1968

EVINRUDE

SERVICE MANUAL

TRIUMPH

55 HP

MODELS

55872 55873

SECTION

EVINRUDE OUTBOARD OIL

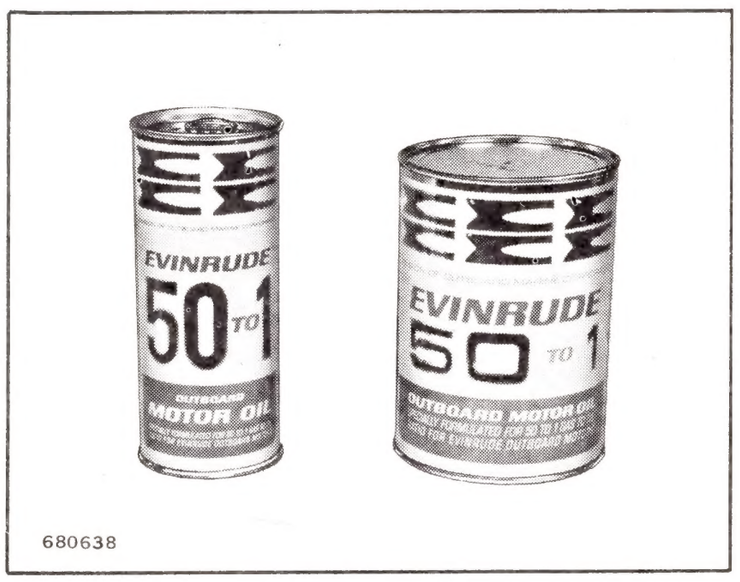
We recommend using EVINRUDE OUTBOARD OIL.

EVINRUDE OUTBOARD OIL is designed specifically for Evinrude outboard motor use at a 50 to 1 gasoline to oil ratio for engine break in and after break in, new and older models. This improved lubrication is formulated to provide additional benefits such as: exceptional lubrication, less varnish and combustion chamber deposits, better spark plug life, good mixability with gasoline even in cold weather, and reduction of pre-ignition.

CAUTION

If Evinrude Outboard Motor Oil should not be available, see Oil Instructions Section 2-4.

USE ONLY THE RECOMMENDED OIL TO GASOLINE MIXTURE, REGARDLESS OF THE CLAIMS MADE FOR SOME LUBRICANTS.



SPURIOUS PARTS

It is recommended that only genuine factory approved replacement parts be used. Replacement parts not manufactured nor approved by Evinrude Motors, should not be used.

Failure resulting from use of parts inferior to those manufactured or approved by Evinrude Motors, will not be covered under warranty.

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SECTION 1
INTRODUCTION

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Evinrude 55 HP outboard motors are designed and built for dependable high performance. To assure continued peak operation, it is important that every Evinrude owner be able to receive skilled and thorough service for his motor. Customer satisfaction and profitable service operation depend on service "know-how" and training.

Read this manual carefully so that you are familiar with the service procedures - then keep it readily available as a reference book in your service department.

Always remember, each service job is a chance for you to maintain motor performance that will keep your customer happy to be an Evinrude owner.

ARRANGEMENT OF MANUAL

This Service Manual includes the specific information you will need to service the 55 HP Models. All general procedures are covered in abbreviated form, mostly by reference to procedural illustrations. The specific procedures which apply only, or primarily, to these motors are covered in fully-illustrated, detailed, step-by-step instructions.

The General Service Information section will help you diagnose a malfunctioning motor. It includes specifications, tune-up procedures, and a Trouble Check Chart. Clearances and torque values are also included for quick reference during servicing operations. Each of the following sections, Fuel System, Ignition System, Power Head, Lower Unit, Electrical System and Remote Control, gives detailed instructions for disassembly, inspection, reassembly, and operating adjustments of the components. These procedures will help you service a specific system, or completely overhaul the 55 HP motors.

PARTS CATALOG

The Evinrude 1968 Parts Catalog contains exploded views illustrating the correct sequence of all parts as well as a complete listing of the parts for replacement. This catalog can be of considerable help as a reference during disassembly and reassembly.

SERVICE POLICY

Whether within or following the warranty period, Evinrude Motors has a constant interest in its products.

It is Evinrude's policy to assist dealers in building up their service knowledge and facilities so that they can give prompt, efficient service. The Evinrude Service School, frequent Service Bulletins, and this Service Manual represent tangible efforts to give Evinrude owners the best and most prompt service possible. This Service Manual covers all phases of servicing the 55 HP motors. However, new situations sometimes arise in servicing a motor. If a service question does not appear to be answered in this manual, you are invited to write to the Service Department for additional help. Always be sure to give complete information, including motor model number and serial number. Write to:

Evinrude Motors
4143 North 27th Street
Milwaukee, Wisconsin 53216
Attention: Service Department

Be sure that you are familiar with the Evinrude warranty. If you have any questions, write the Evinrude Service Department.

SPECIAL SERVICE TOOLS

Evinrude has specially-designed tools to simplify some of the disassembly and reassembly operations. These tools are illustrated in this

Service Manual, in many cases in actual use. Refer to the Special Service Tool Catalog for a description and ordering instructions for these tools.

OUTBOARD MOTOR NOMENCLATURE

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. See Figures 1-1 and 1-2.

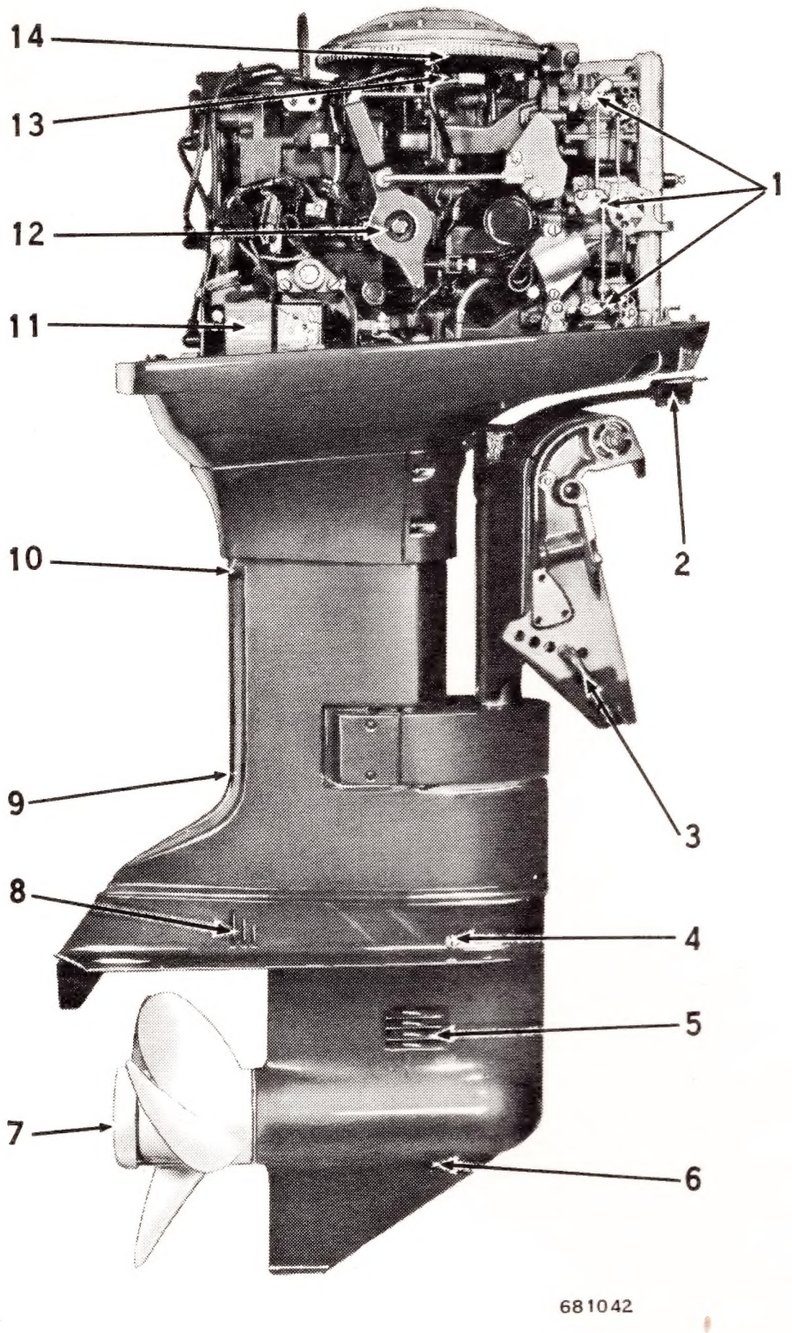
Service required for the 55 HP motors is generally one of three kinds ...

1. NORMAL CARE AND MAINTENANCE, which includes putting a new motor into operation, storing motors, lubrication, and care under special operating conditions such as salt water and cold weather.

2. OPERATING MALFUNCTIONS due to improper motor mounting, propeller condition or size, boat condition, or the malfunction of some part of the motor. This includes motor tune-up procedures to keep the motor in prime operating condition.

3. COMPLETE DISASSEMBLY and overhaul, such as inspecting a motor that has been submerged or rebuilding trade-in units.

It is important to you as the service man to determine before disassembly just what the trouble is, and how to correct it quickly and with minimum expense to the owner. This section of the manual is designed to help you diagnose motor malfunctions and correct them.



1. Carburetors
2. Steering bracket
3. Tilt adjustment rod
4. Oil level plug
5. Water intake
6. Oil drain and fill plug
7. Exhaust outlet
8. Water outlet
9. Exhaust housing
10. Water discharge and exhaust relief
11. Amplifier
12. Throttle lever
13. Distributor
14. Alternator
15. Lifting bracket
16. Fuel pump and filter
17. Exhaust covers
18. Tilt lock lever
19. Water outlet
20. Trim tab
21. Propeller
22. Skeg
23. Gearcase
24. Water intake
25. Stern bracket
26. Air silencer
27. Electric starter

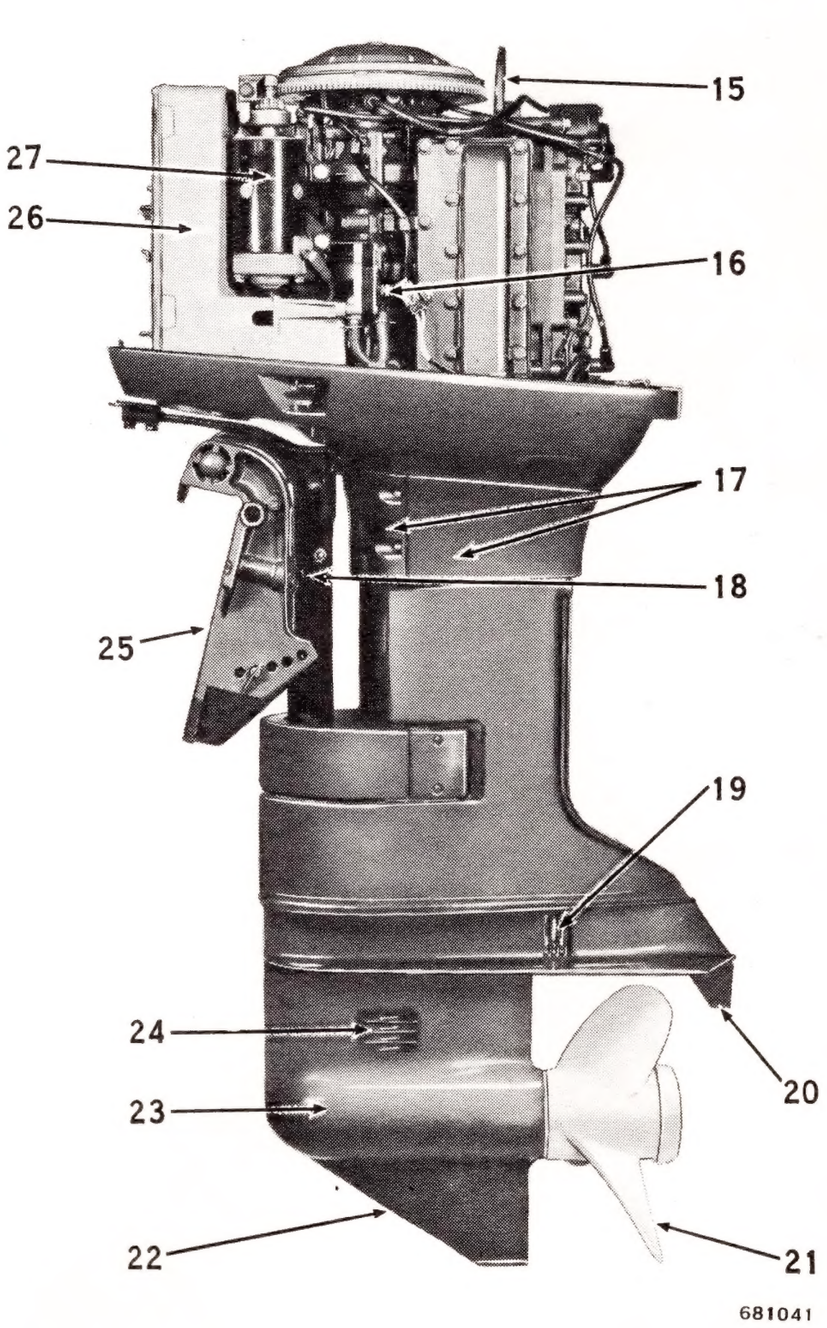


Figure 1-1. Starboard View Less M/C

Figure 1-2. Port Side View Less M/C

SECTION 2
GENERAL SERVICE INFORMATION

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SPECIFICATIONS

Model Numbers . . . . . 55872 (standard length)
55873 (5" longer)
*Horsepower (O.B.C.-certified) . . . . . 55 hp at 5000 rpm
Full throttle operating range . . . . . 4000 to 5000 rpm
Under limited conditions . . . . . 5500 rpm
Tank test with test wheel . . . . . 4600 rpm
Engine type . . . . . 2 cycle, 3 cylinders in line
Bore and stroke . . . . . 3" bore x 2-11/32" stroke
Piston displacement . . . . . 49.7 cubic inches
Piston ring sets (3 per set) standard . . . . . Part Number 381496
.020 oversize . . . . . Part Number 593429
Diameter of ring . . . . . 3.000 in. (standard)
Width of ring . . . . . .0935 - .0925 in.
Piston ring lbs. compression
recommended when compressed . . . . . 7.5 to 13.0 lbs.
Piston less rings
standard . . . . . Part Number 382274
.020 oversize . . . . . Part Number 383144
Crankshaft size
Top journal . . . . . 1.4979 - 1.4974 in.
Center journals . . . . . 1.3752 - 1.3748 in.
Bottom journal . . . . . 1.1815 - 1.1810 in.
Connecting rod crank pin . . . . . 1.1828 - 1.1823 in.
Carburetion . . . 3 carburetors - Float feed with low-speed adjustment.
Automatic, thermo-electric manual lever and remote control choke
Float level setting . . . . . Remove float bowl, turn it upside down so weight of float closes needle; float should now be parallel with rim of casting.
Carburetor orifice plug . . . . . Hole size .054"
Inlet needle seat . . . . . .065 - .062 Use a #52 drill as gage.
Cooling system . . . . .Thermostatically controlled recirculating system
Propeller gear ratio 12:29
Propeller . . . . . 3 blade, 13-1/4" dia. x 17" pitch
Alternate propellers . . . . . 3 blade, 14" dia. x 9" pitch
3 blade, 14" dia. x 11" pitch
3 blade, 14" dia. x 13" pitch
3 blade, 13-3/4" dia. x 15" pitch
3 blade, 13" dia. x 19" pitch
Speed control . . . . . Remote control - Synchronized throttle and spark
Gear shift control . . . . . Electro-hydraulic - forward, neutral, reverse - remote control
Weight (without fuel tank) . . . . . Model 55872 - 190 lbs.
Model 55873 - 195 lbs.
(Fuel tank weight 11 lbs. net)
Fuel capacity . . . . . 6 gallons, suction type tank
Starter . . . . . Electric and emergency rope
Electrical system . . . . . 9 amp alternating current generator
Starter amp draw when cranking . . . . . 135 amperes maximum
Ignition (CD electronic with breaker points) . . . . . Battery
Spark plug . . . . . AC V4OFF or Champion L-19V
Spark plug torque . . . . . 17-1/2 - 20-1/2 foot-pounds
Breaker point gap . . . . . .010 in.
Breaker point spring tension . . . . . 28 - 32 oz.
Part No. 580730 Coil Test Specifications - New Stevens Tester Model No. M.A. - 75

Merc-O-Tronic with Capacitor Discharge Adapter Model 55-980

Operating Amperage	Primary Resistance	Secondary Continuity
Min. - Max.	Min. - Max.	Min. - Max.
.8 - 1.2		22.5 - 25

*Horsepower established at sea level. Allow 2% reduction per 1000' above sea level.

Secondary Continuity	3000 ohms maximum
Primary Continuity	1.2 ohms maximum
Coil Index	60
Coil Test (Normal)	9 minimum
Coil Test (Amplified)	80 minimum
Gap Index	50 maximum

CLEARANCE CHART

Power head	
Piston and wrist pin - loose end	.006 max. - .001 min.
Piston ring gap	.017 max. - .007 min.
Piston ring groove clearance	.007 max. - .0045 min.
Cylinder and piston	.0055 max. - .004 min.
Crankshaft bearings	
Upper	Roller type
Center	Roller type
Lower	Ball type
Crankshaft end play	.011 max. - .003 min.
Connecting rod bearings	
Piston end	Roller type
Crankshaft end	Roller type
Lower unit	
Gearcase head and propeller shaft	Roller type
Driveshaft to gearcase - upper	Roller type
Pinion to gearcase	Roller type
Propeller shaft to oil pump	Roller type
Front gear bushing to propeller shaft	.002 max. - .001 min.
Rear gear bushing to propeller shaft	.0015 max. - .0005 min.
Propeller on shaft	.007 max. - .003 min.

TORQUE CHART

Power head	
Flywheel nut	70-85 ft.-lbs.
Connecting rod screws	348-372 in.-lbs. (29-31 ft.-lbs.)
**Cylinder head screws	168-192 in.-lbs. (14-16 ft.-lbs.)
Crankcase to cylinder screws and nuts	
Upper	144-168 in.-lbs.
Center	144-168 in.-lbs.
Lower	144-168 in.-lbs.
Spark plugs	17-1/2-20-1/2 ft.-lbs.
Lower journal bearing retainer plate screws	96-120 in.-lbs.

**Retorque to 18-20 ft.-lbs. or 216-240 in.-lbs. after motor test.

CAUTION

When tightening two or more screws on the same part, DO NOT tighten screws completely, one at a time. To avoid distortion of the part, first tighten all screws together to one-third of specified torque, then to two-thirds of specified torque, then torque down completely.

NOTE

Retorque cylinder head screws and spark plugs after motor has been run and has reached operating temperature, and has cooled off.

Lower unit
Pull at propeller shaft to overcome
reverse lock (standard length) . . . . . 375-475 lbs.
(long length) . . . . . 300-400 lbs.

Standard screws

	In.-Lbs. *	Ft.-Lbs. *		In.-Lbs. *	Ft.-Lbs. *
No. 6	7-10		1/4"	60-80	5-7
No. 8	15-22		5/16"	120-140	10-12
No. 10	25-35	2-3	3/8"	220-240	18-20
No. 12	35-40	3-4			

*These Torque Values apply unless otherwise specified.

LUBRICATION CHART - ELECTRIC SHIFT

LUBRICATION POINT	LUBRICANT	FREQUENCY (PERIOD OF OPERATION)	
		FRESH WATER	#SALT WATER
1. Starter Pinion Gear Shaft See Figure 2-3	SAE 10 Oil	60 days	30 days
2. Cam Follower, Roller Shaft See Figure 2-4	OMC Type "A"	60 days	30 days
3. Throttle Arm and Distributor Linkage See Figure 2-5	OMC Type "A"	60 days	30 days
4. Safety Switch Cam on Distributor Base See Figure 2-6	OMC Type "A"	60 days	30 days
5. Throttle and Choke Shaft Springs and Linkage See Figure 2-7	OMC Type "A"	60 days	30 days
6. Gearcase See Figure 2-8	OMC Type "C" Capacity 37.2 ozs.	Check level after first 10 hours of operation and every 50 hours of operation thereafter. Add lubricant if necessary. Drain and refill every 100 hours of operation or once each season, whichever occurs first.	Same as Fresh Water Same as Fresh Water
7. Swivel Bracket and Tilt Lock Lever See Figure 2-9	OMC Type "A"	60 days	30 days
8. Ignition - Reverse Cutoff Spring	OMC Type "D"	At time of ignition service.	

#Some areas may require more frequent lubrication.

