 to 6.27	④0.47 to 0.64	④3.40 to 4.63
	Crank case bolt M8	11.76 to 14.7	1.2 to 1.5	8.68 to 10.85	23.5 to 25.5	2.4 to 2.6	17.35 to 18.8
	Exhaust cover bolt	3.92 to 5.88	0.4 to 0.6	2.89 to 4.34	7.84 to 9.8	0.8 to 1.0	5.78 to 7.23
	Magneto nut				88.2 to 107.8	9 to 11	65.07 to 79.53
	Spark plug				24.5 to 29.4	2.5 to 3.0	18.08 to 21.69
	Carburetor fitting bolt				4.61 to 6.27	0.47 to 0.64	3.40 to 4.63
Lower unit	Engine mounting bolt				18.62 to 20.58	1.9 to 2.1	13.74 to 15.18
	Bevel gear B nut				39.2 to 58.8	4 to 6	28.92 to 43.38
	Bracket nut				23.52 to 25.5	2.4 to 2.6	17.35 to 18.80
	Upper mounting rubber bolt				24.5 to 34.3	2.5 to 3.5	18.08 to 25.31
	Lower mounting rubber nut				34.3 to 44.1	3.5 to 4.5	25.31 to 32.54
	Gear case fitting bolt M8				18.62 to 20.58	1.9 to 2.1	13.74 to 15.18
	Propeller nut				29.4 to 39.2	3.0 to 4.0	21.69 to 28.92
Power trim & tilt	Lower pin nut				68.6 to 88.2	7 to 9	50.61 to 65.07
	Oil plug				2.94 to 4.9	0.3 to 0.5	2.17 to 3.62
	Manual valve				1.96 to 2.94	0.2 to 0.3	1.45 to 2.17
	Motor screw				1.57 to 2.16	0.16 to 0.22	1.57 to 1.59
	Motor assembly fitting bolt				4.9 to 6.86	0.5 to 0.7	3.62 to 5.06
	Oil pump fitting bolt				4.9 to 5.39	0.5 to 0.55	3.62 to 3.98
	Relief valve assembly (UP side)				11.76 to 13.72	1.2 to 1.4	8.68 to 10.12
	Spool check valve assembly				8.82 to 9.8	0.9 to 1.0	6.51 to 7.23
	Tilt locking guide				7.84 to 117.6	8 to 12	57.84 to 86.76
	Tilt piston rod nut				49 to 73.5	5 to 7.5	36.15 to 54.23
Other bolts and nuts	M4				1.27 to 1.76	0.13 to 0.18	0.94 to 1.30
	M5				2.65 to 3.53	0.27 to 0.36	1.95 to 2.60
	M6				4.61 to 6.27	0.47 to 0.64	3.40 to 4.63
	M8				11.17 to 15.09	1.14 to 1.54	8.24 to 11.13
	M10				12.74 to 30.58	1.30 to 3.12	9.40 to 22.56

Remarks:

7 SPECIAL TOOLS FOR DISASSEMBLY AND ASSEMBLY

No.	Part Number	Tool	Use
1.	3C7-72211-0	Flywheel puller kit	Detaching and re-attaching the flywheel
2.	345-72215-0	Piston pin tool	Detaching and re-attaching the piston
3.	353-72249-0	Piston ring tool	Detaching and re-attaching the piston rings
4.	345-72227-0	Spring pin tool A (d = 3)	Detaching spring pins
5.	345-72228-0	Spring pin tool B (d = 3)	Attaching spring pin
6.	345-72229-0	Clutch pin snap tool	Detaching and re-attaching the clutch pin snap
7.	3C8-72701-0	Needle bearing puller flange A	Gear case needle bearing, detaching and re-attaching needle bearings in the gear case and propeller shaft housing.
8.	346-72702-0	Needle bearing puller shaft	
9.	345-72705-0	Needle bearing puller guide A	
10.	345-72703-0	Needle bearing puller retainer	
11.	3C8-72704-0	Needle bearing puller shaft stopper A	
12.	346-72706-0	Nut	
13.	346-72707-0	Washer	
14.	346-72701-5	Needle bearing puller flange B	
15.	345-72705-5	Needle bearing puller guide B	
16.	3C8-72704-5	Needle bearing puller shaft stopper B	
17.	346-72231-0	Bevel gear B nut wrench	Detaching and re-attaching bevel gear B nut
18.	346-72232-0	Bevel gear B nut socket wrench	
19.	345-72224-1	Bevel gear A bearing puller assembly	Detaching bevel gear A bearing
20.	3B7-72720-0	Backlash measuring clamp assembly	Measuring bevel gear backlash
21.	345-72723-0	Backlash measuring shaft	
22.	3A3-72713-0	Bevel gear A bearing puller 3	
23.	353-72245-0	Backlash measuring collar	
24.	332-60002-0	O-rings	
25.	910191-0625	Bolt	
26.	3B7-72729-0	Dial gauge plate	
27.	3C8-72791-0	Tilt lock guide wrench	Detaching and re-attaching the power trim and tilt piston rod assembly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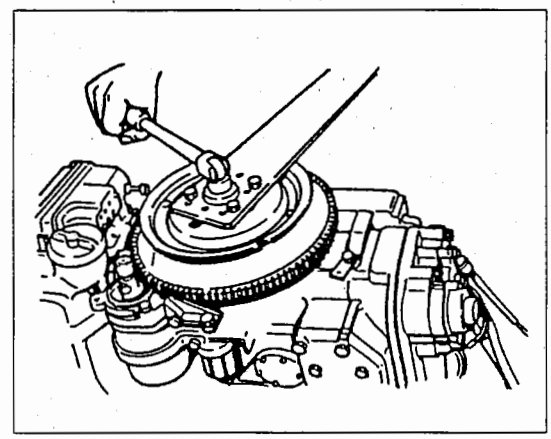
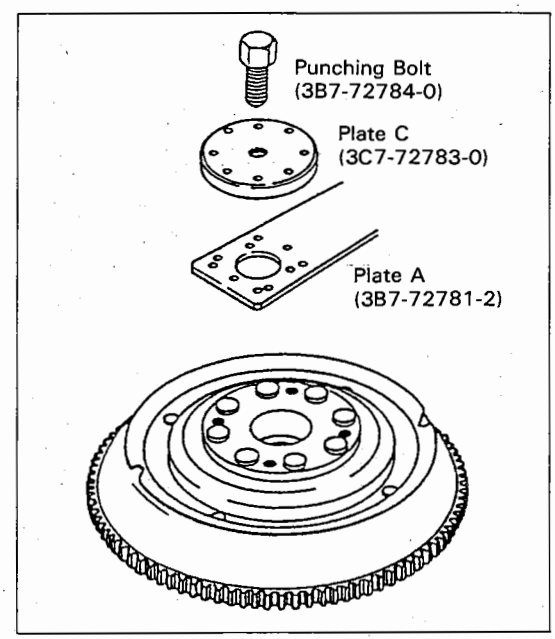
8 USE OF SPECIAL TOOLS

(1) Flywheel removal

a. Flywheel nut removal
Fix the flywheel puller assembly with the hexagonal holed bolts (M8 – 25) and remove the magneto with socket wrench 27.
NOTE: The magneto nut is turn clockwise to loosen.



b. Flywheel removal
Install the flywheel puller assembly (3B7-72214-0) to the flywheel, tighten with a 19 socket wrench, and remove the flywheel.

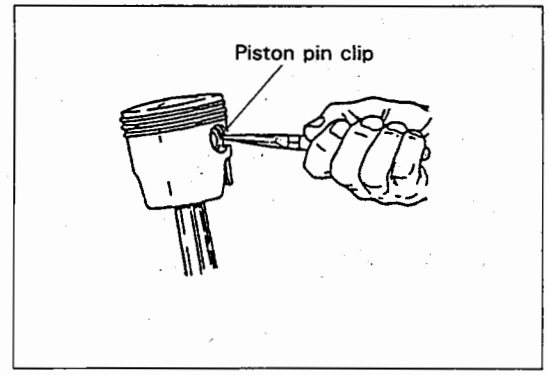


(2) Flywheel installation

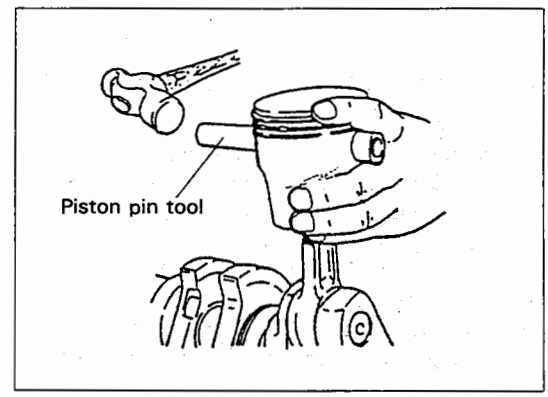
To install the flywheel magneto, first check that the magneto key is inserted. Then, install the flywheel, insert the magneto washer, and tighten the nut. Fix the flywheel puller assembly to the flywheel magneto and tighten to the specified torque (9—11 kg-m).
NOTE:
(i) Remove grease completely from the crank shaft and tapered section of the magneto.
(ii) Apply oil to the screw portion properly.

(3) Disassembly and re-assembly of the piston pin

a. Disassembly
Remove the piston pin clips from both ends.



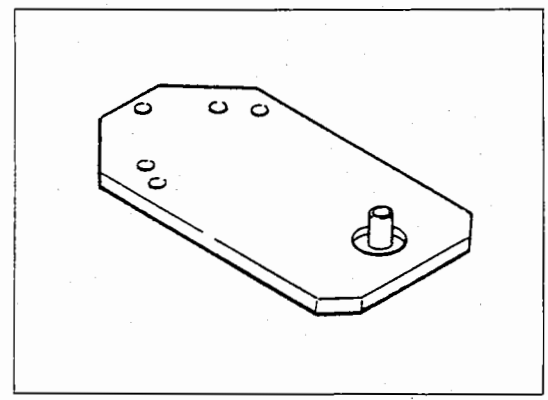
Place a piston pin tool (353-72215-0) against the piston pin and tap lightly with a hammer to remove. Hold the piston firmly taking care that the connecting rod is not bent.



b. Re-assembly
To insert the piston pin, insert the small end bearing into the connecting rod, insert the side washers into both sides, lightly tap on the tip of the piston tool with a hammer to insert, and finally install the piston pin clips.
(Always use new piston pin clips.)

(4) Power head stand

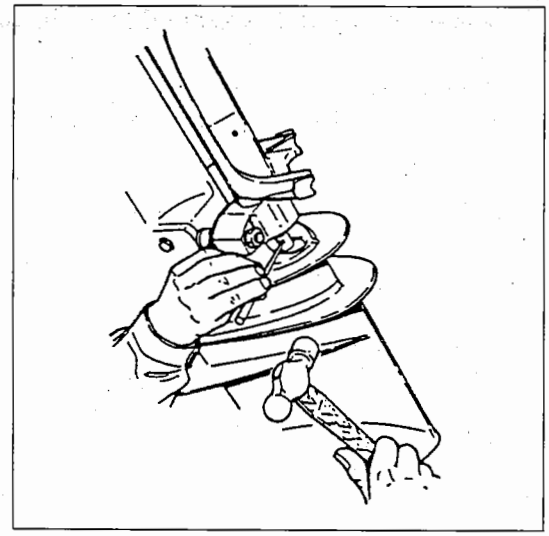
(353-72247-0, common for M70A$_2$)
Use the power head stand when removing the power unit from the outboard motor and always disassemble and re-assemble on a work bench.
Secure the power head stand in a vice, place the engine cylinder's installation surface on the stand and fix with M8 bolts.



(5) Spring pin tool

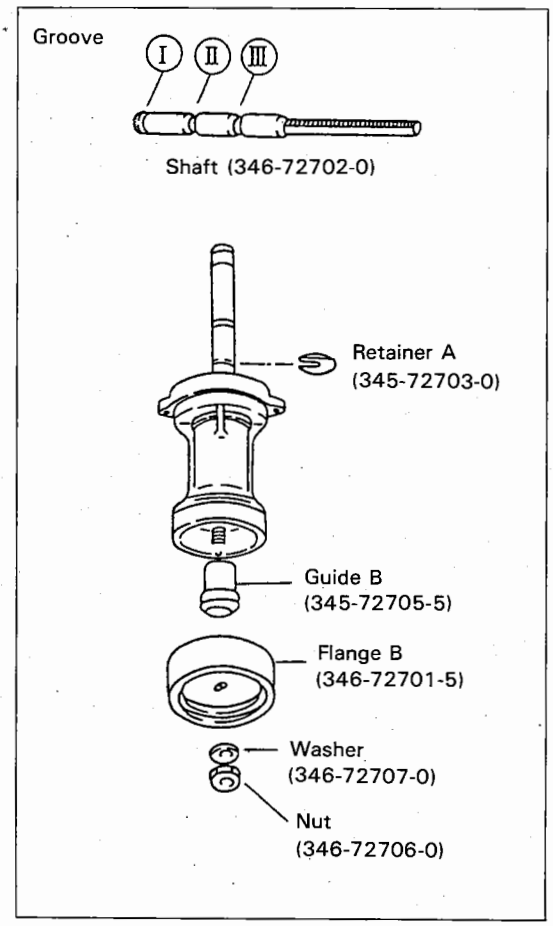
a. Use spring pin tool A (345-72227-0) to remove the spring pins.

b. Use spring pin tool B (345-72228-0) to insert new spring pins.
NOTE:
(i) Always replace spring pins which have been removed.
(ii) After mounting, set so the pins protrude by same amount.

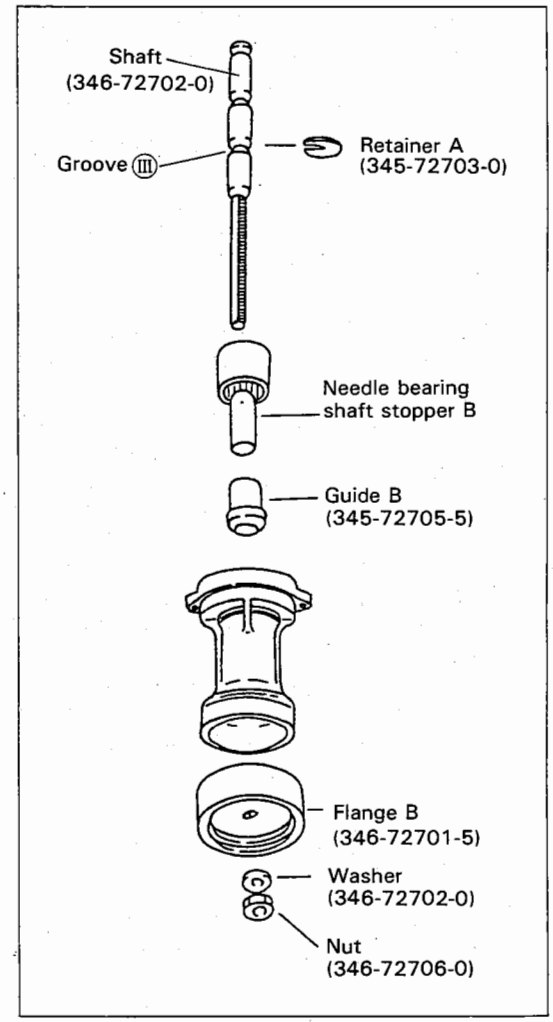


(6) Propeller shaft housing needle roller bearing puller

a. Needle roller bearing removal
1) Remove the oil seal from the propeller shaft housing.
2) Remove bearing C.
3) Insert the shaft (346-72702-0) into the needle roller bearing.
4) Insert the retainer (345-72703-0) into the shaft groove III with the raised surface of the retainer facing the bearings.
5) Attach the needle roller bearing guide B (345-72705-5) and the needle bearing puller flange B (346-72701-5) to the shaft.
6) Attach the washer (346-72707-0) and the nut (346-72706-0) on the shaft.
7) Turn the nut clockwise to remove the needle roller bearing.



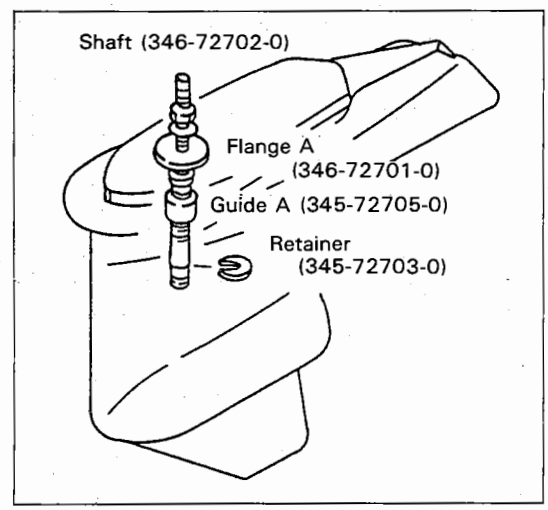
b. Needle roller bearing installation
   1) Insert the retainer A (345-72703-0) into shaft groove III.
   2) Pass the shaft through the needle roller bearing, the needle bearing shaft stopper B (345-72704-5) and guide B.
      Install the needle roller bearing so that the stamped surface is facing the retainer.
   3) Attach the washer and nut. Then tighten the nut until the needle bearing shaft stopper B touches flange B.

