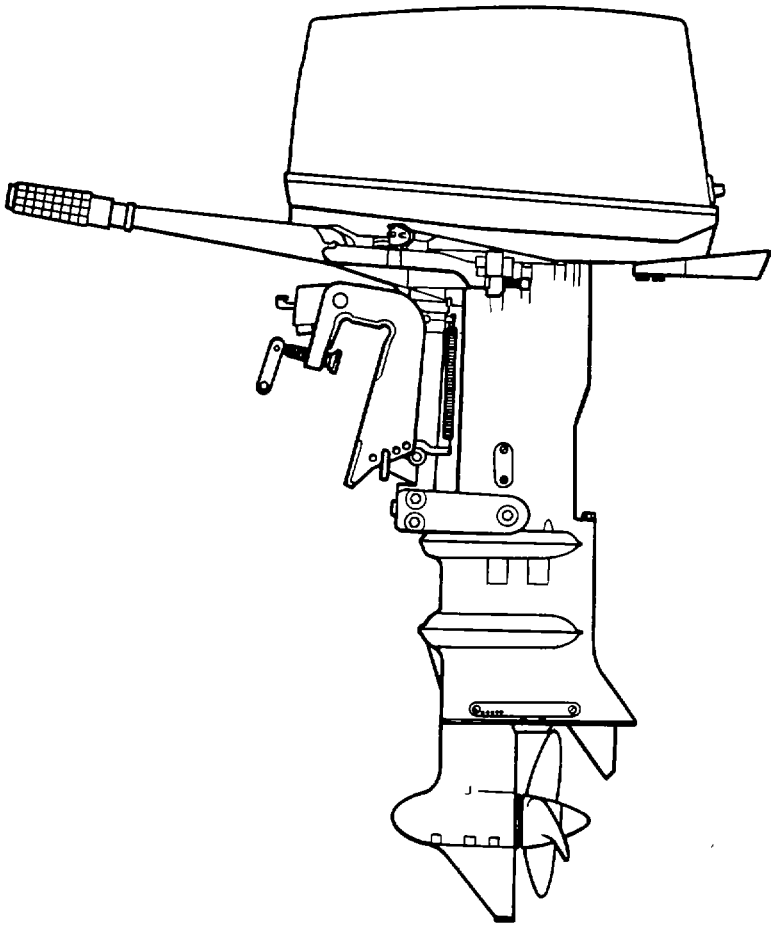
TECHNICAL MANUAL
OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT
MAINTENANCE MANUAL



OUTBOARD MOTOR, GASOLINE
OMC MODEL AM-40A
NSN 2805-01-105-1680

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y
3 MAY 1982

TM 5-2805-261-13
C 2

CHANGE }
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.,17 March 1989

Operator, Organizational and Direct Support
Maintenance Manual

OUTBOARD MOTOR, GASOLINE
OMC MODEL AM-40A
NSN 2805-01-105-1680

TM 5-2805-261-13, 3 May 1982, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

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To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and general Support Maintenance requirements for Motor, Outboard, Gasoline, Model AM-40A

TM 5-2805-261-13

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No. 1 DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 April 1985

OPERATOR, ORGANIZATIONAL AND DIRECT SUPPORT
MAINTENANCE MANUAL

OUTBOARD MOTOR, GASOLINE
OMC MODEL AM-40A
NSN 2805-01-105-1680

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1-3 and 1-4	1-3 and 1-4
2-7 and 2-8	2-7 and 2-8
---	2-8.1/2-8.2
4-23 and 4-24	4-23 and 4-24
4-27 and 4-28	4-27 and 4-28
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To be distributed in accordance with DA Form 12-25D, Operator, Organizational and Direct Support and General Support Maintenance Requirements for Outboard Motors.

WARNING

Before starting engine or operating any of the components ensure that no loose bars, tools, or parts are lying in or on any part of the equipment, as they could cause serious damage to equipment or bodily injury to personnel.

WARNING

Never wear loose clothing, or loose objects or items on person or clothing, while inspecting running engine, moving shafts, or like machinery.

WARNING

Disconnect the spark plug cables prior to engine maintenance to prevent accidental starting and severe shock.

WARNING

Do not touch the ignition system harness during starting or while in operation. Severe shocks or burns could result, and personnel may be seriously injured.

WARNING

When handling gasoline, always provide a metal-to-metal contact between the container and tank. This will prevent a spark from being generated as gasoline flows over the metallic surface.

WARNING

Before refueling, ensure that adequate fire fighting equipment is serviceable and is standing by for immediate use in event of fire or explosion.

WARNING

Noise hazard. Operation of this equipment presents a noise hazard. Wear ear muff or ear plugs to avoid ear injury within 15 feet when operating outboard motor at high RPM.

WARNING

Do not refuel while engine is in operation.

WARNING

Never touch engine or engine accessories with bare hands during operation, or before they have cooled sufficiently. Severe burns can be caused through carelessness.

WARNING

Make certain any lifting device used has a capacity equal to the weight being lifted. Failure to observe this precaution could result in injury or death to personnel and damage to equipment.

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or non-porous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death.

TECHNICAL MANUAL

NO. 5-2805-261-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 3 May 1982

OPERATOR'S ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE MANUAL

OUTBOARD MOTOR, GASOLINE
OMC MODEL AM-40A
NSN 2805-01-105-1680

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You con help improve this manual. If you find any mistake of if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, U.S. Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. SCOPE. This manual is for your use in operating and maintaining the model AM-40A outboard motor. Chapters 2 and 3 provide information on operation, preventive maintenance services, and operator's maintenance of equipment, accessories, components and attachments. Chapters 4 through 5 provide maintenance information for the organizational, and DS levels.

Also included are descriptions of all components.

1-2. MAINTENANCE FORMS AND RECORDS. Equipment maintenance forms and procedures for their use are contained in TM 38-750, The Army Maintenance Management System (TAMMS). These manuals are published to aid in property accountability and are available through: Commander, US Army Adjutant General 2800 Eastern Blvd., Baltimore, MD 21200.

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S). EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Instructions for preparing El R's are provided in TM . The Army Maintenance Managements System. Mail directly to Commander Headquarters, U.S. Army Troop Support and Aviation Materiel Readiness Command, 38-750 Attn: DRSTS-MPDM, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

1-4. WARRANTY INFORMATION. All components of the outboard motor are warranted by outboard marine corporation for a period of 180 days (6 months). Report all defects in material or workmanship to your supervisor, who will take appropriate action through your organizational maintenance shop.

1-5. Hand Receipt. Hand receipts for Components of End Item (COEI), Basic Issue Items (Bll), and Additional Authorization List (AAL) items are published to aid in property accountability and is available through: Commander, US Army Adjutant General Publication Center, 2800 Eastern Blvd., Baltimore, MD 21200.

Section II. EQUIPMENT DESCRIPTION

1-6. PURPOSE OF THE OUTBOARD MOTOR. A propulsion unit for inflatable rafts and small boats (18' or less).

1-7. CAPABILITIES AND FEATURES.

- Uses gasoline for fuel (see LO 5-2805-261-12)
- Can be placed in position by two men
- Can be operated by one man
- Uses external gas tank
- Operational all weather
- Operational salt and fresh water
- Portable

NOTE

Sometimes the words "right" and "left" are very confusing when referring to the sides of an outboard motor. Therefore, the sides are referred to as starboard or port sides. Starboard means on the right hand while facing the bow (front) of the boat; port means left hand.

The outboard motor as a whole unit will be referred to as "motor". The component parts of the outboard motor will be referred to by their proper names, eg. "engine" refers to only the engine.

1-8. LOCATION AND DESCRIPTION OF MOTOR COMPONENTS. (Figures 1-1 and 1-2.)

SHIFT LEVER (1). Shifts gears to one of three positions: forward, neutral, reverse.

CARRYING HANDLE (2). For carrying motor.

TILT FRICTION NUT (3). For adjusting the friction needed to hold the motor in a tilted position.

TILT LOCK (4). Holds motor in a tilted position.

ANGLE ADJUSTING ROD (5). Allows the motor to be positioned in different attitudes relative to the crafts' transom.

OIL LEVEL PLUG (6). Access hole to check level of oil in gearcase.

WATER INTAKE (7). Inlet for cooling water.

SKEG (8). Protects the propeller.

OIL DRAIN/FILL PLUG (9). Access hole to drain and fill gearcase.

GEARCASE (10). Contains forward and reverse gears.

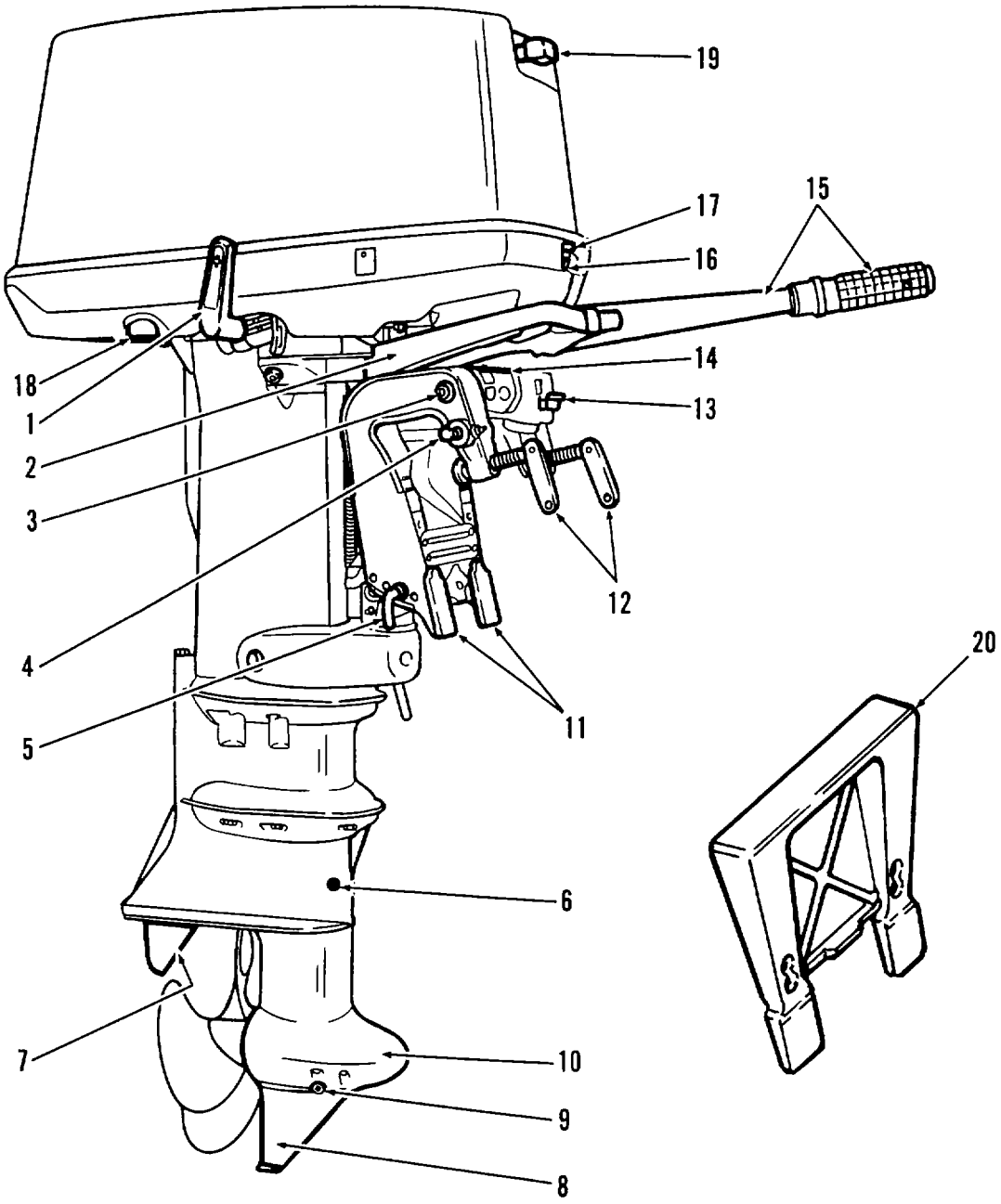


Figure 1-1. Starboard View of Motor

1. Shift lever
2. Steering bracket and carrying handle
3. Tilt friction nut
4. Tilt lock
5. Angle adjusting rod
6. Oil level plug
7. Water intake
8. Skeg
9. Oil drain/fill plug
10. Gearcase
11. Stern brackets
12. Clamp screws
13. Reverse lock lever
14. Identification plate
15. Steering handle and throttle control
16. Stop button
17. Choke
18. Water pump indicator
19. Starter handle
20. Transom wedge

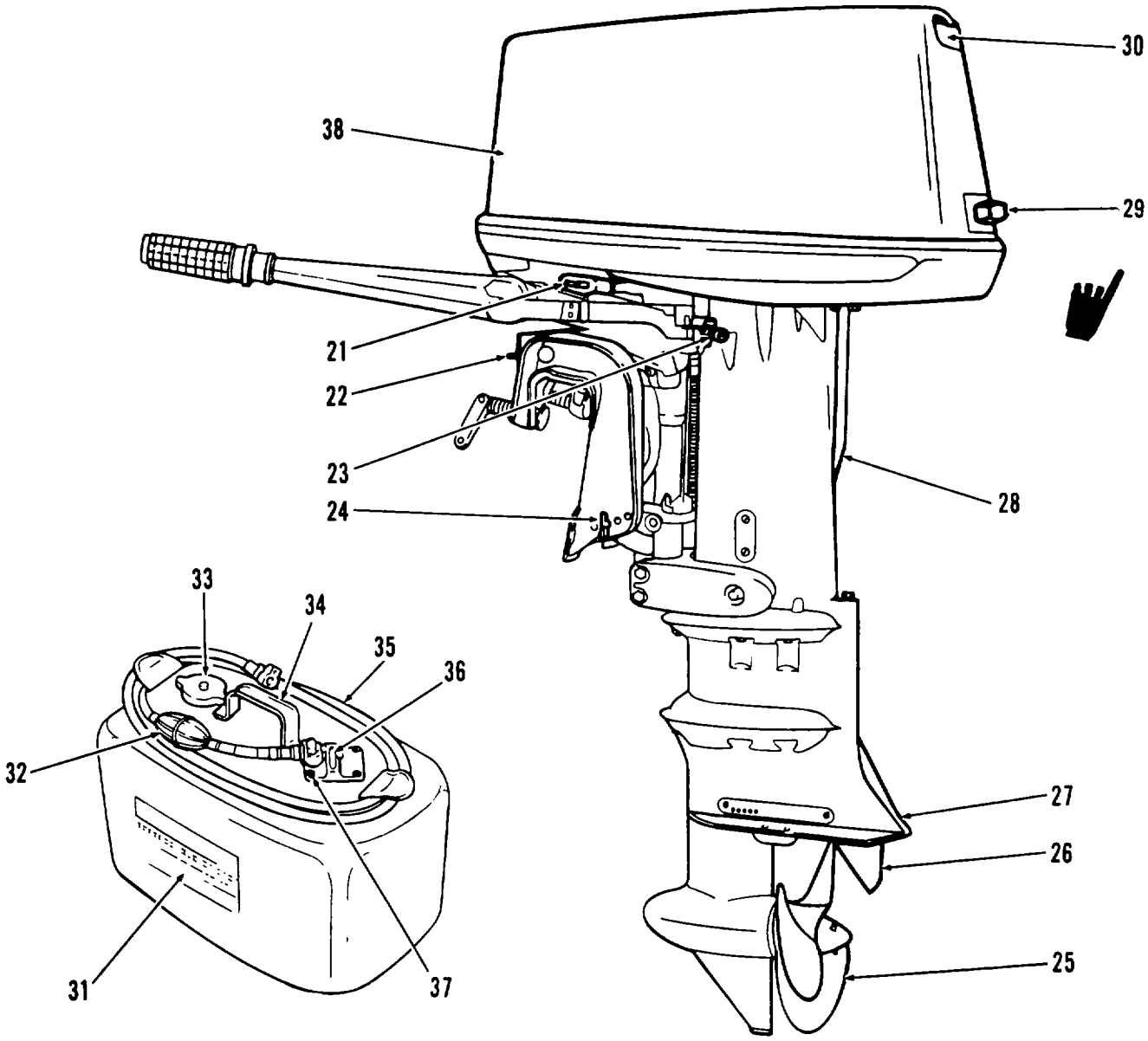


Figure 1-2. Port View of Motor

21. Fuel connector
22. Safety chain lug
23. Idle speed adjusting screw
24. Angle adjustment rod retainer
25. Propeller
26. Exhaust outlet
27. Anti-ventilation plate
28. Water discharge
29. Locking lever - cover
30. Tilt grip
31. Fuel tank
32. Priming bulb
33. Filler cap
34. Handle
35. Fuel line
36. Fuel gauge
37. Drain screw
38. Motor cover

STERN BRACKETS (11). Braces motor against transom.

CLAMP SCREWS (12). Fastens motor to transom.

REVERSE LOCK LEVER (13). Allows the motor to tilt when hitting an underwater obstruction.

IDENTIFICATION PLATE (14), Contains model and serial number.

STEERING HANDLE AND THROTTLE CONTROL (15).

Controls steering and speed.

STOP (SHORTING) BUTTON (16). Stops motor.

CHOKE (17). Adjusts butterfly valve of carburetor for cold weather starts.

WATER PUMP INDICATOR (18). Provides visual evidence of water pump function.

STARTER HANDLE (19). Provides handle for starter pull cord.

TRANSOM WEDGE (20). Prevents clamp screws from damaging the transom.

FUEL CONNECTOR (21). Connection for fuel tank.

SAFETY CHAIN LUG (22). Connection for safety chain.

IDLE SPEED ADJUSTING SCREW (23). Adjusts idle speed.

ANGLE ADJUSTMENT ROD RETAINER (24). Prevents adjustment rod slipping out of holes.

PROPELLER (25). Transfers engine power to water.

EXHAUST OUTLET (26). Exit point for engine exhaust.

ANTI-VENTILATION PLATE (27). Prevents air pockets around propeller.

WATER DISCHARGE (28). Outlet for cooling water.

LOCKING LEVER-COVER (29). Locks engine cover in place.

TILT GRIP (30). Handle to tilt motor.

FUEL TANK (31). Contains fuel for motor.

PRIMING BULB (32). Primes fuel lines and carburetor.

FILLER CAP (33). Pressure cap to secure fuel tank.

HANDLE(34). Carrying handle for fuel tank.

FUEL LINE (35). Carries fuel from tank to engine.

FUEL GAGE (36). Indicates quantity of fuel left in tank.

DRAIN SCREW (37). Used to drain fuel tank.

MOTOR COVER (38). Prevents access to moving parts; covers and protects engine.

1-9. PERFORMANCE DATA.

A. POWERHEAD (ENGINE)

Powerhead	Two cylinder - two cycle, alternate firing, water-cooled
Full throttle operating range	4000 to 5000 RPM
Bore and stroke	80.96 x 69.85 mm (3.190" x 2.750")
Piston displacement	719.39 cc (43.90 cu in)
Horsepower	40 (28.3 kw @ 4500 RPM)
Starter	Manual - Self-winding
Speed control	On steering handle - Manual start. Synchronized throttle and spark

B. FUEL SYSTEM

Carubretion	Single barrel, float feed, fixed high speed/adjustable low-speed, manual choke
Float-level setting	Flush with rim of casting
Inlet needle seat	1.65-1.57 mm (.065-.062") (Use No. 52 drill as gage)
Fuel tank capacity	22.7 litre (6 gallon) tank

C. IGNITION SYSTEM

Ignition	Low tension magneto
Breaker point gap	0.50 mm (0.020")
Spark plug	Champion RL-82
Spark plug gap	0.76 mm (0.030")
Spark plug torque	24 to 27 N-m (17-1/2 to 20-1/2 lb ft).
Spark plug wrench size	21 mm (13/16")
Driver coil	1.45 ± 0.4 OHM
Condenser	Part No. 581419
Capacity	0.25-0.29 Mfd.
Ignition coil	Part No. 581786

D. LOWER UNIT

Gear shift	Forward-Neutral-Reverse
Gear ratio	0.57 (12:21)
Propeller	3 Blade, 27.3 cm (10-3/4") Dia x 27.9 cm (11") Pitch
Propeller nut socket size	20.64 mm (13/16")
Cooling system	combination positive displacement and centrifugal pump

1-10. MAINTENANCE DATE.

Transom Height	495 to 521 mm (19-1/2 to 20-1/2")
Weight (without fuel tank)	61.3 kg (141 lbs)
Fuel tank - empty	5.0 kg (11 lbs)
Fuel Tank - Full	47 lb (21.3 kg)

1-11. REPAIR AND REPLACEMENT STANDARDS.
Table 1-1 lists the manufacturer's sizes and tolerances.

Table 1-1. Repair and Replacement Standards

POWERHEAD	
Piston ring gap	0.007 - 0.017 in. (0.18 - 0.43 mm)
Piston ring groove clearance, lower	0.001 - 0.004 in. (0.038- 0.102 mm)
Piston pin to piston - loose end	0.001 in. (0.025 mm)
Cylinder and piston	0.0005 - 0.0030 in. (0.013 - 0.076 mm)
Crankshaft end play	0.0011 - 0.0030 in. (0.028- 0.76 mm)

LOWER UNIT	
Propeller shaft in front gear bushing	0.001 - 0.002 in. (0.025 - 0.050 mm)
Rear reverse gear to rear bushing	0.0005 - 0.002 in. (0.013 - 0.050 mm)
Reverse gear bushing to propeller shaft	0.0005 - 0.0010 in. (0.013 - 0.038 mm)
Propeller on shaft at drive pin hole	0.0007 - 0.0030 in. (0.018 - 0.076 mm)
Propeller on shaft - above the shoulder	0.0007 - 0.0034 in. (0.017 - 0.086 mm)

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-12. SECTION OVERVIEW. this section contains a description of how the outboard motor works. Paragraph 1-13 describes the operation of the components. Paragraph 1-14 describes the unit as a whole.

1-13. OUTBOARD MOTOR FUNCTION.

A. POWERHEAD. The engine component of the unit. Provides 40 horsepower to drive the propeller. The sequences (views) below give a brief description of engine operation.

View A shows the fuel intake and gas exhaust stage which occurs immediately after firing. Note that the exhaust and intake ports have been uncovered by the piston. Gas vapors resulting from the explosion are exiting through the exhaust port. At the same time a fuel-air mixture in the crankcase is being compressed and forced upward through the intake port, expelling any remaining gas vapor through the exhaust port. At this point the leaf valve is closed. The leaf valve controls the direction of flow of the fuel-air mixture from the carburetor into the crankcase cavity.

As the piston starts its upward or compression stroke, a partial vacuum is created in the crankcase and atmospheric pressure forces the leaf valve open, allowing the next combustible charge to enter the crankcase cavity. By this time the piston has compressed the intake mixture against the cylinder head preparatory to firing.

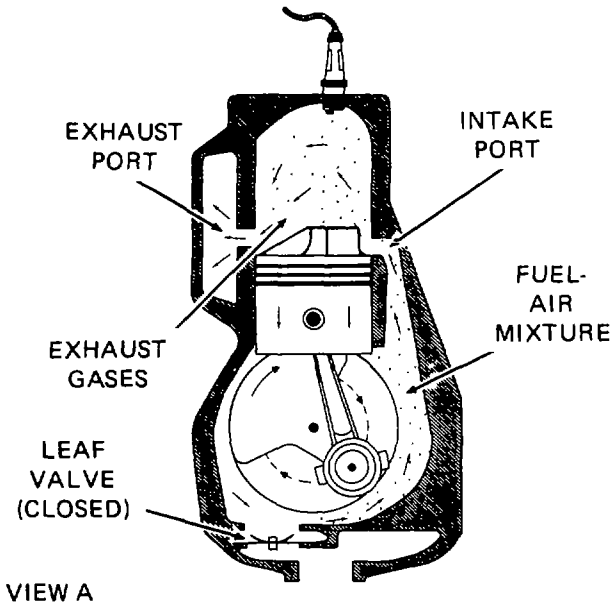


Figure 1-3. View A

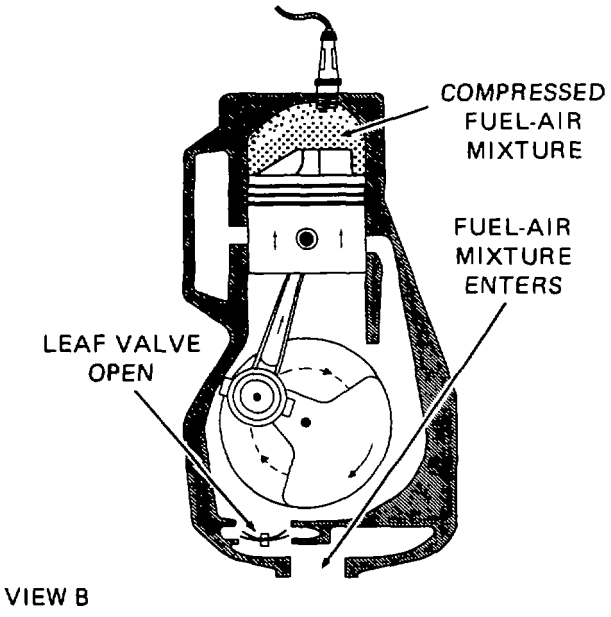


Figure 1-4. View B

The compressed air-fuel mixture ... now highly combustible ... is ignited by the spark plug when a timed electric current jumps the gap between its electrodes. View C illustrates the downward or power stroke of the piston under the force of the explosion. As the piston ... in its downward travel ... uncovers the exhaust and intake ports, the intake and exhaust stage shown in View A again occurs. With an outboard motor engine running at full throttle this cycle may be repeated more than 4500 times per minute.

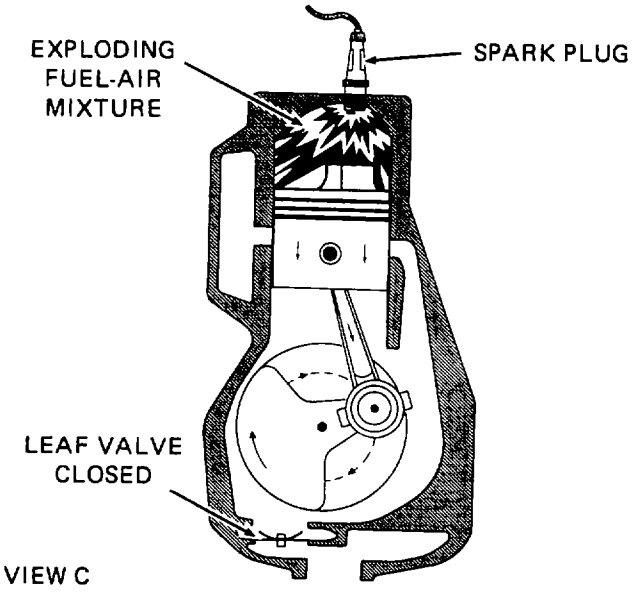


Figure 1-5. View C

B. FUEL SYSTEM. The function of the fuel system is to store, supply, filter and mix gasoline (and lubricant) with air for combustion in the cylinders. The fuel system is composed of the fuel tank, the fuel pump, the carburetor, the leaf plate assembly, and the lines, hoses, and connectors that carry fuel from component to component.

1. The carburetor is a single-barrel, float feed type with a manual choke, fixed high speed jet, and an adjustable slow speed needle valve. The throttle valve is synchronized with the ignition system by a throttle control cam located on the armature plate and the cam follower located on the carburetor body. The cam follower is linked to the throttle valve shaft.

The carburetor mixes fuel and air in proportions determined by engine speed requirements. Fuel is held in a small, bowl-like chamber. A cork float operates the inlet valve which allows fuel to be replaced as it is consumed.

Piston movement creates alternating conditions of pressure and partial vacuum in the crankcase. Atmospheric pressure trying to fill the partial vacuum creates a flow of air through the carburetor throat or barrel. A narrowing in the carburetor throat called the venturi causes the air passing through to speed up. Because the speed of the air moving through the venturi is increased, the air pressure in the venturi is reduced.

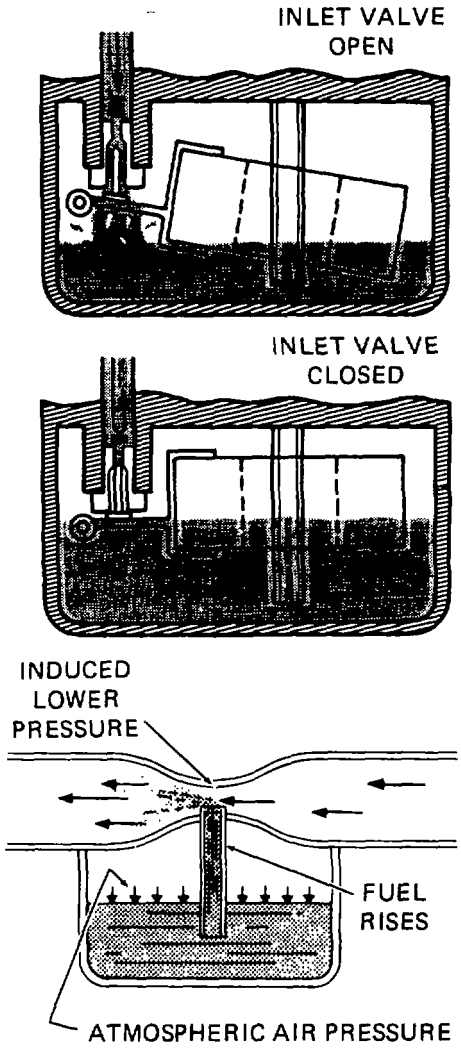


Figure 1-6. Carburetor (1 of 2)

The difference in air pressure over the high speed nozzle and atmospheric pressure in the float chamber, causes the fuel to be pushed up the high speed nozzle and into the air stream in the throat of the carburetor.

The throttle and choke valves work together to control the amount of fuel-air mixture fed to the crankcase and the ratio of fuel to air. The choke valve is used to control the ratio of air to fuel by controlling the air intake. The throttle valve controls the amount of fuel fed to the crankcase.

The fixed high speed jet insures an even flow of fuel up the high speed nozzle. The fuel must pass through the high speed jet before it rises up the high speed nozzle.

The high speed jet is fixed and needs no adjustment in its orifice. The slow speed needle valve is adjustable.

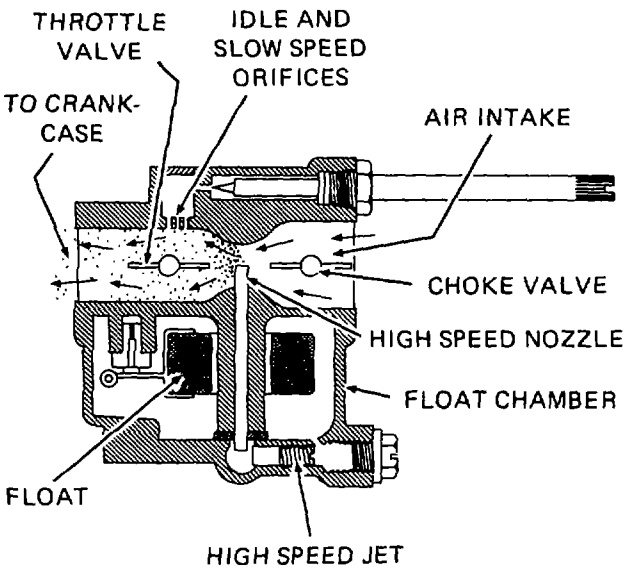


Figure 1-6. Carburetor (2 of 2)

The slow speed needle valve operates when the engine is at idle and slow speeds. The throttle valve is closed and reduces the air flow into the carburetor. This cuts off the flow of fuel from the high speed nozzle. An adjustable flow of fuel is allowed to enter the slow speed reservoir, mix with a small amount of air, and go to the crankcase.

2. There are two leaf valves on the unit, one for each piston and crankcase compartment.

As piston movement creates alternating conditions of pressure and partial vacuum in each compartment, the leaf valves open and close. They open when there is partial vacuum in a crankcase compartment, and close when there is back pressure. This allows the fuel-air mixture to enter the crankcase and prevents it from backing out into the carburetor throat.

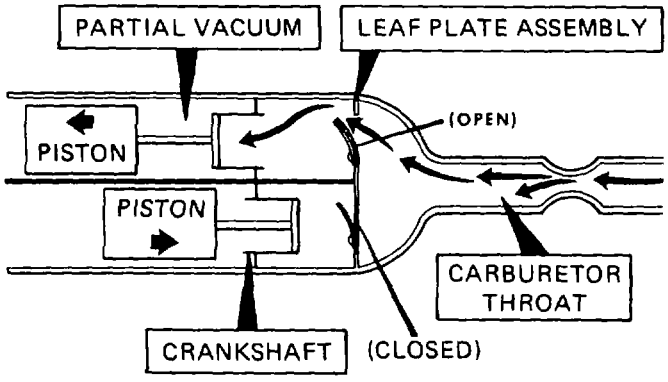


Figure 1-7. Leaf valves

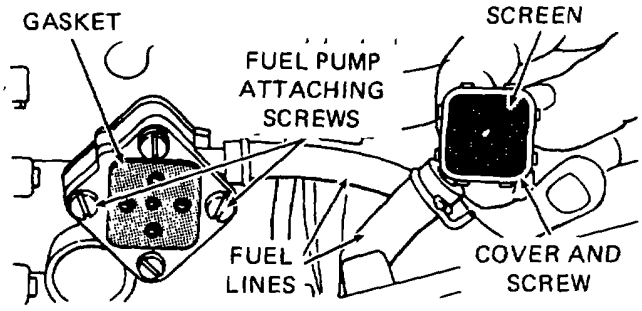
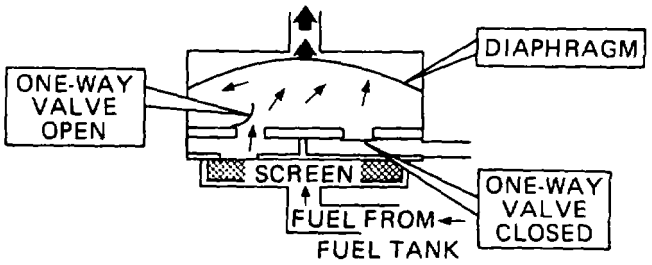


Figure 1-8. Fuel pump

3. The diaphragm operated fuel pump is mounted directly over a port in the crankcase. The pressure and partial vacuum conditions created in the upper crankcase act on the diaphragm, causing it to move back and forth. This back and forth motion is the pumping action.

Two one-way valves in the pump control the direction of fuel flow so that it moves only toward the carburetor.

PARTIAL VACUUM IN POWERHEAD



PRESSURE IN POWERHEAD

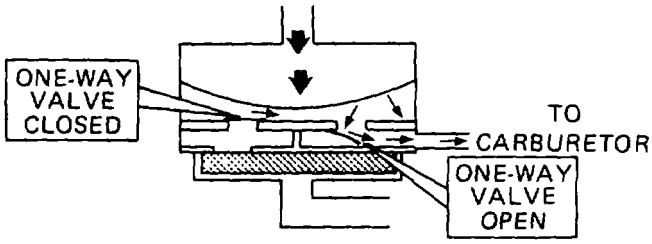


Figure 1-9. Operation of fuel pump

4. The fuel tank has a capacity of six gallons and is portable. Attached to the tank is a bulb primer for priming the fuel pump, fuel hose and connector, a bracket arrangement to hold the fuel line when it is not in use, a handle, and a vent assembly in the filler cap. It also has a gage to show amount of fuel in the tank.

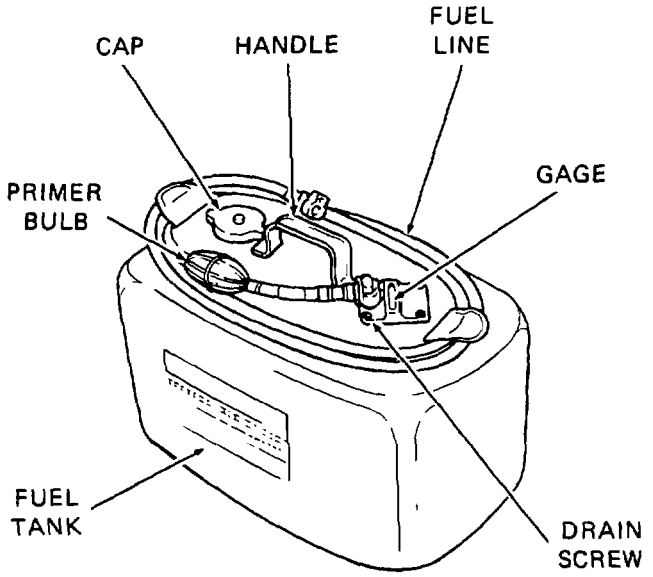


Figure 1-10. Fuel tank

C. IGNITION SYSTEM. The ignition system provides the spark needed to ignite the air/ fuel mixture in the cylinders. It is a capacitor discharge system which means the charge of electricity is generated by magnets in the flywheel rotating past the charge coil. The initial electrical charge is generated by the operator using the manual starter.

1. The magnets have North and South magnetic poles and the charge coil laminations have three legs. Each time one of the magnetic poles passes one of the legs of the charge coil, the laminations become magnetized. When the opposite pole of the magnet passes the same leg, the magnetism in the laminator collapses and reverses polarity. As you can see from diagram A, the magnets keep on rotating past all three legs of the ignition coil. Therefore, this changing magnetism in the coil laminations reverses three times in one pass of a magnet.

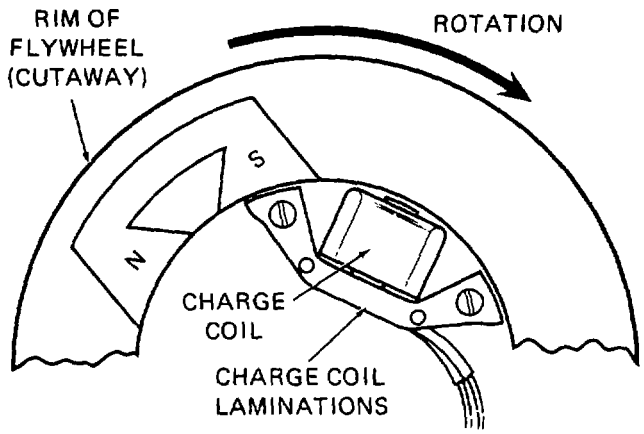


Figure 1-11. Diagram A

The coil of insulated wire wound around the middle leg of the laminations is affected by this fluctuating magnetism. This results in an electric current being set up in the coil.

Because the magnetism is alternating between North and South polarity, the current is also alternating between positive and negative. Diagram B illustrates the alternating current (AC).

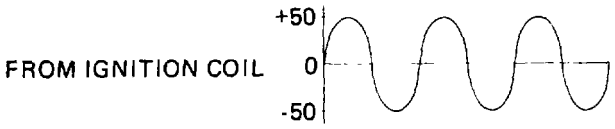


Figure 1-12. Diagram B

This coil current is routed through wires into the power pack where it will be stored temporarily in a capacitor. A capacitor, however, will not store alternating current. Inside the power pack is a diode which is an electronic device that allows current to flow in only one direction. In other words, it only allows the positive current to pass. Diagram C illustrates what happens when the AC is passed through a diode. Only the positive portion of the current remains. The capacitor will accept this.

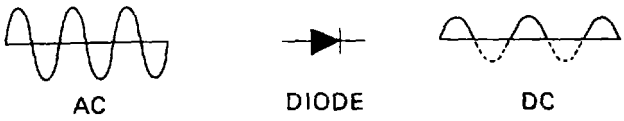


Figure 1-13. Diagram C

The capacitor in the power pack will hold this charge until it's released. Here's how that takes place:

The trigger coil is located on the armature plate opposite the charge coil. (Diagram D) It has only one point of close proximity to the spinning magnets (the charge coil had three). When a magnet passes this coil, an electric current is generated but not repeated three times as with the charge coil. This current or "trigger pulse" is also routed by wires to the power pack.

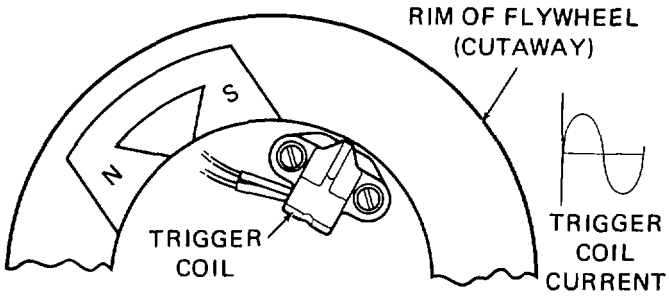


Figure 1-14. Diagram D

Another electronic device inside the power pack, called an SCR, receives the trigger pulse. (Diagram E) An SCR is an electronic switch. When the trigger pulse is applied to its "gate," the SCR allows the charge, which has been stored in the capacitor, to pass out of the power pack.

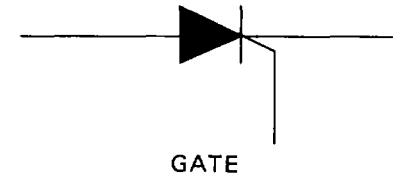


Figure 1-15. Diagram E

Once the SCR has been "turned on," the capacitor releases its charge very rapidly. This charge-discharge process can be compared to that of a spring. A spring may be compressed slowly, but when released, its energy is expended almost instantly.

The burst of electrical energy from the capacitor is routed through wires from the power pack to an ignition coil.

Ignition coils are a form of electrical transformer. (See Diagram F) They consist of a primary winding and a secondary winding encapsulated around an iron-laminated core. The primary winding consists of a few turns of heavy gage wire and the secondary winding has many turns of fine gage wire.

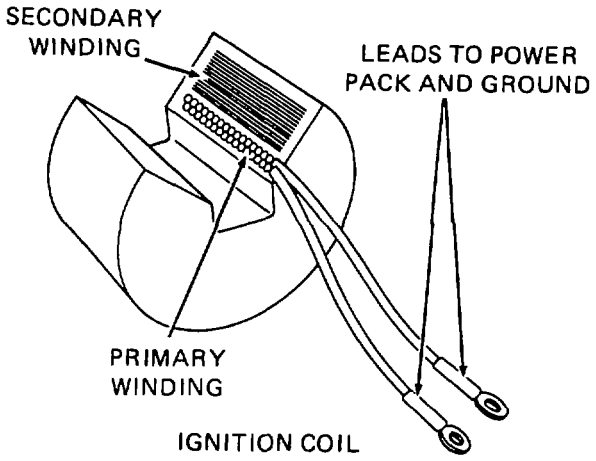


Figure 1-16. Diagram F

The capacitor charge flows through the primary winding and sets up a magnetic field in the core of the ignition coil. When the charge has dissipated, the magnetic field in the core breaks down. As it does so, the magnetic field passes through the secondary windings setting up a current in them. Since the secondary coil has many turns of wire for the field to pass through, the voltage established is very high.

The high tension lead from the ignition coil carries this high voltage current to the spark plug where it jumps the spark gap and ignites the fuel/air mixture in the cylinder.

Since this 40-horsepower outboard has two cylinders, it must have two spark plugs and also has two ignition coils. The charge for the capacitor must be routed to the proper coil at the proper time. This timing decision is made by magnetic polarity.

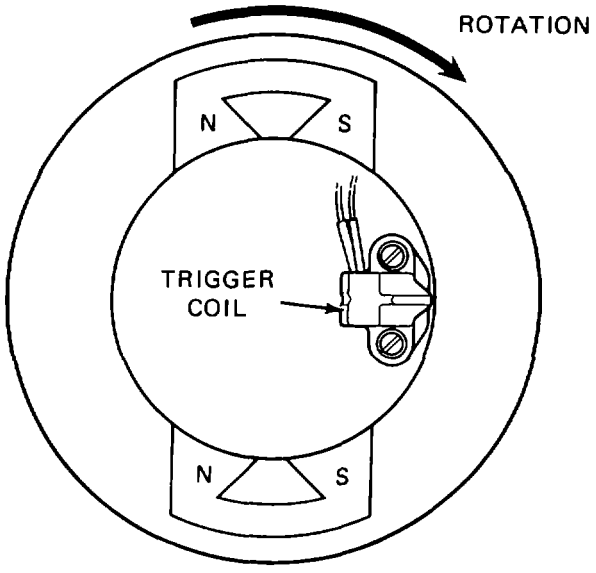


Figure 1-17. Diagram G

Notice in Diagram G that the two flywheel magnets are mounted into the rim of the flywheel with their magnetic polarity reversed from each other. As the flywheel spins past the trigger coil, the S-pole of one magnet passes the coil first and the N-pole of the other magnet passes first. The result of this polarity difference is that the electrical pulse generated in the trigger coil is positive in one instance and negative in the other. Inside the power pack of this 2-cylinder engine, there are two SCR's. Each is connected to a different ignition coil. The SCR's are set up so that one of them triggers on a positive pulse and the other on a negative pulse. In this way, the two spark plugs are alternately fired to provide proper engine timing.