LUBRICATION POINTS

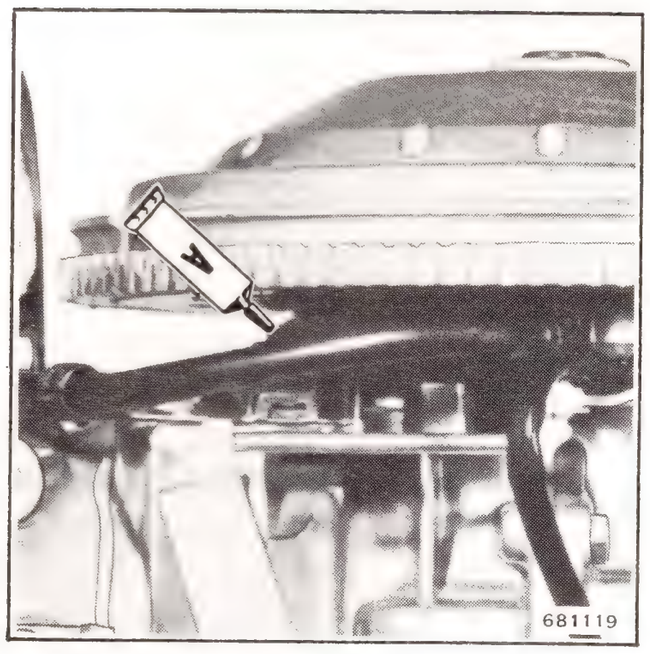


Figure 2-6. Safety Switch Cam on Distributor Base

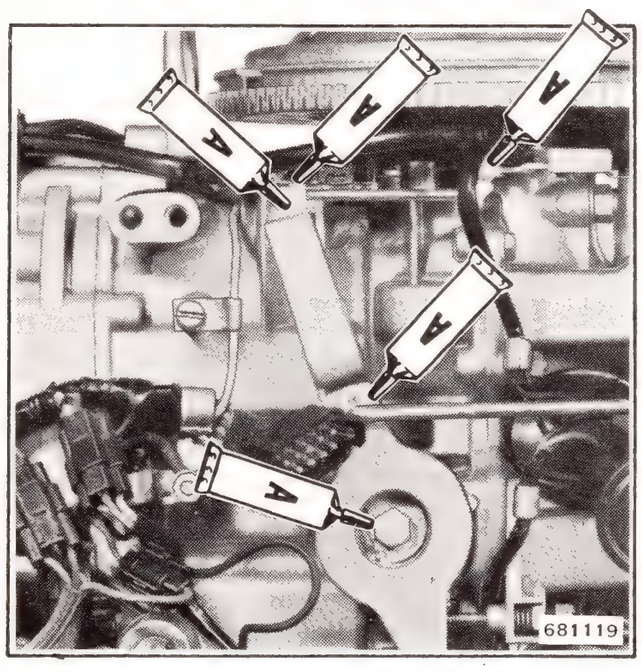


Figure 2-5. Throttle Arm and Distributor Linkage

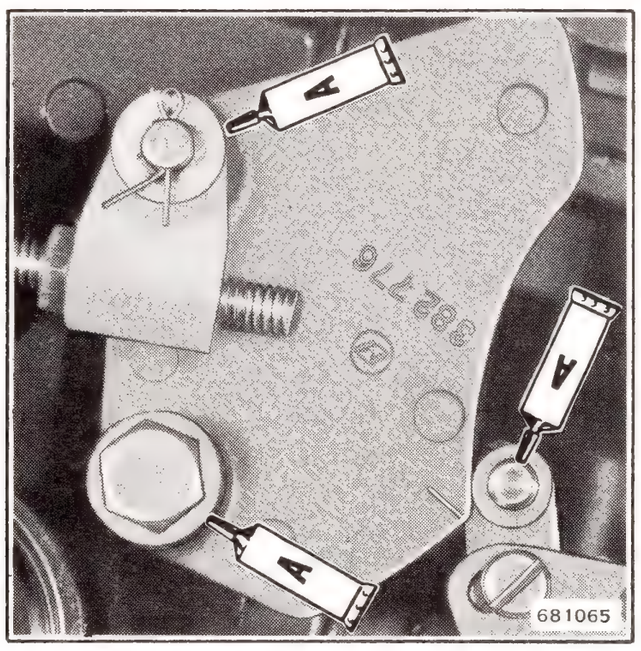


Figure 2-4. Cam Follower and Roller Shaft

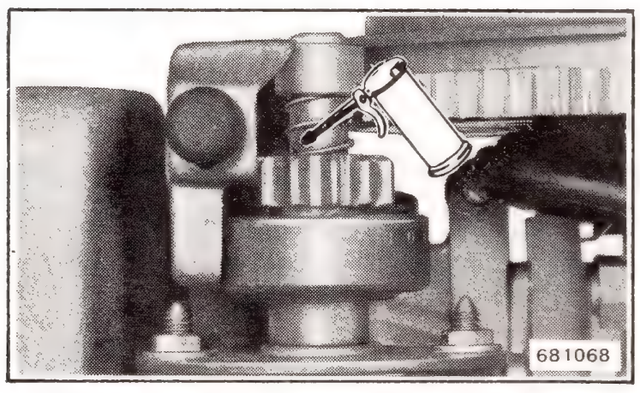


Figure 2-3. Starter Pinion Gear Shaft

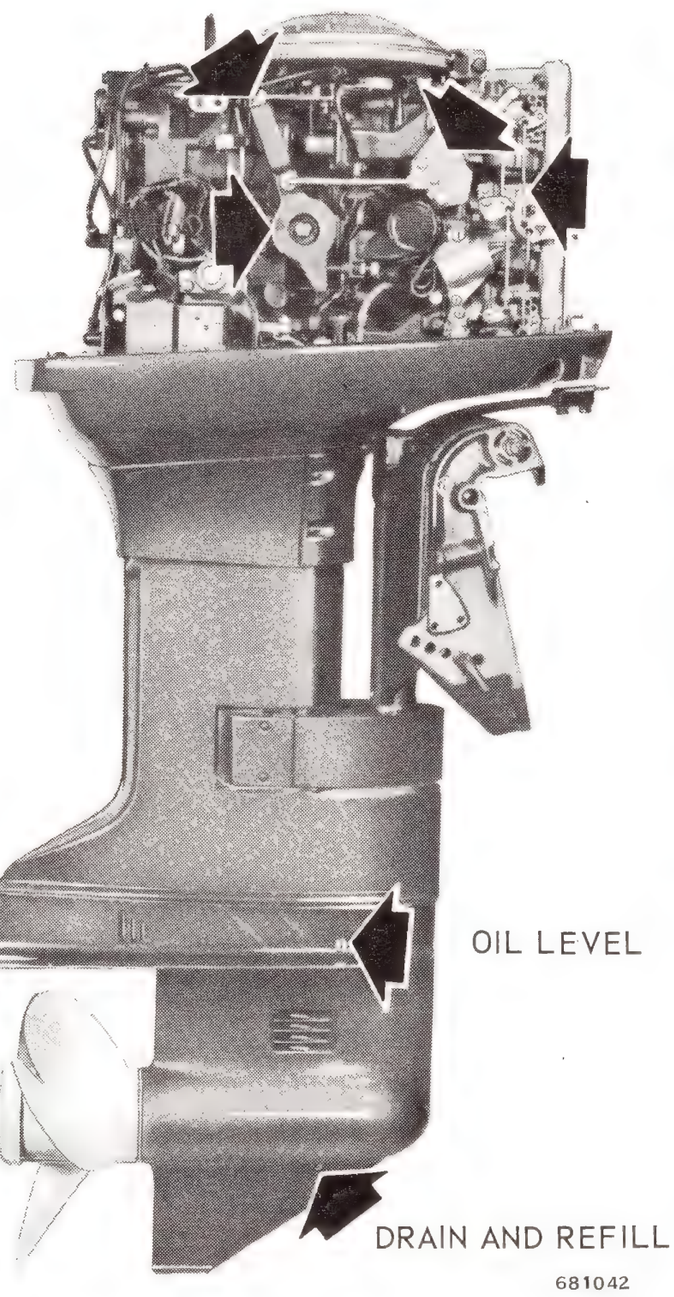


Figure 2-1. Starboard Side

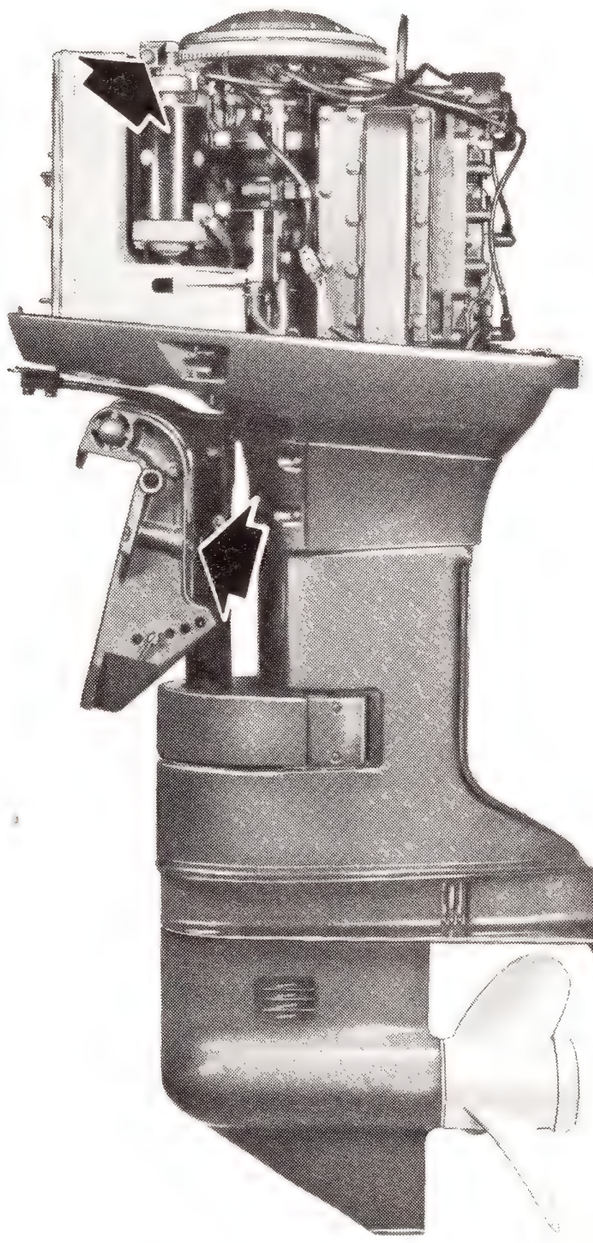


Figure 2-2. Port Side

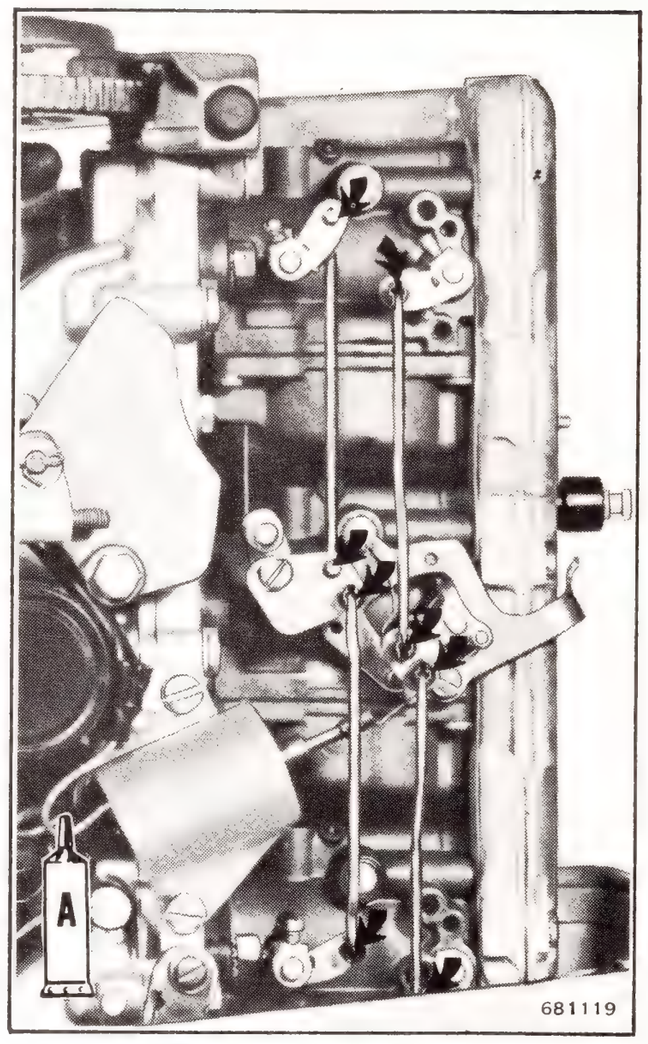


Figure 2-7. Throttle and Choke Shaft Springs and Linkage

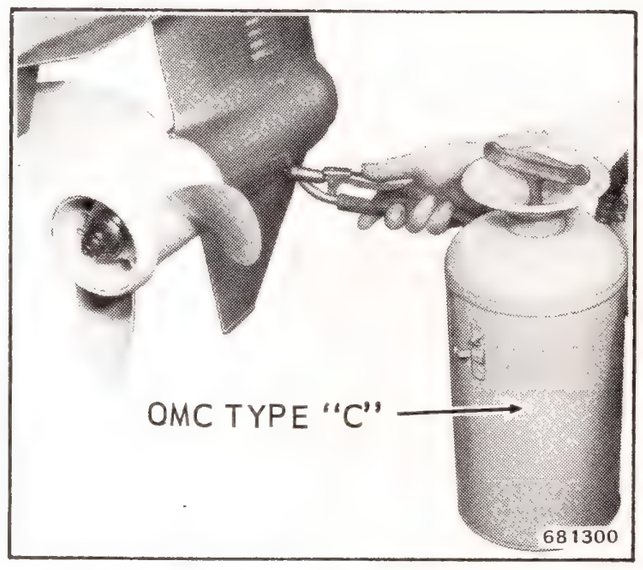


Figure 2-8. Gearcase

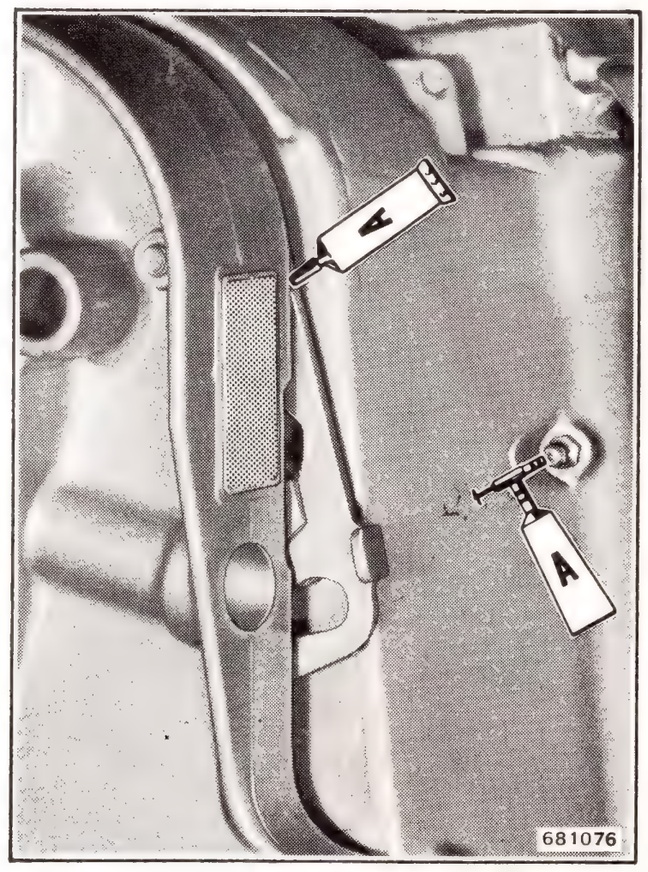


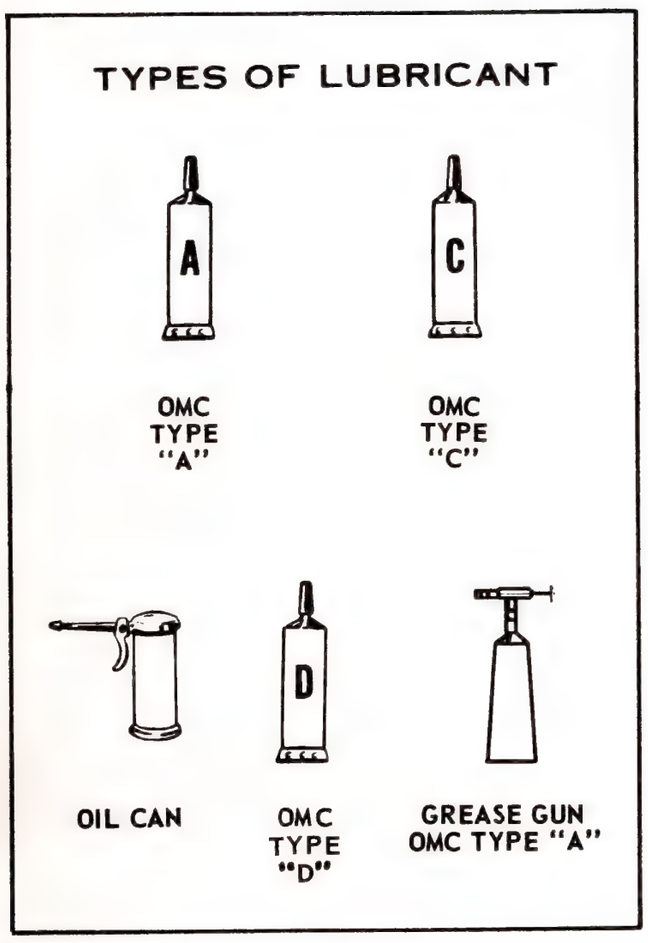
Figure 2-9. Swivel Bracket and Tilt Lock Lever

TYPE OF GASOLINE: Use regular automotive gasoline or white marine gasoline. Higher octane fuels may be used, but generally offer no advantages.

NOTE: When operating in any country other than the United States or Canada, use any gasoline that will satisfactorily operate an automotive engine.

LUBRICANT: Use a reputable outboard motor oil. See inside front cover. If an outboard motor oil is not available, a good quality SAE 30 automotive oil may be used. The oil used should have Service ML-MM or Service MM marked on the container. Additional markings, such as MS, DG, DM, DS designate heavy duty and should be avoided. Avoid low priced, light duty oils (container marked only with ML designation) or multiple viscosity oils, such as SAE 10W-30.

IMPORTANT: Additive compounds such as "tune-up" compounds, "tonics," "friction reducing" compounds, etc., are unnecessary and are not recommended. The use of OMC engine cleaner and OMC rust preventive oil is recommended.



GEARCASE

Remove slotted plugs and gasket assemblies marked "OIL DRAIN" and "OIL LEVEL" from starboard side of gearcase. With propeller shaft in a normal running plane, allow oil to drain completely.

Refill with OMC Type "C" lubricant. With propeller shaft still in a normal running position, fill until lubricant appears at "OIL LEVEL" hole. See Figure 2-1.

Install "OIL LEVEL" plug before removing lubricant filler hose from "OIL DRAIN" hole. Drain plug can then be installed without oil loss.

If filler type can is not available, install drain plug. Slowly fill gearcase through "OIL LEVEL" hole, allowing trapped air to escape. Install plug.

TUNE-UP PROCEDURE

When an owner brings a motor to you for a tune-up, or for some minor operating malfunction, the following procedure should be used as a guide to determine the cause of the malfunction. Write down the owner's comments. Keep an accurate card file on your service shop operation. Each service operation should be on record as to the:

OWNER'S NAME
DATE
MODEL NO.
SERIAL NO.
NATURE OF COMPLAINT
NATURE OF WORK PERFORMED
COST TO THE OWNER
WAS WORK PERFORMED UNDER WARRANTY?

After writing down the owner's comments, check the motor visually and begin a systematic tune-up procedure. Consult the Trouble Check Chart to find the causes of any malfunction which may be discovered when tuning up the motor.

1. Remove exhaust covers and cylinder head. Slowly rotate flywheel and visually inspect pistons, rings, and cylinders for wear, freeness, and carbon deposits.

SPECIAL NOTE

Piston ring condition should be determined before continuing tune-up. Gum and varnish deposits on rings or pistons may be removed with an application of OMC Accessory Engine Cleaner.

If pistons and rings are considered to be in satisfactory condition for continued service, remove carbon, surface and reinstall covers, using new gaskets.

2. Clean carbon from cylinder head and top of pistons. Replace upper bearing crankshaft seal. Surface and reinstall cylinder head, using new gasket.

3. Inspect spark plugs. Clean or replace as necessary.

4. Inspect and test points, coil, and ignition wires. See Section 4 for test procedures. Check for spark on each cylinder.

5. Inspect carburetors and automatic choke.

6. Inspect fuel pump and lines. Replace filter element and gasket.

7. Synchronize carburetor linkage. See Section 4.

8. Inspect electric shift operation. See Section 8 for test procedures.

9. Check propeller for condition and correct pitch. See Section 6.

10. Drain and refill gearcase and thoroughly lubricate all components of the motor. See Pages 2-4 through 2-7.

11. Tighten all screws and nuts, etc., to specified torque. See Page 2-3.

12. Tank-test and adjust carburetor low-speed needles; check cooling system operation. Use a tachometer and test wheel for accurate rpm tests. Retorque cylinder head screws after motor has cooled off.