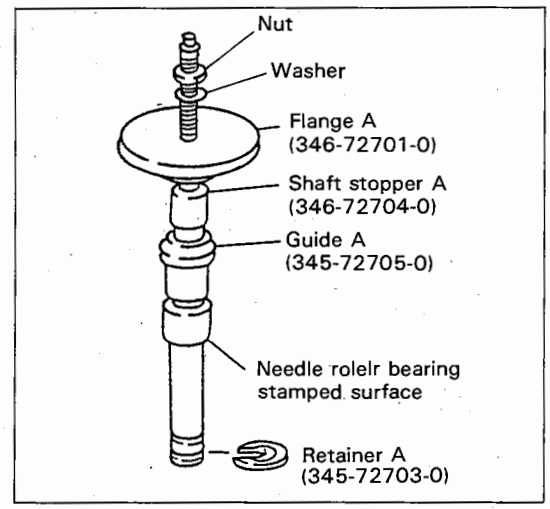


(7) Gear case needle roller bearing puller

a. Needle roller bearing removal
   1) Insert the shaft (346-72702-0) into the gear case.
   2) Insert the retainer A (345-72703-0) into groove I. Attach guide A (345-72705-0) and flange A (3C8-72701-0).
   3) Turn the nut clockwise to remove the needle roller bearing.

b. Needle roller bearing installation
   1) Insert the shaft (346-72702-0) into the gear case.
   2) Fit the needle roller bearing onto the shaft with its stamped surface downward. (The needle roller bearing should be passed through the propeller shaft port and fitted to the shaft from below.)
      Insert retainer A (345-72703-0) into groove I.
   3) Place guide A (345-72705-0) and shaft stopper A (346-72704-0) onto the shaft from above.
   4) Attach flange A, the washer and the nut to the shaft.
   5) Turn the nut clockwise until the shaft stopper A touches flange A.



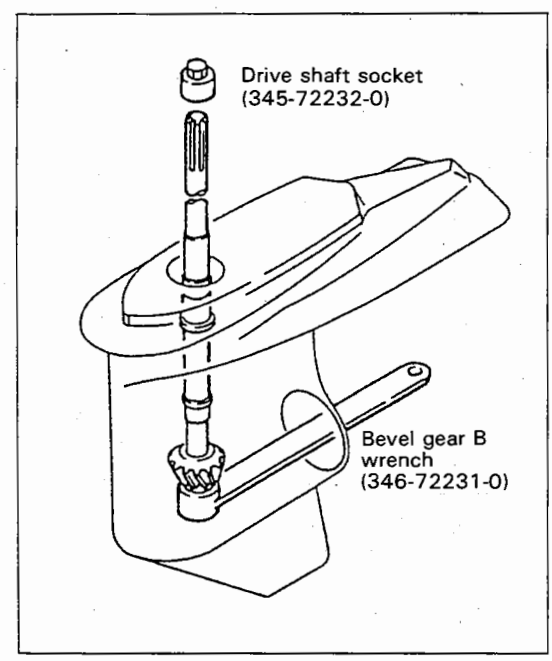


(8) Bevel gear B nut

a. Bevel gear B nut removal
   1) Hold the bevel gear B nut with the bevel gear B wrench (346-72231-0).
   2) Attach the drive shaft socket (345-72232-0) to the drive shaft, and turn the drive shaft counterclockwise.

b. Bevel gear B nut installation
   1) Remove all grease completely from the drive shaft thread and the bevel gear B nut.
   2) Apply screw locking agent (3M 1342) to the bevel gear B nut.
      NOTE: Do not apply more screw locking agent than necessary.
   3) Hold the bevel gear B nut with the wrench and tighten the drive shaft socket to the specified torque.

      Torque: 39.2 to 58.8 N·m (4 to 6 kg·m, 28.9 to 43.4 lbs·ft)

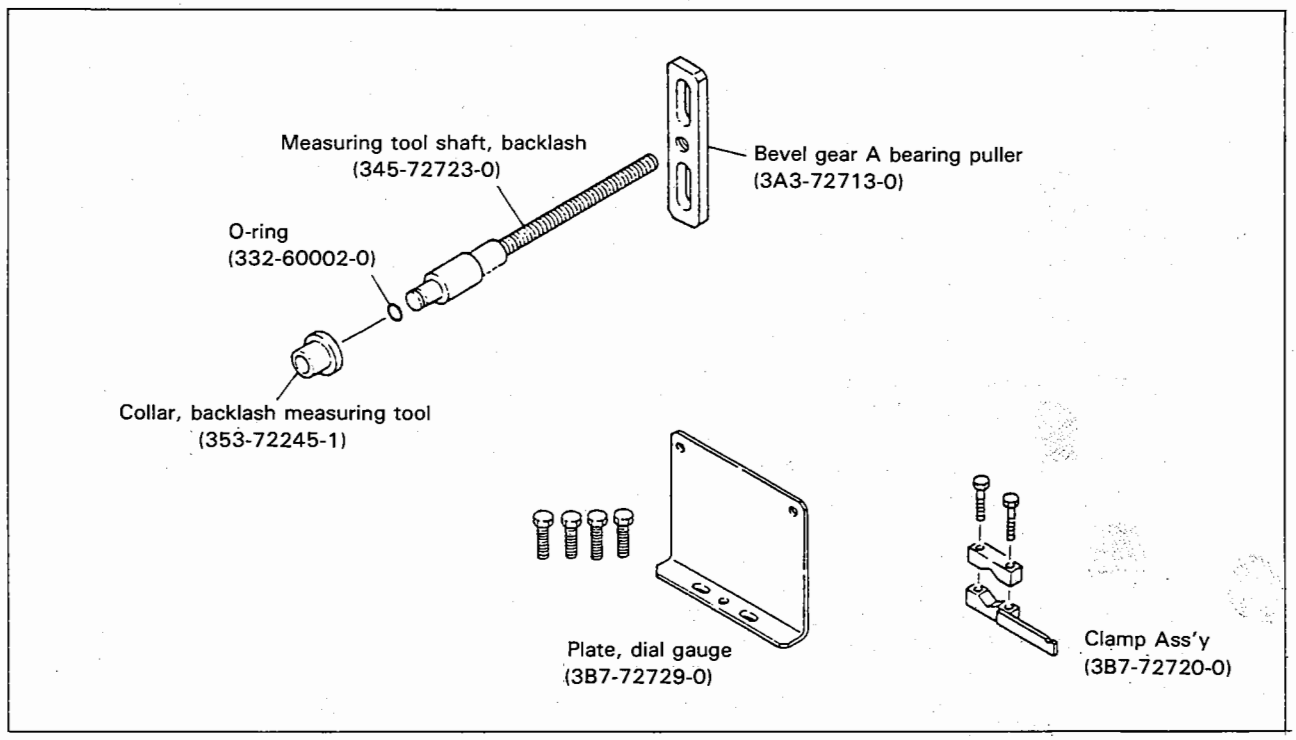


(9) Propeller shaft housing

a. Propeller shaft housing removal
To remove the propeller shaft housing installation bolt, position the housing puller and tighten.

(10) Backlash

a. Backlash measuring tool



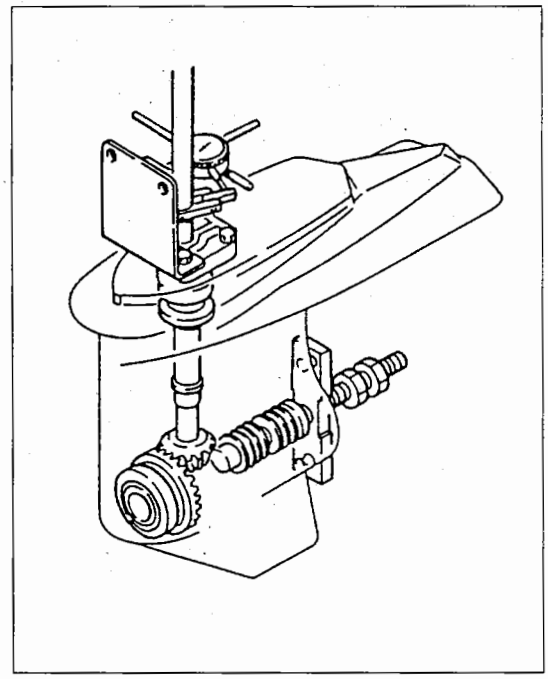
b. Measurement of backlash between gears A and B
   1) Ascertain the position of gear B.
   2) Attach gear A and bearing A.
   3) Pass the conical disk springs (3B7-72734-0) onto the shaft (345-72723-0).
   4) Pass the "O" ring (332-60002-0) onto the shaft and insert the set piece A (3B7-72245-0).
   5) Insert the shaft into the gear case and fix it with the plate (3A3-72713-0).
   6) Tighten the shaft until the drive shaft begins to rotate.
   7) Tighten the shaft another 1/2 turn (180°) from the point at which the drive shaft starts rotating.
   8) Install the clamp assembly (3B7-72720-0) on the drive shaft. (Bring it as near as possible to the lower pump case.)
   9) Install the plate dial gauge (3B7-72729-0) on the gear case.
   10) Set the dial gauge, lift the drive shaft upward, rotate, and read the deflection of the gauge.

   Correct dial gauge reading range: 0.31 to 0.62 mm (0.01220 to 0.0244 in.)

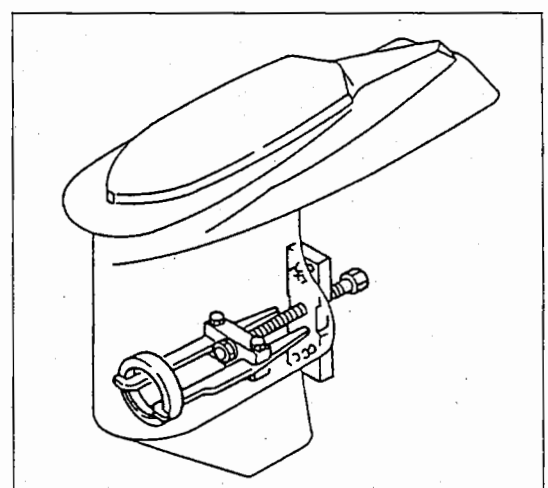
   If the deflection is not within this range, insert a shim between pump case lower and bearing #6304 to adjust.

   When replacing the bevel gear A shim, insert screwdrivers into the notches of gear A to isolate gear A and the bearing section.

   When inserting bearing A into gear A, use the set tool (3B7-72719-0) and press in without inclining bearing A to gear A.



c. Bearing outer race
   1) Removal of bevel gear A bearing outer race.
   2) Installation of bevel gear A bearing outer race. Use the bearing tool kit to install the outer race in the gear case.

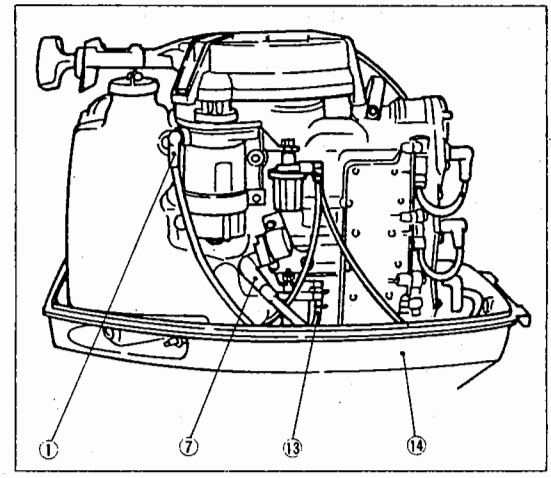


Bevel gear A bearing puller Ass'y (345-72224-1)

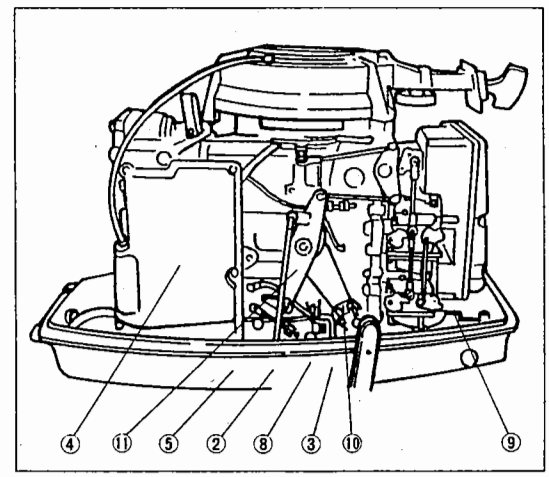
9 REMOVAL, DISASSEMBLY, AND REASSEMBLY OF THE POWER UNIT

(1) Power unit removal

a. Remove the splash cover.
   ① Battery ground lead
   ② Wire harness coupler
   ③ Natural switch lead.
   ④ P.T.T lead.
   ⑤ P.T.T lead B.
   ⑥ Safety switch lead.
   ⑦ Battery (+) lead.

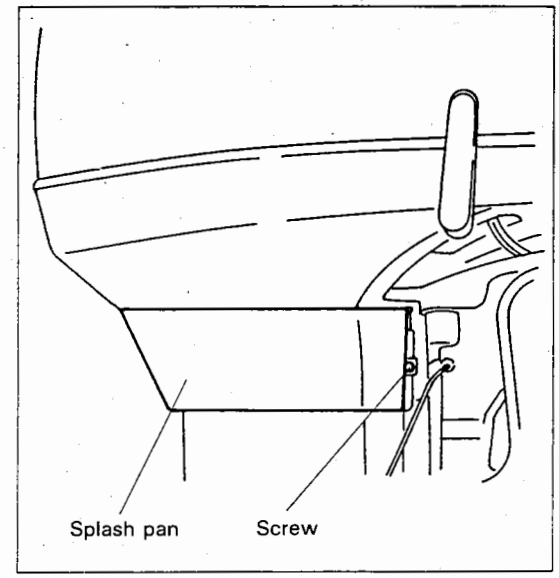


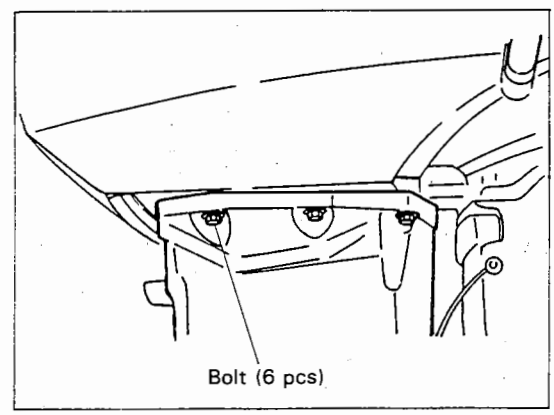
b. Remove the link and wires.
   ⑧ S link 3.5—56 (shift arm-throttle stop arm)
   ⑨ Choke link
   ⑩ Remove the throttle cable from the throttle cable bracket.
   ⑪ Remove the advancer arm and then remove the throttle cable.
   ⑫ Remove the remote control cable (remote control version).



c. Disconnect the fuel pipe, battery cables, remote control cable and ground leads connected to the lower motor cover.
   ⑬ Fuel pipe
   Disconnect the fuel pipe from fuel filter.
   ⑭ Pilot water check pipe
   Disconnect the pilot water check pipe from the exhaust cover.

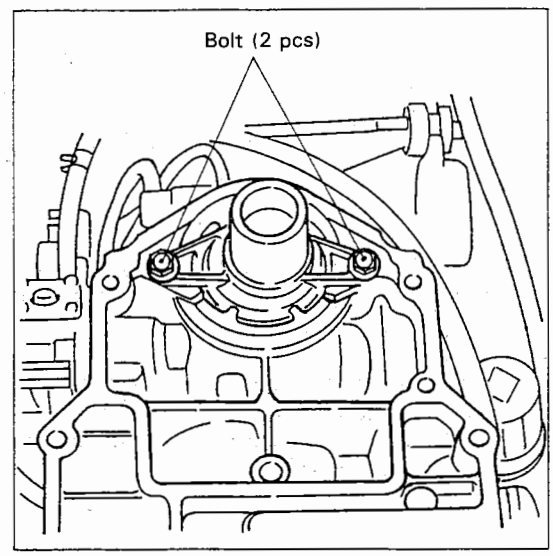
d. Disconnect the shift assist case.





(2) Lower crank case head

Insert flat head screw drivers into the pinch grooves and remove the lower crank case head.
When replacing the lower crank case head, pay attention to the F & R marks.
The F mark must face the carburetors.



(3) Cylinder head

Loosen the cylinder head M6 bolts starting with the one furthest from the horizontal center of the cylinder head. Then, loosen the M8 bolts starting with the highest embossed number and working down.

Cylinder head and cylinder head cover bolt torque

	Initial torque
M6 bolt	1.96 to 2.94 N-m (0.2 to 0.3 kg-m) 1.45 to 2.17 lbs-ft
M8 bolt	11.76 to 14.7 N-m (1.2 to 1.5 kg-m) 8.68 to 10.85 lbs-ft

	Final torque
M6 bolt	4.6 to 6.27 N-m (0.47 to 0.64 kg-m) 3.4 to 4.63 lbs-ft
M8 bolt	23.52 to 25.48 N-m (2.4 to 2.6 kg-m) 17.35 to 18.8 lbs-ft

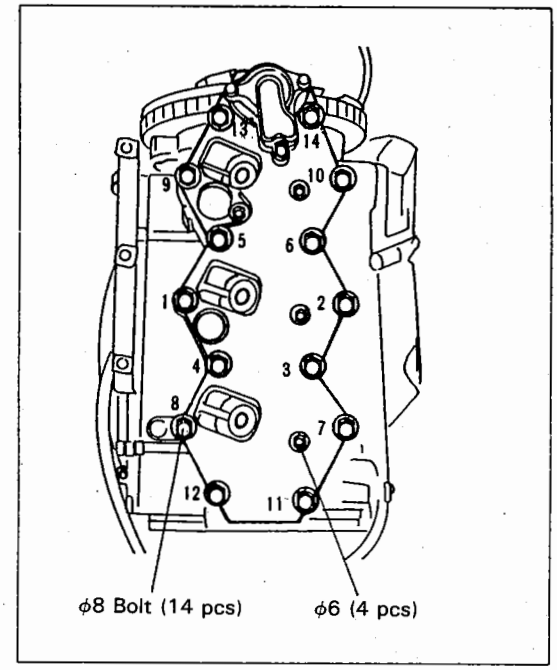
Cylinder head bolts must be tightened in the order described below.