2. The sparkplug must satisfy two engine requirements. It must hold cylinder compressions ... and it must provide a spark of sufficient intensity to insure full explosion of the combustible fuel-air mixture compressed in the cylinder by piston action.

The first requirement is fulfilled only when the threaded reach of the spark plug is fully tightened in the cylinder head. The degree of tightening is determined by the amount of torque specified by the manufacturer. A gasket is also employed to insure correct plug setting. A loosely installed spark plug will overheat and eventually become badly burned. Insufficient spark plug torque is responsible for a large number of engine troubles.

Fulfillment of the second requirement, fuel mixture ignition, is accomplished only when the correct spark plug is in satisfactory operating condition. Spark intensity is affected by fouled or burned electrode tips, cracked insulator porcelain, and by faulty high tension lead connection. Spark intensity can also be reduced by faulty operation of other component parts in the ignition system.

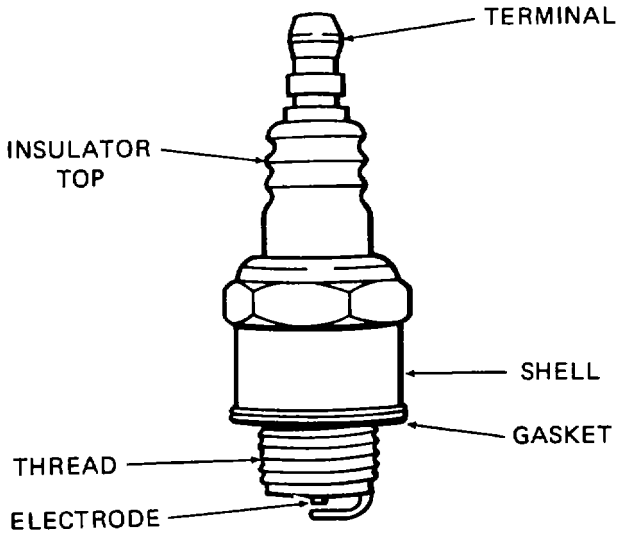


Figure 1-18. Spark plug

3. The manualstarter engages the power head flywheel ratchet with three pawls when the starter rope handle is pulled. A coil spring is wound as the rope unwinds and unwinds as the handle is returned to the starter housing.

This starter has a high speed interlock which prevents the starter from operating if the throttle is in the "FAST" position.

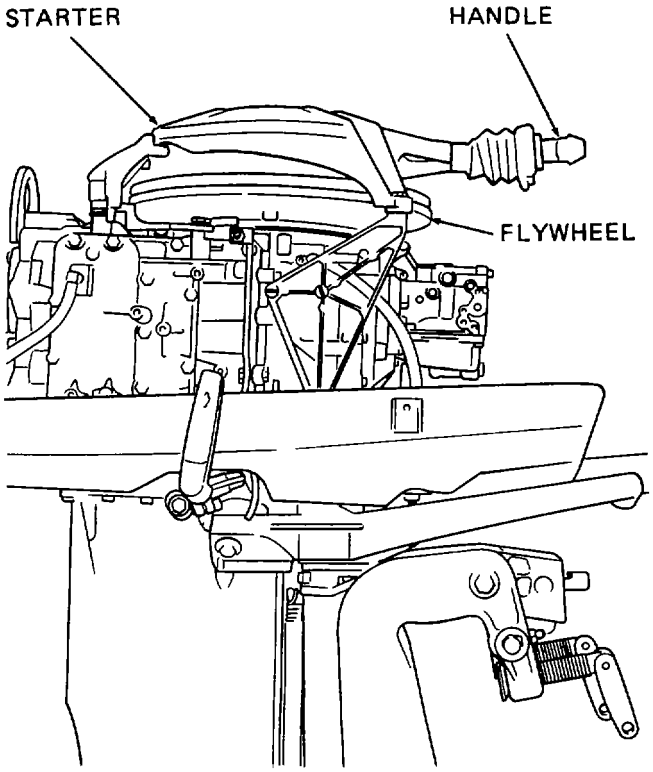


Figure 1-19. View of rewind starter

D. LOWER UNIT. Includes the exhaust housing and gear case. The exhaust housing is basically an extension of the powerhead to the water. It contains the shift lever, upper shift rod, drive shaft, and channels for the exhaust and cooling system. The gear case transfers the power from the drive shaft and powerhead to the propeller. It transfers this power by engaging two level gears, forward or reverse, located on the propeller shaft. The gear case also contains the cooling water inlet and the cooling water pump.

The reciprocating power of the pistons is changed to rotary power by the crankshaft. The crankshaft turns the drive shaft by means of a splined coupling. The drive shaft extends through the lower unit to the gear case where a pinion gear fits on the splined end of the shaft. The pinion gear meshes with two bevel gears which rotate freely and in opposite directions on the propeller shaft. A shifter clutch dog is placed between the two bevel gears and is splined to the propeller shaft. The shifter clutch dog is shifted by the shifter lever fingers, which in turn are operated by the manual shift lever through the action of the shifter rod.

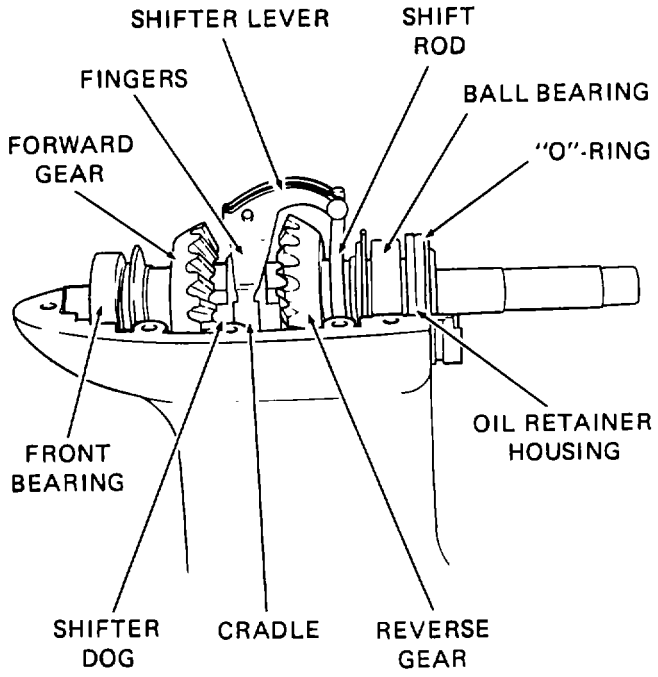


Figure 1-20. Forward and reverse gears

When the shift rod is in the neutral position, the clutch dog is centered between the two bevel gears and is not engaged with either one. Consequently, the propeller shaft remains motionless. When the shift rod is in the forward position, the clutch dog is moved on its splines by the shifter lever into engagement with the forward bevel gear and the propeller shaft is driven clockwise. When the shift rod is in the reverse position, the clutch dog is moved into engagement with the reverse gear and the propeller shaft is driven in a counterclockwise direction.

The water pump consists of an impeller housing, an impeller, an impeller plate and a bearing housing. The impeller is keyed to the driveshaft which passes completely through the water pump. As the driveshaft turns, so does the impeller.

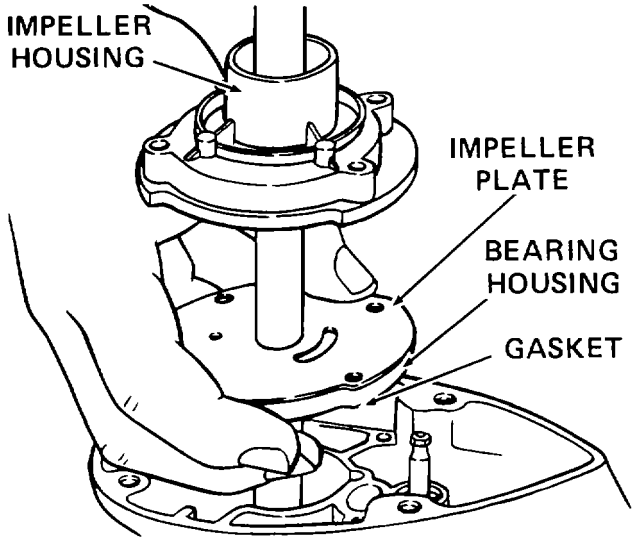


Figure 1-21. Water pump

The impeller housing is offset. This design feature causes the synthetic rubber blades of the impeller to flex as they rotate, with the result that the space between the blades varies. The pump inlet port, in the impeller plate, is open to the impeller blades when the space between them increases. The pump outlet port, located in the impeller housing, is open to the blades when the space between them is decreasing. Consequently, at low engine RPM the impeller functions as a displacement pump by drawing water in and then pushing it up the water tube and through the cooling system channels in the cylinder block. At high engine RPM water resistance prevents the blades from touching the side of the housing and the impeller works as a centrifugal pump.

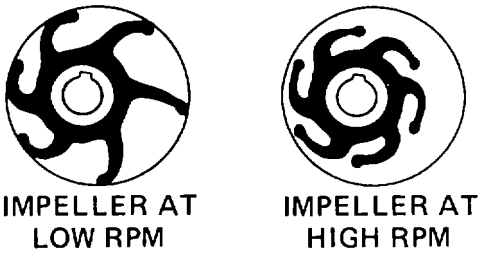


Figure 1-22. Water pump impeller

1-14. OPERATION OF THE UNIT.

The flywheel is rotated initially by pulling the rope on the manual starter. This action brings the pinion gear on the starter into engagement with the ring gear on the flywheel and turns the flywheel. After the engine has started, the pinion gear falls out of mesh with the ring gear.

As the flywheel is turned by the starter, one of the pistons moves upward in its compression stroke. This creates a partial vacuum in the crankcase that is lower than the air pressure in the carburetor throat. Under greater pressure, the leaf valve opens, allowing the next fuel-air charge to enter the crankcase.

As the flywheel spins, the magnets mounted in it spin by in close proximity to the charge coil and trigger coil. A large voltage is established in the charge coil and stored in the condensers until it is released by a pulse from the trigger coil. The ignition coils transform this stored charge into a very high voltage which is routed to the spark plugs where it jumps the spark plug gap and ignites the fuel air mixture.

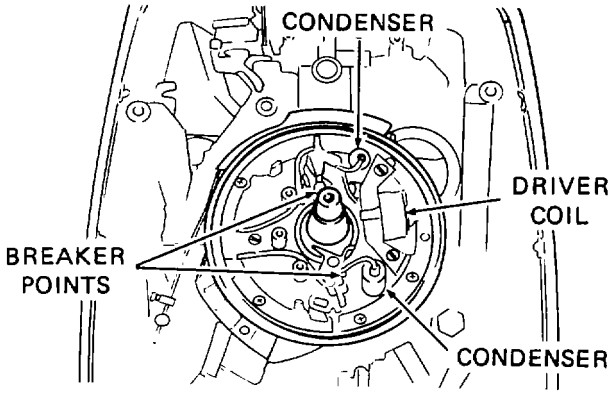


Figure 1-23. Ignition arrangement

NOTE
Figures 1-24, 1-26 illustrate a typical power stroke (one cylinder).

The spark ignites the combustible fuel-air mixture compressed under the cylinder head and the resulting explosive force drives the piston downward. Now internal crankcase pressure is greater than carburetor pressure and the leaf valve is pushed closed.

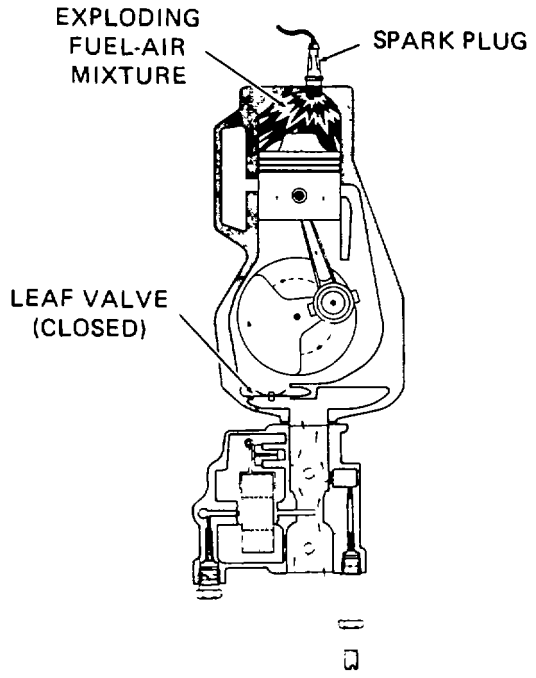


Figure 1-24. Power stroke

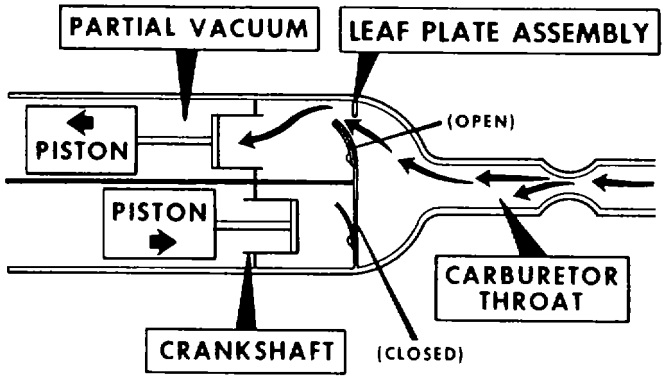


Figure 1-25. Leaf plate operation

As the piston clears the intake and exhaust ports, cast-in deflectors on the piston head route the next charge from the intake port and guide gases, resulting from the explosion, through the exhaust port. Exhaust gases exit through channels in the lower unit and gearcase. By this time the other piston has completed its compression stroke and the second cylinder is fired.

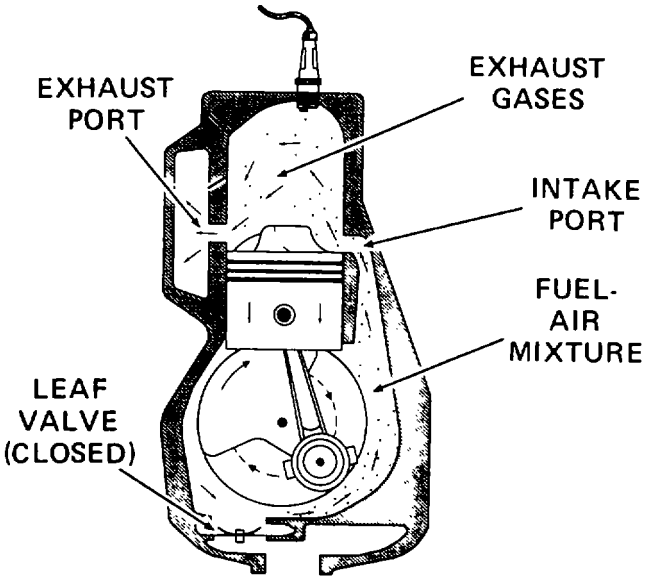


Figure 1-26. Routing of exhaust gases

This cycling is repeated over and over again as long as the engine is running. At full throttle the sequential firing is so close together as to appear simultaneous.

During the engine start and warm-up the thermostatic valve in the cylinder head remains closed, preventing water displaced by the water pump from entering the cooling channels in the cylinder block. Instead, the water is routed through the by-pass channel and exits through the water outlet in the exhaust housing or the under water outlet in the gearcase. When the powerhead temperature gets too hot, the thermostatic valve opens and allows water to circulate through the cylinder block channels.

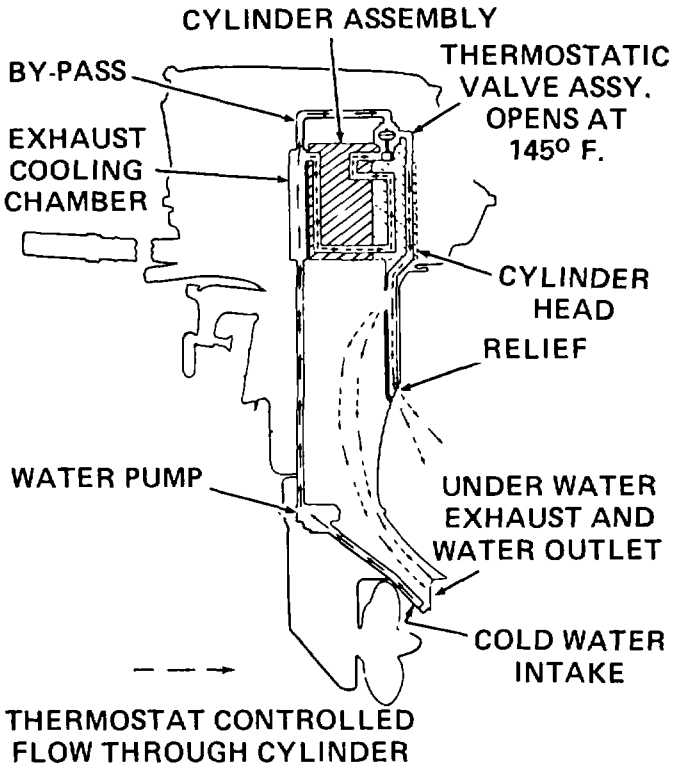


Figure 1-27. Cooling system

During the engine warm-up the shift lever is in the neutral position. The shifter clutch dog remains centered between the two bevel gears. The gears are constantly driven by the driveshaft pinion gear and rotate freely on the propeller shaft. When the shift lever is moved into the forward position, the fingers of the shifter lever move the clutch dog into engagement with the forward gear. When the shift lever is in the reverse position, the clutch dog is moved into engagement with the reverse gear.

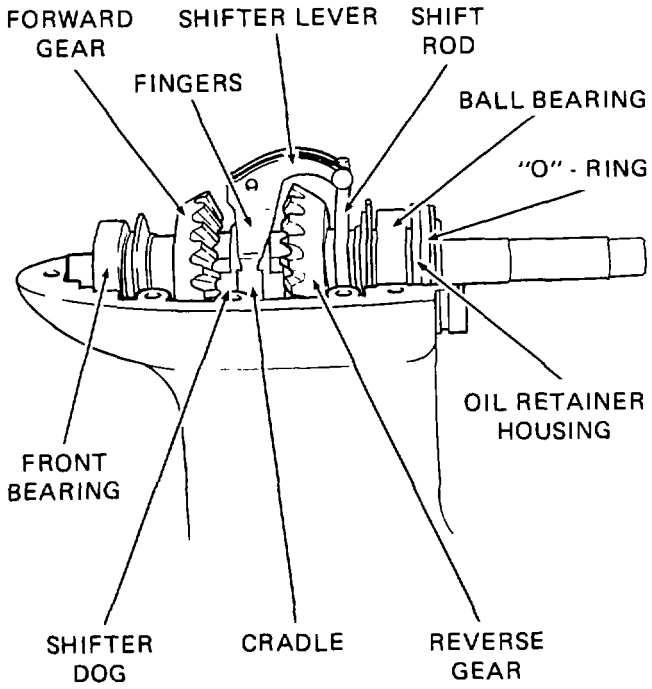


Figure 1-28. Gears arrangement

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. GENERAL. The following paragraphs will show you the controls and indicators you will need to operate the outboard motor.

Key	CONTROL OR INDICATOR	FUNCTION
1	Reverse lock	Releases when motor strikes underwater object.
2	Fuel connectors	Connect engine to fuel tank.
3	Primer bulb	Charges fuel lines.
4	Throttle grip	Used to control engine speed.
5	Shift lever	Allows operator to shift gears; reverse, neutral, forward.
6	Steering handle	Allows operator to swivel engine, to steer craft.
7	Choke knob	Pull OUT for cold weather starts.
8	Starter handle	Pull to start unit. (See Starting and Operation, para 2-6).
9	Water pump indicator	Flow of water from water pump indicator shows operator if water pump is functioning
10	Stop button	Stops engine
11	Cover locking lever	Locks lever in place
12	Tilt lock	Holds motor in position when loading or launching craft.

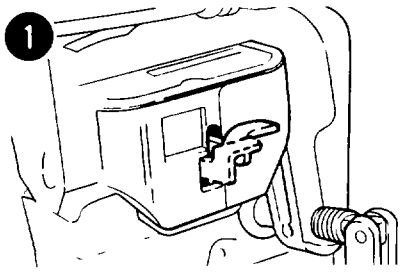


Figure 2-1. Reverse lock

Figure 2-1. Reverse lock

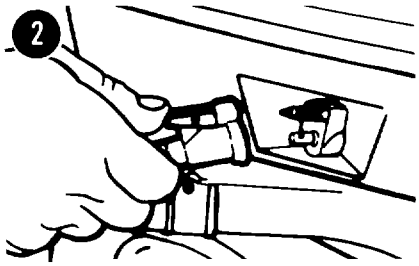


Figure 2-2. Fuel connectors

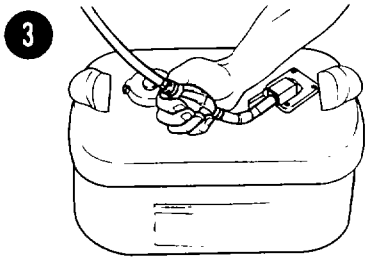


Figure 2-3. Primer bulb

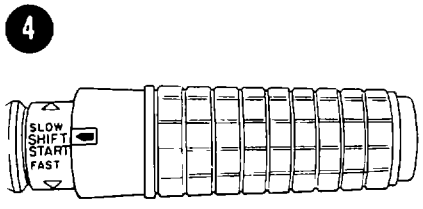


Figure 2-4. Throttle grip

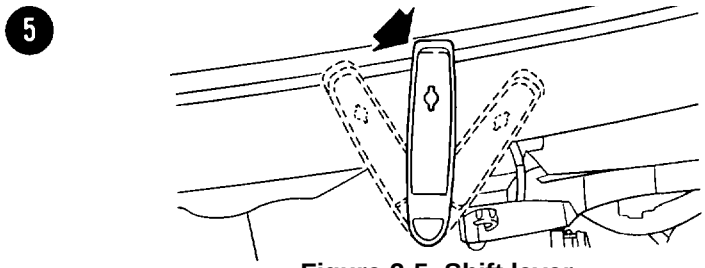


Figure 2-5. Shift lever

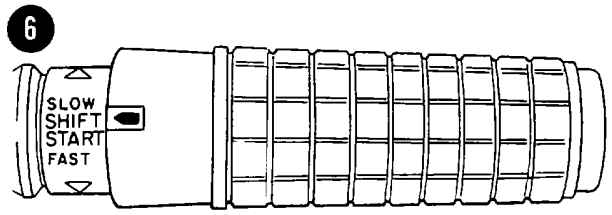


Figure 2-6. Steering handle

Figure 2-6. Steering handle

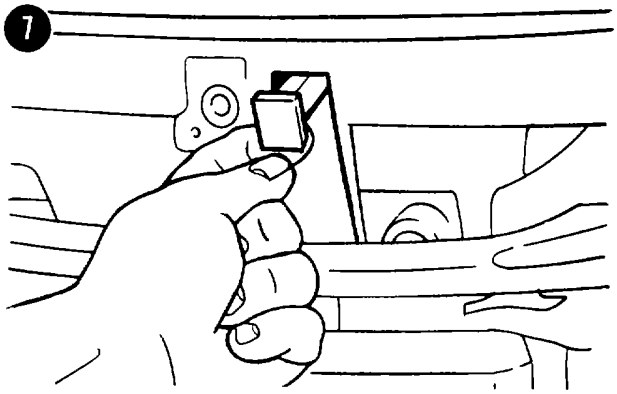


Figure 2-7. Choke knob

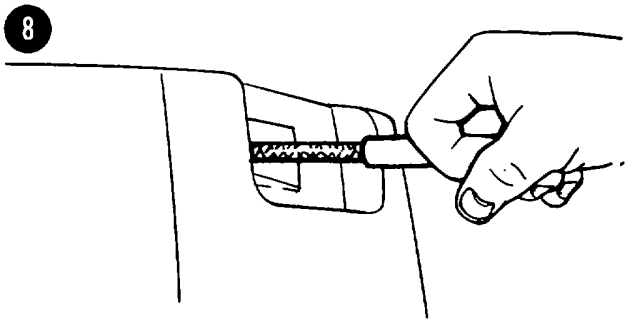


Figure 2-8. Starter handle

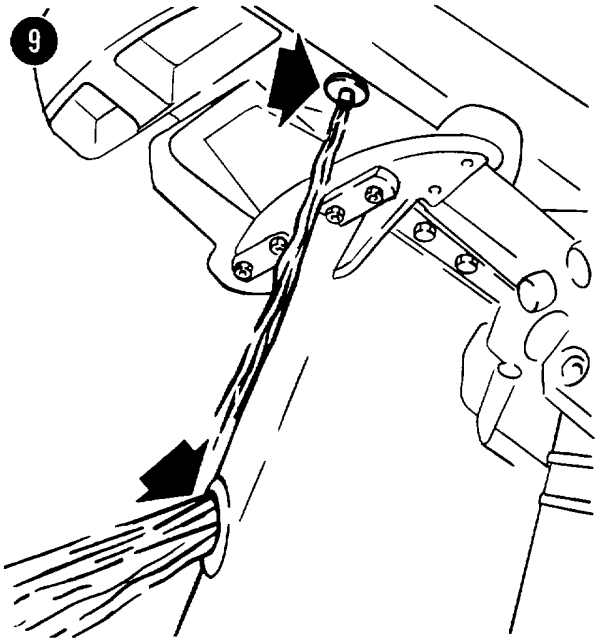


Figure 2-9. Water pump indicator

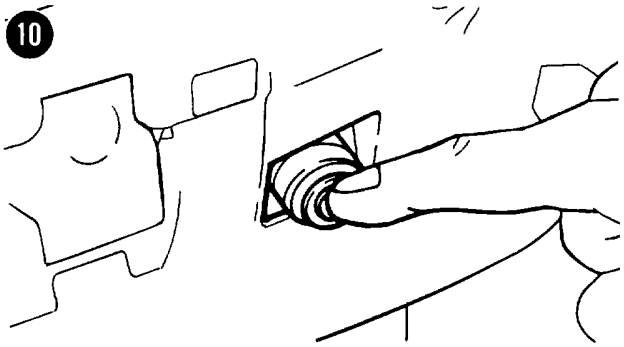


Figure 2-10. Stop button

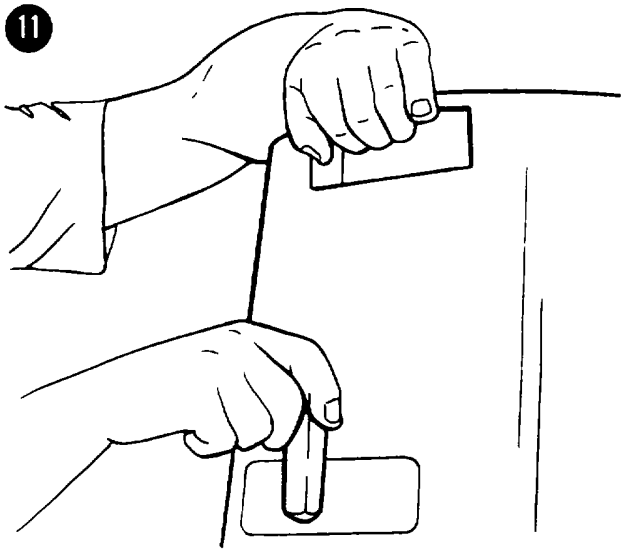


Figure 2-11. Cover locking lever

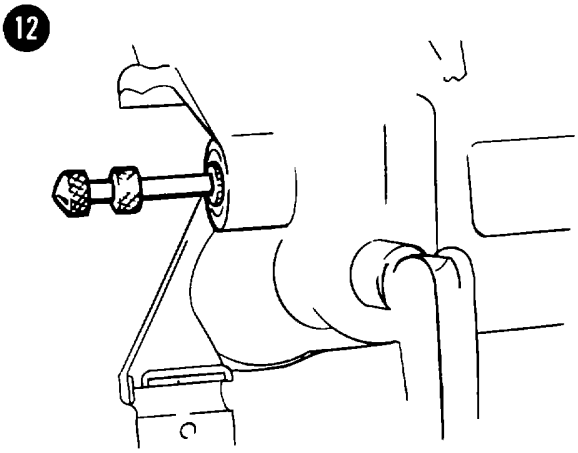


Figure 2-12. Tilt lock

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. GENERAL. To ensure that the outboard motor is ready for operation at all times, it must be inspected systematically so that the defects may be discovered and corrected before they result in serious damage or failure. Defects discovered during operation of the unit shall be noted for future corrections, to be made as soon as an operation has ceased. Stop operation which would damage the equipment if operation were to continue. All deficiencies and shortcomings shall be recorded together with the corrective action taken on DA Form 2404, Equipment Inspection and Maintenance Worksheet, at the earliest opportunity. When performing your Before Operation (B) and During Operation (D) PMCS, always keep in mind the CAUTIONS and WARNINGS. After operation, be sure to perform your (A) PMCS. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms, see TM 38750.

2-3. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES. Refer to table 2-1 for Preventive Maintenance Checks and Services.

A. Item Number Column. Checks and services are numbered in chronological order regardless of interval. This column will be used as a source of item numbers for the "TM Item Number" column on DA Form 2404 in recording results of PMCS.

B. Interval Column. The columns headed B, D, A, W and M, will contain a dot (•) opposite the appropriate check indicating it is to be performed Before, During, After, Weekly, or Monthly.

C. Item to be Inspected Column. The items listed in this column are divided into groups and identifies the items to be inspected.

D. Procedures Column. This column contains a brief description of the procedure by which the check is to be performed.

E. For Readiness Reporting, Equipment is Not Ready/Available If: Column. This column will contain the criteria which will cause the equipment to be classified as not Ready/Available because of inability to perform its primary mission.

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

Table 2-1. Preventive Maintenance Checks and Services

NOTE

Within designated interval, these checks are to be performed in the order listed.

B - Before **D - During** **A - After** **W - Weekly** **M - Monthly**

Item No.	Interval B	D	A	W	M	Item To Be Inspected	Procedures	Equipment Will Be Reported Not Ready/ Available If:
1	•					Cover assembly	Inspect for: cracks, misalined or torn gasket, faulty locking lever.	Cover is cracked. Gasket is torn. Locking lever is faulty.
2	•	•*				Manual starter	Check handle, rope.	Handle cannot be used, or rope is broken.
3	•					Fuel tank	Inspect tank assembly for: leaks, faulty hose, faulty primer bulb, fittings faulty fuel cap.	Tank leaks (ruptured). Hose leaks. Primer bulb faulty. Fuel cap faulty. Fittings leak.

* While starting outboard motor

Table 2-1. Preventive Maintenance Checks and Services - continued

NOTE

Within designated interval, these checks are to be performed in the order listed.

B - Before D - During A - After W - Weekly M - Monthly

Item No.	Interval B	D	A	W	M	Item To Be Inspected	Procedures	Equipment Will Be Reported Not Ready/ Available If:
4	•	•				Steering handle throttle	Check for steering handle function. Check that throttle grip rotates.	Steering handle movement is restricted. Throttle grip movement is restricted.
5	•					Stern bracket	Check for cracks or breaks.	Cracked or broken.
6	•					Screw clamp	Check for stripped threads or broken handles.	Threads are stripped. Handles are broken.
7		•				Shifter lever	Be certain shifter changes gears.	Shifter will not shift gears.
8		•				Water pump	Check to see if a steady stream of water is coming from the water pump indicator.	No water or irregular spurts of water from the water pump indicator.
9	•		•			Water inlet screen	Check for debris clogging screen.	Clogged screen, or missing screen.
10	•		•			Propeller	Check for cracks, breaks, or bent propeller.	Propeller is cracked, broken or bent.
11			•			Motor		Rinse with fresh water.
12			•			Motor		Wipe dry with oily rag.

Section III. OPERATION UNDER USUAL CONDITIONS

2-4. OPERATING PROCEDURE. The operator must know how to correctly operate this equipment. This section gives instructions on starting, operating, and stopping the outboard motor.

2-5. PREPARATION FOR STARTING. Perform the necessary Before Operation Preventive Maintenance Services as indicated in table 2-1.

2-6. INSTALLING AND ADJUSTING THE MOTOR.

WARNING

To prevent possible fuel leakage, disconnect port- able tank fuel line from motor when boat is trailered, docked or when motor is tilted for more than a few minutes.

NOTE

The transom height for this outboard motor must be 19-1/2" to 20-1/2" (495 mm to 521 mm).

A. Be certain transom wedge (20, fig. 1-1) has been installed on the transom of your boat.

WARNING

To ensure proper mounting and prevent side movement of the motor, the transom wedge must be installed on the transom of your boat.

B. Place motor on transom with stern brackets outboard and clamp screws inboard.

1. Use front and rear lifting and carrying handles to perform this step.

2. If a suitable hoist and lift are available, attach to lifting bracket at rear of powerhead and use to position motor on transom.

C. Center motor stern brackets in transom wedge and clamp screws in stern bracket clamp.

D. Tighten clamp screws.

E. Attach safety chains to eyebolts in transom, using clips on end of chains.

CAUTION

Clamp screws must be tightened ONLY by hand. Do not use tools of any kind to tighten clamp screws.

F. Retighten clamp screws after 15 minutes of operation.

2-7. ADJUSTING THE MOTOR ANGLE.

WARNING

The motor must be up-right to the water when boat is underway.

MOTOR ANGLE ADJUSTMENT

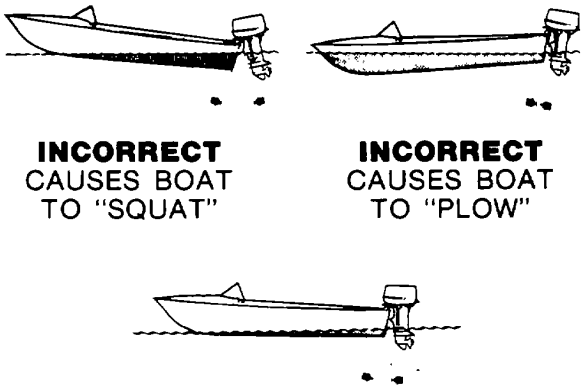


Figure 2-13. Motor angle adjustment

NOTE

The stern bracket has four positions for adjusting motor angle. The vertical angle of motor on boat must be adjusted for best performance.

A. Set reverse lock (1) in RELEASE position.

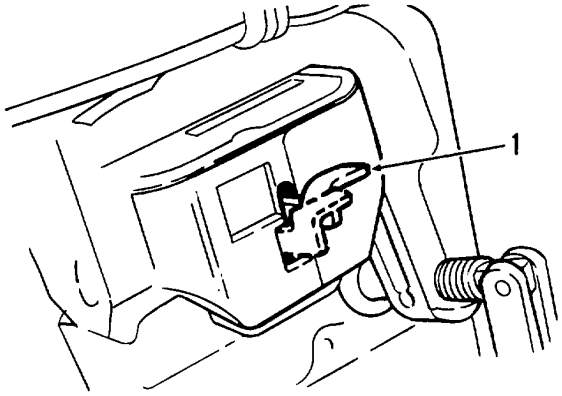


Figure 2-14. Reverse lock

B. Tilt motor up.

C. Turn tilt adjusting rod (2) up.

D. Press rod in against spring and turn retainer (3) to horizontal position.

E. Remove rod from stern brackets holes.

F. Tilt motor to the most nearly vertical angle.

G. Install tilt adjusting rod (2) in stern brackets holes and turn down.

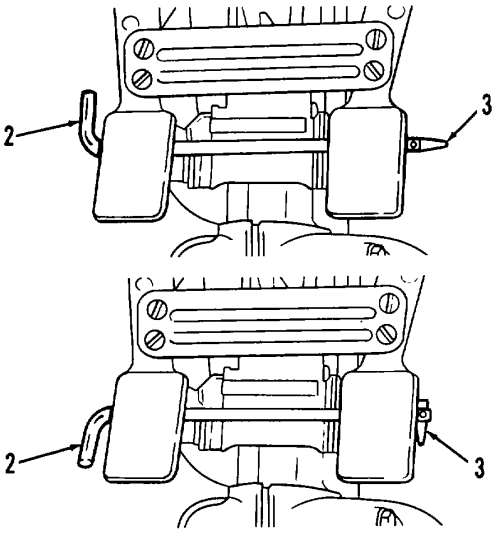


Figure 2-15. Tilt adjusting rod

H. Press tilt adjusting rod (2) against spring and lock retainer (3).

I. Put reverse lock (1) in LOCK position.

2-8. STARTING THE UNIT.

A. Place reverse lock in LOCK position.

CAUTION

During normal operation the reverse lock should be in LOCK (up) position. The RELEASE position (push lever down and to starboard) is used only when tilting the motor, or when operating in shallow or obstructed waters.

The reverse lock, when in LOCK position, will release when the motor strikes an underwater object while traveling forward at moderate speed.

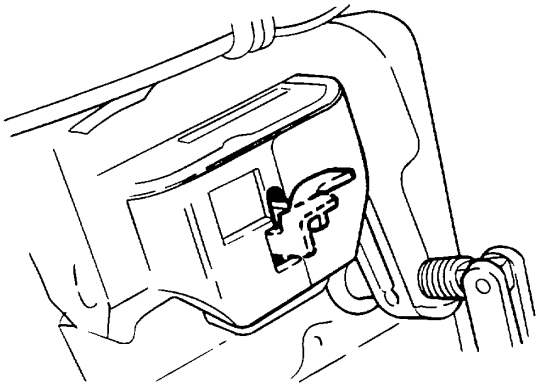


Figure 2-16. Reverse lock

B. Slide fuel line connectors into place, until locking lever snaps.

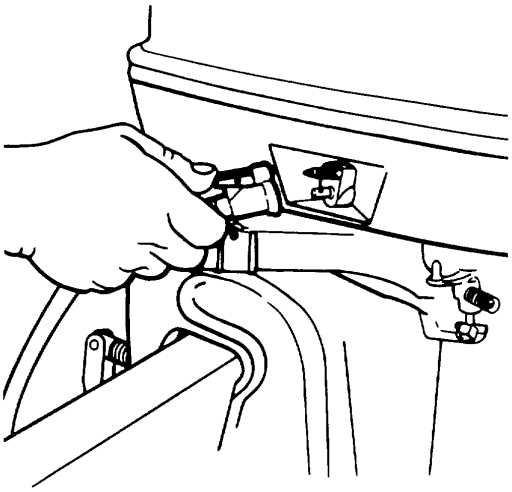


Figure 2-17. Fuel connectors

C. Squeeze fuel line primer bulb several times, until you feel resistance.

NOTE

Hold outlet end up while squeezing. Never hold outlet end down while priming the system.

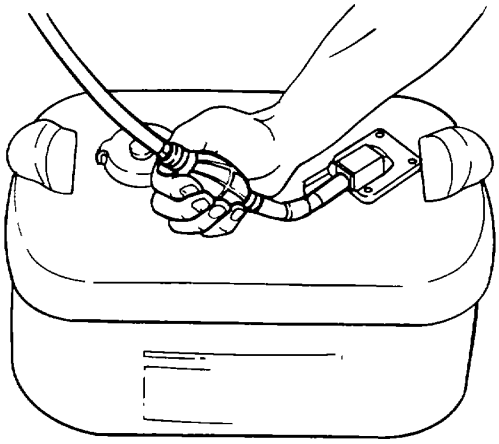


Figure 2-18. Primer bulb

D. Turn throttle grip to SHIFT position.

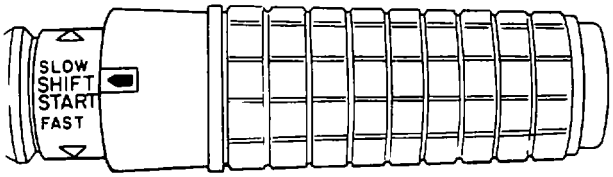


Figure 2-19. Throttle grip

E. Move shift lever to NEUTRAL position.

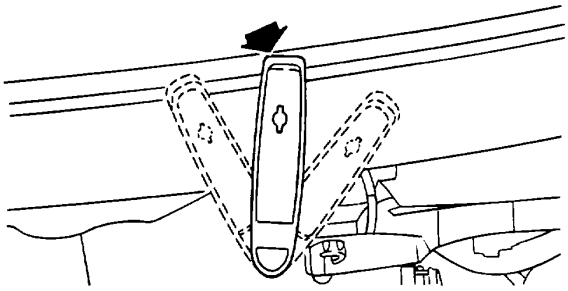


Figure 2-20. Shift lever

F. Turn throttle grip to START position.

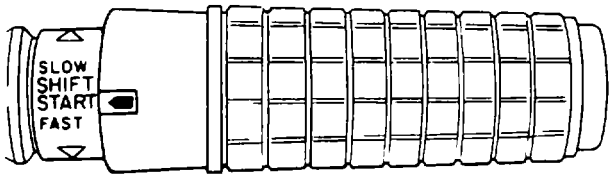


Figure 2-21. Throttle grip

G. Choke. Pull out if motor is cold. Leave in if motor is warm.

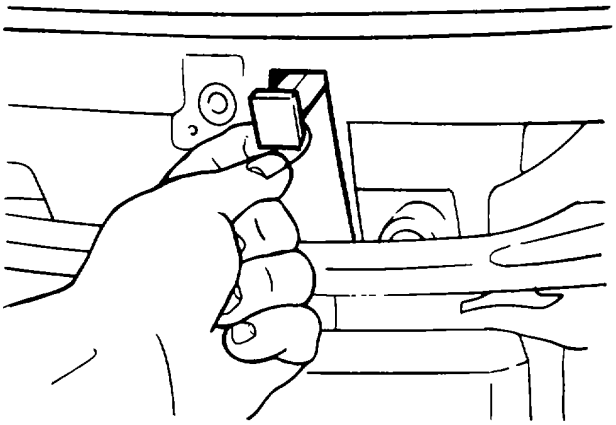


Figure 2-22. Choke

H. Starter handle.

Pull slowly until you feel starter engage. Then pull hard. Repeat until motor starts.

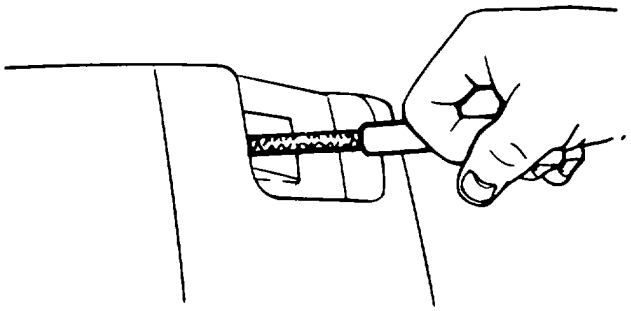


Figure 2-23. Starter handle

NOTE

To avoid damaging the starter, allow starter cord to rewind before releasing the handle.

NOTE

If motor fails to start see Operator Troubleshooting para 3-5.

I. Check to see if water is coming from the water pump indicator.

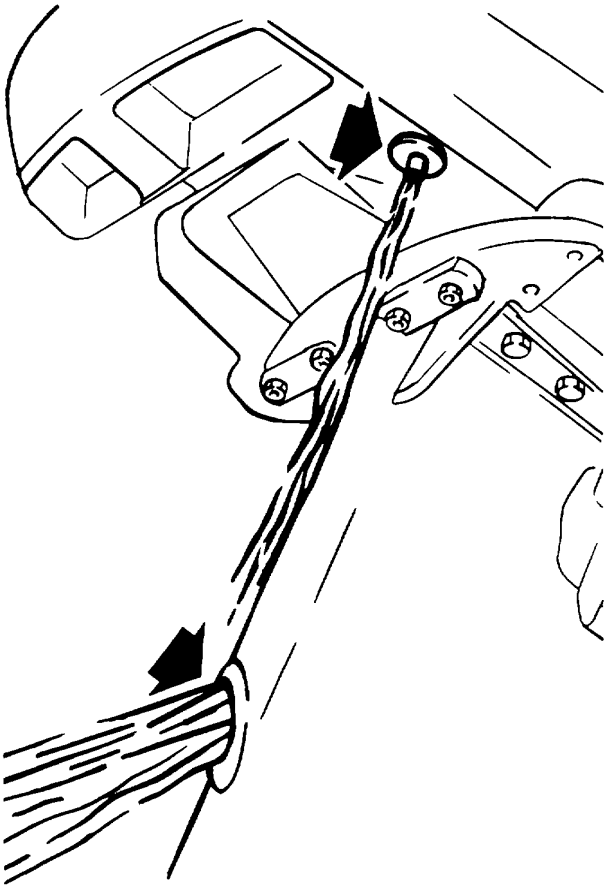


Figure 2-24. Water pump indicator

2-9. OPERATION.

