TOHATSU OUTBOARD MOTOR

M60B/M70B

SERVICE MANUAL

JUN 1995

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1 SPECIFICATIONS

*: Option

Item			Model	M60B EF* / M70B EF*	M60B EFO / M70B EFO	M60B EFTO* / M70B EFTO*	M60B EPO / M70B EPO	M60B EPTO / M70B EPTO
Dimensions	Total length	mm		Approx. 1280 (50.4 in.)			Approx. 720 (28.3 in.)	
	Total width	mm		Approx. 360 (14.2 in.)				
	Total height	mm	L	Approx. 1415 (55.7 in.)				
			XL	Approx. 1542 (60.7 in.)				
	Transom height	mm	L	530 (20.87 in.)				
			XL	657 (25.87 in.)				
Weight		kg	L	Approx.101 (222.8 lbs)	Approx.103 (227.0 lbs)	Approx.115 (253.5 lbs)	Approx.98 (216.0 lbs)	Approx.110 (242.5 lbs)
			XL	Approx.103.5 (228.2 lbs)	Approx.105.5 (232.6 lbs)	Approx.117.5 (259.0 lbs)	Approx.100.5 (221.6 lbs)	Approx.112.5 (248.0 lbs)
Performance	Max. output kW (ps)		M60B	44.7 (60)/5,000 RPM				
			M70B	52.2 (70)/5,500 RPM				
	Full speed operation range		M60B	4900 – 5600 RPM				
			M70B	4900 – 5600 RPM				
	Fuel consumption at full throttle		M60B	Approx. 24 liters/hr. (6.34 gals./hr)				
			M70B	Approx. 28 liters/hr. (7.4 gals./hr)				
Engine	Number of cylinder			3				
	Bore & stroke	mm		74 × 72.7 (2.91 in. × 2.86 in.)				
	Displacement	cc		938 (57.2 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-in25:1 After breaking-in 50:1	50:1 to 120:1			
	Oil tank			–	Integral tank (2.6 liters, 0.69 gals.)			
	Cooling system			Pressurized cooling (by rubber impeller)				
	Water temperature control			Thermostat (with pressure relief valve)				
	Intake system			Reed valve				
	Scavenging system			Loop charge 5 ports				
	Starting system			Electric starter motor (12 V 0.6 kW)				
	Battery			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 plug		M60B M70B	NGK B8HS-10 or CHAMPION L78C (gap 1 mm)				
	Number of carburetors			3				
	Engine rotation			Clockwise				
	Ignition timing		M60B	ATDC 3° – BTDC 16°				
			M70B	ATDC 3° – BTDC 20°				
	Trolling speed			650 – 800RPM				

Item		Model	M60B EF* / M70B EF*	M60B EFO / M70B EFO	M60B EFTO* / M70B EFTO*	M60B EPO / M70B EPO	M60B EPTO / M70B EPTO
Lower unit	Number of trim stage (degree)		5 (8° – 24°)				
	Tilt up angle (degrees)		76°				
	Trim angle running in shallow water						Adjusting by Power Trim & Tilt
	Max. steering angle (degrees)		65°			60°	
	Power trim and tilt		–				Manifold type single cylinder
	Shift system		Dog clutch (F – N – R)				
	Gear ratio		13: 23				
	Exhaust system		Through the propeller hub				
	Transom board-recommended thickness		35 – 60 mm (1.37 – 2.36 in.)				
Other	Operation		Steering bar handle			Remote control	
	Fuel tank		25 liters (6.6 US gals.)				
	Standard propeller (no. of blades × diameter × pitch in inch)	M60B	L transom : 13 (3 × 11.5 × 13.0) XL transom : 12 (3 × 11.6 × 12.0)				
		M70B	L transom : 14 (3 × 11.4 × 14.0) XL transom : 12 (3 × 11.6 × 12.0)				
	Tachometer		–			Poles selecting type with low oil level warning lamp	
	Trim meter		–				Standard equipment
	Remote control box		–		Power trim & tilt switch	RC5B single lever	RC5A single lever
				Warning buzzer (low oil level)		with: * warning buzzer (low oil lever) over heat buzzer * neutral lock * neutral switch * emergency stop switch * level friction * terminal for accessory	
			Over heat buzzer neutral switch emergency stop switch				
	Control device		• High speed ESG (over-running prevention device) • Low speed ESG (requires optional over heating sensor thermostat)				
	Buzzer		–	Low oil level warning buzzer		Low oil level warning lamp and buzzer	
			–				PT/T assembly equipped with a shock absorber for when lowering the power unit. (outboard motor)

Optional parts	Propeller (Number of blades × diameter × pitch in inches)	9 (3 × 12.0 × 9) 10 (3 × 11.5 × 10) 11 (3 × 11.5 × 11) 12 (3 × 11.6 × 12) 13 (3 × 11.5 × 13) 14 (3 × 11.4 × 14) 15 (3 × 11 × 15) 16.5 (3 × 10.7 × 16.4) 17.5 (3 × 10.9 × 17.6)
	Hour meter	
	Fuel guage	
	Speedmeter	50 MPH kit B, 75 MPH kit B
	Water pressure meter	
	Water pressure switch	
	Water temperature meter	
	Voltage meter	
	Drive cleaner kit	
	Tie-bar kit for dual motor (mounting)	
	Twin remote control box kit	
	Binnacle mounted remote control box	

2 PRECAUTIONS DURING DISASSEMBLY AND RE-ASSEMBLY

① Secure the outboard motor to a work stand during repairs.
② Be careful not to damege 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.
⑪ When disassembling the power trim & tilt, make sure to set it in the tilt-up state (piston rod reaches the top dead center) and to open the manual valve slightly for removing internal pressure beforehand.
⑫ When removing component parts of the power trim & tilt, be the most careful of spouting out of oil not to get your clothes and eyes soiled and injured.
⑬ For disassembling/reassembling the power trim & tilt, exclusive tools are specified as follows.
- Wrench for Tilt rod guide
- Wrench for Trim rod guide
- PTT (Power Trim & Tilt) stand

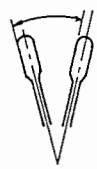
3 SERVICING DATA

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)	73.95 ± 0.01 mm (2.911 ± 0.0003937 in.)	
		Piston clearance	0.04 to 0.08 mm (0.00157 to 0.00314 in.)	
	Piston ring	Ring gap top ring and second ring	0.22 to 0.37 mm (0.00866 to 0.0146 in.)	
	Crank shaft	Deflection	Within 0.05 mm (0.00199 in.) with both ends of crank shaft supported	
	Reed valve stopper	Lift height M60B M70B	10.0 to 10.2 mm (0.393 to 0.401 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.)	833 kPa (8.5 kg/cm^2, 120.9 P.S.I.)	
Fuel	Carburetor		M60B	M70B
		Setting Mark	M60BA	M70BA
		Venturi Diameter	28 mm	28 mm
		Main jet (MJ)	#145	#145
		Main air jet (MAJ)	#145	#145
		Main nozzle	ø3.4 mm	ø3.4 mm
		Slow jet	#75	#75
		Slow air jet	#75	#75
		Pilot screw (turn counter-clockwise)	1½ ± ¼	1½ ± ¼
		Choke valve leak hole	#1 ø11, #2 ø9.3, #3 ø9.3 mm	
		Trolling speed	600 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 17 ~ 15 °	ATDC 3 ~ 1 ° – BTDC 20 ~ 18 °
		Spark performance at 500 rpm (measured with Tohatsu spark tester)	10 mm (0.394 in.) and over at (500 rpm)	
		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 lead wire W~Y W~W [5] Y~W [5]	0.21~0.31 Ω (ohm) 0.72~1.08 Ω (ohm) 0.90~1.36 Ω (ohm)	
		Pulser coil resistance Lead wire W/R or W/B or W/L~B	160 to 240 Ω (ohm)	
		Charge coil resistance Lead wire W/G~Br/W Br/W~W/Y	216 to 324 Ω (ohm) 16 to 24 Ω (ohm)	

Part		Item	Standard Value, Type, Number, etc.
	Ignition coil	Primary coil resistance leadwire B/W~B Secondary coil resistance high tension cord~B	0.16 to 0.24 Ω (ohm) 3.28 to 4.92 k Ω (kilo-ohm)
	CD unit	High speed ESG (cut-in-speed)	6,100 rpm ± 250 rpm
		Low speed ESG (requires optional over heating thermostat)	3,500 rpm ± 400 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
	Water pressure switch	Working water pressure	Activated by water pressure of 9.8 ± 0.98 kPa (0.1 ± 0.01 kg/cm^2) or lower.

2. Repair limits

Part	Repair Item	Repair Limit	Correction Procedure/Precision
Spak Plugs	Plug gap	1.2 mm (0.0472 in.) or greater	0.9 – 1.0 mm (0.0354 – 0.0397 9in.) Replace, if electrode wear is extreme.
Water pressure sensor	Working water pressure	If the switch does not turn off at 9.8 ± 0.98 kPa (0.1 ± 0.01 kg/cm^2, 0.1023 lb/in^2) after being pressurized from zero (In a depressurized state the cut off pressure will vary.)	Gradually pressurize from zero and adjust with the adjusting screw so that the switch turns off at 9.8 ± 0.98 kPa (0.1 ± 0.01 kg/cm^2).
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 and hone 74.50 to 74.53 mm Pay attention to the ports chamfer. Rechamfer if insufficient. Use oversized piston and piston ring after re – boring and honing.
Piston ring	Piston ring end gap	0.8 mm (0.0314 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)	 Other than H= 10.0~10.2 mm (0.393~0.401 in.)	Repair to H=10.0 to 10.2 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 16)
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.	○	○			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 clios, 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 13 ~ 15)
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 head, head cover, thermostant, 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 passage (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	• M60B ATDC 3 ° ± 1 ° ~ BTDC 16 ° ± 1 ° • M70B ATDC 3 ° ± 1 ° ~ BTDC 20 ° ± 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				

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
21. Starter rope	• Inspect for flaws and damage.	Every time before use				Keep for emergency use.
22. Remote control box	• Check operation of key switch, safety switch, accelerator lever, control valve and buzzer.	Every time before use				
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 61.					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	Three Bond 1342	Three Bond 1373B	Three Bond G17	Three Bond 1741	Three Bond 1104-I	Insulating grease	Low temperature standing grease (Lithium)	Tohatsu grease	Three Bond 1107	Tohatsu engin 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 linigs										○				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.
Air silencer screw	○													Thread portion
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												○		Fill between sensor and cylinder.
Starter motor						○①		○②						
Starter solenoid						○								Two terminals
Power trim & tilt solenoid switch						○								Six terminals
Steering handle grip								○						
Steering handle collar								○						

①On terminals ②Thinly on pinion

Item \ Sealing Agents / Adhesives / Lubricants	Three Bond 1342	Three Bond 1373B	Three Bond G17	Three Bond 1741	Three Bond 1104-I	Insulating grease	Low temperature standing grease(Lithium)	Tohatsu grease	Three Bond 1107	Tohatsu engin oil	Tohatsu gear oil	Silicon-oil compound	Automatic transmission fluid	Remarks
Throttle shaft bushing								○						
Throttle shaft lever								○						
Throttle cable								○						
Shift lever shaft bushing								○						
Shift lever bolt	○							○						
Shift lever bolt holder	○							○						
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								○						Inserted 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 locking rubber								○						Outer and inner
Pump case								○						Apply it thinly to the inner portion (inside)
Pump case linner								○						
Engine base sealing rubber				○										
Exhaust housing grommet			○ or ○											Fitting portion
Splash pan fitting bolt								○						Bolt shaft
Splash pan 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 1.9 — 6.8											○			
Cam rod O-rring 3.5 — 27.7							○							
Cam rod stopper bolt							○							Bolt shaft
Gear oil											○			Approx. 700 cc, 1.48 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	Three Bond 1342	Three Bond 1373B	Three Bond G17	Three Bond 1741	Three Bond 1104-I	Insulating grease	Low temperature standing grease (Lithium)	Tohatsu grease	Three Bond 1107	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.
Lower mounting bolt		○												Apply to the thread.
Mounting bracket								○						Spline
Tilt stopper								○						Sliding part
Filler lid hings								○						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.
Engine base seal rubber				○										
Filler lid seal rubber				○										
Engine base gasket									○					
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
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													○	

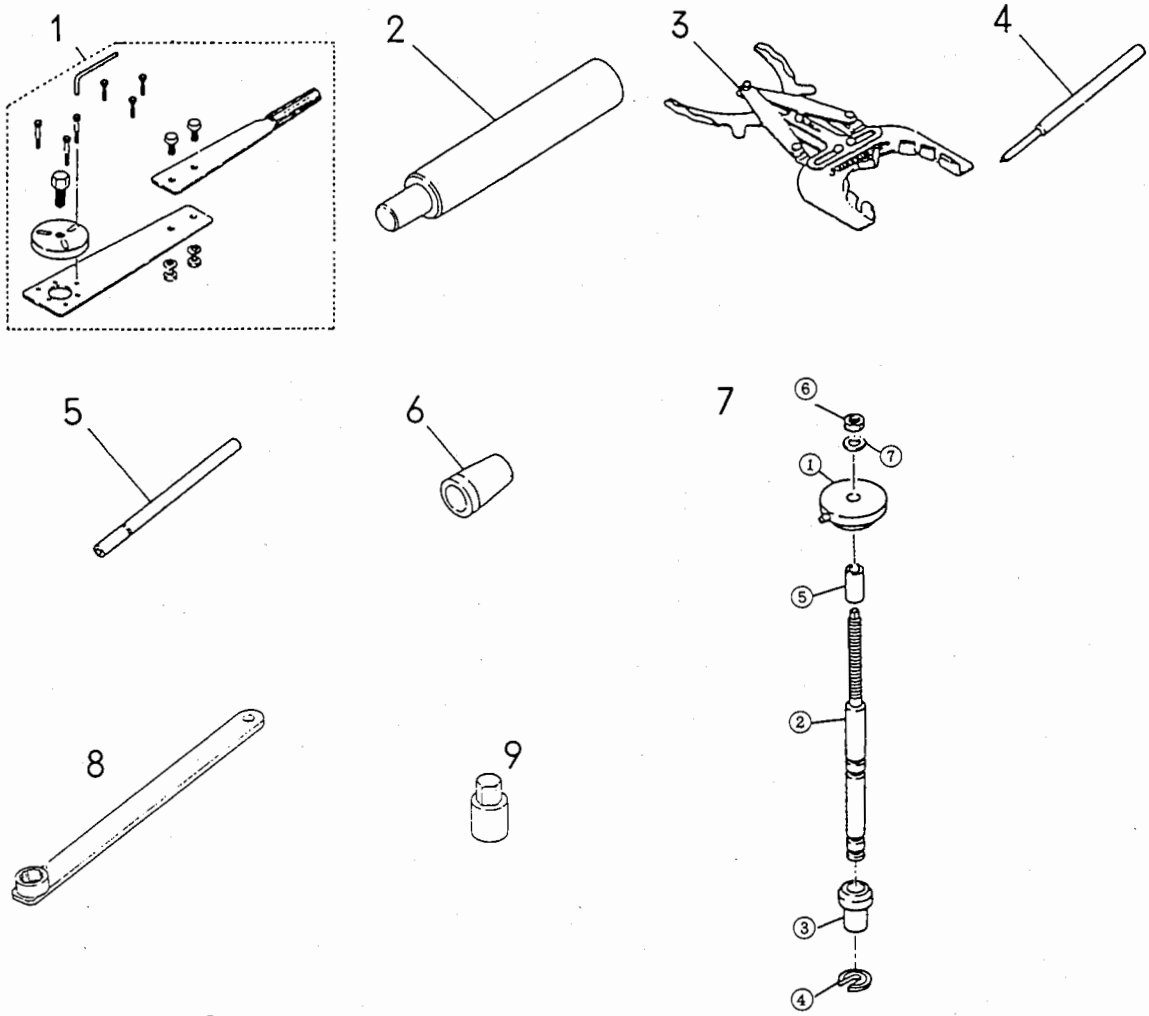
Item			Initial torque			Final torque		
			N − m	kg − m	lb − ft	N − m	kg − m	lb − ft
Engine unit	Cylinder head bolt	M8	②11.76 to 14.7	②1.2 to 1.5	②8.68 to 10.85	③29.4 to 34.3	③3.0 to 3.5	③21.68 to 25.59
	Cylinder head bolt	M6	①2 to 3	①0.2 to 0.3	①1.4 to 2.2	④4.61 to 6.27	④0.47 to 0.64	④3.40 to 4.63
	Crank case bolt	M8	11.76 to 14.70	1.2 to 1.5	8.68 to 10.85	23.52 to 25.48	2.4 to 2.6	17.34 to 18.79
		M10	16.66 to 22.54	1.7 to 2.3	12.29 to 16.62	37.24 to 41.16	3.8 to 4.2	27.46 to 30.35
	Exhause 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
	Inlet Manifold		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					137.2 to 156.8	14 to 16	101.22 to 115.68
	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					39.2 to 49	4 to 5	28.92 to 36.15
	Lower mounting rubber nut					34.3 to 44.1	3.5 to 4.5	25.31 to 32.54
	Gear case fitting bolt	M8				23.52 to 25.5	2.4 to 2.6	17.35 to 18.80
		M10				37.2 to 41.1	3.6 to 4.2	27.48 to 30.37
	Propeller nut					29.4 to 39.2	3.0 to 4.0	21.69 to 28.92
Power trim & unit	Bolt P-T.T					22.5 to 30.5	2.3 to 3.12	16.62 to 22.55
	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 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 assemby (UP side)					11.76 to 13.72	1.2 to 1.4	8.68 to 10.12
	Spool check valve assembly					8.82 to 10.7	0.9 to 1.1	6.51 to 7.95
	Tilt rod guide					78.4 to 117.6	8 to 12	57.84 to 86.76
	Ball joint C					2.94 to 4.9	0.3 to 0.5	2.17 to 3.62
	Neutral switch (F type)					2.94 to 3.43	0.3 to 0.35	2.17 to 2.53
	Air silencer cover					0.49 to 0.98	0.05 to 0.10	0.36 to 0.72
	Electric cover					0.49 to 0.98	0.05 to 0.10	0.36 to 0.72
	Shift lever shaft					5.88 to 7.84	0.6 to 0.8	4.34 to 5.78
	Handle B					23.52 to 25.48	2.4 to 2.6	17.35 to 18.80
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	2.30 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	353-72215-0	Piston pin tool	Detaching and re-attaching the piston
3	353-72249-0	Piston ring tool	Detaching and re-attaching the piston rings
4	369-72217-0	Spring pin tool A (d=3.5)	Detaching spring pins
5	369-72218-0	Spring pin tool B (d=3.5)	Attaching spring pin
6	353-72229-0	Clutch pin snap tool	Detaching and re-attaching the clutch pin snap
7		Needle bearing puller	Detaching and re-attaching needle bearings in the gear case and propeller shaft housing.
①	353-72701-0	Needle bearing puller plate	
②	3B7-72702-0	Needle bearing puller shaft	
③	353-72705-0	Needle bearing puller guide	
④	353-72703-0	Needle bearing puller retainer	
⑤	353-72704-0	Needle bearing puller shaft stopper (ϕ 17.3 × ℓ 35)	
⑥	3B7-72735-0	Nut (M12 P1.5)	
⑦	346-72707-0	Washer (13 − 21 − 2.5)	
8	353-72231-0	Bevel gear B nut wrench	Detaching and re-attaching bevel gear B nut
9	345-72232-0	Bevel gear B nut socket wrench	
10	353-72250-0	Shimming gauge	Measurement of position of bevel gear B
11	353-72251-0	Thickness gauge	
12		Backlash measuring tool	Measurement of backlash between gears A and B Use 4 pcs.
①	3B7-72723-0	Backlash measuring tool shaft	
②	3B7-72734-0	Conedisk spring (d=12)	
③	3B7-72735-0	Nut (M12 P1.5)	
④	332-60002-0	O-ring (2 − 9)	
⑤	3A3-72245-0	Backlash measuring tool set piece A A=20, B=22	
⑥	3B7-72724-0	Backlash measuring tool plate	

No.	Part Number	Tool	Use
13		Backlash measuring tool	Measurement of backlash between gears B and C
①	353-72725-0	Backlash measuring tool plate B	
②	3A3-72726-0	Backlash measuring tool shaft B	
③	3A3-72727-0	Backlash measuring tool set piece B	
④	930191-0800	Nut	
⑤	940191-0800	Washer	
⑥	940191-1000	Washer	
⑦	930191-1000	Nut	
14	3B7-72224-0	Bevel gear A bearing puller Ass'y	Detaching bevel gear A bearing outer
15		Bevel gear A bearing outer press	Attaching bevel gear A bearing outer
①	3B7-72731-0	Bearing outer press rod	
②	3B7-72733-0	Bearing outer press guide	
③	353-72732-0	Bearing outer press plate	
④	931191-1000	Nut	
⑤	941392-1000	Spring washer	
16	353-72252-0	Propeller shaft housing puller Ass'y	Detaching propeller shaft housing
17	353-72247-1	Power head stand	Working table for power unit
18	353-72248-0	Shift rod joint puller	Pull up tool for shift rod joint
19		Power trim & tilt special tool	Detaching and re-attaching piston rod ass'y Detaching and re-attaching trim rod guide
①	3B7-72791-0	Tilt rod guide wrench	
②	3B7-72792-0	Trim rod guide wrench	
③	3B7-72794-0	Power trim & tilt stand	
20	3B7-72720-0	Backlash measuring tool clamp ass'y	Measurment of backlash between gear A and B, Band C
21	3B7-72729-0	Dial gauge plate	
22	910191-0835	Bolt	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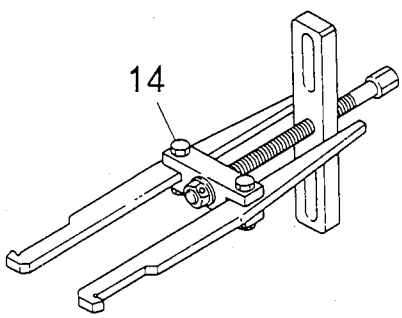
A
B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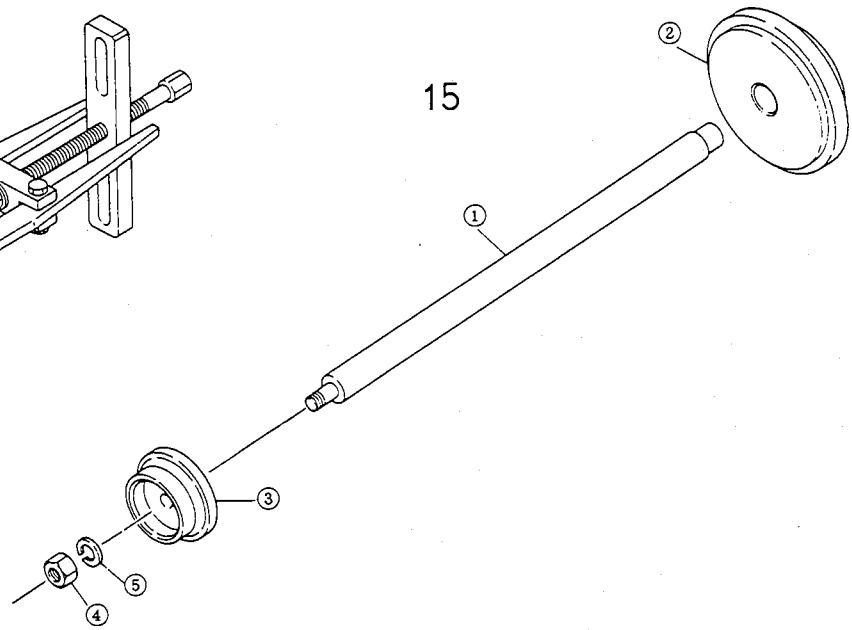
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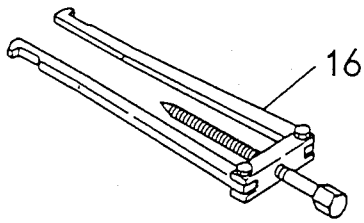
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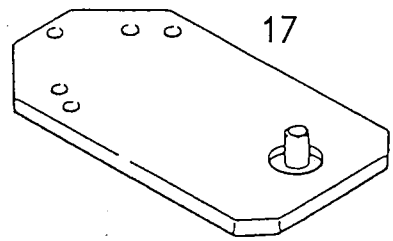
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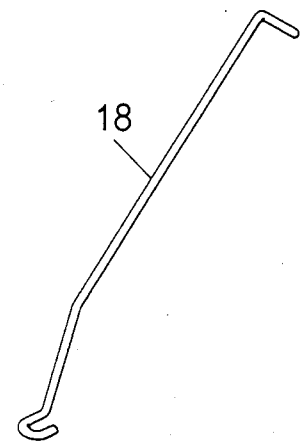
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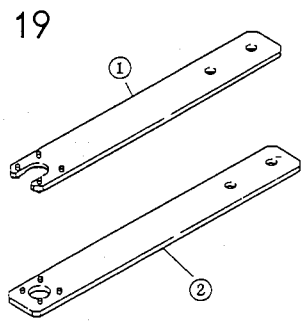
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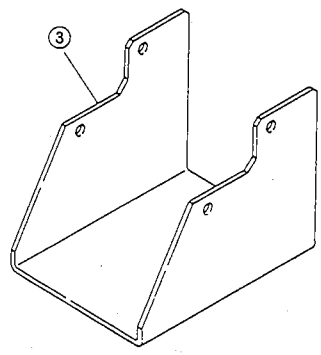
1
2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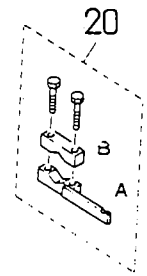
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B
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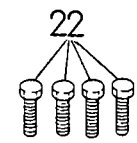
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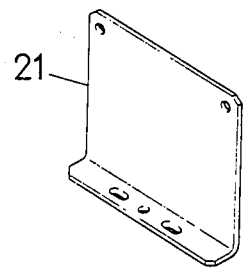
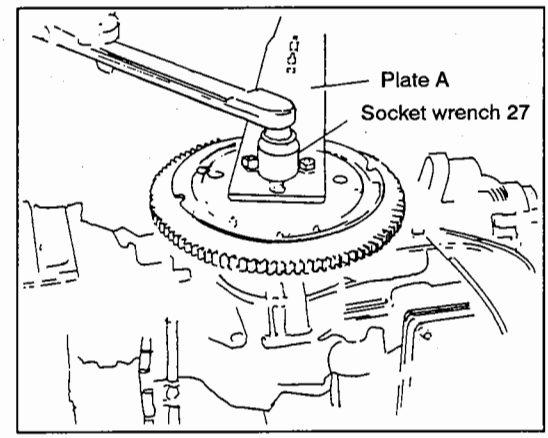

21

8 USE OF SPECIAL TOOLS

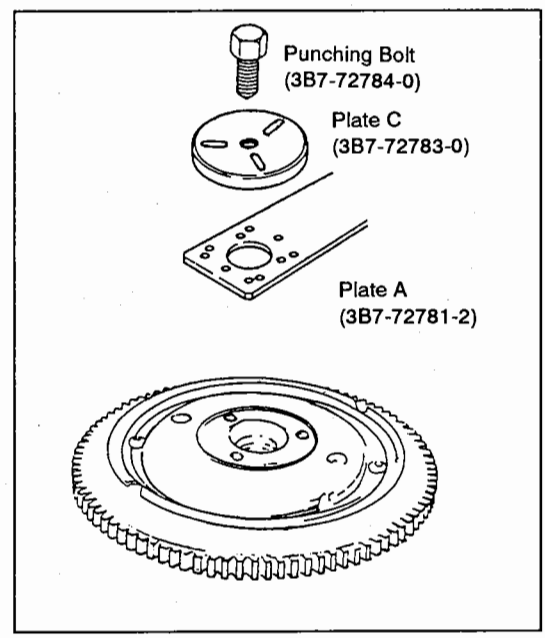
(1) Flywheel removal

a. Removal of flywheel nut
Fix the flywheel puller assembly with the hexagonal holed bolt (M8 × 25) and remove the magneto with socket wrench 27.