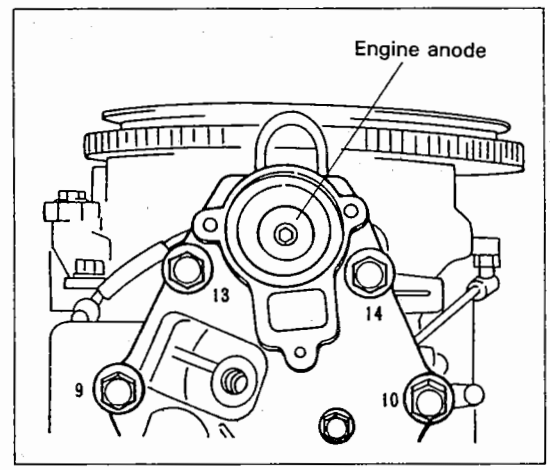
① Tighten the M6 bolts to the specified torque starting with the bolt nearest to the horizontal center of the cylinder head and work out.

② Tighten the M8 bolts to the specified torque in the order of the embossed numbers.

③ Return to step ① and repeat to ensure the bolts are evenly tightened.

NOTE: Check the anode installed in the cylinder block for corrosion. Replace the anode if it is worn by 1/3 of original size or more.

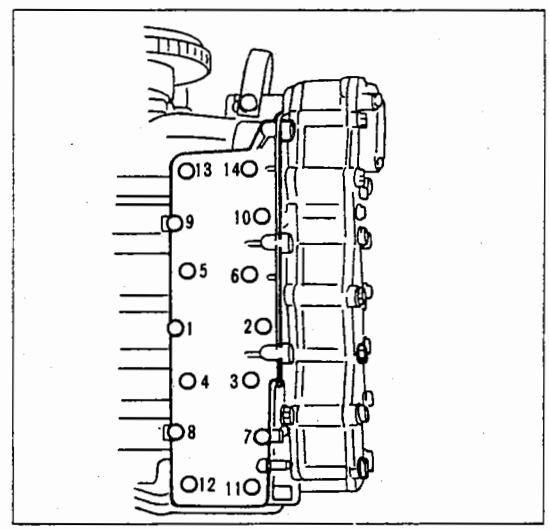




(4) Exhaust cover

Loosen the exhaust cover bolts starting with the highest embossed number and working down.
Insert a screw driver into the notch in the cover to remove.
Tighten the exhaust cover bolts starting with the lowest embossed number and work up.

Initial torque	Final torque
3.92 to 5.88 N-m (0.4 to 0.6 kg-m) 2.89 to 4.34 lbs-ft	7.84 to 9.8 N-m [0.8 to 1.0 kg-m) 5.78 to 7.23 lbs-ft



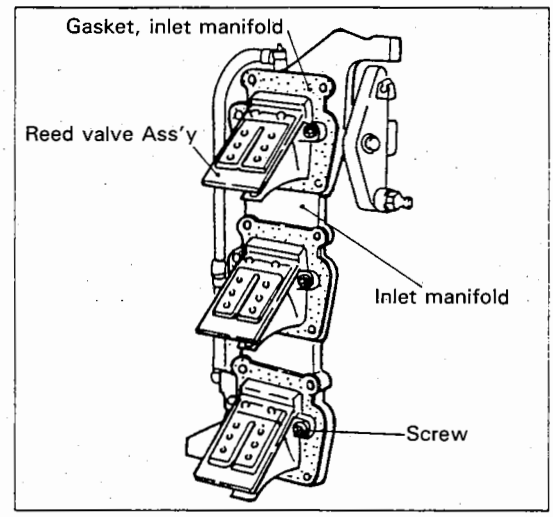
(5) Crank case

To remove the crank case, loosen the bolts in order starting with the ones furthest from the horizontal center of the crank case.
When tightening the crank case bolts, start with the bolts nearest to the horizontal center of the crank case.

Initial torque	Final torque
11.76 to 14.7 N-m (1.2 to 1.5 kg-m 8.68 to 10.85 lbs-ft)	23.52 to 25.48 N-m [2.4 to 2.6 kg-m 17.35 to 18.80 lbs-ft)

NOTE: Pay attention to the positions of the main bearing pins when re-assembling the crank case.

Apply sealing agent (3M 1104I) to the adjacent faces of the crank case.

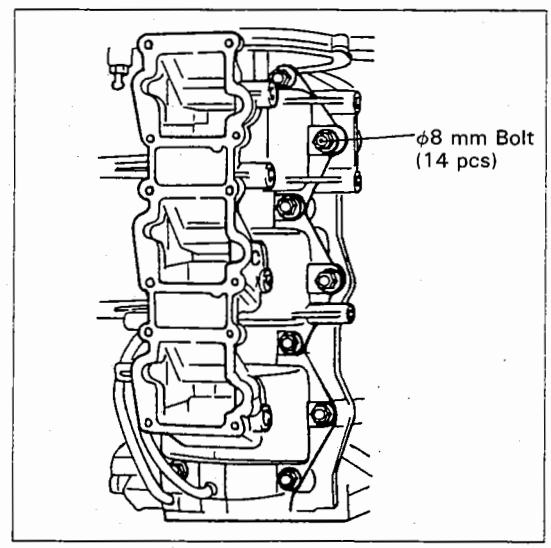


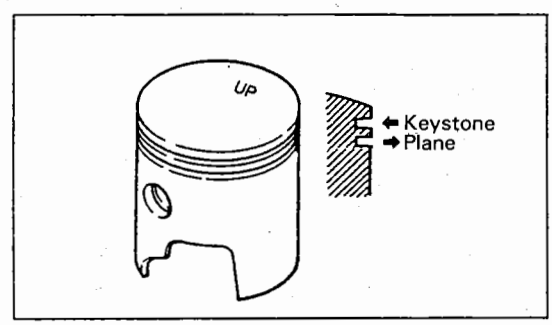
(6) Piston and piston rings

The top ring is of the keystone type and the second ring is of the plane type.
Use the piston ring tool (353-72249-0) when detaching the piston ring.

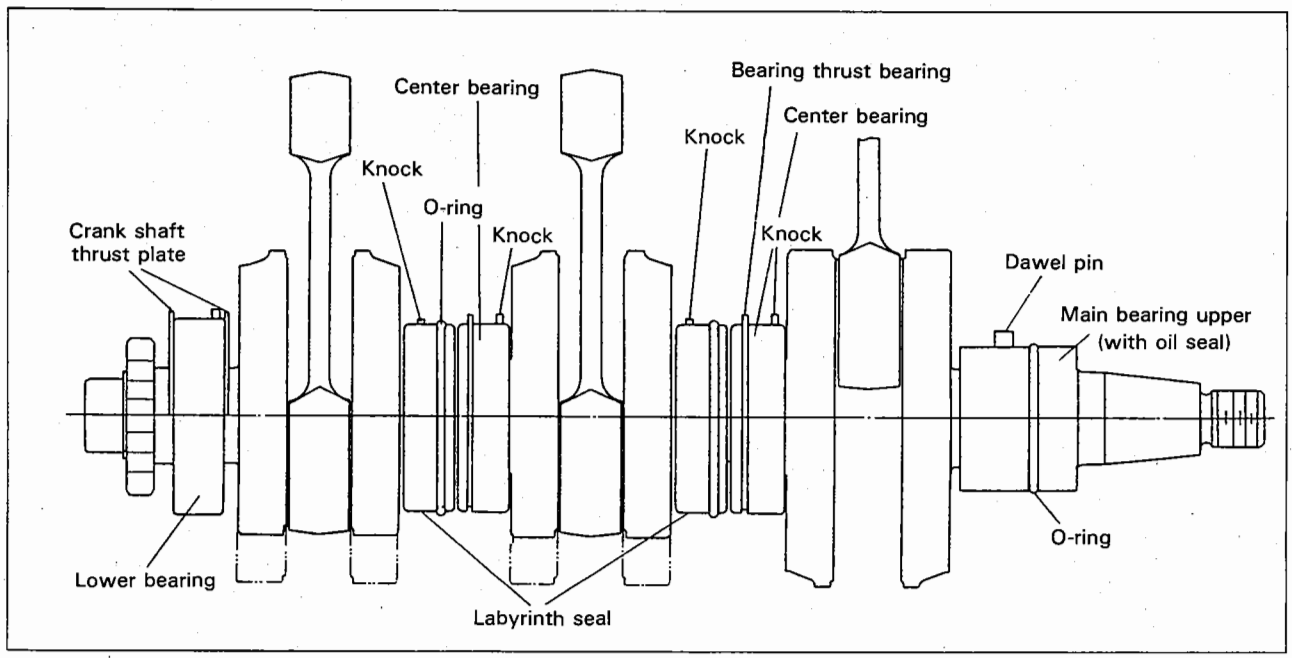
Be sure to assemble the piston with the UP mark on the top facing the flywheel.

Apply engine oil to the piston rings when attaching them to the piston.





(7) Crank shaft



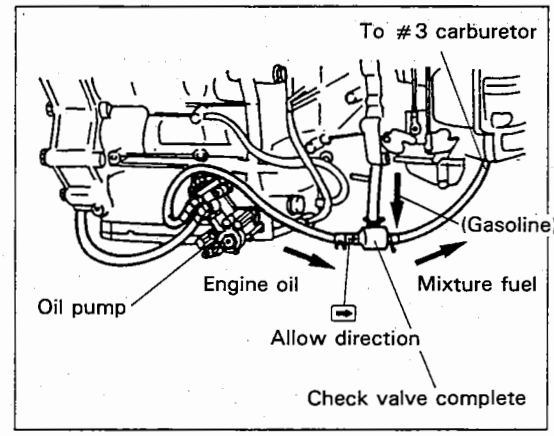
a. Apply Tohatsu grease to the:
   - Upper main bearing oil seal
   - O-ring for labyrinth seal, Upper main bearing

b. Apply Tohatsu engine oil to the:
   - cylinder liner
   - rotating portions of the crank shaft

c. Precautions to be taken when installing the crankshaft
   ① The piston knock must be aligned with the matching piston ring port.
   ② The knock hole in the upper main bearing must be aligned with the cylinder dowel pin.
   ③ Align the knocks of the center bearings and lower bearing with the groove in the adjacent surfaces of the crankcase and cylinder.
   ④ Align the "0" rings of the labyrinth packing with the groove of the cylinder.
   ⑤ Set the crank shaft thrust plates on the lower bearing in the cylinder groove ..... M40D, M50D.
   ⑥ Set the center bearing thrust plates in the cylinder groove (2 locations) ..... M50D.

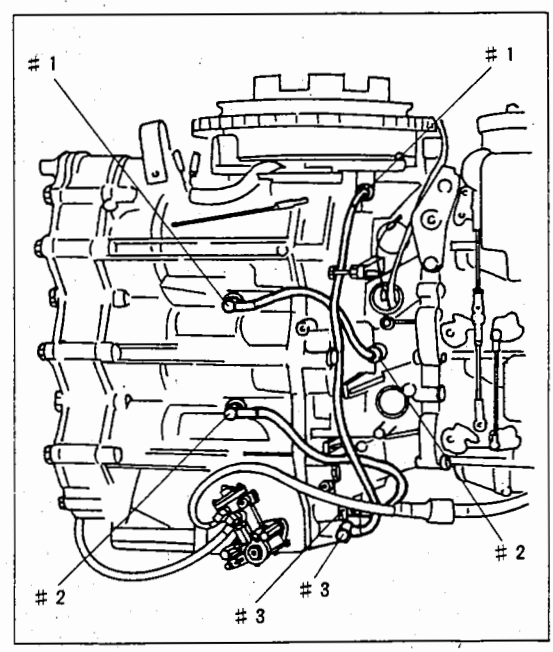
(8) Check valve Complete

A check valve complete is installed between the oil pump and the fuel pump. Install with the check valve direction arrow on the fuel pump side (the arrow indicates the direction of oil flow.)



(9) Oil re-circulation pipe connections

#1 Check valve → #2 Crank case
#2 Check valve → #3 Crank case
#3 Check valve → #1 Crank case

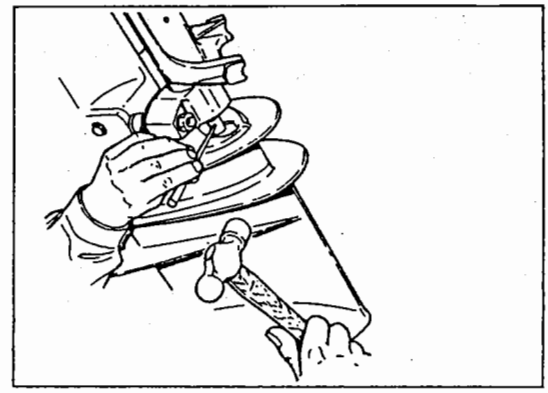


10 REMOVAL, DISASSEMBLY AND RE-ASSEMBLY OF THE GEAR CASE

(1) Remove the shift cam shaft spring pin

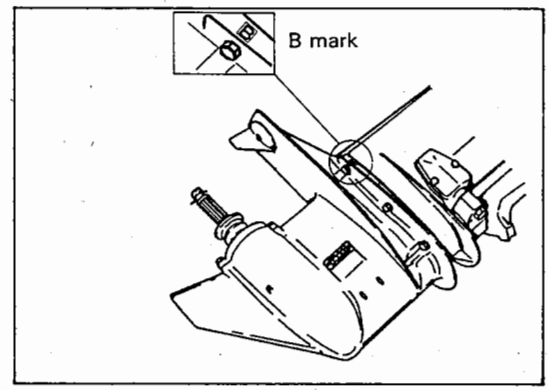
(2) Gear case removal

a. Remove the gear case plate located under the cavitation plate and take out the internal coupling bolt.
b. Remove the 6 gear case mounting bolts.
NOTE: To assemble, first install two bolts in the location marked B to position the gear case, then install the remaining bolts.



c. Gear case installation.
First install the bolt in the location market B, and then install the other bolts.
Tightening torque: 2.4—2.6 kg-m

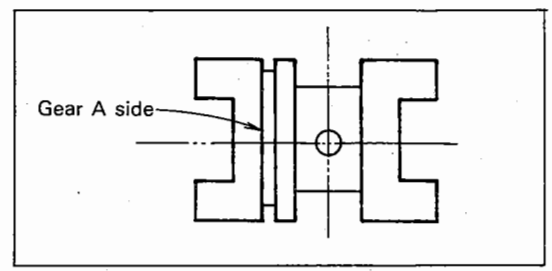
d. Apply a little grease to the spline at the engine side of the drive shaft.



(3) Clutch

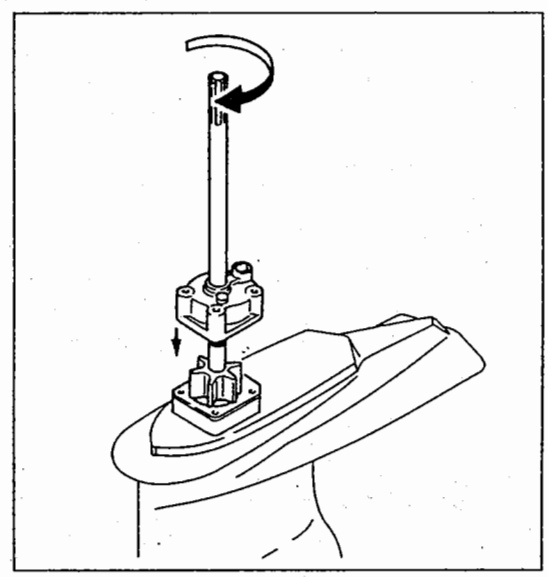
Install with the shortest distance from the center of the clutch pin to the tip of the claw facing the gear A side.
Install so that the narrowest claw (measured from the center of the clutch pin) faces gear A.

Do not force or deform the clutch snap pin.

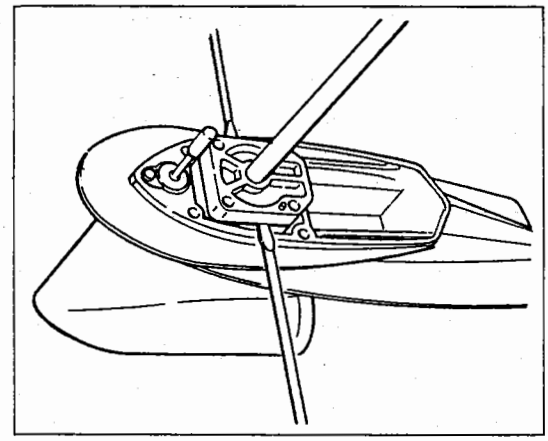


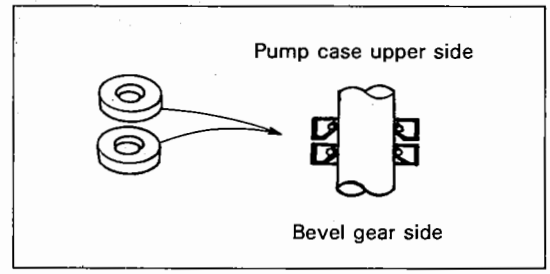
(4) Water pump

a. To install the water pump, rotate the drive shaft clockwise and set the upper water pump case to the impeller.
CAUTION: If the drive shaft is rotated counterclockwise, the impeller will bend in the wrong direction and may be damaged.



b. Lower water pump case removal
Insert a screwdriver into each notch on either side of the case to remove.