WARNING

Do not remove the motor cover while engine is running. The motor cover is a machinery guard. Its removal exposes the operator to moving parts.

WARNING

For best boat, motor performance and safety of personnel, the boat should be driven as nearly parallel to the water as possible. Personnel and equipment should be so distributed in the boat that it is evenly balanced both front to rear and side to side.

CAUTION

Damage to the engine will result if the engine is run in excess of its rated speed even for a short time.

CAUTION

Damage to the engine will result if the engine is run without a propeller or without sufficient load on the propeller. Be sure propeller is completely immersed in water.

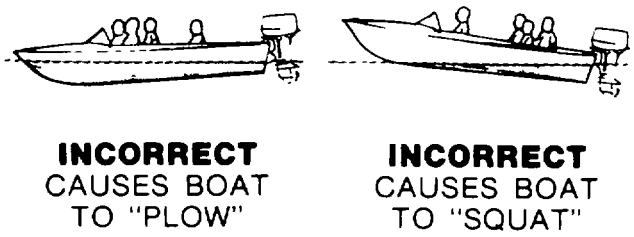


Figure 2-25. Load distribution

A. Perform starting steps A thru I para 2-8.

B. Turn throttle grip to SHIFT position.

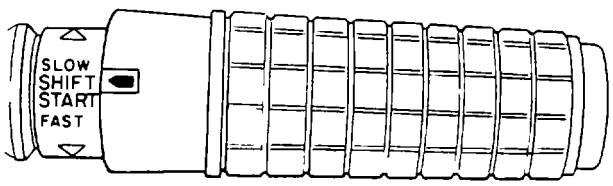


Figure 2-26. Throttle grip

CAUTION

Always place throttle in SHIFT position before shifting gears.

CAUTION

Never attempt to shift gears from neutral when motor is not running.

C. When motor is running and throttle grip is in SHIFT position, shift into desired position.

CAUTION

Always snap the shift lever into position with a quick action.

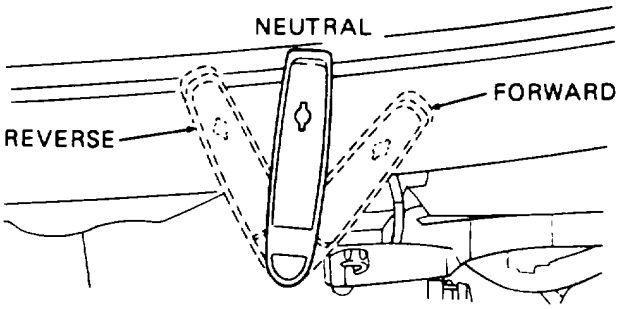


Figure 2-27. Shift lever

D. Turn throttle grip to FAST or SLOW position to select desired speed.

CAUTION

When operating in reverse, be very careful not to hit any underwater objects. The automatic tilt mechanism does not work in reverse.

CAUTION

Do not operate motor in reverse with reverse lock in RELEASE position. Motor may tilt into boat resulting in loss of control.

E. Perform your During Operation preventive checks (table 2-1).

2-10. STOPPING.

A. Turn throttle grip to reduce engine speed.

B. Place throttle in SHIFT position.

C. Put shift lever in NEUTRAL position.

D. Press STOP button until engine stops.

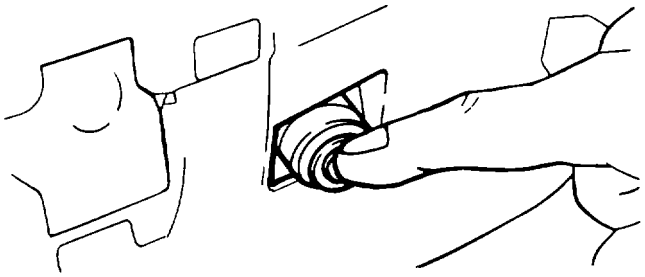


Figure 2-28. Stop button

2-11. REMOVING THE MOTOR.

A. Disconnect fuel line.

CAUTION
Always coil fuel line on top of tank when not in use. This will help protect fuel line and connectors from damage and help prevent sand or dirt from entering connectors.

B. Disconnect safety chain.

C. Loosen clamp screws.

D. Lift motor vertically from boat using lifting handles, or if hoist is available, fasten to lifting bracket and lift out.

E. Hold motor in an upright position to allow water to completely drain.

2-12. REMOVING THE MOTOR COVER.

A. Rotate locking lever (29, fig. 1-2) 1/4 turn UP.

B. Using tilt grip (30, fig. 1-2), tilt motor cover up.

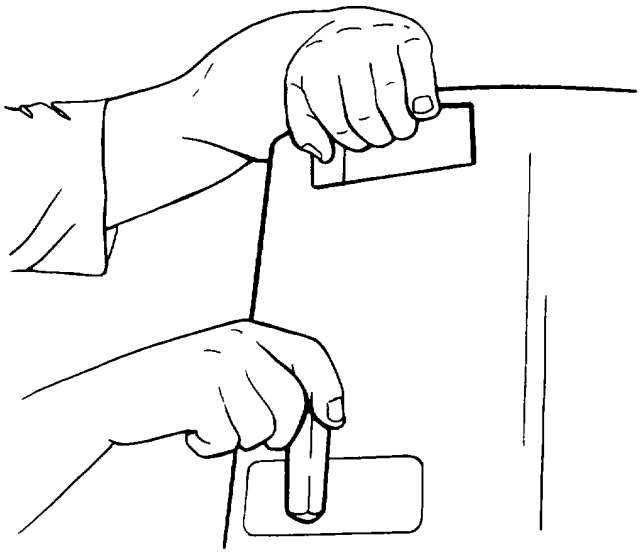


Figure 2-29. Motor cover locking lever

C. Slide motor cover back to disengage front hook from lower pan.

2-13. INSTALLING MOTOR COVER.

A. Slide motor cover hook into aperture in lower pan.

B. Press down on rear of cover (where tilt grip is).

C. Rotate locking lever 1/4 turn down until it engages catch in lower motor cover.

2-14. STEERING FRICTION ADJUSTMENT.

A. Locate steering friction adjustment screw.

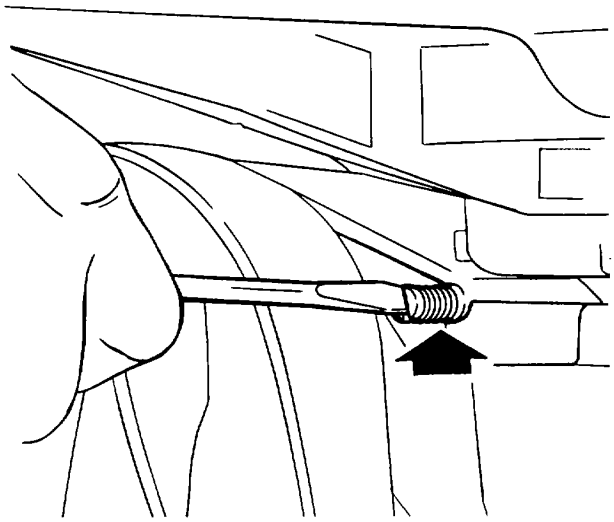


Figure 2-30. Steering friction adjustment screw

B. Using screwdriver, loosen or tighten screw until you feel a slight amount of drag when turning. This provides smooth steering.

WARNING
The steering friction adjustment is not intended to allow "hands off" steering. Loss of control could result.

2-15. TILT FRICTION ADJUSTMENT.

A. Locate tilt friction adjusting nut (3, fig. 1-1).

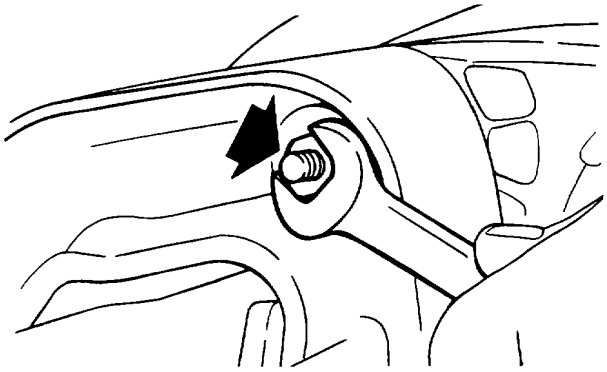


Figure 2-31. Tilt friction adjustment

B. Using a wrench, loosen or tighten nut just enough to hold motor in any position of tilt.

CAUTION

Do not overtighten. This will increase the pressure required to tilt the motor when an obstruction is hit. Failure to tilt when hitting an obstruction can do serious damage to your motor.

2-16. IDLE SPEED ADJUSTMENT.

A. Locate idle speed adjustment screw (23, fig. 1-2).

NOTE

Before making adjustment be sure throttle is in SLOW position and engine is at normal operating temperature.

B. Turn clockwise to increase idle speed.

C. Turn counterclockwise to decrease idle speed.

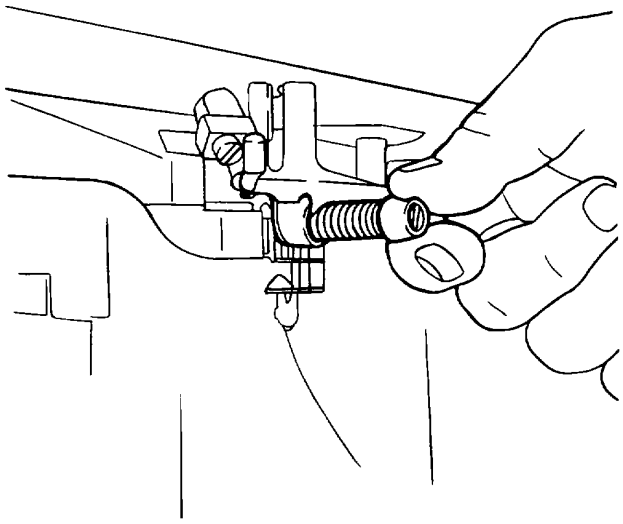


Figure 2-32. Idle speed adjustment

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-17. OPERATION IN SHALLOW WATER.

A. Avoid operating in shallow water, if at all possible.

B. Always proceed at slow speed in shallow water.

C. Be certain reverse lock (13, fig. 1-1) is in RELEASE position. This will allow motor to tilt up more easily if it hits an underwater obstruction.

D. If you hit an underwater obstruction:

1. Slow engine to idle speed immediately.
2. Stop engine.
3. Tilt motor and check lower unit for damage.

NOTE

If motor vibrates excessively after striking an underwater obstruction, it may indicate a damaged propeller. Operate at slow speed. At the first opportunity replace damaged propeller.

2-18. OPERATION IN WEEDY WATER.

CAUTION

Weeds on the propeller will cause motor to vibrate and cooling water intake (7, fig. 1-1) will tend to become clogged.

A. Run motor at slow speeds when weeds are thick.

B. Stop and clear propeller and cooling water intake as often as necessary.

C. When leaving weedy water for clear water, stop and clear propeller and cooling water intake.

2-19. OPERATION IN SALT WATER NOTE Your motor is built to operate in either salt or fresh water.

A. When operation in salt water is ended, remove motor from salt water and rinse external parts with fresh water.

B. Wipe external parts dry with a slightly oily rag after running. This step may be performed after operating in either salt or fresh water and will help preserve the finish of your motor.

2-20. OPERATION IN FREEZING WEATHER.

A. Keep lower unit submerged in water at all times when operating. This will avoid freezing and possible damage to the unit.

B. When operation is over and you are removing unit from water, allow the unit to stand upright and all water to completely drain.

2-21. EMERGENCY STARTING (IF MANUAL STARTER FAILS).

A. Remove motor cover. (See Removing the Motor Cover, para 2-12.)

B. Remove three screws attaching starter. (See para 3-9.)

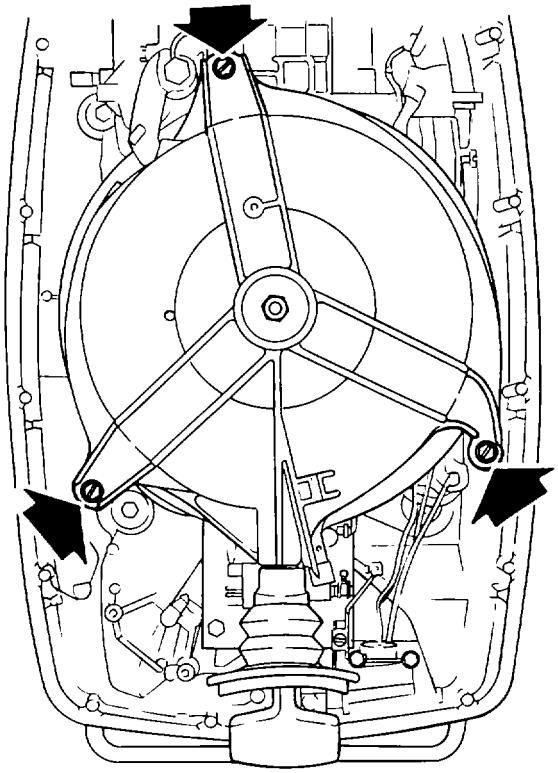


Figure 2-33. Starter screws

C. Lift starter off engine.

D. If pull cord is broken it may still be long enough to use as an emergency cord.

E. If pull cord is not long enough, proceed as follows:

1. Tie a knot in the end of a 1/4 inch (6 mm) thick rope.
2. Place knot in pulley notch and wrap rope around pulley in a clockwise direction.
3. Follow usual procedure for starting. (See Starting the unit, para 2-8).

F. Notify organizational maintenance that the unit needs repair.

2-22. BREAK-IN PROCEDURE.

A. OPERATION (FIRST HOUR): Do not operate engine at continuous full power for the first hour of operation. After 15 minutes of slow to half throttle operation, we recommend a short burst of full throttle operation every 5 to 10 minutes. Run at full throttle for about 90 seconds, then return to half throttle or less.

NOTE

Frequently check operation of cooling system during break-in. A steady steam of water discharged from the water pump indicator ensures proper water pump operation.

B. OPERATION (SECOND HOUR): Reduce power to three-quarter throttle (approximate) while maintaining planing attitude. At intervals during the second hour, apply full power for periods of one to two minutes, returning throttle to original setting three quarter throttle for a cooling period.

Avoid continuous full throttle operation for extended periods during the next three hours.

2-23. MOTOR DROPPED OVERBOARD (NOT RUNNING). If motor is recovered from water immediately, it must be serviced within 3 hours after recovery. Notify organizational maintenance immediately.

2-24. MOTOR DROPPED OVERBOARD (RUNNING). Follow the same procedure as Motor Dropped Overboard (Not Running). However, if there is any binding when flywheel is rotated it indicates a bent connecting rod and no attempt should be made to start the motor. Have it serviced immediately.

2-25. MOTOR DROPPED OVERBOARD (IN SALT WATER). Follow same procedure as Motor Dropped Overboard (Not Running) and (Running) but take the motor to organizational maintenance as soon as possible, even if it can be started, as salt water can cause excessive corrosion of ignition system and internal parts.

2-26. PROLONGED SUBMERSION (FRESH OR SALT WATER). If motor has been dropped overboard and not recovered immediately, then motor must be serviced within 3 hours after recovery. Notify organizational maintenance.

If sand has entered the motor, no attempt at starting should be made. Notify direct support immediately.

NOTE

Since this motor is provided with needle bearings, it must be serviced within 3 hours after recovery to avoid costly repairs. Both fresh and salt water characteristically will start etching the highly machined bearing surfaces of the crankshaft and connecting rods as well as the bearings once exposed to the surrounding atmosphere.

If service is not readily available, proceed as follows:

A. Remove motor cover and rinse motor with fresh water.

B. Disconnect spark plug leads and remove spark plugs. Reattach leads and ground plugs on motor block. (See para 3-10.)

NOTE

To remove or attach leads, pull off or push on with a slight counterclockwise twist.

C. Lay motor down (spark plug openings down) and work out all of the water by rotating flywheel with starter cord approximately 25 times.

D. Place motor in upright position. Remove high speed needle valve and drain carburetor.

E. Reassemble parts you removed and follow starting instructions (see para 2-8). After starting, permit motor to run 1/2 hour or longer on boat or in a test tank with test wheel.

F. If motor fails to start, remove spark plugs again to see if water is present between electrodes. Blow out any water from between electrodes and reinstall or replace with new spark plugs. If the motor still fails to start, have it serviced immediately. Motors which have been submerged must be started or disassembled as soon as possible or extensive repairs will be necessary. To minimize damage, motor must be started or serviced within approximately 3 hours after recovery.

NOTE

If motor cannot be started and if service is not readily available, the motor should be re-submerged immediately in fresh water to avoid exposure to the atmosphere. Make arrangements to have it serviced with the least possible delay.

CHAPTER 3
OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. GENERAL LUBRICATION INFORMATION. This section contains lubrication instructions for the operator and a reproduction of the lube oil chart (LO 5-2805-261-12).

3-2. ENGINE LUBRICATION. Model AM-40A has a two cycle engine. It is lubricated by adding oil (TCW 50/1) to the gasoline. For proper lubrication of the engine, 50 parts of gasoline must be mixed with 1 part of lubricant.

3-3. FUEL MIXING INSTRUCTIONS.

CAUTION

Lubricant and gasoline must be properly mixed or serious damage will result to the engine.

CAUTION

Avoid the use of the following, as they will contribute to deterioration of your engine and shorten spark plug life:

Automotive oils
Premix fuel of unknown oil quality
Premix fuel richer than 50/1 ratio
Premix fuel leaner then 50/1 mixture ratio

A. RECOMMENDED GASOLINE.

Use gasoline with the following Minimum octane numbers:

ANTI-KNOCK INDEX NUMBER	67
Research Octane Number	69

Automotive gasolines, regular-leaded or lead-free, meeting these minimum octane numbers may be used; however, best results will be obtained by using lead-free gasoline.

B. FUEL MIXTURE

1 part approved lubricant to 50 parts gasoline.
8 fl. ozs. lubricant to 3 gallons of gasoline.
16 fl. ozs. lubricant to 6 gallons of gasoline.
20 millilitres lubricant to 1 litre gasoline.

NOTE

Always use fresh gasoline.

WARNING

Gasoline is extremely flammable and highly explosive.

- Always mix fuel outdoors. Never indoors.
- Never smoke or allow open flames or sparks when mixing or refueling.
- Always stop motor before refueling.
- Always maintain metal-to-metal contact between the fill can, funnel, and gas tank when pouring gasoline. (Use a metal funnel for this purpose). This will help avoid a static spark which might ignite the gas fumes.

C. Above 32°F (0°C) pour lubricant into tank, add gasoline. Replace filler cap securely. To mix fuel, tip tank on side and back to upright position.

D. Below 32°F (0°C) pour approximately one gallon into tank, add required lubricant. Replace filler cap securely. Thoroughly mix by shaking tank. Add balance of gasoline.

LUBRICATION ORDER L05-2805-261-12

OUTBOARD MOTOR, GASOLINE POWERED, OMC MODEL AM-40A,

NSN 2805-01-105-1680

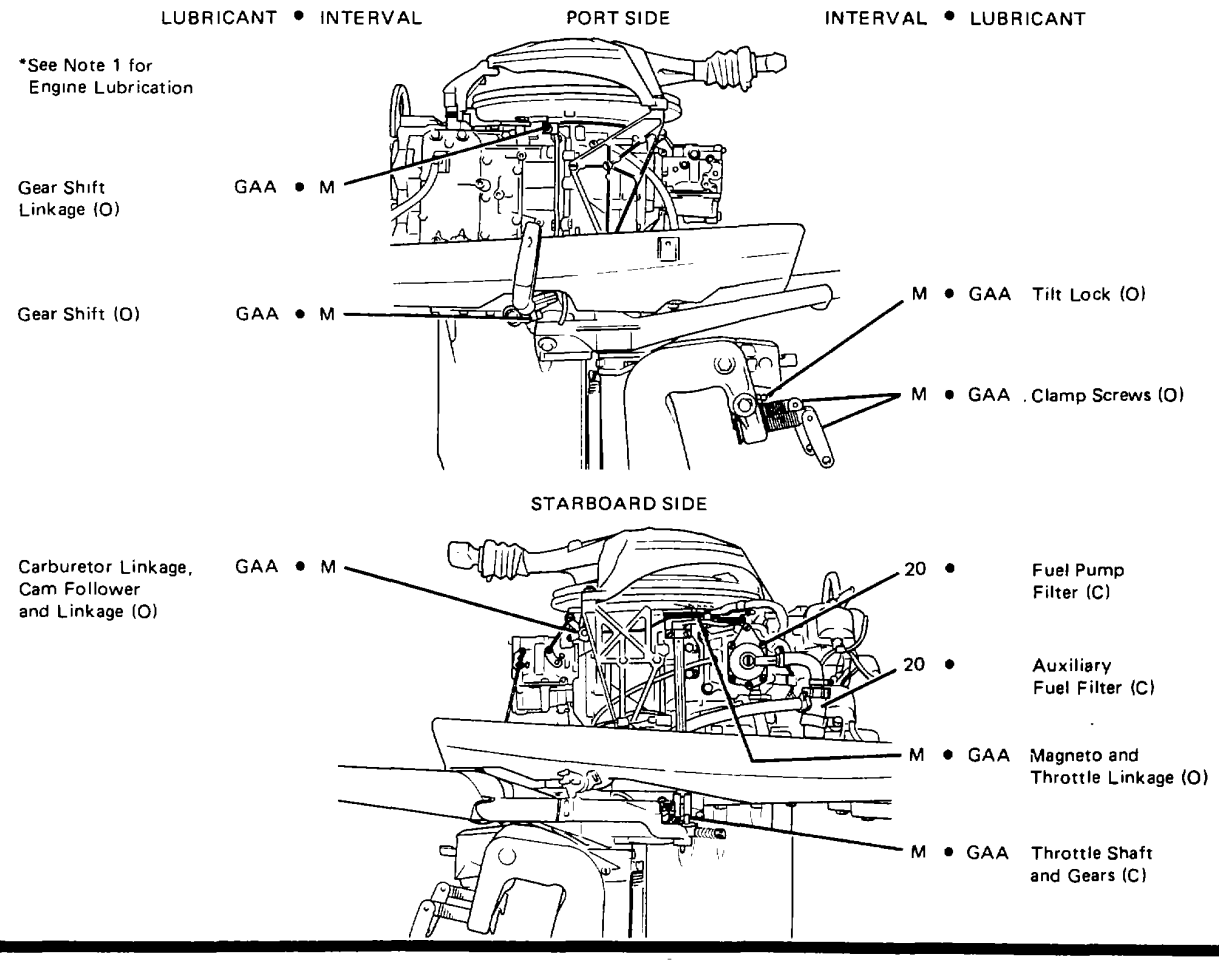
Intervals (on-condition or hard time) and the related man-hour times are based on normal operation. The man-hour time specified is the time you need to do all the services prescribed for a particular interval. On-condition (OC) oil sample intervals shall be applied unless changed by the Army Oil Analysis Program (AOAP) laboratory. Change the hard time interval if your lubricants are contaminated or if you are operating the equipment under adverse operating conditions, including longer-than-usual operating hours. The hard time interval may be extended during periods of low activity. If extended, adequate preservation precautions must be taken Hard time intervals will be applied in the event AOAP laboratory support is not available.

*The time specified is the time required to perform all services at the particular interval.

Clean parts with dry cleaning solvent (SD), type II or equivalent. Dry before lubricating. The lowest level of maintenance authorized to lubricate a point is indicated by one of the following: (C) Operator/crew; or (O) Organizational Maintenance.

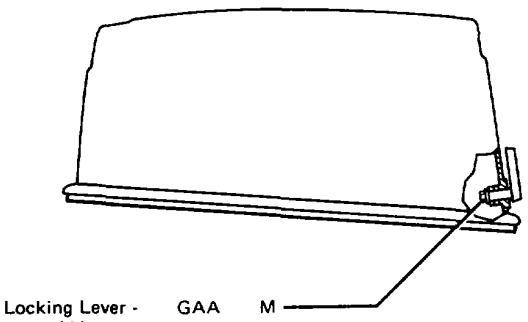
You can help improve this publication. If you find any mistake or if you know of a way to improve the procedures, please let us know. Your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) should be mailed directly to: Commander, U.S. Army Troop Support & Aviation Materiel Readiness Command, ATTN: DRSTS-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished to you.

*TOTAL TASK-HR		*TOTAL TASK-HR	
INTERVAL	TASK-HR	INTERVAL	TASK-HR
M	2.0	20	1.5
Q	1.5	B	Biannually



COVER

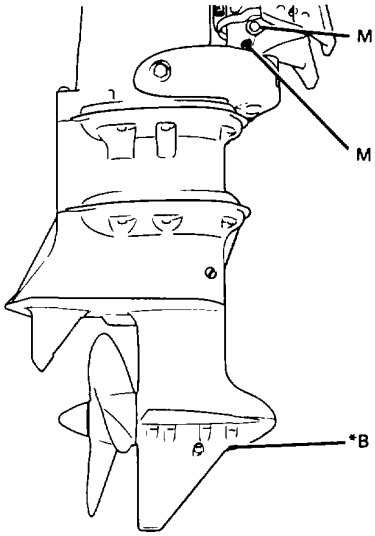
LUBRICANT • INTERVAL



Locking Lever - Cover (O) GAA M

LOWER UNIT

INTERVAL • LUBRICANT



M GAA Reverse Lock Bracket (O)

M GAA Swivel Bracket (O)

*B GO Gearcase (C) Drain/Fill (Capacity 413 cc)

Distribution: To be distributed in accordance with DA Form 12-25A, Operator maintenance requirements for outboard motors, 40 HP MIL STD.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory.

BY ORDER OF THE SECRETARY OF THE ARMY:

E.C. MEYER
General, United States Army
Chief of Staff

OFFICIAL:

ROBERT M. JOYCE
The Adjutant General

NOTES

*1. FUEL MIXTURE (C)

1 part approved lubricant to 50 parts gasoline.
8 fl. ozs. lubricant to 3 (three) gallons of gasoline.
16 fl. ozs. lubricant to 6 (six) gallons of gasoline.
20 millilitres lubricant to 1 litre gasoline.

CAUTION

Lubricant and gasoline must be properly mixed or serious damage will result to the engine.

CAUTION

Avoid the use of the following, they will contribute to deterioration of your engine and shorten spark plug life:

AVOID USE OF:

Automotive oils
Premix fuel of unknown oil quality
Premix fuel richer than 50/1 ratio
Premix fuel leaner than 50/1 mixture ratio

*2. GEARCASE (O)

Change after first 20 hours of operation and check after 50 hours of operation. Add lubricant if necessary.

Drain and refill every 100 hours of operation or every 6 months, whichever occurs first.

– KEY –

LUBRICANTS		REFILL CAPACITY (APP)	EXPECTED TEMPERATURES			For Arctic Operation Refer to TM 9-207	INTERVALS
			Above +32°F Above 0°C	+40°F to -10°F +5°C to -23°C	0°F to -65°F -18°C to -50°C		
B/A Grade TCW 50/1 NSN 9150-00-117-8791	Lubricating Oil, Engine	6 gals. (Gas Tank)	TCW 50/1	TCW 50/1	TCW 50/1		M = Monthly B = Biannually 20 = Hours
GO MIL-L-2105	Gearcase	413 cc	GO	GO	GO		
GAA	Grease	O/C	GAA	GAA	GAA		
MIL-G-2104GR30 (Oil Can Points)	General Purpose Oil						

Section II. TROUBLESHOOTING

3-4. GENERAL.

A. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the outboard motor. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

B. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

3-5. OPERATOR TROUBLESHOOTING. Perform troubleshooting functions in accordance with table 3-1.

Table 3-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. MOTOR WILL NOT START.	
Step 1. Check for throttle grip in start position.	Put throttle grip in start position.
Step 2. Check for shift lever in neutral position.	Put shift lever in neutral position. (See starting the Unit, para 2-8.)
Step 3. Check fuel tank.	Fill fuel tank. (See fuel mixing Instructions, para 3-3.)
Step 4. Check fuel line connectors.	Be sure fuel line connections are properly connected (para 2-8).
Step 5. Check that carburetor has been primed.	Squeeze primer bulb until you feel resistance. (See Starting the unit, para 2-8.)
Step 6. Check for fuel line kinked or fuel tank resting on fuel line.	Move fuel line so it is not kinked or fuel tank not resting on line.
Step 7. Check for damaged primer bulb.	If damaged, notify organizational maintenance to replace.
Step 8. Choke improperly adjusted for cold motor.	Pull choke knob all the way out (para 1-7).
Step 9. Choke improperly adjusted for warm motor.	Push choke knob all the way in (para 1-7).

Table 3-1. Troubleshooting - continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. MOTOR WILL NOT START - continued.
Step 10. Engine flooded.
a. Push choke knob all the way in.
b. Disconnect fuel line connector at motor.
c. Crank motor until it is cleared.
Step 11. Check for water in fuel system.
Replace fuel. (See Fuel Mixing instructions, para 3-3.)
Step 12. Fuel pump filter or auxiliary fuel filter is clogged.
Clean filter (para 3-15, 3-16).
Step 13. Check for loose spark plug leads.
a. Tighten.
b. Replace (para 3-10).
Step 14. Spark plugs carboned, burned, or wet.
Replace or dry (para 3-10).
Step 15. Check for loose spark plugs.
Tighten (para 3-10).
Step 16. Spark plug gap is incorrect.
Regap (para 3-11).
2. MOTOR WILL NOT IDLE PROPERLY.
Step 1. Check for improper fuel mixture.
Dump fuel tank and replace fuel. (See Fuel Mixing Instructions para 3-3.)
Step 2. Carburetor adjustment is improperly set.
Adjust. (See para 3-17.)
Step 3. Defective spark plugs.
Replace (para 3-10).
3. MOTOR LOSES POWER.
Step 1. Check for obstruction at cooling water inlet.
Remove obstruction.

Table 3-1. Troubleshooting - continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
3. MOTOR LOSES POWER - continued	
Step 2. Water pump not functioning.	Notify organizational maintenance.
Step 3. Check for contaminated (dirty) fuel.	Replace fuel. (See Fuel Mixing Instructions, para 3-3.)
Step 4. Defective spark plugs.	Replace (para 3-10).
Step 5. Fuel pump filter or auxiliary fuel filter partially clogged.	Clean (para 3-15, 3-16).
4. MOTOR VIBRATES EXCESSIVELY.	
Step 1. Check for weeds on propeller.	Remove weeds.
Step 2. Check for loose steering friction screw.	Tighten screw. (See Steering Friction Adjustment, para 2-14.)
Step 3. Damaged propeller.	Replace propeller (para 3-14).
Step 4. Carburetor improperly adjusted.	Adjust (para 3-17).
5. MOTOR RUNS BUT MAKES LITTLE OR NO PROGRESS.	
Step 1. Check for weeds on propeller.	Remove weeds.
Step 2. Damaged propeller.	Replace (para 3-14).
Step 3. Sheared propeller drive pin.	Replace (para 3-14).

Section III. MAINTENANCE PROCEDURES

3-6. GENERAL. Instructions in this section are published for the information and guidance of the operator to maintain the outboard motor.

3-7. FUEL TANK, LINES AND FITTINGS.

A. Check all fittings for leaks and retighten if necessary.

B. If leak is found in fuel tank, report to organizational maintenance.

C. Be sure primer bulb works properly.

3-8. THE UNIT AS A WHOLE.

A. Check cover gasket for leaks and notify organizational maintenance if necessary.

B. Be sure starter rope is not frayed or knotted. Notify organizational maintenance if it needs to be replaced.

C. Check propeller for nicks and breaks. Replace if damaged (para 3-14).

D. Check gearcase for cracks and leaks. Notify organizational maintenance.

E. Check clamp screws to be sure they are tight enough.

F. Check for frayed or broken wiring. Notify organizational maintenance.

G. Check fuel pump, clean strainer. (See para 3-15, 3-16).

H. Check spark plugs. (See para 3-10.)

I. Check exhaust housing for cracks, damage. Notify organizational maintenance.

J. Inspect stern brackets for cracks, bends or breaks. Notify organizational maintenance.

Section IV. STARTER MAINTENANCE

MAINTENANCE SUMMARY.

This task covers:

Removal/Installation of the rewind starter

INITIAL SETUP:

Personnel Required
1

General Safety Instructions
None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Removal/installation of the starter	Para 3-9	See Removing/installing the motor cover, para 2-12. See Emergency starting, para 2-21.

3-9. REWIND STARTER REMOVAL/INSTALLATION

This task covers:

Removal/Installation of rewind starter

INITIAL SETUP:

Tools:
TI 5180-00-177-7033
Materials/Parts:
As required
Personnel Required
1 operator

Equipment Condition:
Motor OFF

Approximate Time Required (minutes):
15

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Bolt (1)	Remove	
2. Neutral lockout lever (2)	Remove	
3. Spring (3) washer (4)	Remove	
4. Screws (5)	Remove	
5. Starter (6)	Remove	
INSTALLATION		
1. Starter (6)	Place in position on power head.	
2. Screws (5)	Install.	
3. Lockout lever (2) washer (4) spring (3)	Place in position.	
4. Bolt (1)	Install.	

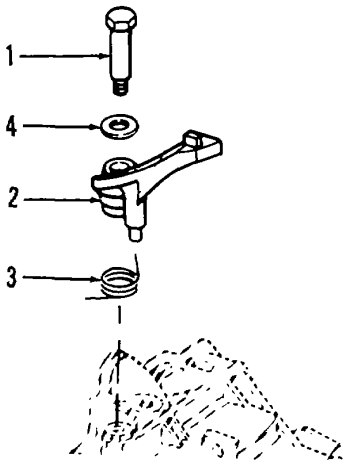


Figure 3-1. Neutral lockout lever

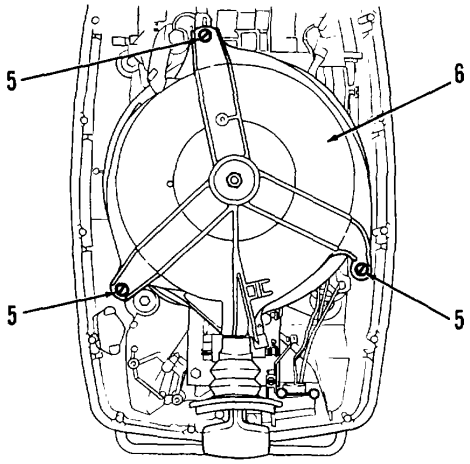


Figure 3-2. Starter

Section V. SPARK PLUGS MAINTENANCE

MAINTENANCE SUMMARY

This task covers:

Servicing the spark plugs.

INITIAL SETUP:

Personnel Required
1

General Safety Instructions

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Spark plugs Removal/ installation.	Para 3-10	Be careful not to get debris in spark plug hole when spark plugs are removed.
2	Adjust spark plugs. (Set gap).	Para 3-11	

3-10. SPARK PLUG REMOVAL/INSTALLATION

This task covers:

Removal/Installation of spark plugs

INITIAL SETUP:

Tools:
13/16 in. deep socket
Torque wrench
TI 5180-00-177-7033

Material/Parts:
RL-82 Champion spark plugs (2)

Personnel Required:
1 operator

Equipment Condition:
Motor OFF

Approximate Time Required (minutes):
15

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Rubber spark plug cover (1) and lead	Remove	Twist slightly counterclockwise and pull.
2. Spark plugs (2) and ratchet.	Remove.	Use spark plug socket wrench 13/16" (21 mm)
INSTALLATION		
1. Spark plug seat in cylinder head	Clean.	
	NOTE **Do not get dirt in spark plug holes.**	

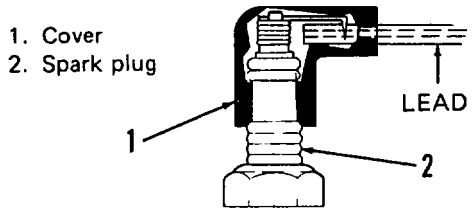


Figure 3-3. Spark plug and lead cover

2. Spark plug and gasket	Install fingertight.	
3. Spark plug (2)	Turn 1/4 turn more using wrench.	If torque wrench is available, tighten to a torque of 17-1/2 to 20-1/2 lb ft (24 to 27 N-m).
	CAUTION **Do not overtighten. Damage may result to cylinder head.**	
4. Spark plug covers (1) and lead	Install.	Be sure that spring clip in spark plug covers make firm contact with spark plug terminals.

3-11. SPARK PLUG GAP

This task covers:

Setting spark plug gap.

INITIAL SETUP:

Tools:
- **Feeler gage**
- **Spark plug cleaning machine**
- **Clean fine bristle, fibre brush**
- **TI 5180-00-177-7033**

Materials/Parts:
- **None**

Equipment Condition:
- **Engine OFF**
- **Spark plugs removed. See para 3-10**

Personnel Required:
- **1 operator**

Approximate Time Required (minutes):
- **15**

LOCATION/ITEM	ACTION	REMARKS
SET SPARK PLUG GAP		
1. Spark plugs	Clean.	Use a sand blasting machine if possible. If not available, use a clean, fine bristle fiber brush.
2. Spark plug gap	Set for 0.030" (0.76mm).	Use a feeler gage to check the gap. Gently tap to close or spread to widen gap.
3. Spark plugs	Install.	See para 3-10.

Section VI. STEERING HANDLE MAINTENANCE

MAINTENANCE SUMMARY

This task covers:

Inspecting and lubricating the steering handle.

INITIAL SETUP:

Personnel Required	General Safety Instructions
1	None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Inspect steering handle	Para 3-12	
2	Lubricate steering handle	Para 3-12	See LO 5-2805-261-12

3-12. STEERING HANDLE MAINTENANCE

This task covers:

a. Steering handle inspection **b.Steering handle lubrication**

INITIAL SETUP:

Tools:
Grease gun

Equipment Condition:
Motor OFF

Materials/Parts:
GAA grease
Clean lint-free rag

Personnel Required:
1 operator

Approximate Time Required (minutes):
15

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
Steering handle	Inspect.	Check for cracked, broken or bent handle. Check to be sure handle can be folded up. Check gears at joint for correct alignment and function. Be sure gears at joint are properly lubricated.
LUBRICATION		
Fitting (1).	Fasten grease gun	Inject grease until new grease appears. Wipe off excess with clean, lint-free rag. See LO 5-2805-261-12

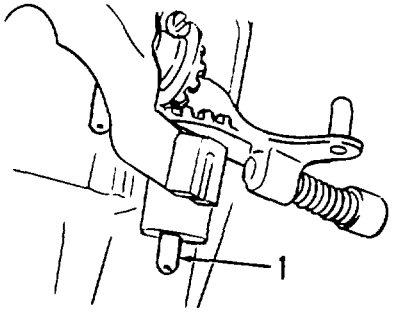


Figure 3-4. Steering handle lubrication

Section VII. GEARCASE MAINTENANCE

MAINTENANCE SUMMARY

This task covers:

Inspection and lubrication of gearcase.

INITIAL SETUP:

Personnel Required
1

General Safety Instructions
None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Inspect gearcase	Para 3-13	
2	Lubricate gearcase	Para 3-13	See LO 5-2805-261-12

3-13. GEARCASE INSPECTION AND LUBRICATION

This task covers:
Inspecting and lubricating gearcase

INITIAL SETUP:

Tools:
Gear oil

Equipment Condition:
Motor OFF

Materials/Parts:
GO MIL-L-2105
Clean, lint-free rag

Personnel Required:
1 operator

Approximate Time Required (minutes):
15

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
1. Gearcase	Inspect.	Look for cracks, loose screws and leaks.
2. Oil level (1)	Remove plug.	Check to be sure lubricant is up to oil level.
LUBRICATION		
1. Oil level plug (1)	Remove.	
2. Drain/fill plug (2)	Remove.	

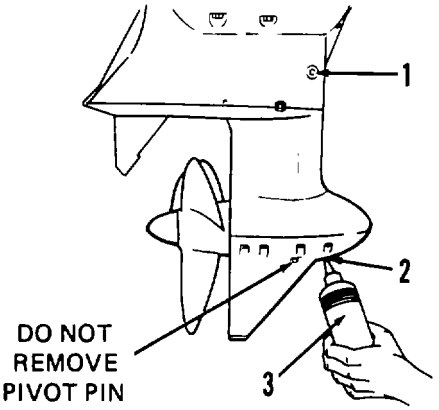


Figure 3-5. Gearcase lubrication

3. Lubricant container (3)	Insert tip in drain/fill plug.	Squeeze container, forcing lubricant into gearcase until lubricant appears at oil level. An empty gearcase will use approximately 14 oz (413 cc) of lubricant.
4. Lubricant container (3)	Remove.	When you remove the container, quickly install the drain/fill plug (2) or lubricant will leak out.
5. Oil level plug (1)	Install.	
6. Excess lubricant	Wipe off with clean, lint-free rag.	

Section VIII. PROPELLER MAINTENANCE

MAINTENANCE SUMMARY

This task covers:

a. Propeller removal/installation **b.Propeller drive pin removal/installation**

INITIAL SETUP:

Personnel Required
1

General Safety Instructions
When replacing propeller, disconnect spark plug leads from spark plugs to avoid accidentally starting motor. Be sure shift lever is in neutral.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Propeller removal/installation	Para 3-14	See spark plugs service, para 3-10, 3-11.
2	Propeller drive pin removal/ installation	Para 3-14	Part of propeller removal/installation procedure.

3-14. PROPELLER REMOVAL/INSTALLATION

This task covers:
Removal/Installation of propeller. (Removal /installation of drive pin is part of this procedure.)

INITIAL SETUP:

Tools:
TI 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
Replacement parts as required

Personnel Required:
1 operator

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Spark plugs	Remove spark plug covers and leads.	See spark plug service, para 3-10.
2. Cotter pin (1)	Remove.	
3. Propeller nut (2)	Remove. **NOTE** **Propeller nut is not threaded. Pull off, do not tu rn.**	
4. Drive pin (3) and washer (4)	Remove. **NOTE** **Old drive pin can be driven out of shaft with new pin.**	
5. Propeller (5)	Slide off shaft (6)	

1. Cotter Pin
2. Propeller Nut
3. Drive Pin
4. Thrust Washer
5. Propeller
6. Shaft

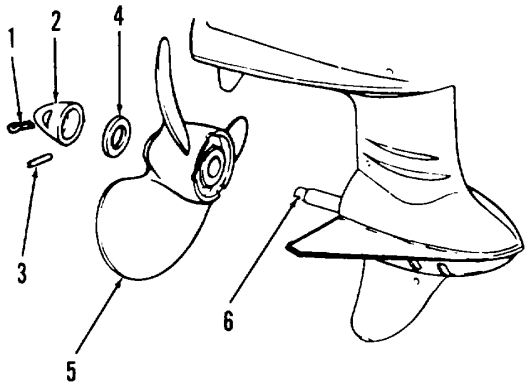


Figure 3-6. Propeller replacement

LOCATION/ITEM	ACTION	REMARKS

3-14. PROPELLER REMOVAL/INSTALLATION (Cont)

INSTALLATION

1.	Propeller (5)	Slide on to shaft (6). Lubricate shaft with GAA grease before installing propeller.	
2.	Washer (4)	Install on shaft.	
3.	Drive pin (3)	Install.	
4.	Propeller nut (2)	Install.	
5.	Cotter pin (1)	Install.	Bend projecting ends of cotter pin.
6.	Spark plug covers and leads	Install.	See spark plug installation para 3-10.

Section IX. FUEL SYSTEM MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Fuel pump inspection
b. Cleaning fuel strainers

INITIAL SETUP:

Personnel Required

1

General Safety Instructions

To prevent excessive fuel spillage disconnect fuel tank line plug-in connector at motor before disassembly.

Gasoline is extremely flammable. Do not smoke or allow sparks while working on fuel system.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Fuel pump inspection	Para 3-15	If fuel pump gasket or diaphragm is damaged notify organizational maintenance.
2	Clean fuel pump strainer	Para 3-15	Part of fuel pump inspection.
3	Clean auxiliary fuel strainer	Para 3-16	

3-15. FUEL PUMP MAINTENANCE

This task covers:

Inspecting fuel pump and cleaning fuel filter.