13. Fog motor for storage, using OMC Accessory Rust Preventative Oil.

14. Use Perfect Seal #4 on all screws, nuts and bolts.

TROUBLE CHECK CHART

TROUBLE	POSSIBLE CAUSE
1. MOTOR WILL NOT START	A. FUEL SYSTEM - See Section 3 Fuel line improperly connected Engine not primed Speed control not advanced (throttle closed) Engine flooded Old fuel Clogged fuel filter screen Automatic choke not closing completely Choke spring broken or disconnected Fuel system faulty B. IGNITION SYSTEM - See Section 4 Reverse cut-out spring Timing, cam or linkage improperly adjusted Sheared flywheel key Safety switch screws loose Ignition system faulty (key switch) C. ELECTRICAL SYSTEM - See Section 7 Starter circuit faulty

TROUBLE CHECK CHART (CONT)

TROUBLE	POSSIBLE CAUSE
2. LOSS OF POWER (Assuming Ignition OK)	A. POWER HEAD - See Section 5 Carburetors and distributor not synchronized Throttle control lever (won't advance) Air leak at manifold gaskets - warped manifold (backfires) Broken leaf valves (backfires) Excessive carbon on pistons and cylinder head Stuck piston rings, or scored cylinder or piston B. CARBURETOR - See Section 3 Old fuel - too much oil Carburetor adjustment - (too lean - backfires) (too rich - excessive fuel) Linkage screws loose Automatic choke not operating Inlet needles and seats worn or stuck Incorrect carburetor float setting Incorrect orifice plug C. FUEL PUMP AND TANK - See Section 3 Faulty fuel hose (clamps or seals) (kinked) Fuel tank or pump filter plugged Fuel filter restricted Fuel and vent valves not opening Valves not operating Fuel hose passages restricted Diaphragm leaking or damaged D. EXHAUST GAS ENTERING CARBURETOR - See Section 6 Exhaust cover screws leaking Damaged exhaust housing seals Adapter gaskets leaking Cracked exhaust housing Exhaust tube to cylinder screws loose or missing E. OVERHEATING POWER HEAD - See Section 5 Thermostat cover or gaskets damaged Pressure control valve damaged Head gasket leaking (warped head) (water in cylinders) F. LOWER UNIT - See Section 6 Water intakes obstructed Pump housing air bleed restricted Water passages obstructed Pump plate not sealing (bottom) Pump impeller damaged Pump housing seal worn (driveshaft grooved) Water tube bushing damaged G. EXHAUST GASES ENTERING COOLING SYSTEM - See Section 6 Pump impeller plate not sealing (bottom) Damaged water tube grommets or "O" rings Pump housing seal damaged Exhaust tube to adapter gasket damaged
3. ENGINE MISFIRES (Assuming Fuel System and Carburetor OK)	A. SPARK PLUGS - See Section 4 Crossed or reversed leads Cover or inner terminal damaged (terminal point out of H.T. lead) Faulty leads Loose - low torque Defective (cracked insulator) Incorrect spark plugs B. DISTRIBUTOR - See Section 4 Incorrectly adjusted breaker points Incorrect timing Loose wiring Breaker point spring tension

TROUBLE CHECK CHART (CONT)

TROUBLE	POSSIBLE CAUSE
3. ENGINE MISFIRES (Assuming Fuel System and Carburetor OK) (Cont)	Loose breaker plate retainer screws Coil or amplifier damaged CORRODED OR CRACKED DISTRIBUTOR CAP & ROTOR - See Section 4 Rotor wave washer missing Loose distributor ground wire Carbon path in distributor cap or rotor Breaker point misalignment
4. POOR PERFORMANCE ON BOAT	A. INCORRECT PROPELLER Incorrect tilt angle (smoking) Poor fuel mix - too much oil (smoking) Remote controls incorrectly adjusted Propeller hub slipping Bent or worn propeller Bent gear housing or exhaust housing Altitude horsepower loss Catamaran (single engine) - venturi effect Exhaust leaks Overheating B. CAVITATION Protruding hull attachments Keel too long Bent propeller (vibration) Transom too high C. BOAT Improper load distribution Marine growth on bottom Added weight (water absorption) Hook in bottom
5. SHIFT WILL NOT OPERATE	A. CONTROL BOX AND ELECTRICAL CONNECTIONS - See Section 8 Control box and/or power head connections not coupled or corroded Ammeter to key switch fuse or blocking diode damaged Faulty electric control switch Open circuit (broken wires) Faulty key switch Vacuum switch damaged B. LOWER UNIT - See Section 6 Incorrect lubricant (Type "C" only) Oil pump screens plugged Faulty solenoids Damaged shift cable Loose knife disconnect terminals
6. ALTERNATOR WILL NOT OPERATE	A. CHARGING CIRCUIT - See Section 7 Faulty wiring Rectifier diodes damaged Shorted or open stator windings
7. STARTER MOTOR WILL NOT OPERATE	A. STARTING CIRCUIT - See Section 7 Loose or corroded battery connections Safety switch inoperative (loose) Throttle advanced too far Weak or shorted battery Defective key switch Jammed starter drive Damaged starter drive parts Worn brushes Broken brush springs Open circuit in solenoid Burned commutator Broken field terminal Shorted or open windings - armature or field

TROUBLE CHECK CHART (CONT)

TROUBLE	POSSIBLE CAUSE
7. STARTER MOTOR WILL NOT OPERATE (Cont)	Ammeter to key switch fuse blown B. EXCESSIVE STARTER CURRENT DRAW - See Section 7 Worn or dry armature shaft bearings Excessive friction in engine Brushes not seating Dirty or corroded commutator Loose pole pieces Bearing heads buckled

SECTION 3
FUEL SYSTEM

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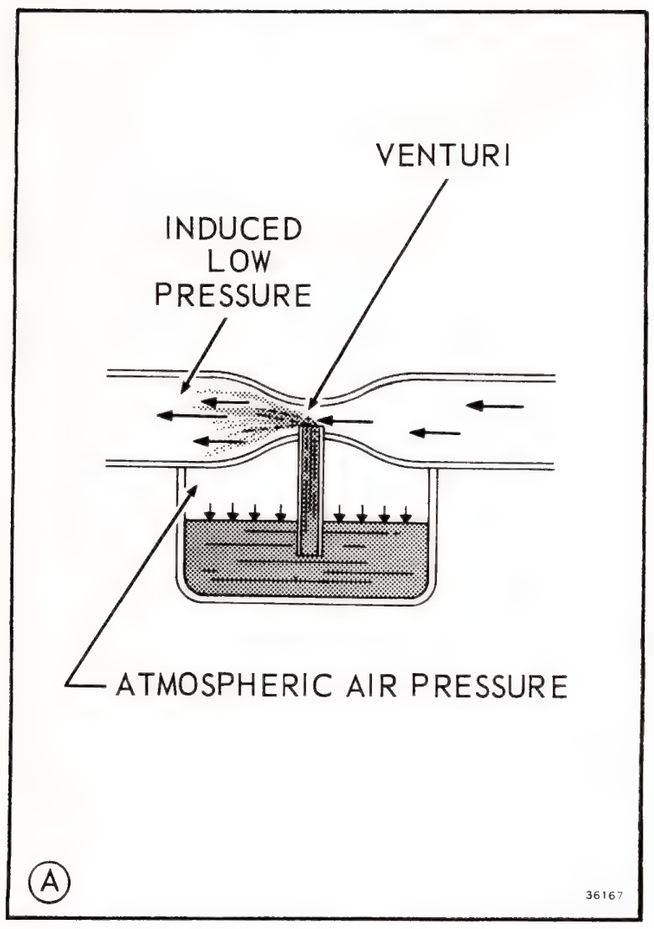
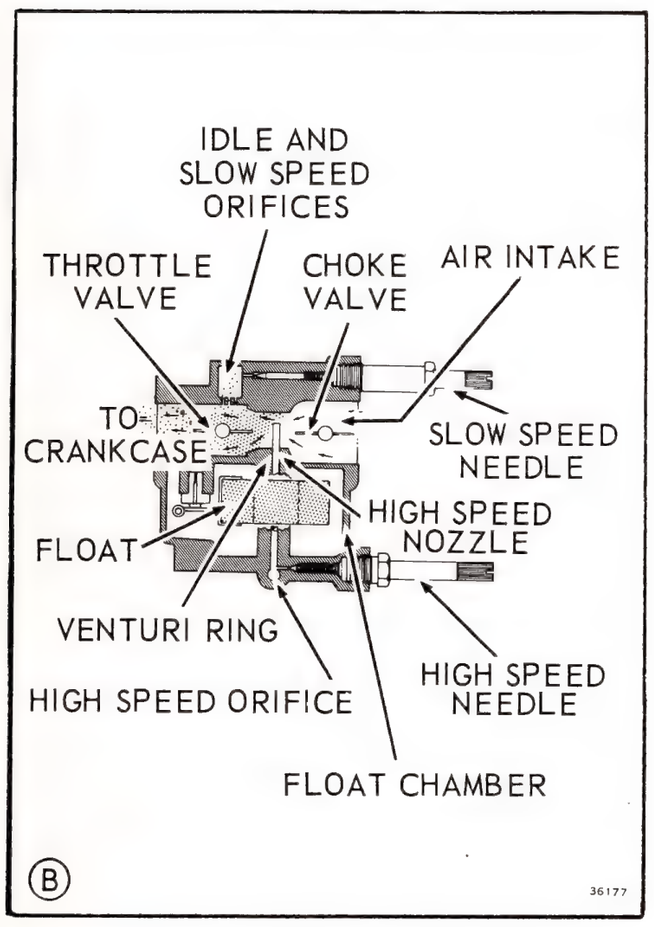




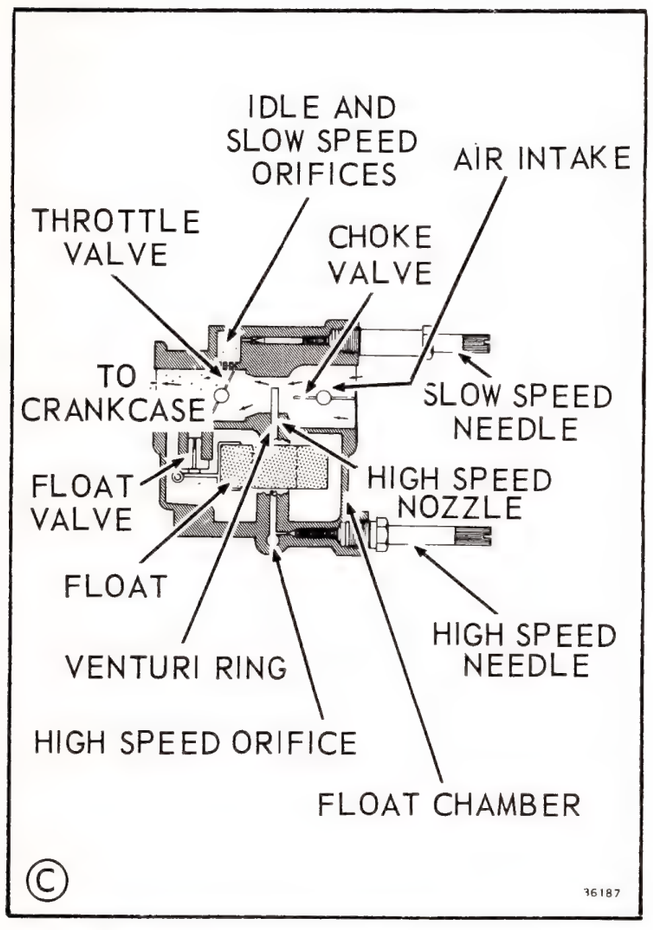


Figure 3-1. Carburetor Principle

DESCRIPTION

FUEL FLOW

The 55 HP fuel system consists of a fuel tank, fuel pump, and three carburetors. The fuel tank is non-pressurized, suction operated. A diaphragm-displacement type fuel pump on the motor draws fuel from the tank and feeds it to the carburetors through a fuel filter.

CARBURETORS

Each carburetor is a single barrel, float feed type. The high-speed jet is fixed and only the low-speed needle is adjustable. Throttle linkage is synchronized with the distributor by a cam.

THEORY OF OPERATION

The carburetor is a metering device for mixing fuel and air. At idle speed, an engine requires a mixture of about 8 parts air to 1 part fuel. High speed mixture is about 12:1.

A small chamber holds the fuel. A float valve admits fuel from the fuel tank to replace fuel as it is consumed by the engine. Metering jets in the carburetor throat extend down into the fuel chamber.

The upstroke of the piston in the cylinder creates a suction that draws air through the throat. A restriction in the throat, called a venturi, has the effect of reducing air pressure at this point by controlling air velocity.

The differential in throat and chamber air pressures causes the fuel to be pushed out of the metering jets and into the air stream. Here it mixes with the air to form a combustible mixture for exploding in the engine cylinders.

In order to mix the fuel and air in just the right proportions for all engine speeds, the low speed jet has an adjustable needle valve to compensate for changing atmospheric conditions. The high speed jet may have a fixed high speed orifice or an adjustable needle valve.

To regulate engine speeds, a throttle valve controls the volume of fuel-air mixture drawn into the engine. To compensate for the extra amount of fuel required to start a cold engine, a choke valve is placed ahead of the metering jets and venturi.

When the valve is closed, a very rich fuel mixture is drawn into the engine. As the engine starts and warms up, the choke is opened to restore the normal ratio required.

The carburetor throat is frequently called the "barrel". Carburetors with single, double, or four barrels have individual metering jets, needle valves, throttle and choke valves for each barrel. The single and two barrel carburetor is fed by a single float and chamber while the four barrel model has a separate float valve and chamber for each barrel.

LEAF VALVES

The leaf valves time the injection of the fuel mixture into the crankcase by opening only when the pressure in the crankcase has dropped to a predetermined point on the compression stroke.

CHOKE AND CHOKE SOLENOID

The carburetor is fitted with a thermo-electric choke to reduce the ratio of air to fuel for cold starts.

The choke may be manually operated. With the choke lever in the "OFF" position, the choke valve is held in a fixed open position, allowing air to pass freely through the inlet. With the choke lever in the "ON" position, the valve is held in a closed position, restricting the flow of air to the carburetor.

With the choke lever in "Automatic" position, a thermal switch in the bottom of the cylinder head energizes a two stage solenoid. This holds the choke in "warm up" position when the motor is cold. If full choking is required, a choke switch in the ignition switch panel can be operated to fully energize the choke solenoid.

When the motor reaches its thermostatically controlled temperature, the thermal switch opens and de-energizes the choke solenoid.

The choke solenoid operates the choke valves through a spring, allowing them to open partially as crankcase suction increases. See Figure 3-4.

FUEL PUMP

The fuel pump is of the diaphragm-displacement type, and is operated by changes in crankcase pressure. Alternate suction and pressure in the crankcase are transmitted to the pump diaphragm. Suction created on the upward stroke of the piston causes the diaphragm to displace and draw in fuel through the inlet valve. On the following downward stroke of the piston, crankcase pressure flexes the diaphragm in the opposite direction. The inlet valve is then seated, preventing the return of fuel to the tank, while the discharge valve is opened, allowing fuel to pass to the carburetor.

Fuel is drawn through a fine filter screen before entering the pump to remove impurities. See Figure 3-2.

FUEL TANK

The fuel tank is a non-pressurized, suction operated tank. Fuel is lifted from the tank to the carburetor by the fuel pump. Priming is achieved by squeezing the primer bulb (part of the fuel line) several times or until pressure required to squeeze the bulb increases. The connector nearest the primer bulb must be connected to the fuel tank. See Figure 3-3.

The tank air inlet and fuel outlet are sealed until the supply line connector is plugged into the tank. When the fuel line is attached, two valve plungers are depressed, forcing the valves off their "O" ring seats. This vents the tank to the atmosphere and opens the fuel outlet. "O" ring seals in the fuel connectors shut off fuel flow when the line is disconnected from the tank or motor. To facilitate draining and cleaning, a drain screw has been provided in the fuel tank upper housing.

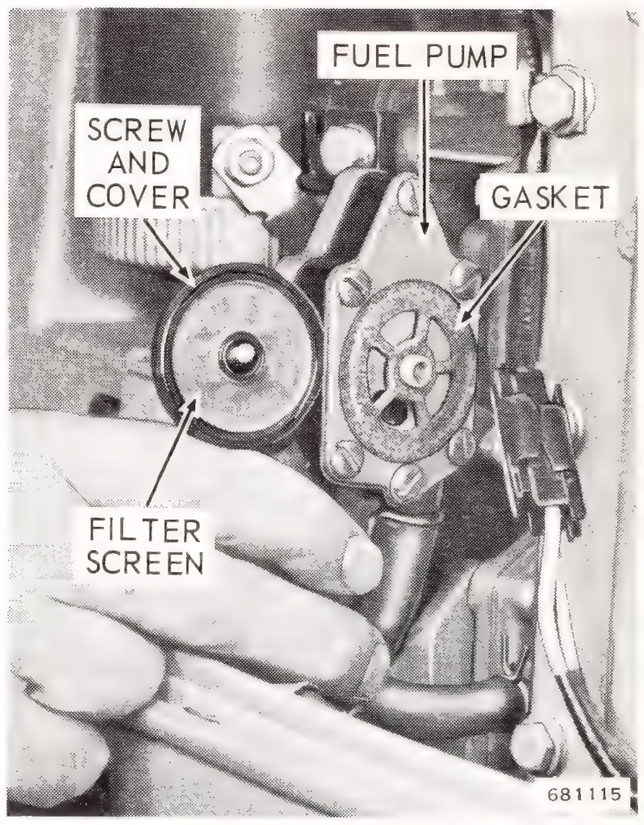


Figure 3-2. Fuel Pump, Filter, and Hoses

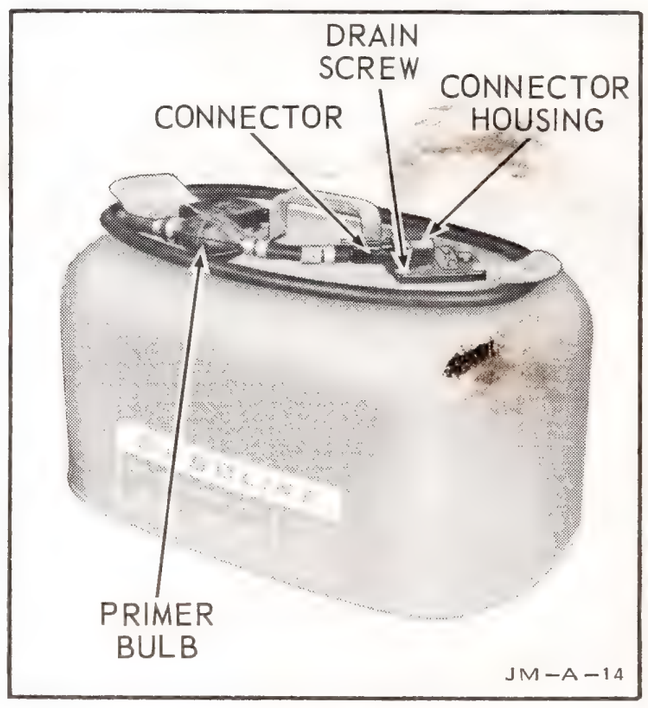


Figure 3-3. Fuel Tank, Primer Bulb, and Connector

REMOVAL OF CARBURETORS FROM MOTOR

a. Disconnect the three fuel hoses at the fuel pump.

b. Remove screw retaining low speed adjustment lever, and pull off lever. See Figure 3-4.

c. Remove screws retaining air silencer cover, and disconnect drain hose.

d. Disconnect choke, throttle, and slow speed needle valve linkages by pulling out of top and bottom carburetor lever retainers. See Figure 3-5.

e. Remove six screws retaining air silencer and remove air silencer and fuel pump as an assembly.

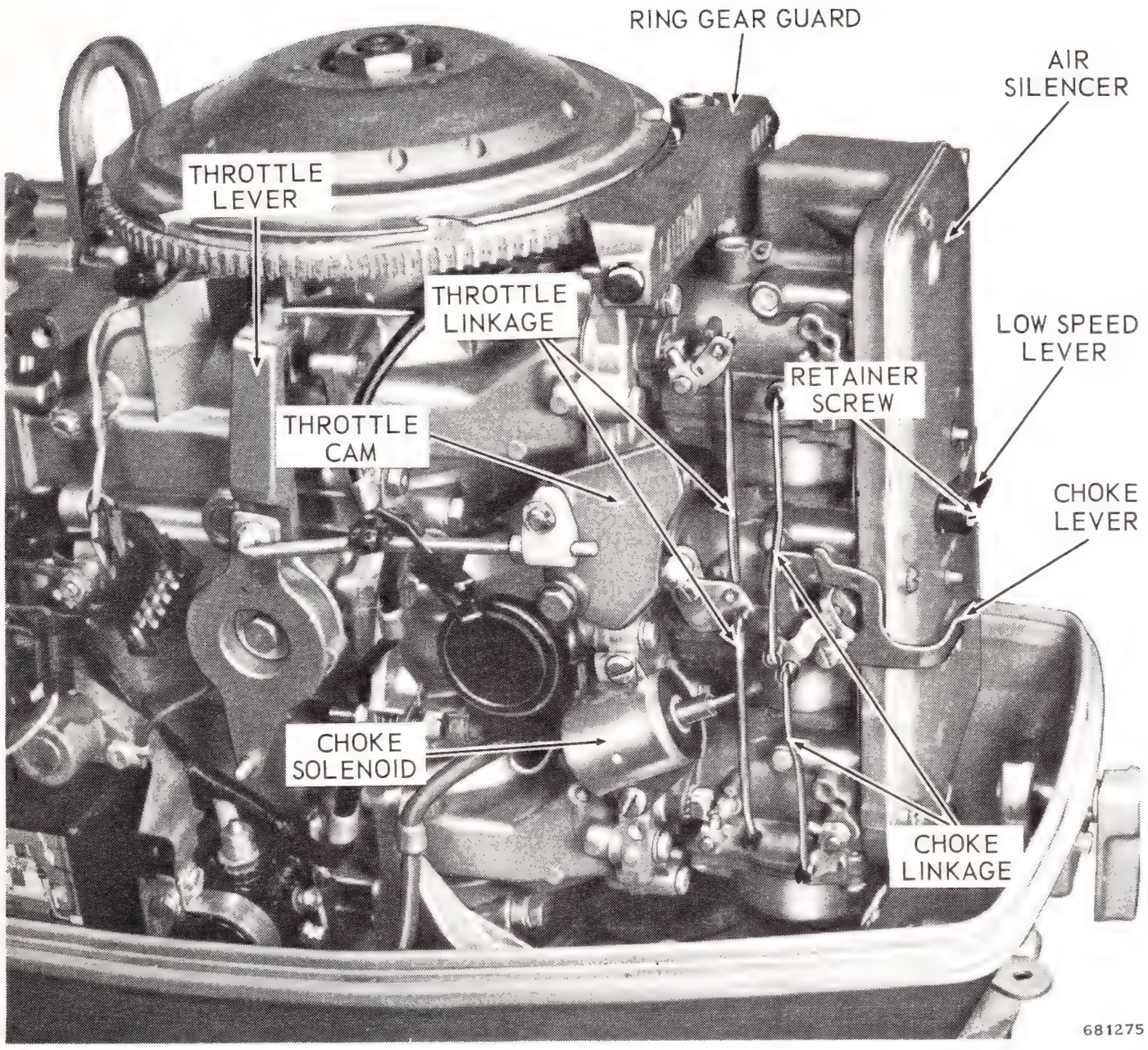


Figure 3-4. Carburetor

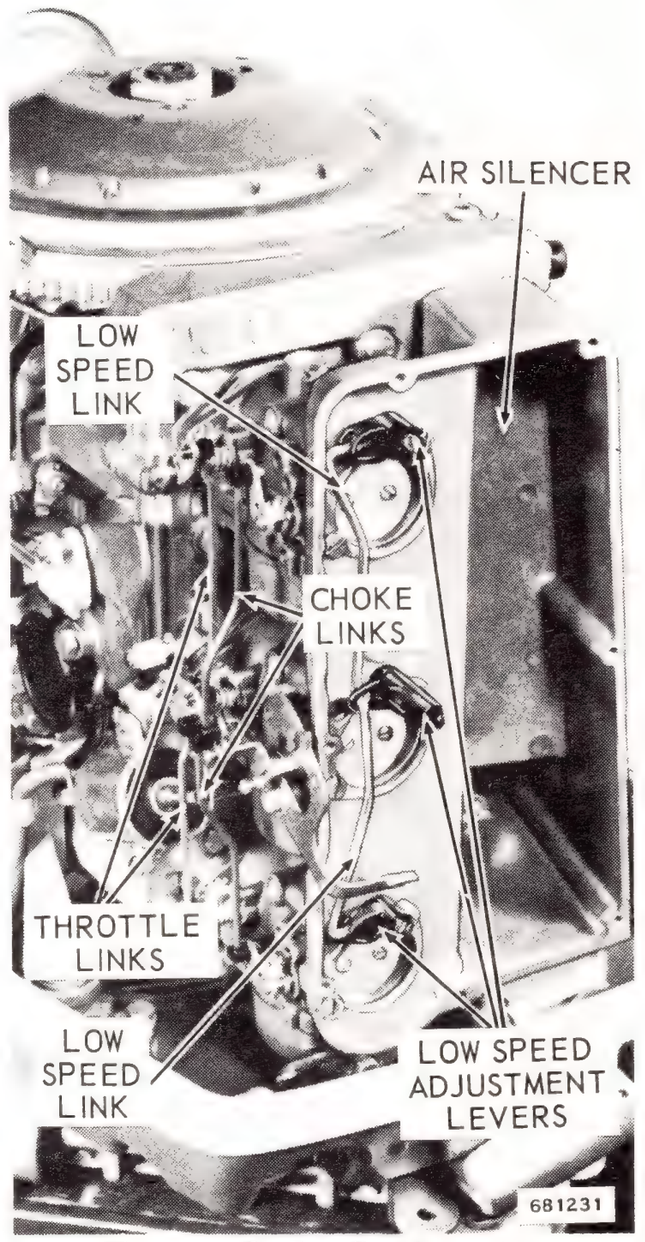


Figure 3-5. Carburetor Linkages

f. Disconnect choke solenoid spring, and remove three screws and ring gear guard.

g. Disconnect fuel hoses between carburetors.

h. Remove carburetor nuts, lockwashers and carburetors. Discard gaskets. See Figure 3-6.