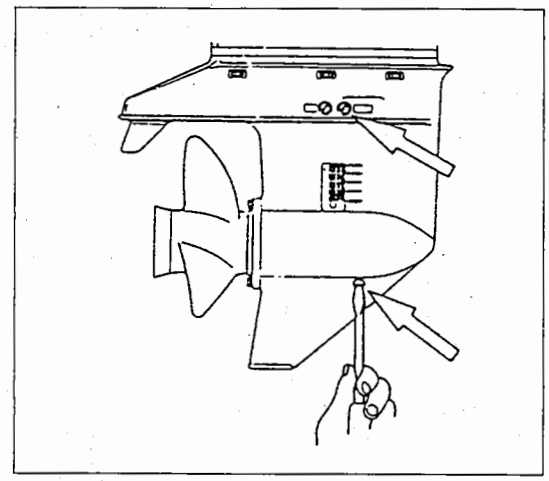


(5) Gear oil

Remove the upper and lower oil plugs to drain the gear oil.

To add gear oil, remove the upper and lower oil plugs and insert the nozzle of the gear oil tube into the lower plug hole. When oil overflows from the upper plug hole, install the upper plug and tighten.
Finally install the lower plug.

Quantity of gear oil: Approx. 500 cc (1.06 pt.)



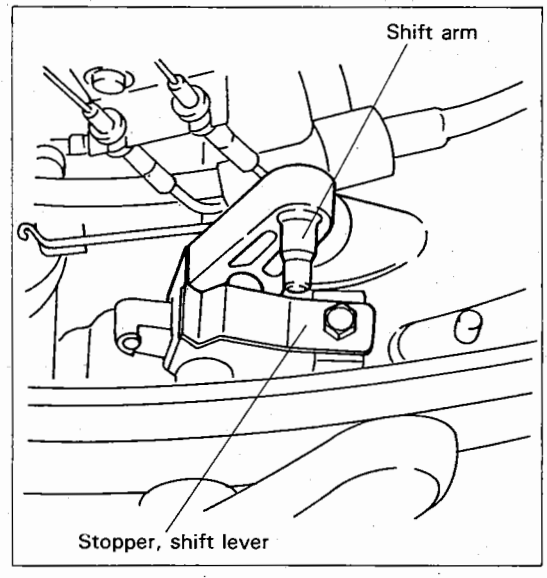
(6) Drive shaft spring

Keep the gear case in a horizontal position.

The drive shaft spring facilitates the supply of lubricating oil to the tapered roller bearings under the lower water pump housing.

Install the drive shaft spring with the open end of the spring facing the gear side and the closed end facing the bearings.

Be sure to install the drive shaft spring in the specified position. If it is installed too high, the supply of oil to the bearings may be insufficient.



(7) Clutch adjustment

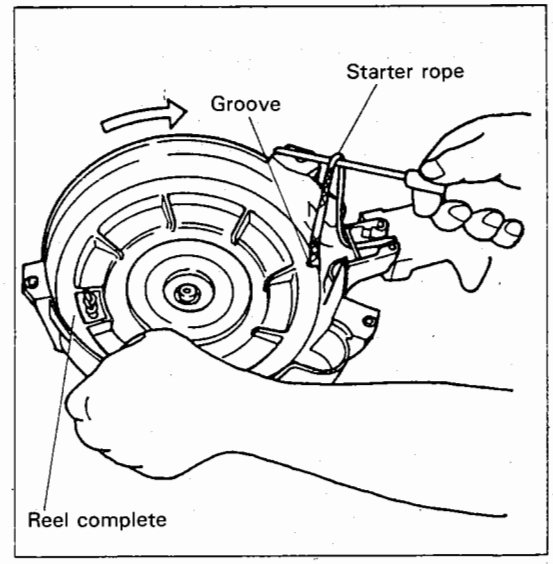
Move the shift arm to forward position, set the shift lever stopper and then secure with the bolt.
Operate the shift lever for checking smooth movement.

11 DISASSEMBLY AND RE-ASSEMBLY OF THE RECOIL STARTER

Disassembly

(1) Rewinding the reel complete

① Pull the starter handle until the groove in the reel complete aligns with the starter rope guide in the housing.
② Hold the reel securely to prevent it turning.
③ Remove the extended starter rope from the groove in the reel complete.
④ Allow the spring coil to rewind slowly in the direction of the arrow.

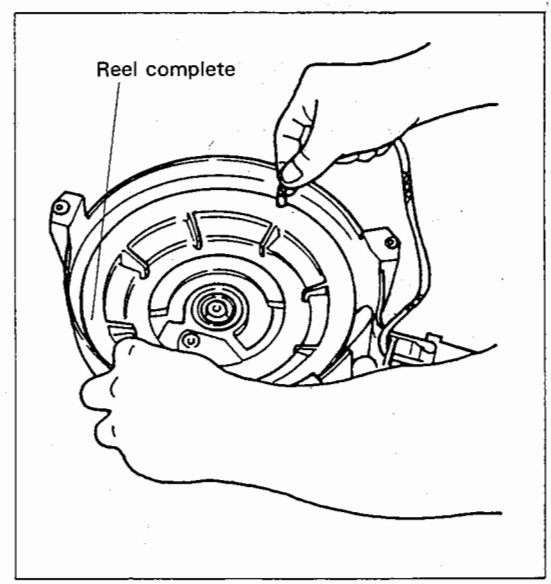


(2) Remove the friction plate, the slide plate and the friction spring from the reel complete.

(3) Remove the C-ring and washer.

(4) Remove the reel complete.

CAUTION: If the reel complete is removed suddenly, the starter spring may catch on the reel and may be dislodged.
To prevent this from occurring, remove the reel slowly while rotating it back and forth.



Re-assembly

(1) Apply low temperature working grease to the:

- starter case shaft portion
- inner and outer surfaces of the bushing
- friction spring fitting point on the friction plate

(2) Reattaching the reel complete

① Wind the starter rope around the reel complete 1.5 times.
Allow the remaining rope to hang from the groove in the reel, and attach the reel to the starter case.

② Turn the reel counter-clockwise five times to wind the remaining rope onto the reel.
Caution: Push the ratchet continuously to prevent it from locking.

③ Feed the rope through the guide in the housing and connect it to the starter handle.

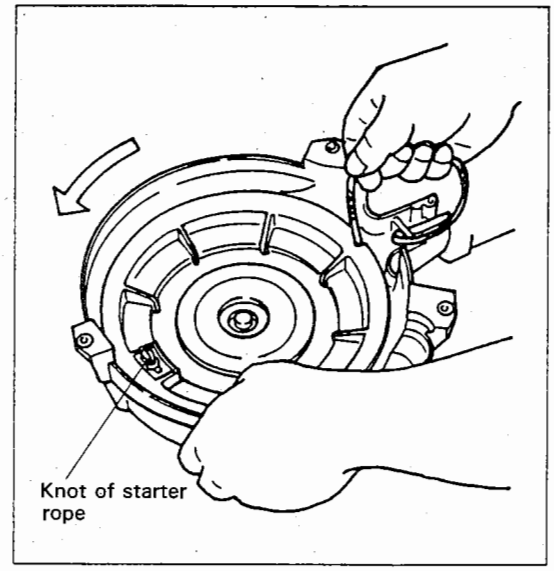
④ Reattach the friction plate, the slide plate and the friction spring to the reel complete.

(3) Checking the function of the recoil starter after re-assembly

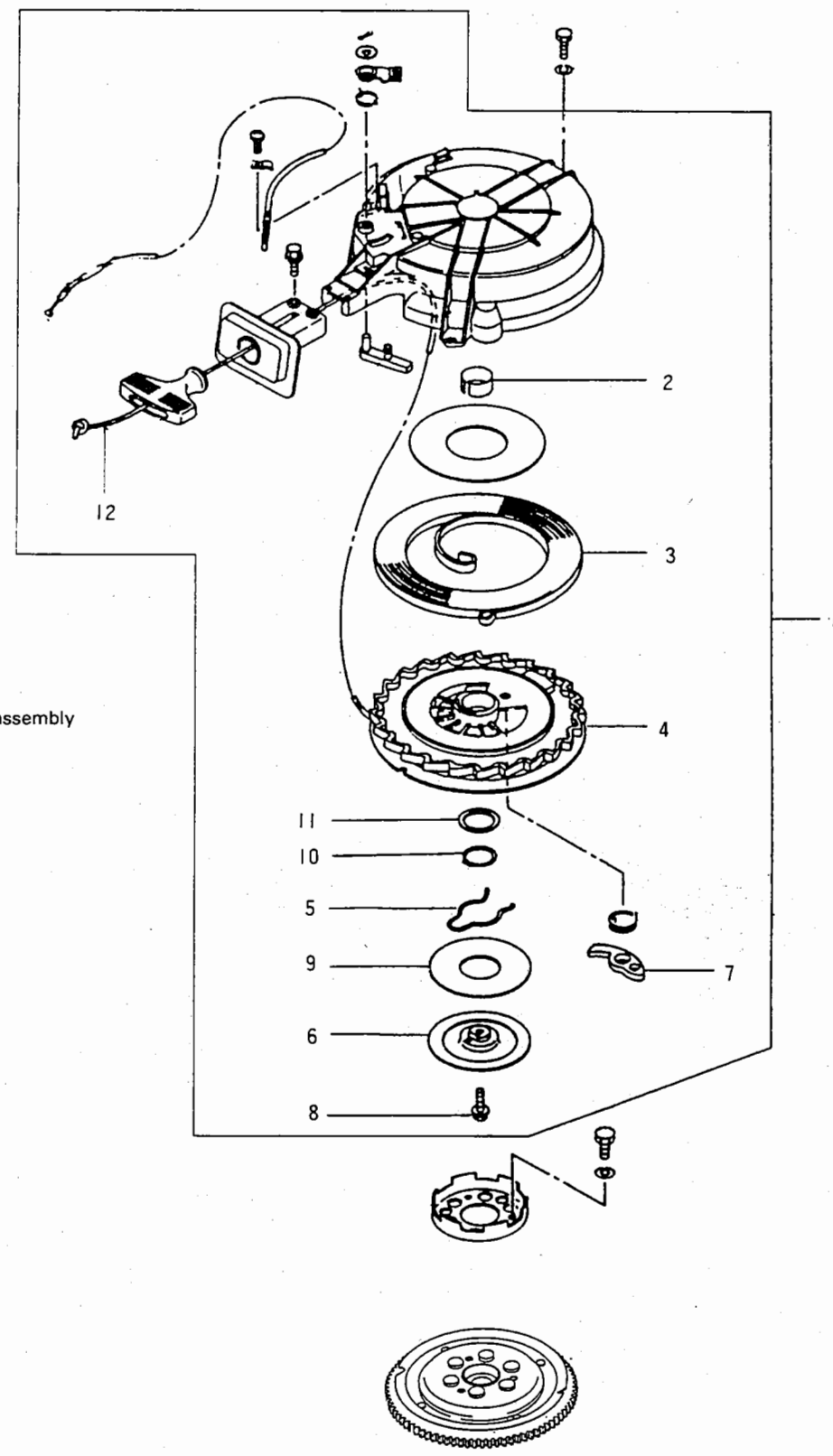
① Pull the reel stopper wire and check it works correctly.

② Pull the starter handle and check that the ratchet works correctly.

③ Pull the starter rope out entirely to check that it moves freely.



Recoil Starter

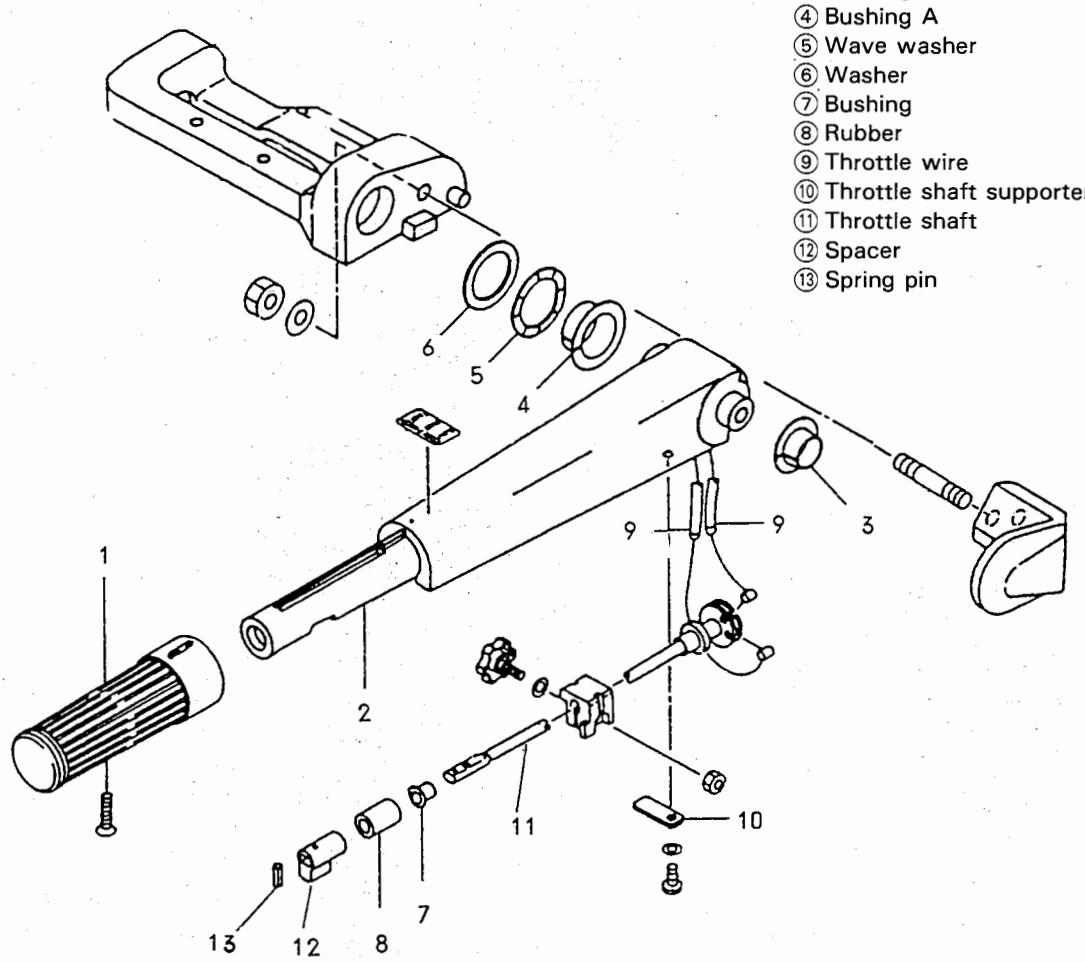


1. Recoil starter assembly
2. Bushing
3. Starter spring
4. Reel complete
5. Friction spring
6. Friction plate
7. Ratchet
8. Bolt
9. Slide plate
10. C ring
11. Washer
12. Starter rope

12 STEERING HANDLE

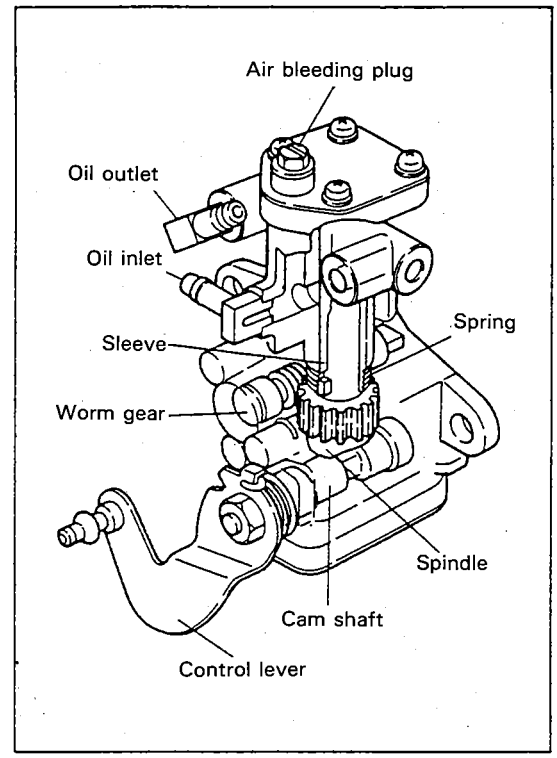
a. Apply Tohatsu grease to all sliding portions.

b. Refer to the illustration below for the installation of the throttle shaft and starter grip.



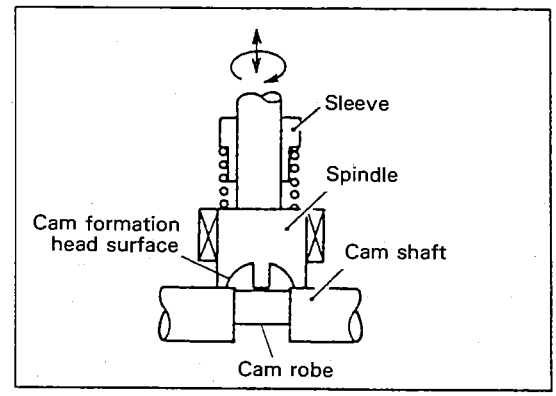
13 AUTO MIXING SYSTEM

(1) System design



(2) System function

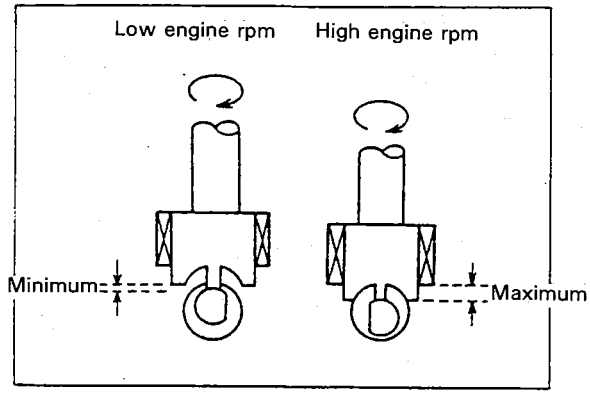
This system feeds the engine oil and the fuel oil to the engine separately. The engine oil is automatically fed to the engine from the oil tank by the oil pump.