INITIAL SETUP:

Tools:
TI 5180-00-177-7033

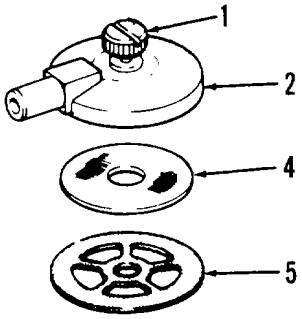
Equipment Condition:
Motor OFF

Materials/Parts:
Cleaning solvent

Personnel Required:
1 operator

Approximate Time Required (minutes):
15

LOCATION/ITEM	ACTION	REMARKS
INSPECTION	**WARNING** **Gasoline is highly flammable. Do not smoke or use open flames or strike sparks while working on the fuel system.**	
DISASSEMBLY		
1. Mounting screw (1)	Remove.	
2. Cover (2)	Remove from fuel pump (3).	
3. Filter (4)	Remove.	
4. Gasket (5) and diaphragm (6)	Inspect for damage.	



1. Screw
2. Cover
3. Fuel Pump
4. Filter
5. Gasket
6. Diaphragm

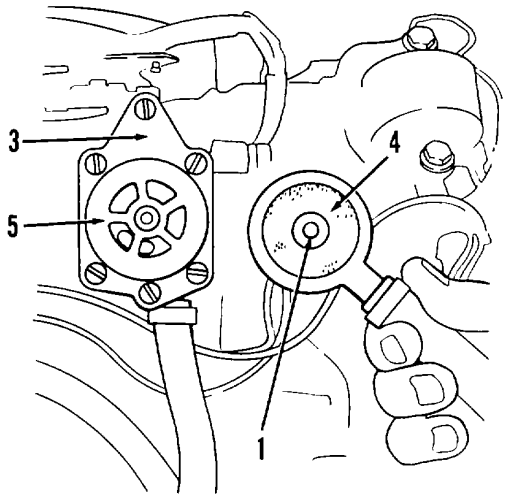


Figure 3-7. Fuel pump

LOCATION/ITEM	ACTION	REMARKS

3-15. FUEL PUMP MAINTENANCE -continued

CLEANING FUEL FILTER	**WARNING** **Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or non-porous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death**.	
Filter element (4)	Wash in suitable solvent using a soft bristle brush.	

ASSEMBLY

1.	Filter element (4)	Install in pump cover (2).	
2.	Pump cover (2)	Position on pump body (3).	
3.	Mounting screw (1)	Install.	
4.	Fuel line	Connect.	Clean up any spilled fuel with a clean lint-free rag.
5.	Fuel system	Prime.	Check for any leaks. Repeat procedure if fuel pump leaks.

3-16. AUXILIARY FILTER CLEANING

This task covers:
Cleaning auxiliary filter

INITIAL SETUP:

Tools:
TI 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
Clean lint-free rag

Personnel Required:
1 operator

Approximate Time Required (minutes):
10

LOCATION/ITEM	ACTION	REMARKS
CLEANING AUXILIARY FILTER		
DISASSEMBLY		
1. Filter assembly (1)	Remove from retaining spring clip.	It is not necessary to remove hose and clamps from filter assy.
2. Cap (2)	Unscrew from base (3).	
CLEANING		
Trap (4) and base (3)	Clean.	Use a clean, lint-free rag.

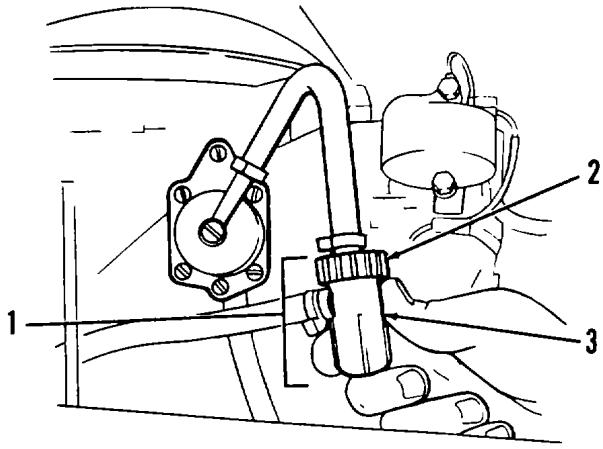


Figure 3-8. Auxiliary filter (1 of 3)

LOCATION/ITEM	ACTION	REMARKS

3-16. CLEANING AUXILIARY FILTER - continued

ASSEMBLY

1. Cap (2) and trap (4)	Screw into base (3).	
2. Filter assembly (1)	Install in retaining spring clip.	

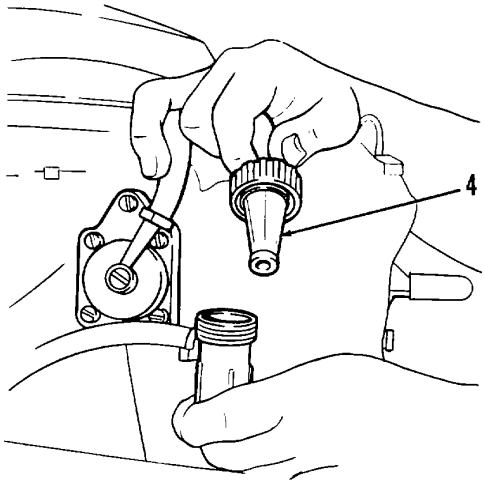


Figure 3-8. Auxiliary filter (2 of 3)

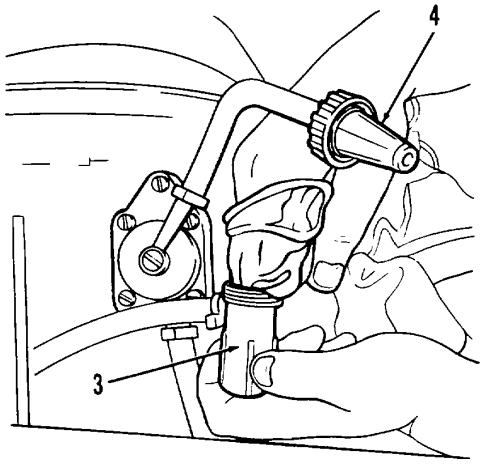


Figure 3-8. Auxiliary filter (3 of 3)

Section X. THROTTLE ADJUSTMENT

MAINTENANCE SUMMARY. This task covers:

The throttle adjustment:

a. Idle speed
b. Low speed (carburetor) adjustment

INITIAL SETUP

Personnel Required

1

General Safety Instructions

Gasoline is extremely flammable. Do not smoke or allow sparks while working on fuel system.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Idle speed adjustment	Para 3-17	NOTE
2	Low speed adjustment	Para 3-17	There is no high speed adjustment.

3-17. THROTTLE ADJUSTMENT

This task covers:

a. Idle speed adjustment
b. Low speed adjustment

INITIAL SETUP:

Tools:
TI 5180-00-177-7033

Equipment Condition:
Follow procedure

Materials/Parts:
None

Personnel Required:
1 operator

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS
	WARNING **Be extremely careful working around engine with motor cover off. Hair, hands or clothing can become caught in moving parts or air intake.**	
IDLE SPEED ADJUSTMENT		
Adjustment knob (1)	a. Turn clockwise to increase idle speed. b. Turn counterclockwise to decrease idle speed.	

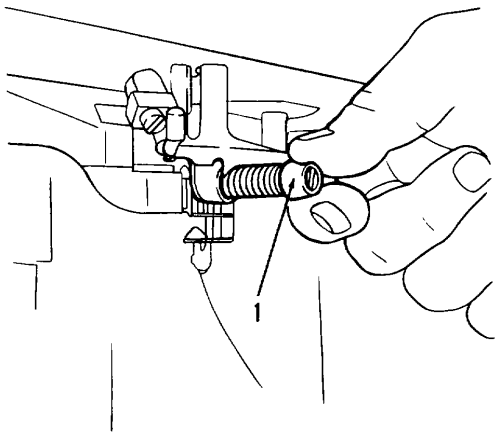


Figure 3-9. Idle speed adjustment

LOCATION/ITEM	ACTION	REMARKS

3-17. THROTTLE ADJUSTMENT - continued

LOW SPEED ADJUSTMENT

1.	Motor	Stop.	
2.	Motor cover	Remove.	See para 2-12
3.	Low speed adjustment screw (1)	a. Turn clockwise until needle valve gently seats. b. Turn counterclockwise 1-1/4 turns.	See para 2-8
4.	Motor	Start.	
5.	Throttle	Set on normal idle speed.	
6.	Low speed adjustment screw (1)	Adjust until best performance is obtained. a. Clockwise to lean out fuel mixture. b. Counterclockwise to enrich fuel mixture.	
7.	Motor	Stop.	See para 2-10.
8.	Cover	Install.	See para 2-12.

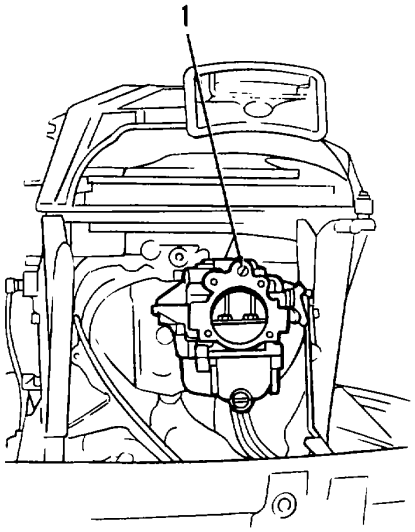


Figure 3-10. Low speed adjustment

Section XI. SCREW ASSEMBLY CLAMP MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

Inspection and removal/installation of the screw assembly clamp

INITIAL SETUP

Personnel Required	General Safety Instructions
1	Be sure motor is adequately supported before removing screw assembly clamp.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Screw assembly clamp inspection	Para 3-18	None
2	Screw assembly clamp removal/ installation	Para 3-18	

3-18. INSPECTION/REMOVAL/INSTALLATION OF SCREW ASSEMBLY CLAMP

This task covers:

Screw assembly clamp inspection/removal/installation

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 operator

Approximate Time Required (minutes):
30

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
Screw assembly clamp (1)	Inspect.	Look for stripped threads, split or bent swivel plate, or broken handle.
REMOVAL		
1. Capscrew (1)	Remove. Swivel plate (2) will come off.	
2. Screw assembly clamp (3)	Turn out of stern bracket assembly.	
INSTALLATION		
1. Screw assembly clamp (3)	Screw into stern bracket.	
2. Swivel plate (2)	Place over capscrew (1).	Be sure concave surface is toward transom.
3. Capscrew (1)	Install tightly in screw assembly clamp.	

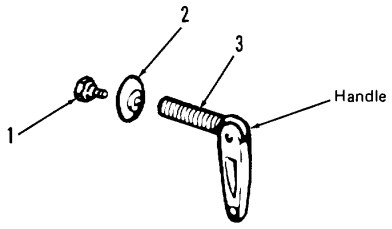


Figure 3-11. Screw clamp assembly

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

4-1. CHAPTER OVERVIEW. This chapter contains maintenance procedures for organizational maintenance personnel.

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

4-2. COMMON TOOLS AND EQUIPMENT. For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-3. SPECIAL TOOLS. See appendix C for special tools.

4-4. SPARES AND REPAIR PARTS. Spares and repair parts are listed and illustrated in the repair parts and special tools list covering organizational and DS maintenance for this equipment (TM 5-2805-261-23P).

Section II. SERVICE UPON RECEIPT

4-5. ASSEMBLY AND PREPARATION FOR USE.

A. UNLOADING.

1. Remove all tiedowns or blocking that secure the crate to the carrier.

WARNING

Make certain any lifting device used has a capacity equal to or greater than the weight being lifted. Failure to observe this precaution could result in injury or death to personnel and damage to equipment.

2. A forklift truck, pipe rollers, or a suitable hoist must be used when removing the motor from the carrier.

B. UNPACKING.

1. Place the outboard motor as close to the point of use as possible.

2. Prepare the motor for inspection and servicing as outlined on DA Form 2258, Depreservation Guide.

3. Remove the motor from the crate.

C. INSPECTION.

1. Make a complete visual inspection of the outboard motor for any loss or damage that may have occurred during shipment. If shipping crate has been damaged, pay particular attention to the motor areas adjacent to damage areas of the crate.

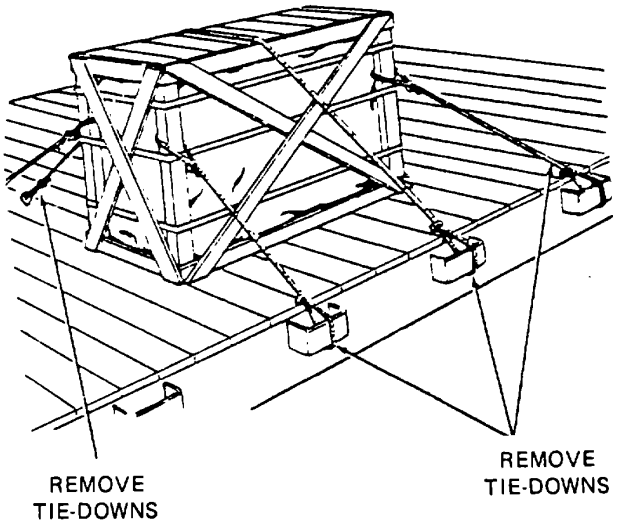


Figure 4-1. Crate and carrier

2. Inspect the motor for cracks, breaks and other defects.

3. Check the contents of the crate against the packing list to make sure no items are missing.

4. Correct all deficiencies or report them to the proper authority.

4-6. LUBRICATION. Check all lubrication points (see LO 52805-261-12) to be certain the outboard motor is properly lubricated.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-7. INTRODUCTION. The preventive maintenance checks and services listed in the PMCS table 4-1 cover procedures to be performed by organizational maintenance personnel.

4-8. PMCS TABLE. Explanation of the columns:

- Item Number. Checks and services are numbered in sequence. This column shall be used as source of item numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.
- Item To Be Inspected. This column gives the name of the item to be inspected or serviced.
- Procedures. This column lists inspection procedures.
- Equipment Will Be Reported Not Ready/Available If: This column contains the criteria which will cause the equipment to be classified as not ready or not available because of inability to perform its primary mission.

Table 4-1. Preventive Maintenance Checks and Services

Legend

W - Weekly **M - Monthly** **Q - Quarterly**

Item No.	INTERVAL W	M	Q	Item To Be Inspected	Procedures	Equipment Will Be Reported Not Ready/ Available If:
1			•	Magneto, flywheel assembly	Inspect (para 4-16, 4-17).	Damaged.
2		•		Ignition coil	Test (para 4-11).	Failed.
3			•	Condenser	Test (para 4-11).	Failed.
4			•	Shorting switch assembly	Inspect (para 4-23).	Failed.
5		•		Spark plugs	Inspect (para 3-10).	Need replacement.
6		•		Breaker points	Inspect (para 4-11).	Need replacement.
7		•		Propeller drive pin	Inspect (para 3-14).	Need replacement.
8		•		Fuel tank	Inspect (para 4-24).	Leaks or cracks.
9			•	Carburetor needle valves	Inspect (para 4-27).	Need replacement.
10			•	Intake manifold	Inspect (para 4-29).	Manifold is damaged or gasket leaks.
11			•	Cylinder and crankcase assembly	Inspect (para 4-30).	Assembly is damaged.
12			•	Cylinder head	Inspect (para 4-30).	Cylinder head is damaged.
13		•		Steering bracket	Inspect (para 4-32).	Steering bracket is damaged.
14		•		Water pump	Inspect (para 4-36).	Engine runs hot.
15	•			Water inlet screen	Inspect (para 4-37).	Screen is damaged.

Section IV. TROUBLESHOOTING

4-9. GENERAL. This section contains troubleshooting procedures to be performed by organizational maintenance personnel.

4-10. TROUBLESHOOTING CHART.

A. MALFUNCTION. Malfunctions listed are the ones most likely to happen. Not all possible malfunctions can be foreseen and listed.

B. TEST OR INSPECTION. Tests or inspections are listed to help you find the cause of the malfunction. The tests are grouped by what system they belong to. (The fuel system tests are with the fuel system.) Within each group the tests are arranged so that the easier tests come before the harder tests.

C. CORRECTIVE ACTION. Corrective actions are listed to help you eliminate the malfunction. Where the corrective action is too complicated to be listed in full detail, the paragraph number of the detailed procedure is given in parentheses.

Table 4-2. Troubleshooting

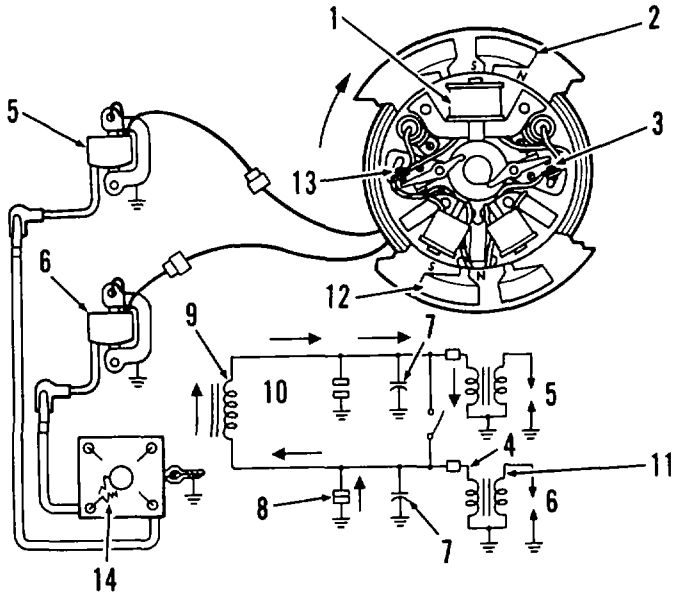
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	MANUAL STARTER	
1. STARTER DOES NOT ENGAGE FLYWHEEL WHEN TRYING TO START MOTOR.		
	Check for broken pawl.	
		Replace pawl (para 4-15).
	IGNITION SYSTEM	
2. IGNITION SYSTEM MALFUNCTIONING.		
	Step 1. Check ignition system (para 4-11).	
		Replace components as necessary.
	FUEL SYSTEM	
3. FUEL SYSTEM MALFUNCTIONING.		
	Step 1. Check fuel delivery (para 4-24).	
		a. Disconnect fuel hose at motor. Squeeze primer bulb until definite pressure is felt. Check hose for leaks. Replace if necessary (para 4-25).
		b. Connect fuel hose at motor. Squeeze primer bulb until definite pressure is felt. Inspect for leaks at hoses, filter, fuel pump, and carburetor. Repair as necessary (para 4-24 thru 4-29).
		c. If you cannot get a definite pressure on the primer bulb, and there is no leakage elsewhere, replace the primer bulb valve (para 4-25).
	Step 2. Inspect carburetor throat for flooding (squeeze primer bulb and observe carburetor throat.)	
		Service carburetor (para 4-27).
	Step 3. Test fuel pump.	
		Connect fuel pump gage to discharge side of fuel pump. Crank engine and observe gage. Gage should read a minimum pressure of 2.5 psi (17 kPa).
		Replace fuel pump (para 4-26).

Table 4-2. Troubleshooting - continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
COOLING SYSTEM	
4. ENGINE OVERHEATS. (See Engine Temperature Test, para 4-38).	
Inspect water pump.	Replace if necessary (para 4-36).
GEARCASE	
5. GEARCASE JUMPS OUT OF GEAR.	
Inspect gearcase components.	Notify direct support.
6. GEAR SHIFT WON'T SHIFT.	
Step 1. Check pivot pin missing or damaged.	Notify direct support.
Step 2. Check shift rod adjustment.	Notify direct support.
Step 3. Check shift rod connection.	Repair as necessary (para 4-34).
Step 4. Inspect gearcase components.	Notify direct support.
7. GEARCASE SEIZED.	
Step 1. Check for lubricant.	a. Lubricate per LO 5-2805-261-12. b. Notify direct support.

4-11. ELECTRICAL TROUBLESHOOTING/TESTING. To use this Troubleshooting section: read the question for each step. If the answer to question is yes, go to step number shown under "YES"; if answer is no, go to step number shown under "NO".

STEP	QUESTION/INSTRUCTION	ANSWER YES	ANSWER NO	REMARKS
	IGNITION SYSTEM			
1	Remove spark plug leads.			See para 3-10.
	Attach leads to spark plug gap test and set gap to 0.43 in. (11 mm). Crank engine with rope.			See fig. 4-2.
	NOTE			
	Remove spark plugs for easier cranking.			See para 3-10.



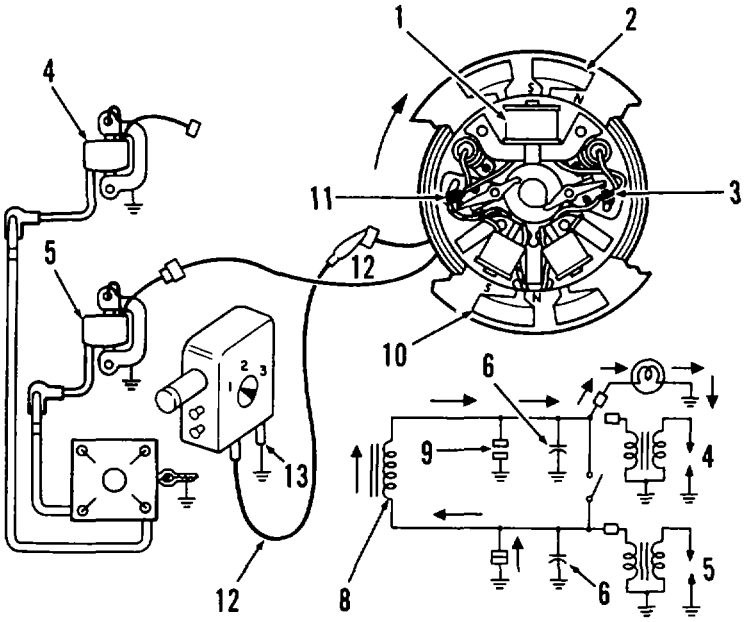
1. Drive Coil
2. Magnet No. 1
3. Point No. 1
4. Primary
5. Coil No. 1
6. Coil No. 2
7. Condenser
8. Point No. 2
9. Driver Coil
10. Point No. 1
11. Secondary
12. Magnet No. 2
13. Point No. 2
14. 0.43 in. (11 mm) Gap

Figure 4-2. Ignition spark test

	Is spark strong and steady and firing for each cylinder?	2	3
2	Replace spark plugs.		See para 3-10.

ELECTRICAL TROUBLESHOOTING/TESTING - continued

STEP	QUESTION/INSTRUCTION	ANSWER YES	ANSWER NO	REMARKS
3	If no spark, check system with stevens S-80 or Merc-o-Tronic neon light test. Disconnect blue primary lead of No. 1 ignition coil. Connect blue lead of neon tester to blue primary lead coming from armature plate. Connect black lead to ground.			See fig. 4-3.



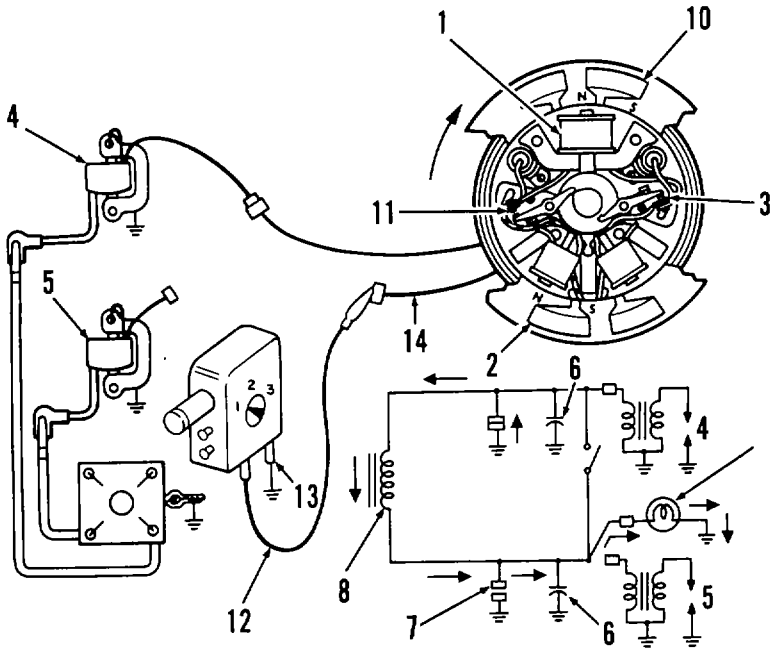
1. Drive Coil
2. Magnet No. 1
3. Point No. 1
4. Coil No. 1
5. Coil No. 2
6. Condenser
7. Point No. 2
8. Driver Coil
9. Point No. 1
10. Magnet No. 2
11. Point No. 2
12. Blue
13. Black

Figure 4-3. Ignition coil no. 1 circuit test

	Set neon test light switch to position No. 1. Crank engine.			
	Is output good (light steady and bright)?	4	5	
	Is light dim?	5	4	
4	Replace No. 1 ignition coil.			See para 4-16.
5	Replace No. 1 condenser.			See para 4-16.
	No light?	6		
6	Check resistance reading of driver coil. Check both sets of breaker points for correct gap and condition of points.			See para 4-16.

ELECTRICAL TROUBLESHOOTING/TESTING - continued

STEP	QUESTION/INSTRUCTION	ANSWER YES	ANSWER NO	REMARKS
7	Connect blue primary lead of No. 1 ignition coil. Disconnect No. 2 ignition coil (blue/white stripe lead) coming from armature plate. Connect blue lead of neon tester to blue/white stripe lead from armature plate. Connect black lead to ground.			See fig. 4-4.



1. Driver Coil
2. Magnet No. 1
3. Point No. 1
4. Coil No. 1
5. Coil No. 2
6. Condenser
7. Point No. 2
8. Driver Coil
9. Point No. 1
10. Magnet No. 2
11. Point No. 2
12. Blue
13. Black
14. Blue/White

Figure 4-4. Ignition coil no. 2 circuit test

	Set neon test light switch to position No. 1. Crank engine.			
	Is output good (light steady and bright)?	8	9	
	Is light dim?	9	8	
8	Replace No. 2 ignition coil.			
9	Replace No. 1 condenser.			
	No light?	10	-	
10	Check resistance reading of driver coil. Check both sets of breaker points for correct gap and condition of points.			See para 4-16.

4-12. WIRE TESTING WITH MULTIMETER.

NOTE
The ohms scale is used for continuity and short circuit testing.

NOTE
Set up and zero the multimeter before each test and before testing each wire.

CAUTION
Always disconnect the circuit being tested. Failure to do this can damage the multimeter.

4-13. TESTING FOR CONTINUITY.

A. Connect meter probes to both terminals of the circuit being tested.

B. Watch needle movement.

1. The circuit has continuity if the needle swings to the far right, over the 0 on the top scale.

2. The circuit is open (broken) if the needle doesn't move.

3. There is a loose connection in the circuit being tested if the needle jumps or flickers.

C. Replace or repair the circuit if you see "2" or "3" above.

4-14. TESTING FOR SHORT CIRCUITS.

A. Connect one probe to one circuit and the other probe to the other circuit, or ground.

B. Watch needle movement.

1. The circuits are short circuited if the needle swings to the far right over the 0 on the top scale.

2. The circuits are intermittently short circuited if the needle jumps or flickers.

3. The circuits are not short circuited if the needle doesn't move.

C. Replace or repair the circuit if you see "1" or "2", above.

Section V. MANUAL STARTER MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

Disassembly/assembly of the starter rewind

INITIAL SETUP

Personnel Required

1

General Safety Instructions

Safety glasses must be worn during this task because of tension in rewind spring.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Disassembly/assembly of starter rewind	Para 4-15	
2	Cleaning and inspection	Para 4-15	

4-15. MANUAL STARTER DISASSEMBLY/CLEANING/INSPECTION/REASSEMBLY

This task covers:

Disassembly/cleaning/inspection/reassembly of manual starter .

INITIAL SETUP :

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705
T4 Rope starter - 378774
T5 Spring winder - 392093

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
180

LOCATION/ITEM	ACTION	REMARKS

WARNING

Safety glasses must be worn during this procedure because of danger to eyes from the rewind spring.

DISASSEMBLY

1.	Starter	Remove.	See para 3-9.
2.	Screw (1)	Remove.	
3.	Pawl (2) and retainer (3)	Remove.	
4.	Starter rope (4)	Pull to end of travel and tie a slip knot 1 foot from end.	
5.	Starter rope (4)	Release slowly.	
6.	Rope anchor (5)	Pry out of handle (6).	
7.	Handle (6)	Remove.	
8.	Starter rope (4)	Release knot in rope.	
9.	Starter pulley (7)	Ease back until spring (8) is fully unwound.	
10.	Nut (9)	Remove.	
11.	Capscrew (10) and washer (11)	Remove from spindle (12).	
12.	Bushing (13), friction ring (14), and spring washer (15)	Remove.	
13.	Starter (16)	Turn over, legs down.	Move your fingers out of way and jar starter against bench top. Pulley (7) and spring (8) will dislodge.
14.	Pulley (7)	Lift off.	
15.	Rope (4)	Remove from pulley (7).	If replacing only rope, no further disassembly is required.

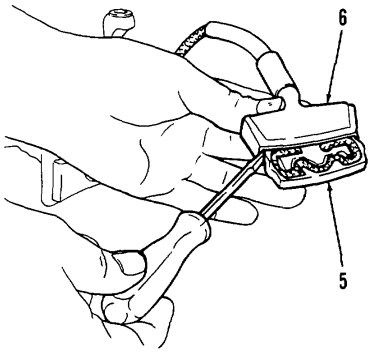
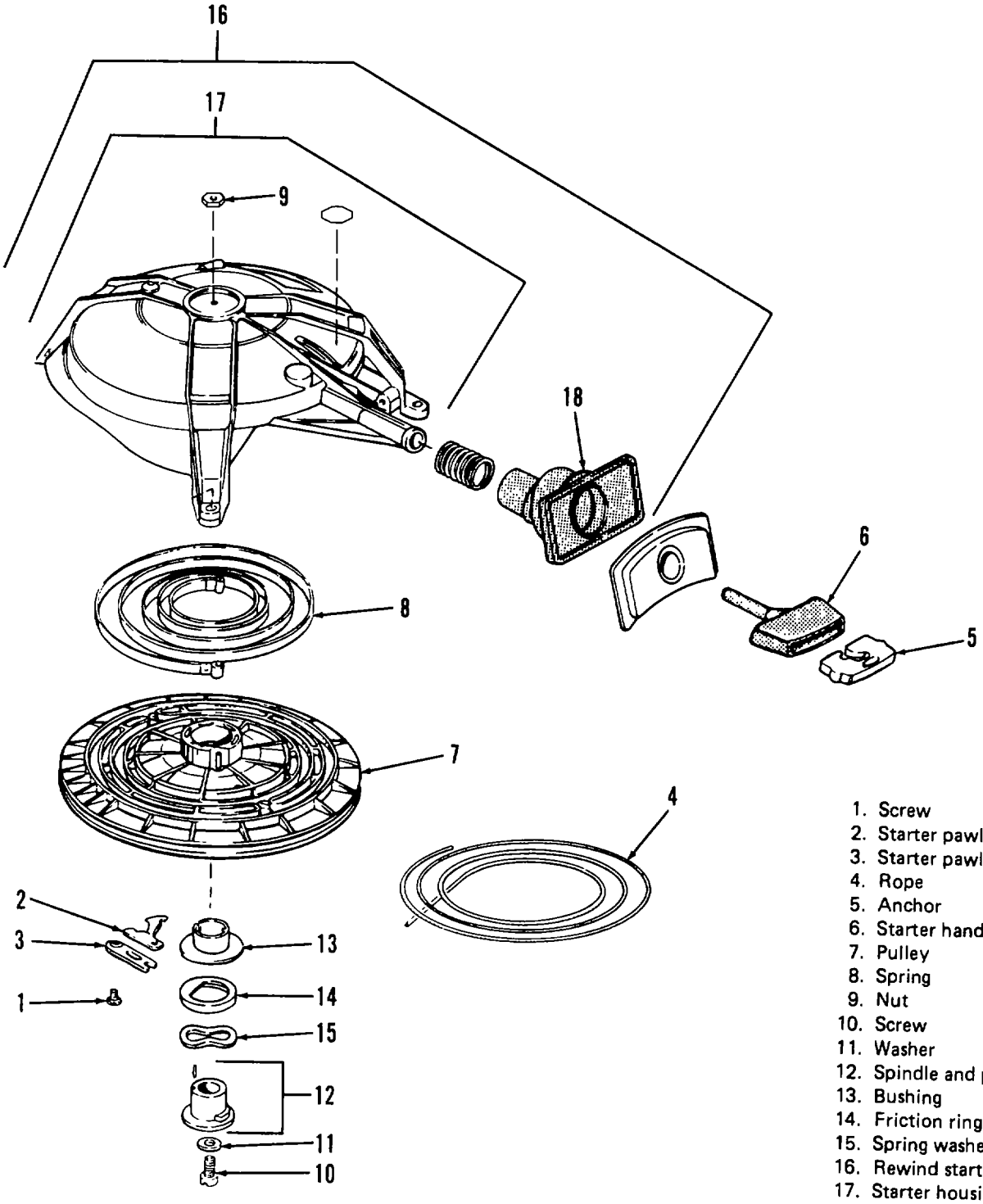


Figure 4-5. Rope anchor

4-15. MANUAL STARTER DISASSEMBLY/CLEANING/INSPECTION/REASSEMBLY - continued



1. Screw
2. Starter pawl
3. Starter pawl retainer
4. Rope
5. Anchor
6. Starter handle
7. Pulley
8. Spring
9. Nut
10. Screw
11. Washer
12. Spindle and pin assembly
13. Bushing
14. Friction ring
15. Spring washer
16. Rewind starter assembly
17. Starter housing
18. Grommet

Figure 4-6. Starter rewind assembly

LOCATION/ITEM	ACTION	REMARKS

4-15. MANUAL STARTER DISASSEMBLY/CLEANING/INSPECTION/REASSEMBLY - continued

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or nonporous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death.

CLEANING AND INSPECTION			
1.	Components	Wash in solvent and dry with lint-free rags.	
2.	Spring (8)	Inspect for broken end loops and weak tension.	
3.	Pawl (2)	Check for wear.	
4.	Rope (4)	Replace if frayed.	
5.	Pulley (7) and housing (17)	Examine for sharp edges and rough surfaces.	File and polish smooth.
6.	Components	Replace any components that are worn or broken.	
REASSEMBLY			
1.	Spring winder (392093)	Position base tightly in vise.	

LOCATION/ITEM	ACTION	REMARKS

4-15. MANUAL STARTER DISASSEMBLY/INSPECTION/CLEANING/ASSEMBLY - continued

2. Cup	Place inside spring winder base.	
3. Spring (8)	Place spring as shown with inside loop in cup.	
4. Crank	Place on winder engaging crank pin in inside loop of spring.	
5. Bolt	Install in spring winder as shown.	
6. Crank	Wind clockwise until all of spring except outside loop is inside cup.	
7. Bolt	Remove.	
8. Crank	Lift off carefully without dislodging spring.	
9. Cup and spring (8)	Lift out of spring winder holding spring in place.	
10. Cup and spring (8)	Place open side down over spring opening in starter housing. Locate outside loop directly over pin in housing and engage slightly onto pin.	
11. Spring (8)	Press into housing through two openings in cup.	
12. Cup	Remove.	
13. Pulley (7)	Install in housing engaging pin with inside loop of spring.	

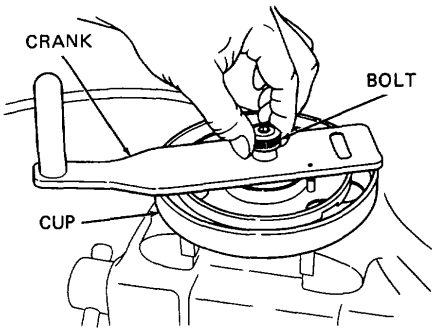


Figure 4-7. Spring winder

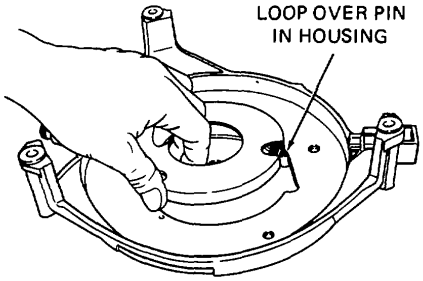


Figure 4-8. Spring cup

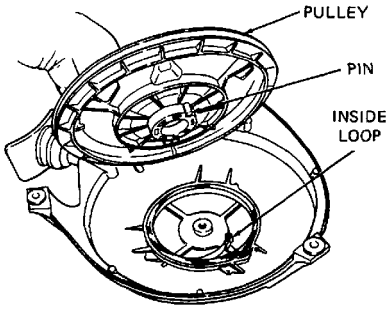


Figure 4-9. Pulley and housing

LOCATION/ITEM	ACTION	REMARKS

4-15. MANUAL STARTER DISASSEMBLY/CLEANING/I NSPECTION/R EASSEMBLY - continued

	NOTE **Lubricate spindle with GAA grease before installation.** **CAUTION** **Be sure cup side of friction ring (14) faces flange on spindle (12). Flat side of friction ring must aline with flat on spindle. Ribs in bushing (13) must engage corresponding slots in spindle** .	
14. Spindle (12)	Assemble with spring washer (15), friction ring (14), and spindle bushing (13).	
15. Spindle assembly	Insert into pulley (7). **NOTE** **Pulley may have to be moved slightly so spindle can drop over boss in housing.**	
16. Screw (10) and washer (11)	Install in spindle (12).	
17. Nut (9)	Install.	After installing nut, be sure pulley does not bind.
18. Grommet (18)	Install in starter housing (17).	
19. Pulley (7)	Turn counterclockwise until tight then back off until rope knot recess in pulley alines with rope opening in housing. Place punch in hole in pulley to hold assembly in position. Punch will engage rib in housing and hold pulley in place. Do not jar assembly.	
20. New rope	Cut a length 6 feet (1.84 meters) of NSN-4020-01-011-0665 and fuse at each end with a flame. **NOTE** **Ends of rope must be fused to a length of 1/2 inch (13mm).**	

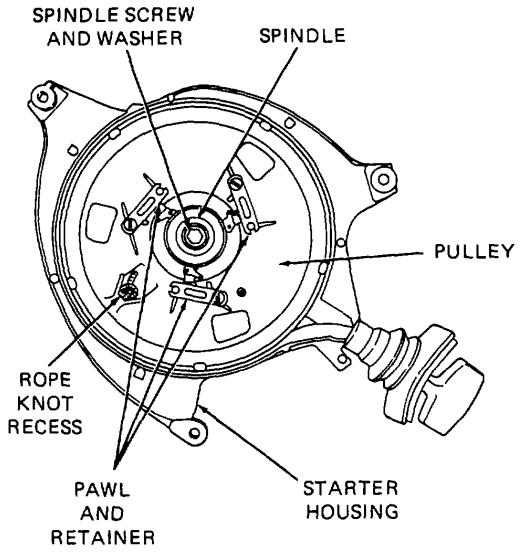


Figure 4-10. View of assembled starter

LOCATION/ITEM	ACTION	REMARKS

4-15. MANUAL STARTER DISASSEMBLY/CLEANING/INSPECTION/REASSEMBLY -continued

21. Rope (4)	Tie knot in one end of rope. Thread other end of rope into pulley and out housing opening through grommet (18). Tie slip knot in rope near grommet end. Hold rope, remove punch and ease rope in until knot contacts grommet.	
22. Rope (4)	Thread through grommet and handle (6).	Use starter rope threading tool, 378774.
23. Rope (4)	Insert in channel in rope anchor (5).	
24. Rope anchor (5)	Insert in handle (6.	
25. Rope (4)	Remove knot.	
26. Starter pawl (2) and retainer (3)	Place in position on pulley.	
27. Capscrew (1)	Install.	
28. Pawl (2)	Check operation.	Pawl should extend when rope is pulled out and retract when rope is released.

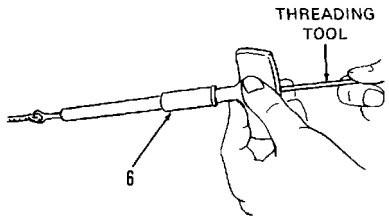


Figure 4-11. Threading the handle

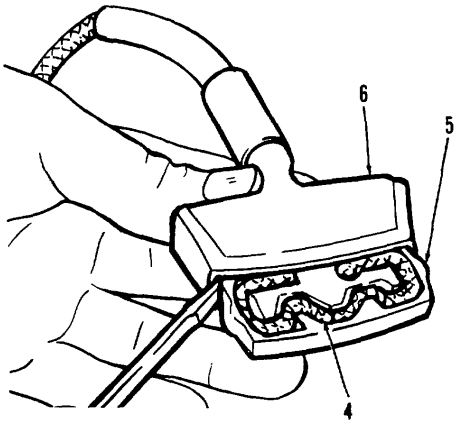


Figure 4-12. View of rope anchor

LOCATION/ITEM	ACTION	REMARKS
4-15. MANUAL STARTER DISASSEMBLY/CLEAING/INSPECTION/REASSEMBLY- continued		
29. Starter	Install on powerhead.	See para 3-9.
30. Starter	Operate a few times and then check timing marks. **NOTE** **When starter is properly timed an arrow on the housing will aline within the limits of a box marked on the pulley.** **NOTE** **A new rope, because it is stiff, may cause timing marks to misaline slightly. This condition will normally be corrected by using the starter a few times.**	

Section VI. ARMATURE PLATE MAINTENANCE (MAGNETO ASSEMBLY)

MAINTENANCE SUMMARY. This task covers:

a. Removal/disassembly/assembly/installation of armature plate (magneto assembly).
b. Removal/installation of flywheel.

INITIAL SETUP

Personnel Required
1

General Safety Instructions

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Armature plate removal/ disassembly/assembly and installation	Para 4-16	There is no need to remove armature plate unless you are replacing leads or other components. Breaker points, condensers, and coils can be checked and replaced without removal of armature plate. (See para 4-18, 19, 20.)
2	Flywheel removal/installation	Para 4-17	

4-16. ARMATURE PLATE REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION

This task covers:

Removal/disassembly/assembly/installation of armature plate

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
160

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Starter	Remove.	See para 3-9.
2. Spark plug leads	Remove.	See para 3-10.
3. Flywheel	Remove.	See para 4-17.
4. Armature plate leads	Tag and disconnect by disconnecting the packard connector (1).	Lift up on tabs and slide connector apart.
5. Ground wire (2)	Tag and disconnect from by pass cover screw (3).	
6. Screw (4) clamping leads to arm on support plate (5)	Remove.	
7. Spring connecting cam and link assembly to control lever	Remove.	
	NOTE Don't lose washer and sleeve on control lever pin.	