NOTE: Magneto nut is turned clockwise to tighten.
Only use specified bolts, or coil plate assmbly electrical components may be damaged.



b. Removal of flywheel
Install plate A and plate C to Flywheel using M8 × 40, tighten with a 19 socket wrench, and remove the flywheel.
Only use specified bolts, or coil plate assembly electrical components may be damaged.



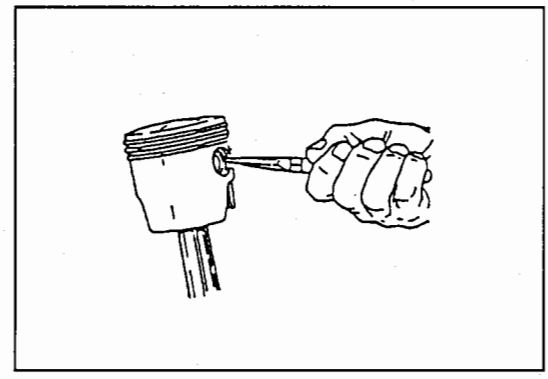
(2) Flywheel installation

To install the flywheel magneto, first check if the magneto key is inserted. Then install the flywheel, insert the magneto washer, and tighten the nut.
Install the flywheel puller assembly on the flywheel magneto and tighten with the specified torque 137.2 to 156.8 N-m (14 to 16 kg-m, 101.22 to 115.68 lbs-ft.).

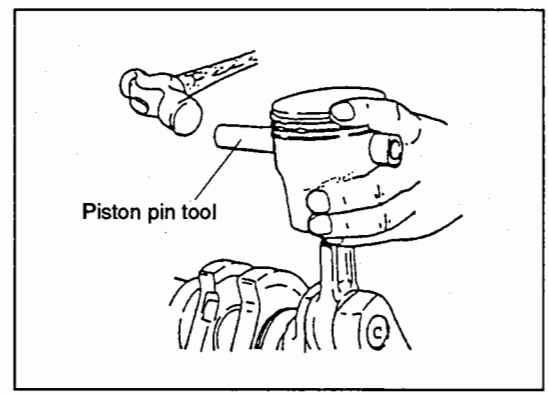
NOTE: (i) Remove grease completely from the crank shaft and tapered part of the magneto.
(ii) Apply oil to the thread.

(3) Disassembly and assembly of piston pin

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



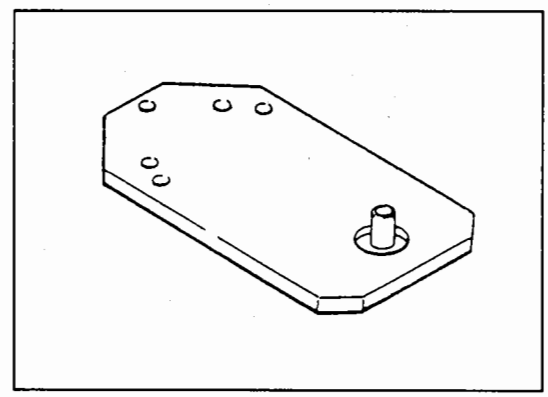
Place piston pin tool (353-72215-0) against the piston pin and tap lightly with a hammer to remove. Hold the piston by hand and be careful that the connecting rod is not bent.
(Take care not to hit the small end bearing washer.)



b. Assembly
To insert the piston pin, insert the small end bearing into the connecting rod, insert the side washers into both sides, lightly tap the tip of the piston tool with a hammer to insert, and finally install the piston pin clips.
NOTE: Always use new piston pin clips.

(4) Power head stand

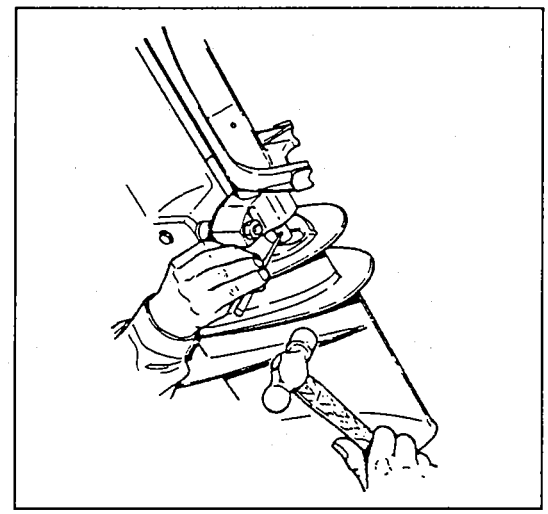
(353-72247-1 common for M70A2)
Use the power head stand when removing the power unit from the outboard motor and disassembling or assembling on a work table.
Secure the power head stand in the vice, position the cylinders engine base with the contacting surface on the stand and fix with M10 Pitch 1.25 bolts.



(5) Spring pin tool

a. Use spring pin tool A (369-72217-0) to remove the spring pin.

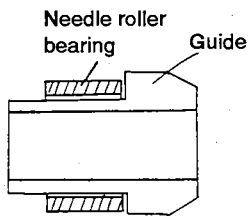
b. Use spring pin tool B (369-72218-0) to insert the spring pin.
NOTE: (i) Always replace spring pins which have been removed.
(ii) After mounting, set so that each pin protrudes by the same amount.
iii) Set the joggle of spring pin upward or downward.

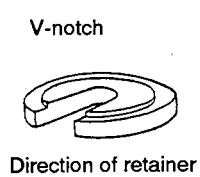


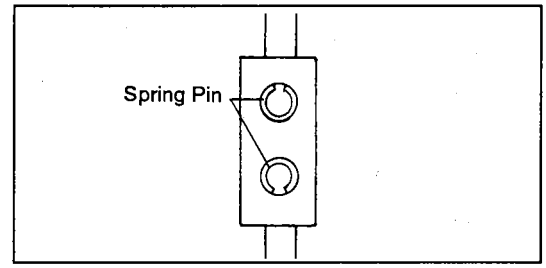
(6) Propeller shaft housing needle roller bearing puller

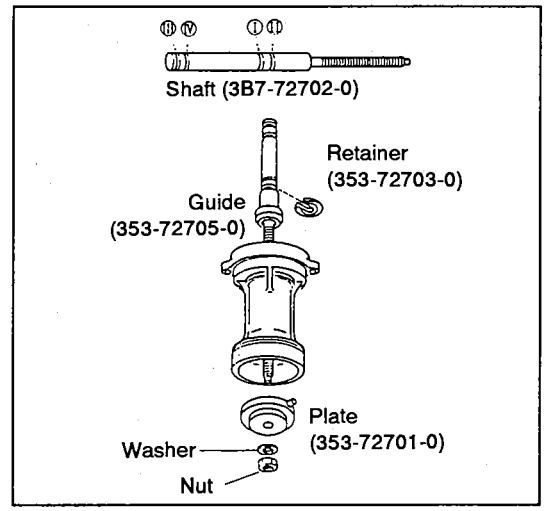
a. Removal of needle roller bearing
1) Remove the oil seal from propeller shaft housing.
2) Remove bearing by heating the propeller shaft housing.
3) Insert the shaft (3B7-72702-0) into the needle roller bearing.
4) Attach retainer (353-72703-0) to shaft groove Ⅱ. Set the V-shaped groove surface of retainer on the bearing side.
5) Install guide (353-72705-0) and plate (353-72701-0) to the shaft and remove the needle roller bearing.

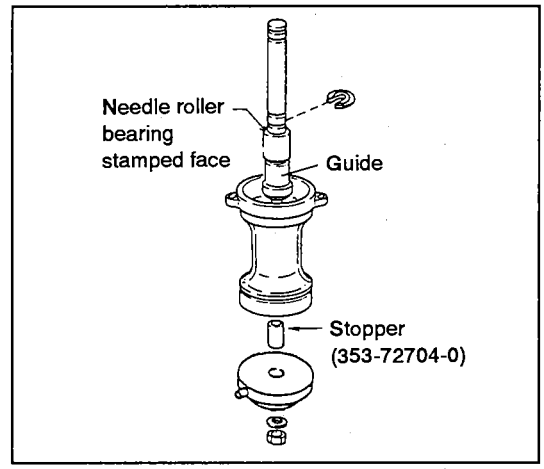
b. Installation of needle roller bearing
1) Attach retainer to shaft groove Ⅱ
2) Set the needle roller bearing, install guide, and insert the propeller shaft housing from the propeller side.
3) Attach the stopper (353-72704-0) and plate from the gear side of the propeller shaft housing.
4) Set the needle roller bearing with its stamp facing the retainer. The V-notch should be set in the bearing side.
5) Tighten nut together with washer. Needle roller bearing and guide (353-72705-0) shall be set as shown below.







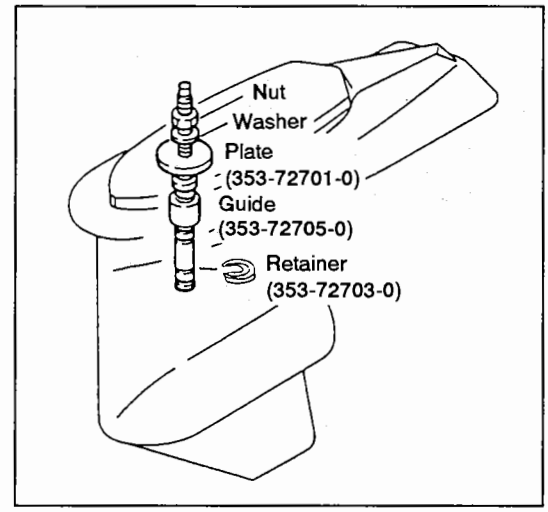


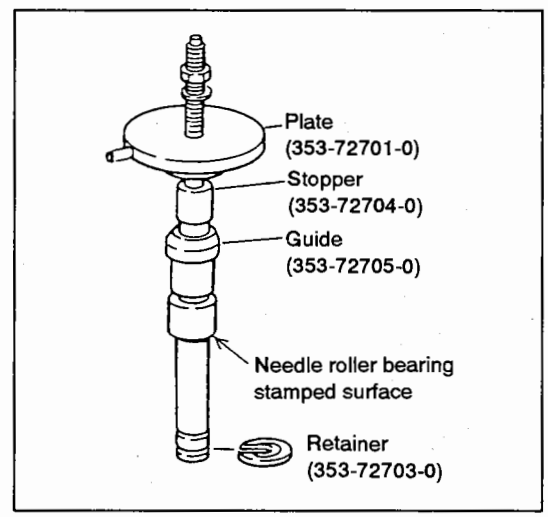


(7) Gear case needle roller bearing puller

a. Needle roller bearing removal
   1) Insert the shaft (3B7-72702-0) into the gear case.
   2) Insert the retainer (353-72703-0) into groove Ⅳ. Attach guide (3B7-72705-0) and plate (3B7-72701-0).
   3) Turn the nut clockwise to remove the needle roller bearing.

b. Needle roller bearing installation
   1) Insert the shaft (3B7-72702-0) 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 (353-72703-0) into groove Ⅲ.
   3) Place guide (3B7-72705-0) and shaft stopper (346-72704-0) onto the shaft from above.
   4) Attach plate, the washer and the nut to the shaft.
   5) Turn the nut clockwise until the shaft stopper touches plate.



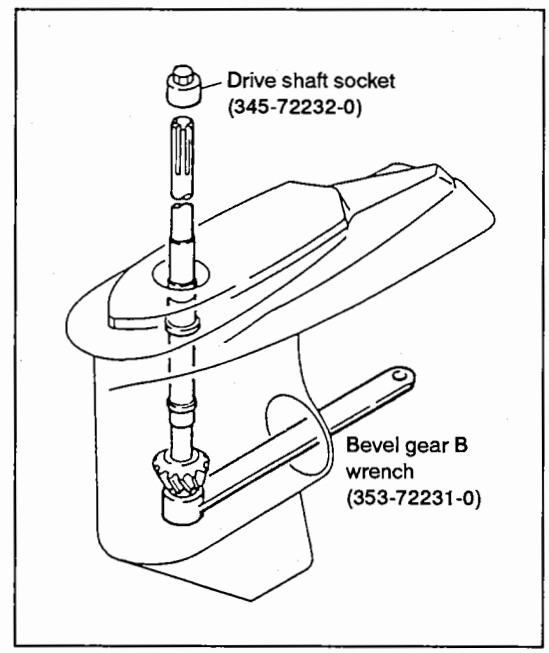


(8) Bevel gear B nut

a. Bevel gear B nut removal
   1) Hold the bevel gear B nut with the bevel gear B wrench (353-72231-0).
   2) Attach the drive shaft socket (345-72232-0) to the drive shaft, and turn the drive shaft counterclockwise.

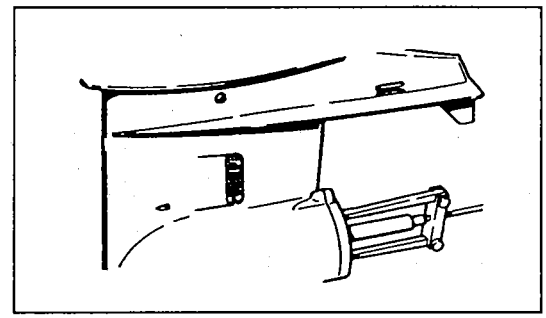
b. Bevel gear B nut installation
   1) Remove all grease completely from the drive shaft thread and the bevel gear B nut.
   2) Apply screw locking agent (Three Bond 1342) to the bevel gear B nut.
      NOTE: Do not apply more screw locking agent than necessary.
   3) Hold the bevel gear B nut with the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

      Torque: 39.2 to 58.5 N-m
      (4 to 6 kg-m
      28.9 to 43.4 lbs-ft)



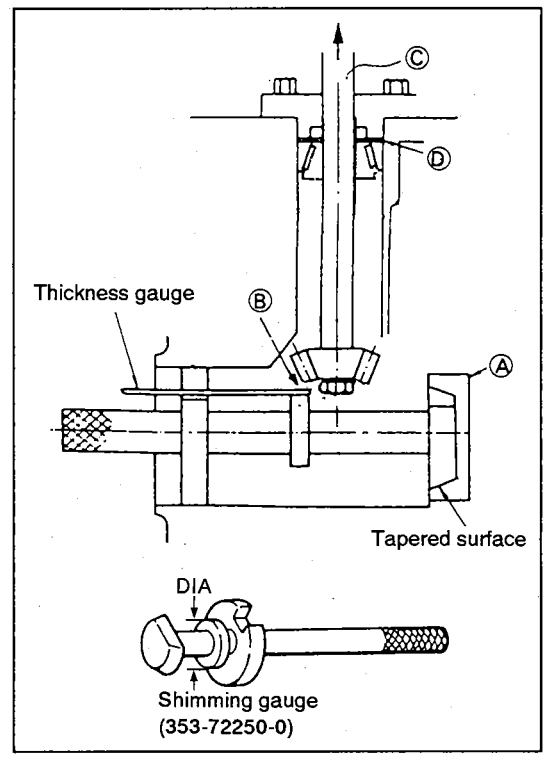
(9) Propeller shaft housing

a. Removal of propeller shaft housing
   Remove the propeller shaft housing installation bolt, set the housing puller and tighten.



(10) Shimming gauge (353-72250-0)

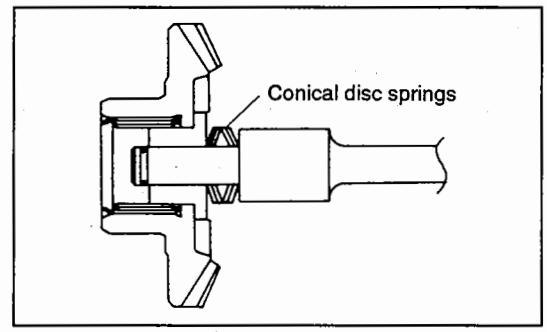
a. Install the drive shaft assembly on the gear case. Install the lower pump case and fix. (Use M8 × 30 and plane washer 8.)
b. Install bevel gear B on the drive shaft with the nut (tightening torque: 4~6 kg-m).
c. insert the shimming gauge into the gear case and set so that the tapered surface of the gauge is in contact with the tapered surface of the bevel gear A bearing outer race A.
d. Measure the gap between the gear B end and the shimming gauge with the thickness gauge.
   (When measuring, lift the drive shaft upward to eliminate looseness.)
   Gap: 0.95~1.00 mm (with impress of "1", DIA=54mm)
   2.20~2.25 mm (with impress of "2.25", DIA=51.5mm)
   If the gap is not as specified, insert a shim into the bottom of the lower pump case D to adjust.

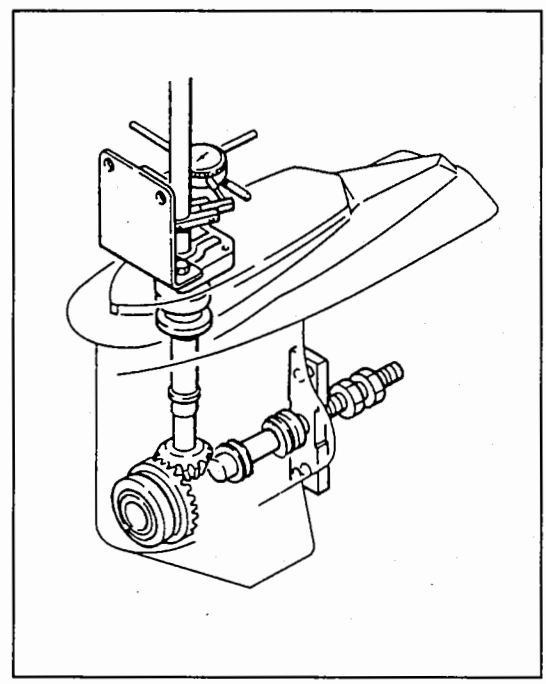


(11) Backlash

a. Measurement of backlash between gears A and B
   1) Ascertain the position of the gear B.
   2) Attach gear A and bearing A.
   3) Insert the conical disc springs (3B7-72734-0) onto the shaft (3B7-72723-0) 4 pcs.
   4) Insert the "O" -ring (332-60002-0) onto the shaft and insert the set piece A (3A3-72245-0).
   5) Insert the shaft into the gear case and fix it with the plate (3B7-72724-0).
   6) Tighten the shaft until the drive shaft begins to rotate.
   7) Tighten the shaft another 1/2 revolution (180 °) from the point at which the drive shaft starts rotating.
   8) Install the clamp assembly (3B7-72720-0) on the drive shaft. (Bringing it as near as possible to the lower pump case.)
   9) Install the dial gauge plate for dial gauge (3B7-72729-0) on the gear case.
      Note: Precise backlash may not be obtained with a new gear. In this case, repeatedly loosen and tighten the shaft (3B7-72723-0) at least three times and measure the backlash.
   10) Set the dial gauge, lift the drive shaft, and rotate it clockwise and counter-clockwise to read the deflection on the gauge.

       Correct dial gauge reading range: 0.24 to 0.48 mm
       If the deflection is not within this range, insert a shim between the bearing and gear A.



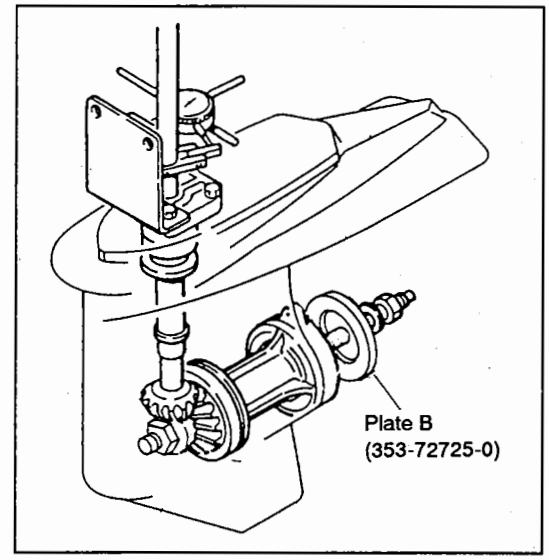


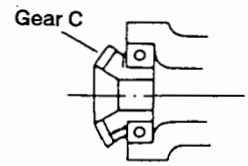
b. Adjustment of backlash between gears B and C
   1) Ascertain the position of gear B.
   2) Remove gear A.
   3) Install gear C on the propeller housing and insert the shaft. (3A3-72726-0)
   4) Insert set piece B into the shaft and fix with washer and nut.
   5) Put plate B through the shaft.
      Set plate B so that the side with small steps faces the gear.
   6) Insert the gear case and secure with the propeller shaft housing bolt.
   7) Install the clamp assemblies on the drive shaft.
   8) Tighten the nut on the shaft with your fingers.
   9) Fix the clamp assemblies by hand and tighten the nut further approximately 1/4 turn (90°).
   10) Life the drive shaft upward, rotate it both ways, and read the deflection on the dial gauge. Set the dial gauge against the notch on the clamp assembly.