(3) Oil pump

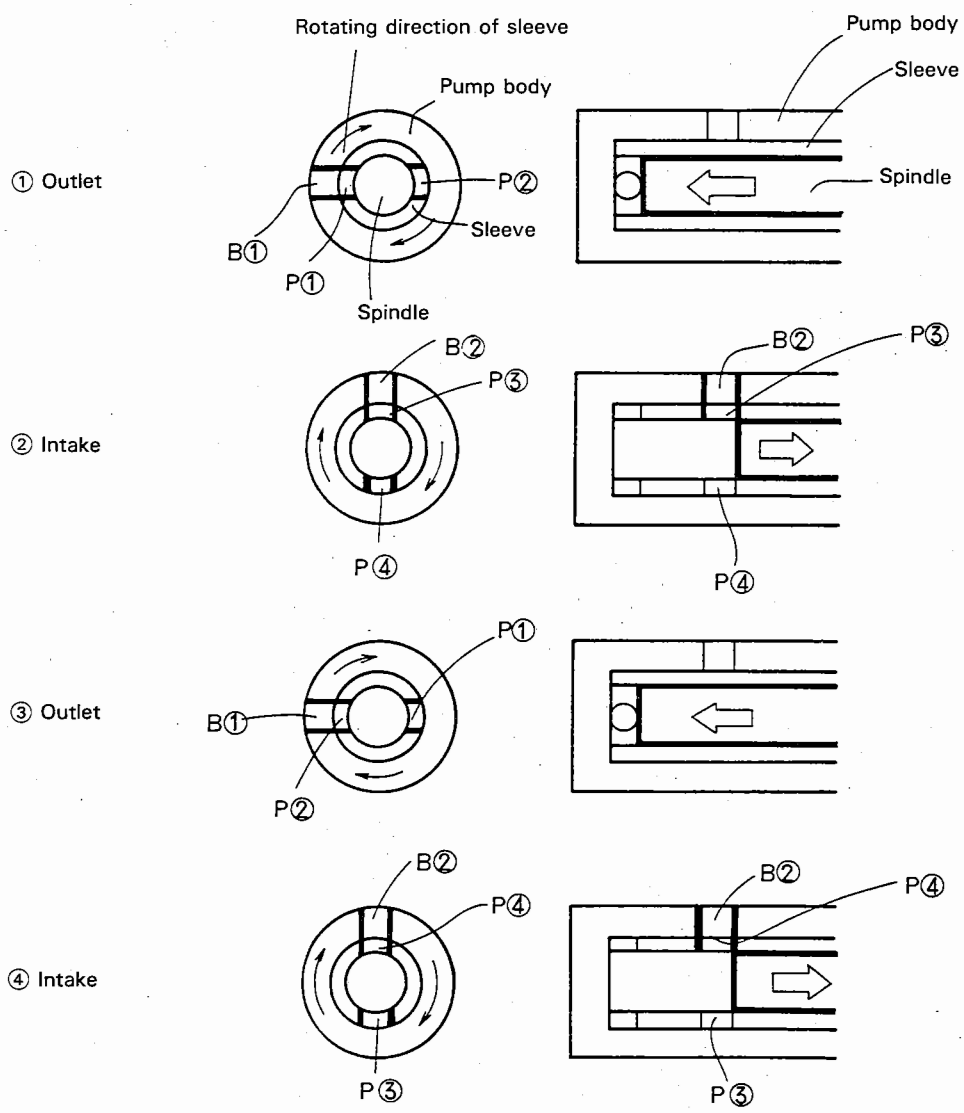
1) Structure
This is a plunger type oil pump.
The spindle is driven by a worm gear. The cam at the bottom of the spindle gear is linked to the piston and forces feeding. The oil flow is regulated by changing the stroke of the spindle with the cam which is linked to the control lever.

Furthermore, the rotation of the worm gear also changes according to the engine speed, so there is double control of the oil flow.



(4) Operation of oil pump

The oil flows from the oil tank through the oil filter to the oil pump inlet. Fig. 1 shows the position of the sleeve and spindle during oil output. Oil is output through ports P1 in the sleeve and B1 in the body when P1 and B1 are aligned. Next the sleeve rotates through 90° to align P3 and B2 to intake oil. To complete the cycle P2 and B1 are aligned for the next output and finally P4 and B4 for the second intake.



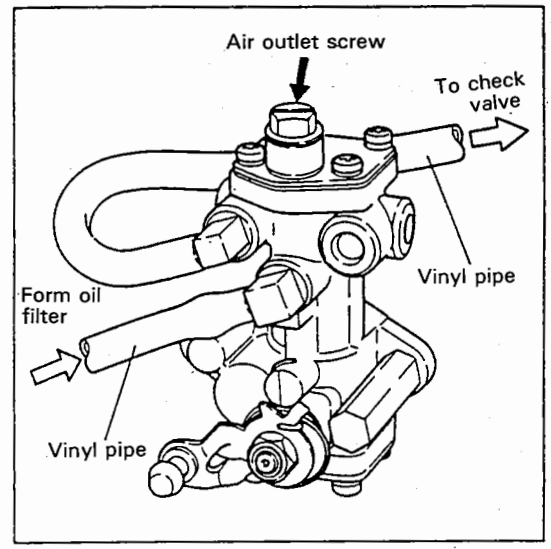
(5) Bleeding the oil system

Always bleed the air from the oil system of a new outboard motors or whenever the motor runs cut of oil.

a. Bleeding air from between the oil tank and oil pump
   1) Fill the oil tank with engine oil.
   2) Loosen the air bleeding plug.
   3) Bleed the air from the oil pipe and oil filter.
   4) Check that there is no more air, then retighten the air bleeding plug.

b. Bleeding air from between the oil pump and intake manifold
   1) Fill the oil tank with engine oil.
   2) Continue idling until there is no air remaining in the transparent oil pipe.

NOTE: When starting a new outboard motor, add engine oil at 50:1 mixture in the fuel tank, in addition to the engine oil in the oil tank.

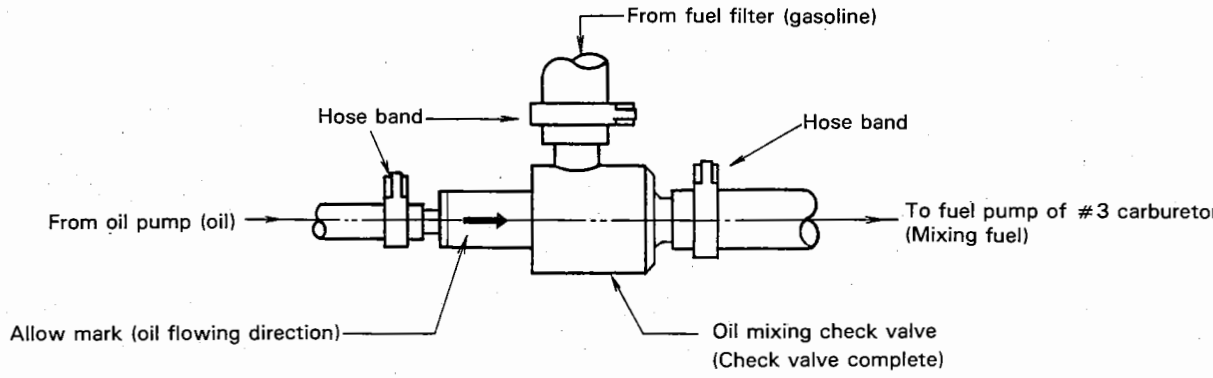


(6) Precautions and inspection of auto mixing system

No.	Part	Caution/Inspection
1	Oil	◦ Use "Tohatsu Super Gold engine oil.
2	Oil pump "O" ring	◦ Check the "O" ring upon assembly. ◦ Apply genuine oil.
3	Oil pipe	◦ Clip securely at the point of insertion. ◦ Clamp at specified places. ◦ Do not bend or bring the pipe into contact with sharp angles. ◦ Remove all air from the pipe.
4	Oil tank cap	◦ Check that the auto air vent functions properly.
5	Oil link rod	◦ Apply grease to the ball joint. ◦ Check that the rod is properly secured.
6	Oil level sensor	◦ Check that the sensor functions properly.
7	Oil strainer	◦ Ensure that the filter is free of water dirt and gel.
8	Alarm device	◦ Check that the lamp functions. ◦ Check that the buzzer functions properly.

(7) Auto mixing check valve

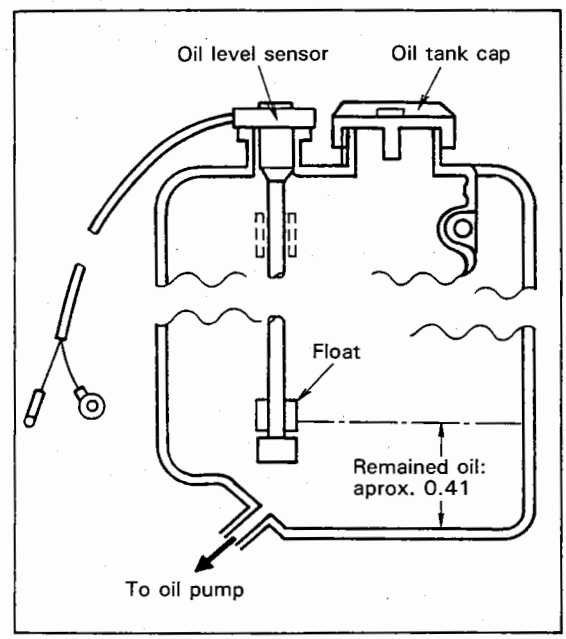
The gasoline and engine oil are mixed at the oil mixing check valve.



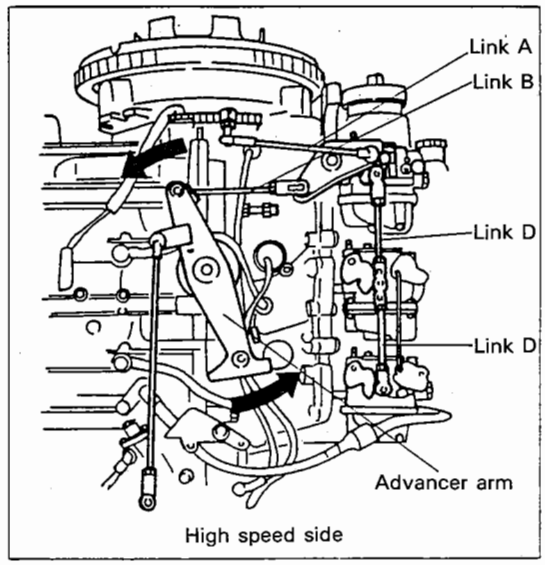
(8) Warning system

B. Oil level sensor
The float switch is activated by an oil level in the tank of 0.4 liters (0.85 pt.) or less.

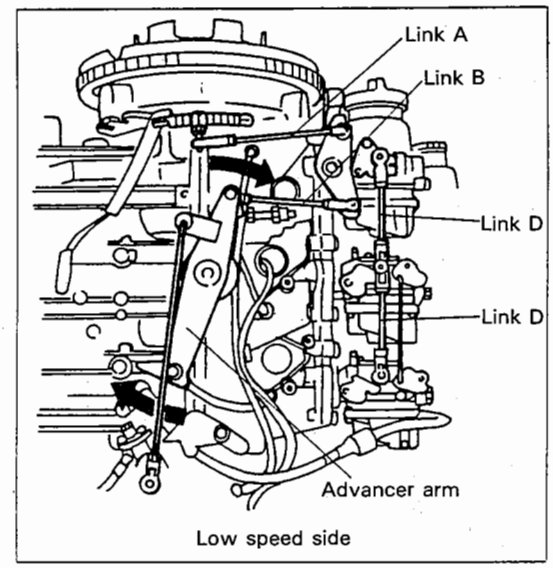
B. Warning lamp, and warning buzzer
The buzzer in the remote control box, the warning lamp in the tachometer and the warning lamp installed on the front face of the lower motor, are activated work by a signal from the oil level sensor.



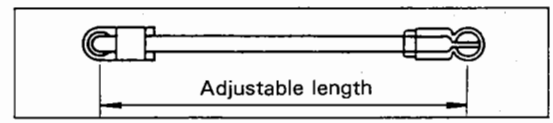
14 LINK ADJUSTMENT



High speed side



Low speed side

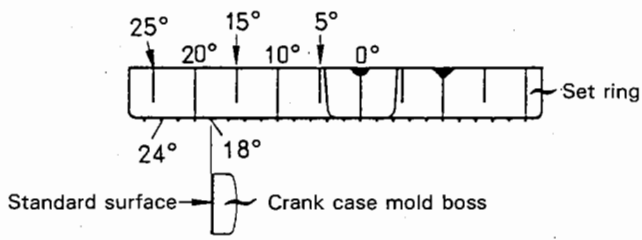


(1) Ignition timing adjustment

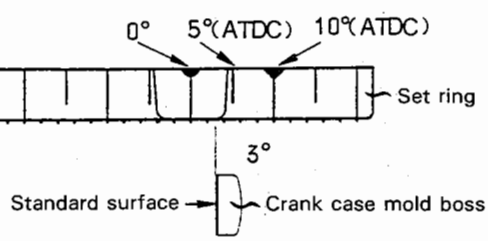
a. Length of links A and B
Link A (ignition timing link) ... 129 mm (5.04 in.)
Link B (throttle link) ..... 99 mm (3.86 in.)

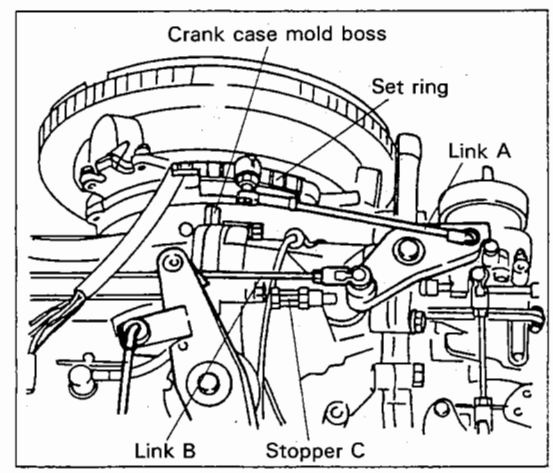
b. Check that the carburetor throttle is fully open when the advancer arm is in the fully advanced position. Use link B for finer adjustment.
Adjust link A so that the ignition timing at full throttle is BTDC 18° and 24° for M40D and M50D respectively.

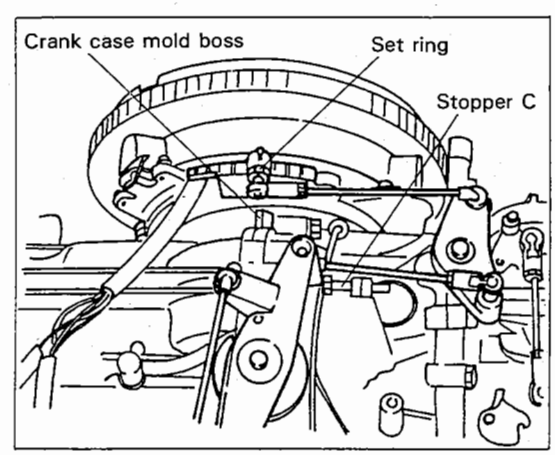
c. Set the advancer arm with the throttle fully closed and adjust the stopper C so that the ignition timing is A.T.D.C. 3°.

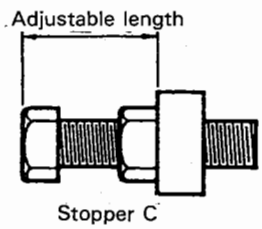


d. After adjusting at maximum engine speed set the advancer arm to minimum engine speed and adjust the ignition to ATDC 3° with stopper C.









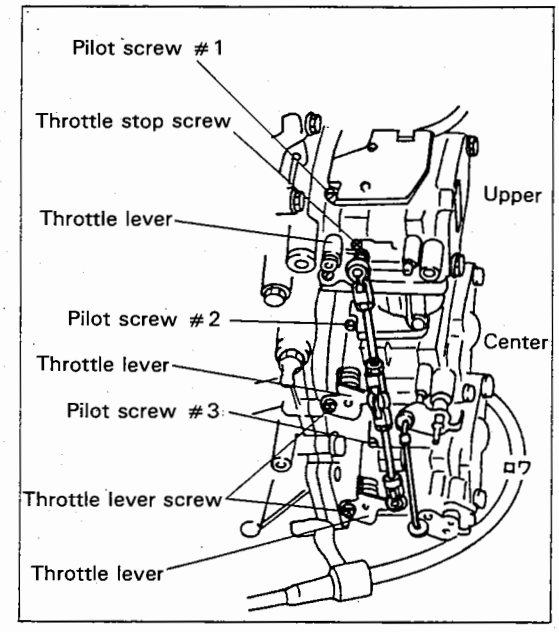
(2) Carburetor tuning

a. Length of link D
Link D (throttle link rod) ..... 90 mm (3.54 in.)
Length is defined as the distance between the centers of the ball joint caps.
NOTE:
Apply Tohatsu grease to the ball joints.

b. Adjustment of synchronizing the carburetors
1) Turn the center and lower carburetor throttle lever screws clockwise to loosen. (Counterclockwise threaded screws)
2) Loosen the upper carburetor throttle stop screw until the throttle valve is fully closed.
3) Lightly press on the center carburetor throttle lever so that the butterfly valve is fully closed and turn the throttle lever screw counterclockwise to open.
4) Tighten the lower carburetor throttle lever screw in the,same way.
5) Tighten the throttle stop screw and adjust so that the throttle opening is approx. 2-1/2 turns.