4-16. ARMATURE PLATE REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

1. Connector housing
2. Ground lead
3. Screw
4. Screw
5. Support plate
6. Ignition coil assembly
7. Screw, philips head
8. Armature plate
9. Retainer plate
10. Armature plate assembly
11. Support screw
12. Bearing
13. Coil and lamination
14. Condenser
15. Breaker assembly
16. Wick

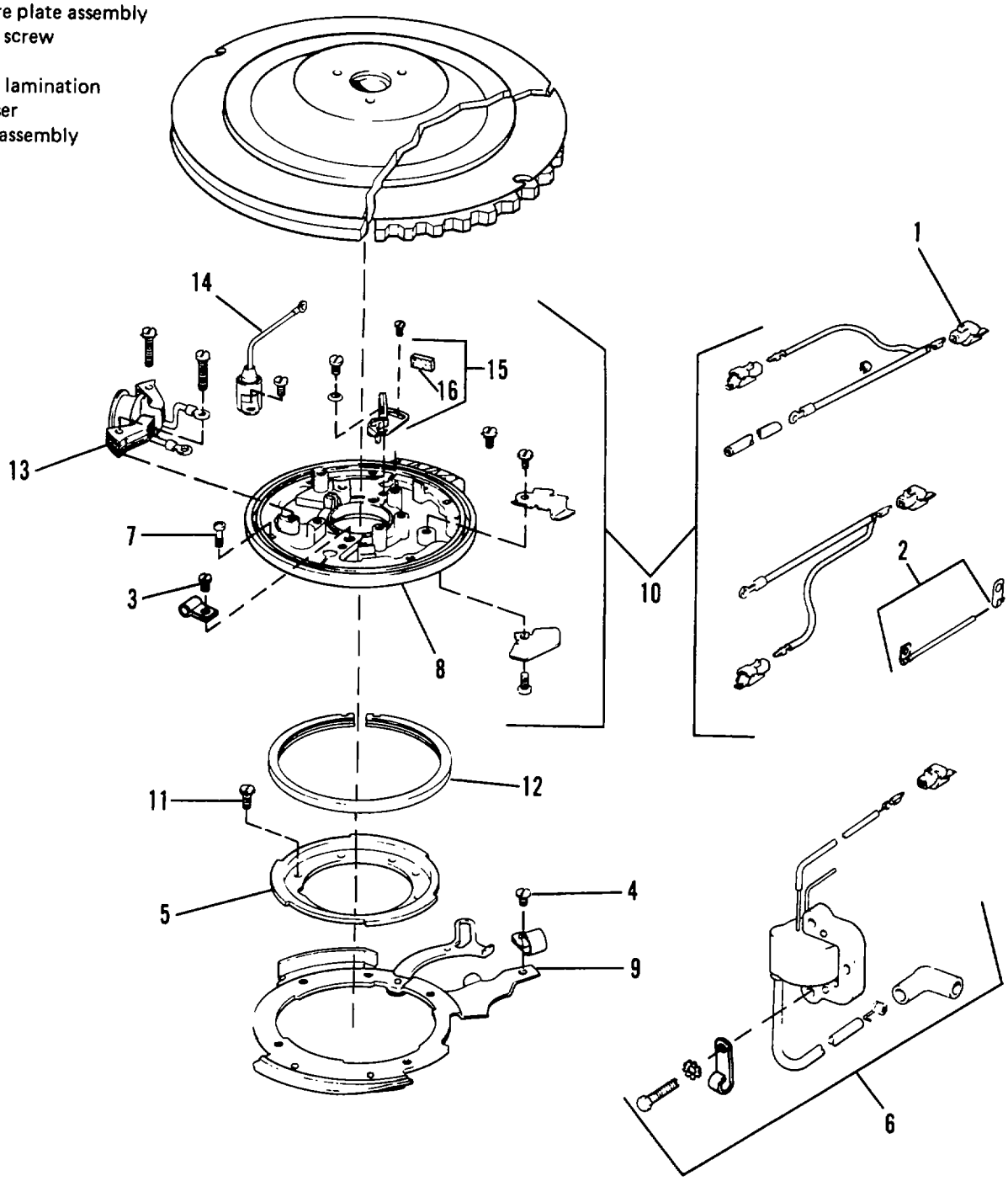


Figure 4-13. Armature plate

LOCATION/ITEM	ACTION	REMARKS
4-16. ARMATURE PLATE REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued		
DISASSEMBLY		
1. Ignition coils (6)	Remove.	
	NOTE **Ignition coils and leads are removed as an assembly.**	
2. Five screws (7) attaching armature plate (8) to retainer plate (9)	Remove.	
3. Armature plate assembly (10)	Remove.	
4. Four screws (11) holding retainer plate (9) to support plate (5)	Remove.	
5. Support plate and retainer	Remove.	
6. Bearing (12) (9).	Remove from retainer plate	
7. Coil and laminations (13)	Remove from armature plate (10).	
8. Condenser (14)	Remove.	
9. Breaker assembly (15)	Remove.	
10. Oiler wick (16)	Replace.	Oiler wick must be replaced with new wick.
ASSEMBLY		
1. Oiler wick (16)	Install in breaker assembly (15).	
2. Breaker assembly (15)	Install.	
3. Condenser (14)	Install in armature plate.	

LOCATION/ITEM	ACTION	REMARKS
4-16. ARMATURE PLATE REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued		
4. Coil and laminations (13)	Installation on armature plate.	
5. Bearing (12)	Install on retainer plate (9).	Lubricate bearing with GAA grease before installation.
6. Retainer plate (9)	Attach to support plate (5).	
7. Retainer plate (9) and support plate (5)	Attach to crankcase with four screws (11).	Tighten four screws (11) to a torque of 8-10 lb ft (11-14 N.m).
8. Bearing (12)	Place on retainer plate.	
9. Armature plate (8)	Place in position over crankshaft, retainer plate, and bearing.	Be careful not to damage breaker arms.
10. Bearing (12)	Use a needle-nose pliers and compress the bearing.	
11. Armature plate	Locate over bearing.	
12. Armature plate	Aline armature plate holes with holes in support plate.	
13. Screws (7)	Install.	Tighten screws to a torque of 8-10 lb ft (11-14 N.m).
INSTALLATION		
1. Ignition coils (6)	Install.	
2. Spring connecting cam and link assembly to control lever	Install.	

LOCATION/ITEM	ACTION	REMARKS
4-16. ARMATU RE PLATE R EMOVAL/D ISASSEMB LY/ASSEMB LY/INSTALLATION - continued		
3. Screws (4) clamping leads to arm on support plate (5)	Install.	
4. Ground wire (2)	Connect to by-pass cover screw (3).	
5. Armature plate lead	Connect, using packard connectors (1).	
6. Flywheel	Install.	See para 4-17.
7. Spark plug leads	Install.	See para 3-10.
8. Starter	Install.	See para 3-9.
9. Breaker point adjustment	Check.	See para 4-21.

4-17. FLYWHEEL REMOVAL/INSTALLATION

This task covers:

Removal/installation of flywheel.

INITIAL SETUP:

Tools:
Universal puller
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:

As required
Clean, lint free rag

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
45

LOCATION/ITEM	ACTION	REMARKS
	CAUTION **Do not let cleaning solvent wash oil out of breaker point oiler wick.**	
REMOVAL		
1. Starter	Remove. (See para 3-9.)	
	NOTE **Use a strap wrench to hold the flywheel (4) in place.**	
2. Flywheel nut (1)	Remove.	
3. Capscrews (2)	Remove.	
4. Ratchet (3)	Remove.	
	WARNING **You must wear safety glasses when using the hammer. A chip from the hammer could strike an eye.**	

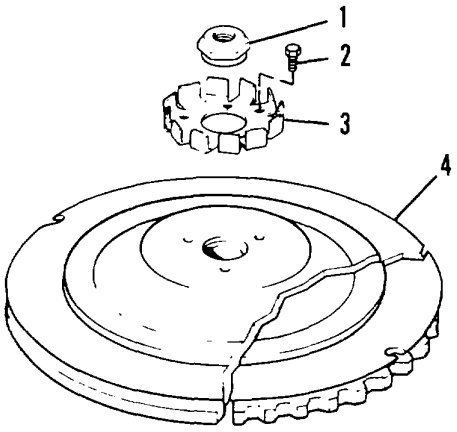


Figure 4-14. Flywheel

LOCATION/ITEM	ACTION	REMARKS
4-17. FLYWHEEL REMOVAL/INSTALLATION - continued		
5. Flywheel (4)	Remove.	
	NOTE **Use a universal puller to remove flywheel. Install capscrews in holes for capscrews (2). Apply tension and pop flywheel loose by hitting center of pressing screw with a brass hammer.**	
	WARNING **Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or nonporous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death.**	
1. Crankshaft and flywheel	Clean tapers.	
2. Ratchet (3)	Install on flywheel with capscrews (2).	
3. Flywheel (4)	Place in position on crankshaft.	
4. Flywheel nut (1)	Install and tighten to torque of 100-105 lb ft (135-140 N.m).	Use strap wrench to hold flywheel in place. Do not let solvent wash oil out of breaker point oiler wick. **CAUTION** **A loose flywheel nut will cause damage to the crankshaft.**

Section VII. IGNITION SYSTEM MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Ignition coil removal/installation

b. Condenser removal/installation

c. Breaker points removal/installation

d. Breaker points adjustment

e. Motor stop (shorting) switch removal/installation.

f. Motor stop switch test

INITIAL SETUP

Personnel Required	General Safety Instructions
1	None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Ignition coil removal/ installation	Para 4-18	Breaker points can become worn or corroded. Questionable breaker assemblies should be replaced.
2	Condenser removal/ installation	Para 4-19	Breaker point contacts must be kept clean from dirt and oil.
3	Breaker points removal/	Para 4-20	Clean breaker points with a strip of heavy paper or clean cloth.
4	Breaker points adjustment	Para 4-21	
5	Motor stop (shorting) switch removal/installation	Para 4-22	
6	Motor stop switch test	Para 4-23	

4-18. IGNITION COILS REMOVAL/INSTALLATION

This task covers:

Removal/installation of ignition coils

INITIAL SETUP:

Tools:
Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
45

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Spark plug cover (1)	Remove from spark plug.	See para 3-10.
2. Lead (2)	Disconnect from connector (3).	
3. Capscrews (4) and washers (5)	Remove.	
4. Coil (6)	Remove.	
INSTALLATION		
1. Coil (6)	Place in position.	
2. Capscrews (4) and washers (5)	Install.	
3. Lead (2)	Connect to connector (3).	
4. Spark plug cover (1)	Install.	See para 3-10.

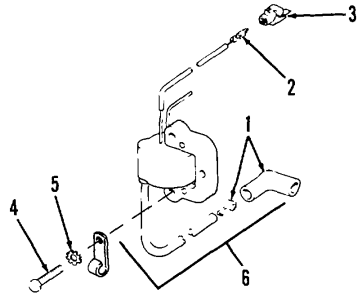


Figure 4-15. Ignition coil

4-19. CONDENSERS REMOVAL/INSTALLATION

This task covers:

Removal/installation of condensers.

INITIAL SETUP:

Tools:
Universal puller
TI 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
180

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Starter	Remove.	See para 3-9.
2. Flywheel	Remove.	See para 4-17.
3. Capscrew (1) and washer (2)	Remove from lead.	
4. Fastening capscrew (3)	Remove.	
5. Condenser (4)	Remove.	
INSTALLATION		
1. Condenser (4)	Hold in position and install fastening capscrew (3).	
2. Lead	Fasten with capscrew (1) and washer (2).	
3. Flywheel	Install.	See para 4-17.
4. Starter	Install.	See para 3-9.

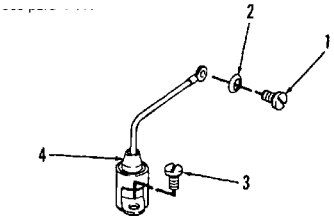


Figure 4-16. Condenser

4-20. BREAKER POINTS REMOVAL/INSTALLATION

This task covers:

Removal/installation of breaker points.

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

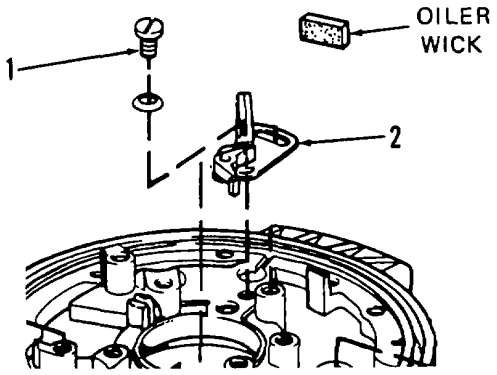
Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
180

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Starter	Remove.	See para 3-9.
2. Flywheel	Remove.	See para 4-17.
3. Fastening capscrew (1)	Remove.	
4. Breaker (2)	Remove.	
	NOTE **If breaker assembly is replaced, oiler wick must be replaced.**	
5. Oiler wick (3)	Remove.	
INSTALLATION		
1. Oiler wick (3)	Install in breaker (2).	
2. Breaker (2)	Place in position.	
3. Fastening capscrew (1)	Install.	
4. Breaker points (3)	Adjust.	See para 4-21.
5. Flywheel	Install.	See para 4-17.
6. Starter	Install.	See para 3-9.



4-21. BREAKER POINT ADJUSTMENT

This task covers:

Adjustment of breaker points.

INITIAL SETUP:

Tools:
Timing light-CD-85
Feeler gage
Timing fixture-386635

Equipment Condition:
per procedure

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
30

LOCATION/ITEM	ACTION	REMARKS
1. Starter	Remove.	See para 3-9.
2. Flywheel	Remove.	See para 4-17.
3. Ignition coils	Remove.	See para 4-18.
4. Breaker point assemblies	Disconnect all leads.	Connect meter or test light between breaker plate and no. 1 breaker point screw terminal.
5. Timing fixture	Place on crankshaft. **NOTE** **Rotate crankshaft only in clockwise direction.**	Rotate crankshaft so side of fixture marked "T" is aligned with first timing mark on armature plate.

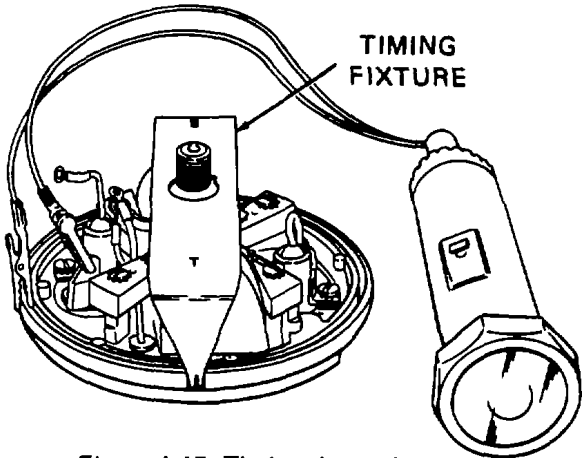


Figure 4-17. Timing the engine

6. Timing fixture	Move slowly until light comes on.	The light will come on at the exact instant the breaker points open. The points should break open when timing fixture is midway between the two timing marks on the armature plate.

LOCATION/ITEM	ACTION	REMARKS
4-21. BREAKER POINT ADJUSTMENT - continued		
6. Timing fixture (cont.)		If timing is not correct aline timing fixture with first mark. Adjust points until light comes on (indicates an open circuit).
		If new breaker point assemblies were installed adjust so that points will open at first timing mark.
7. Timing	Recheck as described in 5 and 6.	
ALTERNATE METHOD		
1. Feeler gage	Use to adjust breaker point gap.	
		Use feeler gage if timing light is not available.
		Set gap to 0.020 in.(0.51mm) with breaker arm rubbing the block on the "set" mark of the cam (full open). If new points are used, set for 0.022 in. (0.56mm) to allow for seating of the fibre breaker block.
2. Crankshaft	Rotate 1800 and set points of second breaker assembly by same method.	

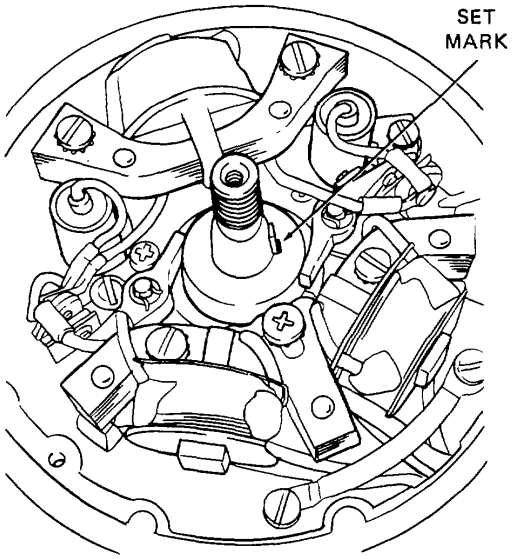


Figure 4-18. Breaker point adjustment

LOCATION/ITEM	ACTION	REMARKS
4-21. BREAKER POINT ADJUSTMENT - continued		
	Finish either of two methods by:	
1. Ignition coils	Install.	See para 4-18.
2. Flywheel	Install.	See para 4-17.
3. Starter	Install.	See para 3-9.
4. Throttle	Check adjustment.	See para 3-17.
5. Engine	Start.	See para 2-8.
6. Timing	Check with timing light.	If the breaker point settings are correct, the flywheel timing mark will line up between the two timing marks on the armature plate. Connect the timing light to each spark plug lead and run motor at low idle for this test.

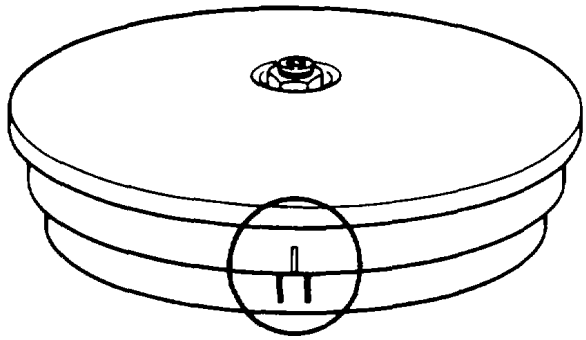


Figure 4-19. Timing marks

4-22. MOTOR STOP (SHORTING) SWITCH REMOVAL/INSTALLATION

This task covers:

Removal/installation of motor stop switch.

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
One Mechanic

Approximate Time Required (minutes):
30

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Connectors (1)	Tag and disconnect.	Depress connector clips and pull out terminals (2).
2. Capscrews and clamp (3)	Remove.	
3. Stop switch (4)	Pull through hole in engine lower cover and remove.	
4. Mounting ring (5)	Remove.	
INSTALLATION		
1. Terminals (2) and wires	Insert through hole and put switch (4) in position.	
2. Mounting ring (5)	Place in position.	
3. Capscrews and clamp (3)	Install on switch (4).	
4. Terminals (2)	Install in proper connectors (1).	

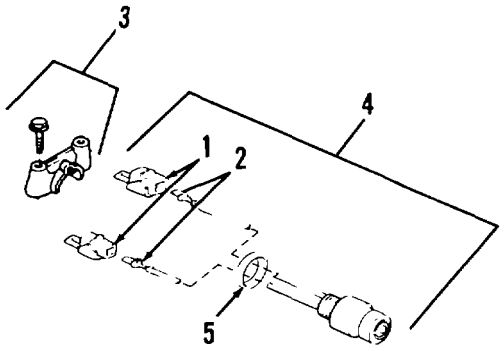


Figure 4-20. Motor stop (shorting) switch

4-23. TEST STOP (SHORTING) SWITCH

This task covers:

Testing the stop switch.

INITIAL SETUP:

Tools:
Multimeter

Equipment Condition:
Motor OFF

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS
1. Multimeter	Set up and zero.	Follow manufacturers' directions on multimeter.
TEST FOR CONTINUITY		
1. Terminals	Disconnect.	See para 4-22.
2. Meter probes	Attach one to each end of wire.	Follow test directions as outlined in para 4-13.
3. Terminals	Replace if necessary.	
TEST FOR SHORT CIRCUIT		
1. Terminals	Disconnect.	See para 4-22.
2. Meter probes	Attach one to one terminal and one to the other terminal.	Follow test directions as outlined in para 4-14. In addition, test switch with button in two positions: a. Depressed. b. Not depressed.
3. Switch	Replace if necessary.	See para 4-22.

Section VIII. FUEL SYSTEM MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Fuel tank inspection

b. Fuel tank pressure test

c. Fuel tank disassembly/assembly

INITIAL SETUP

Personnel Required	General Safety Instructions
1	Do not make or cause sparks while working on any part of the fuel system. Gasoline and fumes are extremely flammable. Carelessness can result in injury to personnel.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Fuel tank inspection	Para 4-24	
2	Fuel tank pressure test	Para 4-24	
3	Fuel tank disassembly/assembly	Para 4-25	
4	Fuel pump removal/installation	Para 4-26	
5	Carburetor inspection/ cleaning. (Needle valve removal, inspection)	Para 4-27	
6	Carburetor removal/installation	Para 4-28	
7	Intake manifold inspection	Para 4-29	

4-24. FUEL TANK INSPECTION/TEST

This task covers:

Fuel tank inspection and pressure testing.

INITIAL SETUP:

Tools:
T11 Pressure tester - S34
T12 Adapter - 389945
Syringe

Equipment Condition:
Fuel tank drained

Materials/Parts:
Tank of water

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
45

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
Fuel tank and hoses	Inspect for leaks.	If leaks are suspected, pressure test tank and hose assembly.
PRESSURE TEST		
1. Fuel cap (1)	Remove.	Disengage cap anchor and completely remove cap from tank.
2. Fuel tank (2)	Empty.	Fuel tank must be emptied completely. Use a syringe to remove the last of the fuel.
	NOTE **If any fuel remains in the tank during testing it could conceal a leak.**	
3. Pressure tester adapter (3)	Attach to fuel tank.	
4. Fuel cap (1)	Install in adapter without anchor.	

LOCATION/ITEM	ACTION	REMARKS
4-24. FUEL TANK INSPECTION/TEST - continued		
5. Pressure tester (4)	Screw into fitting (5) on adapter.	
6. Air release valve (6)	Open.	
	NOTE **Pump pressure tester in short bursts. This will minimize the chance of over-pressurizing. Over-pressurizing will permanently damage the tank.**	
7. Pressure tester (4)	Pump until pressure gage (7) reads 10 psi (69 kPa).	
8. Fuel hose depress ball check valve to expel any remaining fuel.	Hold end in container and	
9. Pressure tester	Pump until air is back up to 10 psi (69 kPa).	
10. Air release valve (6)	Close.	
11. Pressure tester	Remove.	
12. Fuel tank check for air leaks.	Submerge in water and	Check all areas of tank carefully.
	NOTE **Any air bubbles indicate a leak point and the tank must be replaced.**	
13. Fuel hose	Disconnect from tank.	
14. Fuel connector assembly	Submerge in water and check for leaks.	If assembly leaks, replace it. (See para 4-25.)
15. Release valve (6)	Open and relieve pressure in tank.	

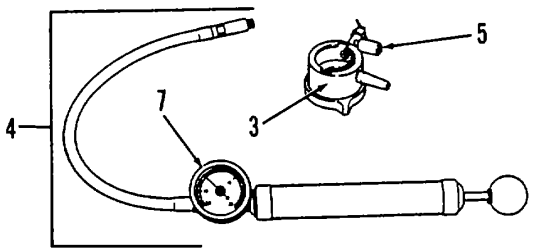


Figure 4-21. S34 pressure tester

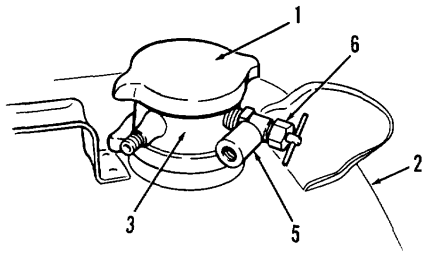


Figure 4-22. Pressure tester adapter

4-25. FUEL TANK DISASSEMBLY/ASSEMBLY

This task covers:

Disassembly/assembly of fuel tanks and fuel line.

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Fuel tank drained

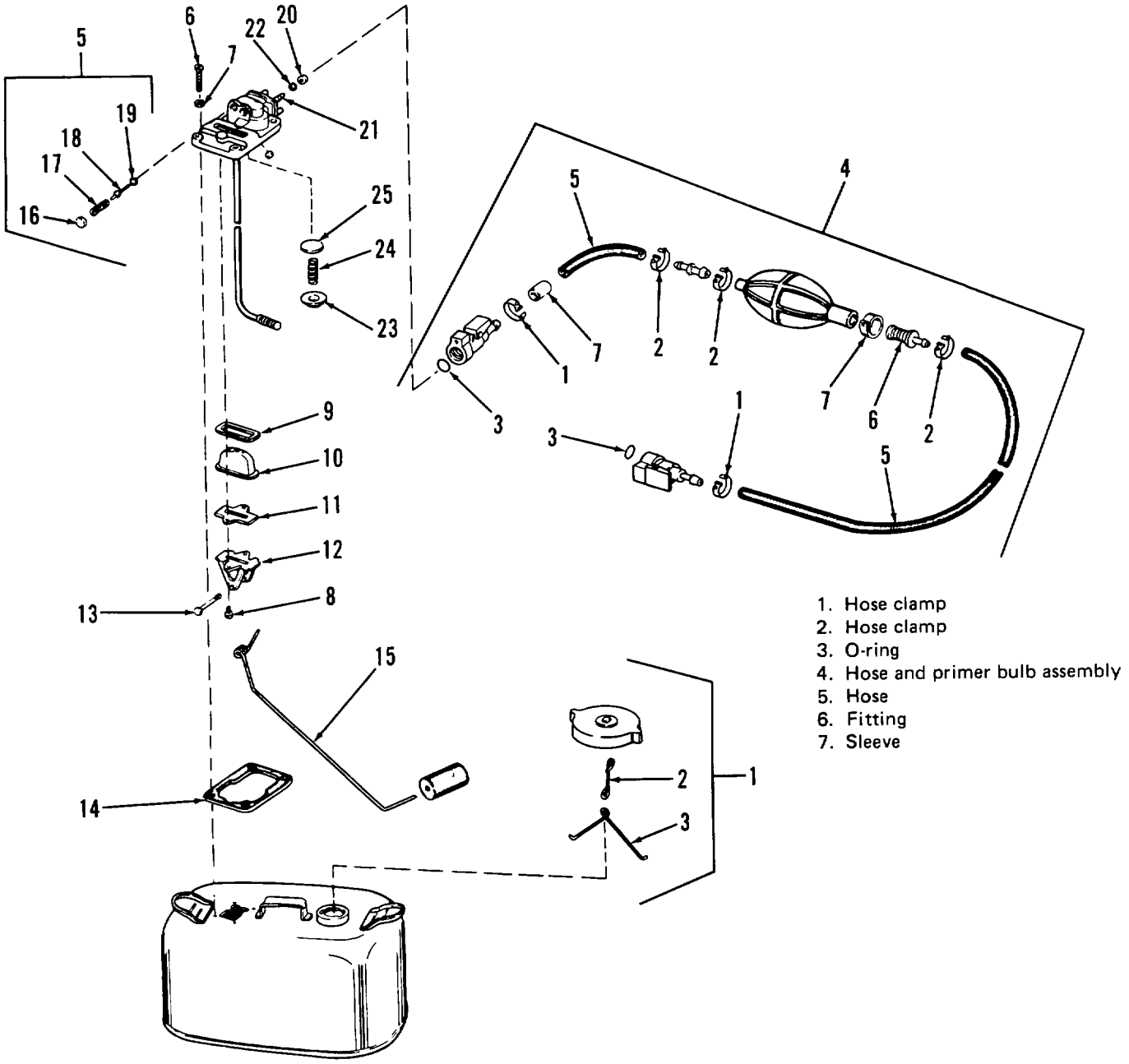
Materials/Parts:
Gasket - 310984
Seal - 312192
Gasket - 312193

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
120

LOCATION/ITEM	ACTION	REMARKS
DISASSEMBLY		
1. Fuel cap (1)	Remove.	
2. Anchor link (2) and anchor (3)	Remove from fuel cap.	
3. Fuel hose (4).	Disconnect from housing and fuel line assembly (5).	
4. Capscrews (6) and washers (7)	Remove.	
5. Fuel line housing (5)	Lift out of tank.	
6. Capscrews (8)	Remove from indicator support.	
7. Fuel tank indicator assembly	Remove from housing (5).	
8. Seal (9), lens (10) gasket (11) and support (12)	Will come apart.	
9. Pin (13)	Remove from support (12).	
10. Indicator (15)	Remove from support (12).	
11. Core plugs (16)	Remove.	
12. Valve springs (17), release valves (18), and valve seat O-rings (19)	Will slide out of housing (5).	

4-25. FUEL TANK DISASSEMBLY/ASSEMBLY - continued



1. Fuel tank cap assembly
2. Link
3. Anchor
4. Hose and primer bulb assembly
5. Upper housing and fuel assembly
6. Screw
7. Washer
8. Screw
9. Seal
10. Lens
11. Gasket
12. Support, indicator
13. Pin
14. Gasket
15. Indicator
16. Plug
17. Spring
18. Release valve
19. O-ring
20. Retainer
21. Guide pin
22. O-ring
23. Retainer
24. Spring
25. Disc valve

Figure 4-23. Fuel tank and fuel lines

LOCATION/ITEM	ACTION	REMARKS
4-25. FUEL TANK DISASSEMBLY/ASSEMBLY - continued		
13. Retainer (20)	Slip off guide pin (21).	
14. O-ring (22)	Remove.	
15. Retainer (23)	Remove.	
16. Disc valve spring (24) and disc valve (25)	Will come out of housing (5).	
DISASSEMBLY OF HOSE AND PRIMER BULB ASSEMBLY		
1. Hose clamps (1)	Remove.	
2. Hose clamp (2)	Remove.	
3. O-rings (3)	Remove.	
4. Hoses (5) and (6)	Slip off nipples.	Don't lose sleeve (7) to inlet fitting.
ASSEMBLY OF HOSE AND PRIMER BULB ASSEMBLY		
1. Hoses (5) and (6)	Slip over nipples of fittings.	Put sleeve (7) over inlet fitting before putting on hose.
2. O-rings (3)	Install.	
3. Hose clamp (2)	Install over primer bulb stem and outlet valve (6).	Hose is cut to desired length, from roll of bulb hose.
4. Hose clamps (1)	Use to clamp hoses (4) and (5) to nipples of fittings.	

LOCATION/ITEM	ACTION	REMARKS
4-25. FUEL TANK DISASSEMBLY/ASSEMBLY - continued		
ASSEMBLY OF FUEL TANK		
1. Disc valve (25) and spring (24)	Insert into housing (4) and secure with retainer (15).	
2. O-ring (22)	Slip over guide pin (21).	
3. Retainer (20)	Use to secure O-ring (9) on guide pin (21).	
4. Valve seat O-rings (19), release valves (18) and valve springs (17)	Slide into housing (5) and secure with core plugs (16).	
5. Indicator (15)	Place in position in support (12).	
6. Pin (13)	Install in support and indicator assembly.	
7. Gasket (11) lens (10) and seal (9)	Position on support (5).	
8. Indicator assembly	Secure to housing with capscrews (8).	
9. Gasket (11)	Position on fuel tank.	
10. Fuel line housing (5)	Position on gasket (14) and secure to fuel tank with capscrew (6) and washers (7).	

4-26. FUEL PUMP REMOVAL/INSTALLATION

This task covers:

Removal/installation of fuel pump

INITIAL SETUP:

Tools:
T6 Tie strap wrench - 325043
T1 5180-00-177-7033

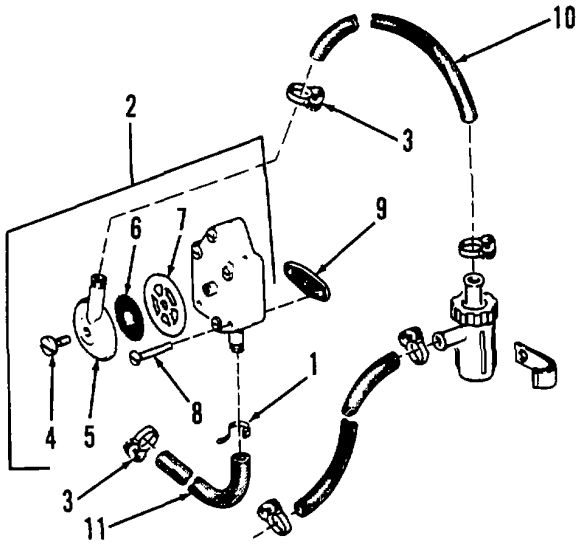
Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
30

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Tie strap (1)	Remove from pump (2) outlet.	
2. Clamp strap (3)	Remove from pump inlet.	
3. Capscrew (4)	Remove.	
4. Filter cap (5), screen (6) gasket (7)	Remove from pump.	
5. Capscrews (8)	Remove from pump.	
6. Pump and gasket (9)	Remove.	
INSTALLATION		
1. Pump	Position on crankcase with gasket (9)	
2. Capscrews (8)	Install. Tighten to a torque of 24-36 in.lb. (2.84.0 N m).	



1. Tie strap
2. Fuel pump assembly
3. Clamp strap
4. Capscrew
5. Filter cap
6. Filter screen
7. Gasket
8. Screw
9. Gasket
10. Hose
11. Hose

Figure 4-24. Fuel pump

LOCATION/ITEM	ACTION	REMARKS
4-26. FUEL PUMP REMOVAL/INSTALLATION - continued		
	NOTE **Install a new filter screen element and gaskets when replacing fuel pump.**	
3. Gasket (7) screen (6) and filter cap (5)	Position on pump.	
4. Capscrew (4)	Install.	
5. Clamp strap (3) pump inlet.	Install on hose (10) and	
6. Tie strap (1)	Install on hose (11) and pump outlet.	

4-27. CARBURETOR MAINTENANCE

This task covers:

a. Carburetor inspection and cleaning

b. This procedure includes needle valve inspection and replacement

INITIAL SETUP:

Tools:
Flat end center punch
T1 5180-00-177-7033
T2 4910-00-754-0705
T6 325043

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Equipment Condition:
Motor OFF

Approximate Time Required (minutes):
60

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
1. Gasket (1)	Check for leaks. Replace if necessary.	
2. Core plugs (2) and (3)	Check for leaks. If leaks are found: a. A smart tap with a hammer and a flat end center punch in the center of the core plug will usually stop leaks. b. If leaks persist, drill a hole in core plug (no more than 0.059 in. (1.5mm) below surface) and pry out.	
CORE PLUG REPLACEMENT		
1. Casting opening	Inspect for damage.	Replace carburetor if damaged. (See para 4-28.)
2. Adhesive	Apply to edge of core plug (2) and (3).	

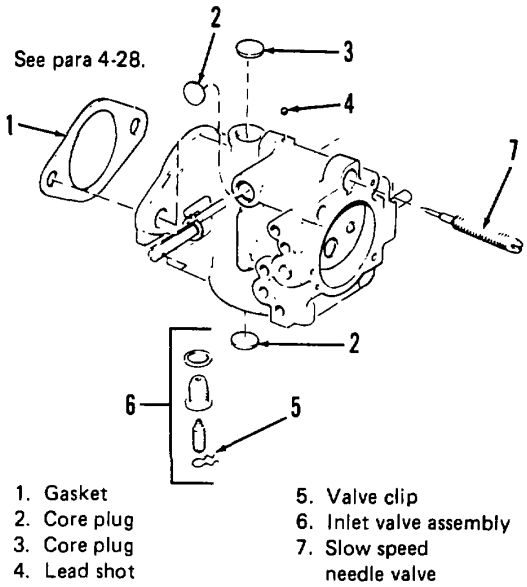


Figure 4-25. Carburetor and needle valves

LOCATION/ITEM	ACTION	REMARKS
4-27. CARBURETOR MAINTENANCE -continued		
3. Core plug (2), (3)	Place in casting opening with convex side up.	
4. Core plug	Use a hammer and a flat end center punch to rap into position.	Check for leakage after carburetor is installed. (See para 4-10.)
LEAD SHOT REPLACEMENT		
1. Lead shot (4)	Check for leaks.	Usually a sharp rap with a flat end center punch and a hammer will stop the leak.
2. Lead shot (4)	Pry out with sharp tool.	
3. Lead shot (4)	Place new lead shot in hole and rap into place with a flat end center punch and hammer.	
NEEDLE VALVES		
1. Inlet needle valve clip (5)	Remove.	
2. Inlet needle valve (6)	Remove.	Check for grooves, nicks or scratches. Replace if necessary.
3. Inlet needle valve seat	Inspect with magnifying glass.	Check for nicks, grooves or scratches. Turn out of casing and replace if necessary.
4. Slow speed needle valve (7)	Turn out of casing.	Inspect for nicks, grooves, scratches, and off-centered condition. Replace if necessary.

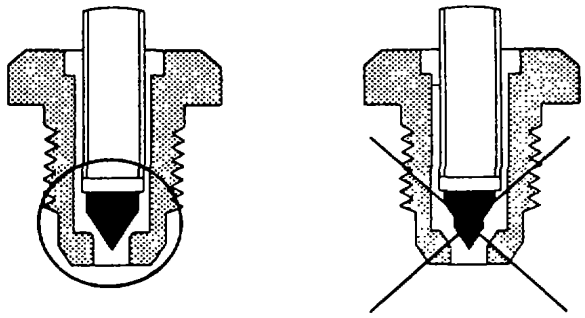


Figure 4-26. Inlet needle valve and seat

LOCATION/ITEM	ACTION	REMARKS
4-27. CARBURETOR MAINTENANCE - continued		

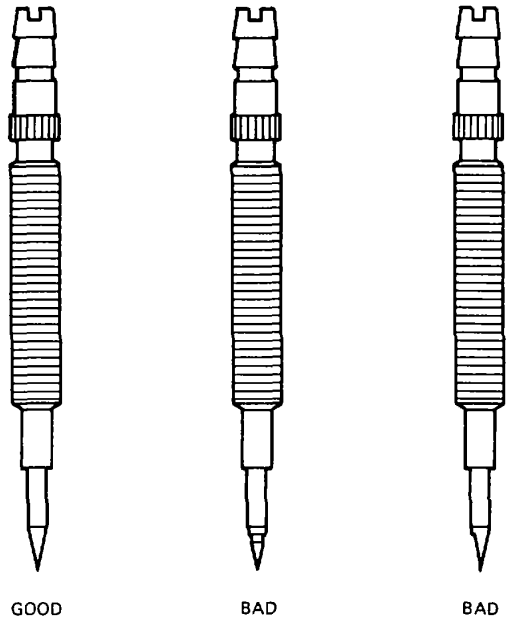


Figure 4-27. Slow speed needle valve

4-28. CARBURETOR REMOVAL/INSTALLATION

This task covers:

Removal/installation of carburetor

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705
T6 325043

Equipment Condition:
Motor OFF

Materials/Parts:
Gasket - 325092

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
45

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Screw (1)	Back off until loose.	
2. Choke arm (2)	Slide off shaft.	
3. Tie down on inlet hose	Remove.	
4. Inlet hose	Slide off carburetor inlet.	
5. Nuts (3) and lockwashers (4)	Remove.	
6. Carburetor and gasket (5)	Remove.	Replace gasket. Inspect flanges for nicks and cuts. Finish with fine emery cloth (120 and then 180 grit) if necessary.
INSTALLATION		
1. Carburetor and gasket (5)	Place in position.	
2. Nuts (3) and lockwashers (4)	Install.	
3. Inlet hose	Install on carburetor inlet and secure with tiedown.	
4. Choke arm (2)	Slide onto shaft and secure with capscrew (1).	
5. Motor	Start.	See para 2-8.
6. Carburetor	Adjust.	See para 3-17.
		Inspect carburetor for leaks.

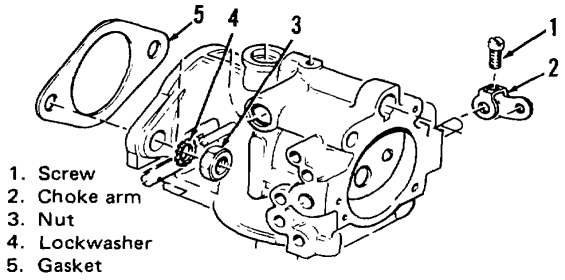


Figure 4-28. Carburetor

4-29. INTAKE MANIFOLD INSPECTION

This task covers:

Inspection of intake manifold

INITIAL SETUP:

Tools:

Equipment Condition:

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
5

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
1. Gaskets (1) and (2)	Inspect for leaks.	If you find any evidence of leakage, notify direct support maintenance to replace gaskets.
2. Manifold (3)	Inspect for cracks or damage.	If you see any signs of damage, notify direct support to replace manifold.

1. Gasket
2. Gasket
3. Manifold

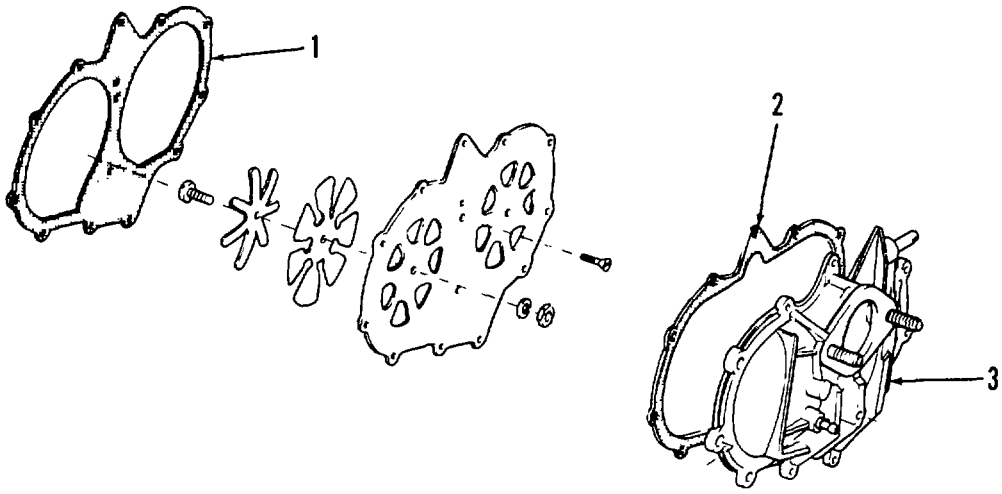


Figure 4-29. Intake manifold

Section IX. ENGINE MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Cylinder and crankcase inspection

b. Cylinder head inspection

INITIAL SETUP

Personnel Required	General Safety Instructions
1	Keep hands, hair, and clothing away from starter, flywheel, and air intake.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Cylinder and crankcase inspection	Para 4-30	
2	Cylinder head inspection	Para 4-30	

4-30. CYLINDERS, CYLINDER HEADS, AND CRANKCASE INSPECTION

This task covers:

Inspection of cylinders, cylinder heads and crankcase.

INITIAL SETUP:

Tools:
Flashlight

Equipment Condition:
Engine running

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
10

LOCATION/ITEM	ACTION	REMARKS
	WARNING **During the course of this inspection it will be necessary for you to remove the engine cover. Keep hands, hair and clothing away from flywheel, starter, and air intake.**	
Engine	While engine is running, inspect for leaks around the head gaskets and crankcase gaskets.	A flashlight can help by illuminating puffs of smoke. If you detect any leaks, notify direct support.

Section X. LOWER UNIT MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Steering handle/throttle shaft removal/installation
b. Steering bracket inspection
c. Stern bracket removal/installation
d. Shift lever adjustment
e. Shift lever removal/installation

INITIAL SETUP

Personnel Required	General Safety Instructions
1	

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Steering handle/throttle removal/installation.	Para 4-31	
2	Steering bracket inspection	Para 4-32	
3	Stern bracket removal/installation	Para 4-33	
4	Shift lever removal/installation	Para 4-34	
5	Shift lever adjustment	Para 4-35	

4-31. STEERING HANDLE REMOVAL/INSTALLATION

This task covers:

Removal/installation of steering handle and throttle shaft.

INITIAL SETUP

Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Cotter pin (1)		
2. Nut (2)	Loosen.	
	NOTE **Capscrew (3) is threaded into steering bracket (4).**	
3. Capscrew (3)	Turn out of handle (5), steering bracket (4) and nut (2).	
4. Spring washer (6) and washer (7)	Remove with capscrew (2).	
5. Handle (5) and throttle shaft	Remove as an assembly.	
INSTALLATION		
1. Handle (5) and throttle shaft	Position on steering bracket (4).	Position throttle shaft gears by alining the long space in each gear with the long tooth in each gear.
2. Washer (7) and spring washer (6)	Place on capscrew (3) as shown.	
3. Nut (2)	Place in position in steering handle.	
4. Capscrew (3) (4), steering handle (5) and nut (2).	Turn into steering bracket	Tighten capscrew (3) and nut (2) until friction is enough to hold handle in any position.
5. Cotter pin (1)	Install.	

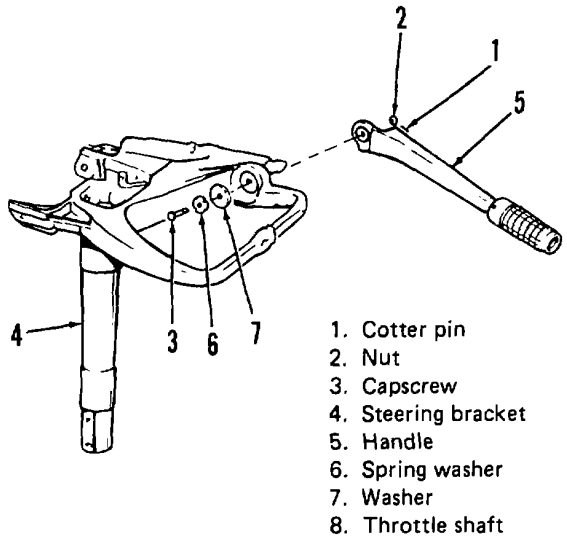


Figure 4-30. Steering handle

4-32. STEERING BRACKET INSPECTION

This task covers:

Inspecting steering bracket

INITIAL SETUP:

Tools:

Equipment Condition:
Motor OFF

Materials/Parts:

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
5

LOCATION/ITEM	ACTION	REMARKS
INSPECTION		
Steering bracket	Inspect for cracks, breaks and worn or missing rubber mounts.	Notify direct support to replace or repair as necessary.