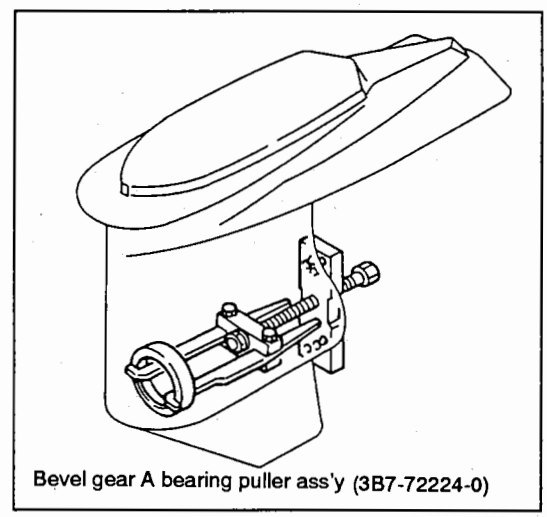
      Correct dial guage reading range: 0.24~0.81 mm

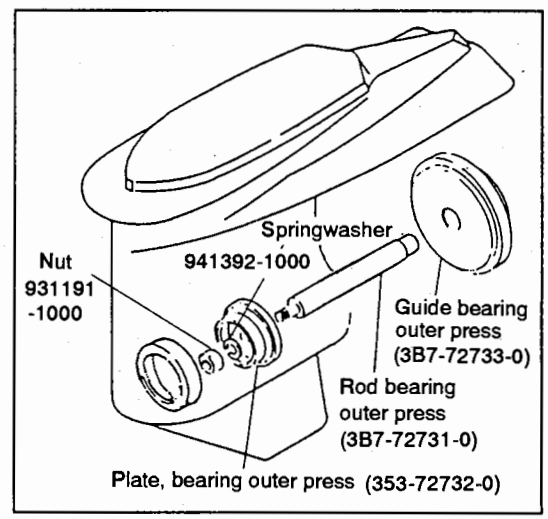
      If the deflection is not within this range, insert a shim between the gear C and the ball bearing, then proceed to readjust.

c. Bearing outer race
   1) Removal of bearing outer race of bevel gear A
      Set bearing puller to gear case as shown in the right figure and tighten it by a wrench (13 mm) to pull it out.
   2) Reassembling of bearing outer race of bevel gear A Fix rod bearing outer race (3B7-72731-0) and plate bearing outer race (353-72732-0) with nut M10 P1.5 (931191-1000) and spring washer (941392-1000).
      Fix gear case horizontally standing on the front side, and fit the outer circumference of bearing outer into the bearing set hole of bevel gear A fitting (taper side up). Insert plate bearing outer race (353-72732-0) into bearing outer. Stand rod bearing section vertically and set guide bearing outer race (3B7-72733-0) to gear case by the smaller diameter (ø83 mm) side. Then press it in tightly by hammering the rod head.
      • Make sure that the bearing fitting surface of gear case is not dusty and scratched.
      • Apply gear oil onto the bearing outer race.









Adjustment shim table for backlash

Backlash gauge reading mm	Actual backlash mm	Necessary shim + increase − decrease mm
0 ~ 0.12	0 ~ 0.03	− 0.10
0.13 ~ 0.28	0.03 ~ 0.08	− 0.05
0.29 ~ 0.44	0.08 ~ 0.12	0
0.45 ~ 0.60	0.13 ~ 0.17	+ 0.05
0.61 ~ 0.77	0.17 ~ 0.21	+ 0.10
0.78 ~ 0.93	0.22 ~ 0.26	+ 0.15
0.94 ~ 1.09	0.27 ~ 0.31	+ 0.20
1.10 ~ 1.25	0.31 ~ 0.35	+ 0.25
1.26 ~ 1.41	0.35 ~ 0.40	+ 0.30
1.42 ~ 1.57	0.40 ~ 0.45	+ 0.35
1.58 ~ 1.74	0.45 ~ 0.50	+ 0.40
1.75 ~ 1.90	0.50 ~ 0.54	+ 0.45
1.91 ~ 2.06	0.54 ~ 0.58	+ 0.50

NOTE: Backlash Standard Value (Dial guage reading rang)

Bevel gear A − B 0.24 ~ 0.48 mm

Bevel gear B − C 0.24 ~ 0.81 mm

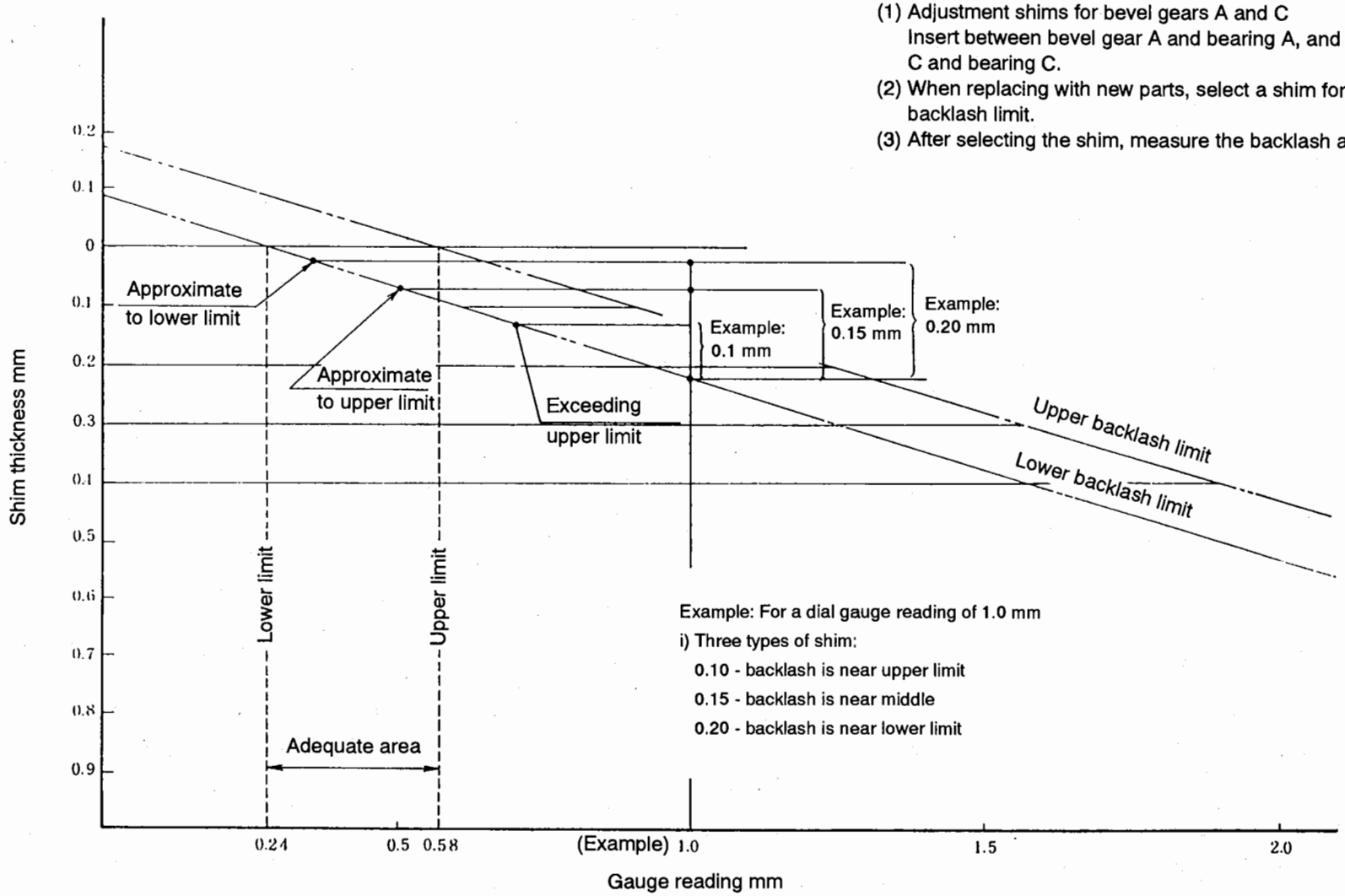
Table of gauge readings and necesary shim thickness

NOTES:

(1) Adjustment shims for bevel gears A and C
Insert between bevel gear A and bearing A, and bevel gear C and bearing C.

(2) When replacing with new parts, select a shim for the lower backlash limit.

(3) After selecting the shim, measure the backlash again.

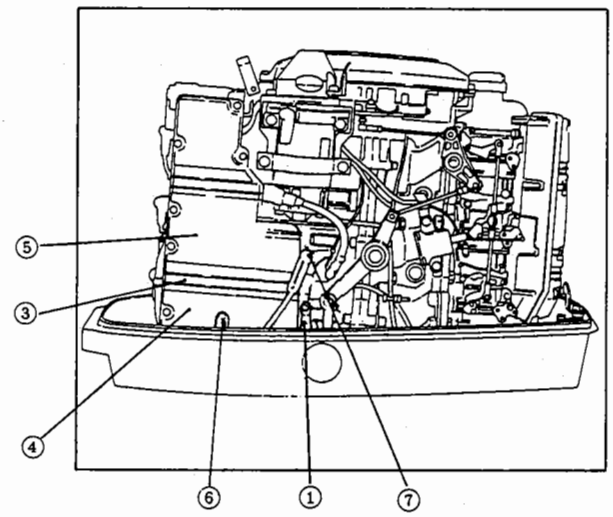


9 REMOVAL, DISASSEMBLY AND RE-ASSEMBLY OF POWER UNIT

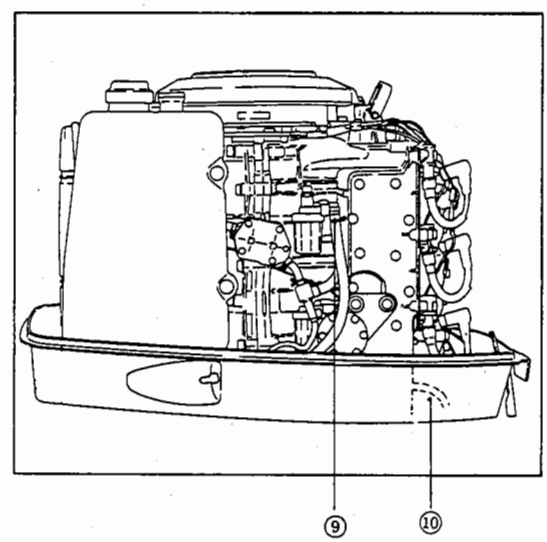
(1) Power unit removal

a. Remove the power cables.
- ① Battery ground lead
- ② Wire harness coupler
- ③ Neutral switch lead
- ④ P.T.T lead
- ⑤ P.T.T switch lead B
- ⑥ Safety switch lead
- ⑦ Battery (+) lead

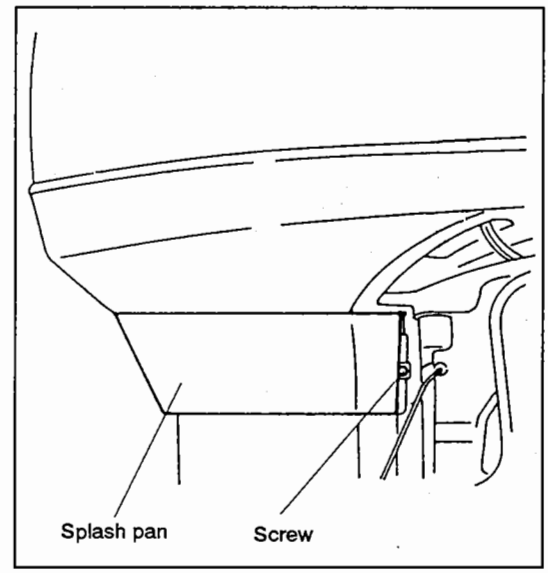
b. Remove the cables
- ⑧ Disconnect the cable joint from advancer arm and shift arm



c. Remove the pipes
- ⑨ Fuel pipe
  Disconnecct the fuel pipe from fuel filter
- ⑩ Pilot water check pipe
  Disconnect the pilot water check pipe from the exhaust cover

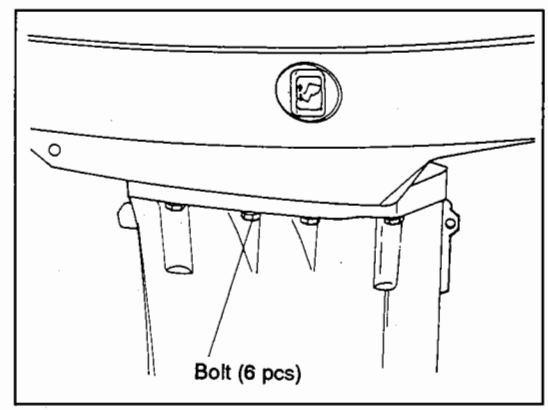


d. Remove splash pan



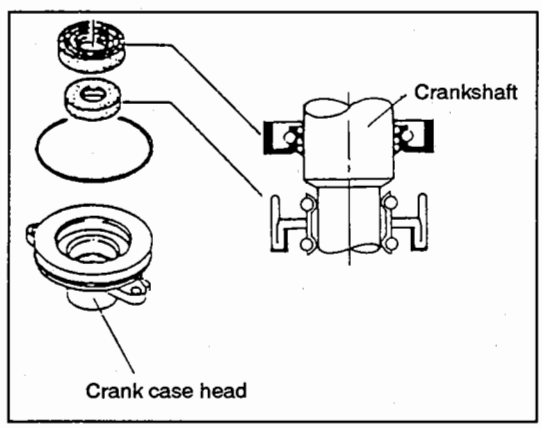
e. Remove the sixth, drive shaft housing mounting bolts

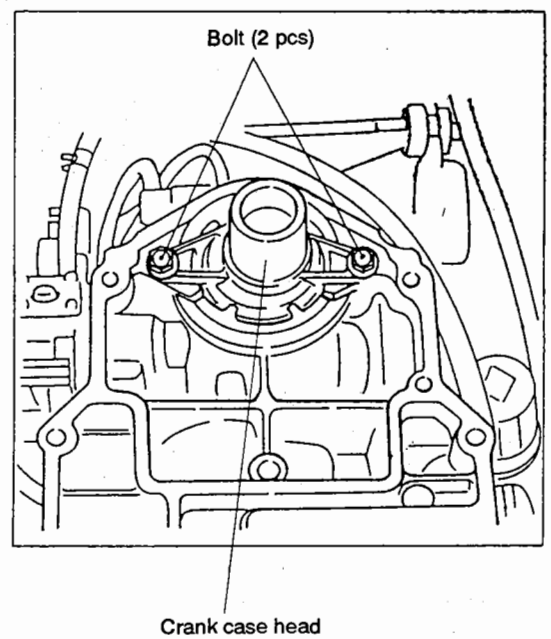
f. Remove the power unit



(2) Crank case lower head

a. Set oil seal of crank case lower head as illustrated below.





(3) Cylinder head and Cylinder head cover

Loosen the cylinder head bolts starting with the highest embossed number and work down.
Tighten the cylinder head bolts in the ascending order of the embossed numbers.

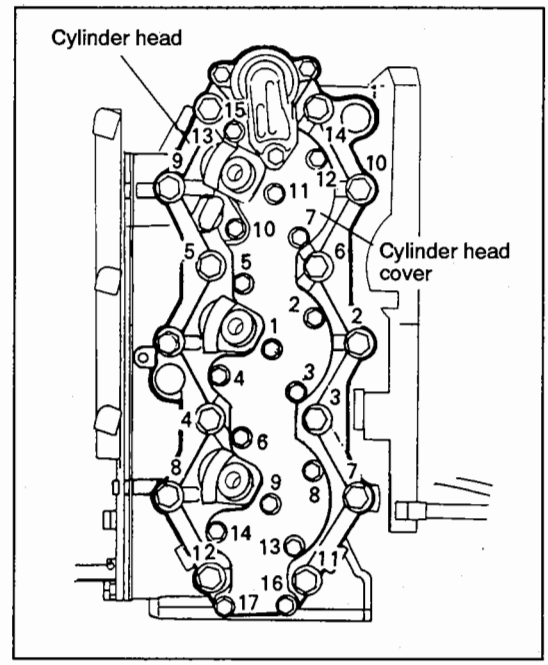
Cylinder head and cylinder head cover bolt torque.

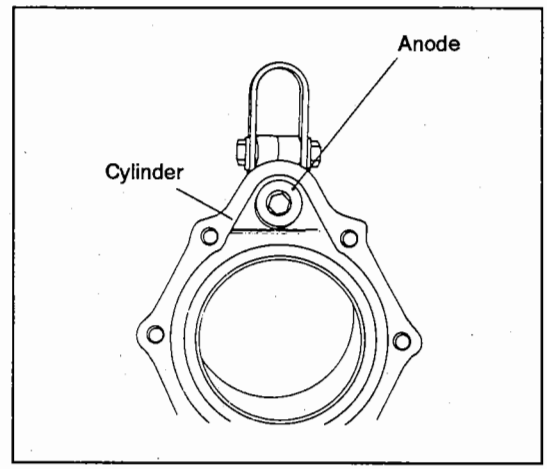
	Initial torque
M6 bolt	2 to 3 N-m (0.2 to 0.3 kg-m 1.4 to 2.2 lbs-ft)
M8 bolt	11.76 to 14.7 N-m (1.2 to 1.5 kg-m 8.68 to 10.85 lbs-ft)

	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	29.4 to 34.3 N-m (3.0 to 3.5 kg-m 21.68 to 25.59 lbs-ft)

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.

Check the thermostat
Remove dust on pressure relief valve

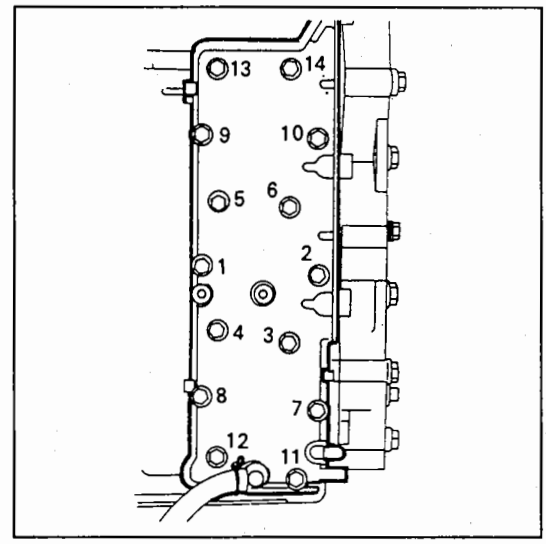




(4) Exhaust cover

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.

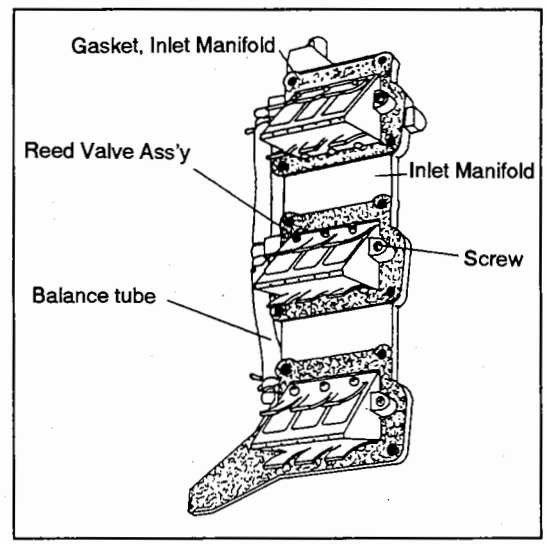
Initial torque	Final torque
3.92 to 5.88 N-m (0.4 to 0.6 kg-m 2.89 to 4.34 lbs-ft)	7.84 to 9.8 N-m (0.8 to 1.0 kg-m 5.78 to 7.23 lbs-ft)



(5) Inlet Manifold

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)

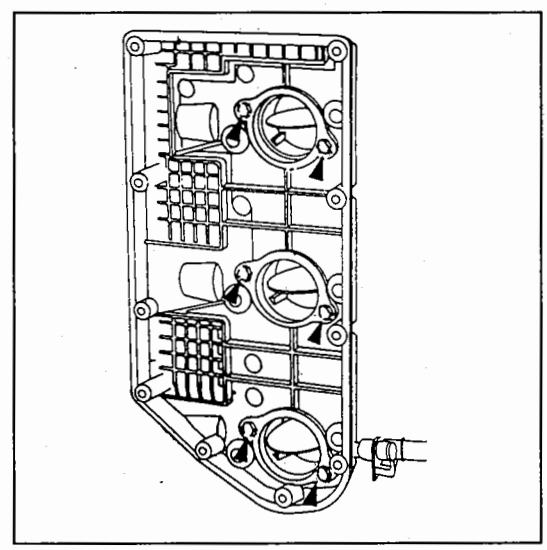
NOTE: For replacing gasket, remove reed valve ass'y since gasket is inserted between reed valve ass'y and inlet manifold.



(6) Air silencer

a. Make sure to lock setscrew of air silencer by engaging pawl of lock plate. (Shown by ▲ mark in the left figure)

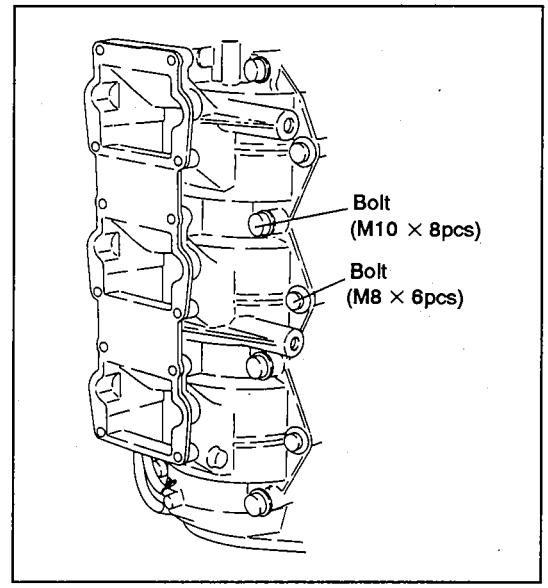
Initial torque	Final torque
1.0 to 2.0 N-m (0.1 to 0.2 kg-m 0.7 to 1.4 lbs-ft)	2.65 to 3.53 N-m (0.27 to 0.36 kg-m 1.95 to 2.6 lbs-ft)



(7) Crank case

To remove the crank case, first loosen the M8 bolts starting with those furthest from the center of the crank case and work in. Then loosen the M10 bolts, again starting with those furthest from the center of the crank case and working in.

When tightening the crank case bolts, start with the M10 bolts nearest to the center and work out. Then tighten the M8 bolts from the center and work out.



① M10 bolt tightenin torque

Initial tightening	N – m	16.66 to 22.54
	kg – m	1.7 to 2.3
	lb – ft	12.29 to 16.63
Final tightening	N – m	37.24 to 41.16
	kg – m	3.8 to 4.2
	lb – ft	27.48 to 30.37

② M8 bolt tightening torque

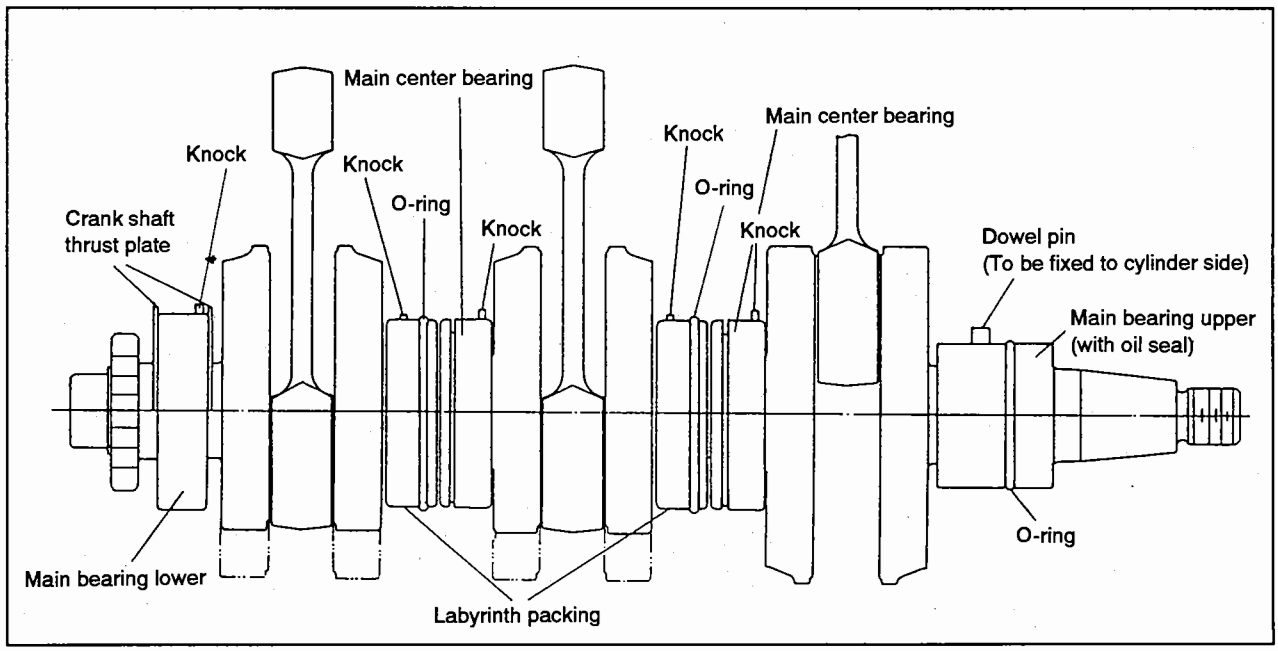
Initial tightening	N – m	11.76 to 14.70
	kg – m	1.2 to 1.5
	lb – ft	8.68 to 10.85
Final tightening	N – m	23.52 to 25.48
	kg – m	2.4 to 2.6
	lb – ft	8.68 to 18.80

NOTE: 1) Pay attension to the dowel pin positions on the bottom of the cylinder block when assembling the crank case.