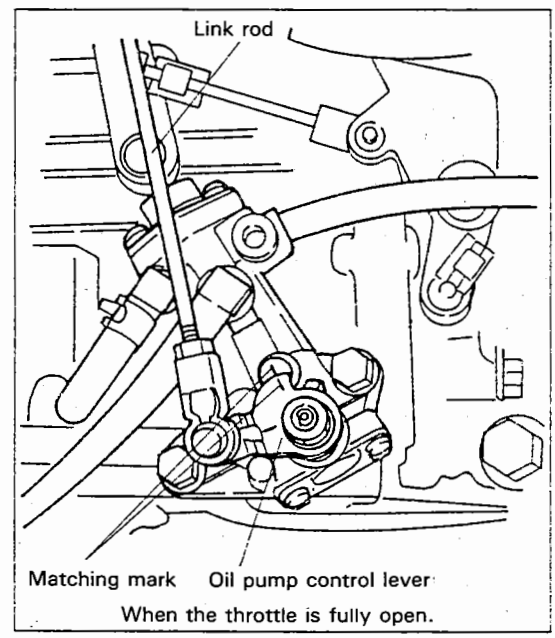
c. Pilot screw adjustment
1) After thoroughly warming the engine, adjust the upper, center and lower carburetors gradually to find the setting at which the engine speed increases the most when the pilot screw is turned 2-1/2 ± 1/4 for the M40D and 2-3/4 ± 1/4 for the M50D.
2) Return the screw another 1/8 turn from this position to give the setting when the engine is cold.
3) Adjust the throttle stop screw to obtain the recommended speeds.
Specified trolling speed: 650—700 rpm
Idling speed: 850—900 rpm

• Adjust by installing the air silencer cover.



(3) Oil pump aperture adjustment

Adjust the link rod length so that the cut angle of the control lever is aligned with the mark on the ϕ7 boss when the carburetor is at full throttle.
NOTE: Adjust the oil pump aperture after adjusting the carburetor and ignition timing.



When the throttle is fully open.

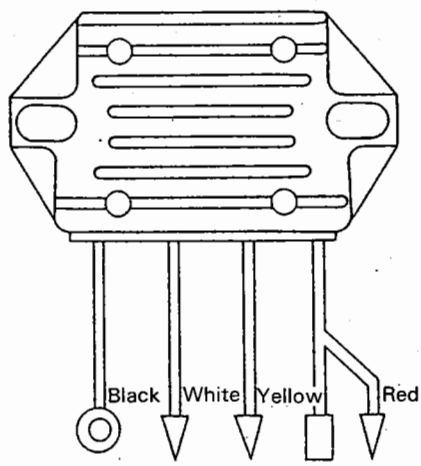
15 INSPECTION OF ELECTRICAL PARTS

(1) Measuring coil resistance

To measure the coil resistnce, connect the tester between the coil leads, and check the change in resistance as tension to the coil leads gently applied and released.

a. Alternator resistance	between yellow and white leads	0.3—0.5 Ω
b. Exciter coil resistance	between orange and white/green leads	520—720 Ω
	between orange lead and plate Ass'y	
	between white/green lead and plate Ass'y	
c. Pulser coil resistance	between white/red and black leads	160—220 Ω
	between white/black and black leads	
	between white/blue and black leads	
d. Ignition coil primary coil resistance	between black/white and black leads	0.18—0.24 Ω
Secondary coil resistance	between high voltage cord and black lead	2.7—3.7 Ω

(2) Rectifier



As measured with a HIOKI 3000 test meter

⊖ \ ⊕	black	red	white	yellow
black		conductive (80 Ω)	conductive (16 Ω)	conductive (16 Ω)
red	not conductive		not conductive	not conductive
white	not conductive	conductive (16 Ω)		not conductive
yellow	not conductive	conductive (16 Ω)	not conductive	

NOTE:

1. Disconnect all leads when measuring.
2. Number in ( ) shows approx. resistance (measured using the n × 1Ω range of the tester.)

(3) CD unit

a. Cautions on handling the CD unit

1) Do not disconnect or short circuit the coil base lead wires or CD unit wires while the engine is running.
2) Do not change the installed position of the CD unit.
3) Do not touch the spark plugs or high voltage cords with your hand while the engine is running, as the voltage and current are high.
4) When checking the spark of one spark plug, always keep the other two plugs in contact with the engine otherwise the CD unit may be damaged.
5) Disconnect the coil plate lead wires and CD unit wires when measuring compression.
6) CD unit inspection
   Use a test meter with an internal battery of 3V or less to measure the CD unit resistance.
   If a tester with a high voltage battery is used, the diodes in the CD unit may be damaged.
7) Measure the resistance when the air temperature is at 20°C at meter readings may vary with the air temperature.

Standard values for the CD unit (± 15%)
Tester: Tohatsu test meter (HIOKI model 3000), range kΩ

unit: kΩ unless otherwise specified

	Tester (red lead)											
	B	Sb	Br	Or	W/G	W/R	W/B	L/W	B/W	B/R	B/G	
B		15	17	5	5	16	16	16	4.3	4.3	4.3	
Sb	∞		∞	∞	∞	∞	∞	∞	∞	∞	∞	
Br	∞	∞		∞	∞	∞	∞	∞	∞	∞	∞	
Or	100	150	5		150	150	150	150	150	150	150	
W/G	• 14	22	• 82	• 31		• 46	• 46	• 46	• 28	• 28	• 28	
W/R	∞	∞	∞	∞	∞		∞	∞	24	∞	∞	
W/B	∞	∞	∞	∞	∞	∞		∞	∞	24	∞	
L/W	∞	∞	∞	∞	∞	∞	∞		∞	∞	24	
B/W	∞	∞	∞	∞	∞	∞	∞	∞		∞	∞	
B/R	∞	∞	∞	∞	∞	∞	∞	∞	∞		∞	
B/G	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		

Tester (black lead)

Measure with the (B/Y) lead connected.

NB. • Initially the tester will register a lower value than that indicated, and after a short delay will register the specified value.

NOTE: 1) The indicated values were measured with the Totatsu test meter (HIOKI 3000) and may differ greatly when tested with other models.

2) The measuring values should be used as standard values since the values may vary large margin (from 1/2 to 2 times) according to the measuring condition, allowarable difference, etc.

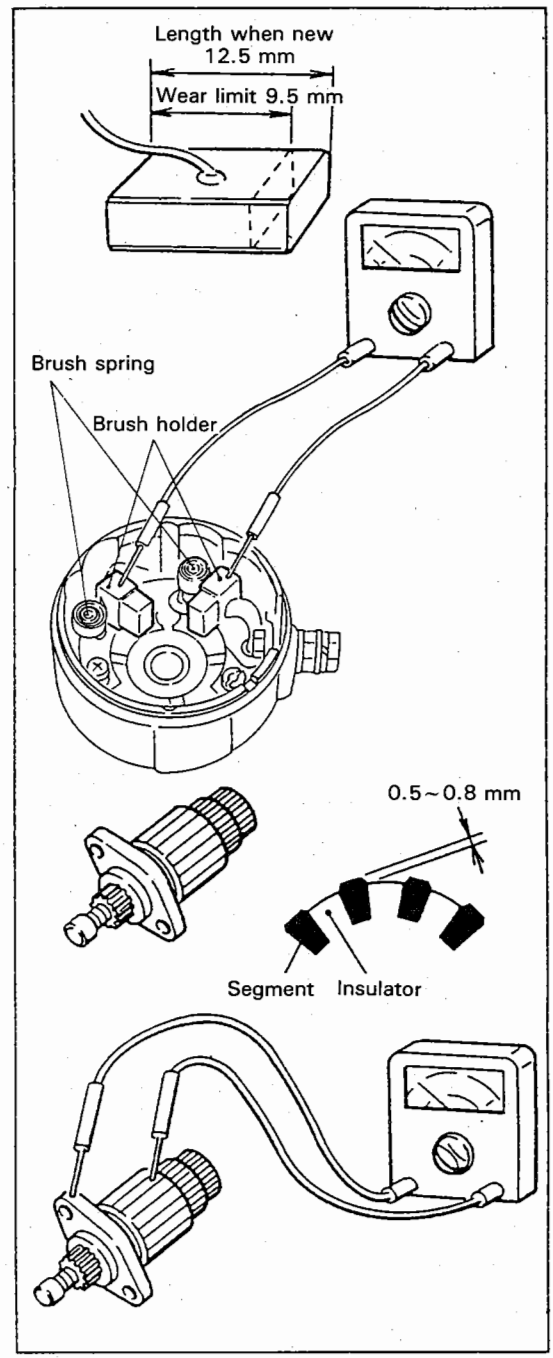
Abbreviations:

B — black
Sb — sky blue
Br — brown
R — red
L — Blue
Or — orange
W/G — white/green
W/R — white/red
W — white
G — green
W/B — white/black
L/W — blue/white
B/W — black/white
Y — yellow

(4) Starter motor

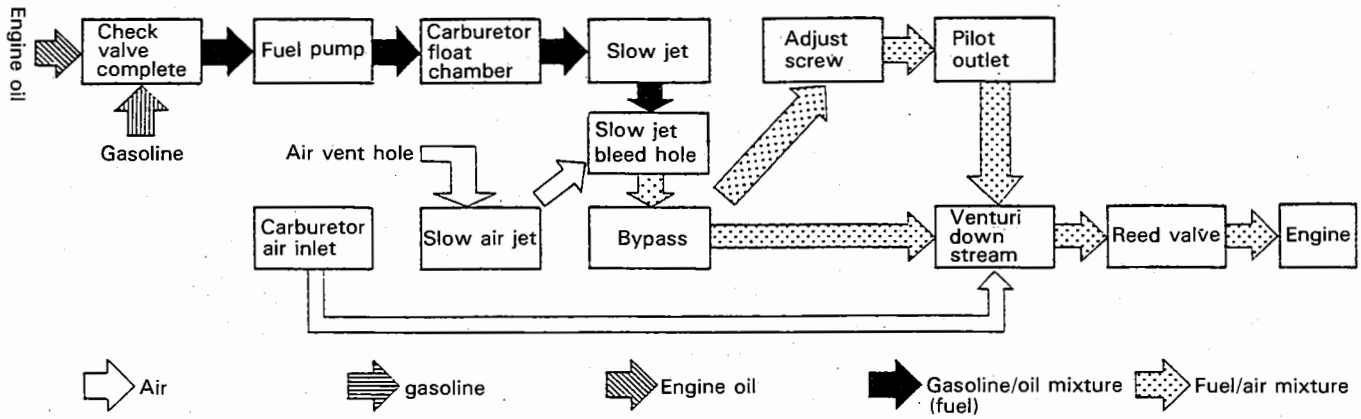
a. Brush and spring
   1) Check the extent of brush wear.
      Replace if the brush length is 9.5 mm or less.
   2) Check the insulation between brush holders.
      If electricity is conducted, clean and insulate or replace.
   3) Brush spring tension
      Replace if the brush spring tension is reduced.

b. Armature
   1) Measure the armature insulator depth.
      If the depth is less than 0.5 to 0.8 mm, or if misshapen, repair with a hacksaw blade etc. to restore the specified depth.
   2) If the armature has carbon or other deposits, remove them using #500 ~ #600 emery paper.
   3) Check the armature's insulation.
      If electricity is conducted, replace the motor assembly.

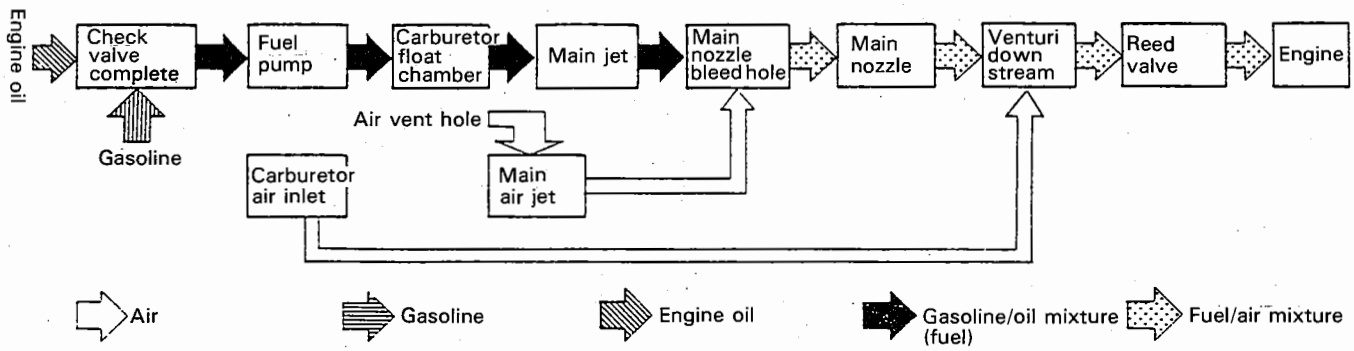


16 CARBURETOR

(1) Pilot system and Idling system



(2) Main system

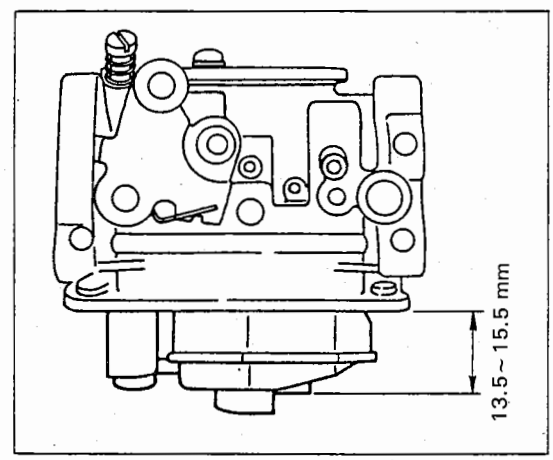


(3) Float Height

Measure from the tip of the float, at the opposite side to the float valve, to the surface of the float chamber.

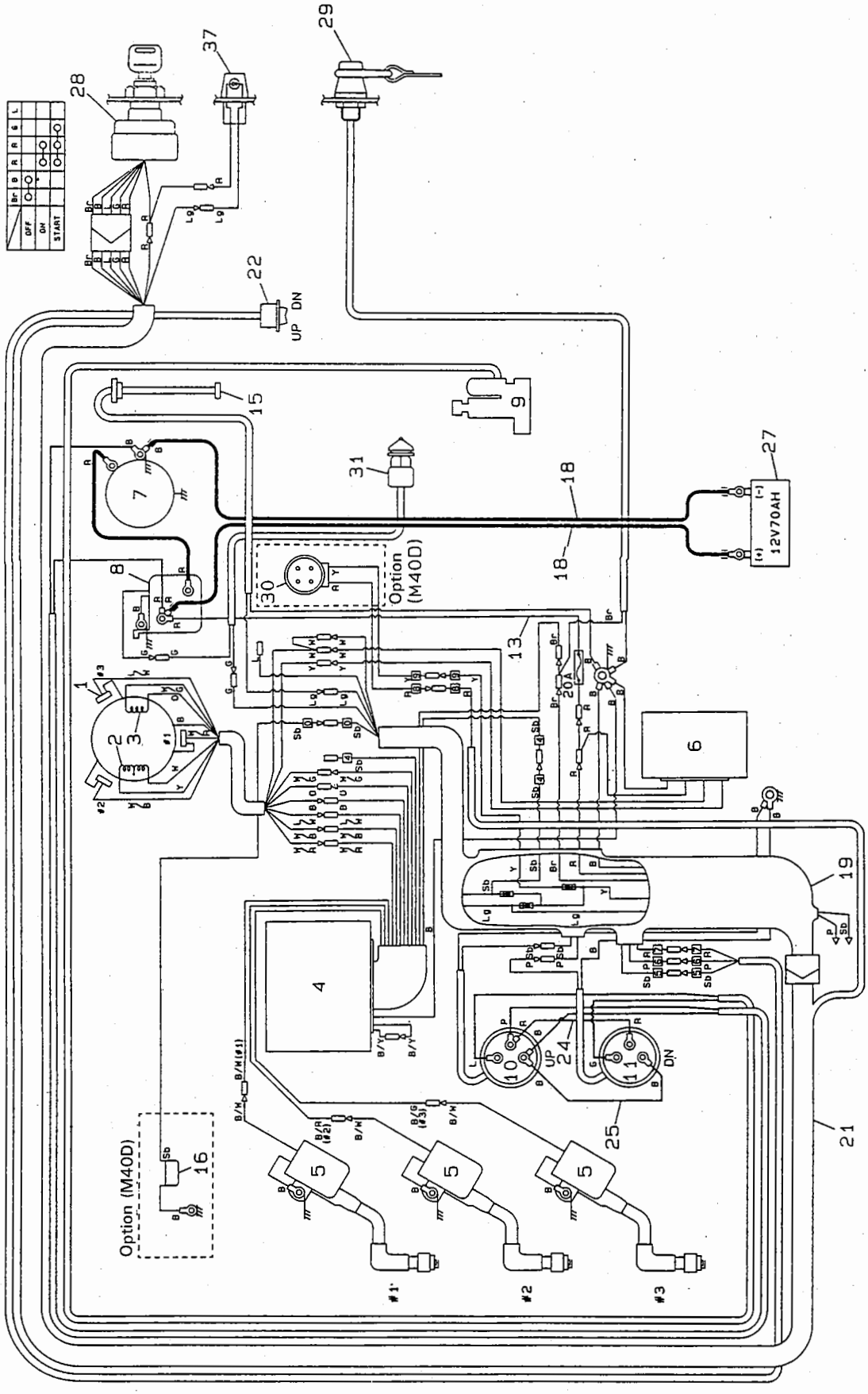
Standard float height:

14.5 ± 1.0 mm (lower surface of float)

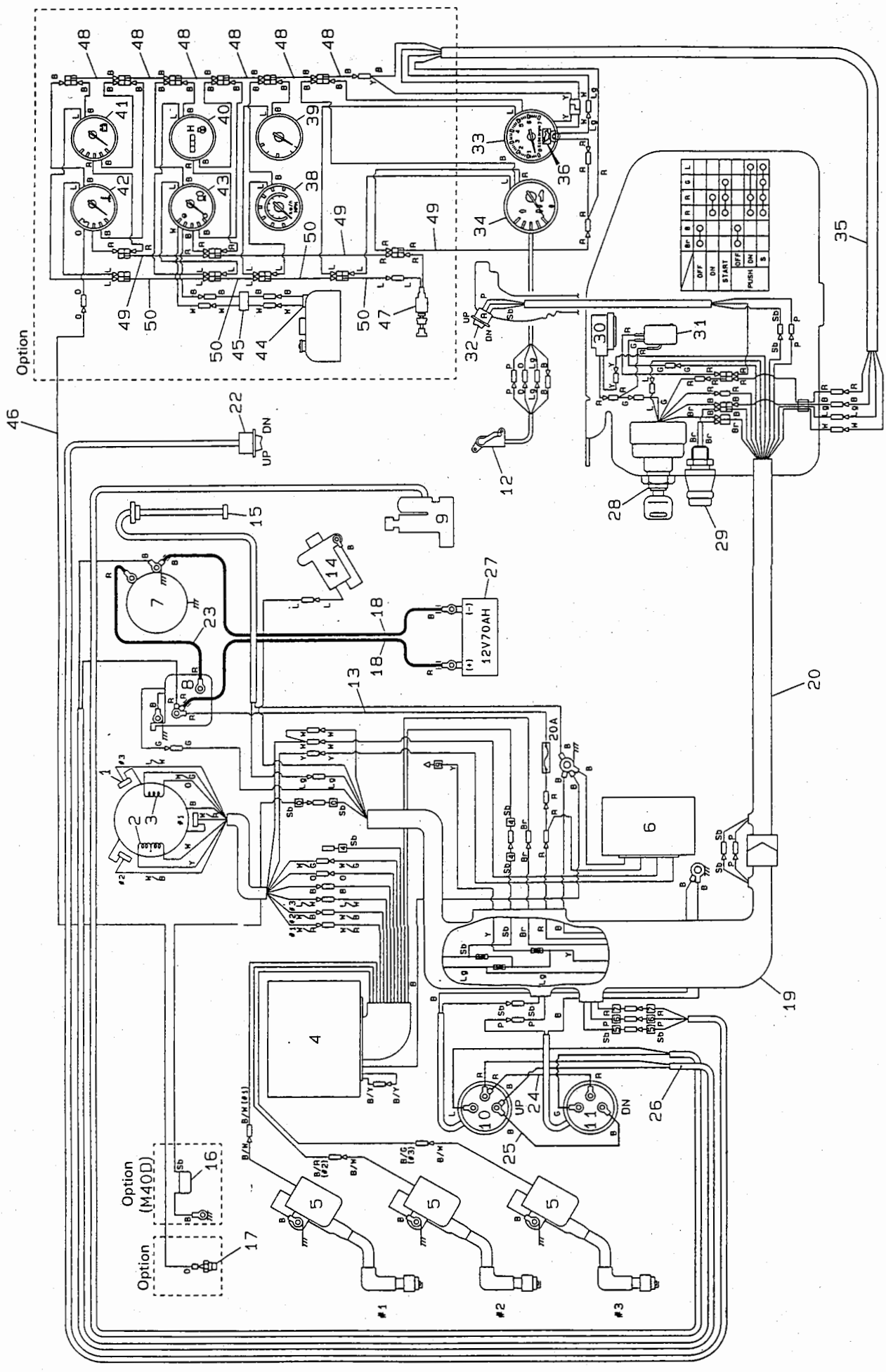


17 ELECTRICAL WIRING DIAGRAM

TYPE: F, EF, EPO, EFTO



TYPE: EP, EPTO



Part name table of Electrical Wiring Diagram (M40D, M50D)

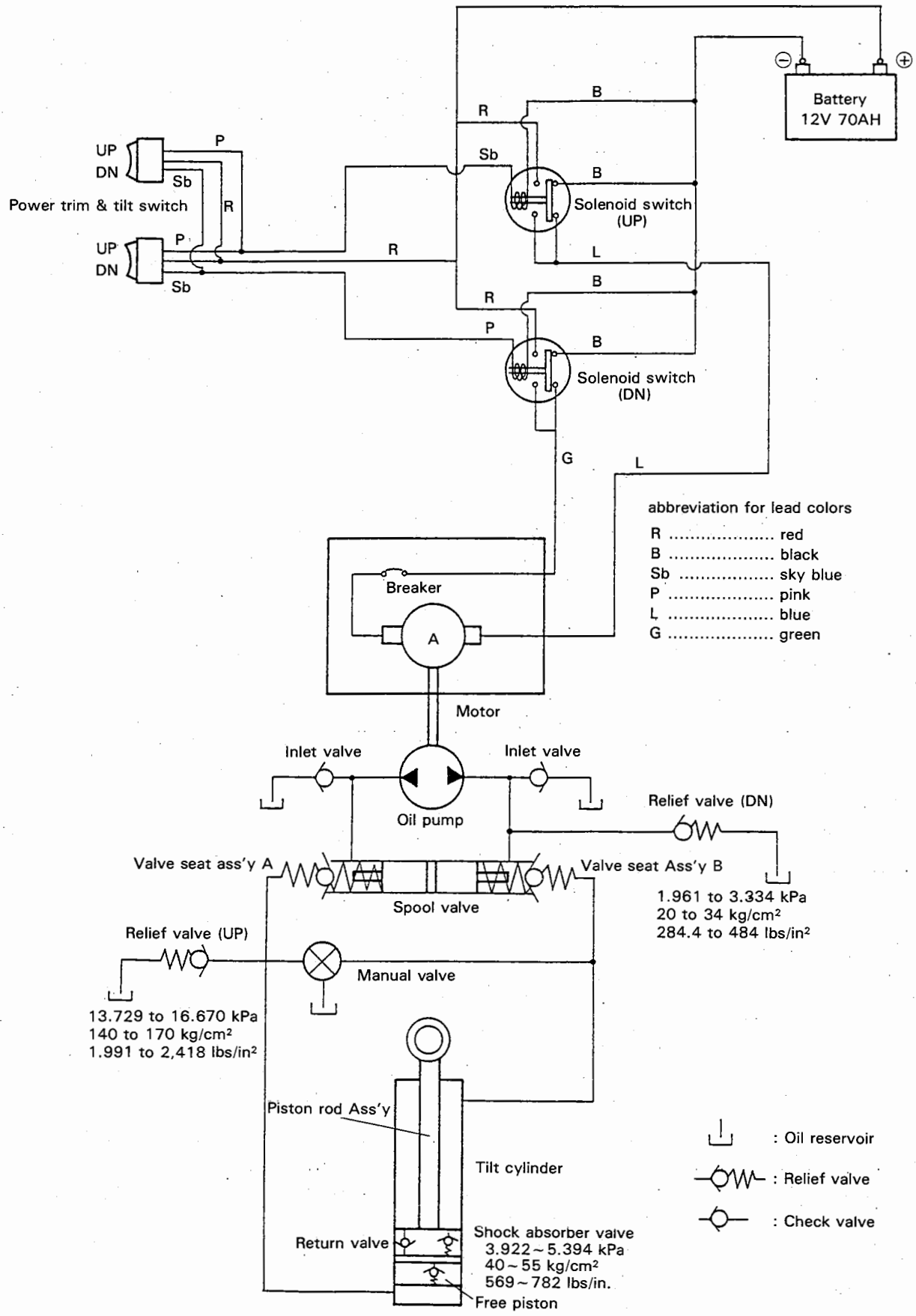
No.	Part name	No.	Part name	No.	Part name
1	Pulser coil ass'y	18	Battery cord	35	Lead wire, meter
2	Alternator	19	Cord Ass'y A	36	Oil lamp
3	Exciter coil	20	Cord Ass'y B	37	Pilot lamp
4	C.D. Unit	21	Cord Ass'y C	38	Speedometer
5	Ignition coil	22	PTT switch B	39	Water pressure meter
6	Rectifier complete	23	Starter cord	40	Hourmeter
7	Starter motor	24	Cord A, Solenoid switch	41	Voltmeter
8	Starter solenoid	25	Cord B, Solenoid switch	42	Water temp. meter
9	Power trim and tilt	26	Cord C, Solenoid switch	43	Fuel meter
10	Solenoid switch A, PTT	27	Battery (to be supplied locally)	44	Fuel gauge sensor unit
11	Solenoid switch B, PTT	28	Main switch	45	Cord, fuel meter
12	Trim sender	29	Safety switch	46	Lead wire, water temp. meter
13	Fuse wire	30	Over heat buzzer	47	Meter lamp switch
14	Choke solenoid	31	Neutral switch	48	Asist cord (Black)
15	Oil bell sensor	32	PTT switch	49	Asist cord (Red)
16	Over heat sensor	33	Tachmeter	50	Asist cord (Blue)
17	Sender, water temp.	34	Trim meter		

Color of cord

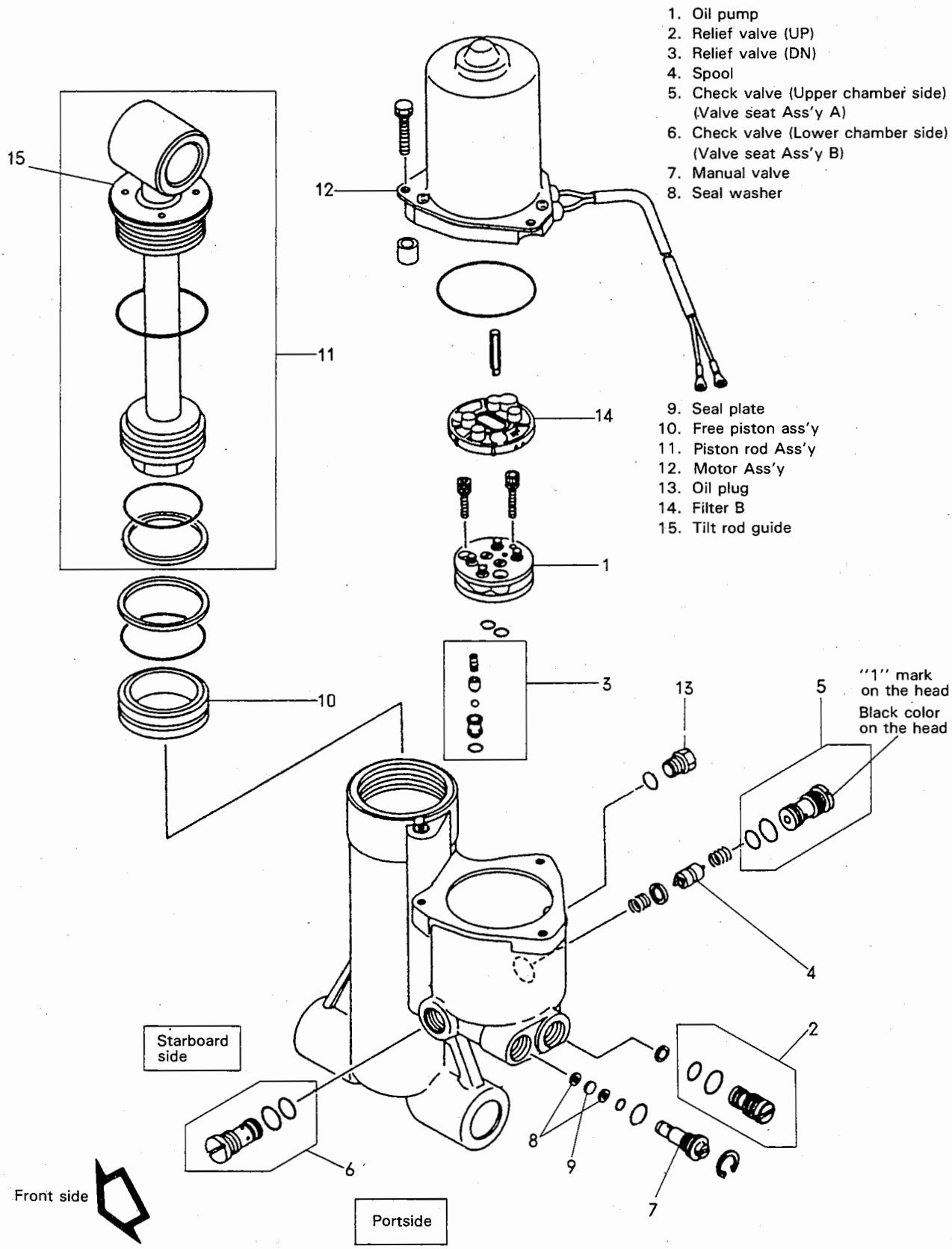
B	Black
Br	Brown
G	Green
L	Blue
Lg	Light green
Or	Orange
P	Pink
R	Red
Sb	Sky blue
W	White
Y	Yellow