REMOVAL OF CHOKE SOLENOID

a. Disconnect leads at Packard connector.

b. Remove two screws and clamp retaining solenoid.

REMOVAL OF INTAKE MANIFOLD AND LEAF VALVES

a. Remove 17 screws retaining intake manifold and leaf valve assembly. See Figure 3-7.

b. Remove leaf plate and base assembly.

DISASSEMBLY OF CARBURETOR

a. Drain carburetor by removing screw plug from bottom of float chamber. See Figure 3-8.

b. Remove fixed high-speed jet. To prevent damage to threads in float chamber assembly, use fixed jet screwdriver (Special Tool #379664). See Figure 3-9.

c. Remove low-speed needle valve from carburetor using lever to turn it out. See Figure 3-10.

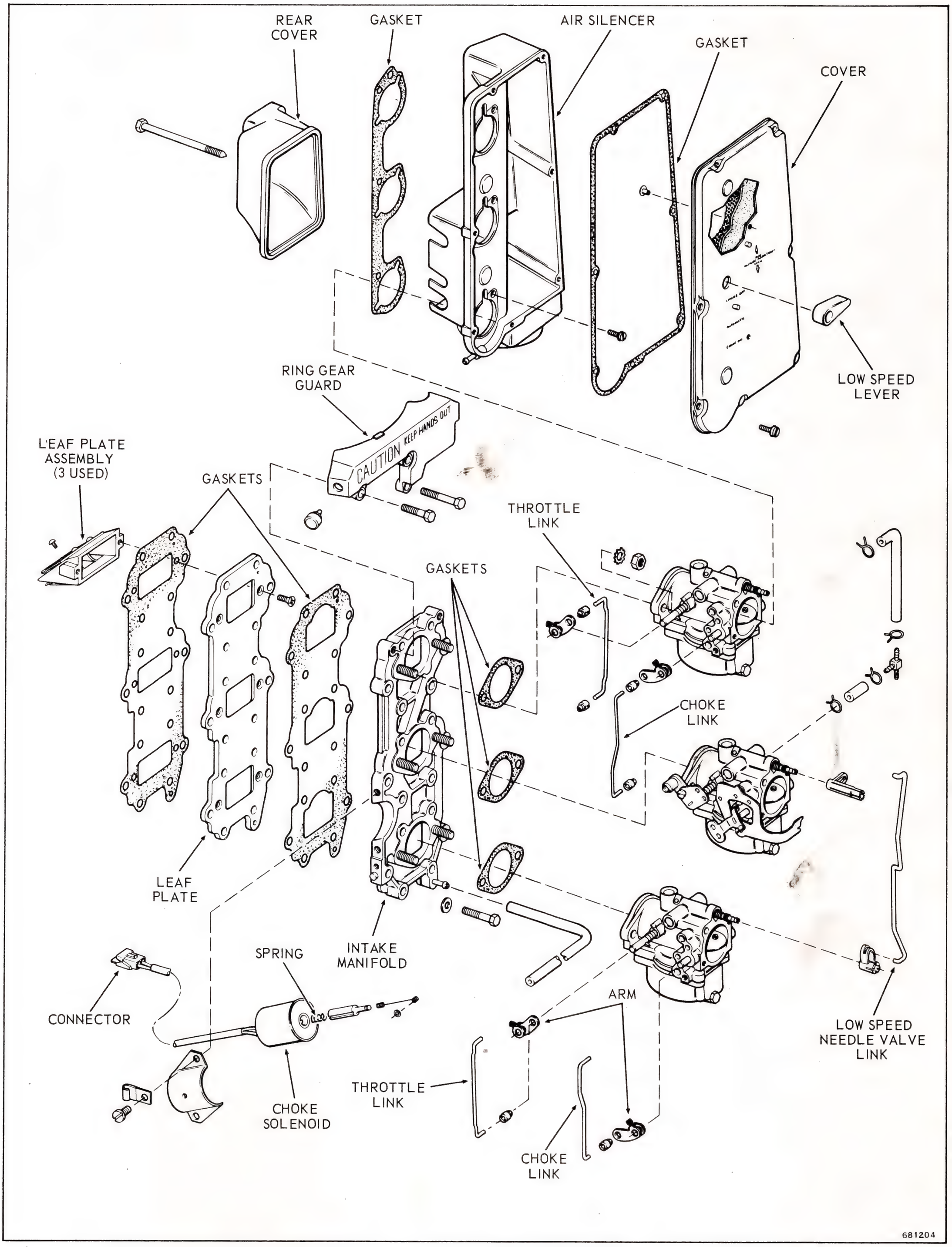


Figure 3-6. Air Silencer, Carburetors, Intake Manifold, and Leaf Valves

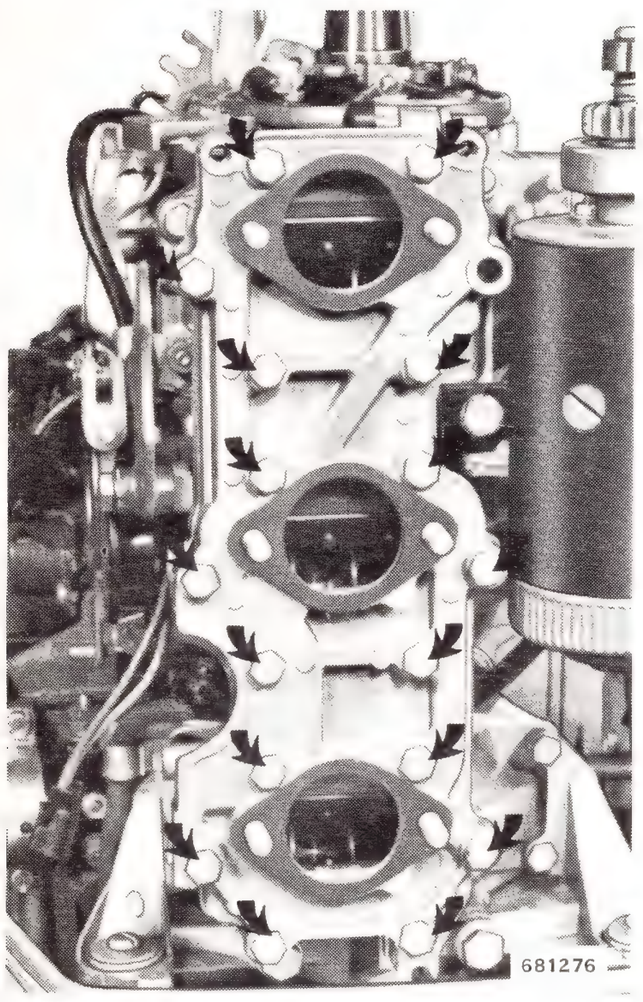


Figure 3-7. Intake Manifold Screws

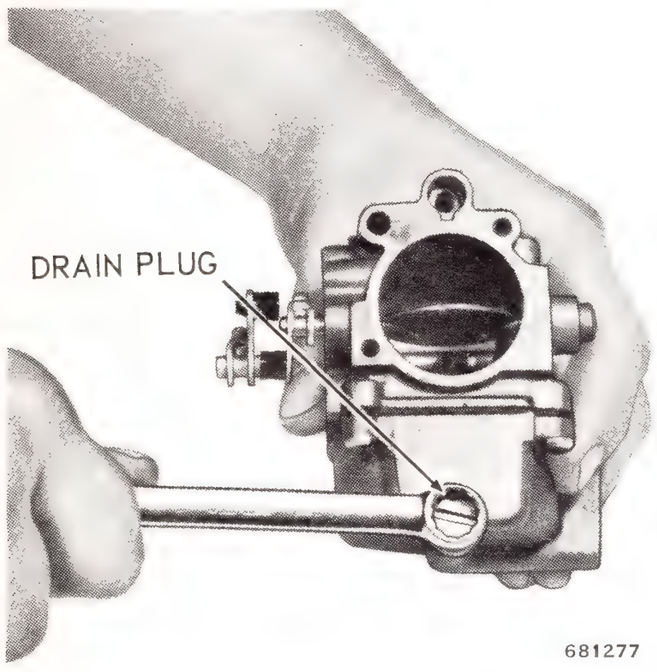


Figure 3-8. Drain Carburetor

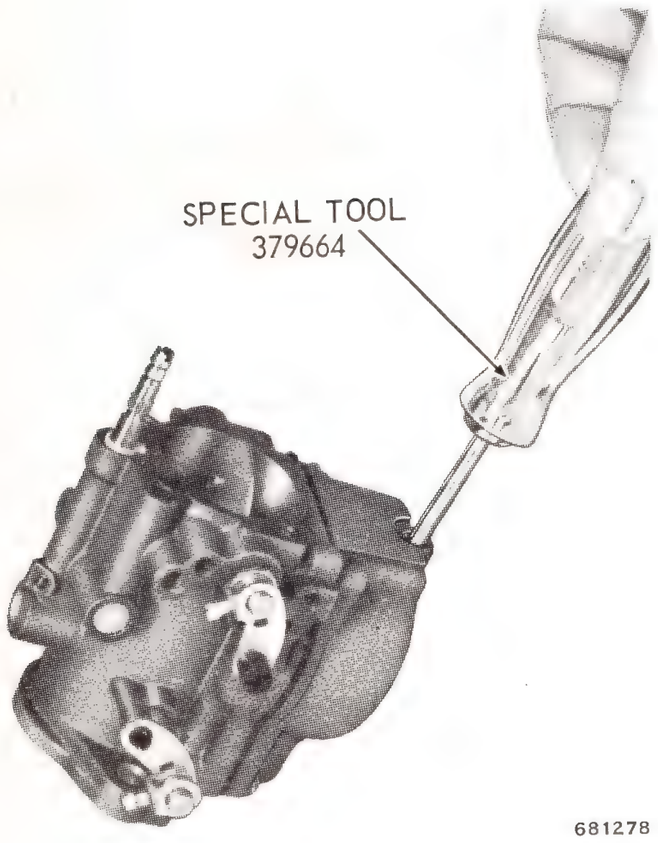


Figure 3-9. Removing Fixed Jet

d. Remove four screws attaching float chamber to carburetor body. Remove float chamber and gasket. Remove nylon hinge pin to permit removal of float and float arm assembly. See Figure 3-11.

e. Remove float valve, float valve seat, and gasket assembly from carburetor body. Unscrew high-speed nozzle.

CLEANING, INSPECTION AND REPAIR

GENERAL INSTRUCTIONS

Clean all parts, except float and float valve, in solvent and blow dry. DO NOT dry parts with a cloth as lint may cause trouble in the reassembled carburetor. Be sure all particles of gaskets are removed from gasket surfaces. Flush all passages in the carburetor body with solvent and remove any gummy deposits with OMC Accessory Engine Cleaner. Certain solvents will not remove this gum which accumulates particularly in the float chamber and on needle valves.

FLOAT AND NEEDLE VALVE

a. Inspect float and arm for wear or damage. If the float has become oil-soaked, discard it and install a new one. Check float arm wear in the hinge pin and needle valve contact areas. Replace if necessary.

b. Inspect the inlet needle valve for grooves, nicks, or scratches. If any are found, replace float valve assembly. See Figure 3-12. Gum or varnish on the needle valve must be removed with OMC Accessory Engine Cleaner. DO NOT attempt to alter the shape of the needle valve.

c. Check the needle valve seat with a magnifying glass; if seat is nicked, scratched, or worn out-of-round, it will not give satisfactory service. See Figure 3-13. The valve seat and needle are a matched set; if either is worn, both parts must be replaced. Use a new gasket when reinstalling the needle seat.