2) Before assembling crank case, degrease contact surfaces and apply specified packing solvent onto them with care not to flow it out to guide plate and crank case surface to contact crank case head.

3) Make sure nothing abnormal (including dust, burr, casting fin, impact failure, etc.) on cylinder and contact surfaces of crank case.

(8) 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 "O" 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.

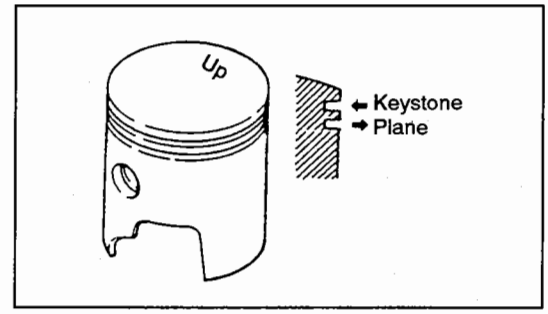
(9) Piston and piston rings

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.

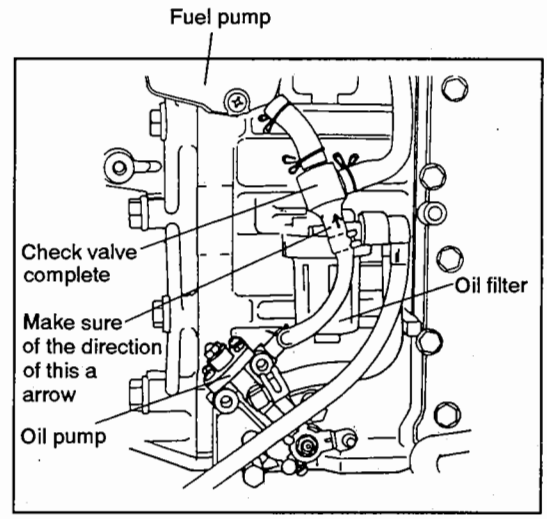
Apply engine oil to the piston rings when attaching them to the piston.

NOTE: Make sure to use new piston pin clip every time it is removed.



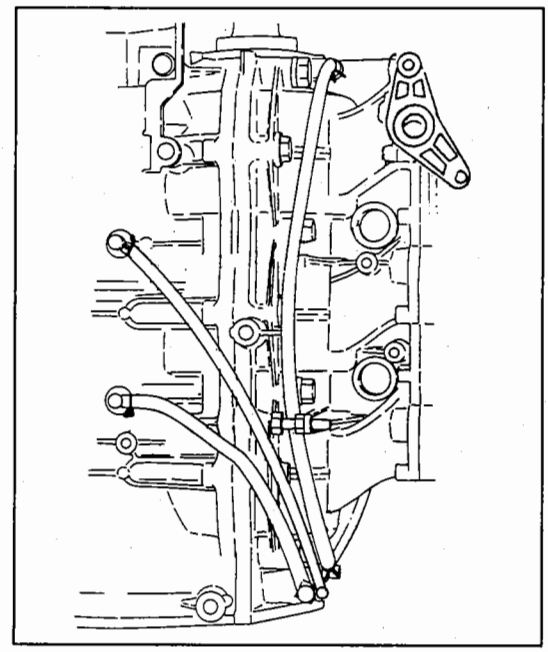
(10) Check valve Complete

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.)



(11) Oil re-circulation pipe connections

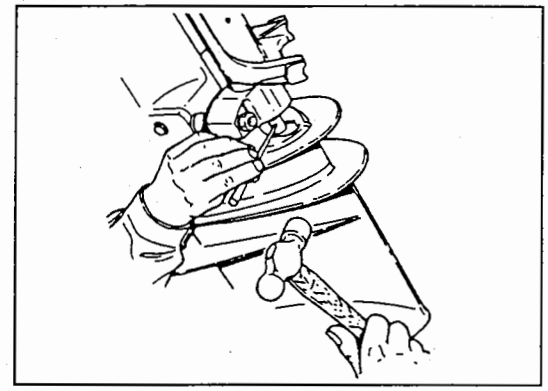
#1 Cylinder check valve
→ #3 Crank case
#2 Cylinder check valve
→ #3 Crank case
#3 Crank case check valve
→ #1 Crank case



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

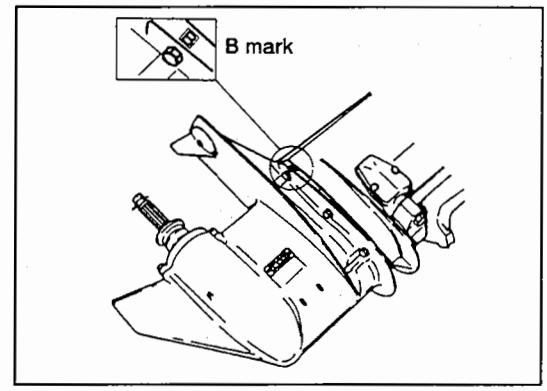
(1) Remove the shift cam shaft spring pin

a. Use spring pin tool A (369-72217-0) to remove the spring pins.
b. Use spring pin tool B (369-72218-0) to insert new spring pins.
NOTE:
(i) Always replace spring pins which have been removed.
(ii) After mounting, set so that each pin protrude by same amount.



(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.



① M10 bolt tightenin torque

Initial tightening	N – m	16.66 to 22.54
	kg – m	1.7 to 2.3
	lb – ft	12.29 to 16.63
Final tightening	N – m	37.24 to 41.16
	kg – m	3.8 to 4.2
	lb – ft	27.48 to 30.37

② M8 bolt tightening torque

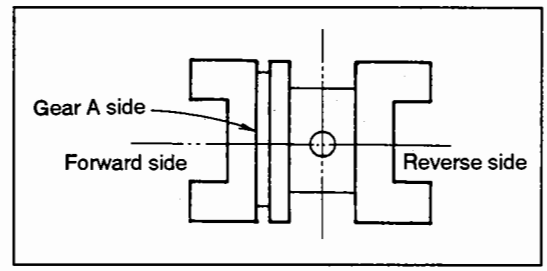
Initial tightening	N – m	11.76 to 14.70
	kg – m	1.2 to 1.5
	lb – ft	8.68 to 10.85
Final tightening	N – m	23.52 to 25.48
	kg – m	2.4 to 2.6
	lb – ft	8.68 to 18.80

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

(3) Clutch

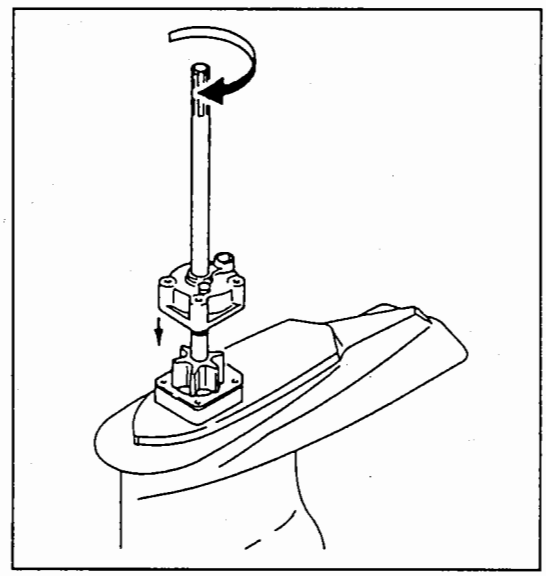
Install with the shortest distance from the center of the clutch pin to the tip of the claw facing the gear A side. (Forward side)
Install so that the narrowest claw (measured from the center of the clutch pin) faces gear A.

Do not force or deform the clutch snap pin.

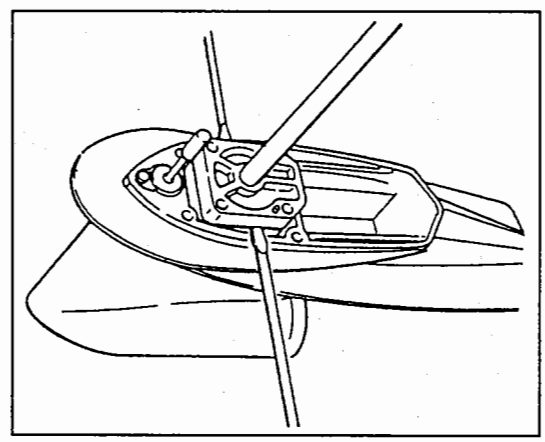


(4) Water pump

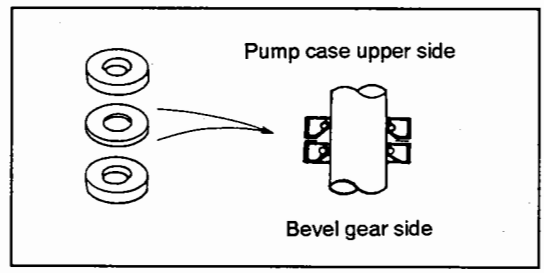
a. To install the water pump, rotate the drive shaft clockwise and set the upper water pump case to the impeller.
CAUTION: If the drive shaft is rotated counterclockwise, the impeller will bend in the wrong direction and may be damaged.



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



c. For lower pump case, use two oil seals and take care of respective directions of lip.

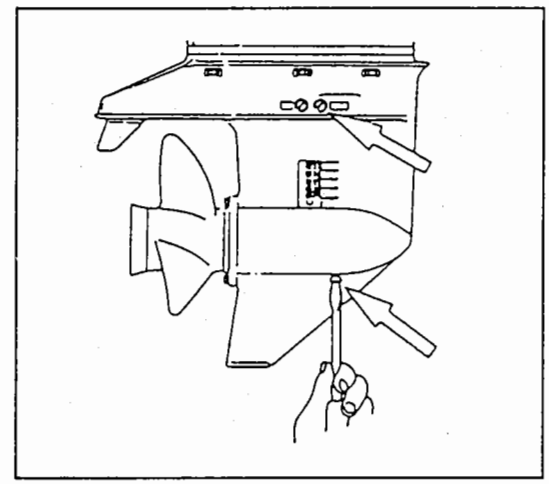


(5) Gear oil

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

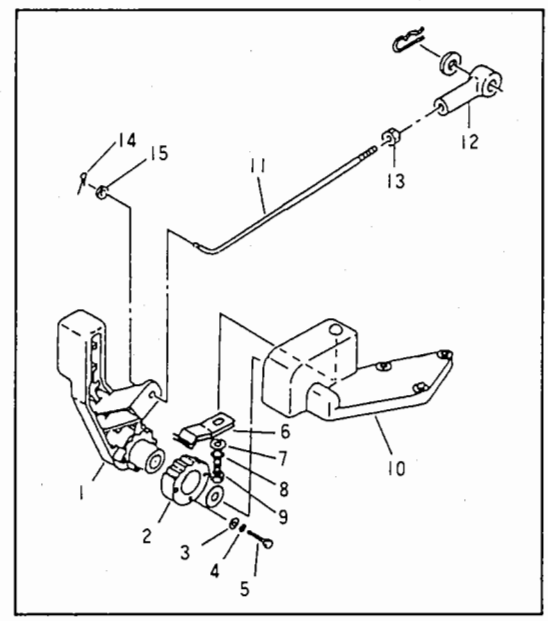
To add gear oil, remove the upper and lower oil plugs and insert the nozzle of the gear oil tube into the lower plug hole. When oil overflows from the upper plug hole, install the upper plug and tighten. Finally install the lower plug.

Quantity of gear oil: Approx. 700 cc (1.48 pt.)



(6) Adjustment of clutch (EF, EFO, EFTO types)

① Assemble shift lever and shift lever stopper plate.
② Set shift lever stopper to shift lever bracket centering the fitting hole.
③ Join shift lever stopper plate and shift lever by the cogs for neutral position and temporarily fix them with shift lever stopper.
④ In the above state, screw cable joint into rod and adjust the length. (Screwing must be more than 10 mm deep.)
⑤ After confirming the above stevps ③ and ④ again, fix shift lever, shift lever stopper and rod.



1. Shift Lever
2. Stopper Plate, Shift Lever
3. Washer
4. Spring Washer
5. Bolt
6. Stopper, Shift Lever
7. Washer
8. Spring Washer
9. Bolt
10. Bracket, Shift Lever
11. Rod, Shift Lever Stopper
12. Cable Joint
13. Nut

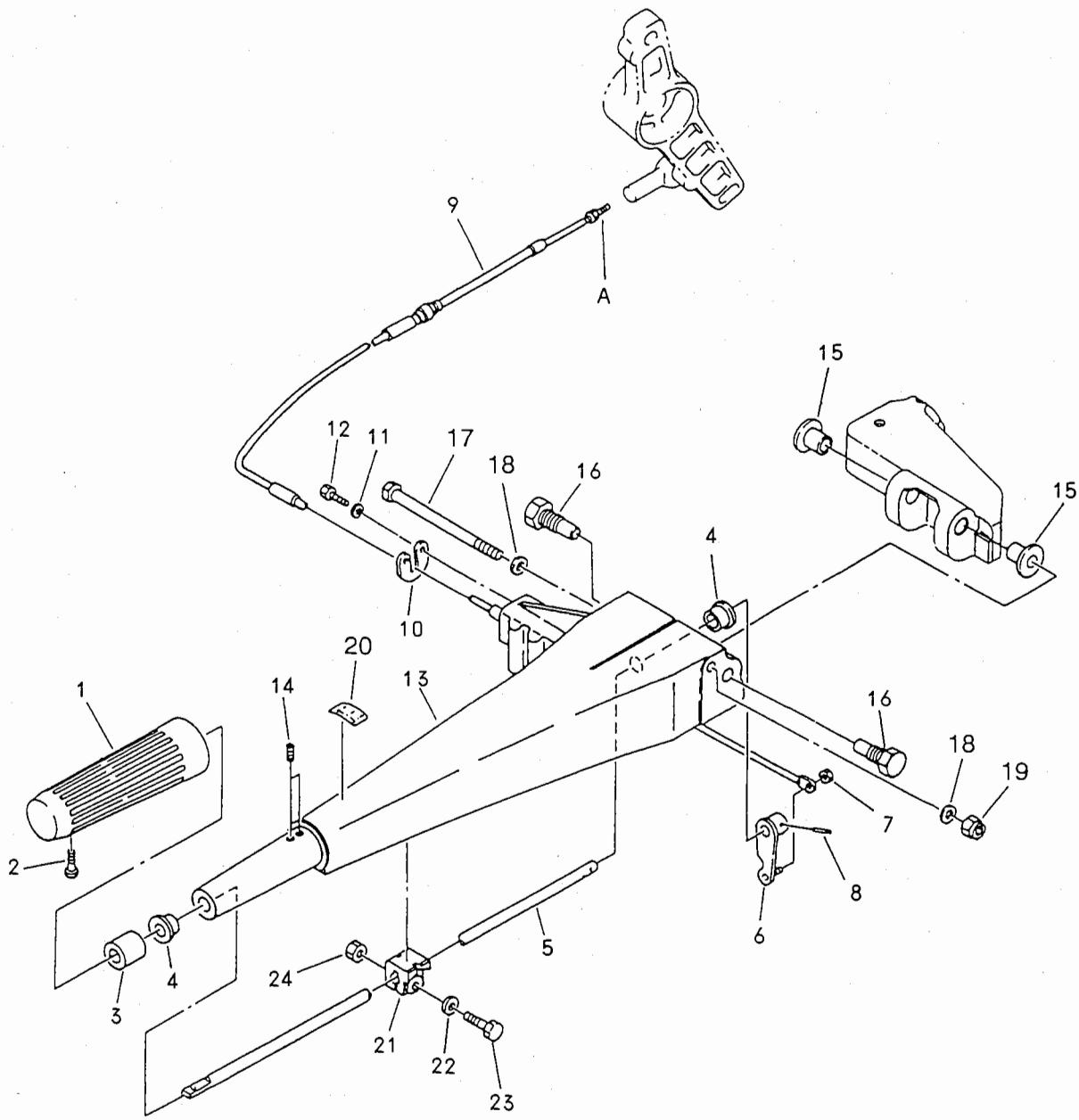
11 STEERING HANDOLE

a. Apply Tohatau grease to all sliding portions.

b. Adjust screwing depth of cable (No. 9) tip (A) so that grip (No. 1) contacts to stopper (No. 14) when throttle grip is in full open position. Next, return throttle grip for idling and confirm that there is play between stopper and throttle grip.

c. For getting throttle grip to have proper turning friction, adjust friction piece (No. 21) by tightening or loosening bolt (No. 23).

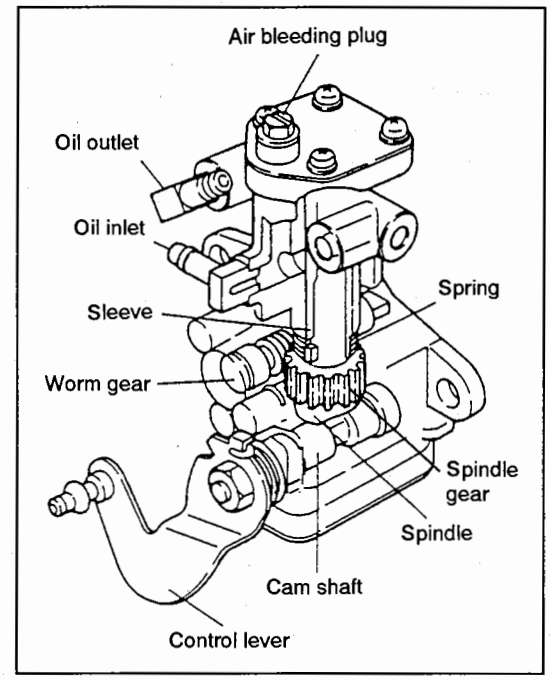
1. Grip
2. Screw
3. Rubber, Throttle Shaft A
4. Bushing
5. Throttle Shaft
6. Lever, Throttle Shaft
7. Nylon Nut
8. Spring Pin
9. Throttle Cable
10. Holder, Throttle Cable
11. Spring Washer
12. Bolt
13. Handle A
14. Screw
15. Collar
16. Bolt, handle A
17. Bolt
18. Washer
19. Nylon Nut
20. Label, Throttle
21. Friction Piece
22. Washer
23. Bolt
24. Nut



12 AUTO MIXING SYSTEM

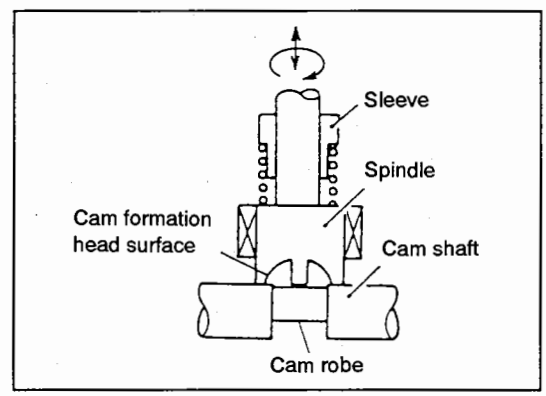
(1) Structure of oil pump

The oil pump is mainly composed of the worm gear interlocking with engine revolution, the spindle gear engaged with the worm gear, the cam shaft that contacts the spindle and controls oil supply in accordance with operation of the throttle lever, etc.



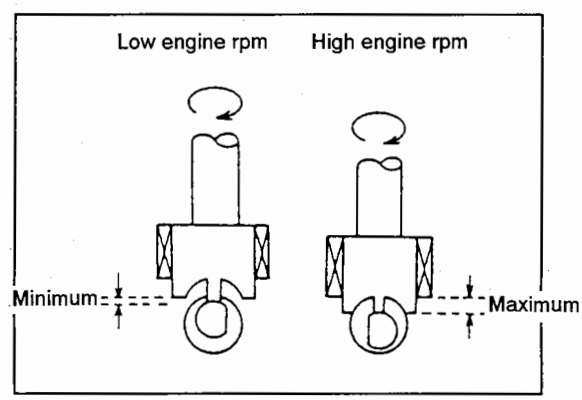
a. Operation of plunger

The spindle gear that is rotated by the worm gear moves up and down since the bottom of the spindle unified with the gear has the shape of a cam to slide on the cam shaft. This up-and-down motion brings pressure on the plunger inserted into the sleeve to feed oil.



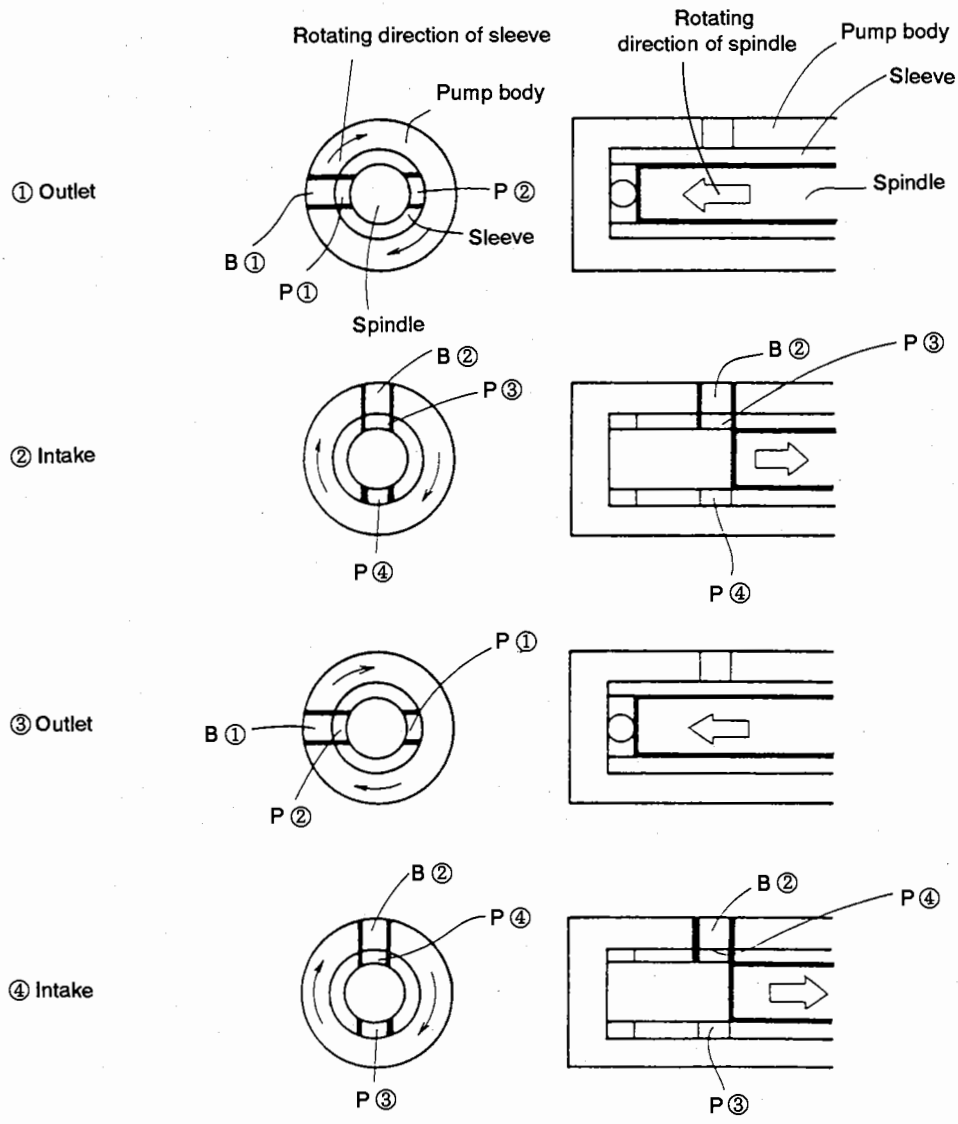
b. Control of oil feeding

The center projection on the cam shape surface of the bottom of the plunger changes the stroke of the plunger according to the position of the cam robe, therefore, oil feeding changes in amount. In detail, since the cam shaft is connected with the throttle linkage by the shaft end, position of the cam shaft is automatically adjusted to feed oil appropriately for engine revolution.