4-33. STERN BRACKETS REMOVAL/INSTALLATION

This task covers:

Removal/installation of stern brackets

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

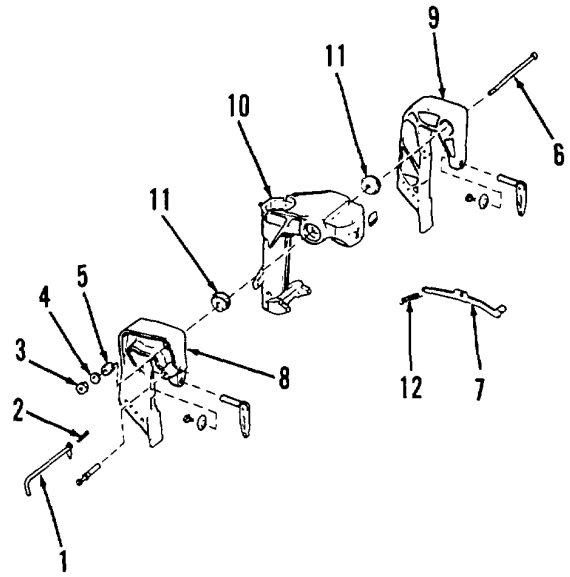
Equipment Condition:
Motor tilted up on aft handles

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
45

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Thrust rod (1) and retainer	Remove with spring (2).	
2. Nut (3), washer (4) and spring (5)	Remove.	
3. Tilting shaft bolt (6) spring and reverse lock arm (7).	Slide out of stern brackets (8) and (9).	
4. Stern brackets (8) and (9)	Will come off swivel bracket assembly (10).	
5. Conical Tilting shaft washers (11)	Remove.	
INSTALLATION		
1. Conical tilting shaft washers (11)	Install in swivel bracket assembly (10).	
2. Stern bracket (9) assembly (10).	Position on swivel bracket	



1. Thrust rod
2. Spring
3. Nut
4. Washer
5. Spring
6. Tilting shaft bolt
7. Reverse lock arm
8. Stern bracket
9. Stern bracket
10. Swivel bracket assembly
11. Conical washer
12. Spring

Figure 4-31. Stern brackets

LOCATION/ITEM	ACTION	REMARKS
4-33. STERN BRACKETS REMOVAL/INSTALLATION -continued		
3. Tilting shaft bolt (6)	Insert through stern bracket (9) with spring (12) and reverse lock arm (7) and swivel bracket assembly.	
4. Stern bracket (8)	Position over tilting shaft bolt (6) and swivel bracket assembly (10).	
5. Spring (5), washer (4)	Secure to tilt shaft bolt with nut (3).	
6. Thrust rod and retainer (1)	Install with spring (2).	See para 2-7 for tilt adjustment.

4-34. SHIFT LEVER REMOVAL/INSTALLATION

This task covers:
Shift lever removal/installation

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

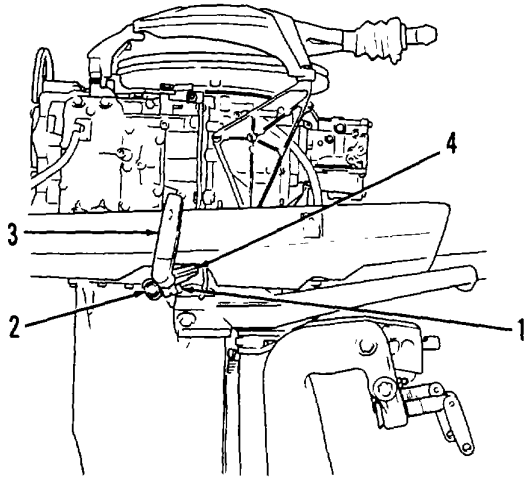
Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
30

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Clamp screw (1)	Remove.	
2. Adjustment screw (2)	Remove.	
3. Shift lever (3)	Remove.	
	NOTE	
	If shift bracket and shaft (4) must be replaced notify direct support maintenance.	
INSTALLATION		
1. Shift lever (3)	Position on shaft (4).	
2. Adjustment screw (2)	Install but do not tighten completely.	
3. Clamp screw (1)	Install but do not tighten completely.	
4. Shift lever (1)	Adjust. (See shift lever adjustment, para 4-35.)	



1. Clamp screw
2. Adjustment screw
3. Shift lever
4. Shaft

Figure 4-32. Motor - starboard view

4-35. SHIFT LEVER ADJUSTMENT

This task covers:

Adjusting shift lever

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Follow procedure

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS
	WARNING	
ADJUSTMENT	**Remove spark plug leads before performing this procedure (see para 3-10).**	
1. Shift lever (1)	Place in neutral position.	
2. Roller on shift lever	Should be centered on neutral detent of shifter lock lever.	After placing shift lever in neutral, propeller should turn freely.
3. Shift lever (1)	Shift into forward gear.	You should feel a slight drag when turning propeller back and forth. This indicates full engagement between clutch dog and forward gear.
4. Shift lever	Shift into neutral if you don't feel drag.	Propeller should turn freely.
5. Shifter lever clamp (2)	Loosen.	
6. Adjustment screw (3)	Loosen.	
7. Shift lever (1)	Move into neutral detent on shifter lock lever.	

LOCATION/ITEM	ACTION	REMARKS

4-35. SHIFT LEVER ADJUSTMENT - Continued

8. Clamp screw (2) and adjustment screw (3)	Tighten.	
9. Shift lever (1)	Move to forward gear and feel for drag as in step no. 3.	
10. Shift lever (1)	If you do not feel drag: a. Loosen screws (3) and (2). b. Adjust shift lever slightly toward reverse position. c. Tighten screws. d. Again check for drag. **NOTE** **Repeat as many times as necessary. This slight drag in forward gear ensures that shifter dog and gear are correctly engaged.**	

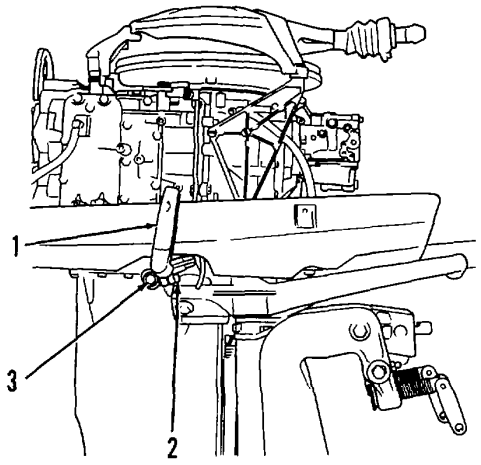


Figure 4-33. Motor - starboard view

Section XI. COOLING SYSTEM MAINTENANCE

MAINTENANCE SUMMARY. This task covers:

a. Water pump removal/disassembly/assembly/installation
b. Water intake screen service
c. Engine temperature test

INITIAL SETUP

Personnel Required	General Safety Instructions
1	

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Water pump removal/disassembly/ assembly/installation	Para 4-36	
2	Water intake screen service	Para 4-37	
3	Engine temperature test	Para 4-38	

4-36. WATER PUMP REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION

This task covers:

Water pump replacement and repair.

INITIAL SETUP:

Tools:
T1 5180-00-177-7033

Equipment Condition:
Motor suspended with lower unit free.

Materials/Parts:
Gaskets (item 15, 325299),
(item 17, 325229)

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
120

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Long capscrew (1)	Remove from top of extension (2).	It is not necessary to remove extension (2) to perform procedure.
2. Capscrews (3)	Remove - both sides.	
3. Access cover and gasket.	Remove from exhaust housing.	Access cover is not shown. Located on starboard side. Be sure shift lever is in neutral position for easy accessability through access cover.
4. Top connector screw (4) and lockwasher (5)	Remove so that upper shift rod can be disconnected from lower shift rod (6).	
5. Gearcase and bearing assembly (7)	Separate from extension (2).	
6. Water tube adapter (8)	Will separate from water pump housing outlet when gearcase is lowered.	
7. Gearcase (9)	Lower away from upper section and support on blocks.	Drive shaft (12) is connected to crankshaft by a splined coupling. Lower gearcase straight down so drive shaft will not bind on coupling.

4-36. WATER PUMP REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

1. Long capscrew
2. Extension
3. Capscrew
4. Capscrew
5. Lockwasher
6. Lower shift rod
7. Gearcase and bearing assembly
8. Water tube adapter
9. Gearcase and bearing assembly
10. Capscrew
11. Washer
12. Drive shaft
13. Housing
14. Impeller cup
15. Impeller
16. Gasket
17. Plate
18. Gasket
19. Seal
20. Key
21. Shift rod connector

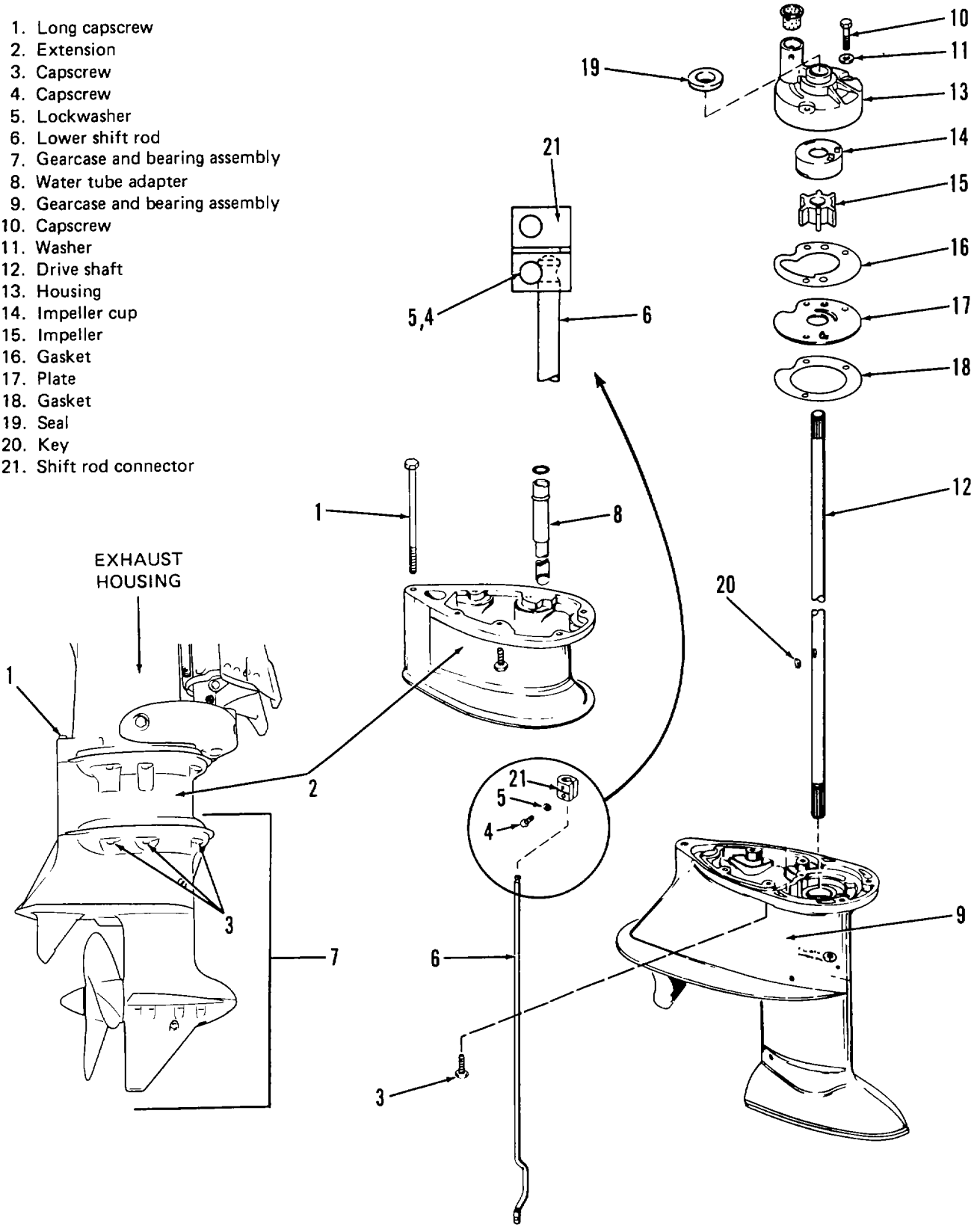


Figure 4-34. Lower unit and water pump

LOCATION/ITEM	ACTION	REMARKS
4-36. WATER PUMP REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued		
DISASSEMBLY		
1. Capscrews (10) and washers (11)	Remove.	Lubricate drive shaft with light oil. This will make disassembly of water pump easier.
2. Drive shaft (12) and water pump assembly.	Lift out of gearcase.	
3. Housing (13)	Slide off shaft (12)	Inspect seal (19) and replace if necessary.
4. Impeller cup (14)	Slide off shaft.	
5. Impeller (15)	Slide off shaft.	Remove key (20) from drive shaft and put in a safe place when you remove impeller.
6. Gasket (16)	Remove and discard.	
7. Impeller housing plate (17)	Remove.	Inspect and replace all worn or damaged parts. Clean impeller housing plate thoroughly to remove all fragments of gasket material.
8. Gasket (18)		Remove and discard.
ASSEMBLY		
1. Gasket (18)	Install in gearcase (9).	Be sure capscrew holes line up correctly.
2. Impeller housing plate (17)	Install in gearcase assembly.	
3. Gasket (16)	Install on impeller housing plate.	
4. Key (20)	Install in slot on drive shaft (12).	
5. Impeller (15)	Position on drive shaft so slot in impeller mates with key (20).	
6. Impeller cup (14)	Install.	
7. Housing (13)	Position on gearcase (9)	Replace seal (19) before installing housing.
8. Drive shaft and water pump assembly	Install in gearcase (9).	Rotate shaft to be sure pump assembly does not bind.
9. Capscrews (10) and washers (11)	Install.	

LOCATION/ITEM	ACTION	REMARKS

4-36. WATER PUMP REMOVAL/DISASSEMBLY/ASSENBLY/INSTALLATION - continued

INSTALLATION

1.	Gearcase and bearing assembly (7)	Position under extension (2).	
2.	Flywheel	Rotate back and forth to engage splined coupling while carefully lifting gearcase assembly.	
3.	Water tube adapter (8)	Install in water pump outlet.	
4.	Shift rod connector (21)	Engage with upper shift rod.	
5.	Gearcase and bearing assembly	Lift into position and install capscrews (3).	
6.	Long capscrew (1)	Install.	
7.	Shift rod connector (21)	Secure to upper shift rod with capscrew (4) and lockwasher (5).	Be sure capscrew (4) engages slot in upper shift rod (6).
8.	Access cover and gasket.	Install over access hole.	

4-37. WATER INTAKE SCREEN SERVICE

This task covers:

Water intake screen service

INITIAL SETUP:

Tools:
Fiber brush

Equipment Condition:
Motor OFF

Materials/Parts:
Screen - 302521 (if necessary)

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
5

LOCATION/ITEM	ACTION	REMARKS
SERVICE		
1. Retaining plug	Remove.	
2. Screen	Remove.	
3. Screen	Clean. Use fiber brush. Replace screen if damaged or corroded.	

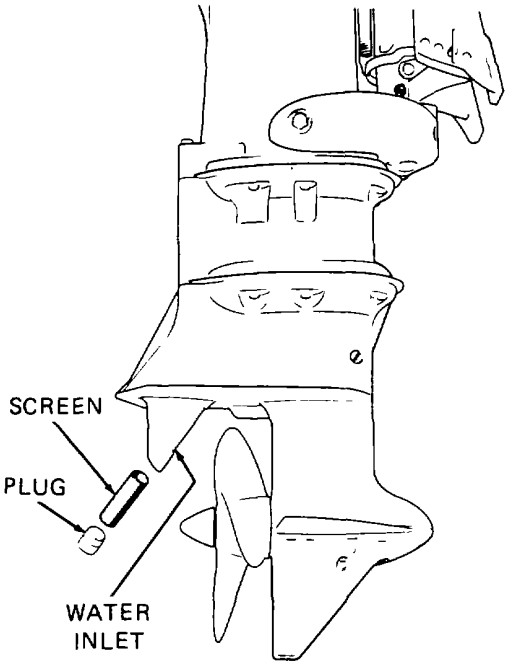


Figure 4-35. Water intake screen

4-38. ENGINE TEMPERATURE TEST

This task covers:

Testing engine temperature

INITIAL SETUP:

Tools:
163°F (73°C) markal thermomelt stik

Equipment Condition:
Follow procedure

Materials/Parts:
None

Personnel Required:
1 Mechanic

Approximate Time Required (minutes):
20

LOCATION/ITEM	ACTION	REMARKS

TEST

NOTE

This test is best performed on an operating engine, on a boat. If this is not possible run motor in test tank at 3/4 throttle for at least 5 minutes.

1. Engine — Make a mark on the surface with the stik.

NOTE

The mark will be dull and chalky in appearance. When the surface reaches the rated temperature of the stik, the mark will melt, becoming liquid and glossy in appearance.

2. Mark — If the mark melts, the cooling system of the motor is not functioning properly.

a. Check the inlet screen. — See para 4-37.

b. Replace the water pump. — See para 4-36.

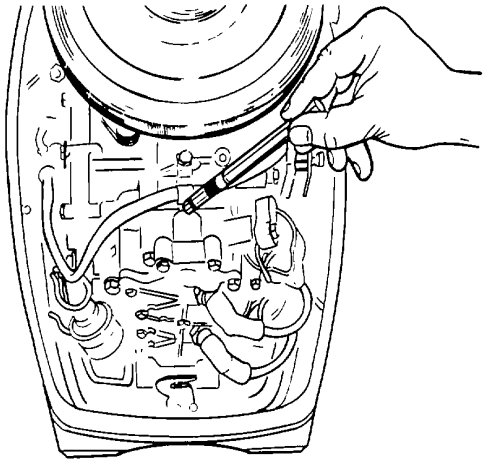


Figure 4-36. Markal thermomelt stik

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

5-1. CHAPTER OVERVIEW. This chapter contains maintenance that will be performed by direct support maintenance personnel.

Section 1. REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

5-2. COMMON TOOLS AND EQUIPMENT. For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

5-3. SPECIAL TOOLS. Special tools are listed in appendix C and in TM 5-2805-261-23P.

5-4. SPARES AND REPAIR PARTS. Spares and repair parts are listed and illustrated in the repair parts and special tools list covering organizational and DS maintenance for this equipment (TM 5-2805-261-23P).

Section II. MOTOR COVER

MAINTENANCE SUMMARY. This task covers:

Motor cover removal/disassembly/assembly/installation.

INITIAL SETUP

Personnel Required	General Safety Instructions
1	

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Motor cover removal/disassembly/ assembly/installation	Para 5-5	

5-5. MOTOR COVER REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION

This task covers:

Motor cover maintenance

INITIAL SETUP:

Tools:
- 1/4" drill
- Pop rivet tool
- T1 5180-00-177-7033
- T2 4910-00-754-0705

Materials/Parts:
- As required

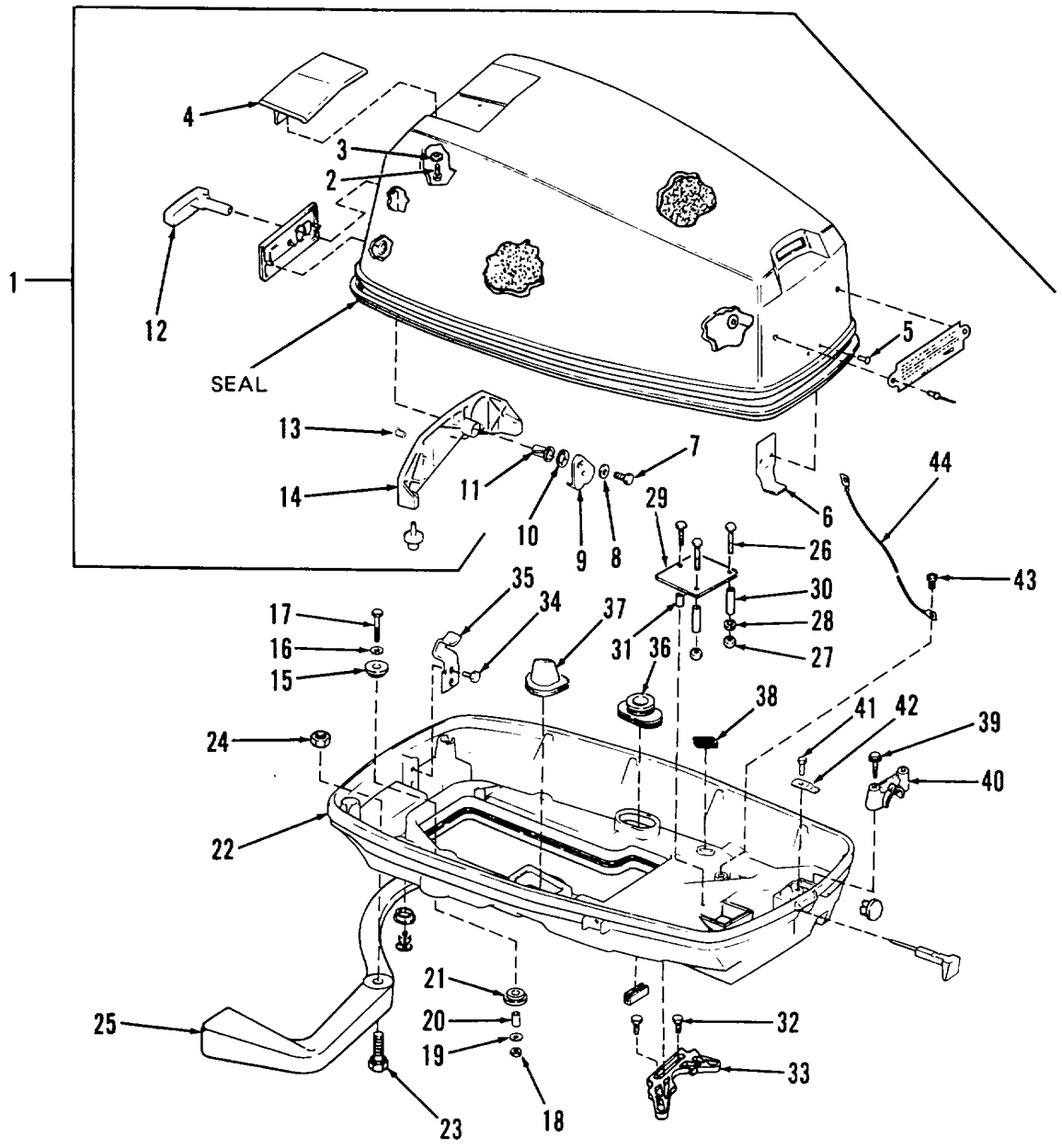
Personnel Required:
- 1 mechanic

Equipment Condition:
- Motor on motor stand

Approximate Time Required (minutes):
- 180

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Upper motor cover (1)	Remove.	See para 2-12.
2. Engine	Remove.	See para 5-8
DISASSEMBLY-UPPER MOTOR COVER		
1. Capscrews (2) and washers (3)	Remove.	
2. Tilt handle (4)	Remove.	
3. Rivets (5)	Drill out.	
4. Hooks (6)	Remove.	
5. Capscrew (7) and washer (8)	Remove	
6. Latch (9), bushing washer (10) and bushing (11)	Remove from handle (12)	

5-5 - continued



1. Upper motor cover assembly
2. Capscrew
3. Washer
4. Tilt handle
5. Rivet
6. Hook
7. Capscrew
8. Washer
9. Latch
10. Washer
11. Bushing
12. Handle
13. Rivet
14. Bracket
15. Grommet
16. Washer
17. Capscrew
18. Nut
19. Washer
20. Spacer
21. Grommet
22. Lower motor cover
23. Capscrew
24. Nut
25. Carrying handle
26. Capscrew
27. Nut
28. Lockwasher
29. Baffle
30. Spacer
31. Spacer
32. Capscrew
33. Bracket
34. Capscrew
35. Hook
36. Grommet
37. Grommet
38. Grommet
39. Capscrew
40. Clamp
41. Capscrew
42. Detent
43. Capscrew
44. Lead

Figure 5-1. Upper and lower motor cover

LOCATION/ITEM	ACTION	REMARKS
5-5. MOTOR COVER REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - contineud		
7. Handle (12)	Remove.	
8. Bracket rivets (13)	Drill out.	
9. Bracket (14)	Remove.	
10.		
ASSEMBLY - UPPER MOTOR COVER		
1. Tilt handle (4)	Place in position on cover (1).	
2. Capscrew (2) and washer (3)	Install.	
3. Hook (6)	Place in position. **NOTE** **Capscrews and lockwashers can be used to fasten hook and bracket to cover, but rivets are the recommended method.**	
4. Bracket (14)	Place in position and fasten to cover.	
5. Handle (12)	Insert through hole in cover and bracket.	
6. Bushing (11)	Insert in bracket.	
7. Bushing washer (10) and latch (9)	Place in position on assembly and fasten with capscrew (7).	
8. Motor cover (1)	Install.	**See para 2-13.**
REMOVAL - LOWER MOTOR COVER		
1. Four retaining assemblies (15 thru 17) and (18 thru 21) attaching lower motor cover (22) to exhaust housing.	Remove.	

LOCATION/ITEM	ACTION	REMARKS
5-5. MOTOR COVER REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued		
2. Lower motor cover (22)	Remove.	
DISASSEMBLY - LOWER MOTOR COVER		
1. Capscrew (23) and nut (24)	Remove.	
2. Carrying handle (25)	Remove.	
3. Capscrews (26), nuts (27) and lockwashers (28)	Remove.	
4. Baffle (29) and spacers (30) (31)	Remove.	
5. Capscrew (32)	Remove.	
6. Bracket (33)	Remove.	
7. Capscrew (34)	Remove.	
8. Hook (35)	Remove.	
9. Grommets (36), (37) and (38)	Should be replaced if worn or cracked.	
10. Capscrews (39)	Remove.	
11. Clamp (40) and stop switch	Remove.	See para 4-22, removal/installation of stop (shorting) switch.
12. Detent screw (41) and choke knob detent (42)	Remove.	
13. Screw (43) and lead (44)	Remove.	

LOCATION/ITEM	ACTION	REMARKS

5-5. MOTOR COVER REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

ASSEMBLY - LOWER MOTOR COVER			
1.	Carrying handle (25)	Position on lower cover (22).	
2.	Capscrew (23) and nut (24)	Install.	
3.	Baffle (29) and spacers (30)	Use capscrews (26) to form an assembly. Insert capscrews into holes in lower cover.	
4.	Nuts (27)	Install.	
5.	Bracket (33)	Position on lower cover.	
6.	Capscrews (32)	Install.	
7.	Hook (35)	Place in position on lower cover.	
8.	Capscrews (34)	Install.	
9.	Grommets (36), (37) and (38)	Install.	
10.	Cover clamp (40) and stop switch	Position on cover	
11.	Capscrews (39)	Install.	See para 4-22, removal/installation of stop (shorting) switch.
12.	Choke knob detent (42)	Position on cover.	
13.	Ground wire (43) and screws (44)	Install.	
14.	Detent screw (41)	Install.	

LOCATION/ITEM	ACTION	REMARKS

5-5. MOTOR COVER REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

INSTALLATION

1.	Fuel hose	Insert through opening in lower motor cover.	
2.	Lower cover (22)	Position on exhaust housing.	
3.	Ground wire (44)	Install.	
4.	Four retaining assemblies (15 thru 17) and (18 thru 21)	Install on exhaust housing studs, securing lower cover to exhaust housing.	
5.	Engine	Install.	See para 5-8
6.	Upper motor cover (1)	Install.	See para 2-13.

NOTE

Upper motor cover seal can be replaced, but it cannot be glued on. It must be fastened to the motor cover using stainless steel wire at regular spaces around the perimeter of the cover.

Section III. FUEL SYSTEM

MAINTENANCE SUMMARY. This task covers:

a. Carburetor disassembly/assembly
b. Intake manifold removal/installation
c. Leaf plate assembly removal/inspection/installation

INITIAL SETUP

Personnel Required	General Safety Instructions
1	Do not smoke or allow sparks when working on fuel system. Gasoline is extremely flammable and can cause burns.

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Carburetor disassembly/ assembly	Para 5-6	
2	Intake manifold removal/ installation.	Para 5-7	**NOTE** **Leaf plate assembly/removal/inspection/ and installation is part of the removal/installation procedure for the intake manifold.**
3	Leaf plate assembly removal/ inspection/installation	Para 5-7	

5-6. CARBURETOR DISASSEMBLY/ASSEMBLY

This task covers:

Disassembly/assembly of the carburetor

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705
T6 325043

Equipment Condition:
Motor OFF

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
60

LOCATION/ITEM	ACTION	REMARKS
DISASSEMBLY I		
1. Carburetor (1)	Remove.	See para. 4-28.
2. Needle valve (2) and retainer (3)	Remove.	See para. 4-27.
3. Needle valve assembly (4)	Remove.	See para. 4-27.
4. Core plugs (5) and (6)	Remove.	See para. 4-27.
5. Lead shot (7)	Remove.	See para. 4-27.
6. Roll pin (8)	Remove.	See illustration, page 5-11.
7. Throttle return spring (9) and retainer (10)	Remove.	
8. Capscrews (11)	Remove.	
9. Float chamber assembly (12) and gasket (13)	Remove.	Nozzle gasket (14) will come out with the float bowl assembly.
10. Choke arm and screw assembly (15)	Remove.	

5-6. CARBURETOR DISASSEMBLY/ASSEMBLY - continued

1. Carburetor assembly
2. Needle valve assembly
3. Retainer
4. Float valve and seat assembly
5. Core plug
6. Core plug
7. Lead shot
8. Roll pin
9. Spring
10. Retainer
11. Capscrew
12. Float chamber
13. Gasket
14. Gasket
15. Choke arm and screw
16. Pin
17. Float and arm assembly

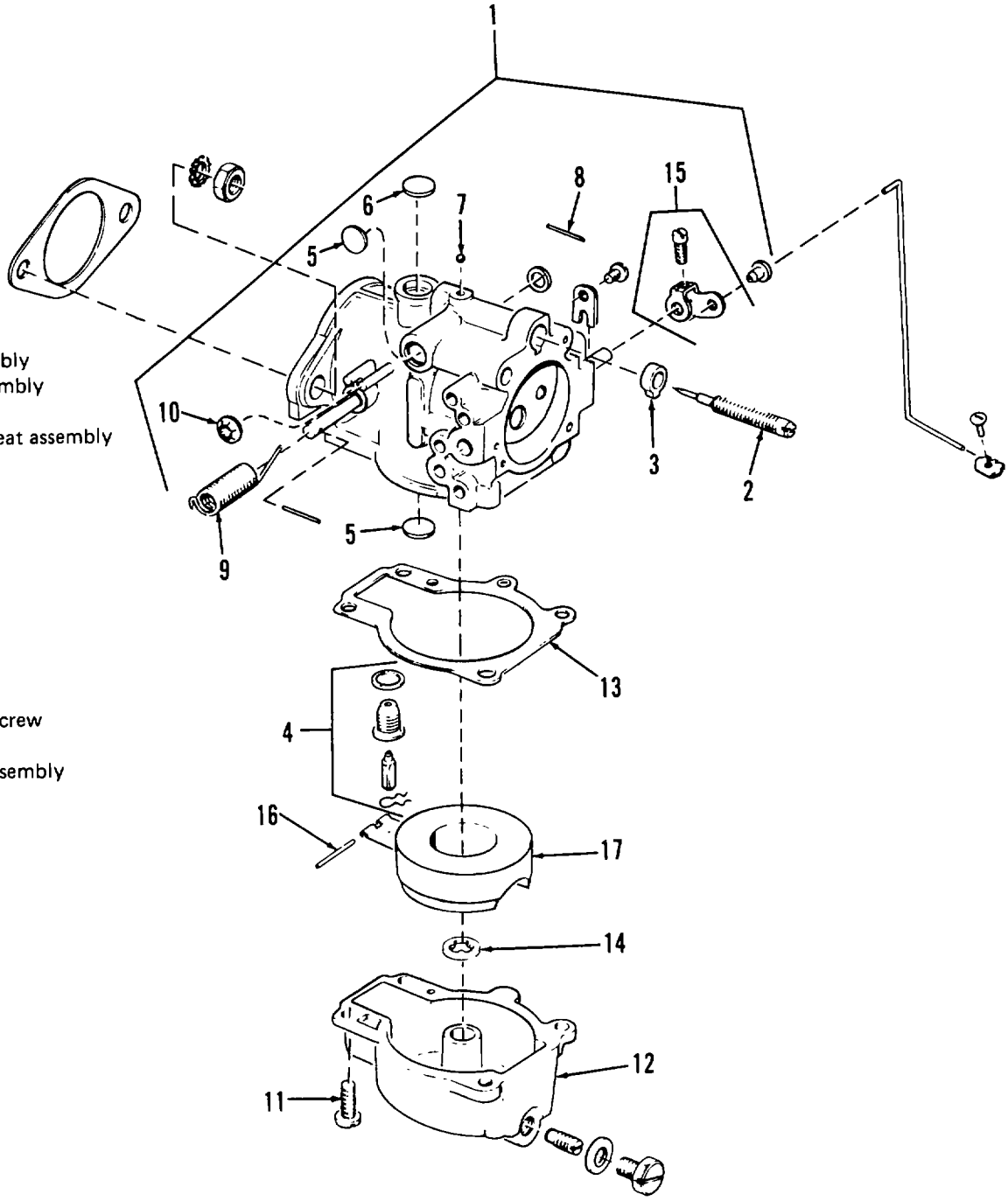


Figure 5-2. Carburetor

LOCATION/ITEM	ACTION	REMARKS
5-6. CARBURETOR DISASSEMBLY/ASSEMBLY - continued		
10. Float hinge pin (16)	Remove.	
11. Float (17)	Remove.	
CLEANING	**WARNING** **Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or non-porous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death.**	
1. Jets and passages	a. Clean with solvent. b. Dry with clean lint-free cloth.	Be sure to remove all gum and varnish.
2. Needle valves	a. Clean with solvent. b. Dry with clean lint-free cloth.	
ASSEMBLY		
1. Float (17)	Position hinge and insert float hinge pin (23).	Be sure hinge moves freely, with no binding.
2. Float chamber assembly (12) and gasket (13)	Position on carburetor.	
3. Capscrew (11)	Install.	
4. Throttle return spring (9) and retainer (10)	Install.	
5. Roll pin (8)	Install.	
6. Choke arm and screw assembly (15)	Remove.	
7. Lead shot (7)	Install.	See para. 4-27.
8. Core plugs (5) and (6)	Install.	See para. 4-27.
9. Needle valve assembly (4)	Install.	See para. 4-27.
10. Needle valve (2) and retainer (3)	Install.	See para. 4-27.
11. Carburetor (1)	Install.	See para. 4-28.

5-7. INTAKE MANIFOLD REMOVAL/INSTALLATION

This task covers:

Removal/Installation/Inspection of intake manifold and leaf plate assembly

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Motor OFF

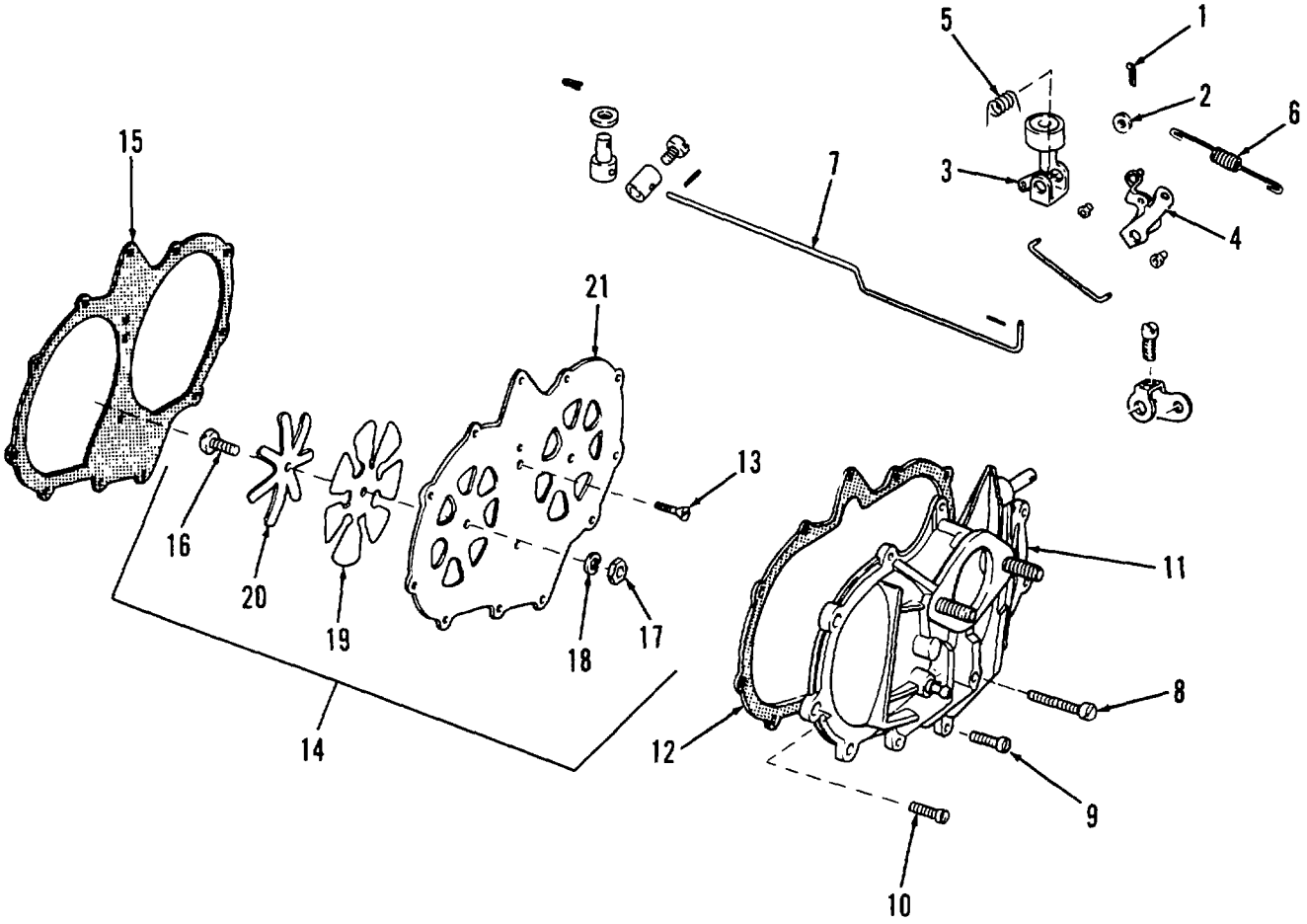
Materials/Parts:
As required

Personnel Required:
mechanic

Approximate Time Required (minutes):
100

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Carburetor	Remove.	See para. 4-28.
2. Cotter pin (1) and washer (2)	Remove.	
3. Cam follower (3) and throttle lever (4)	Slide off shaft.	
4. Springs (5) and (6)	Remove.	When sliding the cam follower off the shaft, hold spring (5) in place.
5. Cam follower (3)	Disengage from rod (7).	
6. Capscrews (8), (9), and (10)	Remove.	Capscrews are of three different lengths. Take notice of where each length goes.
7. Intake manifold (11), and gasket (12)	Remove.	
8. Capscrew (13)	Remove.	
9. Leaf plate assembly (14)	Remove.	
10. Gasket (15)	Remove.	
11. Capscrew (16), nut (17) and lockwasher (18)	Remove.	

5-7. INTAKE MANIFOLD REMOVAL/INSTALLATION - continued



1. Cotter pin
2. Washer
3. Cam follower
4. Throttle lever and pin
5. Spring
6. Spring
7. Rod
8. Long capscrew
9. Short capscrew
10. Capscrew
11. Intake manifold
12. Gasket
13. Capscrew
14. Leaf plate assembly
15. Retainer
16. Capscrew
17. Nut
18. Lockwasher
19. Leaf valve
20. Leaf valve stop
21. Leaf plate
22. Capscrew

Figure 5-3. Intake manifold

LOCATION/ITEM	ACTION	REMARKS

5-7. INTAKE MANIFOLD REMOVAL/INSTALLATION - continued

INSTALLATION		**CAUTION** **Do not attempt to repair a distorted leaf valve.**	
1.	Leaf plate assembly (14)	Inspect.	
		NOTE **Leaf valves (19) must be free from all gum and varnish. They must be perfectly flat and without distortion, so that they form a perfect seal with the leaf plate.**	
2.	Leaf valves (19)	a. Replace if broken or distorted. b. Clean if necessary.	
		WARNING **Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact by wearing rubber or non-porous gloves when handling the solvent or material wet with drycleaning solvent. Wash hands immediately after exposure with soap and water and use a lanolin based skin cream to prevent skin drying. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C). Do not work with solvent in a closed room. Be sure there is good ventilation or the solvent vapors will build up in the air and become a poisonous mixture which can cause physical injury or even death.**	
3.	Leaf valve stop (20), leaf valve (19) and leaf valve plate (21)	Assemble using capscrew (16), nut (17) and lockwasher (18).	Be sure the leaf valves line up with the holes in the valve plate and the leaf valve stop arms are lined up correctly, behind the leaf valves.
4.	Gasket (15)	Position on crankcase.	
5.	Leaf plate assembly (14)	Position over gasket (15), on crankcase.	

LOCATION/ITEM	ACTION	REMARKS

5-7. INTAKE MANIFOLD REMOVAL/INSTALLATION - continued

6.	Capscrew (13)	Use to fasten leaf plate assembly and gasket to crankcase.	
7.	Gasket (12)	Place on leaf plate assembly (14).	
8.	Intake manifold (11)	Position over gasket (12) and leaf plate assembly.	
9.	Capscrews (8), (9) and (10)	Install.	
10.	Spring (5) assembly (3).	Position in cam follower	
11.	Cam follower assembly (3) and throttle lever (4)	Slide onto shaft.	
12.	Spring (13)	Install.	
13.	Cam follower	Engage with rod (7).	
14.	Washer (2) and cotter pin (1)	Install on shaft.	
15.	Carburetor	Install.	See para. 4-28.

Section IV. ENGINE ASSEMBLY

MAINTENANCE SUMMARY. This task covers:

a. Engine removal/installation.
b. Engine disassembly/assembly.
c. Crankshaft and pistons disassembly/assembly.
d. Bearings removal/installation.
e. Cylinder head removal/installation.

INITIAL SETUP

Personnel Required	General Safety Instructions
1	None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Engine removal/installation	Para. 5-8	
2	Engine disassembly/assembly	Para. 5-9	Cylinder head removal/installation is part of Engine disassembly/assembly, para. 5-9.
3	Crankshaft and pistons disassembly/assembly.	Para. 5-10	Bearings replacement is part of para. 5-10, crankshaft and pistons disassembly/assembly.

5-8. ENGINE REMOVAL/INSTALLATION

This task covers:

Removal/Installation of engine

INITIAL SETUP:

Tools:
T6 Tie strap wrench - 325043
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Motor in shop

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
180

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Starter (1)	Remove.	See para. 3-9.
2. Flywheel (2)	Remove.	See para. 4-17.
3. Armature (3)	Remove.	See para. 4-16.
4. Carburetor (4)	Remove.	See para. 4-28.
5. Intake manifold and leaf valve assembly (5)	Remove.	See para. 5-7.
6. Fuel pump (6), auxiliary fuel filter (7), and fuel hoses (8)	Remove. (See para. 4-26.)	
7. Spark plugs (9)	Remove. (See para. 3-10.)	
8. Ignition coils (10)	Remove. (See para. 4-18.)	
9. Starter mounting brackets (11)	Remove.	
10. Throttle control rod assembly	Slide out of pivot pin. (See page 5-21.)	
11. Cam follower spring	Disconnect from intake manifold. (See page 5-21.)	
12. Throttle control lever (12)	Remove by: a. Remove two screws and clamps. (See page 5-20.) b. Lift lever from lower motor cover.	