18 POWER TRIM AND TILT

(1) System diagram

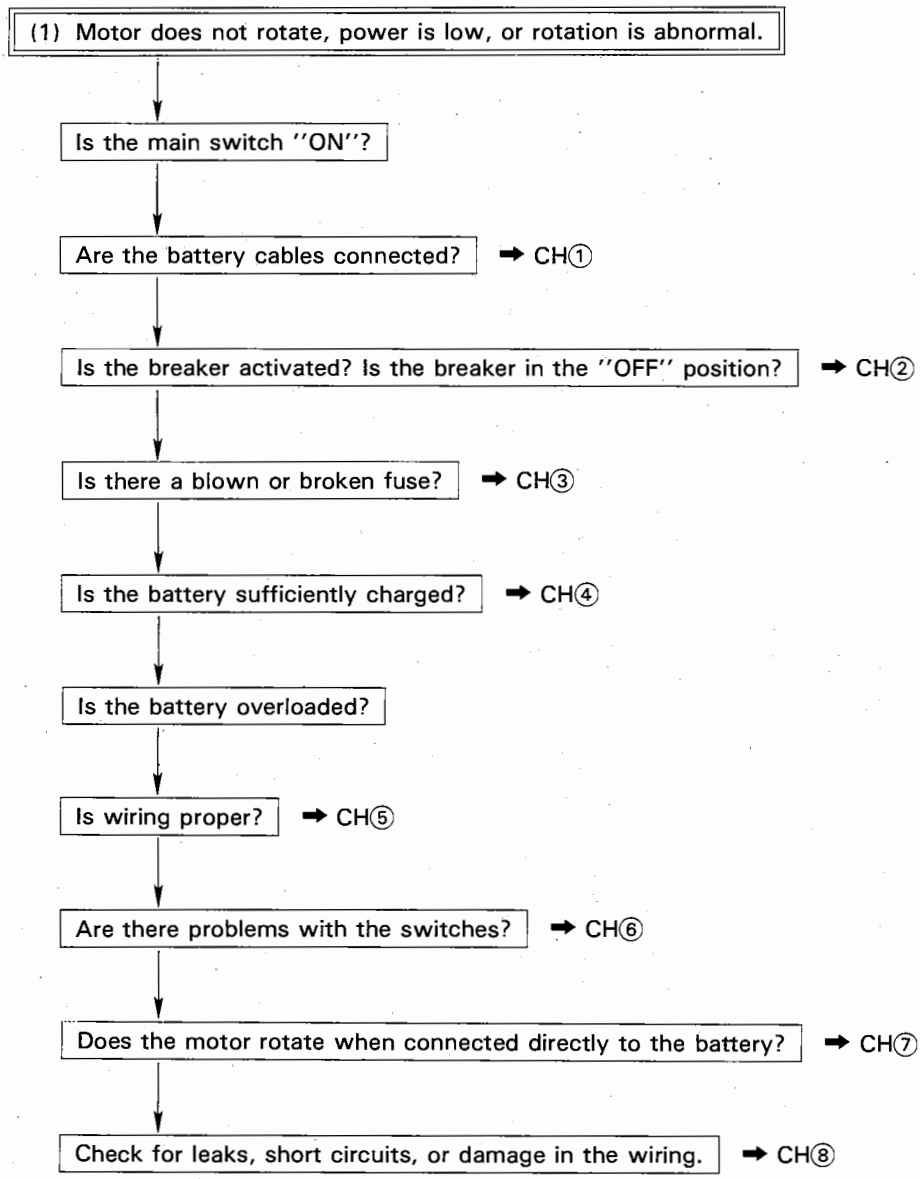


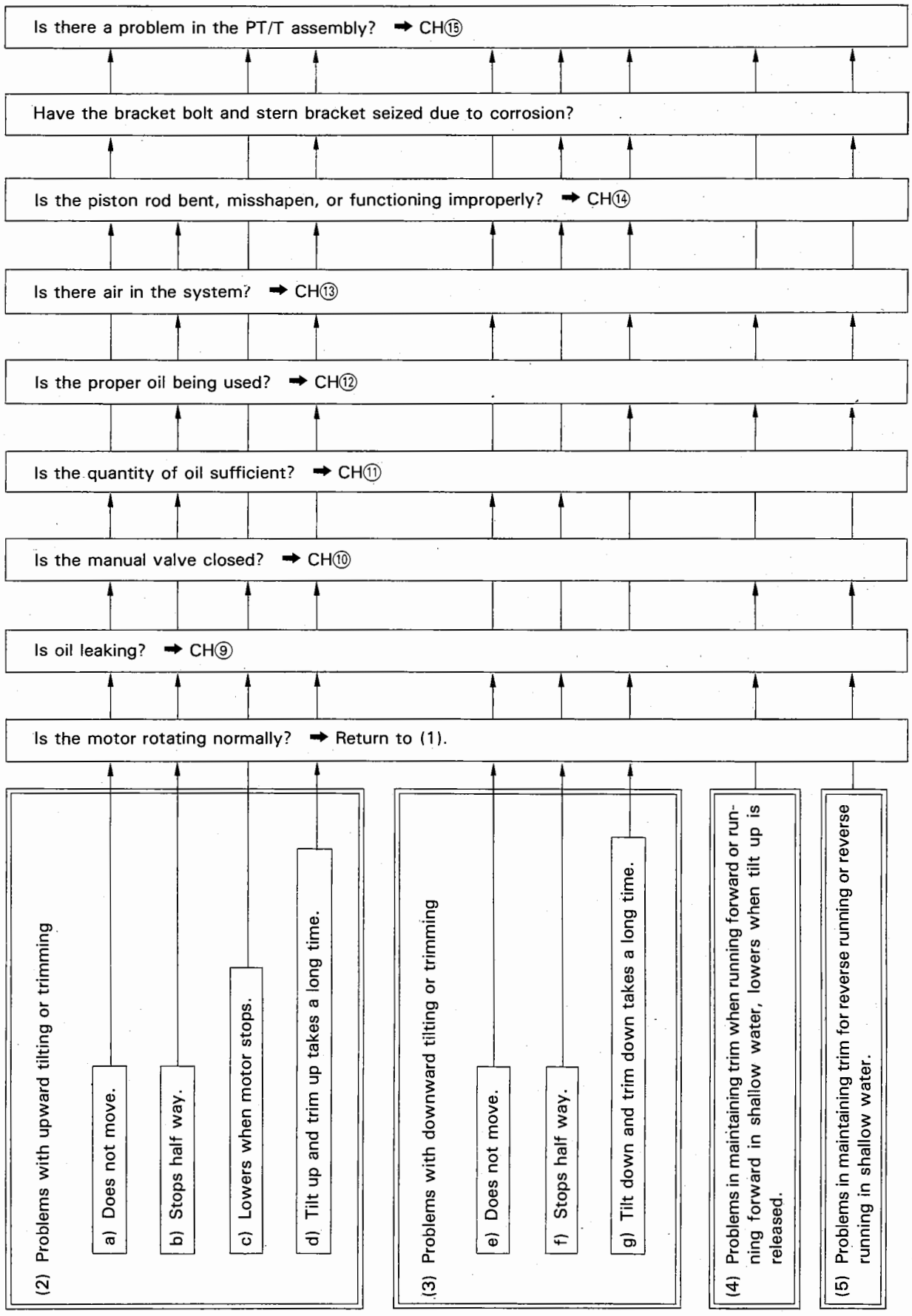
(2) POWER TRIM & TILT COMPONENTS



(3) Troubleshooting

1) Description of problem and checks




Is there a problem in the PT/T assembly? ➡ CH⑮
Have the bracket bolt and stern bracket seized due to corrosion?
Is the piston rod bent, misshapen, or functioning improperly? ➡ CH⑭
Is there air in the system? ➡ CH⑬
Is the proper oil being used? ➡ CH⑫
Is the quantity of oil sufficient? ➡ CH⑪
Is the manual valve closed? ➡ CH⑩
Is oil leaking? ➡ CH⑨
Is the motor rotating normally? ➡ Return to (1).
(2) Problems with upward tilting or trimming
a) Does not move.
b) Stops half way.
c) Lowers when motor stops.
d) Tilt up and trim up takes a long time.
(3) Problems with downward tilting or trimming
e) Does not move.
f) Stops half way.
g) Tilt down and trim down takes a long time.
(4) Problems in maintaining trim when running forward or running forward in shallow water, lowers when tilt up is released.
(5) Problems in maintaining trim for reverse running or reverse running in shallow water.

2) Checks

CH① Is a cable disconnected?

- Is the battery cable connected to the battery?
- Are the cables connected securely?

CH② Is the breaker activated? Is the breaker in the "OFF" position?

- Touch the motor. If it is hot, the breaker may be activated. Let it cool for at least three minutes.

CH③ Is there blown or broken fuse?

- Open the engine cover and check the fuses in the electric bracket.

CH④ Is the battery sufficiently charged?

- A battery of 12V 70AH to 12V 100AH should be used.
- Check the specific gravity of the battery elecrolyte. If it is 1.22 (at 20°C) or less recharge the battery.
- Operate the starter motor. If it rotates, the battery is OK.

CH⑤ Is wiring proper?

- Check for any mistakes using the wiring diagram.

CH⑥ Are there problems with the switches?

- Inspect the main switch. — Operate the other equipment (choke solenoid, starter motor, buzzer). Check they operate properly.
  Also use a tester to check the conductivity between the red leads. Electricity should flow when the switch is on.
- Power Trim & Tilt switch — Disconnect the sky blue lead (or the pink lead) from the solenoid switch in the engine's electric bracket, and touch the terminal directly to the terminal plate of the red cord. If the power trim and tilt assembly works, the power trim and tilt switch is defective. (to test trim up: use the sky blue lead, to test trim down: use the pink lead.) Also use a tester to check the conductivity of the power trim and tilt switch.
  Press the UP button of the switch. Electricity should flow between the red lead and the sky blue lead.
  Press the DOWN button of the switch. Elecricity should flow between the red lead and the pink lead.
- Solenoid switch — Disconnect the sky blue lead or the pink lead and touch the terminal of the red battery from lead. A clicking sound should be heard. Next check the conductivity between the solenoid switch terminals. Test results should match those in the table below when the solenoid switch is OFF. (NOTE: Disconnect the red battery lead when testing.)
  If the UP or DOWN side of one solenoid switch is known to be good without checking switch leads to test the other.

Item	Test points	Remote switch ON	Remote switch OFF
Solenoid switch for tilting up	between the blue and the black lead	non conductive	conductive
	between the blue and the red lead	conductive	non conductive
Solenoid switch for tilting down	between the green and the balck lead	non conductive	conductive
	between the green and the red lead	conductive	non conductive

CH⑦ **Does the motor rotate when connected directly to the battery?**

- Disconnect the power trim and tilt blue and green leads from the solenoid switch terminals and touch the terminals separately to the red lead and the black lead terminals. If it moves up when the blue lead is touched to the red lead and the green lead is touched to the black lead, and if it moves down when the blue lead is touched to the black lead and the green lead is touched to the red lead, the power trim and tilt motor is functioning correctly.
- Bring the power trim and trim assembly leads from the engine cover and touch the terminals directly to the battery terminals.
  If the motor does not turn, it is defective.

CH⑧ **Check for electric leaks from connectors, short circuits, or damage in the wiring and check the electric circuitry.**

- Check the conductivity and for short circuits, especially in the leads.
- Also check for damage to the switch leads.

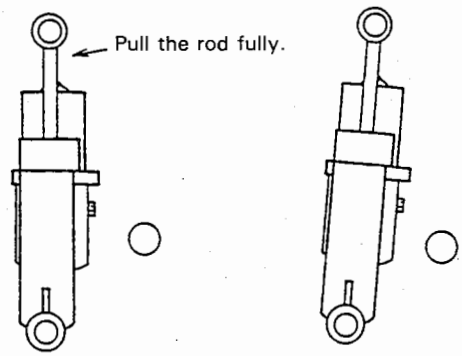
CH⑨ **Is oil leaking?**

- Check outside to see if oil is leaking.
- Small leaks are hard to find, so operate the power trim and tilt assembly and check for oil floating on the water.
- If oil is leaking from the power trim and tilt assembly or cylinder, or if there is breakage or incorrect assembly. Disassemble and inspect, and replace if necessary.

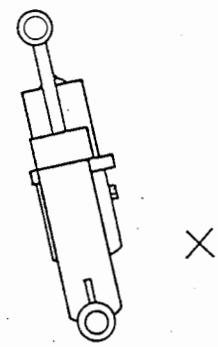
CH⑩ **Is the manual valve closed?**

CH⑪ **Is the quantity of oil sufficient?**

- Check the oil level.
- When the oil reservoir is empty and powered tilting up is not possible, turn the manual valve a few turns counterclockwise.
  Then tilt the engine up manually and set the tilt stopper.
  Check for oil leaks.
- Engine position when charging oil into the oil reservoir tank.



The power trim and tilt unit is vertical or inclined backward slightly.



If oil is added with the power trim and tilt unit inclined forward, overfilling may result. This may damage the unit.

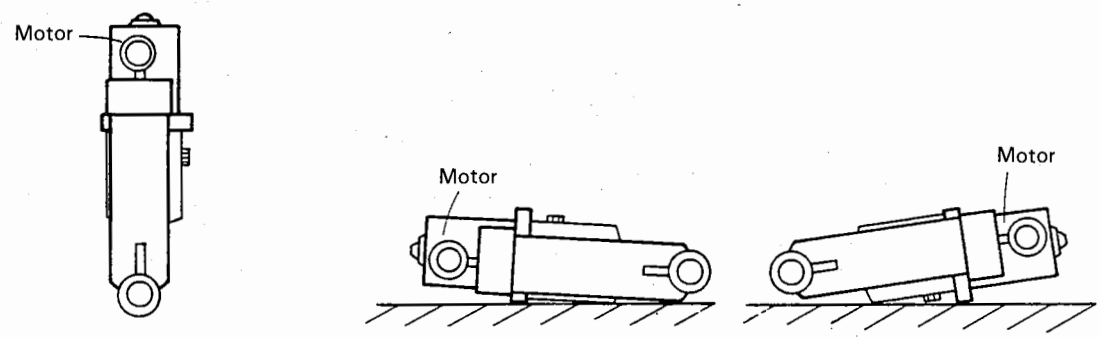
CH⑫ **Is the proper oil being used?**

- Only use the specified oil.
  (The oil used in this engine is NIHON SEKIYU ATF Dexron.)
  Specified oil: Automatic transmission fluid (conforming to GM standards)
  Mobil: Mobil DTE #22
  Mobil ATF 220
  Esso: Esso automatic transmission fluid
  Shell: Shell dexron II
  Shell terrace oil #22, K22

CH⑬ Is there air in the system?

- If the power trim and tilt assembly is operated with air in the system, muffled sounds can be heard.
- Air bleeding procedure (Close the oil plug while bleeding air).
  Open the manual valve and manually tilt up and down five times or more. Finally perform power tilt up and check the oil level.
- If air is deep in the system.
  This air cannot be easily bled, so bleeding the system at intervals of a few hours for several days.

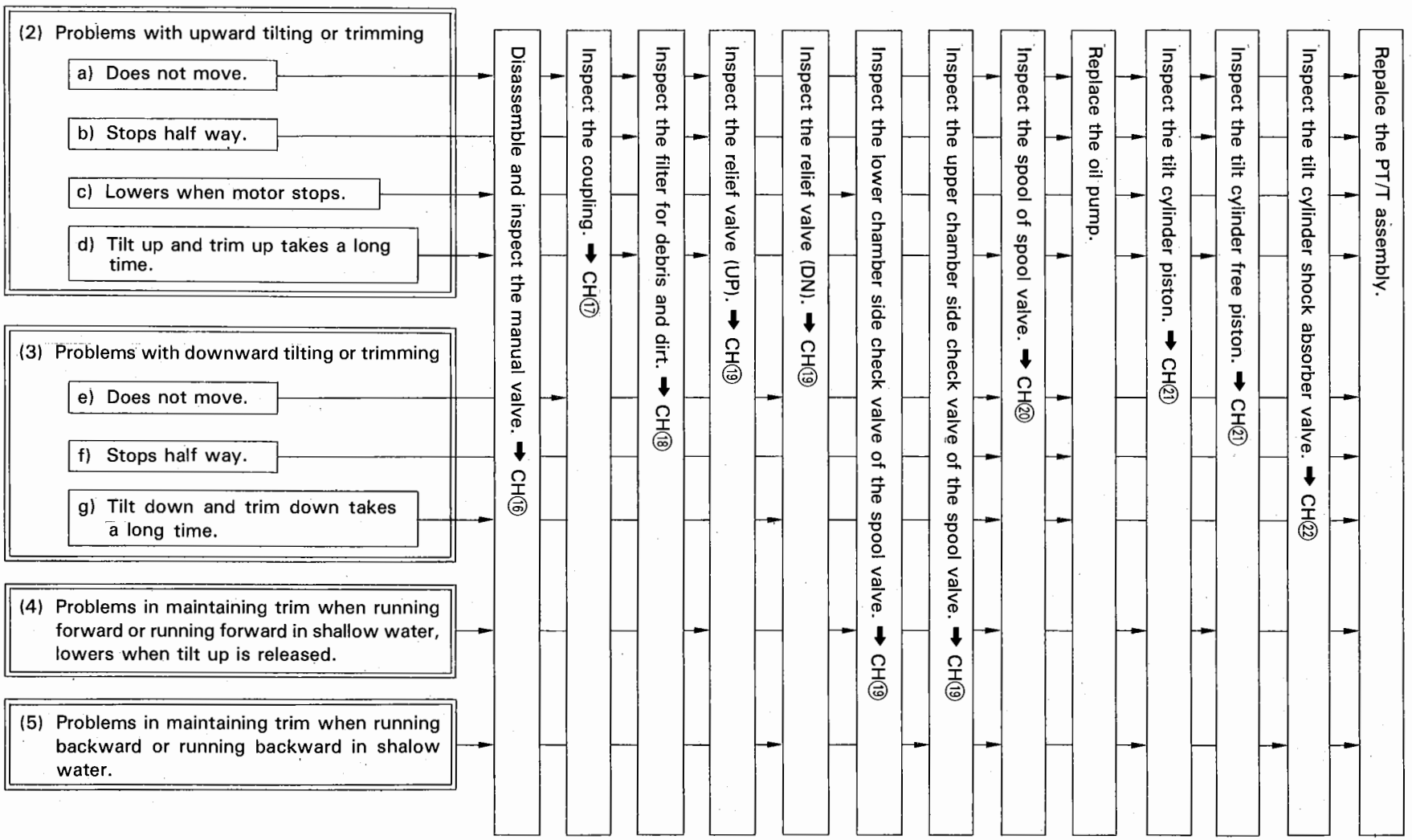
The following shows the storage position in which air will not enter the system.
(In the opposite positions, air will enter the system.)



CH⑭ Is the piston rod bent, misshapen, or functioning improperly?

- Open the manual valve, tilt up and down manually, and check that operation is smooth.
- Check visually.

CH⑮ Is there a problem in the PT/T assembly? ..... The inspection differs according to the problem. Refer to the following.



NOTES:

1. Use the exclusive stand (special tool) when disassembling the PT/T assembly.
2. When disassembling, tilt up (with piston rod extended), open the manual valve, then leave for a while until the inner pressure reaches 0.
3. When removing parts, take care that oil does not squirt out into your eyes or onto your clothes.
4. Open the reservoir tank oil plug and remove the oil, then remove the motor and reservoir tank.

CH⑯ **Disassemble and inspect the manual valve.**

Check for:
- Damage to the manual valve end surface
- Damage to the "O" ring
- Damage to the seal washers (especially the rubber seal)
- Damage to the bottom surface of the valve mounting hole

NOTE: Be careful that the seal washer is positioned properly when re-assembling.

CH⑰ **Inspect the coupling.**

Remove the motor and inspect the coupling.
- Is it disconnected?
- Is it damaged?

CH⑱ **Inspect the filter for debris & dirt.**

Remove the motor, filter and clean.

CH⑲ **Inspect the relief valves and check valves.**

Check for:
- Deterioration or bending of the spring
- Damage to the valve seat
- Damage or wear of the valve (ball)
- Smooth operation ... (catching on dirt, etc.) Push the ball manually and check return.
- Also inspect the UP relief valve filter for debris & dirt.
- Damage to the "O" ring

CH⑳ **Inspect the spool of valve spool.**

Check for:
- Smooth operation (to move push lightly by hand)
- Damage or wear of the backup ring

CH㉑ **Inspect the cylinder pistons.**

- Damage or wear of "O" ring and backup ring
- Damage to piston sliding surface of cylinder

CH㉒ **Inspect the tilt cylinder shock absorber valve.**

Disassemble the piston.
Check for:
- Deterioration or damage to the spring
- Damage to the valve (ball)
- Damage to the valve seat
- Dirt

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TOHATSU CORPORATION

Address: 4-9, 3-chome, Azusawa, Itabashi-ku, TOKYO 174, Japan
Cable: "TOHATSU TOKYO"
Telex 272-2051 THT J
Facsimile: TOKYO (03) 3969-7885 (GII・GIII)
Phone: TOKYO (03) 3966-3111

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