(2) Operation of oil pump

The oil flows from the oil tank through the oil filter to the oil pump inlet. Fig. shows the position of the sleeve and spindle during oil output. Oil is output through ports P ① in the sleeve and B ① in the body when P ① and B ① are aligned. Next the sleeve rotates through 90 ° to align P ③ and B ② to intake oil. To complete the cycle P ② and B ① are aligned for the next output and finally P ④ and B ② for the second intake.



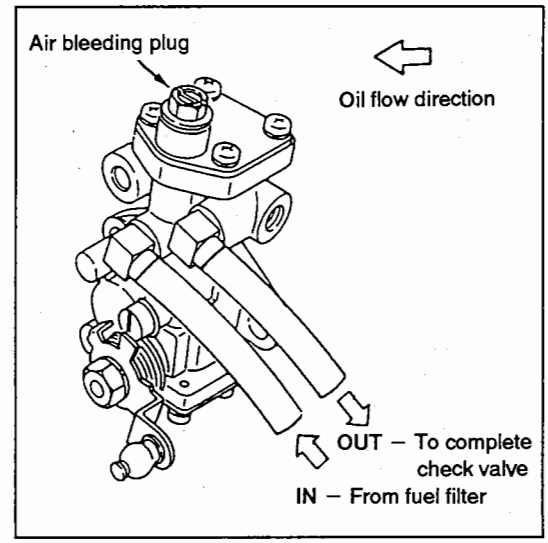
(3) Bleeding the oil system

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. Air discharge from between oil pump and complete check valve
   1) Start engine and idle it. (800~950 rpm, with clutch off)
   2) Continue idling until air completely discharged from transparent oil pipe.
   3) For quick air discharge, remove oil link rod and run engine with lever being set to full open position.

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.

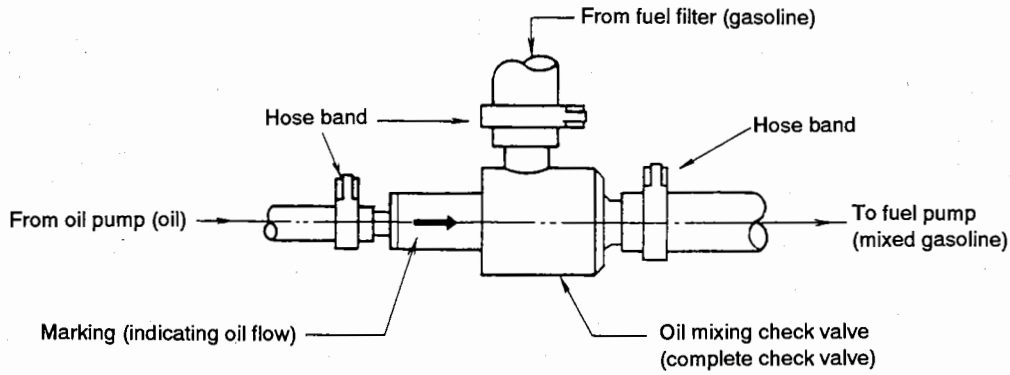


(4) Cautions and inspection of the auto mixing system

No.	Part	Caution/Inspection
1	Engine oil	Use Tohatsu genuine engine oil. If not available, another Marine Engine Manufacturer's outboard motor oil with NMMA(BIA) certified TC-W or TC-WII must be used. **CAUTION:** Do not mix different brands of oil. The TOHATSU AUTOMIXING SYSTEM is equipped with an engine oil filter assembly located between the Integral engine oil tank and the engine oil pump. The mixing of different brands of oil or different kinds of oil even of the same brand may cause jelling (gel), resulting in blockage of oil filter screens. This may lead to serious engine damage due to the lack of powerhead lubrication.
2	Oil pump "O" -ring	• Check the "O" -ring upon assembly. • Apply 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 edges. • 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 ball joint. • Check that the rod is correctly secured.
6	Oil level sensor	• Check that the sensor functions correctly.
7	Oil filter	• Ensure the filter is free of water, dirt and gel.
8	Alarm device	• Make sure of alarm lamp lighting. (1st and 2nd alarm lamps) • Make sure of normal operation of alarm buzzer (overheat alarm serving as water pressure sensor and oil level sensor also). (Interlocking with 2nd alarm lamp)

(5) Auto mixing check valve

Gasoline and oil are mixed by oil mixing check valve.

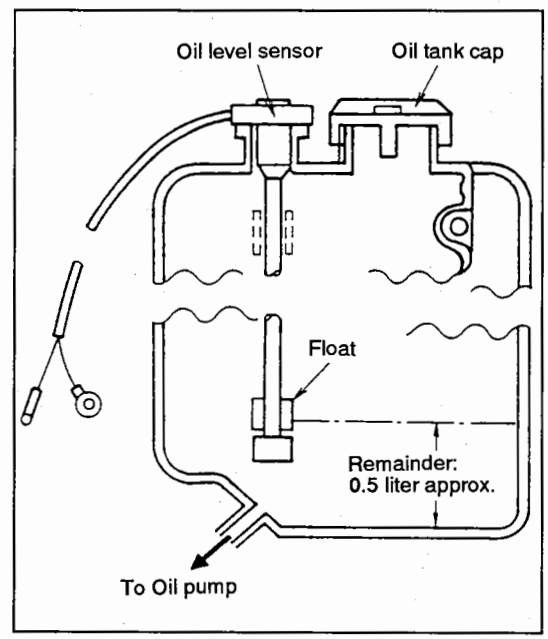


(6) Warning system

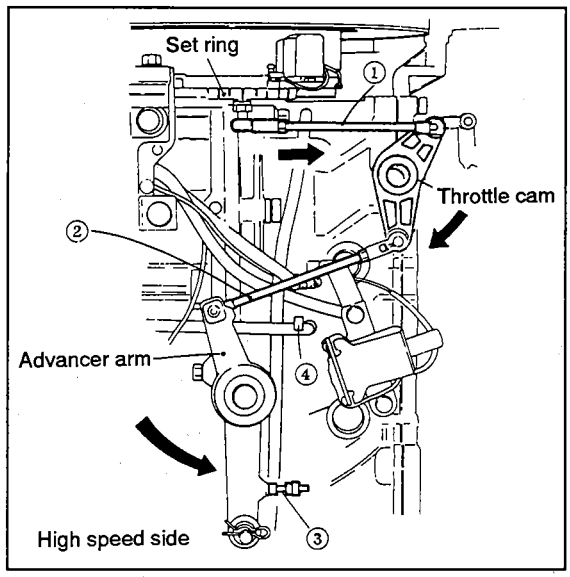
Engine of conventional oil mixing lubrication system in which lubrication oil is mixed with fuel has no trouble caused by poor lubrication since engine stops when fuel runs out. However, in engine of automatic oil mixing type, gasoline is supplied even when no oil remains in oil tank as far as engine continues running. To prevent engine from such condition and seizure, this engine is equipped with the following alarm devices.

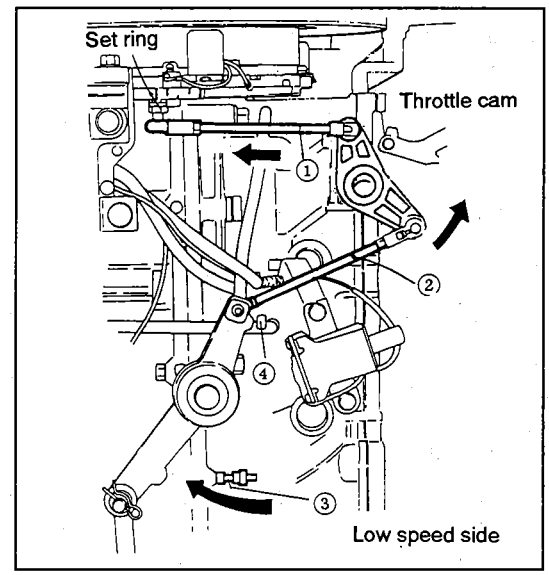
a. Oil level sensor This is a float switch that turns on when oil remainder is 0.5 liter.

b. Alarm lamp and buzzer According to signal from oil level sensor, alarm buzzer in remote control box sounds and alarm lamp in tachometer lights at the same time.



13 LINK ADJUSTMENT

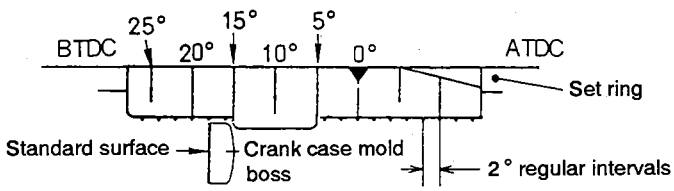




(1) Ignition timing adjustment

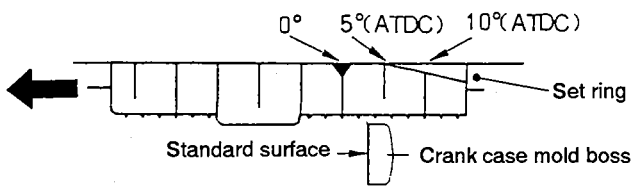
a. Length of links ① and ②
Link ① (ignition timing link)....133 mm (5.24 in.)
Link ② (throttle link).....127 mm (5.0 in.)
Stopper ③ .....7 mm

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 ① so that the ignition timing at full throttle is BTDC 16 ° and 20 °for M60B and M70B respectively.

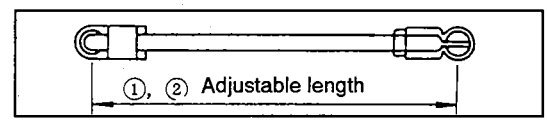


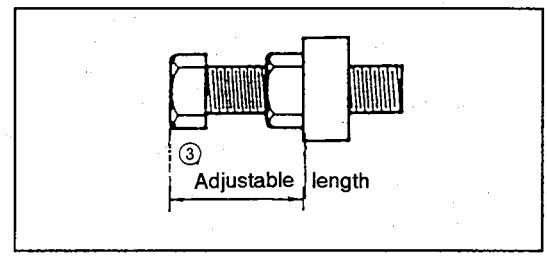
c. After adjusting at maximum engine speed set the advancer arm to minimum engine speed and adjust the ignition to ATDC 3 °with link ② when low speed side stopper ④ and advancer arm contact with each other.

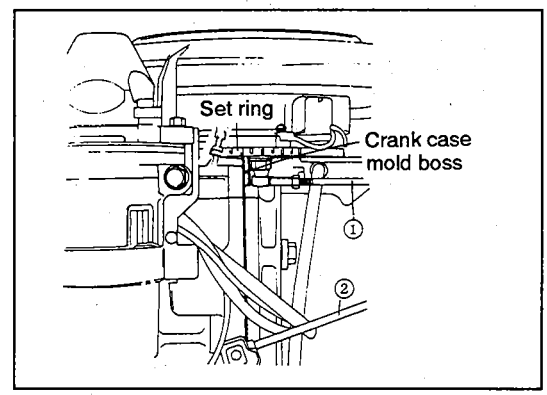
NOTE: Perform adjustment with set ring pushed slightly in the direction of arrow (⬅).

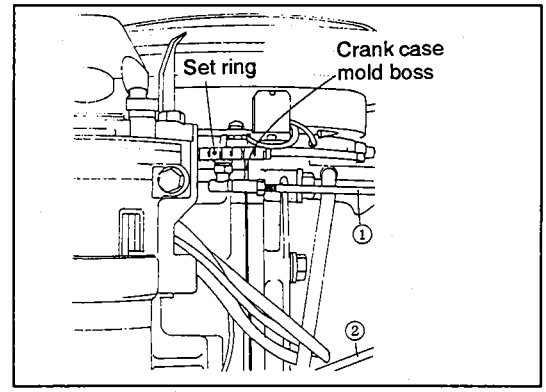


d. Return advancer arm to the maximum speed position, and adjust length of bolt by turning nut so that advancer arm and stopper ③ at high speed side contact with each other.









(2) Carburetor tuning

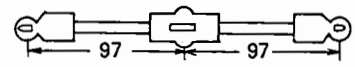
a. Length of link

Link ⑤ (throttle link rod).....97 mm (3.81 in.)

Length is defined as the distance between the centers of the ball joint caps.

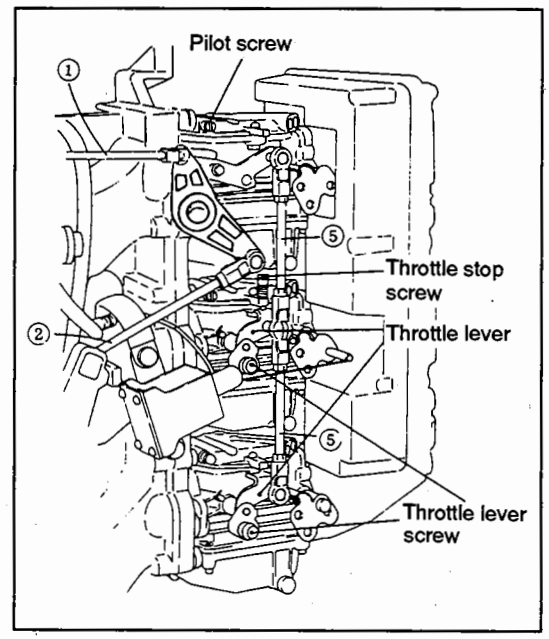
NOTE:

Apply Tohatsu grease to the ball joints.



b. Adjustment of synchronizing the carburetors

1) Loosen the center carburetor throttle stop screw until the throttle valve is fully closed.
2) Turn the center and lower carburetor throttle lever screws clockwise to loosen. (Counterclockwise threaded screws)
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. 1-1/4 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 1-1/2 ± 1/4 for the M60B and 1-1/2 ± 1/4 for the M70B
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: 650~800 rpm
   Idling speed: 800~950 rpm

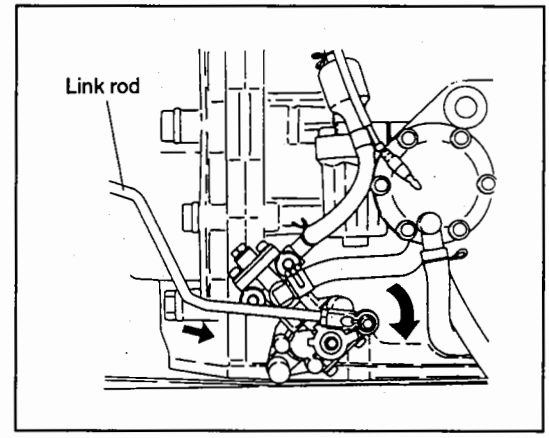
   • Adjust by installing the air silencer cover.

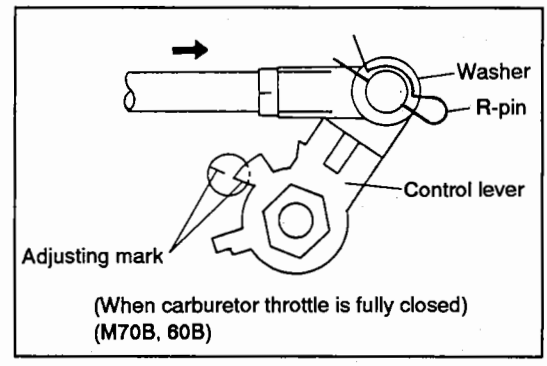
(3) Oil pump aperture adjustment

Adjust the link rod length so that the cut angle of the control lever is aligned with the mark on the ø7 boss when the carburetor throttle is fully closed.

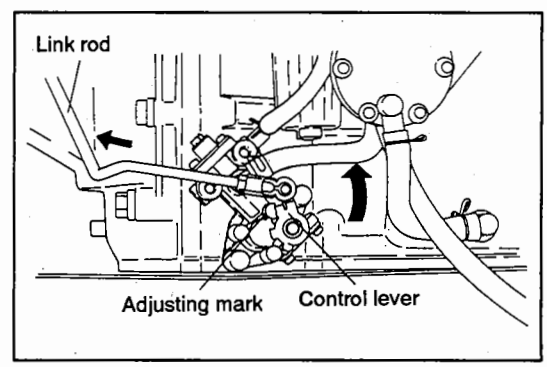
NOTE: Adjust the oil pump aperture after adjusting the carburetor and ignition timing.

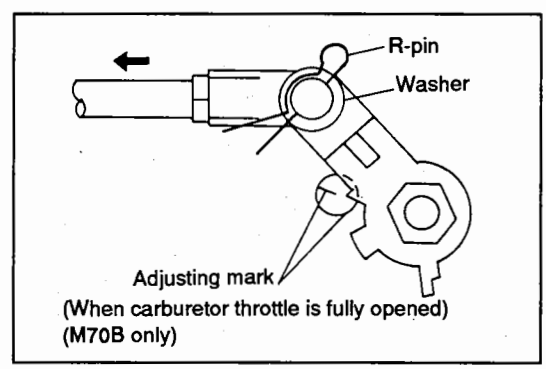
When assembling link rod to control lever, make sure to set washer and R-pin.





(When carburetor throttle is fully closed)
(M70B, 60B)





(When carburetor throttle is fully opened)
(M70B only)

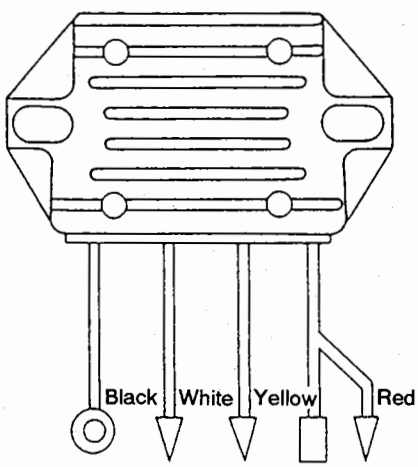
14 INSPECTION OF ELECTRICAL PARTS

(1) Measuring coil resistance

To measure the coil resistance, 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	Lead wire W ↔ Y Lead wire W ↔ W [5] Lead wire Y ↔ W [5]	0.21~0.31 Ω 0.72~1.08 Ω 0.9 ~1.36 Ω
b. Exciter coil resistance	Lead wire W/G ↔ Br/W Lead wire Br/W ↔ W/Y	216~324 Ω 16~ 24 Ω
c. Pulser coil resistance	Lead wire W/R ↔ B Lead wire W/B ↔ B Lead wire W/L ↔ B	160~240 Ω
d. Ignition coil primary coil resistance secondary coil resistance	Lead wire B/W ↔ B High voltage cord ↔ B	0.16~0.24 Ω 3.28~4.92 Ω

(2) Rectifier



As measured with HIOKI 3030 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 × 1 Ω 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 readinds may vary with the air temperature.

Standard values for the CD unit (± 15%)
Tester: Tohatsu test meter (HIOKI model 3030),range k Ω

unit: k Ω unless otherwise specified

Tester (black lead)		Tester (red lead)														
		4P coupler				W/Y	W/G	Br	Sb	Br/W	#1 B/W	#2 B/W	#3 B/W	B	B/Y	B/Y
		W/R	B	W/B	W/L											
4P coupler	W/R		ON 2	ON 4	ON 4	ON 180	ON 6.3	ON 220	ON 90	ON 6.8	ON 7	ON 7	ON 7	ON 2	ON 4	ON 17
	B	ON 2		ON 2	ON 2	ON 180	ON 3.7	ON 220	ON 85	ON 3.7	ON 4.2	ON 4.2	ON 4.2	ON 0	ON 4.6	ON 15
	W/B	ON 4	ON 2		ON 4	ON 180	ON 6.3	ON 220	ON 90	ON 6.7	ON 7	ON 7	ON 7	ON 2	ON 4	ON 17
	W/L	ON 4	ON 2	ON 4		ON 180	ON 6.3	ON 220	ON 90	ON 6.7	ON 7	ON 7	ON 7	ON 2	ON 4	ON 17
W/Y		ON 150	ON 150	ON 150	ON 150		ON 200	ON 3.7	ON 350	ON 200	ON 200	ON 200	ON 200	ON 150	ON 200	ON 170
W/G		CON 18	CON 14.6	CON 18	CON 18	ON 250		ON 300	ON 180	CON 28	CON 30	CON 30	CON 30	CON 14.6	CON 25	CON 36
Br		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
Sb		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
Br/W		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
#1 Br/W		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
#2 Br/W		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)
#3 Br/W		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)	OFF (∞)	OFF (∞)
B		ON 2	ON 0	ON 2	ON 2	ON 180	ON 3.7	ON 220	ON 85	ON 3.7	ON 4.2	ON 4.2	ON 4.2		ON 4.6	ON 15
B/Y		OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)	OFF (∞)		OFF (∞)
B/Y		ON 17	ON 15	ON 17	ON 17	ON 200	ON 23	ON 250	ON 110	ON 23	ON 24	ON 24	ON 24	ON 15	ON 24	

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 value were measured with the Tohatsu test meter (HIOKI 3030) 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.

3) About meter indications: With "CON" indication, meter shows condensor's characteristic, and in this measurement pointer shakes before it becomes stable. With "ON" indication, pointer shakes until it shows measurement value. With "OFF" indication, pointer does not shake.