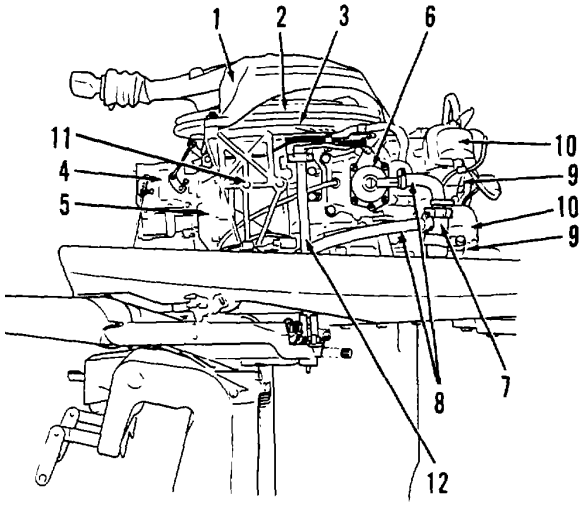


Figure 5-4. Motor - port view

LOCATION/ITEM	ACTION	REMARKS

5-8. ENGINE REMOVAL/INSTALLATION - continued

13. Shifter lock (13) and shifter lock spring	Remove. (See page 5-20.)	
14. Water indicator line (14)	Remove at fitting.	
15. Fuel return line (15)	Remove clamps and slide off fittings.	
16. Two nuts, seven 3/8 capscrews, and two 1/2 capscrews attaching engine to exhaust housing	Remove.	
17. Engine.	Remove **NOTE** **Pick engine straight up so the splined connection between crankshaft and drive shaft will not be harmed.**	
18. Two gaskets and engine plate	Remove from exhaust housing.	

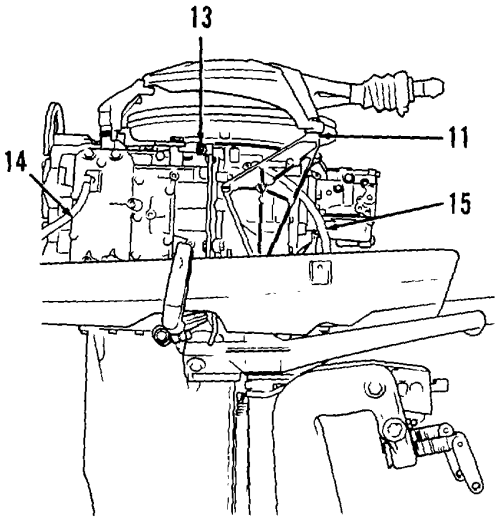


Figure 5-5. Motor- starboard view

INSTALLATION

1. Two gaskets and engine plate	Position on exhaust housing. **NOTE** **Line up splined coupling between crankshaft and drive shaft. Line up bolt holes correctly.**	
2. Engine	Position very carefully on exhaust housing.	

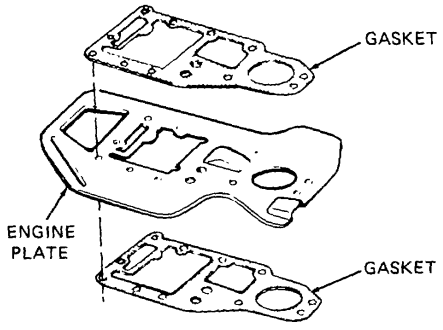


Figure 5-6. Engine plate and gaskets

LOCATION/ITEM	ACTION	REMARKS

5-8. ENGINE REMOVAL/INSTALLATION - continued

3.	Two nuts, seven 3/8 capscrews, and two 1/2 capscrews	Use to attach engine to exhaust housing.	
4.	Fuel return line (15)	Install on fitting.	Use pliers to squeeze the two projecting ends of the clamp. This will expand the clamp.
5.	Water indicator line (14)	Install on fitting.	
6.	Shifter lock (13) and shifter lock spring	Install.	
7.	Throttle control lever (12)	Place in position.	
8.	Two screws and clamps	Use to secure throttle control lever.	

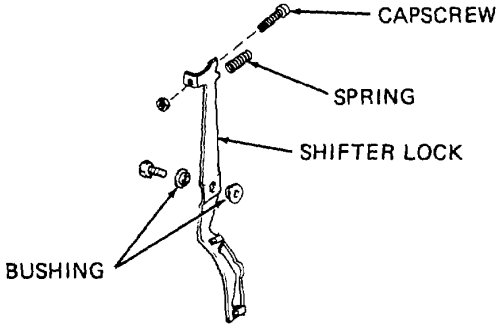


Figure 5-7. Shifter lock

9.	Starter mounting brackets (11)	Install.	Remove retaining pin from control lever. Remove grommet from lower motor cover and slide grommet onto control lever. Install retaining pin and engage pin in throttle control gear.
10.	Ignition coils (10)	Install.	See para. 4-18.
11.	Engine ground wire and clamp for stop switch leads	Fasten to bottom screw of port bracket.	
12.	Spark plugs (9)	Install.	See para. 3-10.
13.	Fuel pump (6)	Install.	See para. 4-26.
14.	Auxiliary fuel filter (7) and fuel hoses (8)	Install.	See para. 4-26.
15.	Intake manifold and leaf valve assembly (5)	Install.	See para. 5-7.
16.	Carburetor (4)	Install.	See para. 4-28.
17.	Armature (3)	Install.	See para. 4-16.

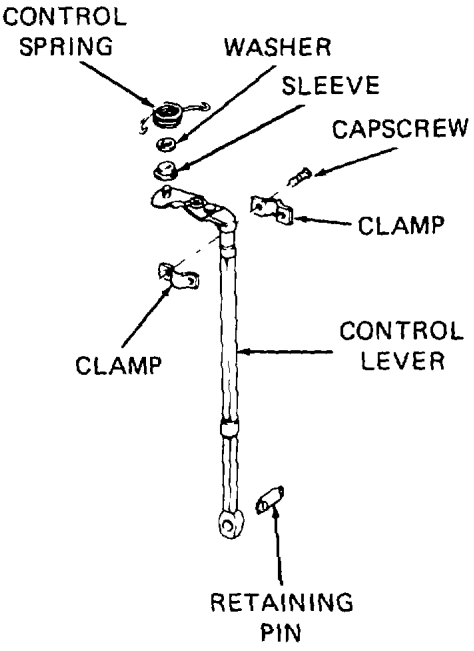


Figure 5-8. Throttle control lever

LOCATION/ITEM	ACTION	REMARKS

5-8. ENGINE REMOVAL/INSTALLATION - continued

18. Throttle lever assembly, follower and follower spring	Assemble as shown and slide on shaft.	
19. Washer and cotter pin	Install.	
20. Spring	Connect to throttle lever and intake manifold as shown.	
21. Throttle link	Snap into throttle arm and lever assembly as shown.	
22. Flywheel (2)	Install.	See para. 4-17.
23. Starter (1)	Install.	See para. 3-9.

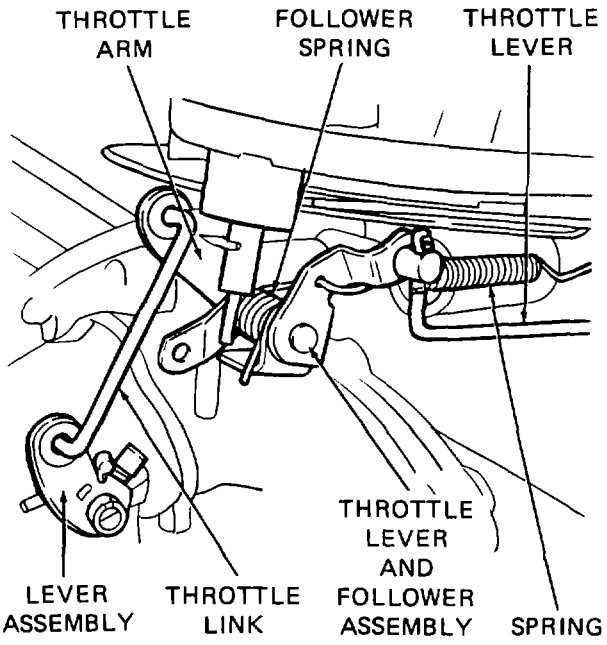


Figure 5-9. Throttle linkage

5-9. ENGINE DISASSEMBLY/ASSEMBLY

This task covers:

Engine disassembly/assembly and cylinder head removal/installation

INITIAL SETUP:

Tools:
- T8 Engine holder - 303605
- T10 Retaining ring pliers - 303859
- T9 Piston ring compressor - 326592
- T1 5180-00-177-7033
- T2 4910-00-754-0705

Equipment Condition:
- Engine removed from exhaust housing. (See para. 5-8.)
- Engine installed in engine holder 303605 and back of engine holder clamped securely in vise.

Materials/Parts:
- Sealant 327361

Personnel Required:
- 1 mechanic

Approximate Time Required (minutes):
- 330

LOCATION/ITEM	ACTION	REMARKS
DISASSEMBLY		
1. Capscrews (1)	Remove.	
2. Cylinder head cover (2) and gasket (3)	Remove.	
3. Capscrews (4) and lift bracket (5)	Remove from cylinder head (6).	
4. Cylinder head (6) and gasket (7)	Remove from cylinder block (8).	
5. Capscrews (9) and valve housing (10)	Remove.	
6. Capscrews (11), lock-washers (12) and bracket (13)	Remove.	
7. Taper pins (14)	Remove.	
8. Eight small capscrews (15)	Remove.	Tap out of crankcase from cylinder side of engine towards crankcase side.
9. Four large capscrews (16) and washers (17)	Remove.	
10. Two alien screws (18)	Remove.	
11. Crankcase (19)	Remove from cylinder block (8).	Tap on top of crankcase with rawhide mallet until it comes free.
	CAUTION **Be careful not to scratch or mar any machined surfaces.**	
12. Lower main bearing seal housing.	Remove from crankshaft.	See para. 5-10.
13. Large retaining ring	Remove from crankshaft.	See para. 5-10.

5-9. ENGINE DISASSEMBLY/ASSEMBLY

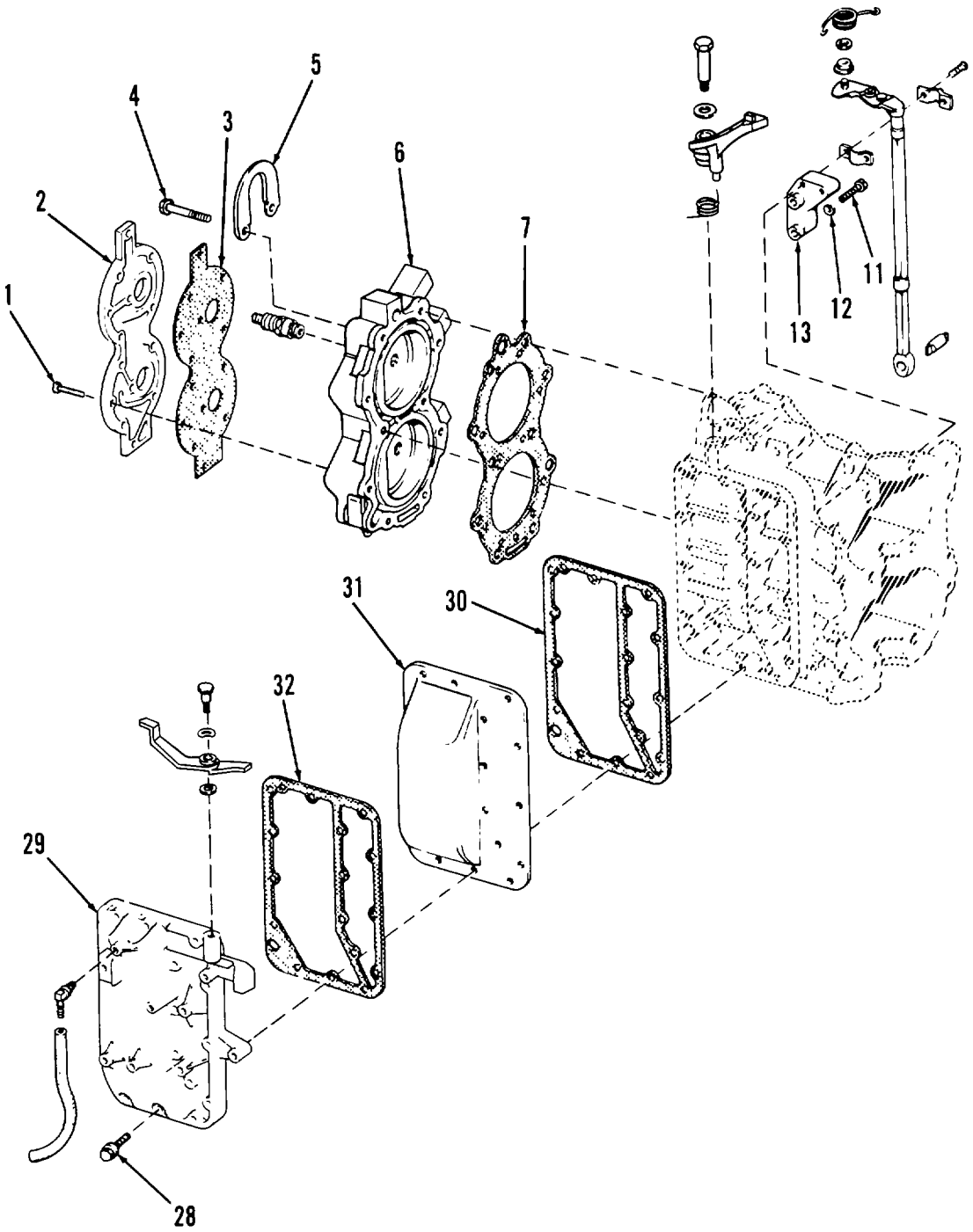
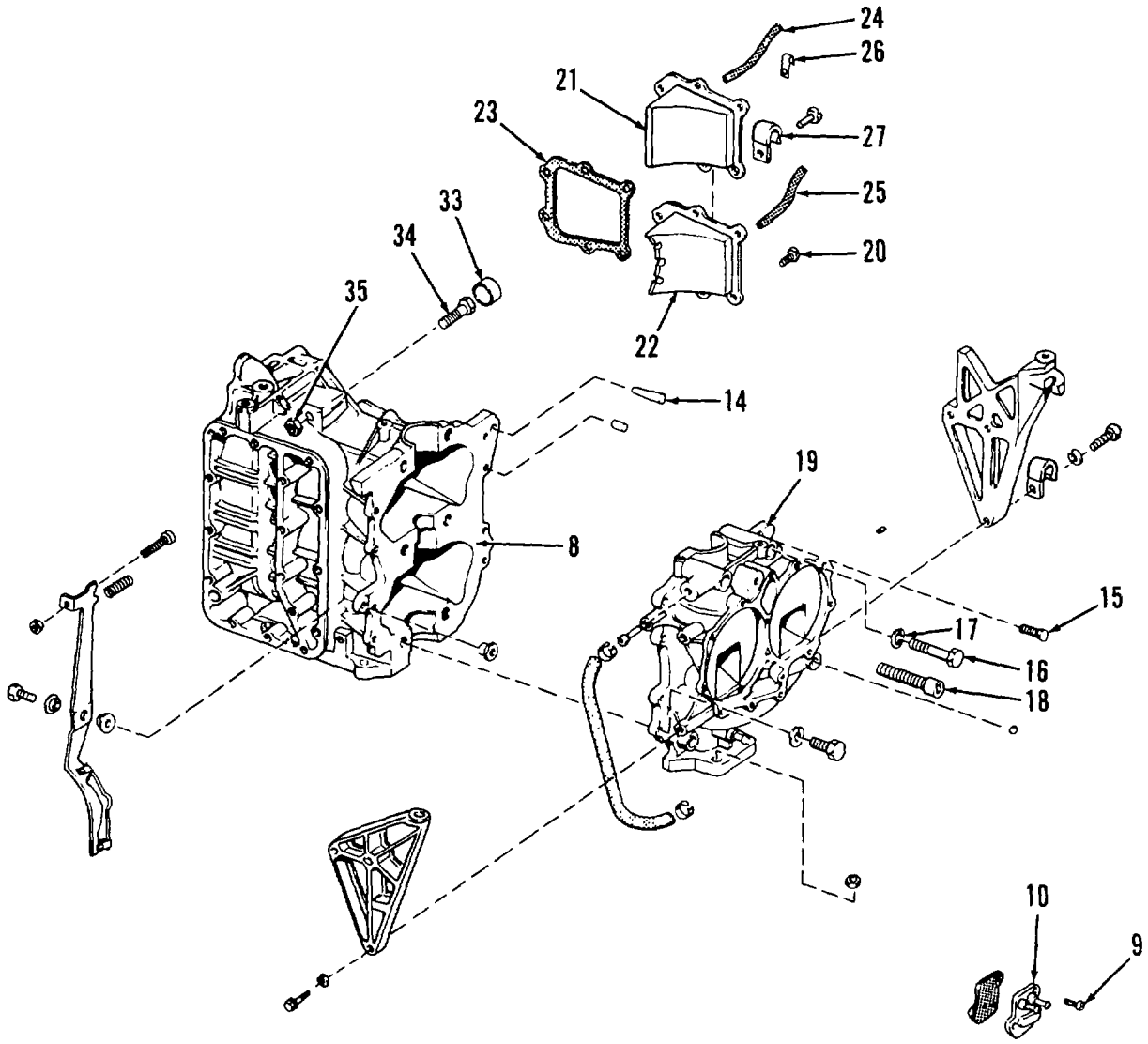


Figure 5-10. Engine (1 of 2)

5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued



1. Capscrew
2. Cover
3. Gasket
4. Capscrew
5. Lift bracket
6. Cylinder head
7. Gasket
8. Cylinder block
9. Capscrew
10. Housing nipple and valve assembly
11. Capscrew
12. Lockwasher
13. Bracket
14. Taper pin
15. Capscrew
16. Long capscrew
17. Washer
18. Allen screws
19. Crankcase
20. Capscrew
21. By-pass cover
22. By-pass cover
23. Gasket
24. Hose
25. Hose
26. Clamp
27. Clamp
28. Capscrew
29. Outer exhaust cover
30. Gaskets
31. Inner exhaust cover
32. Gaskets
33. Bumper
34. Capscrew
35. Nut

Figure 5-10. Engine (2 of 2)

LOCATION/ITEM	ACTION	REMARKS

5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued

	CAUTION **Pistons, connecting rods and caps are matched parts and seat with the operation of the motor. Because of this, it is essential to maintain their original positions at reassembly. Mark each connecting rod and cap, piston, and bearing component to assure correct mating when they are reassembled. Also mark the cylinders from which they are removed.**	
14. Connecting rod bearing caps	Remove. (See para. 5-10.)	
15. Sixteen needle bearings	Remove from connecting rod bearing caps. (See para. 5-10.)	
16. Crankshaft	Lift from cylinder block.	
	NOTE **Be sure to match bearing caps with connecting rods.**	
17. Connecting rod bearing caps	Place back on connecting rods.	
18. Piston and connecting rods	Remove from cylinder block.	See para. 5-10 for disassembly/assembly of crankshaft, pistons and connecting rods.
19. Capscrews (20)	Remove.	

LOCATION/ITEM	ACTION	REMARKS

5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued

20. Upper (21) and lower (22) by-pass covers and gaskets (23)	Remove from cylinder block.	
21. Hoses (24), (25) and clamps (26) and (27)	Remove from by-pass covers.	
22. Capscrews (28)	Remove.	
23. Outer exhaust cover (29) and gasket (30) and inner exhaust cover (31) and gasket (32)	Remove from cylinder block as a unit.	
24. Inner and outer exhaust cover	Separate.	
25. Armature plate stop bumper (33)	Pull off capscrew (34).	
26. Capscrew (34) and nut (35)	Remove from cylinder block (8).	

LOCATION/ITEM	ACTION	REMARKS

5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued

ASSEMBLY

1. Capscrew (34) and nut (33)	Install in cylinder block (8).	
2. Armature plate stop bumper (33)	Install on capscrew (34).	
3. Bracket (13)	Position on cylinder block (8).	
4. Capscrew (11) and lockwasher (12)	Install.	
5. Inner (31) and outer (29) exhaust cover and gaskets (30, 32)	Assemble and position on cylinder block.	
6. Capscrews (27)	Install.	
7. Upper (21) and lower (22) by-pass covers and gaskets (23)	Position on cylinder block.	
8. Capscrews (20)	Install.	
9. Hoses (24) and (25) with clamps (26) and (27).	Install on by-pass covers	
	CAUTION **Compress the piston ring with ring compressor (326592). Do not use an automotive type ring compressor. Be sure each piston goes back into the correct cylinder. Be sure the intake side of the piston deflector is toward the intake part.**	
10. Pistons and connecting rod assemblies	Coat with oil and install in cylinder block.	
11. Connecting rod bearing caps.	Remove.	
	NOTE **Be sure both upper and lower main bearings seat in their locating dowels in the cylinder block.**	
12. Crankshaft	Position in cylinder block with connecting rod bearings against crankshaft journals.	

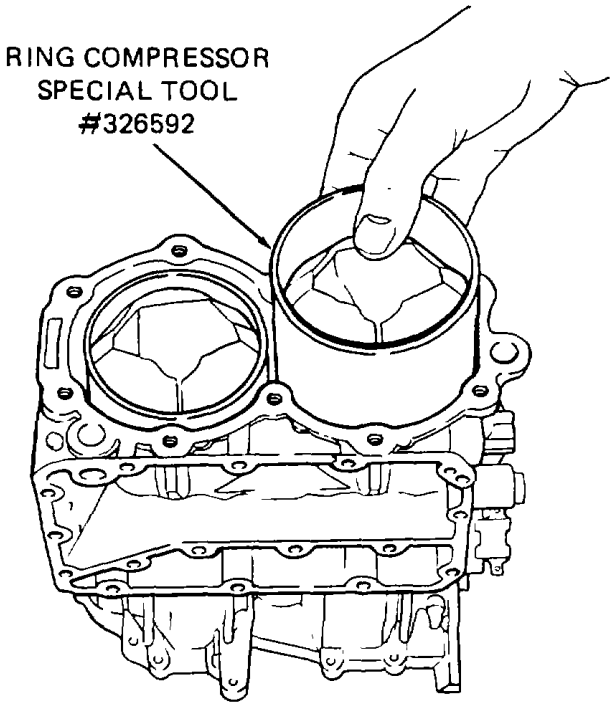


Figure 5-11. Piston installation

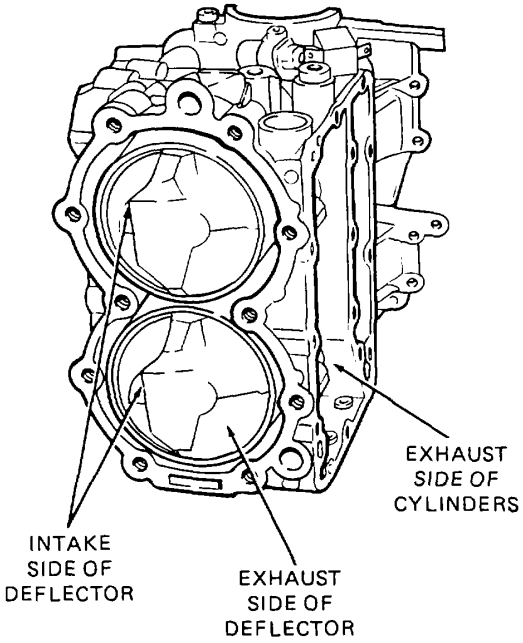


Figure 5-12. View of deflectors

LOCATION/ITEM	ACTION	REMARKS
5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued		
13. Needle bearings and retainers.	Install. **CAUTION** **two end needles in positon. Rods and caps have fracture joints that must match perfectly. Snug rod cap screws and feel machined surface of rod with finger nail. If alignment is not perfect, tap rod cap lightly with a mallet from several directions and snug screws again when alignment is correct, torque screws to 29-31 ft. lb. (40-42 N·m).**	Smear a little heavy grease in connecting rod. Place retainer half in con rod and install 6 needles. Bring up to crankshaft. Using grease to hold needles, place Put other retaining half in place and install remaining needles. Put rod cap in place and install screws finger-tight. Then install bearings in other rod the same way.
14. Connecting rod bearing caps	Install and tighten to a torque of 29-31 lb. ft. (40-42 N•m).	
15. Crankcase 327361 and position on cylinder block.	Apply sealant OMC no.	
16. Four large capscrews (16) and washers (17)	Install finger-tight.	
17. Two allen screws (18)	Install finger-tight.	

LOCATION/ITEM	ACTION	REMARKS
5-9. ENGINE DISASSEMBLY/ASSEMBLY - continued		
18. Eight small capscrews (15)	Install finger-tight.	
19. Taper pins (14)	Install snugly with light taps of a hammer.	This will align the crankcase to cylinder block.
20. Large capscrews (16)	Tighten to a torque of 18-20 lb. ft. (24-27 N•m).	
21. Allen screws (18)	Tighten.	
22. Large retaining ring	Install on crankshaft.	
23. Lower main bearing seal housing	Place on crankshaft.	
24. Cylinder head (6) and gasket (7)	Position on cylinder block.	
25. Capscrews (4)	Install.	Install lift bracket (5) when installing capscrews (4).
26. Cylinder head cover (2) and gasket (3)	Position on cylinder head.	
27. Capscrews (1)	Install and tighten to a torque of 14-16 lb. ft. (19-22 N•m) Tighten in the sequence shown at right.	
28. Engine	Install in exhaust housing.	See para. 5-8.

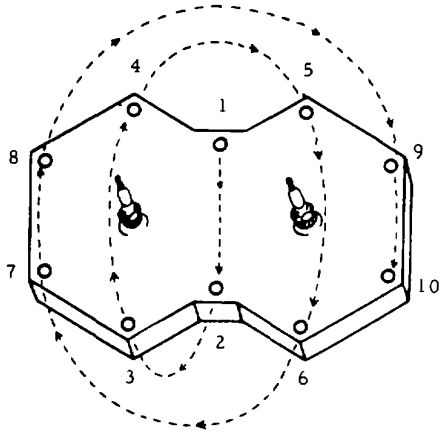


Figure 5-13. Cylinder head bolt tightening sequence

5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY

This task covers:

Disassembly and assembly of crankshaft and pistons (including bearings).

INITIAL SETUP:

Tools:
- TB Engine holder - 303605
- T10 Retaining ring tool - 303859
- T9 Piston ring compressor - 326592
- Micrometer
- T1 5180-00-177-7033
- T2 4910-00-754-0705

Equipment Condition:
- Engine removed and held in tool no. 303605.

Materials/Parts:
- As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
80

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
Follow steps 1 thru 12, para. 5-9.		See para. 5-9, steps 1 thru 12. Be careful not to scratch or mar components of the assembly when removing.
DISASSEMBLY		
1. Retaining ring (1)	Remove.	Use tool no. 303859.
2. Crankcase head (2)	Remove.	
3. "O" ring (3)	Remove from head (2).	
4. Seals (4)	Remove.	
5. Snap ring (5)	Remove.	Use tool no. 303859.
6. Roller bearing (6)	Remove.	Use gear puller.
7. "O" ring (7)	Remove.	
8. Seal (8)	Remove	Support head on blocks and drive out with seal driver.
9. Roller bearing (9)	Remove.	

5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY - continued

1. Snap ring
2. Head
3. O-ring
4. Seal
5. Retaining ring
6. Roller bearing
7. O-ring
8. Seal
9. Roller bearing
10. O-ring
11. Key
12. Capscrew
13. Retainer
14. Needles
15. Piston rings
16. Retaining ring
17. Wrist pin
18. Bearing
19. Split sleeve
20. Retainer and needles
21. Piston
22. Crankshaft.

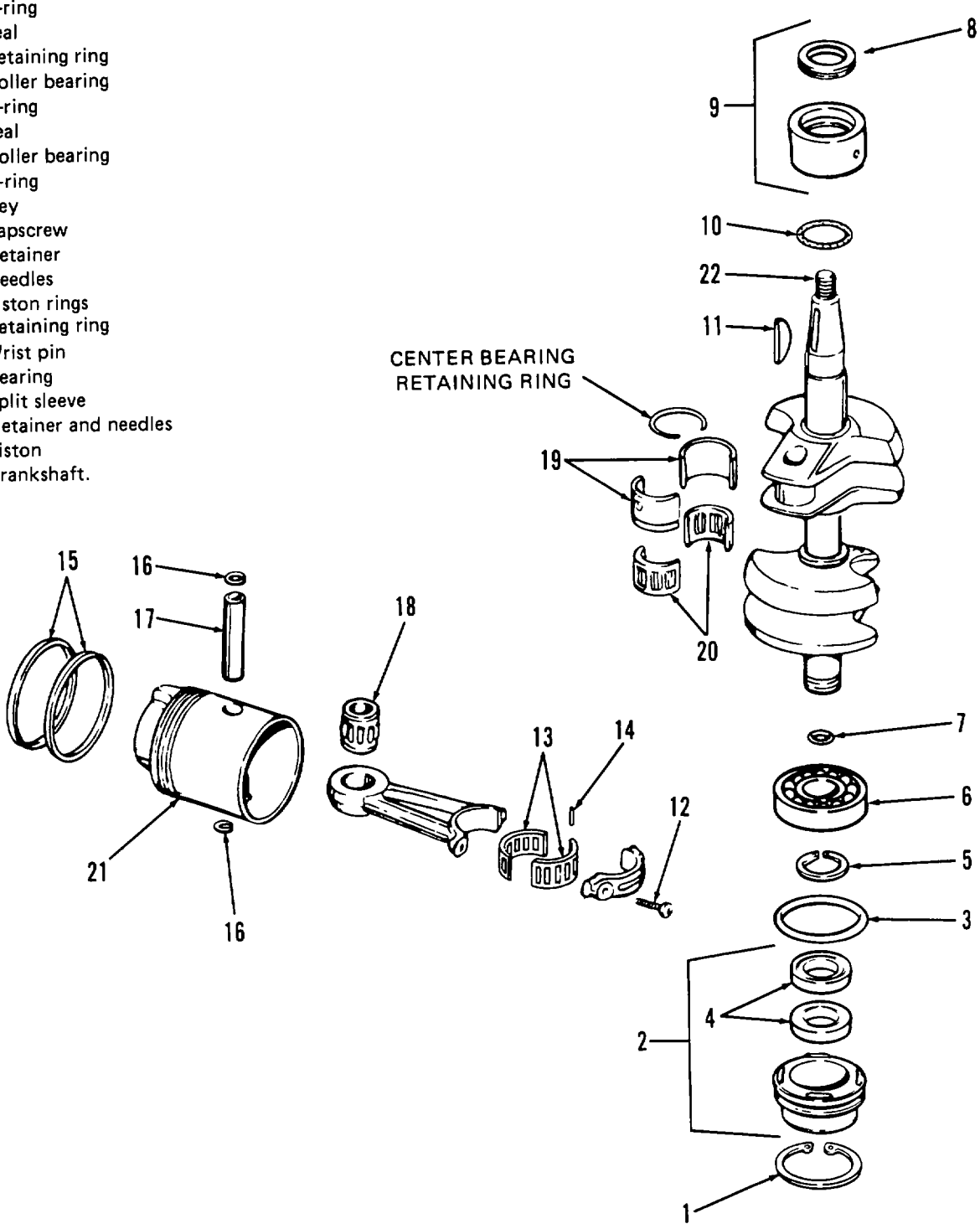


Figure 5-14. Crankcase and piston assembly

LOCATION/ITEM	ACTION	REMARKS

5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY - continued

10. "0" ring (10) — Remove.

11. Key (11) — Remove.

12. Connecting rod cap-screws (12) — Remove.

CAUTION
Pistons, connecting rods and caps are matched parts and seat with the operation of the motor. Because of this, it is essential to maintain their original positions at reassembly. Mark each connecting rod and cap, piston, and bearing component to assure correct mating when they are correct mating when they are reassembled. Also mark the cylinders from which they are removed.

13. Connecting rod caps — Remove.

14. Needle bearing retainers (13) and bearings (14) — Remove.

15. Piston rings (15) — Remove and discard.

16. Retaining rings (16) — Remove.

CAUTION
One piston boss is bored larger than the other for a loose fit. The inside of the piston is marked with an "L" for "loose," on the larger side. Lay the piston down in a piston cradle with the loose side down and drive out the wrist pin from the tight side.

17. Wrist pin (17) — Remove.

18. Wrist pin bearing (18) — Press out.

19. Center bearing retaining ring — Lift out of groove and slide aside.

20. Center bearing split sleeve halves (19) — Remove from crankshaft center journal.

21. Center bearing needle bearing retainers and needle bearings (20). — Remove.

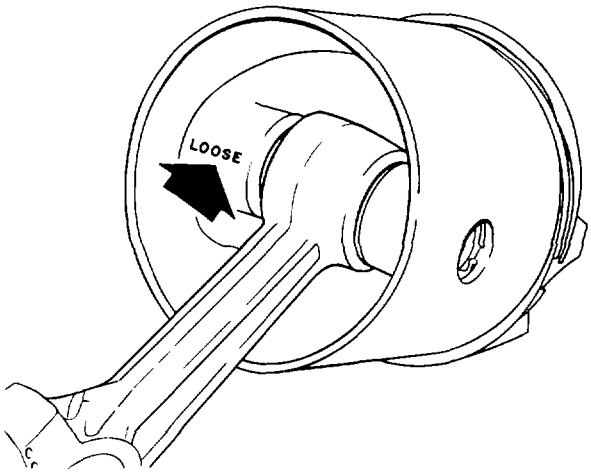


Figure 5-15. Piston - "loose" boss

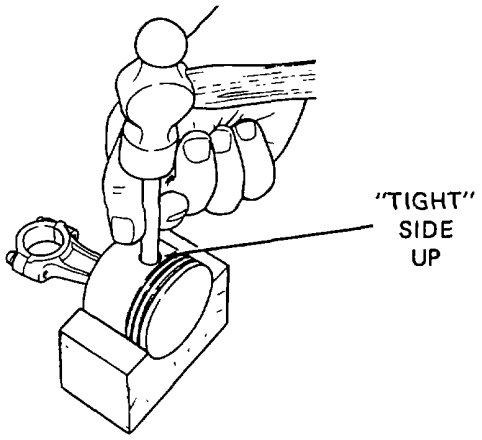


Figure 5-16. Driving out the wrist pin

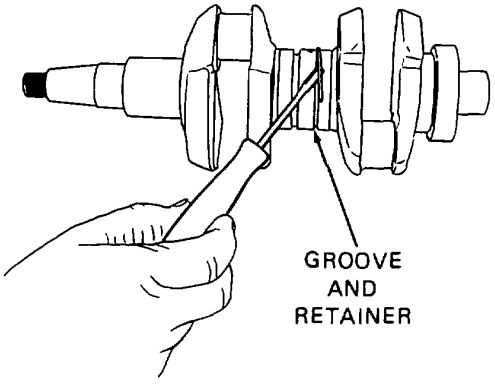


Figure 5-17. Crankshaft center bearings

LOCATION/ITEM	ACTION	REMARKS

5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY - continued

ASSEMBLY

CAUTION
Oil all components with 50/1 lubricant before assembly.

1.	Center needle bearings and retainers (20)	Position on crankshaft center journal.
2.	Center bearing split sleeve halves (19)	Position over bearing retainers (20).
3.	Center bearing retainer ring	Install in groove in split sleeve.
4.	Wrist pin bearing (18)	Press into connecting rod.

CAUTION
Be sure to install pistons on connecting rods so the intake side of the deflector will be toward the intake port of the cylinder block when pistons and crankshaft are installed.

5.	Connecting rod and wrist pin bearing.	Position in piston.

CAUTION
Be sure to press in wrist pin from the loose side (marked) "L," or "loose" inside piston to the tight side.

7.	Retaining rings (16) pin.	Install in grooves in wrist

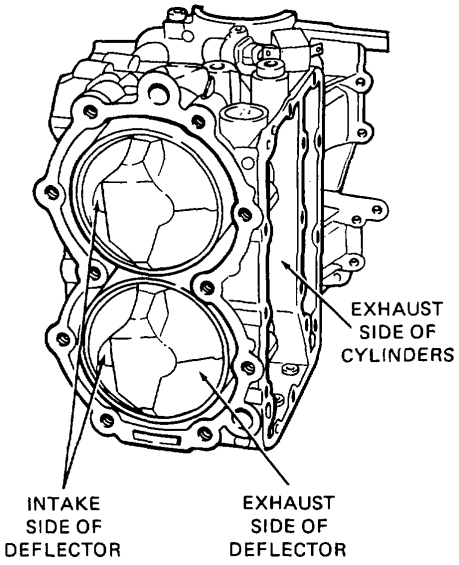


Figure 5-18 View of deflectors

LOCATION/ITEM	ACTION	REMARKS

5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY - continued

ASSEMBLY

8. Pistons (21)	Check with micrometer to see if piston has become distorted during assembly. the pistons at the bottom (skirt).	MICROMETER CHECK Take micrometer readings of the outside diameter of Take two readings, 90° apart.
9. Pistons (21)	Replace if the variation in the readings at the skirt are greater than 0.0025 in. (0.0064 cm). **CAUTION** **Be sure rings fit freely. Be sure the retaining pin in the piston groove is in the center of the piston ring gap.**	
10. Piston rings (15)	Install on pistons.	
11. "O" ring (10)	Slide on to crankshaft (22).	
12. Seal (8)	Install.	
13. Bearing (9)	Slide on to crankshaft (22).	
14. "O" ring (7)	Install in crankshaft (22).	
15. Bearing (6)	Press on to crankshaft (22).	
16. Snap ring (5) bearing (6).	Install in groove behind	Use snap ring tool no. 303859.
17. Seals (4)	Install back-to-back in crankcase head (2).	
18. "O" ring (3)	Install in groove in crank-case head (2).	

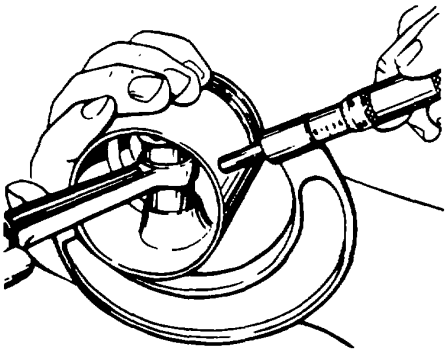


Figure 5-19. Micrometer check of pistons

LOCATION/ITEM	ACTION	REMARKS
5-10. CRANKSHAFT AND PISTONS DISASSEMBLY/ASSEMBLY - continued		
19. Crankcase head assembly (2)	Install on crankshaft.	
20. Snap ring (1)	Install.	Use retaining ring tool 303859.
21. Key (11)	Install in keyway.	
	CAUTION **Be sure of installing the correct bearings and bearing caps on the correct connecting rods and crankshaft journals.**	
22. Needle bearings (14) and retainer (13)	Install one half of set in connecting rod.	
23. Piston connecting rod bearing assembly	Install on crankshaft journal.	Smear a little heavy grease in connecting rod. Place retainer half in con rod and install 6 needles. Bring rod up to crankshaft. Using grease to hold needles,
24. Needle bearings (14) and retainer (13) bearing cap.	Place bottom half on crankshaft journal and install	place two end needles in position. Put other retaining half in place and install remaining needles. Put rod cap in place and install screws finger-tight. Then install bearings in other rod the same way.
25. Capscrews (23) torque of 29-31 lb. ft. (40-42 N•m).	Install and tighten to a	
INSTALLATION		
1. Piston and connecting rods assembly	Install in cylinder block.	
	NOTE **Lubricate cylinder walls and pistons before installation. Use ring compressor 326592 to compress piston rings.**	
2. Follow steps 23-29, para. 5-9	**CAUTION** **Rods and caps have fracture joints that must match perfectly. Snug rod cap screws and feel machined surface of rod with finger nail. If alignment is not perfect, tap rod cap lightly with a mallet from several directions and snug screws again when alignment is correct, torque screws to 29-31 ft. lb. (40-42 N·m).**	

Section V. EXHAUST HOUSING ASSEMBLY

MAINTENANCE SUMMARY. This task covers:

a. Steering and swivel brackets removal/installation/disassembly/assembly
b. Exhaust housing removal/installation
c. Steering handle repair

INITIAL SETUP

Personnel Required	General Safety Instructions
1	None

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Steering and swivel bracket removal/ installation/disassembly/assembly	Para. 5-1 1	
2	Exhaust housing removal/ installation	Para. 5-12	
3	Steering handle disassembly/ assembly	Para. 5-13	

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION

This task covers:

Removal/Disassembly/Assembly/Installation of the steering and swivel brackets.

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Motor suspended from lift bracket

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
120

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Engine	Remove.	See para. 5-8.
2. Lower motor cover	Remove.	See para. 5-5.
3. Stern brackets (1) and (2)	Remove.	See para. 4-29.
4. Acorn nuts (3), cap-screws (4) and (5) and lockwashers (6)	Remove.	
5. Housings (7)	Remove.	
6. Both lower rubber mounts (8) and bumper (9)	Remove from housings (7).	Replace any rubber mounts that are worn or deteriorated.
7. Capscrew (10) and lockwasher (11)	Remove.	
8. Lower front rubber mount (12) and gasket (13)	Remove.	
9. Nuts (14) and washers (15)	Remove.	
10. Capscrews (16) and washers (17)	Remove.	

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

11. Nut (15) and washer (19)	Remove.	
12. Upper front rubber mount (20)	Remove from exhaust housing.	
13. Steering friction adjustment screw (21)	Loosen.	
14. Steering bracket assembly (22) and swivel bracket assembly (23)	Lift away from exhaust housing (24).	
15. Upper rubber side mounts (25)	Remove.	
16. Steering bracket (22)	Lift out of swivel bracket assembly (23)	
DISASSEMBLY		
1. Reverse lock spring (26)	Stretch slightly, lift off retainer at top of swivel bracket and detach from reverse locking lever (27).	
2. Cotter pin (28)	Remove.	
3. Reverse lock rod (29)	Remove from swivel bracket and reverse locking lever (27).	
4. Reverse lock shaft (30) and link (31)	Remove from swivel bracket and reverse lock links (32).	

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ ASSEMBLY/INSTALLATION - continued

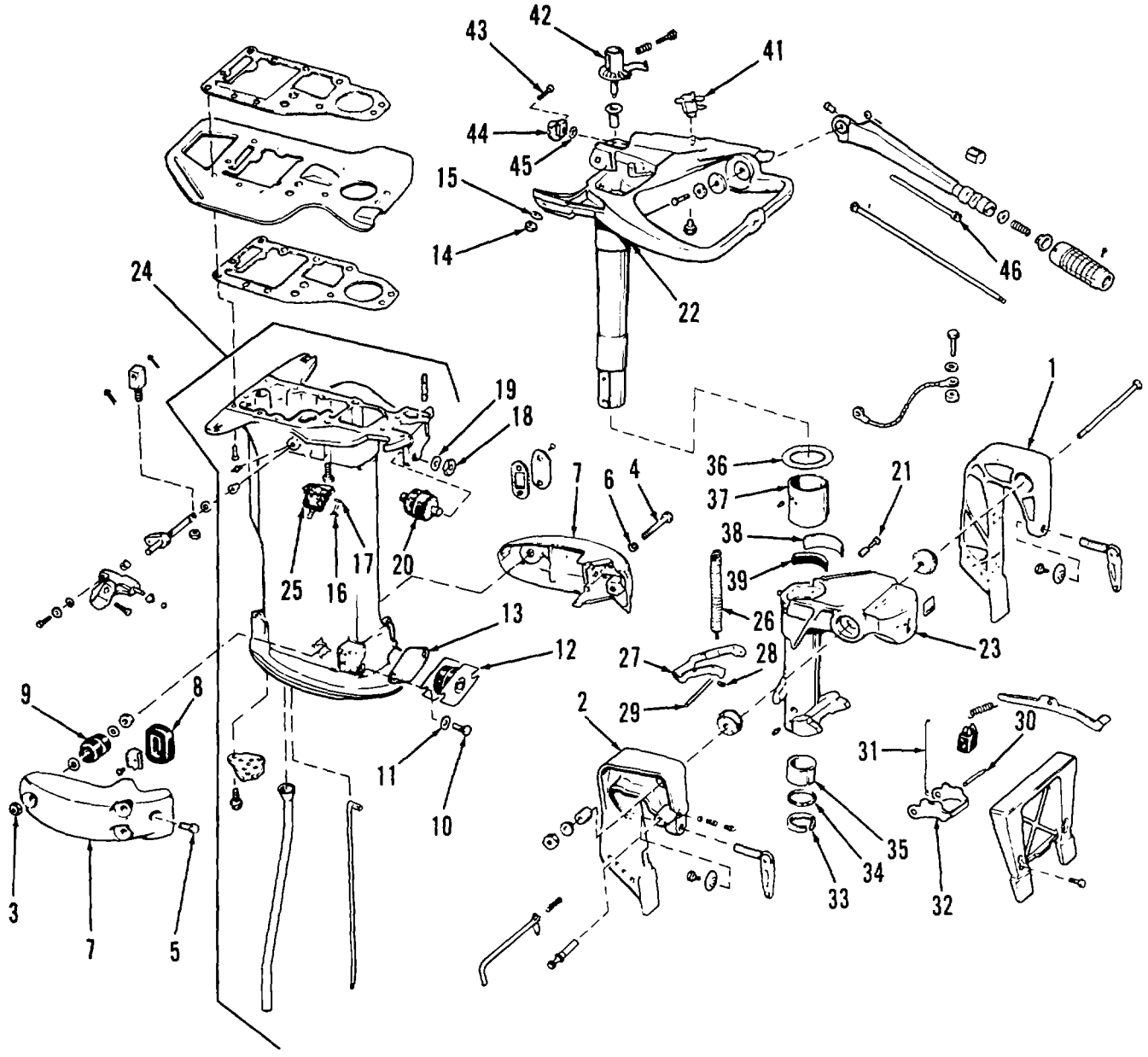


Figure 5-20. Lower unit

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued

1. Stern bracket
2. Stern bracket
3. Acorn nut
4. Capscrew
5. Capscrew
6. Lockwasher
7. Housing
8. Bumper
9. Mount
10. Capscrew
11. Washer
12. Mount
13. Gasket
14. Nut
15. Washer
16. Capscrew
17. Washer
18. Nut
19. Washer
20. Mount
21. Capscrew
22. Steering bracket
23. Swivel bracket
24. Exhaust housing assembly
25. Mount
26. Spring
27. Reverse locking lever
28. Cotter pin
29. Rod
30. Shaft
31. Link
32. Link
33. Spacer
34. O-ring
35. Liner
36. Thrust washer
37. Liner
38. Plate
39. Spacer
40. Capscrew
41. Connector
42. Gear
43. Capscrew
44. Pinion
45. Washer
46. Throttle shaft

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ ASSEMBLY/INSTALLATION - continued

5. Spacer (33), "O" ring (34) and liner (35)	Remove from bottom of swivel bracket.	
6. Thrust washer (36) and liner (37)	Remove from top of swivel bracket.	
7. Plate (38) and spacer (39)	Remove.	
8. Capscrew (40)	Remove.	
9. Fuel connector (41)	Remove.	
10. Throttle control gear (42)	Slide up and out of steering bracket (22).	
11. Capscrew (43) control pinion (44).	Remove from throttle	
12. Throttle control pinion (44) and washer (45)	Slide off throttle shaft (46).	
ASSEMBLY		
1. Washer (45) and throttle control pinion (44)	Slide on throttle shaft (46).	
2. Capscrew (43)	Install but do not tighten.	
3. Throttle control gear (42)	Slide into position on steering bracket (22).	Mesh gears (42) and (44) and rotate back and forth a few times to seat teeth.
4. Capscrew (43)	Tighten.	