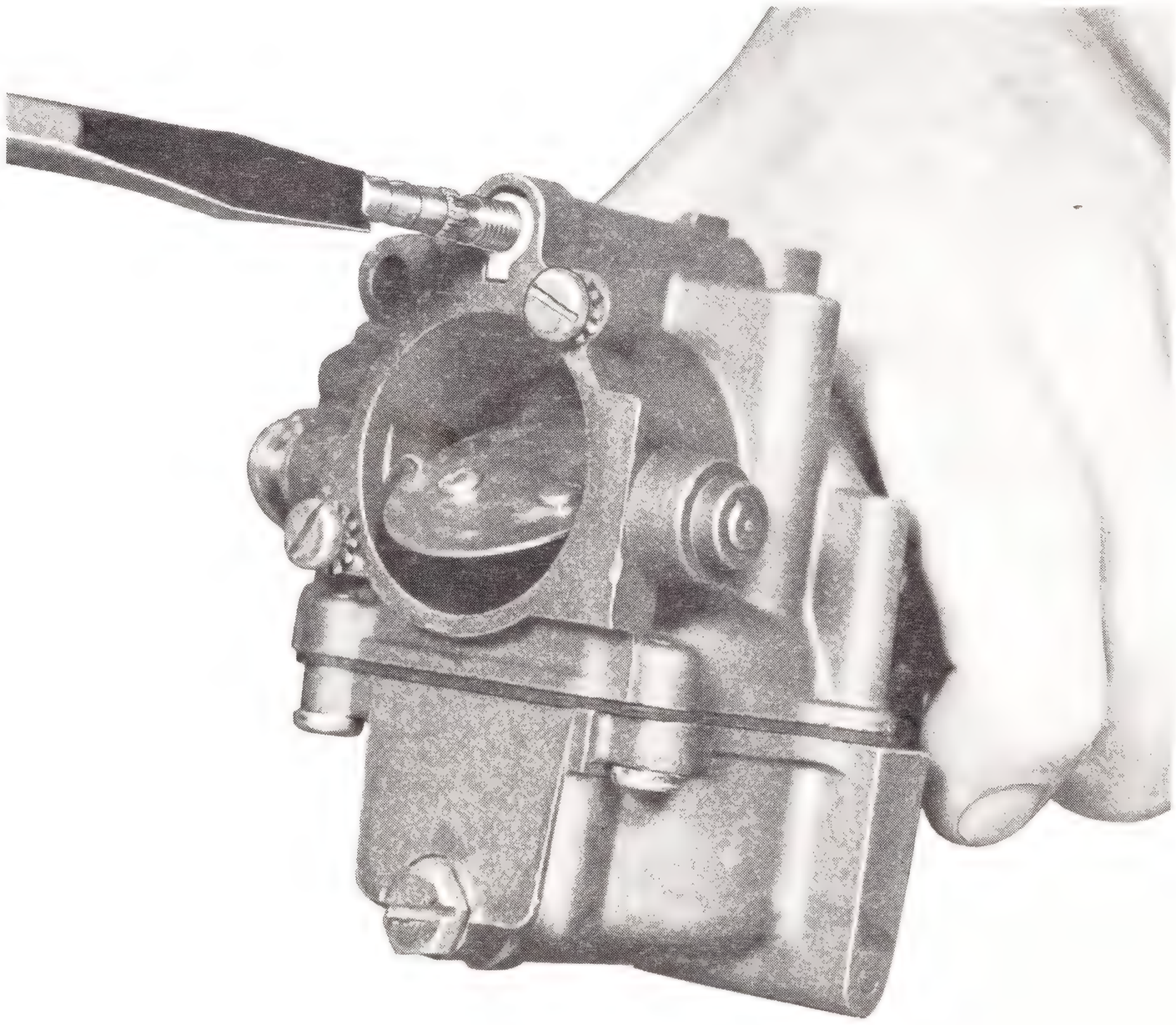


Figure 3-10. Removing Low-Speed Needle

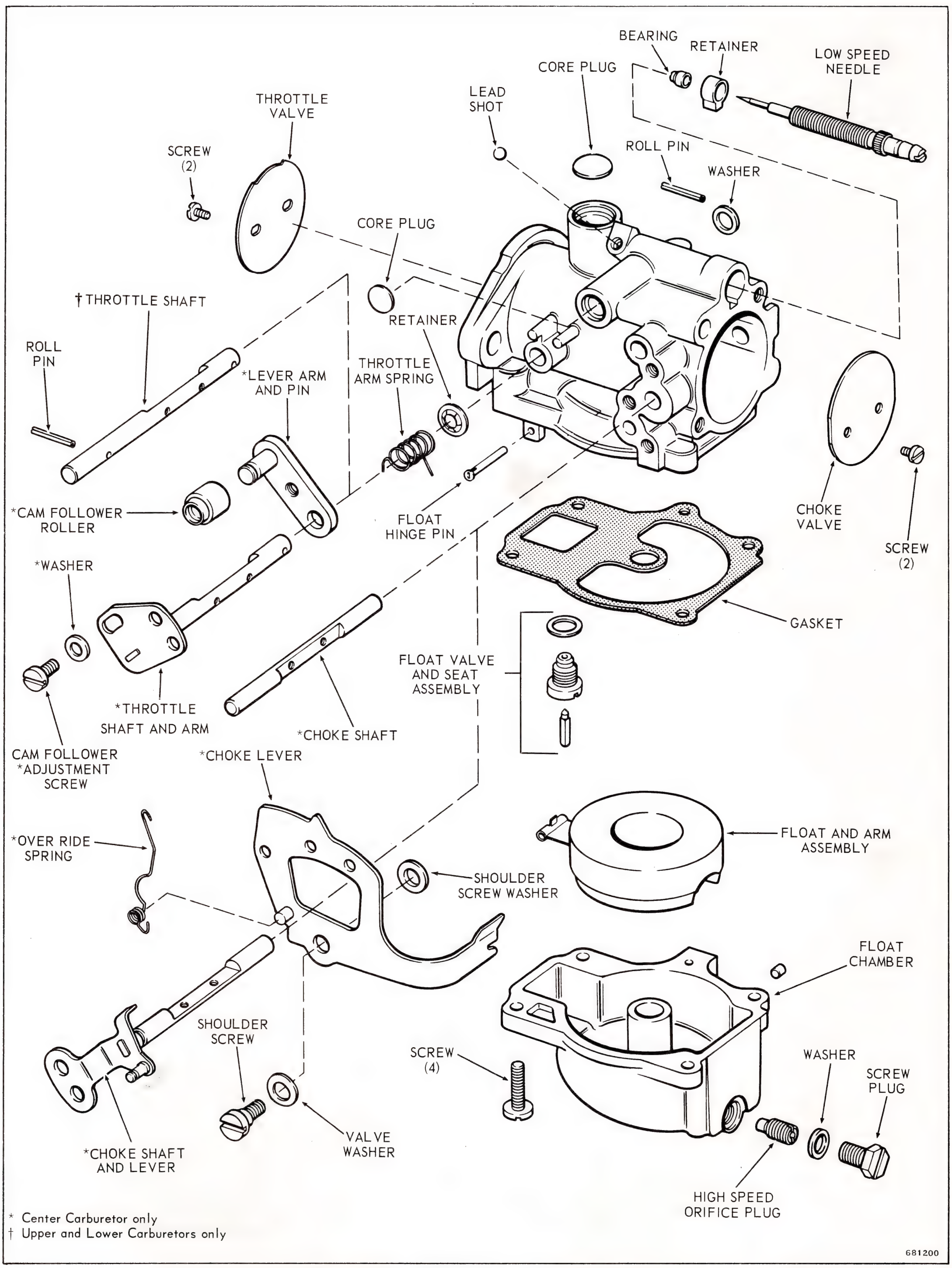


Figure 3-11. Carburetor Assembly View

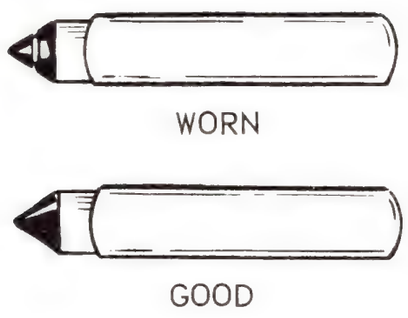


Figure 3-12. Needle Valve Wear

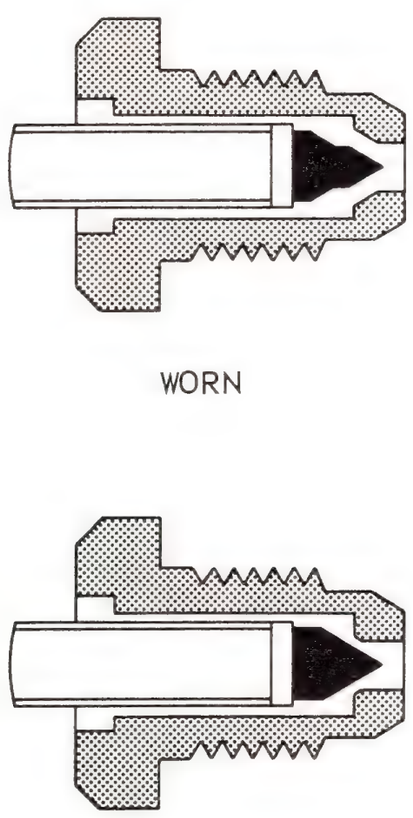


Figure 3-13. Needle Valve Seat Wear

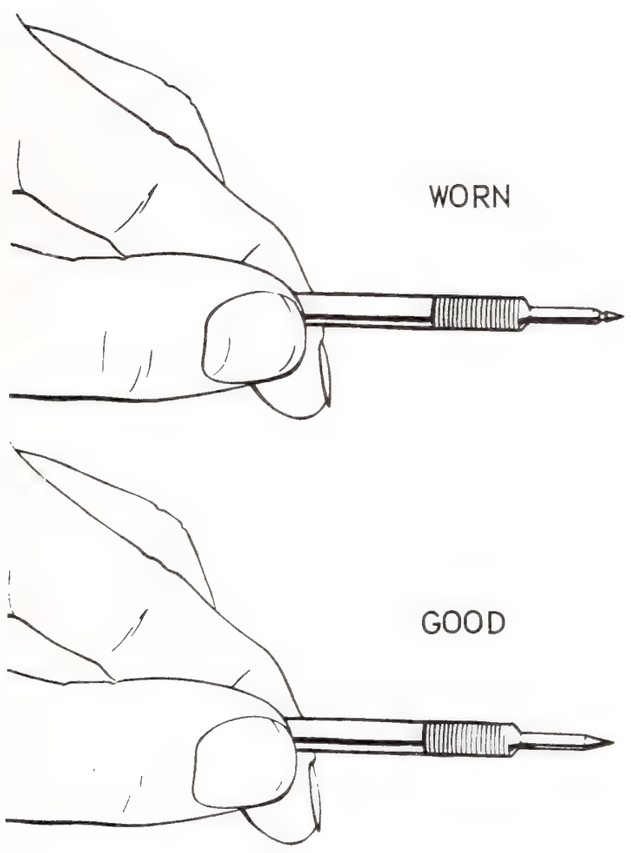


Figure 3-14. Low-Speed Needle Valve Wear

NEEDLE VALVES

a. Inspect the tapered end of the needle valves for grooves, nicks, or scratches; replace if necessary. See Figure 3-14.

b. DO NOT attempt to alter the shape of the low-speed needle valve.

CARBURETOR BODY

a. Clean out all the jets and passages, and the venturi, making sure no gum or varnish deposits remain. Dry after cleaning with compressed air. Keep clean for final reassembly.

b. Check all gasket surfaces for nicks, scratches, or distortion. Slight irregularities can be corrected with the use of a surface plate and emery cloth.

c. Check throttle and choke shafts for excessive play. Check operation of choke and throttle valves to be sure they correctly shut off air flow, yet move freely without binding. Replace carburetor body if valves or shafts are excessively worn or damaged.

NOTE

The threaded edges of the choke and throttle valve attaching screws are staked during carburetor assembly to prevent loss during operation. Disassembly of these valves is possible, but replacement of the carburetor body is recommended.

CORE PLUGS

If necessary, remove core plug to clean out slow speed orifice holes Figure 3-1.

If leakage occurs at a core plug area, follow these steps:

a. If leakage is slight, a smart tap with a hammer and flat end punch in the center of the core plug will normally correct this condition. See Figure 3-15.

b. If leakage persists, drill a 1/8 inch hole through the center of the core plug to a depth of not more than 1/16 inch below its surface. With a punch carefully pry out the core plug. See Figure 3-16.

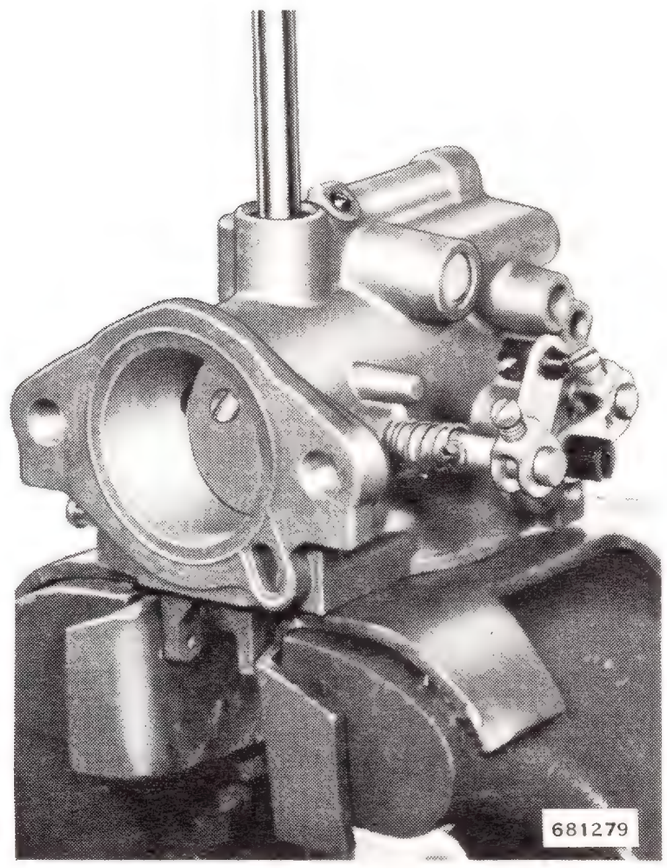


Figure 3-15. Re-Seating or Installing Core Plug

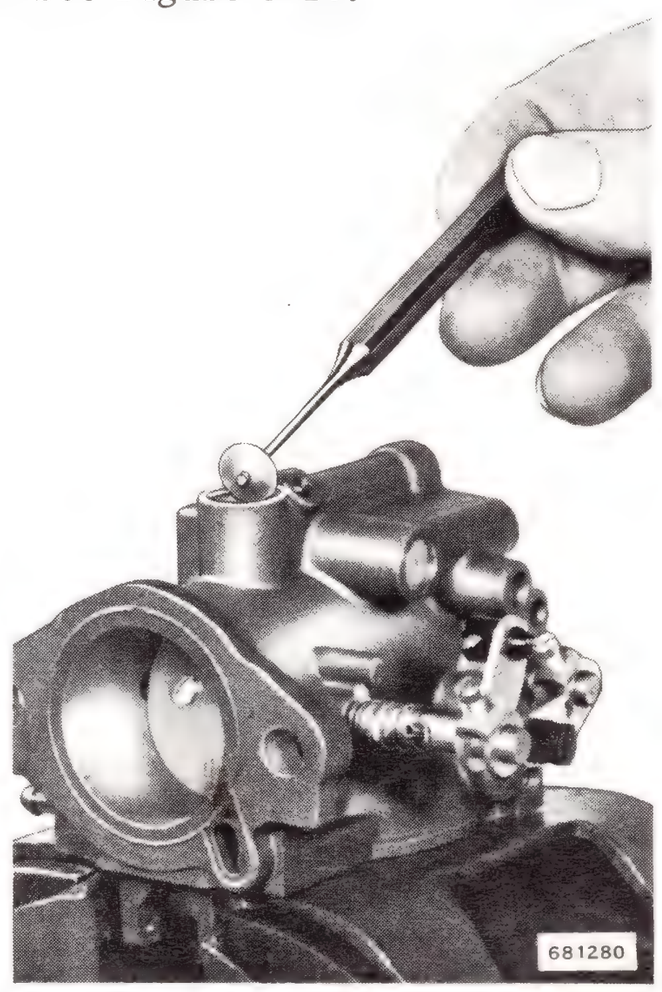


Figure 3-16. Removing Core Plug

c. Inspect and clean casting contact area; if nicks, scratches, or an out-of-round condition exist, the casting will have to be replaced. If the casting opening is normal, apply a bead of Sealer 1000 to the outer edge of a new core plug and place the new core in the casting opening, convex side up. Flatten to a tight fit with a flat end punch and hammer. Check for leakage.

LEAF VALVES

a. Inspect the leaf plate assembly and disassemble if necessary. The leaf valves must be free from all varnish and gum, and the leaves must be perfectly flat and without distortion so that they form a seal with the leaf plate base. See Figure 3-17.

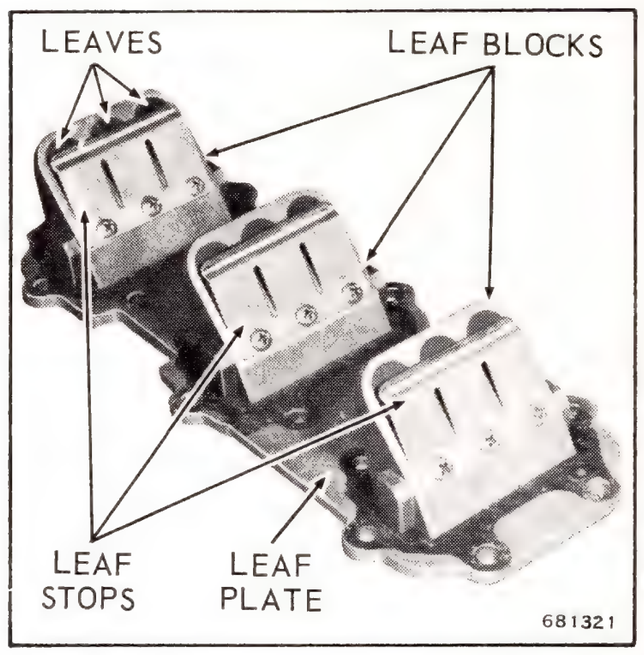


Figure 3-17. Leaf Valves

b. DO NOT attempt to bend or repair a damaged leaf; replace the complete assembly if damaged. DO NOT under any circumstances bend or flex the leaves by hand.

c. Replace the leaf plate assembly if any leaves are broken.

AUTOMATIC CHOKE

For efficient operation, the solenoid plunger should be free from dirt and corrosion so that it can move freely in the housing. DO NOT lubricate the plunger, since the oil film will only attract dust and cause sluggish plunger movement.

Operation of the thermal switch in the cylinder head can be checked with a continuity light connected between the switch lead terminals. The light should indicate a closed circuit on a cold motor and open as the motor reaches 145° F. For replacement of thermal switch, see Section 5.

REASSEMBLY OF CARBURETOR

GENERAL INSTRUCTIONS

Reassemble the carburetor, paying particular attention to the following procedure. Keep all dust, dirt, and lint out of the carburetor during reassembly. Be sure that parts are clean and free from gum, varnish, and corrosion when reassembling them. Replace all gaskets and "O" rings. DO NOT attempt to use original gaskets and "O" rings because leaks may develop after the engine is back in use.

Check the Torque Chart in Section 2 for correct torque recommendations during reassembly.

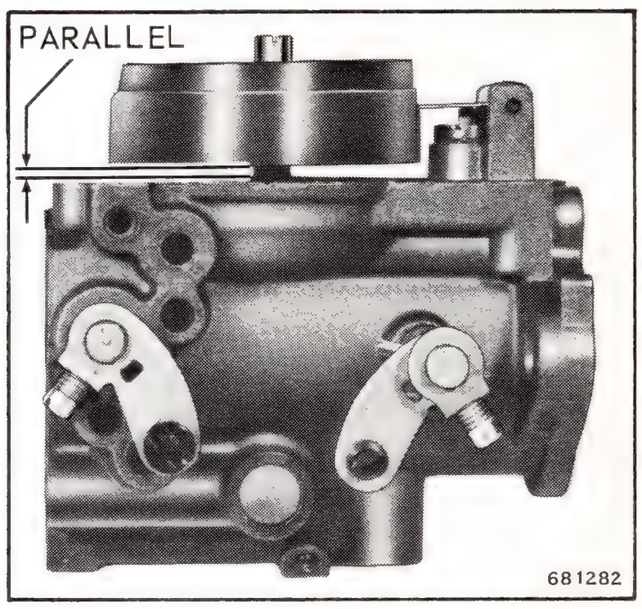


Figure 3-18. Float Level

FLOAT AND FLOAT CHAMBER

a. Install high-speed nozzle and new carburetor boss gasket in float chamber. Replace float valve seat and gasket, float valve, float, and hinge pin.

b. Check for correct positioning of float. Turn carburetor body upside down so weight of float closes needle. Top of float should be parallel with rim of casting. See Figure 3-18.

c. Reassemble float chamber to carburetor body, using a new gasket.

d. Replace the high-speed orifice plug and screw plug.

LOW-SPEED NEEDLE

a. Install the low-speed needle and Delrin retainer, turning in carefully with finger pressure (use the low-speed adjusting lever for this operation) until it comes lightly against the seat, then back off 5/8 turn. CAUTION should be taken to prevent jamming the needle against the seat.

b. Adjust the low-speed needle as described under "Carburetor Adjustments" after installing carburetor on power head, and replace adjusting levers.

CHOKE

Check the choke for free operation. Choke valves must move freely, without binding.

LEAF VALVES

a. The importance of keeping the leaves in these valves free from distortion cannot be over-emphasized. Replace any leaf valve assembly which shows any indication of distortion or damage of leaf stop. Check leaf plate with scale for distortion.

b. The leaf is so designed that it maintains constant contact with the leaf block, and will spring away from the block when predetermined pressure is exerted against it. Leaf travel away from the block is limited by the leaf stop. When pressure is removed, the inherent spring action of the segments returns and holds them against the block. Attach the leaf segments and leaf stops to the leaf blocks, then examine each leaf carefully. Each leaf must lie flat against the block with no edges turned up or away from the block. See Figure 3-17.

c. Attach the leaf plate assemblies to the leaf plate base. Tighten screws and nuts to specified torque to avoid distortion of the leaf blocks.

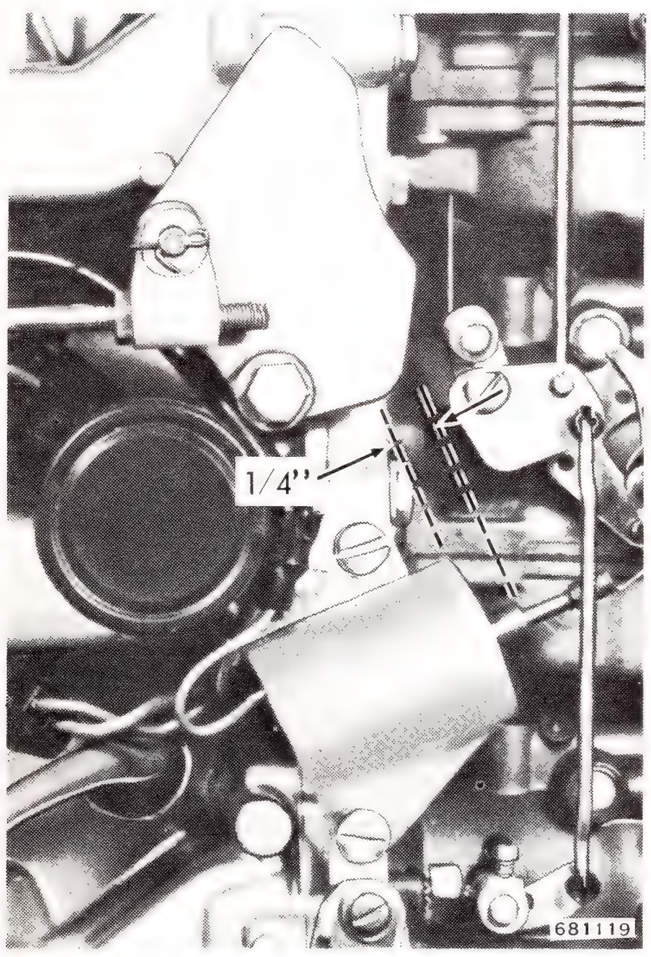


Figure 3-19. Adjusting Solenoid

INSTALLATION OF CHOKE SOLENOID

NOTE

If spring is removed from solenoid plunger, install by twisting on to plunger 2-1/2 to 3-1/2 turns.

a. Attach solenoid to intake manifold with clamp and two screws. For proper adjustment, see Figure 3-19.

b. Connect leads at Packard connector.

INSTALLATION OF LEAF VALVES AND INTAKE MANIFOLD

a. Using new gaskets, install leaf valve and plate assembly and intake manifold.

b. Tighten attaching screws to torque specified in Section 2.

REASSEMBLY OF CARBURETORS TO MOTOR

a. Place new gaskets in position on studs on manifold. Place carburetors on studs and fasten in place with nuts and lockwashers.

b. Connect fuel hoses between carburetors. Connect choke and throttle linkages.

c. Connect choke solenoid spring, and install ring gear guard.

d. Install air silencer, and connect fuel hoses to fuel pump and filter.

e. Adjust carburetors as described in paragraph "Carburetor Adjustments".

f. Connect drain hose and install air silencer cover.

g. Install low-speed needle adjustment lever in horizontal position facing to port and secure with retainer screw.

CARBURETOR ADJUSTMENTS

THROTTLE AND CHOKE LINKAGE

a. Loosen upper and lower carburetor throttle arm retaining set screws to allow spring on throttle shafts to close throttle valves. Tighten set screws.

b. Repeat same procedure for choke valves by manually closing choke valves.

THROTTLE CAM ADJUSTMENT

a. Scribe mark on throttle cam should align with center of cam follower roller. See Figure 3-21.

b. With scribe mark on throttle cam aligned with center of cam follower roller, loosen center carburetor throttle arm screw. Move arm to close throttle valves and retighten screw. See Figure 3-21.

SYNCHRONIZING CARBURETOR AND DISTRIBUTOR LINKAGE

To assure proper spark advance at all throttle settings, carburetor and distributor must be synchronized after distributor linkage has been reassembled. Follow the instructions given in Section 4, "Synchronizing Carburetor and Distributor Linkage."

LOW-SPEED NEEDLE

a. Turn each low-speed needle clockwise until needles seat gently. DO NOT FORCE.

b. Turn each low-speed needle counterclockwise 5/8 turn.

NOTE

Allow motor to reach normal operating temperature by running in a tank with test propeller at one-half throttle or slightly more before proceeding to next step.

c. With motor at operating temperature, run at fast idle (700-750 rpm) with test propeller in tank or on boat IN GEAR. Adjust one low-speed needle at a time until highest rpm and smoothest performance are obtained. Allow ample time for motor to respond to adjustment.

d. Pull off levers and connect linkages. DO NOT disturb position of needles. Position levers so they are pointing straight to starboard and push back to original position on needles.

e. Adjust idle adjustment screw so motor will idle at 600 to 650 rpm IN GEAR.

FUEL PUMP AND FILTER

Before servicing or replacing fuel pump, remove the fuel filter screen, and install a new filter screen. See Figure 3-22. Also remove the fuel hose from the fuel tank and blow through all passages and lines with compressed air to be sure they are open. If clogged lines are the cause of the difficulty, this procedure would eliminate unnecessary servicing of the fuel pump. If this procedure does not correct the trouble, fuel pump is probably malfunctioning and should be replaced.

REMOVAL OF FUEL PUMP AND FILTER

a. Disconnect hoses from pump and filter assembly.

b. To remove fuel pump, remove two screws attaching pump and filter assembly to air silencer, and remove pump and filter assembly. See Figure 3-22.