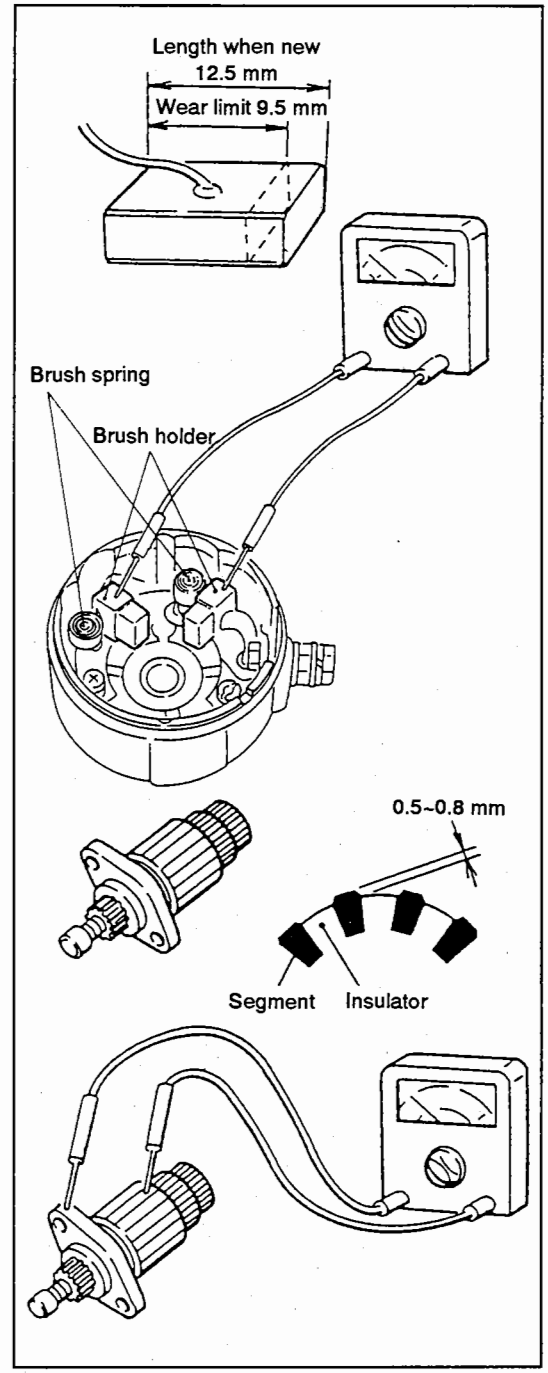
Abbreviation:

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

(4) Starter motor

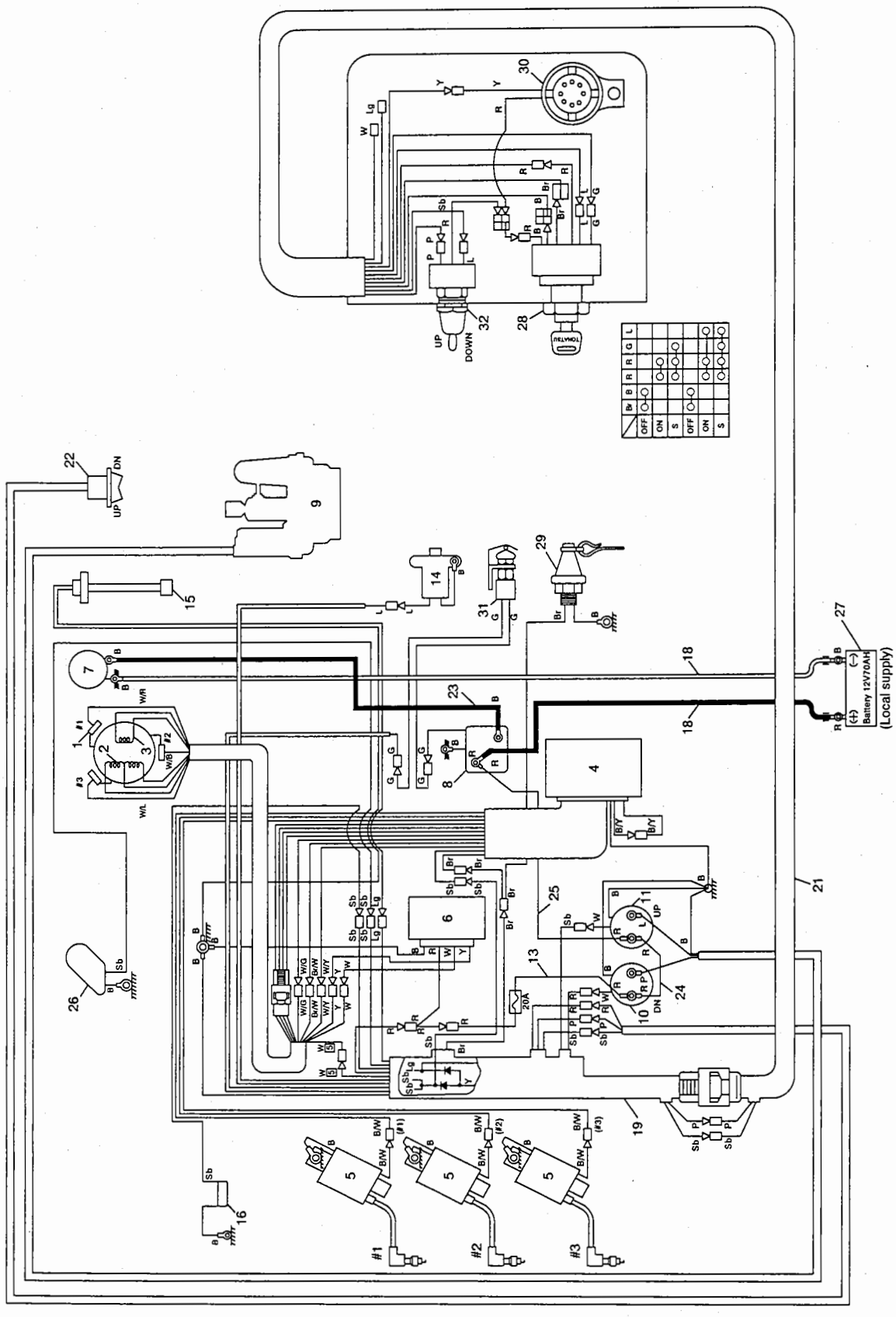
a. Brush and spring
   1) Check the extent of brush wear.
      Reolace if the brush length is 9.5 mm or less.
   2) Check the insulation between brush holders.
      If electricity is conducted, clean and insulate or replace.
   3) Brush spring tension
      Replace if the brush spring tension is reduced.

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.



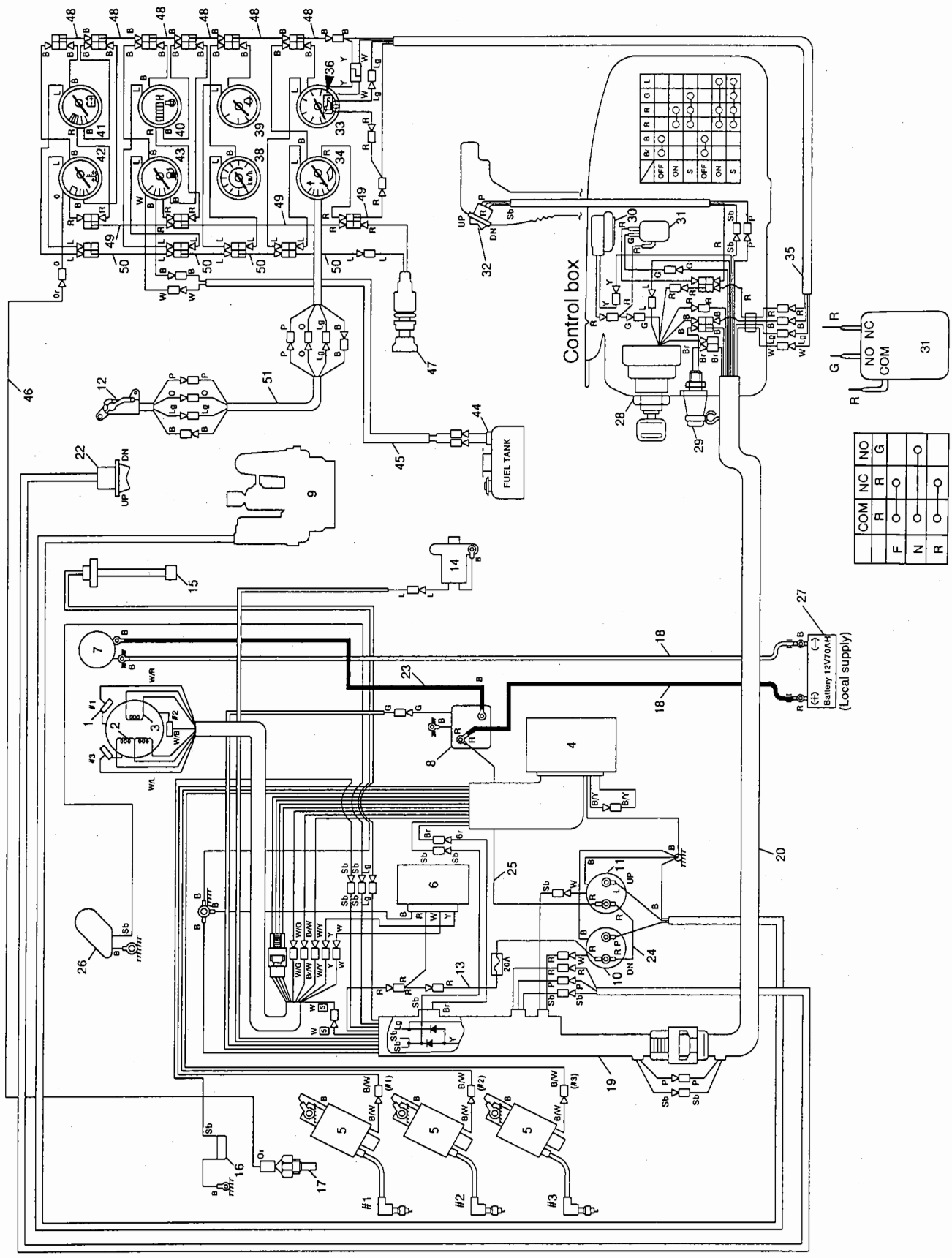
15 ELECTRICAL WIRING DIAGRAM (1)

EFO/EFTO types



ELECTRICAL WIRING DIAGRAM (2)

EPO/EPTO types



Part name table of Electrical Wiring Diagram (M60B/M70B)

EP/EPTO/EF/EFO/EFTO

1. Pulser coil
2. Exciter coil
3. Alternator
4. C.D. Unit
5. Ignition coil
6. Rectifier regulator complete
7. Starter motor
8. Starter solenoid
9. Power trim & tilt
10. Solenoid switch, power trim & tilt
11. Solenoid switch, power trim & tilt
12. Trim sender
13. Fuse wire
14. Choke solenoid
15. Oil level sensor
16. Over heat sensor
17. Sender, water temp. (Optional)
18. Battery cord
19. Cord assembly A
20. Cord assembly B
21. Cord assembly C
22. Power trim & tilt switch B
23. Starter cord
24. Cord A, Solenoid switch
25. Cord B, Solenoid switch
26. Pressure switch (Optional)
27. Battery (Local supply, 12V 70A or over)
28. Main switch
29. Emergency stop switch
30. Over heat & oil level buzzer
31. Neutral switch
32. Power trim & tilt switch
33. Tachometer
34. Trim meter
35. Lead wire, meter
36. Oil lamp
37. Not used
38. Speedometer (Optional)
39. Water pressure meter (Optional)
40. Hour meter (Optional)
41. Voltmeter (Optional)
42. Water temp. meter (Optional)
43. Fuel meter (Optional)
44. Fuel gauge sensor unit (Optional)
45. Cord, fuel meter (Optional)
46. Lead wire, water temp. meter (Optional)
47. Meter lamp switch (Optional)
48. Assist cord (Black) (Optional)
49. Assist cord (Red) (Optional)
50. Assist cord (Blue) (Optional)
51. Extension cord, trim sender

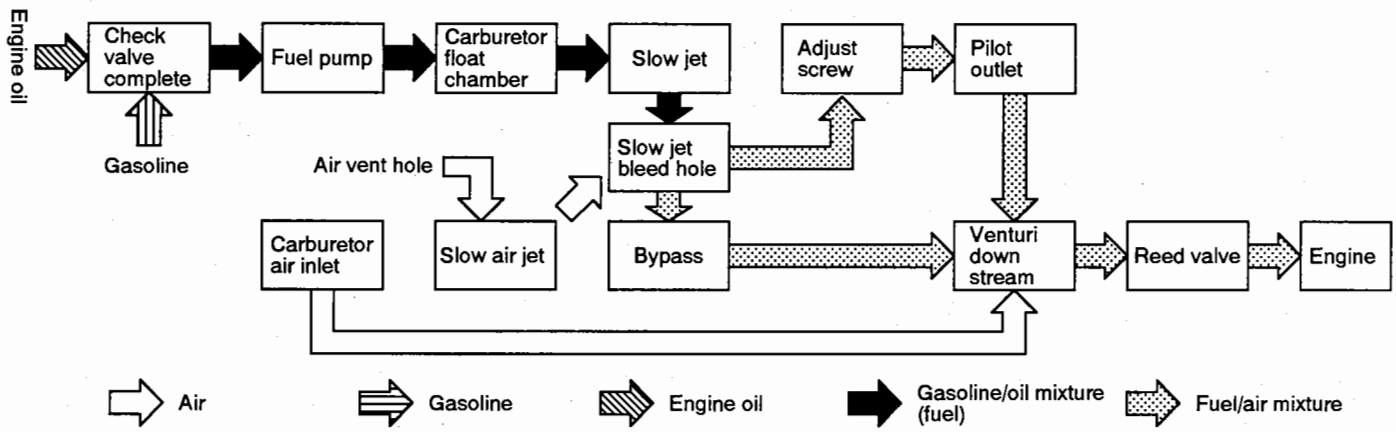
Colour of Cord

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

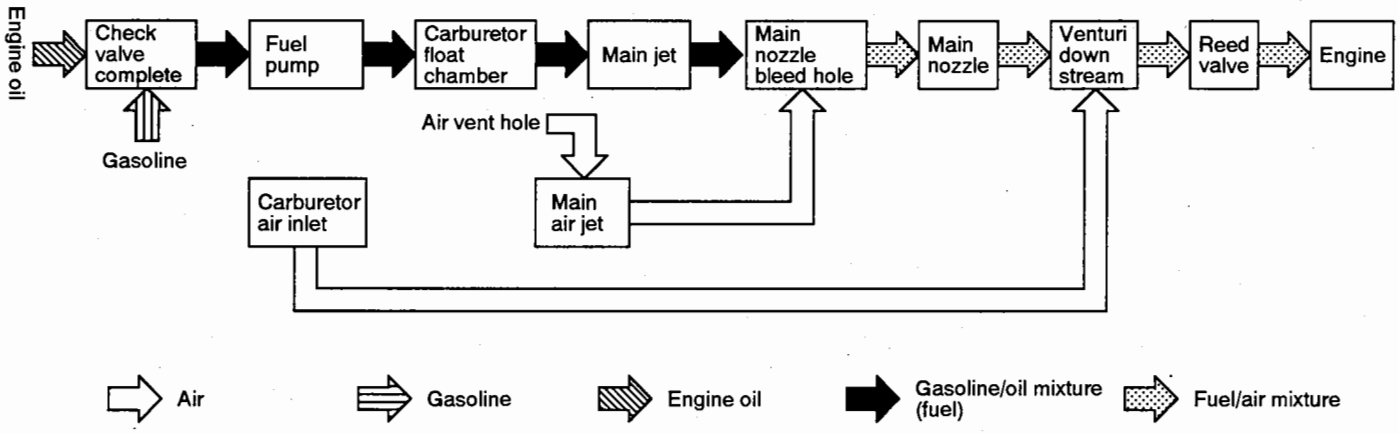
Note: (/) means stripe cord colour.

16 CARBURETOR

(1) Pilot system and Idling system



(2) Main system

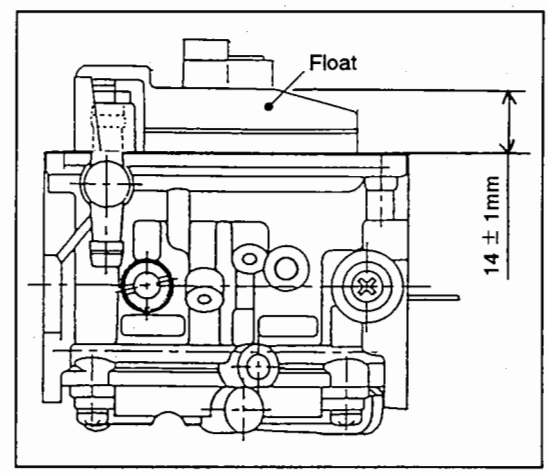


(3) Float Heigth

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

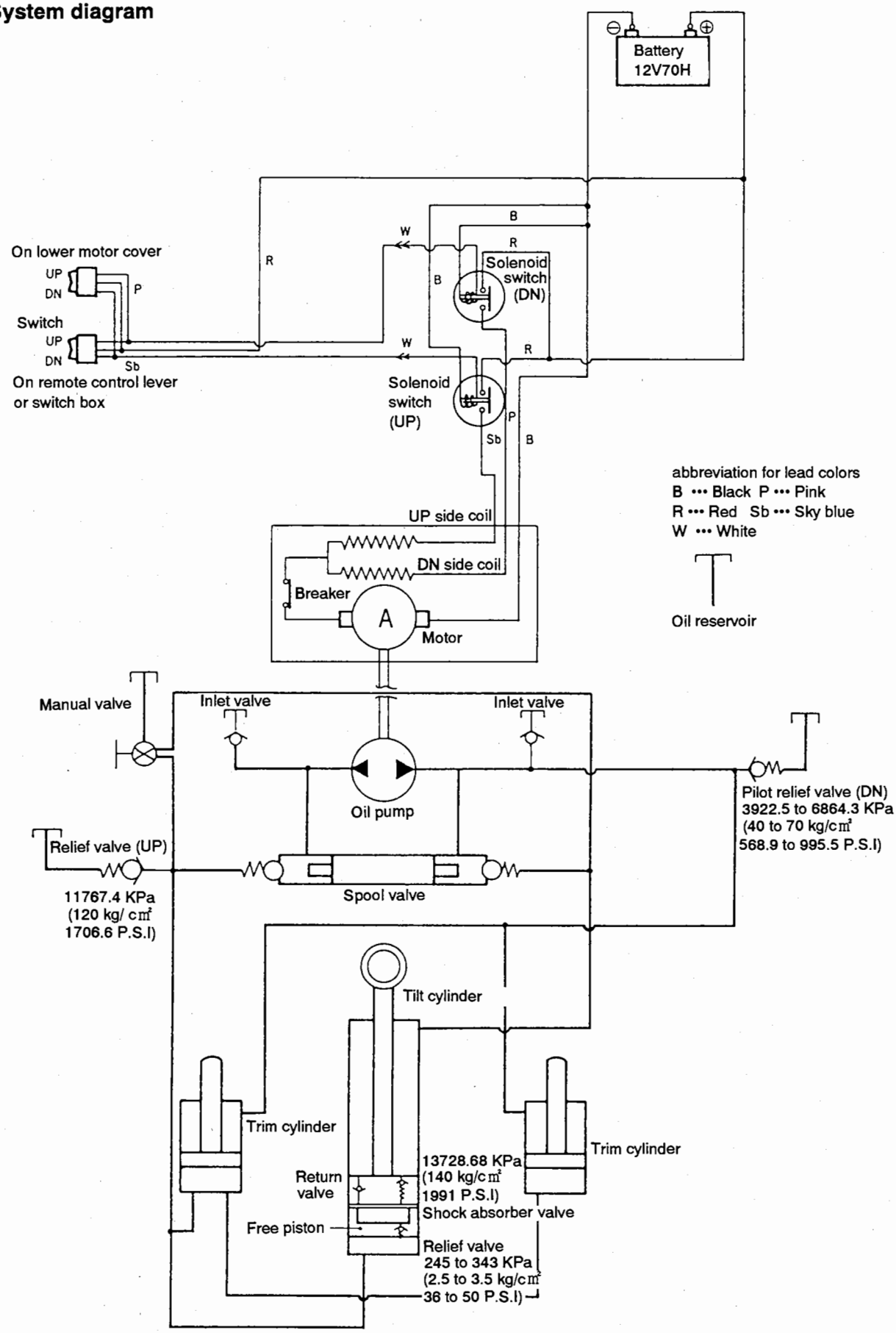
Standard float height:

14 ± 1.0 mm (lower surface of float)



17 POWER TRIM AND TILT

(1) System diagram

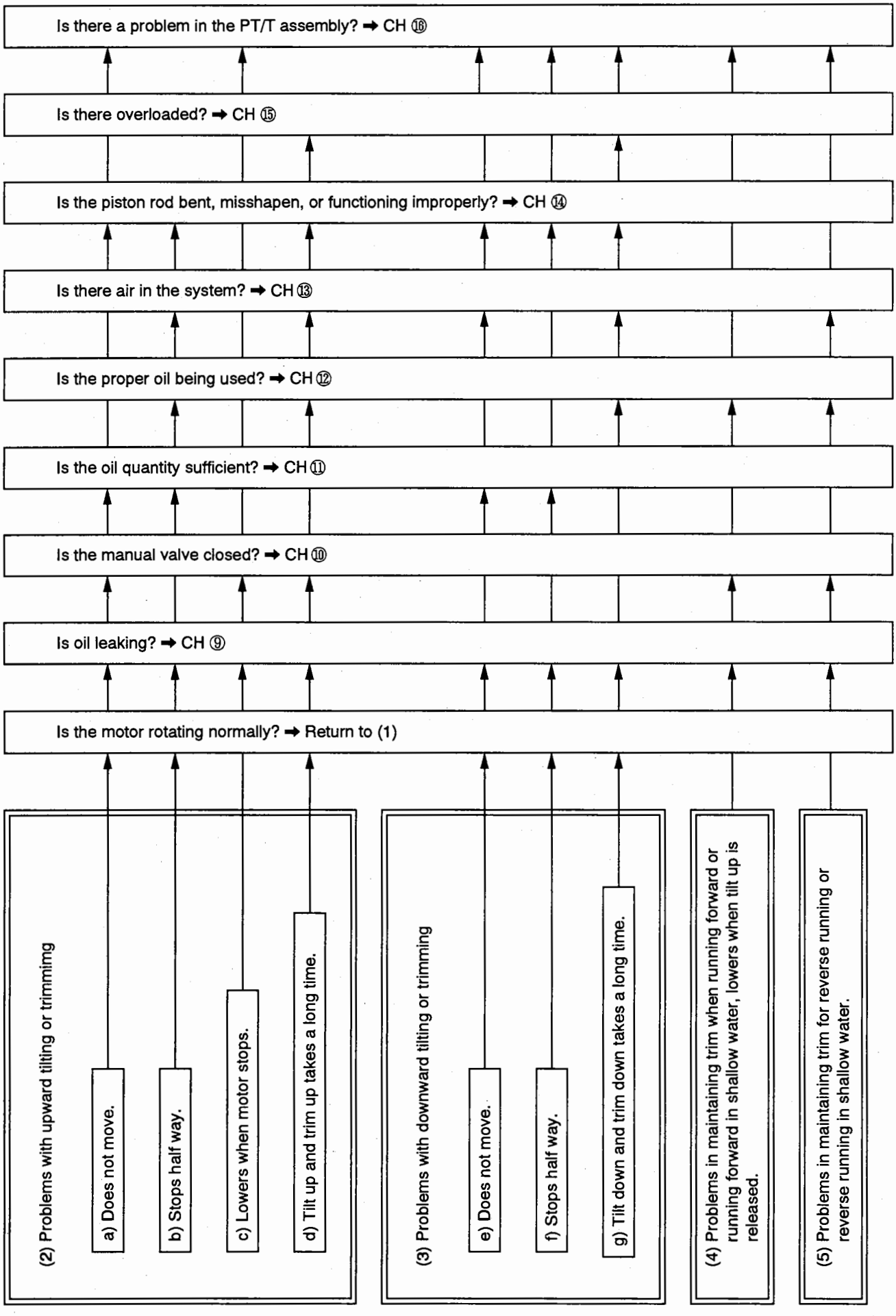


(2) Power trim and tilt troubleshooting

1) Description of problem and checks

(1) Motor does not rotate, power is low, or rotation is abnormal.

- Is the main switch at "ON"?
- Is a cable disconnected? → CH①
- Is the breaker in the "OFF" position? → CH②
- Is there a broken fuse? → CH③
- Is the battery capacity and charge sufficient? → CH④
- Is the battery capacity insufficient because it is being used for other things?
- Is wiring proper? → CH⑤
- Are there problems with the switches? → CH⑥
- Does the motor rotate when connected directly to the battery? → CH⑦
- Check for leaks, short circuits, or damage in the wiring and check the electric circuit. → CH⑧


Is there a problem in the PT/T assembly? ➡ CH ⑯
Is there overloaded? ➡ CH ⑮
Is the piston rod bent, misshapen, or functioning improperly? ➡ CH ⑭
Is there air in the system? ➡ CH ⑬
Is the proper oil being used? ➡ CH ⑫
Is the oil quantity sufficient? ➡ CH ⑪
Is the manual valve closed? ➡ CH ⑩
Is oil leaking? ➡ CH ⑨
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 in the "OFF" position?

- Touch the motor. If it is hot, the braker may be activated. Let it cool for at least 3 minutes.

CH③ Is there a broken fuse?

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

CH④ Is the battery capacity and charging sufficient?

- A battery of 12V, 70AH or greater should be used.
- Check the specific gravity of the battery electrolyte. If it is 1.22 (20 °C) or less, charge the battery.
- Check that the starter motor rotates. It should rotate.

CH⑤ Is wiring proper?

- Check for any miswiring 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 that they operate properly.
  Also use a tester to check the conductivity between the red leads. Electricity should flow when the switch is on.
- PT/T switch – Disconnect the white lead wire from the solenoid switch in the engine's electric bracket, and touch the terminal directly to the terminal board of the red lead. If the PT/T assembly works, the PT/T switch is defective (both up and down).
  Also use a tester to check the the conductivity of the PT/T switch.
  Press UP. Electricity should flow between the red lead and the sky blue lead.
  Press down. Electricity should flow between the red lead and the pink lead.
- Solenoid switch
  Disconnect the same white lead as above and touch it directly to the terminal board of the red lead. A clicking sound should be heard.
  Next check the conductivity between board terminals. Electricity should flow when the solenoid relay switch is on. (NOTE: Disconnect the red lead before checking.) If one side is judged OK, switch to the other.

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

- Disconnect the PT/T assembly blue and pink leads from the solenoid switch terminal board and touch the terminals separately to the red lead terminal. Should move up when the blue terminal is touching and down when the pink terminal is touching.
- Bring the PT/T assembly leads through the engine cover and touch the terminals directly to the battery terminals. If the motor does not turn, it is defective.

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

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

CH⑨ **Is oil leaking?**

- Look outside to see if oil is leaking.
  Sligth leaks are hard to find, so operate the PT/T assembly and check for oil floating on the water.
- If the oil tube nut is loose, tighten it.
  (Tightening torque: 11.17 N-m to 15.1 N-m, 1.14 to 1.54 kg-m. 8.2 to 11.1 ft-Lb)
- If oil leaking from the PT/T assembly or cylinder, there is breakage, or assembly is wrong. Disassemble and inspect, and if necessary replace.
  NOTE: Replace the O ring after disassembling the oil tube.