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ ASSEMBLY/INSTALLATION - continued

5.	Fuel connector (41)	Position on steering bracket.
6.	Capscrew (40)	Install.
7.	Spacer (39) and (38)	Install in swivel bracket (23).
8.	Liner (37) and thrust washer (36)	Install in top of swivel bracket.
9.	Liner (35), "O" ring (34) and spacer (33)	Install in bottom of swivel bracket.
10.	Reverse lock links (32)	Position on swivel bracket.
11.	Reverse lock shaft (30)	Install.
12.	Link (31)	Install.
13.	Reverse locking lever (27)	Position on swivel bracket,
14.	Reverse lock rod (29)	Install.
15.	Cotter pin (28)	Install.
16.	Spring (26)	Install.

INSTALLATION

1.	Steering bracket (22)	Install in swivel bracket (23).
2.	Side mounts (25)	Position on exhaust housing (24).

LOCATION/ITEM	ACTION	REMARKS

5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ ASSEMBLY/INSTALLATION - continued

3. Capscrews (16) and washers (17)	Install.	
4. Steering and swivel bracket assembly	Position on exhaust housing on rubber side mount (25).	
5. Nuts (14) and washers (15)	Install and tighten to a torque of 12-13 lb. ft. (17-18 N•m).	
6. Upper front rubber mount (20)	Install in exhaust housing and steering bracket with nut (18) and washer (19). Tighten to a torque of 21-26 lb. ft. (28-35 N•m).	
7. Lower front rubber mount (12) and gasket (13)	Install on exhaust housing.	
8. Rubber mounts (8), (9) and gaskets, bumper retainer and screw	Position in side mounts (7).	
9. Side mounts (7)	Position on exhaust housing and steering bracket.	
10. Capscrews (4), (5) and lockwashers (6) and nuts (3)	Install and tighten to a torque of 10-12 lb. ft. (14-16 N•m).	

LOCATION/ITEM	ACTION	REMARKS
5-11. STEERING AND SWIVEL BRACKETS REMOVAL/DISASSEMBLY/ASSEMBLY/INSTALLATION - continued		
11. Stern brackets (1) and (2)	Install.	See para. 4-29. Place unit on workstand.
12. Steering friction screw (21)	Tighten.	See para. 2-14.
13. Lower motor cover	Install.	See para. 5-5.
14. Engine	Install.	See para. 5-8.

5-12. EXHAUST HOUSING REMOVAL/INSTALLATION

This task covers:

Replacement of exhaust housing

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Follow procedure

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
120

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Engine	Remove.	See para. 5-8.
2. Lower motor cover	Remove.	See para. 5-5.
3. Steering and swivel brackets	Remove.	See para. 5-11.
4. Gearcase and exhaust removal/disassembly/ housing extension	Remove.	See para. 4-36, water pump assembly/installation.
5. Shift lever	Remove.	See para. 4-34.
6. Cotter pins (1)	Remove.	
7. Upper shift rod (2)	Disengage from connector (3) and remove.	
8. Connector (3)	Unscrew from shift bracket and shaft (4) and remove.	
	NOTE	
	Do not let nut (5) fall into exhaust housing.	

LOCATION/ITEM	ACTION	REMARKS
5-12. EXHAUST HOUSING REMOVAL/INSTALLATION - continued		
9. Bracket and shaft (4)	Remove.	
10. "O" ring (6) and bushing (7)	Remove from exhaust housing (8).	
11. Grease fitting (9)	Remove.	
12. Capscrew (10) and cover (11)	Remove.	
13. Water tube (12)	Remove.	
ASSEMBLY		
1. Cover (11)	Install and secure with capscrew (10).	
2. Grease fitting (9)	Install.	
3. Bushing (7)	Insert in exhaust housing	
4. "0" ring (6) shaft (4).	Install on shift bracket	
5. Shift bracket and shaft (4)	Install.	
6. Connector (3) and nut (5)	Install on shift bracket shaft (4).	
7. Upper shift rod (2) (3) with cotter pins (1).	Install.	Fasten to connector
8. Water tube (12)	Install.	
9. Shift lever	Install.	See para. 4-34.

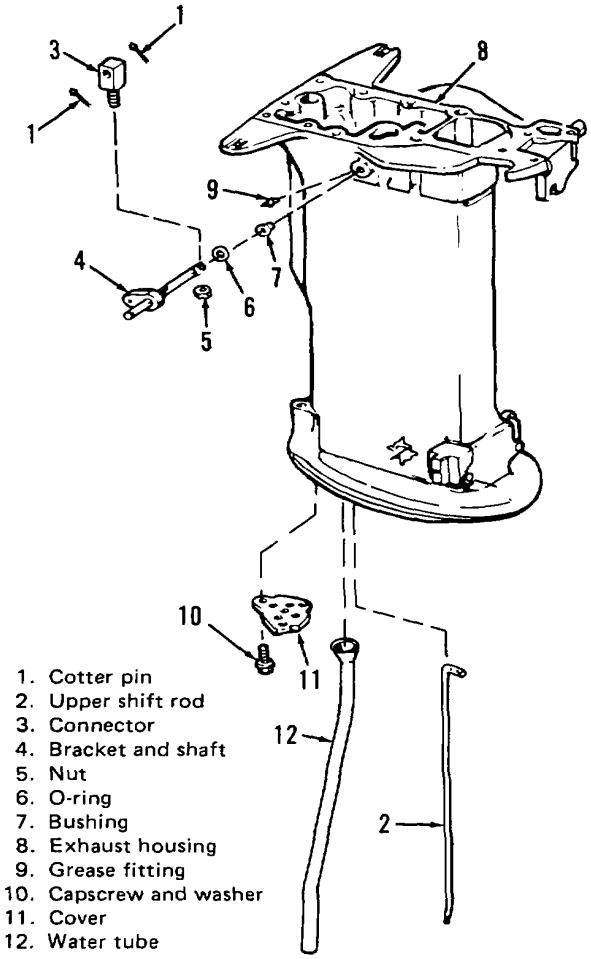


Figure 5-21. Exhaust housing

LOCATION/ITEM	ACTION	REMARKS
5-12. EXHAUST HOUSING REMOVAL/INSTALLATION - continued		
10. Gearcase and exhaust removal/disassembly/	Install.	See para. 4-36, water pump assembly/installation
11. Steering and swivel bracket	install.	See para. 5-11.
12. Lower motor cover	Install.	See para. 5-5.
13. Engine	Install.	See para. 5-8.

5-13. STEERING HANDLE DISASSEMBLY/ASSEMBLY

This task covers:

Steering handle repair

INITIAL SETUP:

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Motor on repair stand

Materials/Parts:
As required

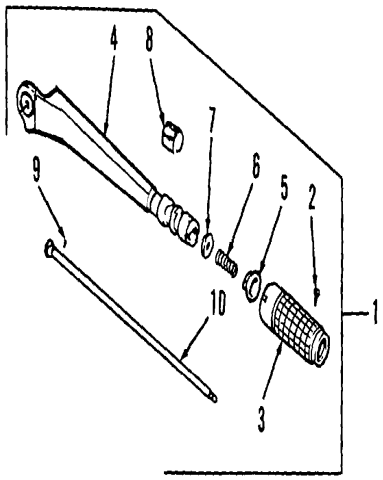
Personnel Required:
1 mechanic

Approximate Time Required (minutes):
60

LOCATION/ITEM	ACTION	REMARKS

DISASSEMBLY

1.	Steering handle (1)	Remove.	See para. 4-31.
2.	Phillips head screw (2)	Remove.	
3.	Grip (3)	Slide off end of arm (4).	
4.	Friction blocks (5)	Remove.	
5.	Spring (6) and washer (4)	Remove.	
6.	Bushing (8)	Remove.	
7.	Groove pin (9)	Remove.	
8.	Throttle shaft (10)	Slide out of arm.	



LOCATION/ITEM	ACTION	REMARKS

5-13. STEERING HANDLE DISASSEMBLY/ASSEMBLY -continued

ASSEMBLY

	LOCATION/ITEM	ACTION	REMARKS
1.	Throttle shaft (10)	Slide into arm (4).	
2.	Groove pin (9)	Install in throttle shaft (10).	
3.	Bushing (8)	Install on arm.	
4.	Washer (7) and spring (6)	Position on arm.	
5.	Friction block (5)	Place in grip (3).	
6.	Grip (3) and friction block (5)	Position on arm so screw holes line up.	
7.	Phillips head screw (2)	Install.	
8.	Steering handle (1)	Install.	See para. 4-31.

Section VI. GEARCASE

MAINTENANCE SUMMARY. This task covers:

a. Gearcase disassembly/assembly.
b. Shift rod removal/installation.
c. Gearcase tests.
d. Driveshaft removal/installation.

INITIAL SETUP

Personnel Required	General Safety Instructions
1	

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Gearcase disassembly/ assembly	Para. 5-14	
2	Shifter rod removal/ installation	Para.	Part of gearcase disassembly/assembly.
3	Gearcase pressure and vacuum tests	Para. 5-15	
4	Driveshaft removal/installation	Para. 5-16	

5-14. GEARCASE DISASSEMBLY/ASSEMBLY

This task covers:

Gearcase disassembly/assembly

INITIAL SETUP

Tools:
Gear puller
T1 5180-00-177-7033
T1 4910-00-754-0705

Equipment Condition:
Motor suspended by hoist attached to lift bracket

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
180

LOCATION/ITEM	ACTION	REMARKS
DISASSEMBLY	**CAUTION** Support gearcase while removing capscrews.	
1. Gearcase	Remove.	See para. 4-36, water pump
2. Water pump	Remove (para.	4-36).
3. Gearcase	Drain through drain/fill plug (1).	
4. Shift rod pivot pin (2) and seal (3)	Remove.	

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		
5. Propeller assembly (4)	Remove.	See para. 3-14.
6. Capscrews (5) attaching gearcase halves	Remove.	
7. Lower gearcase assembly	Separate from upper gear assembly.	
8. Cradle (6) and shifter lever (7)	Swing up and out of the way. Remove cradle (6).	
9. Lower gearcase assembly	Remove.	
10. Propeller shaft (8) and components	Lift out of gearcase as a unit.	
11. Pinion (9)	Remove.	
	NOTE **Use a suitable gear puller to remove bearings and gears.**	
12. Bearing (10)	Remove.	
13. Forward gear (11) and thrust washer (12)	Remove.	
	NOTE **The detent balls (17) and spring (18) will pop free when the clutch dog shifter is removed.**	
14. Clutch dog shifter (13)	Slide off shaft (8).	
15. Oil retainer (14), housing (15) and O-ring (16)	Remove.	Slide housing assembly off shaft. Remove O-ring and pry oil retainer from housing.
16. Bearing (19), thrust washer (20), bushing (21), reverse gear (22), and thrust washer (23)	Remove.	

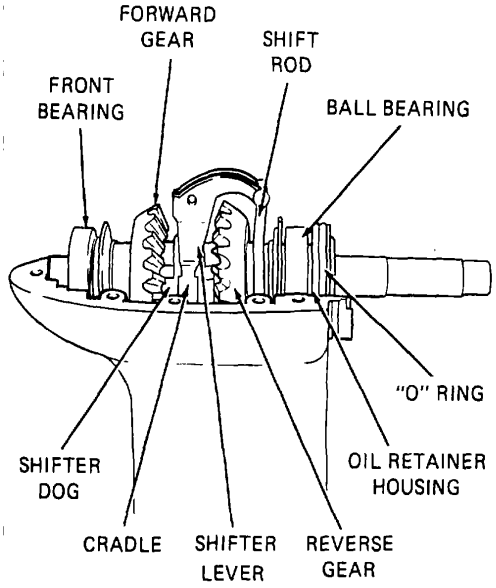


Figure 5-23. Gearcase arrangement

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		

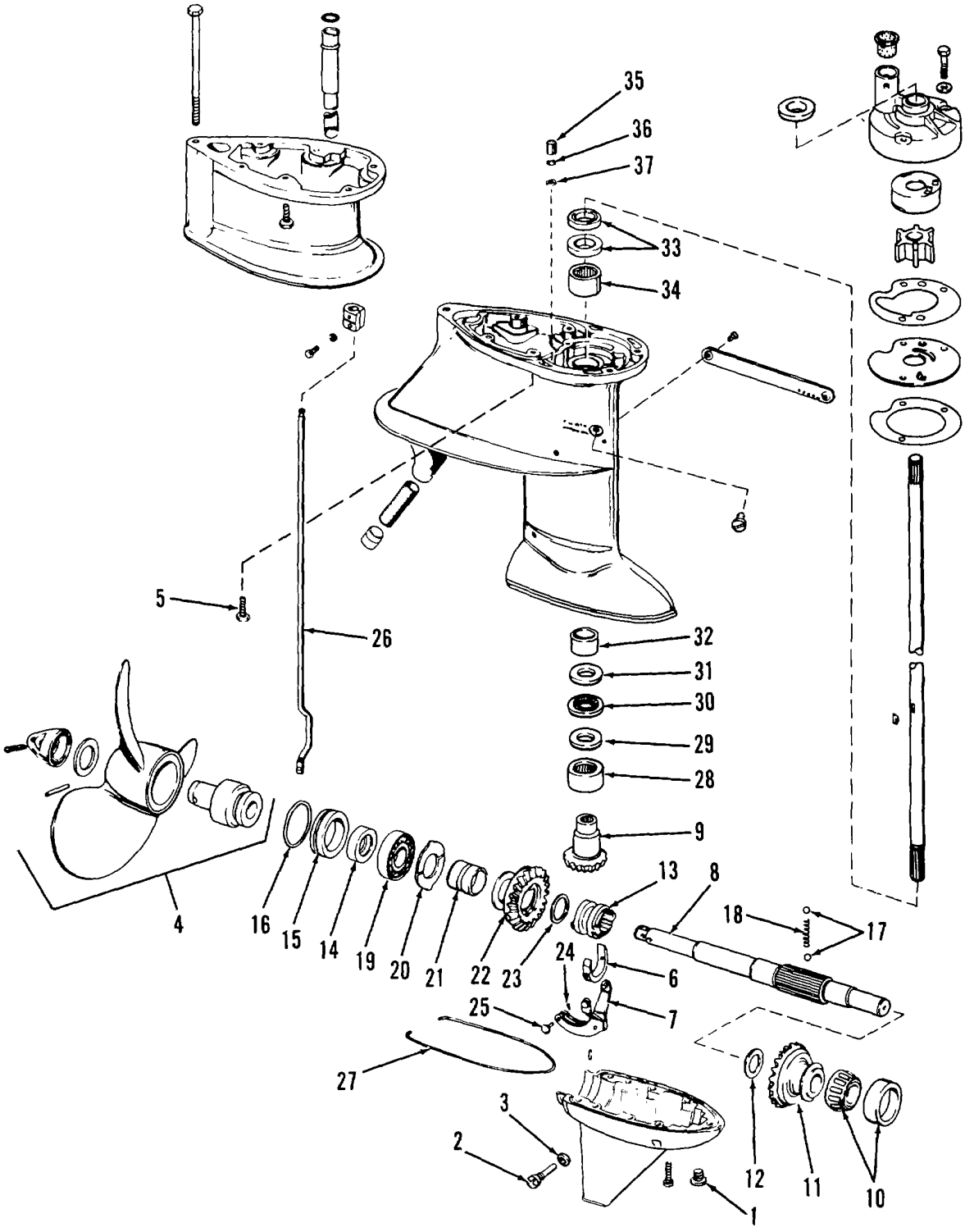


Figure 5-24. Gearcase

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		

1. Oil level plug and washer
2. Shift rod pivot pin
3. Seal
4. Propeller assembly
5. Capscrew
6. Clutch dog cradle
7. Shifter lever
8. Propeller shaft
9. Pinion
29. Pinion washer
10. Roller bearing assembly
11. Forward gear and bushing
12. Thrust washer
13. Clutch dog shifter
14. Oil retainer
15. Housing
16. O-ring
17. Detent ball
18. Detent spring
19. Ball bearing
20. Thrust washer
21. Reverse gear bushing
22. Reverse gear
23. Thrust washer
24. Cotter pin
25. Shift rod pin
26. Lower shift rod
27. Seal
28. Pinion bearing
29. Pinion washer
30. Thrust bearing
31. Pinion washer
32. Pinion bearing assembly
33. Seals
34. Bearing
35. Shift rod bushing
36. Gasket
37. Gasket

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		
17. Cotter pin (24) and shift rod pin (25)	Remove from shifter lever (7). Remove shift rods (26) from gearcase.	
18. Seal (27)	Remove from crankcase half.	
	NOTE **Use an internal bearing puller and remove (38), (37), (36), (35), (34).**	
19. Bearing (28) and pinion washer (29)	Remove from upper gearcase half.	
20. Thrust bearing (30) and pinion washer (31)	Remove.	
21. Pinion bearing assembly (32)	Remove.	
22. Seals (33)	Remove.	
23. Bearing (34)	Remove.	
24. Bushing (35)	Remove.	
25. O-ring (36) and gasket (37)	Remove.	
ASSEMBLY		
1. Gasket (37) and O-ring (36)	Insert in exhaust housing.	
2. Bushing (35)	Install in exhaust housing on top of O-ring and bushing.	Use a suitable mandrel to drive bushing into place.
3. Bearing (34) and seals (33)	Install.	Use a suitable driver and install seals back-to-back.

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		
4. Pinion bearing assembly (32)	Install.	
5. Pinion washer (31) and thrust bearing (30)	Install.	
6. Pinion washer (29) and bearing (28)	Install.	Oil propeller shaft for easier assembly.
	CAUTION Aline notches in clutch dog shifter over the detent balls. If they appear off-center, rotate clutch dog 1800. The machined groove on the clutch dog must face forward (away from the propeller end) of the shaft.	Chamfer on pinion washer (29) must face pinion gear (9).
7. Detent balls (17) and spring (18)	Install in shaft (8) and hold in position while sliding the clutch dog shifter (13) onto shaft and into place over detent balls.	
8. Thrust washer (23) and	Install on shaft (8). forward gear (11)	
9. Bearing (10)	Install.	
10. Thrust washer (23) and reverse gear (22)	Install.	
11. Bushing (21) and thrust washer (20)	Install.	
12. Bearing (19)	Install.	
13. Oil retainer (14), housing (15), and O-ring (16)	Assemble and install on shaft.	
14. Lower shift rod (26)	Position in shifter lever (7) and secure with shift rod pin (25) and cotter pin (24). Place cradle (6) on assembly.	

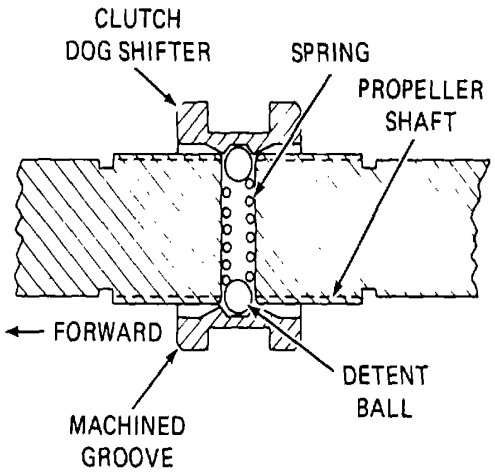


Figure 5-25. Clutch dog shifter and shaft

LOCATION/ITEM	ACTION	REMARKS
5-14. GEARCASE DISASSEMBLY/ASSEMBLY - continued		
15. Shifter lever and shift rod assembly	Position in lower gearcase. **CAUTION** Rotate housing (15) and bearing (19) so the alining hole in these components engages dowel (8) in lower gearcase.	
16. Propeller shaft and gear assembly	Position in lower gearcase so shift cradle (6) engages slot in clutch dog shifter (13).	
17. Gearcase seal (27)	Install on lower gearcase.	Cut from bulk roll to a length of 16.094 (40.88 cm). (See para.F-4.)
18. Shift rod pivot pin (2) and seal (3)	Install so pin engages shifter lever properly.	
19. Lower gearcase position more easily.	Position on upper gearcase.	Oil lower shift rod (26) so it will slide into
20. Capscrews (5) gearcase.	Install in upper and lower	
21. Propeller assembly (4)	Install.	See para. 3-14.
22. Drive shaft and water pump assembly	Install.	See para. 4-36.
23. Gearcase	Install.	See para. 4-36.
24. Gearcase	Lubricate.	See para. 3-13 and LO 5-2805-261-12.
25. Shifter	Shift a few times to check for free movement.	

5-15. GEARCASE PRESSURE AND VACUUM TESTS

This task covers:

Testing gearcase for air and water tightness.

INITIAL SETUP

Tools:
- T11 Pressure test group - S34
- T12 Adaptor 389945
- T1 5180-00-177-7033
- T2 4910-00-754-0705

Materials/Parts:
- Container of water large enough to hold gearcase

Personnel Required:
- 1 mechanic

Equipment Condition:
- Motor on test stand

Approximate Time Required (minutes):
- 60

LOCATION/ITEM	ACTION	REMARKS
PRESSURE TEST		
	NOTE Pressure and vacuum tests are performed at the same time.	
1. Lower unit removal/installation.	Remove.	See para. 4-36, water pump
2. Propeller	Remove.	See para. 3-14.
3. Drain/fill plug	Remove.	
4. Gearcase	Drain.	
	NOTE Be sure gearcase is completely empty before testing.	
5. Pressure test group hole.	Screw into drain/fill plug	
6. Pressure test group (21-42 kPa).	Pump pressure to 3-6 psi gearcase.	Watch gage. If pressure drops, there is a leak in the
7. Gearcase water.	Submerge in container of	Look for bubbles at source of leak.
8. Gearcase	Repair as necessary.	If there are no leaks proceed to step 9.
9. Pressure test group (110-124 kPa).	Pump pressure to 16-18 psi	If gage pressure drops perform steps 7 and 8.

LOCATION/ITEM	ACTION	REMARKS
5-15. GEARCASE PRESSURE AND VACUUM TESTS - continued		

VACUUM TEST

1.	Vacuum test group	Screw into drain/fill plug hole.	
2.	Vacuum test group	Pump out to 19-32 in. (76-127 mm) of mercury.	Watch gage. If mercury drops (vacuum doesn't hold) there is a leak in the gearcase.
3.	Oil	Put around area of suspected leak.	If oil is drawn in or if leak stops, the seal in that area is defective and must be replaced. If there are no leaks proceed to step 4.
4.	Vacuum test group	Pump out to 97 in. (381 mm) of mercury.	If gage pressure drops perform step 3.
5.	Gearcase	Repair as necessary.	

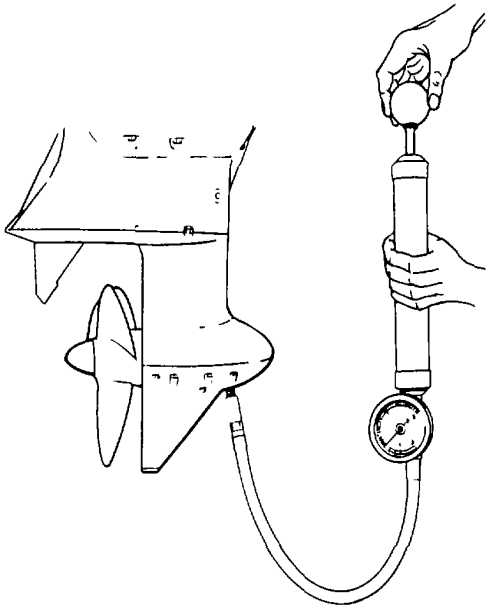


Figure 5-26. Gearcase pressure test

5-16. DRIVESHAFT REMOVAL/INSTALLATION

This task covers:

Removal/installation of the driveshaft

INITIAL SETUP

Tools:
T1 5180-00-177-7033
T2 4910-00-754-0705

Equipment Condition:
Motor on stand

Materials/Parts:
As required

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
60

LOCATION/ITEM	ACTION	REMARKS
REMOVAL		
1. Gearcase	Remove.	See para. 4-36, water pump removal/installation.
2. Water pump	Remove.	See para. 4-36, water pump removal/installation.
3. Driveshaft	Remove.	
INSTALLATION		
1. Driveshaft	Install.	
2. Water pump	Install.	See para. 4-36.
3. Gearcase	Install.	See para. 4-36.

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, and technical manuals referenced in this manual.

A-2. FORMS.

Equipment Inspection and Maintenance Work Sheet.....DA Form 2404
Quality Deficiency Report .....SF 368
Recommended Changes to..... DA Publications .....DA Form 2028

A-3. TECHNICAL MANUALS.

Operator, Organizational and DS Maintenance Manual, Outboard Motor, Gasoline, Model AM-40A..... TM 5-2805-261-13
Organizational and DS Maintenance Repair Parts and Special Tools List, Outboard Motor, Gasoline, Model AM40A..... TM 5-2805-261-23P
The Army Maintenance Management System (TAMMS) ..... TM 38-750

A4. MISCELLANEOUS PUBLICATIONS.

Lubrication Order, Outboard Motor Gasoline, Model AM-40A ..... LO 5-2805-261-12

APPENDIX B

BASIC ISSUE ITEMS AND INTEGRAL COMPONENTS OF END ITEM

Section I. INTRODUCTION

B-1. SCOPE. This appendix lists Outboard Motor Basic Issue Items (BII) for the Outboard Motor to help you inventory items required for safe and efficient operation.

B-2. GENERAL. Section II. Basic Issue Items. These are minimum essential items required to place the outboard motor in operation, to operate it and to perform emergency repairs. Although shipped separately packed, they must accompany the outboard motor during operation and whenever it is transferred between accountable officers.

Section III. Integral Components of End Item. These items are necessary for the function of the motor and must accompany it whenever it is transferred or turned in. This manual is your authority to requisition replacement BII based on Table(s) of Organization and Equipment (TOE)/ Modification Table of Organization and Equipment (MTOE) authorization of the end item.

B-3. EXPLANATION OF COLUMNS.

a. Illustration. This column is divided as follows:
   1. Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).
   2. Item Number. The number used to identify item called out in the illustration (if applicable).

b. National Stock Number (NSN). Indicates national stock number assigned to the end item which will be used for requisitioning (if applicable).

c. Part Number (P/N). Indicates the primary number used by the manufacturer which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

d. Description. Indicates the federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Usable on Code. "Usable On" codes are included to help you identify which component items are used on the different models (if applicable).

g. Quantity Required (Qty Reqd). This column lists B-1 the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the received column, list the quantity you actually receive on your major TM 5-2805-261-13 item. The date columns are for use when you inventory the major item at a later date, such as Section II. BASIC ISSUE ITEMS for shipment to another site.

Section II. BASIC ISSUE ITEMS

(1) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO. AND FSCM	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY REV'D	DATE	DATE	DATE
			329400 (80256)	Plug, spark		2					
		531500-089-8968	306394 (32195)	Key, cotter		2					
			329585 (32195)	Propeller		1					
		5120-00-104-4155	GGG-P471 (81348)	Pliers		1					
			389933 (80256)	Wrench, spark plug		1					
		5120-00-227-7338	GGG-S-121 (81348)	Screw driver		1					
		7520-00-559-9618	MIL-L-11743 (81349)	Case, operation and maintenance publication		1					
				Department of the Army Publications							
			TM 5-2805-261-13	Operator, organizational and direct support maintenance		1					
			LO 5-2805-261-12	Lubrication Order		1					
		5315-00-504-8826	304575 (32195)	Pin, propeller drive		1					

Section III. INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO. AND FSCM	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY REV'D	DATE	DATE	DATE
		2910-00-353-1794	377331 (32195)	Tank assembly	Motor chest	1					
		--	--	Chest, motor	--	1					

APPENDIX C
MAINTENANCE ALLOCATION CHART
SECTION I
INTRODUCTION

C-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool set s) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

C-2. Maintenance functions. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g, by sight, sound or feel).

b. Test. To verify serviceability by measuring the mechanical, pheumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact pos ition, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or tests, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of maintenance performed by the Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

C-3. Explanation of Columns in the MAC, Section II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, sub-assemblies, and modules with the next higher assembly. End item group number shall be "00." b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2).

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

C ..... Operator or crew
O ..... Unit Maintenance
F ..... Intermediate Direct Support Maintenance
H ..... Intermediate General Support Maintenance
L ..... Specialized Repair Activity (SRA)
D ..... Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code those common tool sets (not individual tools) and special tools, TMDE and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code in alphabetic order, which shall be keyed to the remarks contained in Section IV.

C-4. Explanation of Columns In Tool and Test Equipment Requirements, Section Ill.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

C-5. Explanation of columns in Remarks, Section IV.

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	INTERMEDIATE F	INTERMEDIATE H	DEPOT D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
01	Cover Assembly								
	Cover Motor	Inspect	.01						
		Replace	.01					T1	
		Repair			3.0			T1, T2	
02	Starting System-								
	Starter	Inspect	01						
	Rewind	Replace	02					T1, T3, T4, T5	
		Repair		1.0				T1, T3, T5, T6	
03	Magneto Flywheel								
	Assy	Inspect		02					
		Replace		05				1, T3	A
	Ignition Coil	Test		02				1, T7	
	Assy	Replace		07					
	Condenser	Test		02				T1	
		Replace		05					
	Break points	Test		03				T1	
		Replace		07				T13	
	Wiring	Inspect	01						
		Test		02				T1, T7	
		Replace		04				T1, T7	
	Shorting Switch	Inspect		01					
	Assy	Test		02				T1	
		Replace		03				T1	
04	Fuel Tank-								
	Tank Assy	Inspect		01					
		Test		07				T, T11, T12	
		Replace		02				T1	
05	Fuel Pump								
	Pump Assy	Inspect	01	T1					
		Replace		02				T1	
06	Carburetor								
	Carburetor	Inspect		01					A
	Assy	Adjust		01				T1	
		Replace		08				T1, T3, T6	
		Repair			1.0			T1, T2, T6	
		Overhaul			1.0			T1, T2, T6	

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
	Needle Value Assy	Inspect		.01					
		Replace		.01				T1	
07	Intake Manifold Assy	Inspect		05					
		Replace			1.6			T1, T2	
	Leaf Plate Assy	Inspect			05				
		Replace			1.3			T1, T2	
08	Crankshaft								
	Crankshaft and Piston	Inspect			1.3			T1, T2	
		Replace			5.5			T1, T2, T8, T9, T10	
	Bearings	Inspect			1.0				
		Replace			4.0				
09	Cylinder and Crankcase								
	Cylinder and Crankcase Assy	Inspect		0.2					A
		Replace			06			T1, T2	
		Repair			4.0			T1, T2, T8, T9, T10	
	Spark Plug	Inspect	.01						
		Adjust	.03					T1	
		Replace	.03					T1	
	Cylinder Head	Inspect		.02					
		Replace			.06				
10	Exhaust Housing								
	Exhaust Housing Assy	Inspect	.01						
		Replace			2.0			T1, T2	
	Steering/Handle Throttle	Inspect	.01						
		Service	.01						
		Adjust	.01					T1	
		Replace		.05				T1	
		Repair			1.0			T1, T2	
	Steering and Swivel Bracket	Inspect		05					
		Replace			2.0			T1, T2	

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	INTERMEDIATE F	INTERMEDIATE H	DEPOT D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
	Stern Bracket	Inspect	.01						
		Replace	.	05				T1	
	Screw Assy	Inspect	.01						
	Clamp	Replace	.02					T1	
	Shifter Lever	Inspect	.01						
		Adjust		.02				T1	
		Replace		.05				T1	
11	Gearcase Assy	Inspect	.01						
		Replace			1.0			1, T2	
		Service	.02						
		Test			1.0			T1, T2, T11	
		Repair			3.0			1, T2	
	Driveshaft	Inspect			.04				
		Replace			.08			1, T2	
	Water Pump	Inspect		1.0					A
		Replace		1.0				T1	
		Repair		1.0				T1	
	Engine Temperature	Test		.5				Markai Thermomelt Stik	
	Water Intake Screen	Inspect		.02					
		Replace		.02				T1	
		Service		.02				T1	
	Shifter Rod and Shifter Shaft	Inspect			.01				
		Replace			1.0			1, T2	
	Propeller	Inspect	.01						
		Replace	.02					T1	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/ NATO Stock Number	(5) Tool Number
T1	C,O,F,H	Tool Kit, General Mechanic, Automotive	5180-00-177-7033	
T2	F	Shop Set, Automotive Repair, Field Maintenance, Basic	4910-00-754-0705	
T3	O	Shop Equipment Automotive Maintenance and Repair: Organization, Common No. 1	4910-00-754-0654	
T4	O	Spring winder	392093	
T5	O	Rope starter	378714	
T6	C,O,F	Hose clamp wrench	325043	
T7	O	Stevens S-80, or mercontronic tester, ignition, AC,DC circuit.	ST75C	
T8	F	Engine holder	303605	
T9	F	Piston ring compressor	326592	
T10	F	Retaining ring pliers	303859	
T11	O,F	Tester	S34	
T12	O,F	Adapter	389945	
T13	O	Timing fixture	386635	

SECTION IV, REMARKS

(1) Reference Code	(2) Remarks
A	Complete Kit is available

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE. This appendix lists additional items you are authorized for the support of the outboard motor

D-2. GENERAL. This list identifies items that do not have to accompany the outboard motor and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA or JTA.

D-3. EXPLANATION OF LISTING. National stock number, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. "USABLE ON" codes are identified as follows:

Code	Used On
MAA	Model AM-40A

(1) National Stock Number	(2) Part Number & FSCM	Description	(3) Usable On Code	(4) U/M	Qty Auth
7520-00-559-9618		Cotton Duck Case	MAA	EA	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE. This appendix lists expendable supplies and materials you will need to operate and maintain the outboard motor.

These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS'

a. Column 1 - Item Number. This number is assigned to the entry in the listing.

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

C ..... Operator/Crew

O ..... Organizational Maintenance

F ..... Direct Support Maintenance

H ..... General Support Maintenance

c. Column 3 - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item in dicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Expendable Supplies and Materials List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C, O, F	6850-00-274-5421	Drycleaning Solvent, P-D-680	gal.
2	C	7920-00-205-1711	Rag, wiping	lb.
3	C, O, F	9150-00-190-0904	GAA Grease, Auto/Artillery MIL-G-10924 (81349)	lb.
4	C	9150-00-117-8791	50/1 lube oil, engine	gal.
5	C, O, F	9150-00-905-9100	GO lubricating oil, grade 90 MIL-L-2105 (81349)	gal.
6	C, O, F	9150-00-181 9858	Lubricating oil, Engine OE 30 MI L-L-2104 (81349)	gal.
7	O		Markal thermomelt stik	ea.
8	F	OMC 327361	Sealant	pt.

APPENDIX F

ILLUSTRATED LIST OF MANUFACTURED ITEMS

Section I. GENERAL

F-1. This appendix contains the procedures for fabricating the manufactured items you are authorized to make. Section II is the index. The index shows the RPSTL part number, the procedure page of the appendix and the paragraph in the text in which it can be found. Section III contains the procedures, drawings and dimensions to fabricate these items.

Section II. INDEX

Section III. MANUFACTURED ITEMS

MAINTENANCE SUMMARY. This task covers:

a. Fabrication of starter rope
b. Fabrication of hoses
c. Fabrication of gearcase seal

INITIAL SETUP

Personnel Required	General Safety Instructions
1	

TASK SUMMARY

NO.	TASK	REFERENCE	REMARKS
1	Starter rope fabrication	F-2	
2	Hose fabrication	F-3	
3	Seal fabrication	F4	

F-2. STARTER ROPE FABRICATION

This task covers:

Fabrication of starter rope

INITIAL SETUP

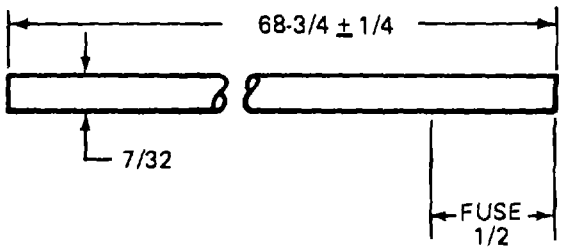
Tools:
T-1

Materials/Parts:
Rope - 316705

Personnel Required
1 mechanic

Approximate Time Required (minutes):
10

LOCATION/ITEM	ACTION	REMARKS
1. Rope	Measure 68-3/4" (174.63 cm) and cut.	
2. Ends of rope	Fuse each end of rope a length of 1/2" (1.27 cm) from end.	This will prevent the ends of the rope unraveling.



NOTES

1. Fabricate from 316705.
2. All dimensions are inches.

F-3. HOSE FABRICATION

This task covers:

Fabrication of hoses

INITIAL SETUP

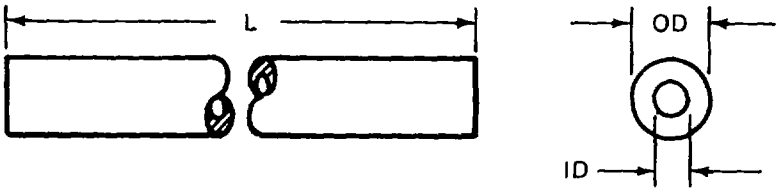
Tools:
T-1

Materials/Parts:
See graph below

Personnel Required:
1 mechanic

Approximate Time Required (minutes):
10

LOCATION/ITEM	ACTION	REMARKS
1. Hose part numbers.	Measure to length and cut.	The graph below has all necessary dimensions and



BULK PART NUMBER	FABRICATED PART NUMBER	LENGTH	DIA. OD (In.)	DIA. ID (In.)
305872	320417	93 ± 1/2	$1/2^{+0}_{-1/64}$	$1/4^{+1/64}_{-0}$
305872	305871	3 ± 1/8	$1/2^{+0}_{-1/64}$	$1/4^{+1/64}_{-0}$
319719	323090	13 ± 1/8	$1/2^{+0}_{-1/64}$	$1/4^{+1/64}_{-0}$
319719	319729	16-1/2 ± 1/8	$1/2^{+0}_{-1/64}$	$1/4^{+1/64}_{-0}$
326449	326449-1	10-1/2 ± 1/8	$1/4^{+1/64}_{-0}$	$2/35^{-0}_{+1/64}$
326449	326449-2	9 ± 1/8	$1/4^{+1/64}_{-0}$	$2/35^{-0}_{+1/64}$
303617	321890	7-7/8 ± 1/8	1/2 ± 1/64	$1/4^{+1/64}_{-0}$
303617	322999	7-7/8 ± 1/8	1/2 ± 1/64	$1/4^{+1/64}_{-0}$

F-4. SEAL FABRICATION

This task covers:

Fabrication OF CRANKCASE SEAL

INITIAL SETUP

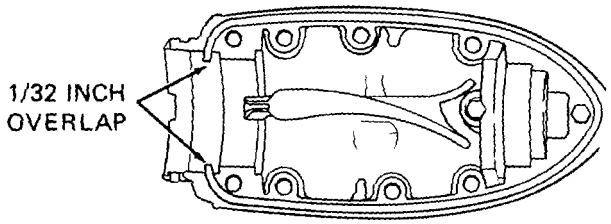
Tools:
T-1

Materials/Parts:
Seal - 309044

Personnel Required:
1 mechanic

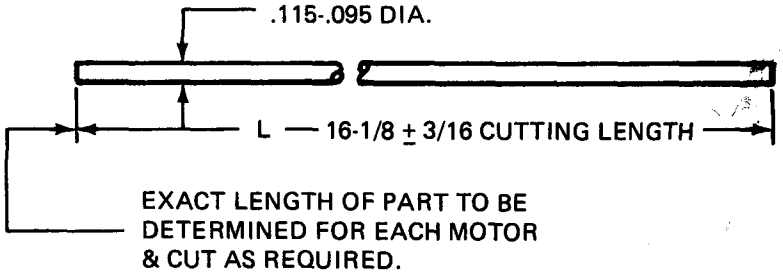
Approximate Time Required (minutes):
10

LOCATION/ITEM	ACTION	REMARKS
1. Seal	Measure and cut to length.	Seal must be cut so it will overlap the casting 1/32 in. (.079 cm) at each end.



NOTES:

1. Fabricate from 309044.
2. All dimensions are in inches.



APPENDIX G

Torque Limits

POWER HEAD	
Flywheel nut	100-105 lb ft (136-142 N-m)
Connecting rod screw	29.05-31 lb ft (40-42 N-m)
Cylinder head screws	14-16 lb ft (19-22 N-m)
Crank case to cylinder screws -	
upper and lower	12-13 lb ft (16-18 N-m)
center	18-20 lb ft (24-27 N-m)
Spark plug	18-20 lb ft (24-27 N-m)
Starter housing screws	8-10 lb ft (11-14 N-m)
LOWER UNIT	
Side mounts - upper and lower nuts	12.5-13 lb ft (17-18 N-m)
Front mount - upper nut	21-26 lb ft (28-35 N-m)
Pilot shaft to steering bracket screws	10-12 lb ft (14-16 N-m)
Slip Clutch Propeller	180 lb ft (244 N-m)

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3.2808.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu in.
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Square measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. in.
1 sq. decimeter = 100 sq. centimeters = 15.5 inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 feet
1 sq. dekameter (are) = 100 sq. meters = 1.076.4 sq. ft.
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 hectometers = .386 sq. miles

Liquid Measure

1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons
1 liter = 10 deciliters = 33.81 fl. ounces
1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3 38 fl. ounces
1 metric ton = 10 quintals = 1.1 short tons

Approximate Conversion Factors

To change	To	Multiply by
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
sq. inches	sq. centimeters	6.451
sq. feet	sq. meters	.093
sq. yards	sq. meters	.836
sq. miles	sq. kilometers	2.590
acres	sq. hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29.573
pints	liters	.472
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound inches	newton-meters	.11296

To change	To	Multiply by
ounce inches	newton-meters	.0070062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
sq. centimeters	sq. inches	.155
sq. meters	sq. yards	10.764
sq. kilometers	sq. miles	1.196
sq. hectometers	acres	2.471
cubic meters	cubic feet	35.315
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102
pound-feet	newton-meters	1.356

Temperature (Exact)

°F Fahrenheit temperature — 5/9 (after subtracting 32) — Celsius Temperature °C