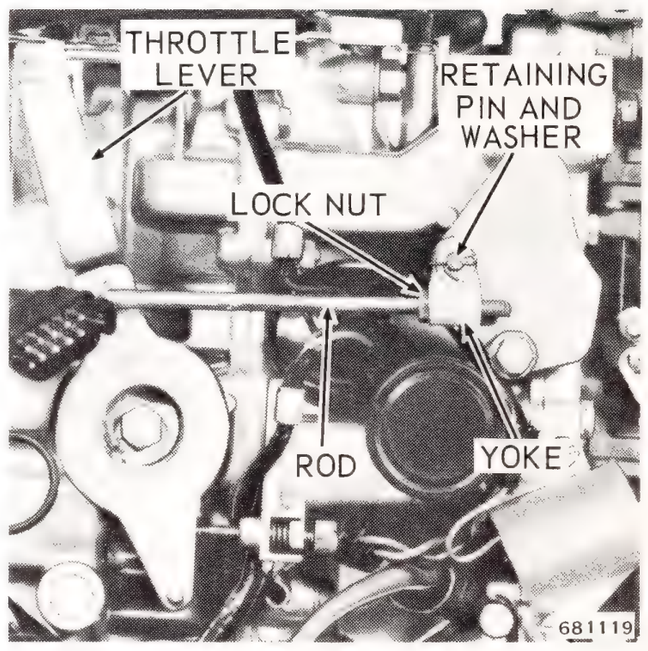


Figure 3-20. Throttle Rod Adjustment

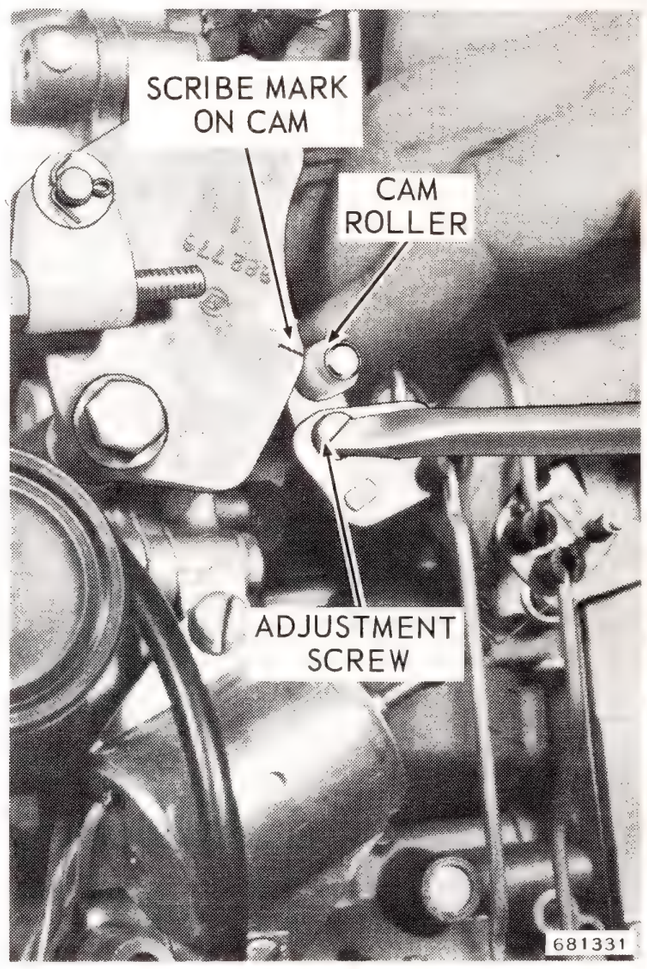
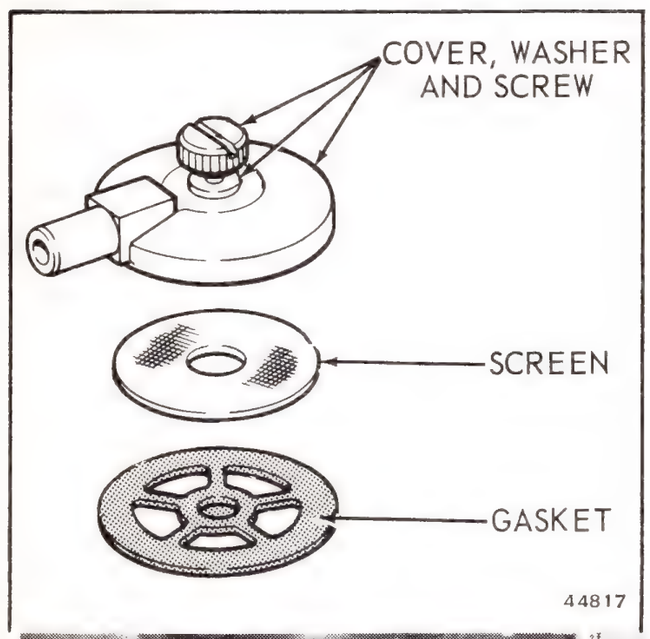


Figure 3-21. Synchronizing Throttle and Spark



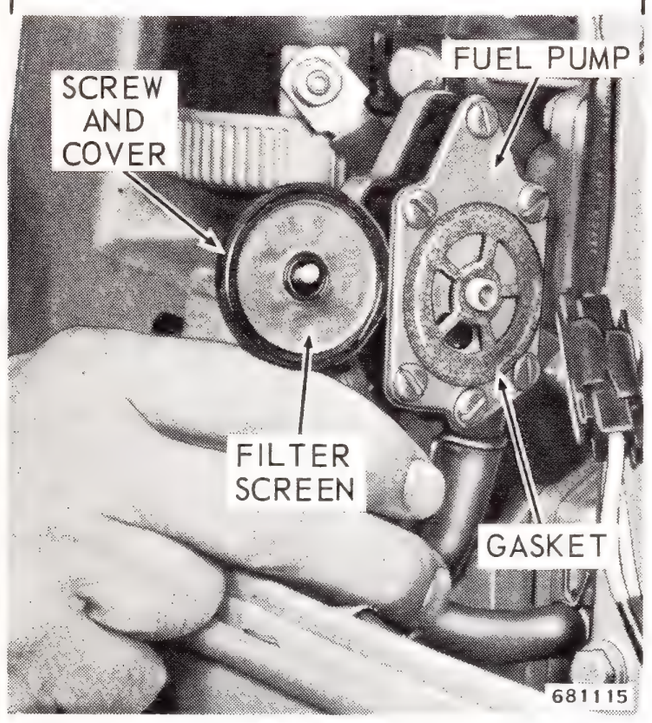


Figure 3-22. Fuel Filter and Pump

CLEANING, INSPECTION AND REPAIR

a. The fuel pump operating components are not serviced separately. If a malfunction occurs, replace the complete pump.

b. Inspect the filter for accumulation of sediment by removing the filter cap screw and the filter cap. See Figure 3-22.

c. Clean all parts of the filter assembly and fuel connectors in solvent and blow dry. DO NOT dry parts with a cloth, as lint may stick to the parts and clog the passages or prevent the fuel pump valves from seating. Dissolve any gummy deposits with OMC Accessory Engine Cleaner (certain solvents will not dissolve these deposits).

NOTE

It is recommended that a new fuel filter element and gasket be installed when servicing the filter and pump assembly.

REASSEMBLY OF FUEL PUMP AND FILTER

Reassemble the fuel filter to the pump in the reverse order of disassembly being sure lip of screen faces pump.

a. Attach fuel pump to air silencer. Tighten filter and pump screws securely. Check for leaks by connecting fuel tank line to motor and squeezing primer bulb until definite pressure is felt in the bulb.

FUEL TANK

FUEL MIXTURE

A motor in excellent mechanical and operating condition may give faulty performance because of an improper fuel mixture. Petroleum gum and varnish which precipitate from a stale mixture may clog the filter screen and any small orifices, interfering with starting and normal running. For proper fuel mixture, see inside front cover and Owner's Manual.

To assure that the fuel tank contains the proper mixture, drain and flush the tank at least once a year, and at every tune-up or major repair. To facilitate complete draining of the tank, a drain screw is provided in the fuel tank upper housing. See Figure 3-23. Clean the tank by flushing with clear gasoline or solvent.

DESCRIPTION

The fuel tank is of simple but rugged construction, with a capacity of 6 gallons of fuel mixture. It includes the bulb primer (for priming the fuel pump), fuel level gage, fuel hose and connectors, a bracket arrangement to hold the fuel line when not in use, and a carrying grip. The fuel tank upper housing, which provides the connection to the fuel hose, contains two release valves and a disc valve which prevent any escape of gasoline or fumes, minimizing the danger of explosion or fire.

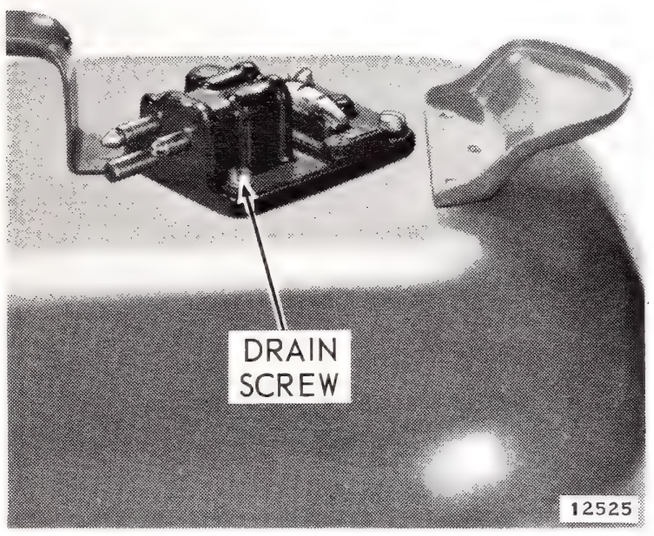


Figure 3-23. Fuel Tank Upper Housing

CLEANING, INSPECTION AND REPAIR

UPPER HOUSING AND FUEL LEVEL INDICATOR

The fuel indicator is mounted to the upper housing and fuel line assembly. The entire assembly may be removed by removing the four attaching screws. Lift the assembly from the tank carefully to avoid damaging the indicator float or the screen at the end of the fuel line. See Figure 3-24.

Check for free movement of the indicator on the indicator pin. Remove the pin from the indicator support by compressing the free end and pull-

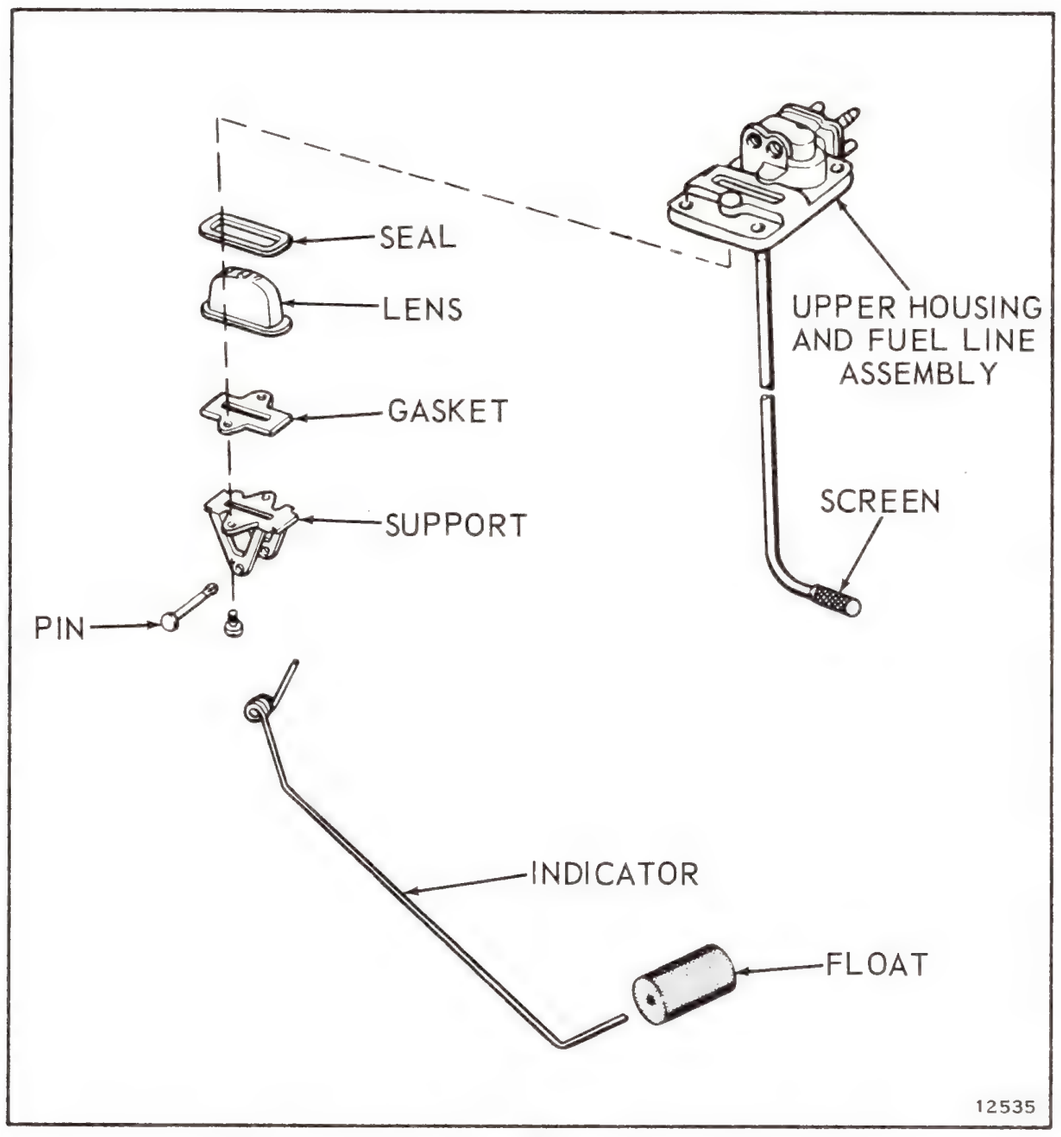


Figure 3-24. Fuel Tank Level

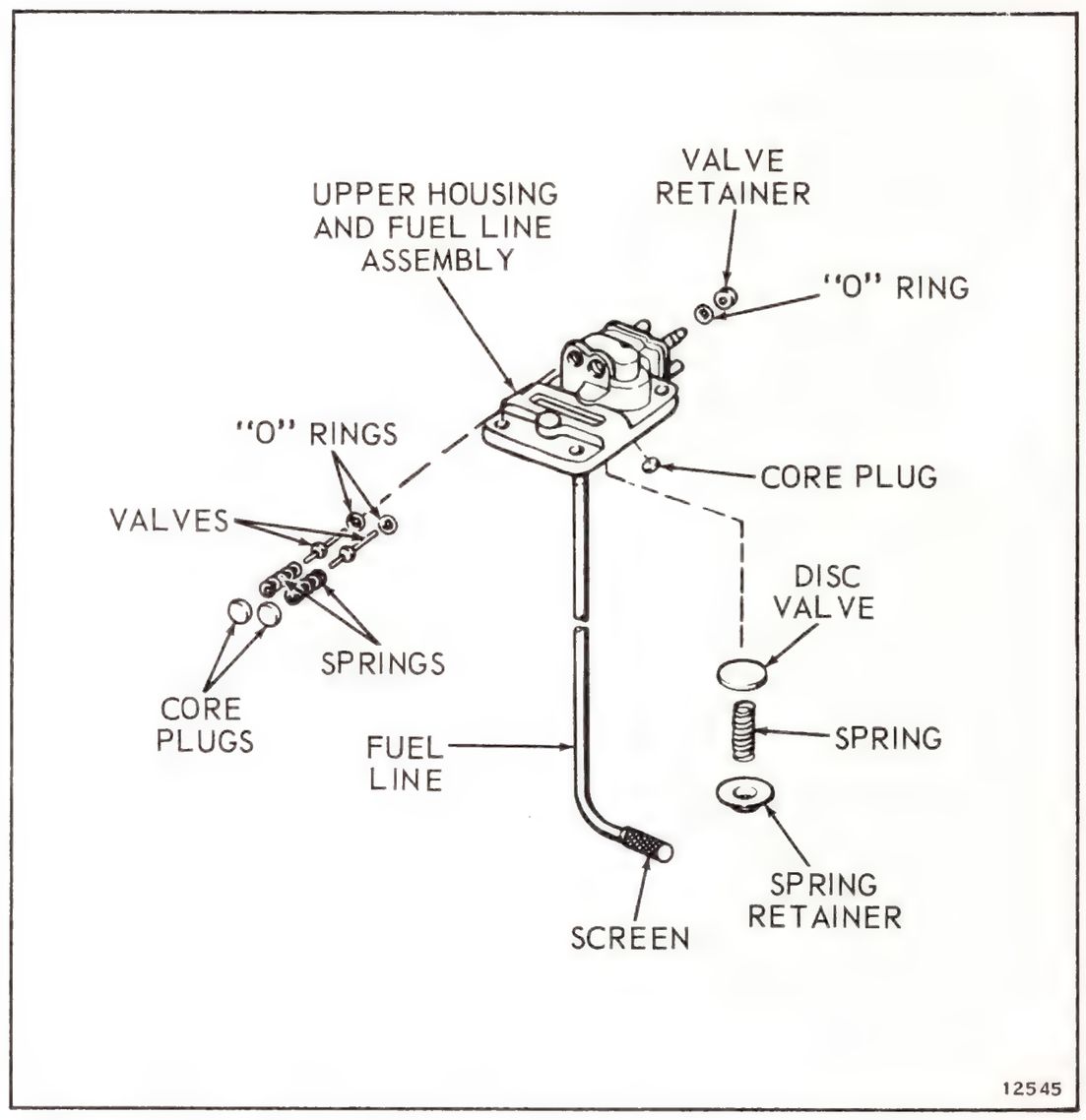


Figure 3-25. Fuel Tank Upper Housing and Valves

ing it out. Inspect the indicator to make sure that the float arm is not bent and that the float is not damaged or oil-soaked.

Remove the two screws attaching the indicator support to the upper housing. Lift the indicator lens out of the upper housing, and clean it with grease solvent or lacquer thinner to remove any foreign matter which may be clouding the lens. Inspect the lens seal for cracks or shrinkage which may allow leakage. The release valves must seat tightly to prevent gasoline or fumes from leaking out, but must open a clear passage for air to enter the tank and for fuel to be drawn out when the fuel hose is connected. Dirt may keep the release valves from seating properly. The release valves are best cleaned by removing the core plugs and disassembling. Replace valve seats ("O" rings) to assure a tight seal. See Figure 3-25.

The air inlet disc valve must seat tightly to prevent fumes from escaping the tank when the fuel hose is connected, but must allow air to enter the tank. The disc valve spring retainer is staked to the upper housing and may be removed by filing off the burrs if replacement is necessary. Restake with a small punch.

HOSE AND PRIMER BULB ASSEMBLY

CLAMPS

To disassemble hose clamps, grip clamp with pliers. Bend overlapping hook backward (in direction of arrow) to release clamp. See Figure 3-26.

To assemble hose clamps, grip clamp firmly with pliers. Apply slight pressure to hook on top side with screwdriver. Squeeze clamp with pliers until hooks interlock. See Figure 3-27.

CONNECTOR HOUSINGS

NOTE

If "O" ring is damaged air will enter fuel line and carburetor. Motor will run out of fuel.

Figure 3-26. Removing Hose Clamps

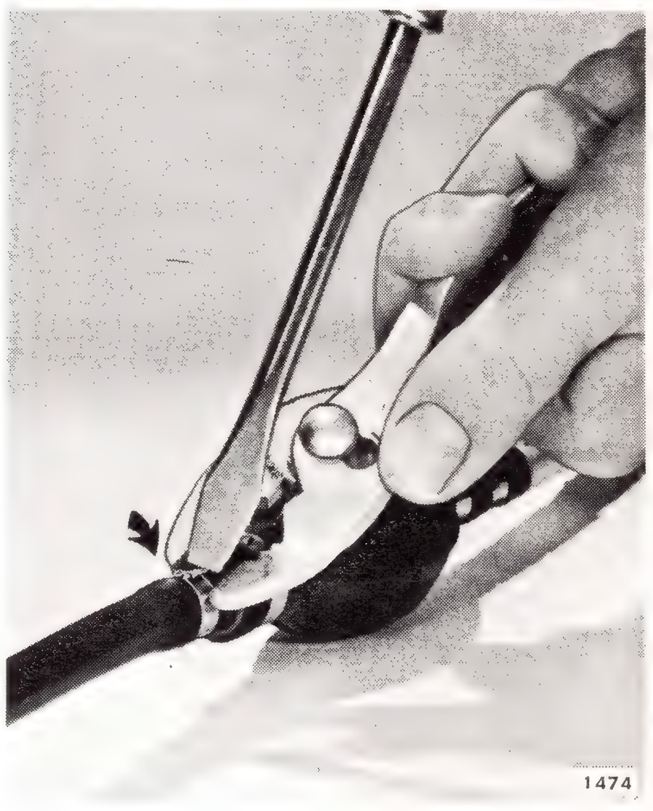


Figure 3-27. Attaching Hose Clamp

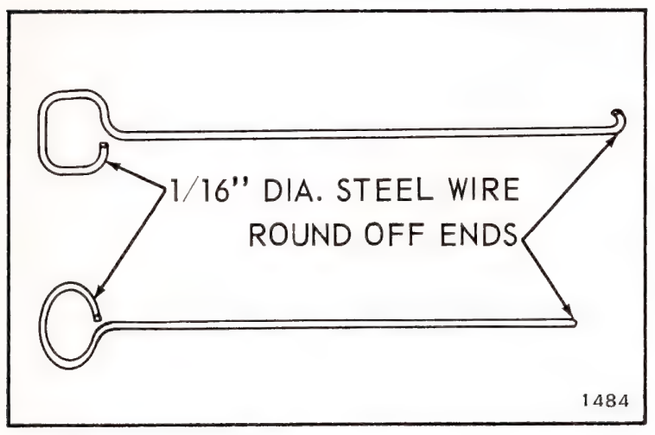


Figure 3-28. "O" Ring Tools

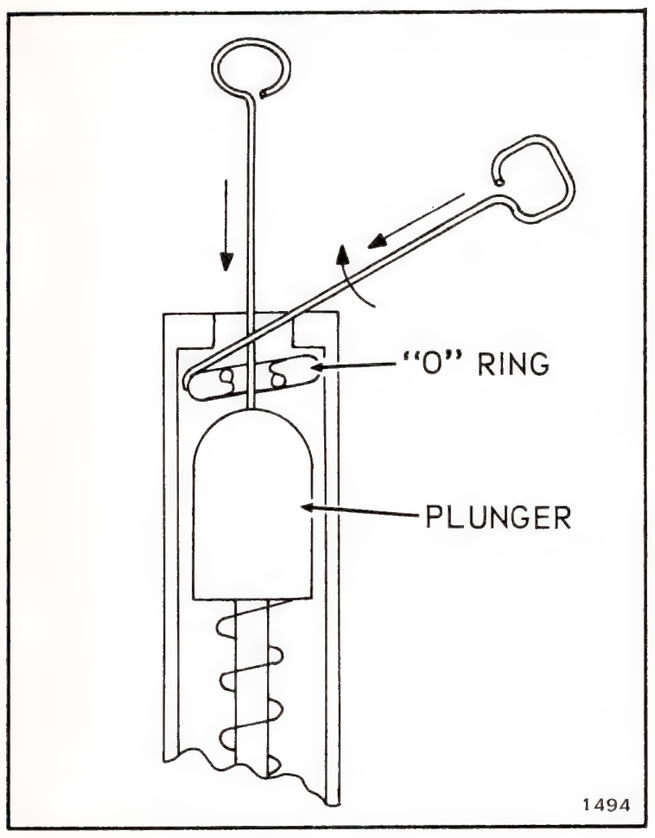


Figure 3-29. Removing "O" Rings

Installation of the "O" ring in the fuel hose connectors requires the use of two instruments, one to hold the plunger down and one to remove the "O" ring. Both instruments are illustrated and can be made easily of 16 gage (1/16" diameter) steel wire. A piece of discarded remote control wire may be used. Form a small hook on the bottom end of the longer tool of about 1/16" radius. After cutting the wires to length, be sure the ends are rounded off to prevent scratching or damaging the "O" ring seats or the plungers. See Figure 3-28.