CH⑩ **Is the manual valve closed?**

- Try tightening the manual valve.
  Direction: Clockwise torque: 1.96 N-m to 2.94 N-m (0.2 kg-m to 0.3 kg-m, 17 in. lbs. to 26 in. lbs)

CH⑪ **Is the oil quantity sufficient?**

- Check the oil level.
  Proper oil level – oil must reach the oil plug hole when the engine is tilted up with all piston rods fully extended.
  NOTE: When the quantity of oil is insufficient and oil is added, be sure to bleed the air then recheck the oil level.
  Refer to CH ⑬ for the air bleeding instructions.
- If tilting up is impossible when it is almost empty:
  Open the manual valve and tilt up manually, then apply the tilt stopper so that the engine does not lower.
  Check for oil leakage.
  Add oil up to the bottom of the oil plug hole, operate the PT/T assembly a little in the tilt up direction, and tilt up in steps while pouring in the oil. Close the manual valve to keep air out. When the motor is tilted up, release the tilt stopper, bleed the air, check the oil level, check the tilt up and down operations, and if necessary bleed the air and check the oil level.
- The normal total oil quantity: 730 cc (24.6 fl-oz)
  NOTE: For PT/T assembly position when supplying oil, see page 61.

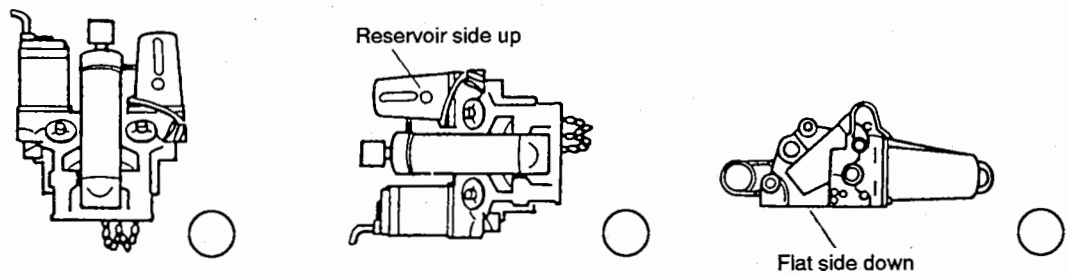
CH⑫ **Is the proper oil being used?**

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

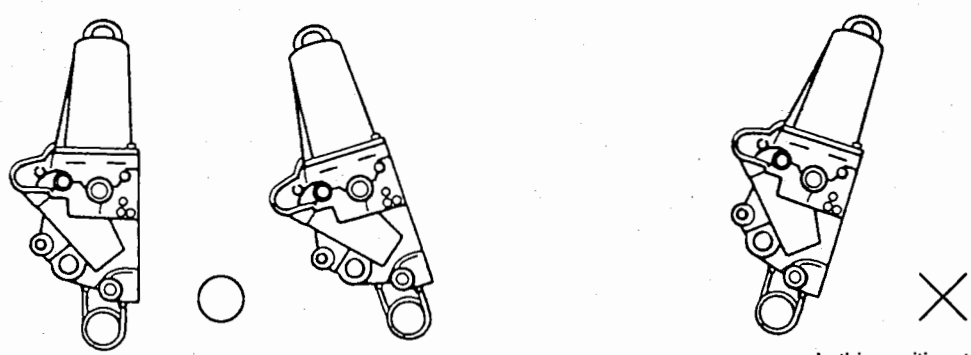
CH ⑬ **Is there air in the system?**

- If the PT/T assembly is operated with air inside, muffled sounds can be heard.
- Air bleeding procedure (close the oil plug while bleeding air.)
  Open the manual valve and repeatedly tilt up and down manually at least 4 times. Finally perfrom power tilt up and check the oil level.
- If air is deep inside.
  This air cannot easily be bled at once, so wait several days before bleeding.
  NOTE: Be careful for standing position not to let air in.

The following shows the storing positions so that air will not enter (in the opposite positions air will enter).



The position for adding oil in CH ⑪ is as follows:



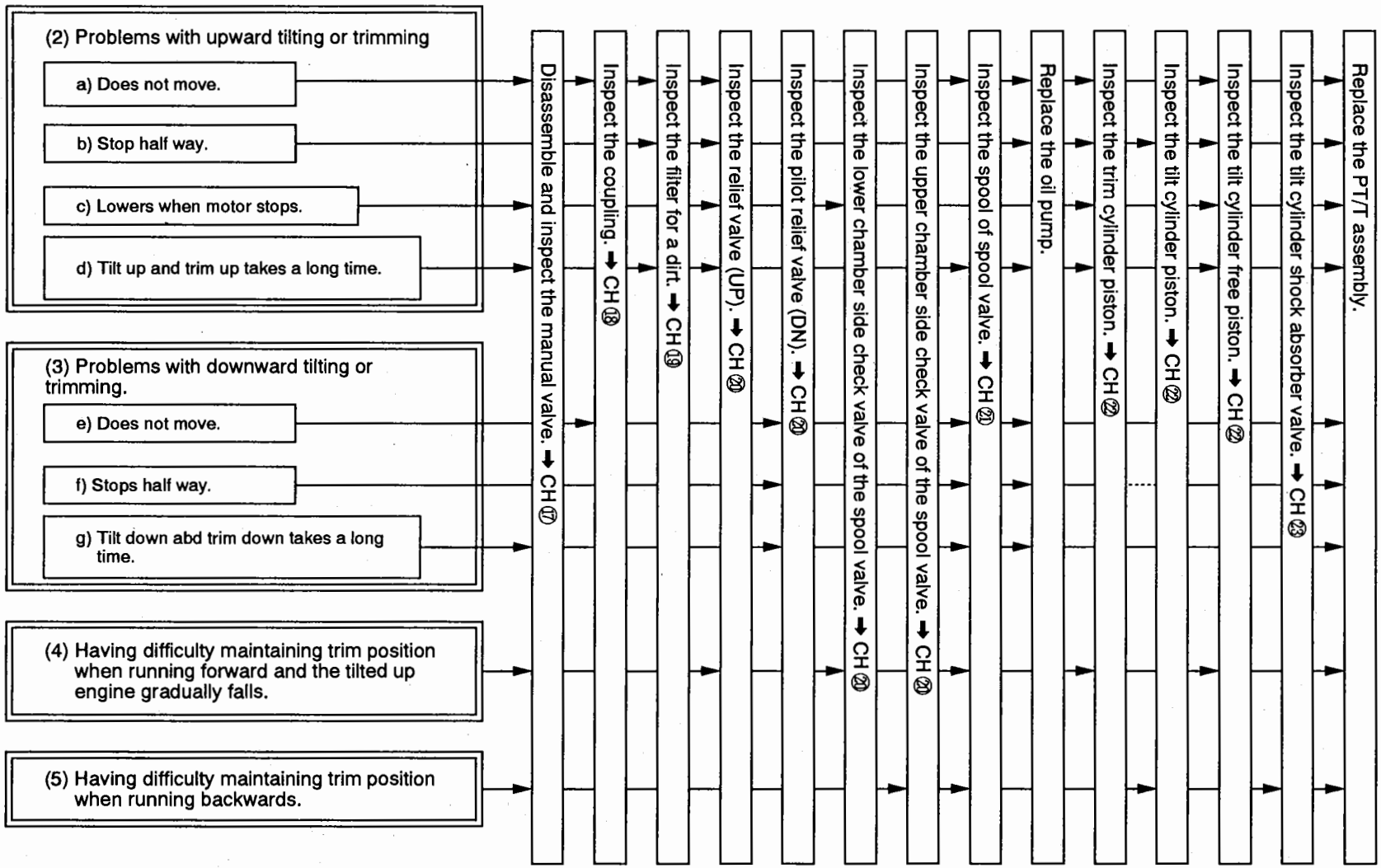
CH ⑭ **Is the piston rod bent, misshappen, or functioning improperly?**

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

CH ⑮ **Is there overloaded?**

Check lubrication condition of the stern bracket and the bracket bolt, and apply grease, if necessary.

CH⑯ Is there a problem in the PT/T assembly? .....The inspection differs according to the problem. Refer to the following.



NOTE:

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 O.
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.

CH ⑰ **Disassemble and inspect the manual valve.**

- Damage to manual valve end surface
- Damage to "O" ring
- Damage to seal washer (especially rubber seal)
- Damage to bottom surface of valve mounting hole

NOTE: Be careful that seal washer is positioned properly when assembling

CH ⑱ **Inspect the coupling.**

Remove the motor and inspect the coupling.

- Is it disconnected?
- Is it damaged?

CH ⑲ **Inspect the filter for dirt.**

Remove the motor and filter and clean.

CH ⑳ **Inspect the relief valves and check valves.**

- Deterioration or bending of spring
- Damage to valve seat
- Damage or wear of valve (ball)
- Smooth operation – Catching on dirt, etc. (push the ball by hand and check return.)
- For the UP relief valve, also inspect filter for dirt.
- Damage to "O" ring

CH ㉑ **Inspect spool of the spool valve.**

- Smooth operation (move by pushing lightly by hand.)
- Damage or wear of backup ring

CH ㉒ **Inspect the cylinder pistons.**

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

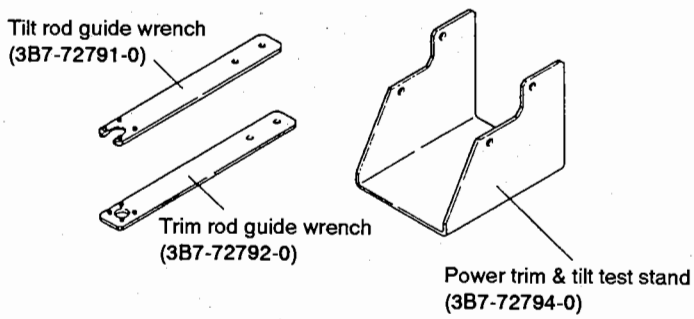
CH ㉓ **Inspect the tilt cylinder shock absorber valve.**

Disassemble the piston.

- Deterioration or damage to spring
- Damage to valve (ball)
- Damage to valve seat
- Dirt

(3) Disassembly and reassembly

1. Precautions during disassembly and reassembly of the Power Trim and Tilt
   Use the special tool kit for the power trim and tilt (3B7-72790-0) when disassembling and reassembling.



(1) Before disassembling, tilt up (with piston rod extended), open the manual valve, then leave the power trim and tilt for a while until the inner pressure reaches zero. It is very dangerous to open the manual valve entirely with the engine tilted down, due to the discharge of compressed oil.
(2) Open the oil plug of the reservoir tank and drain the oil.
(3) When removing parts, tank care that oil does not splashing your eyes.
(4) Before re-assembling, clean the all parts so that no dirt foreign substances enter the system.

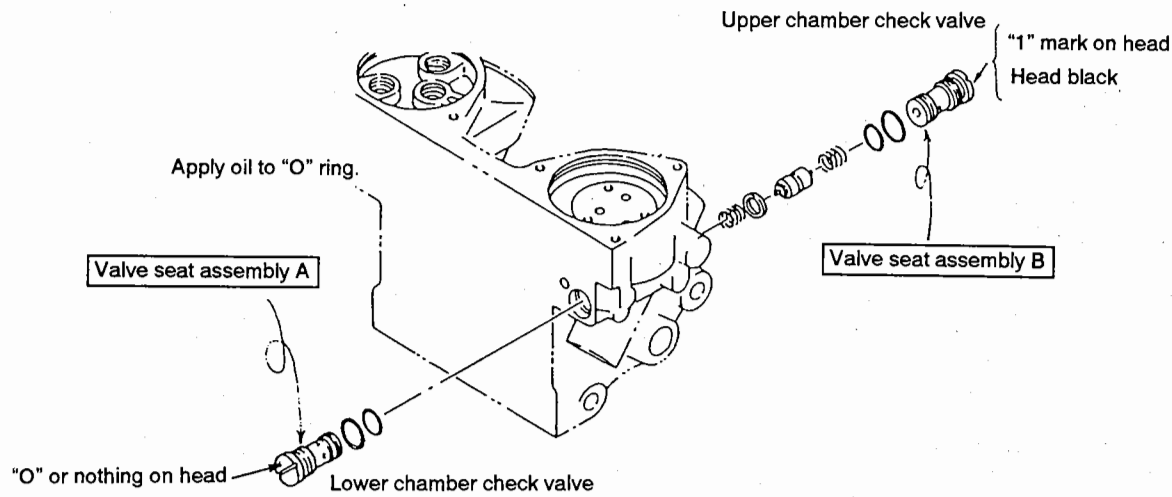
2. Assembly

(1) Oil pump assembly (internal parts cannot be disassembled)
Bolt tightening torque:
4.9 N-m to 5.39 N-m
(0.5 kg-m to 0.55 kg-m
3.62 ft-lb to 3.97 ft-lb)
"O" ring – Apply oil.

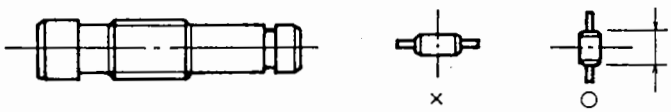
(2) Relief valve (UP)
Tightening torque:
11.76 N-m to 13.72 N-m
(1.2 kg-m to 1.4 kg-m
8.67 ft-lb to 10.12 ft-lb)
"O" ring – Apply oil.

(3) Pilot relief valve (DN)
Tightening torque:
11.776 N-m to 13.72 N-m
(1.2 kg-m to 1.4 kg-m
8.67 ft-lb to 10.12 ft-lb)
"O" ring – Apply oil.

(4) Spool valve
Apply oil to the outer surface and backup spring.
There are two types of check valves, one for the upper chamber, and one for the lower chamber.
Be careful not to confuse these. (See drawing below.)
Check valve tightening touque: 8.82 N-m to 10.78 N-m (0.9 kg-m to 1.1 kg-m, 6.51 ft-lb to 7.95 ft-lb)



(5) Manual valve
Be careful to assemble the seal washer, spring and inner collar in the correct order. (Refer to the parts list.)
Assemble the seal washer in the correct direction (if tightened on its side it will break).



Tightening torque:
1.96 N-m to 2.94 N-m
(0.2 kg-m to 0.3 kg-m
17.4 in-lb to 26.0 in-lb)
O ring – apply oil

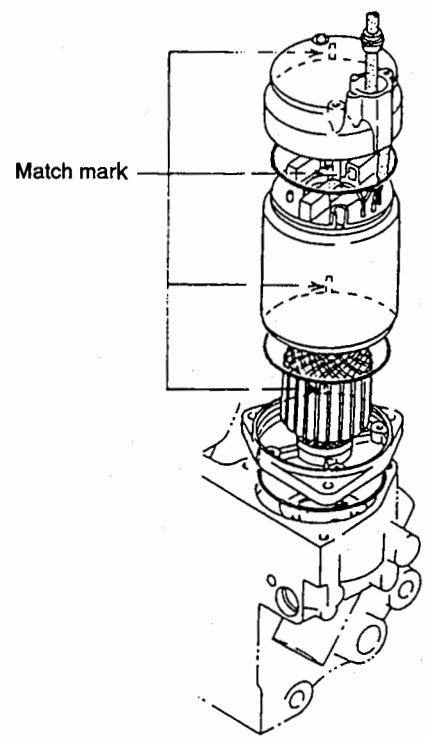
(6) Piston sub assembly, trim
Apply oil to O ring, backup ring and outer surface of piston.

(7) Rod guide sub assembly, trim
Tightening torque:
68.6 kg-m to 88.2 N-m
(7 kg-m to 9 kg-m
50.6 ft-lb to 65.1 ft-lb)
O ring – Apply oil.
Oil seal – Apply grease.

(8) Cylinder assembly, tilt
Apply grease to shaft and outer surface of bushing.
Replace "O" ring and oil tube nut.
Screw in oil tube nut two or three turns with your fingers then tighten using a spanner (using a spanner from the beginning will make it crooked).
Oil tube nut tightening torque:
10.78 N-m to 12.7 N-m
(1.1 kg-m to 1.3 kg-m
8.33 ft-lb to 9.34 ft-lb)
Apply oil to free piston "O" ring, backup ring, and outer piston surface.
Apply oil to piston rod assembly "O" ring and backup ring.
Apply oil to rod guide "O" ring.
Rod guide tightening torque:
78.4 N-m to 117.6 N-m
(8 kg-m to 12 kg-m
57.8 ft-lb to 86.8 ft-lb)

(9) Motor
Through bolt tightening torque:
Screw (for cord outlet seal plate) tightening torque:
3.43 N-m to 4.41 N-m
(0.35 kg-m to 0.45 kg-m
30.4 ft-lb to 39 ft-lb)
Line up marks when assembling armature and yoke compressor
Bolt (for motor assembly) tightening torque:
4.9 N-m to 6.8 N-m
(0.5 kg-m to 0.7 kg-m
43.4 ft-lb to 60.8 ft-lb)

(10) Oil reservoir
Bolt tightening torque:
4.9 N-m to 6.8 N-m
(0.5 kg-m to 0.7 kg-m
43.4 ft-lb to 60.8 ft-lb)
Apply oil to "O" ring
Oil plug tightening torque:
2.94 N-m to 4.9 N-m
(0.3 kg-m to 0.5 kg-m
26.0 ft-lb to 43.4 ft-lb)

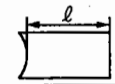


(4) Power Trim and Tilt Service Data

1. Pump assembly

Oil pump	Geared pump
Relief valve (UP) opening pressure	11,767 to 13,728 kPa (120 to 140 kg/cm^2, 1,706 to 1,991 psi)
Relief valve (Free piston) opening pressure	245 to 343 kPa (2.5 to 3.5 kg/cm^2, 36 to 50 psi)
Pilot relief valve (DN) opening pressure	3,922 to 6,864 kPa (40 to 70 kg/cm^2, 569 to 995 psi)
Spool check valve upper chamber opening pressure	235 kPa (2.4 kg/cm^2, 34 psi)
Spool check valve lower chamber opening pressure	117.7 kPa (1.2 kg/cm^2, 17psi)
Oil capacity	730 cc (24.66 fl. oz)
Oil	Nippon Sekiyu ATF DEXRON
Oil filter	150-mesh

2. Motor

Rated time	60 sec	
Rated voltage	12V (DC)	
Output	0.3 kW	
Direction of rotation	Forward, reverse convertible	
Breaker	DC sensor type	
Activation	40 to 120 sec (52A)	
Reset	Within 35 sec	
Commutator standard outer diameter	28 mm (1.102 inch)	
Usage limit	27 mm (1.063 inch)	
Brush standard dimensions (1 on diagram)	11.5 mm (0.453 inch)	
Usage limit	5.5 mm (0.216 inch)	
Replacement dimensions	7.5 mm (0.295 inch)	
Armature shaft core deflection standard value	0.15 mm or less	
Usage limit	0.15 mm or greater	
Field coil standard resistance	0.050 Ω (pink – blue)	

3. Trim cylinder

Piston diameter	38 mm (1.50 inch)
Piston rod diameter	16 mm (0.63 inch)
Stroke	69 mm (2.72 inch)

4. Tilt cylinder

Piston diameter	45 mm (1.77 inch)
Piston rod diameter	19 mm (0.75 inch)
Stroke	131 mm (6.16 inch)
Shock absorber valve opening pressure	12,258 to 15,200 kPa (125 to 155 kg/cm^2, 1,778 to 2,204 psi)

5. Switch

Control box (P type)	Single pole double throw paddles locker switch (3 A)
Motor cover lower	Single pole double throw paddles locker switch (3 A)
Panel (F type)	Single pole double throw paddles toggle switch (20 A)

6. Solenoid switches (UP and DN)

Rated voltage	12V (DC)
Rated time	30 sec (at 100 A)
Excitation current	3 A or less
Excitation coil standard resistance	5.2 Ω

7. Tightening torques

PT/T assembly mounting bolt		22.54 to 30.58 N-m (2.30 to 3.12 kg-m, 16.6 to 22.6 ft-lb)
Oil plug		2.94 to 4.9 N-m (0.3 to 0.5 kg-m, 26 to 44 in-lb)
Manual valve		1.96 to 2.94 N-m (0.2 to 0.3 kg-m, 17 to 26 in-lb)
Oil tube nut		10.78 to 12.74 N-m (1.1 to 1.3 kg-m, 7.96 to 9.4 ft-lb)

Motor	Through bolt	3.43 to 4.41 N-m (0.35 to 0.45 kg-m, 30.4 to 39 in-lb)
	Seal plate (cord outlet) screw	3.43 to 4.41 N-m (0.35 to 0.45 kg-m, 30.4 to 39 in-lb)
	Motor assembly mounting bolt	4.9 to 6.86 N-m (0.5 to 0.7 kg-m, 43.4 to 60.8 in-b)
Oil reservoir mounting bolt		4.9 to 6.86 N-m (0.5 to 0.7 kg-m, 43.4 to 60.8 in-b)

Pump	Oil pump mounting bolt	4.9 to 5.39 N-m (0.5 to 0.55 kg-m, 43.4 to 47.7 in-b)
	Relief valve assembly (UP)	11.76 to 13.72 N-m (1.2 to 1.4 kg-m, 8.68 to 10.13 ft-lb)
	Relief valve assembly (DN)	11.76 to 13.72 N-m (1.2 to 1.4 kg-m, 8.68 to 10.13 ft-lb)
	Pilot relief valve assembly (DN)	11.76 to 13.72 N-m (1.2 to 1.4 kg-m, 8.68 to 10.13 ft-b)
	Spool check valve assembly	8.82 to 10.78 N-m (0.9 to 1.1 kg-m, 6.51 to 7.96 ft-lb)
Trim rod guide		68.6 to 88.2 N-m (7 to 9 kg-m, 50.6 to 65.1 ft-lb)
Tilt rod guide		78.4 to 117.6 N-m (8 to 12 kg-m, 57.9 to 86.8 ft-lb)
Tilt piston rod fixing nut		78.4 to 117.6 N-m (8 to 12 kg-m, 57.9 to 86.8 ft-lb)

Switches	PT/T switch (P type) fitting screw	0.49 to 0.78 N-m (0.05 to 0.08 kg-m, 4.3 to 6.9 in-lb)
	PT/T switch (F type) fitting nut	1.47 to 2.94 N-m (0.15 to 0.3 kg-m, 13 to 26 in-lb)

8. "O" ring (standard dimensions)

		Line diameter – Inner diameter
Oil plug	P-9	1.9 – 8.8 mm (0.075 – 0.346 inch)
Oil reservoir	A-03	1.78 – 69.6 mm (0.07 – 2.740 inch)
Motor assembly	A-03	1.78 – 69.6 mm (0.070 – 2.740 inch)
Motor	S-70	2.0 – 69.5 mm (0.079 – 2.736 inch)
Through bolt	P-5	1.9 – 4.8 mm (0.075 – 0.186 inch)
Pump assembly outlet passage	S-7	1.5 – 6.5 mm (0.059 – 0.256 inch)
Manual valve	S-10	1.5 – 9.5 mm (0.059 – 0.374 inch)
	P-18	2.4 – 17.8 mm (0.094 – 0.701 inch)
Relief valve assembly (UP)	S-11.2	1.5 – 10.7 mm (0.059 – 0.421 inch)
Relief valve assembly (DN)	P-9	1.9 – 8.8 mm (0.075 – 0.346 inch)
Spool check valve	P-15	2.4 – 14.8 mm (0.094 – 0.583 inch)
	S-14	1.5 – 13.5 mm (0.059 – 0.531 inch)
Trim rod guide	P-39	3.5 – 38.7 mm (0.138 – 1.524 inch)
	P-16	2.4 – 15.8 mm (0.094 – 0.622 inch)
Trim piston	P-32	3.5 – 31.7 mm (0.138 – 1.248 inch)
Tilt rod guide	S-45	2.0 – 44.5 mm (0.079 – 1.752 inch)
Tilt piston	P-39	3.5 – 38.7 mm (0.138 – 1.524 inch)
Free piston	P-39	3.5 – 38.7 mm (0.138 – 0.524 inch)
Oil tube	P-5	1.9 – 4.8 mm (0.075 – 0.189 inch)

9. Spring (standard value) — Line diameter – Outer diameter – Free length

Spring brush	0.55 – 7 – 18.5 mm (0.0216 – 0.276 – 0.728 inch)
Spring, manual brush	1.2 – 11.5 – 6 mm (0.0472 – 0.453 – 0.236 inch)
Spring, spool	1.0 – 10.2 – 10.5 mm (0.0394 – 0.402 – 0.413 inch)
Spring, relief valve (UP)	1.0 – 5 – 19.5 mm (0.0394 – 0.197 – 0.768 inch)
Spring, pilot relief valve	1.4 – 6.7 – 12.4 mm (0.0551 – 0.264 – 0.488 inch)
Spring, shock absorber valve	1.4 – 6.8 – 16.3 mm (0.0551 – 0.268 – 0.642 inch)
Spring, spool	1.0 – 10.2 – 10.5 mm (0.0394 – 0.402 – 0.413 inch)

10. Steel ball (standard diameter) — Diameter

Relief valve (UP)	3.969 mm (5/32 inch)
Pilot relief valve	3.175 mm (1/8 inch)
Shock absorber valve	4.763 mm (3/16 inch) using number: two

11. Spring seat (standard height)

Pilot relief valve (DN)	11.2 mm (0.441 inch)
Shock absorber valve	13 mm (0.512 inch)

12. Oil seal — Inner diameter – Outer diameter – Thickness

Motor	8 – 18 – 4.5 mm (0.315 – 0.709 – 0.177 inch)
Trim rod guide dust seal	15.2 – 24 – 4.5 mm (0.598 – 0.945 – 0.177 inch)
Tilt rod guide dust seal	18.2 – 27 – 4.5 mm (0.717 – 1.063 – 0.177 inch)

13. Backup ring — Inner diameter – Outer diameter – Thickness

Tilt piston	39 – 45 – 1.25 mm (1.535 – 1.772 – 0.0492 inch)
Free piston	39 – 45 – 1.25 mm (1.535 – 1.772 – 0.0492 inch)
Trim piston	32 – 38 – 1.25 mm (1.260 – 1.496 – 0.0492 inch)
Spool valve	9 – 12 – 1.25 mm (0.354 – 0.472 – 0.0492 inch)

14. Seal washer — Inner diameter – Outer diameter – Thickness

Manual valve	4.3 – 11.5 – 1.6 mm (0.169 – 0.453 – 0.063 inch)

15. Others

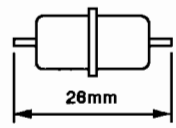
Inner collar (manual valve)	Thickness: 9.5 mm (0.374 inch)
Spool	Total length: 26 mm (1.024 inch)

(I) Periodic Inspection

Inspection	Procedure	Frequency
1. Oil leakage	• Inspect by sight. • When small and difficult to judge, operate PT/T assembly and check for oil floating on water. • If oil tube nut is loose, tighten. (Torque: 10.78 to 12.74 N-m 1.1 to 1.3 kg-m 7.96 to 9.40 ft-lb)	• Upon purchase • 10 hours or 1 month • 50 hours or 3 months • Every 200 hours or 1 season
2. Damaged or misshapen oil tube	• Inspect by sight. • For severe misshape or damage, replace.	• Upon purchase • When damage occurs
3. Loose oil tube nut	• Retighten. (Touque: 10.78 to 12.74 N-m 1.1 to 1.3 kg-m 7.96 to 9.4 ft-lb)	• Upon purchase • Every 200 hours or 1 season
4. Loose PT/T mounting bolt	• Retighten. (Torque: 22.54 to 30.58 N-m 2.30 to 3.12 kg-m 16.6 to 22.6 ft-lb)	• Upon purchase • Every 200 hours or 1 season
5. Bent piston rod, bent upper cylinder pin, lost or misshapen E ring	• Inspect by sight.	• Upon purchase • Every 200 hours or 1 season • After collision
6. Oil level Specified oil Air bleeding	• Oil level should reach the lower surface of oil plug hole when tilted up (piston rods fully extended). • After adding oil, bleed air then recheck oil level. See troubleshooting CH⑫. See troubleshooting CH⑫.	• Upon purchase • 10 hours or 1 month • 50 hours or 3 months • Every 200 hours or 1 season
7. Manual valve operation	• Open manual valve and manually move up and down. (**NOTE:** Tightening torque: 1.96 to 2.94 N-m 0.2 to 0.3 kg-m 17 to 26 in-lb)	• Upon purchase • Every 200 hours or once a season

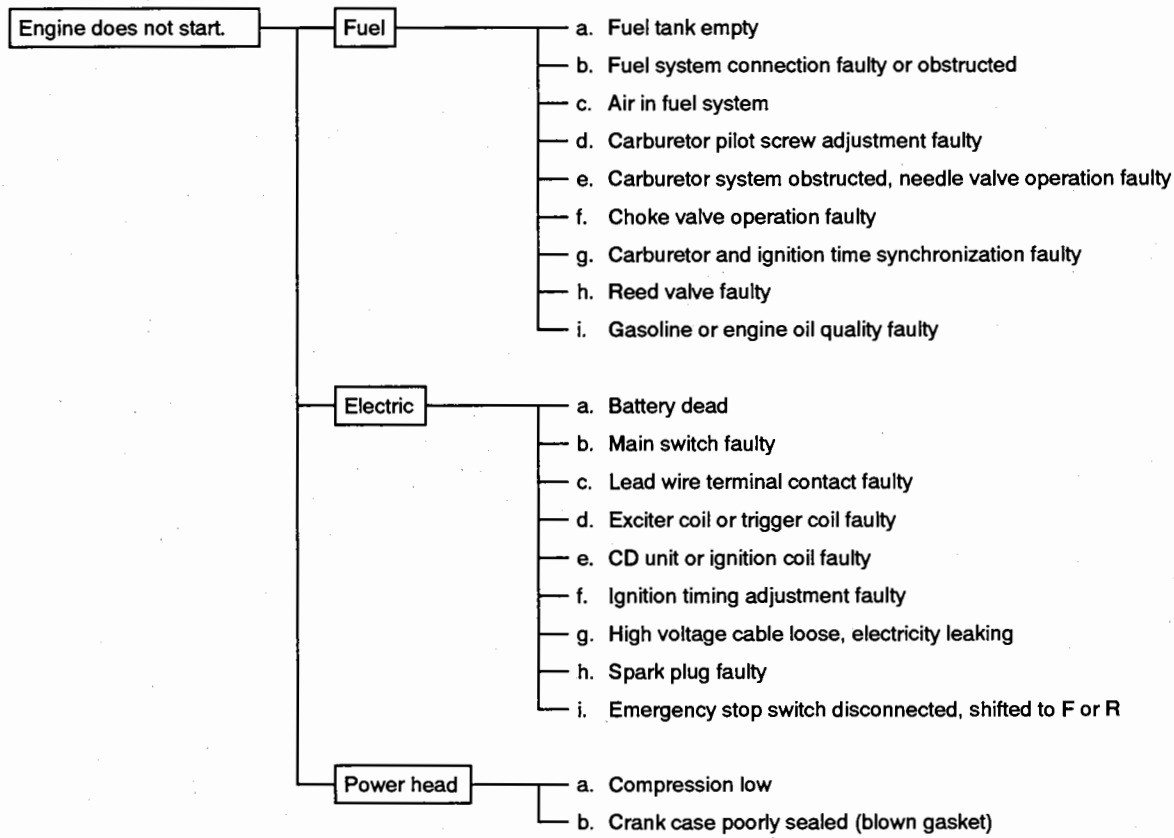
(II) Disassembly and Inspection

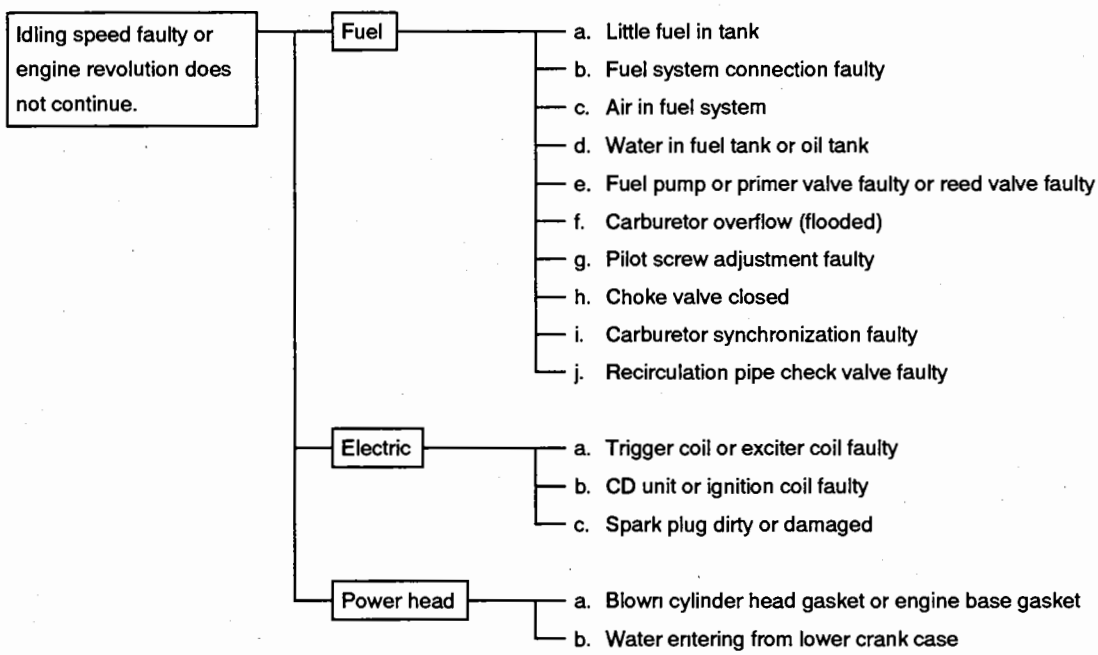
Part	Inspection	Standard Value	Replacement Limit
1. Motor			
1) Amature assembly	① Shaft core deflection	0.15 mm (0.0059 inch) or less	0.15 mm (0.0059 inch) or more
	② Commutator outer diameter	28 mm (1.102 inch)	27 mm (1.063 inch) or less
	③ Faulty coil insulation Resistance between commutator and shaft	With 500V megatester over 1 M Ω	Less than 1MΩ
2) Yoke compressor	① Damaged field coil Standard resistance		
	Blue terminal – + side brush	0.030 Ω	
	Pink terminal – + side brush	0.030 Ω	
	Blue terminal – pink terminal	0.050 Ω	
	② Faulty thermal breaker (Conductivity at both ends)		Faulty conductivity
	③ Damaged ground cable Black terminal – (–) side brush		Faulty conductivity
	④ Insulation of cable and field coil Resistance between all terminals – yoke	0.1 M Ω or greater with 500V megatester	
3) Brush	① Brush wear	11.5 mm (0.453 inch)	7.5 mm (0.295 inch)
	② Damaged brush spring	Line diameter – outer diameter – free length 0.55 – 7 – 18.5 mm (0.0216 – 0.276 – 0.728 inch)	
4) O ring	Damaged	Line diameter – inner diameter 2.0 – 69.5 mm (0.078 – 2.736 inch)	
5) O ring through bolt	Damaged	Line diameter – inner diameter (1.9 – 4.8 mm (0.075 – 0.189 inch)	
2. Pump			
1) Filter B	Blockage due to foreign substances Damaged		
2) Coupling	Damaged		
3) "O" ring	Damaged	Line diameter – inner diameter 1.78 – 69.6 mm (0.070 – 2.740 inch) 1.5 – 6.5 mm (0.059 – 0.256 inch)	
4) Oil seal	Damaged or worn lip	Inner diameter – outer diameter – thickness 8 – 18 – 4.5 mm (0.315 – 0.709 – 0.177 inch)	
3. Manual valve			
1) Manual valve	Worn or damaged tip		
2) "O" ring	Damaged	Line diameter – inner diameter 1.5 – 9.5 mm (0.059 – 0.374 inch)	
3) "O" ring	Damaged	Line diameter – inner diameter (2.4 – 17.8 mm (0.094 – 0.701 inch)	
4) Washer, seal	Damaged rubber lip Worn plate	Inner diameter – outer diameter – thickness 4.3 – 11.5 – 1.6 mm (0.169 – 0.453 – 0.063 inch)	
5) Spring	Damaged, cracked	Line diameter – outer diameter – free length 1.2 – 11.5 – 6 mm (0.0472 – 0.453 – 0.236 inch)	
6) Collar, inner	Damaged, worn	Thickness 9.5 mm (0.374 inch)	

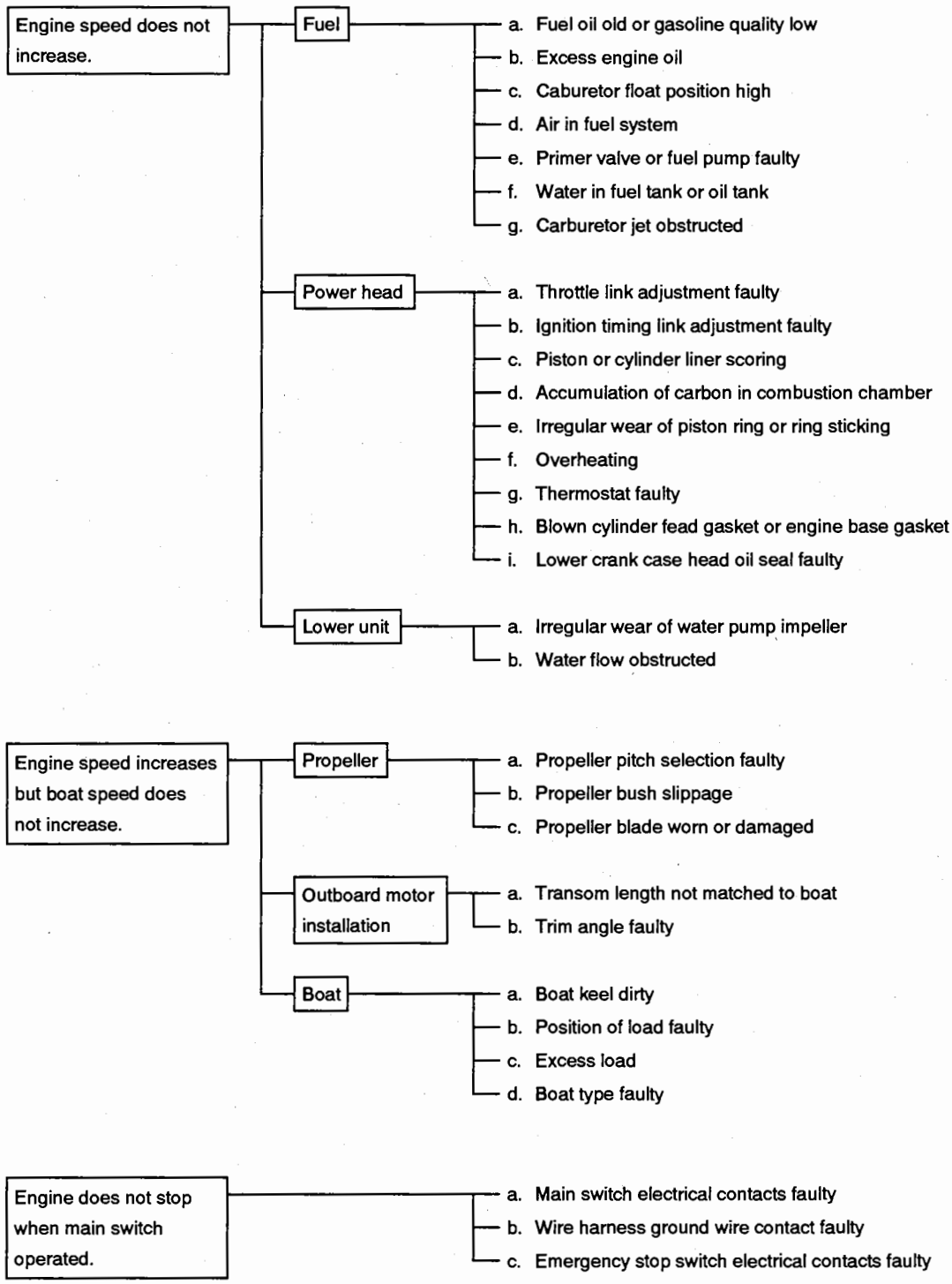
Part	Inspection	Standard Value	Replacement Limit
4. Relief valve (UP) Pilot relief valve (DN)			
1) Spring	Deterioration, damage	Line diameter – outer diameter – free length	
	Relief valve UP	1.0 – 5 – 19.5 mm (0.0394 – 0.197 – 0.768 inch)	
	Pilot relief valve DN	1.4 – 6.7 – 12.4 mm (0.0551 – 0.264 – 0.488 inch)	
2) Valve seat	Damaged		
3) Valve (ball)	Dameged or worn	Diameter	
	Relief valve UP	3.969 mm (5/32 inch)	
	Pilot relief valve DN	3.175 mm (1/8 inch)	
4) Filter (UP only)	Jammed		
5) "O" ring	Damaged	Line diameter – inner diameter	
	S – 11.2	1.5 – 10.7 mm (0.059 – 0.421 inch)	
	S – 9	1.5 – 8.5 mm (0.059 – 0.335 inch)	
5. Spool valve			
1) Valve seat Assembly A – B	Deteriorated or damaged spring Damaged valve seat Damaged or worn valve (ball) Smooth operation		
2) "O" ring	Damaged	Line diameter – inner diamter 2.4 – 14.8 mm (0.094 – 0.583 inch) 1.5 – 13.5 mm (0.059 – 0.531 inch)	
3) Spring	Damaged or deterioration	Line diameter – outer diameter – free length 1.0 – 10.2 – 10.5 (0.0394 – 0.402 – 0.413 inch)	
4) Spool	Bent or damaged projection	 (1.024 inch)	
5) Backup ring	Damaged or worn		
6. Reservoir tank			
1) "O"ring Oil plug 2) "O"ring Reservoir tank	Damaged	Line diameter – inner diameter 1.9 – 8.8 mm (0.075 – 0.346 inch) 1.78 – 69.6 mm (0.070 – 2.740 inch)	
7. Tilt cylinder			
1) "O" ring Oil tube nut	Damaged	Line diameter – inner diameter 1.9 – 4.8 mm (0.075 – 0.189 inch)	Replace after disassembly.
2) Rod guide Compressor			
a. "O" ring	Damaged or worn	Line diameter – inner diameter 2.0 – 44.5 mm (0.079 – 1.752 inch)	
b. Dust seal	Damaged or worn	Inner diameter – outer diameter – height 18.2 – 27 – 4.5 mm (0.717 – 1.063 – 0.177 inch)	

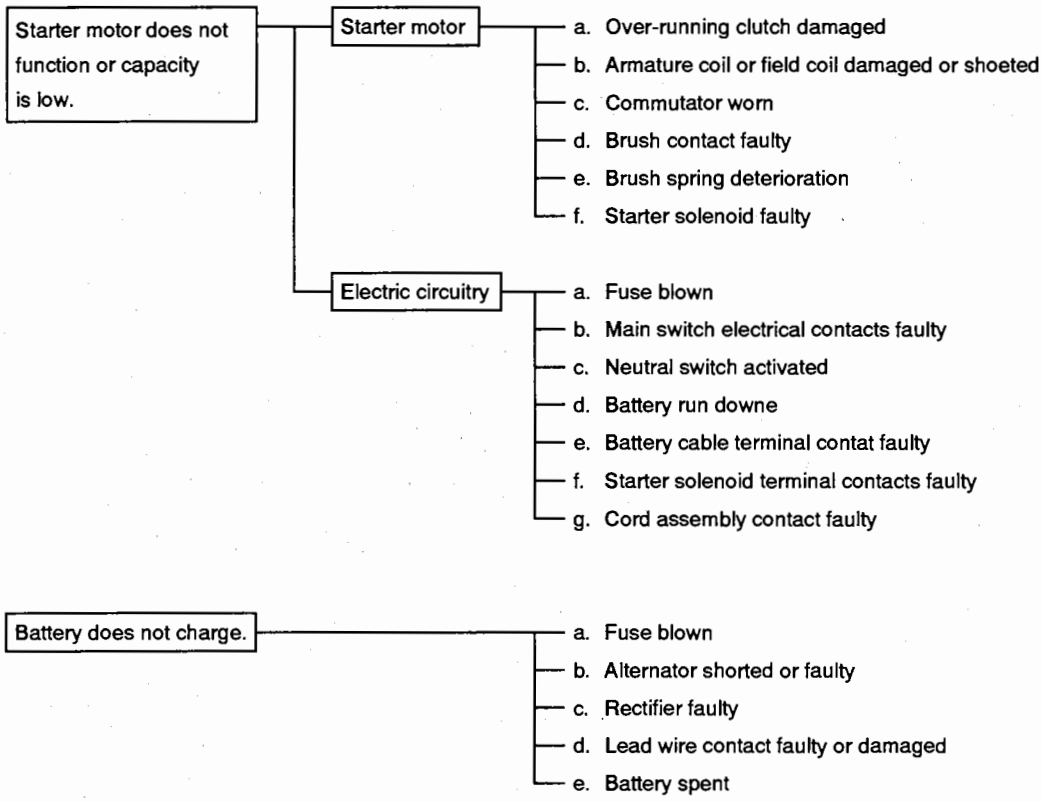
Part	Inspection	Standard Value	Replacement Limit
3) Piston rod assembly			
a. "O" ring	Damaged or worn	Line diameter – inner diameter 3.5 – 38.7 mm (0.138 – 1.524 inch)	
b. Backup ring	Damaged or worn	Inner diameter – outer diameter – thickness 39 – 38.7 – 1.25 mm (1.535 – 1.772 – 0.049 inch)	
c. Shcok absorber	Damaged seat surface Deteriorated or damaged spring	Line diameter – outer diameter – free length 1.4 – 6.8 – 6.3 mm (0.0552 – 0.268 – 0.2480 inch)	
	Damaged or worn valve (ball)	Diameter 3.97 mm (5/32 inch)	
4) Free piston			
a. "O" ring	Damaged or worn	Line diameter – inner diameter 3.5 – 38.7 mm (0.138 – 1.524 inch)	
b. Backup ring	Damaged or worn	Inner diameter – outer diameter – thickness 39 – 45 – 1.25 mm (1.535 – 1.772 – 0.049 inch)	
8. Trim cylinder			
1) Rod guide sub assembly			
a. "O" ring	Damaged or worn	Line diameter – inner diameter 3.5 – 38.7 mm (0.138 – 1.524 inch) 2.4 – 15.8 mm (0.094 – 0.622 inch)	
2) Piston rod			
a. "O" ring	Damaged or worn	Line diameter – inner diameter 3.5 – 31.7 mm (0.138 – 1.248 inch)	
b. Backup ring	Damaged or worn	Inner diameter – outer diameter thickness 32 – 38 – 1.25 mm (1.260 – 1.496 – 0.0492 inch)	

18 TROUBLESHOOTING






Engine speed does not increase.
Fuel
a. Fuel oil old or gasoline quality low
b. Excess engine oil
c. Caburetor float position high
d. Air in fuel system
e. Primer valve or fuel pump faulty
f. Water in fuel tank or oil tank
g. Carburetor jet obstructed
Power head
a. Throttle link adjustment faulty
b. Ignition timing link adjustment faulty
c. Piston or cylinder liner scoring
d. Accumulation of carbon in combustion chamber
e. Irregular wear of piston ring or ring sticking
f. Overheating
g. Thermostat faulty
h. Blown cylinder fead gasket or engine base gasket
i. Lower crank case head oil seal faulty
Lower unit
a. Irregular wear of water pump impeller
b. Water flow obstructed
Engine speed increases but boat speed does not increase.
Propeller
a. Propeller pitch selection faulty
b. Propeller bush slippage
c. Propeller blade worn or damaged
Outboard motor installation
a. Transom length not matched to boat
b. Trim angle faulty
Boat
a. Boat keel dirty
b. Position of load faulty
c. Excess load
d. Boat type faulty
Engine does not stop when main switch operated.
a. Main switch electrical contacts faulty
b. Wire harness ground wire contact faulty
c. Emergency stop switch electrical contacts faulty


Starter motor does not function or capacity is low.
Starter motor
a. Over-running clutch damaged
b. Armature coil or field coil damaged or shoeted
c. Commutator worn
d. Brush contact faulty
e. Brush spring deterioration
f. Starter solenoid faulty
Electric circuitry
a. Fuse blown
b. Main switch electrical contacts faulty
c. Neutral switch activated
d. Battery run downe
e. Battery cable terminal contat faulty
f. Starter solenoid terminal contacts faulty
g. Cord assembly contact faulty

Battery does not charge.
a. Fuse blown
b. Alternator shorted or faulty
c. Rectifier faulty
d. Lead wire contact faulty or damaged
e. Battery spent

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