To remove the "O" ring from the connector, proceed as follows:

a. Place the connector in a vise between two wood blocks.

b. Push the plunger down with the straight instrument.

c. Insert the hooked instrument between the "O" ring and its seat with the hook in a flat or horizontal position. See Figure 3-29.

d. Twist the hook around to grasp the "O" ring, then pull out.

To install the "O" ring in the connector, proceed as follows:

a. Place a drop or two of oil on the "O" ring.

b. Place the "O" ring on face of the connector.

c. Push the plunger down with the straight instrument.

d. Pinch the "O" ring together and gently push into position with fingers.

When reassembling the fuel hose, check for cracks in the primer bulb or in the hose. The primer bulb must be attached so that fuel flow is from the shorter to the longer hose length. Fuel flow through the primer bulb is indicated by an arrow. See Figure 3-30.

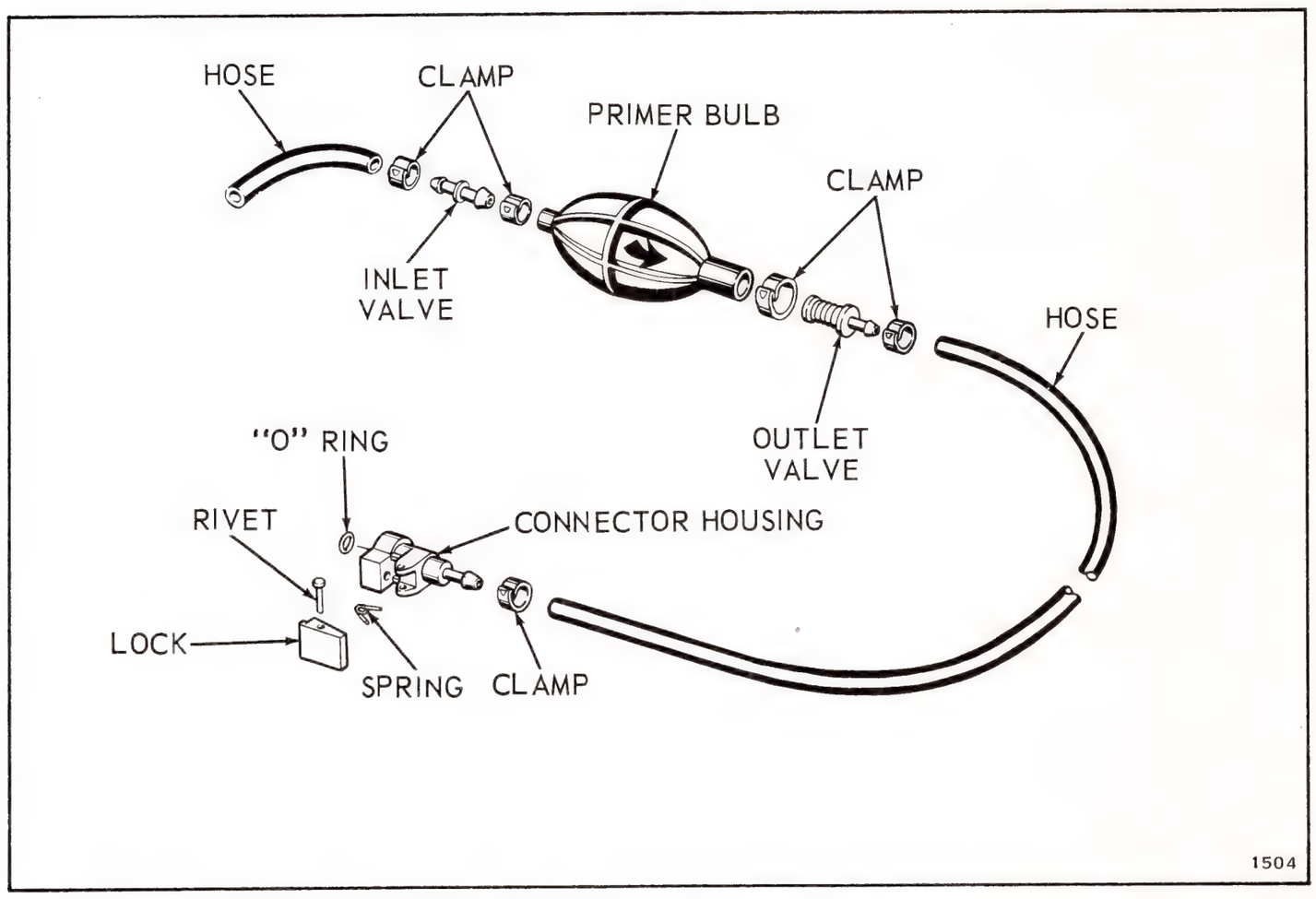


Figure 3-30. Primer Bulb and Hose Assembly

SECTION 4
IGNITION SYSTEM

TABLE OF CONTENTS

DESCRIPTION

The breaker point capacitor discharge (C.D.) ignition system consists of three major electronic components. These are the ignition coil, two sets of breaker points, and an amplifier assembly. The amplifier assembly is completely sealed and is attached to a bracket on the lower motor cover.

CAUTION

DO NOT ATTEMPT TO OPEN THE AMPLIFIER ASSEMBLY AS THIS WILL VOID THE WARRANTY.

To compliment the C.D. ignition system, special surface gap spark plugs are used. These are Champion L-19V (OMC Part Number 381992), or AC V4OFF (OMC Part Number 383181).

THEORY OF OPERATION

A transistorized voltage converter changes the 12-volt battery supply to 350 volts and stores it in the energy storage capacitor. The breaker point circuit, opened by the action of the distributor cam (see Figure 4-3), triggers the amplifier. An electronic switch then operates, allowing the storage capacitor to discharge into the ignition coil. The ignition coil boosts the 350 volts to the 25000 volts available at the spark plugs. See Figure 4-2.

As the crankshaft rotates, the breaker points close, allowing the transistorized converter to recharge the storage capacitor.

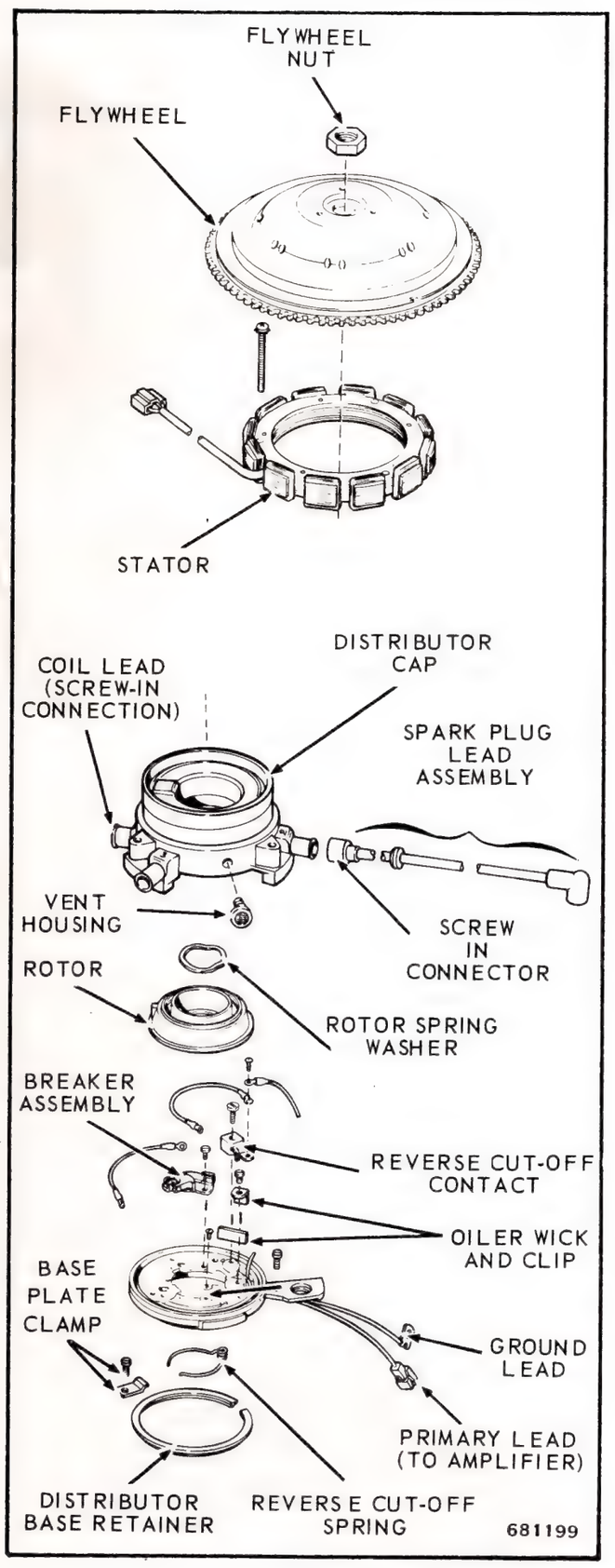


Figure 4-1. Breaker Type C.D. Ignition - Distributor and Alternator

TROUBLESHOOTING THE C.D. IGNITION

A malfunction in the system will result in (1) engine miss, (2) engine surge, (3) engine will not run.

PRECAUTIONS TO BE OBSERVED WHILE TROUBLESHOOTING THE C.D. IGNITION SYSTEM.

1. Conduct all tests with spark plug high tension leads connected to a ground on the power head unless otherwise specified. If possible, mount motor on test tank.

2. Do not attempt to operate the engine without a battery in the system. Damage to the ignition components will result.

3. Whenever the troubleshooting procedure requires a check for spark discharges, DO NOT hold the high tension lead in your hand. This system produces high voltages which could result in severe electrical shock.

4. Do not pull high tension lead at coil. Coil and lead are an assembly. Lead is sealed in coil.

Engine missing or surging may also be caused by insufficient, contaminated or excessive fuel. After determining that this condition is not caused by carburetion, proceed (in order listed) to check the ignition system.

1. CHECKING FOR SPARK. Use a spark checking device, such as an adjustable spark gap checker (see Figure 4-4), or a conventional automotive neon spark checker, to check for spark at the plug leads. If sparking does not occur while cranking engine, proceed with following checks. If sparks are apparent, proceed to "CHECKING TIMING" paragraph 6.

2. WIRING. Insert a probe from a continuity light using a #57 bulb into the socket of the red lead to the amplifier and the other lead to ground. With the ignition key in "ON" position, the #57 bulb should

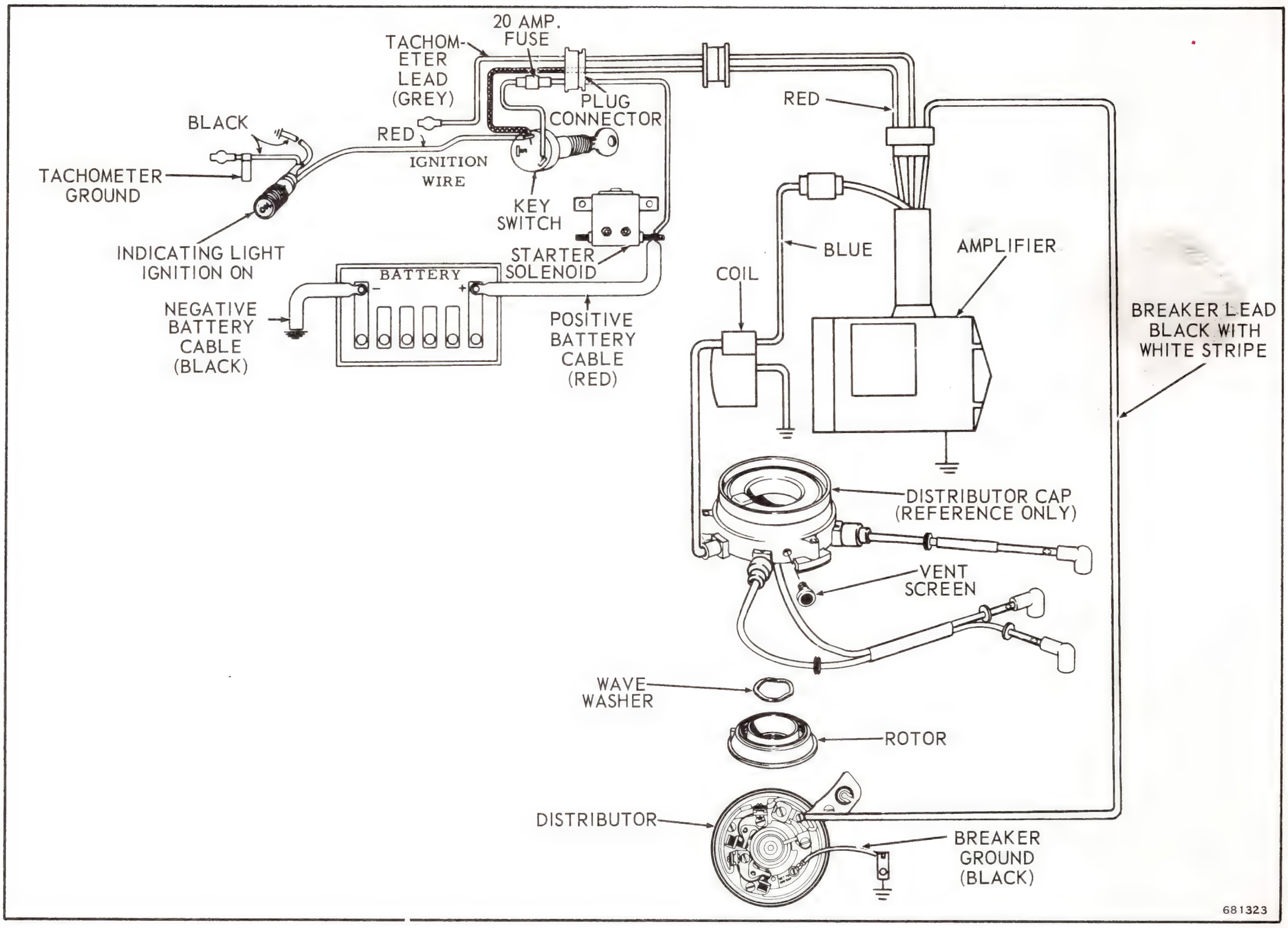


Figure 4-2. C.D. Breaker Point Ignition System

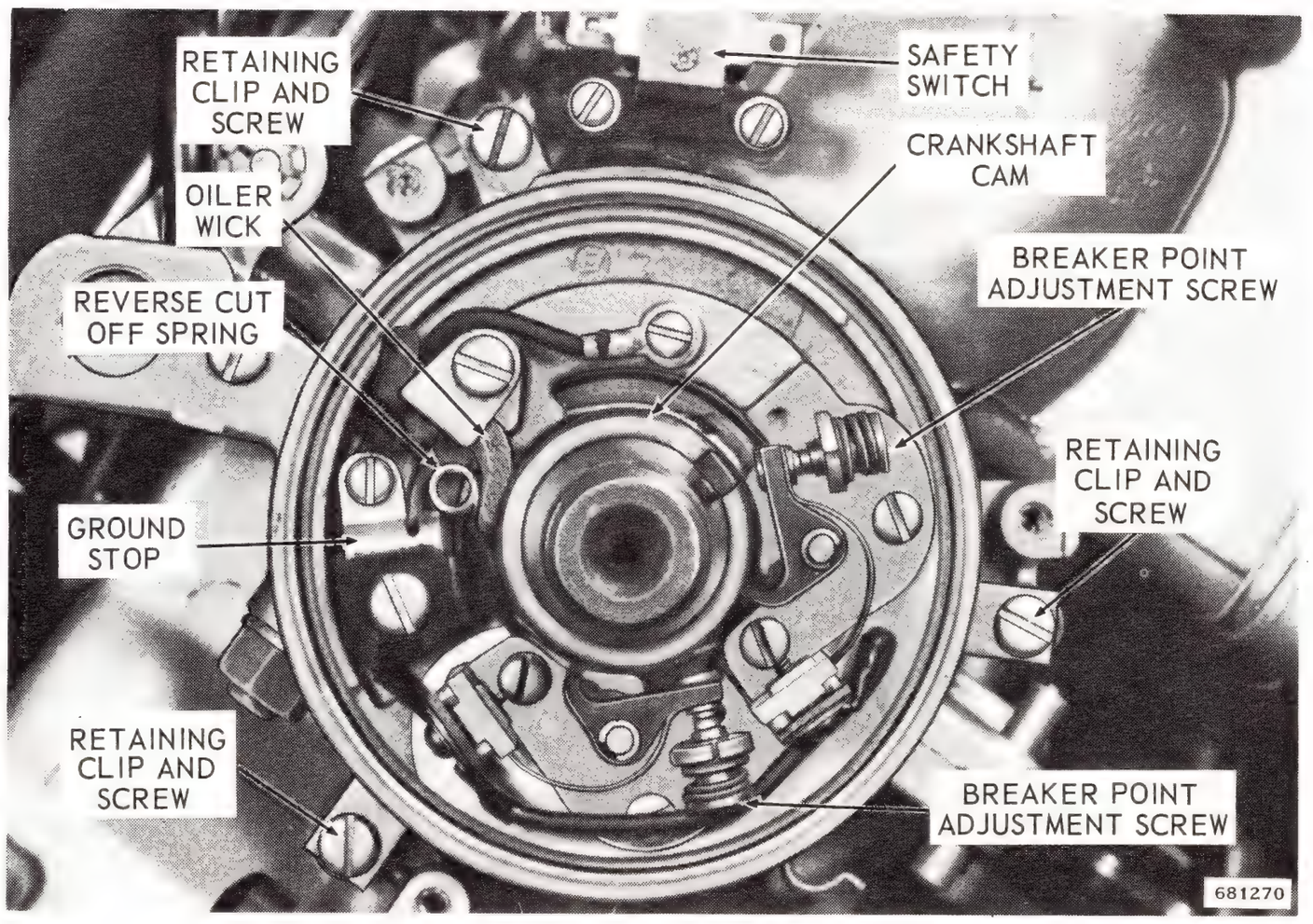


Figure 4-3. Breaker Plate

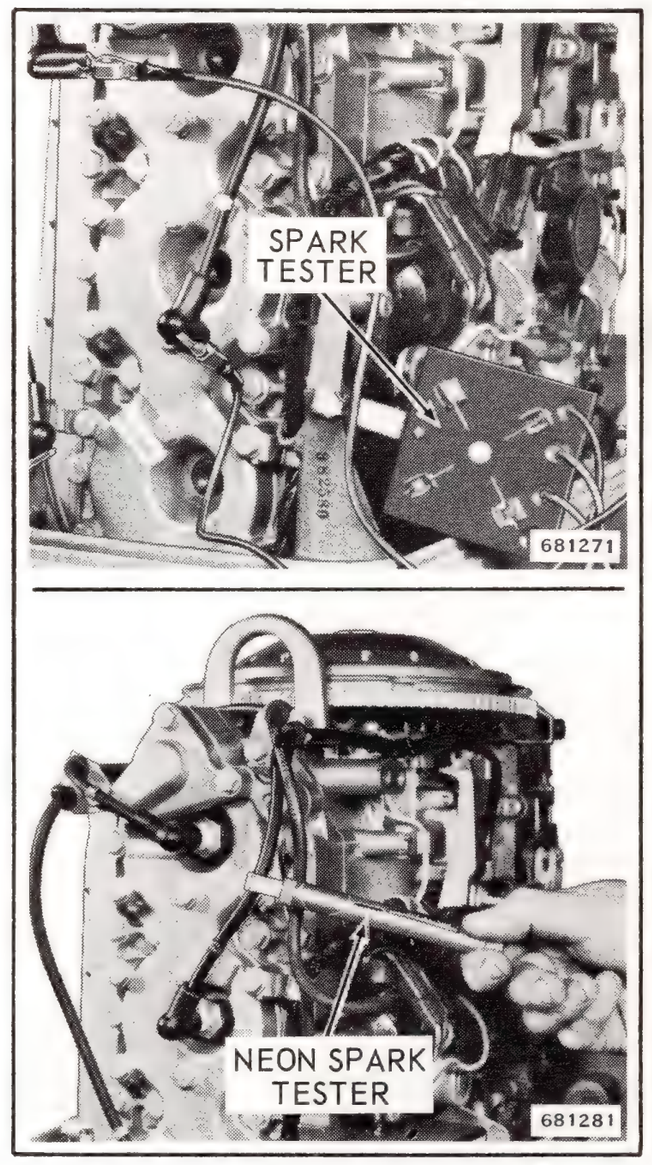


Figure 4-4. Checking for Spark

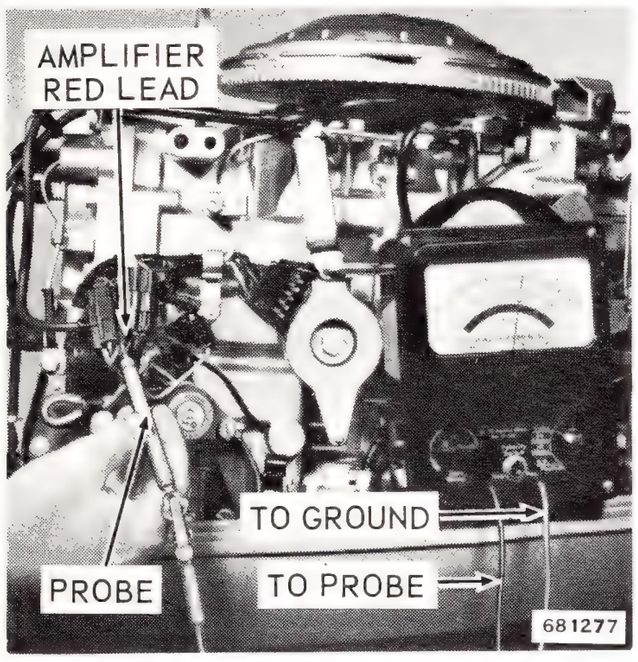


Figure 4-5. Checking Voltage at Amplifier

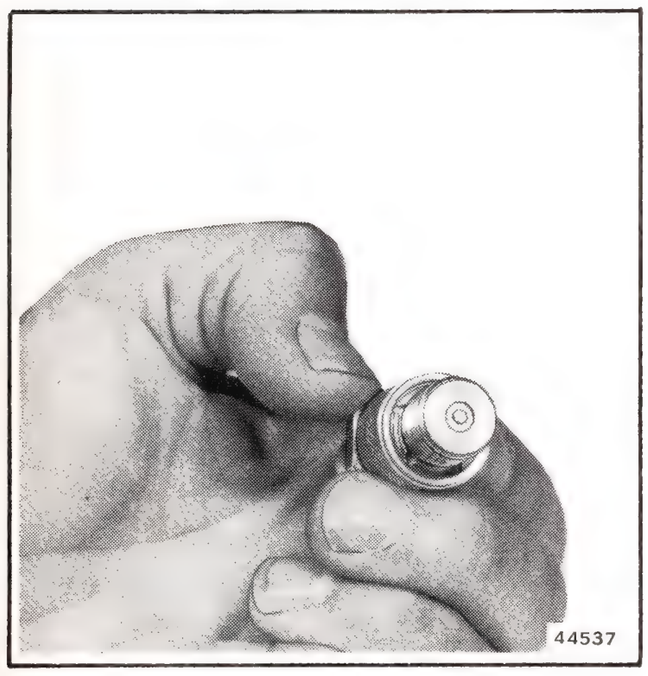


Figure 4-6. Surface Gap Spark Plug

light brightly. This test can also be performed with a voltmeter. See Figure 4-5.

Check all wiring associated with the system for any loose or corroded terminal connections and plug-in connections. Make sure of a clean, tight connection from the negative (-) terminal of the ignition coil to the ground. Also check for a clean, tight battery ground cable connection. Probe all high tension leads for cracked or damaged insulation.

The high tension leads should also be checked with an ohmmeter to locate any excessive resistance or opens. Check for correct battery polarity (negative ground). Make sure battery cable connections are clean and tight.

3. SPARK PLUGS. The spark plugs should be removed and examined. If the center electrode has worn to a point, it should be replaced. Naturally, any plug which has a cracked insulator or shows other signs of damage should be replaced. See Figure 4-6.

4. CHECKING AMPLIFIER. Ground the high tension spark plug leads. Insert a probe from a continuity light (using a #57 bulb) into the connector in the blue lead between the amplifier and the coil. DO NOT open this connection. Crank the engine. The #57 bulb should glow faintly, indicating that the output from the amplifier is satisfactory. See Figure 4-7. If the bulb does not glow, replace the amplifier assembly.

5. CHECKING COIL. Separate the black wire with the white stripe at the connector on top of the power head. See Figure 4-8. Connect one end of a jumper wire to the amplifier end of this lead. A conventional automotive neon spark tester, held against the coil to distributor high tension lead, will flash when the jumper is lifted from ground. If flashing does not occur when ground lead is lifted, replace coil and lead assembly. The coil can also be checked with a conventional ignition analyzer, using information given in "Specifications" page 2-2.

6. CHECKING TIMING. The timing of the engine should not change during normal engine operation. However, if the spark advance stop screw has been disturbed, or the amplifier assembly has been replaced, the timing should be checked. See Figure 4-9.

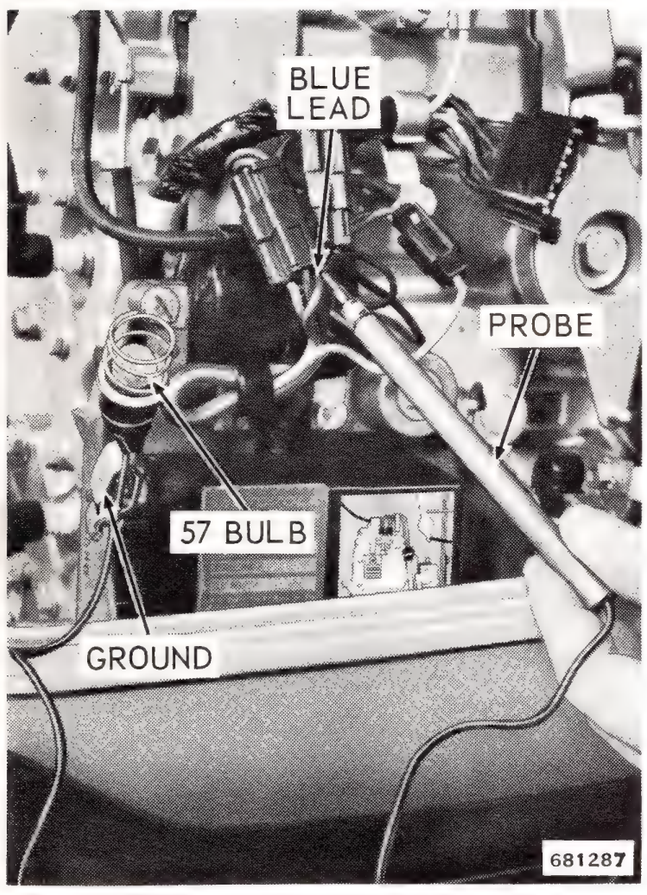


Figure 4-7. Testing Amplifier

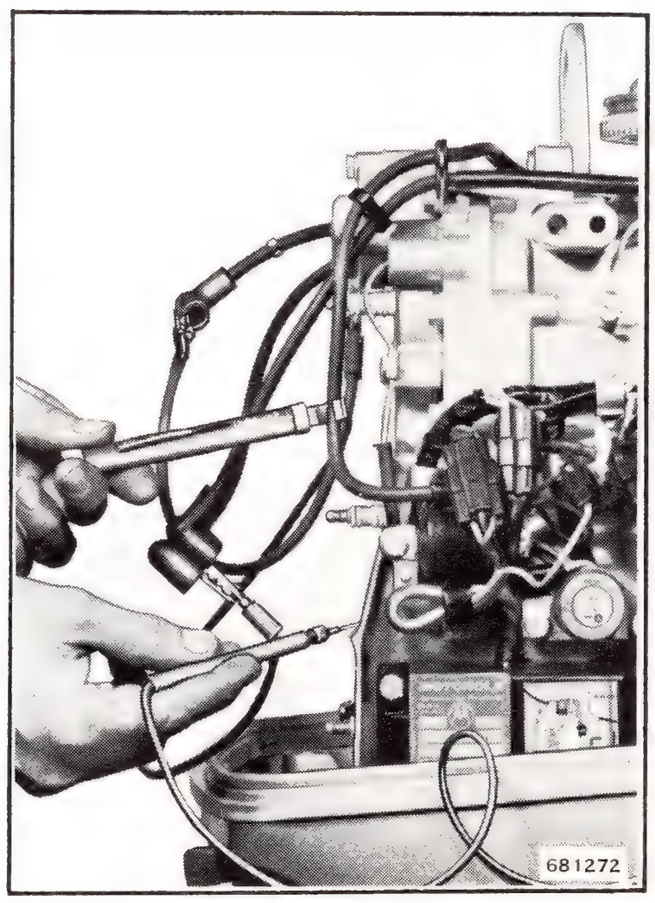


Figure 4-8. Checking Coil

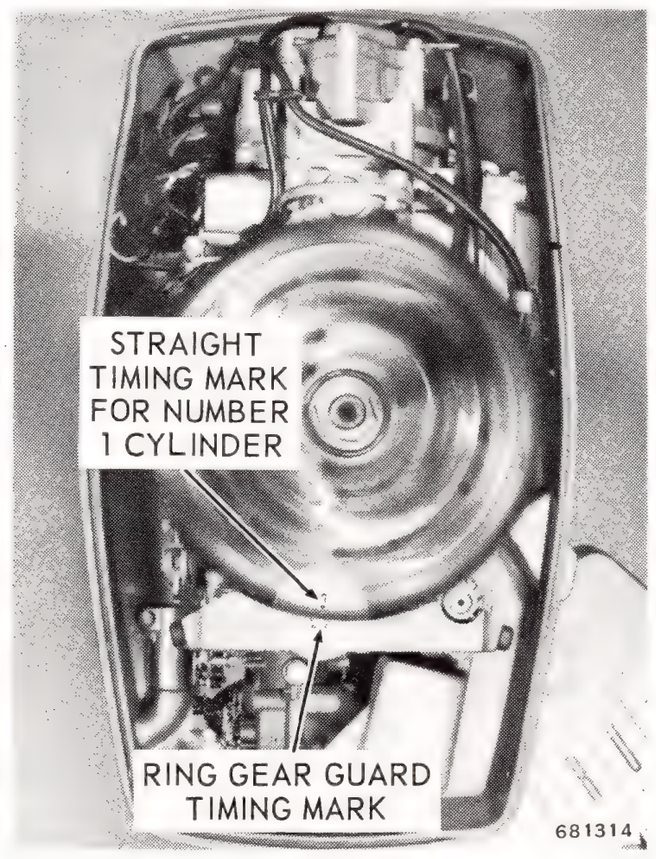


Figure 4-9. Flywheel Timing Marks

With the timing light connected to No. 1 cylinder, start the engine and set engine speed to full throttle (in gear). The straight timing mark on the flywheel must fall within the square timing mark on the ring gear guard. See Figure 4-9. If necessary, move advance stop adjustment screw to obtain proper setting. See Figure 4-10.

NOTE

There are two flywheel timing marks. The straight mark is used for timing the 55 HP. motor. The triangular shaped timing mark is not used.

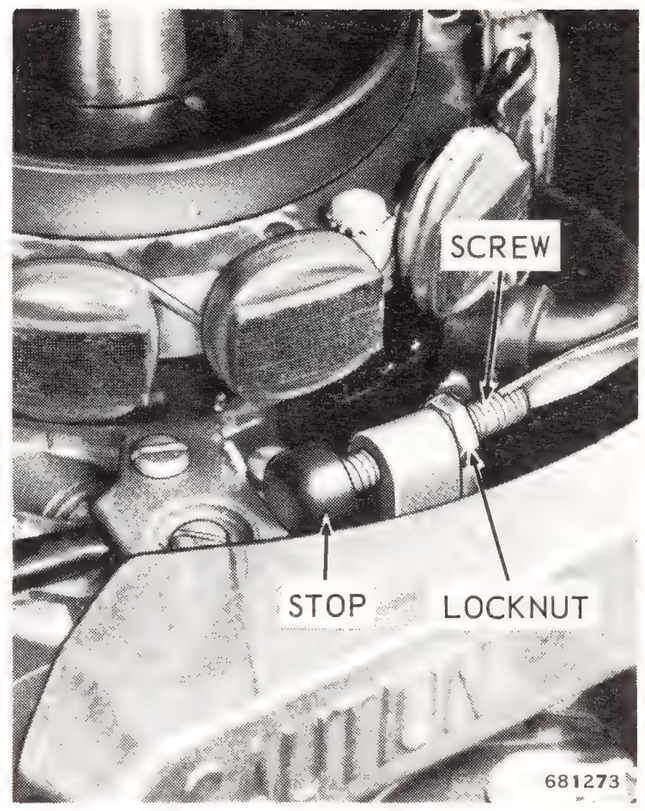


Figure 4-10. Full Spark Advance Stop Screw

DO'S AND DON'TS FOR C.D. IGNITION SYSTEMS

1. DO make sure of clean, tight connections on all wiring, especially all ground connections.

2. DO make sure correct battery polarity is observed (negative ground) and that battery cable and ammeter connections are clean and tight. (Owner should be cautioned to check this periodically as preventive maintenance.)

3. DO make sure the plug-in connectors are fully engaged and the terminals are free of corrosion.

4. DO make sure all wiring is located properly so that it will not rub against any sharp metal edges. Vibration would eventually wear a hole in the insulation and result in a service problem that might be difficult to locate.

5. DO make sure accurate test equipment is used when troubleshooting the system.

6. DO use proper tools when installing system components.

DO NOT

1. DO NOT attempt to open the amplifier, as this will void any warranty consideration.

2. DO NOT pull on high tension lead at the ignition coil.

3. DO NOT open or close any plug-in connectors while the ignition switch is on.

4. DO NOT set timing to other than specifications.

5. DO NOT hold the spark plug wires with your hand while checking for spark discharges. A severe electrical shock will result. Use insulated pliers designed for this purpose.

6. DO NOT attempt any tests except those listed in the troubleshooting procedure.

7. DO NOT connect an electric tachometer to this system unless it is a type which has been approved for use with this system.

8. DO NOT connect the system to any voltage source other than 12 volt negative ground.

9. DO NOT bench test this system without proper ground connections and these ground connections to be as short as possible.

DISASSEMBLY OF DISTRIBUTOR

Remove flywheel nut using an appropriate flywheel holding fixture. Remove flywheel, using puller (Special Tool #378103). See Figure 4-11.

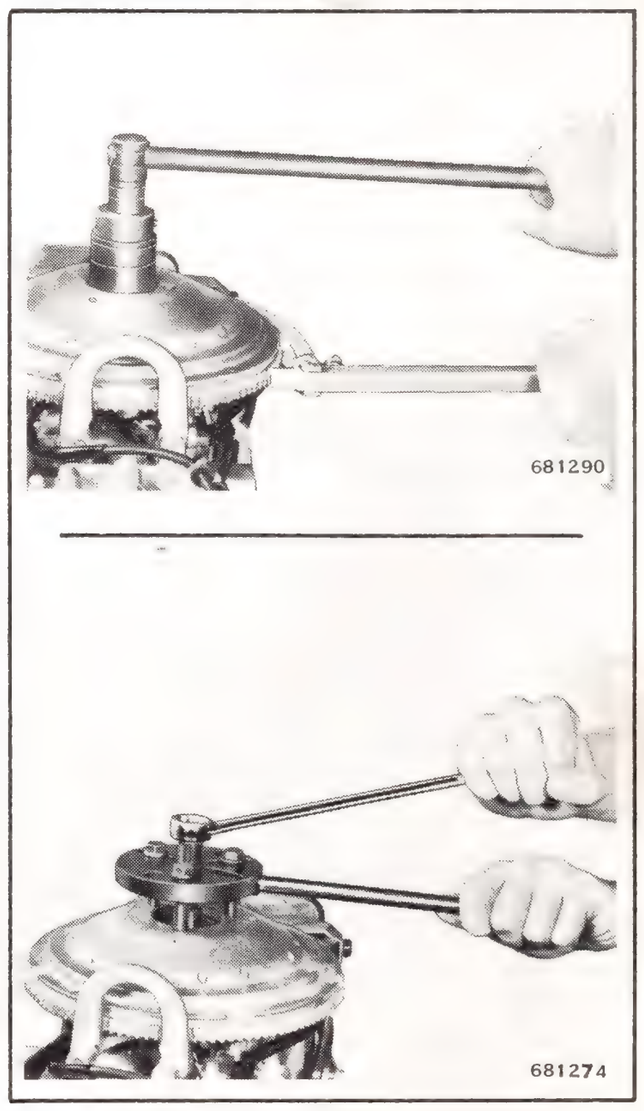


Figure 4-11. Removing Flywheel

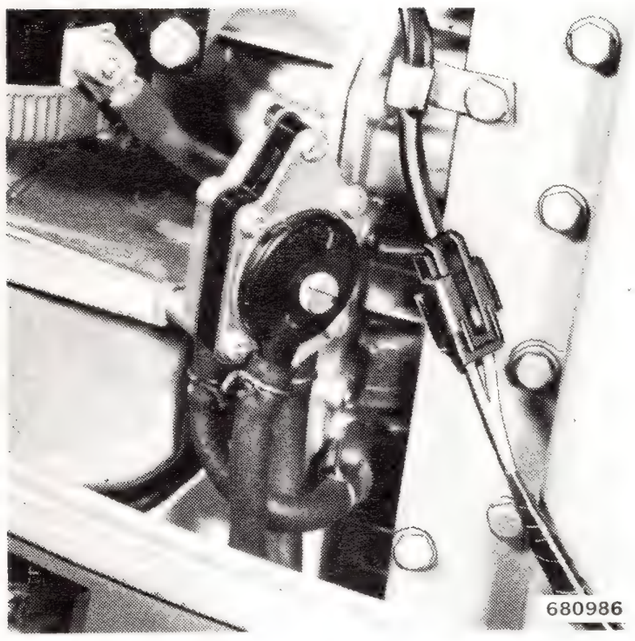


Figure 4-12. Stator Leads

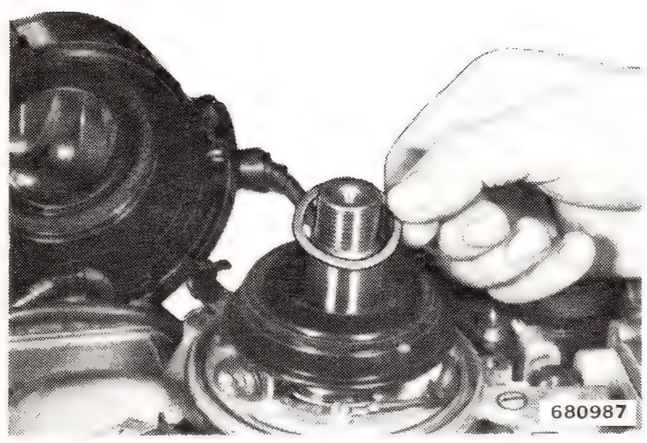


Figure 4-13. Wave Washer

Disconnect stator leads (yellow) at connector (see Figure 4-12), remove 3 screws, and remove stator. See Figure 4-20. Lift off distributor cap, wave washer, and rotor. This will expose breaker point assemblies and anti-reverse mechanism. See Figure 4-14.

The breaker base is held in place by three retaining clips and screws. See Figure 4-15. These clips engage a nylon ring (T-shaped cross-section) which fits around the breaker base.

CLEANING, INSPECTION AND REPAIR

SPARK PLUGS

Inspect plugs for cracked porcelain and excessively worn electrodes. The gap between the center electrode and the rim of the plug is preset and is not adjustable. If center electrode is worn to a point it should be replaced.

Poor motor performance and premature spark plug failure may result from improper spark plug installation.

Before installing the plug, be sure the plug seat in the cylinder head is clean and free from obstructions. See Figure 4-16. Install a new spark plug gasket, screw the plug in by hand, then tighten to the specified 17-1/2 to 20-1/2 foot-pounds.

TESTING DISTRIBUTOR CAP AND HIGH TENSION LEADS

TEST EQUIPMENT

To determine accurately the condition of components of the ignition system, an ignition analyzer should be used. Without the use of test equipment, assemblies may be replaced needlessly.

A wide variety of ignition analyzers is available from various manufacturers. In addition, some automotive testers having the proper specifications can be used. The use of the Graham, Merc-O-Tronic, or Stevens ignition analyzers is particularly recommended, since these units have provisions for checking all functions of the ignition system. See Figure 4-25.

Detailed instructions for the use of any tester are provided with the unit; therefore, only general information is given here.

LEAKAGE TESTING

The distributor cap, rotor, and spark plug high tension leads may be tested for leakage or insulation failures by using the ignition analyzer

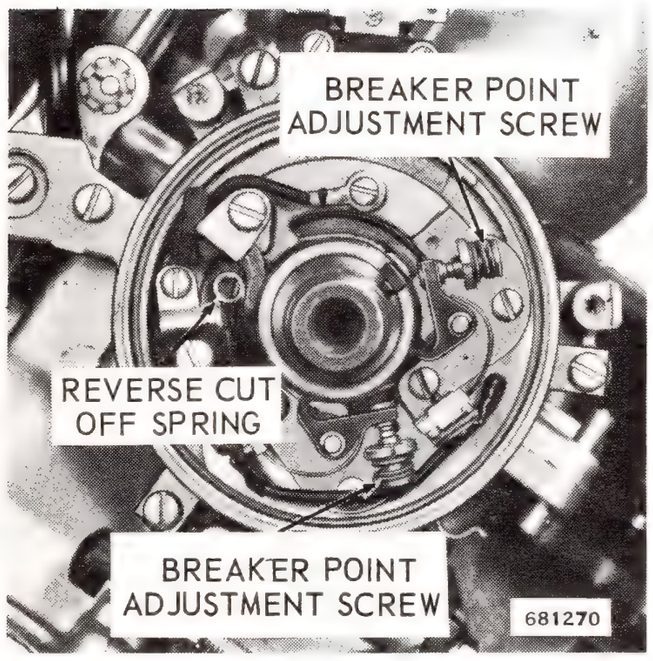


Figure 4-14. Breaker Type C.D. Ignition Distributor

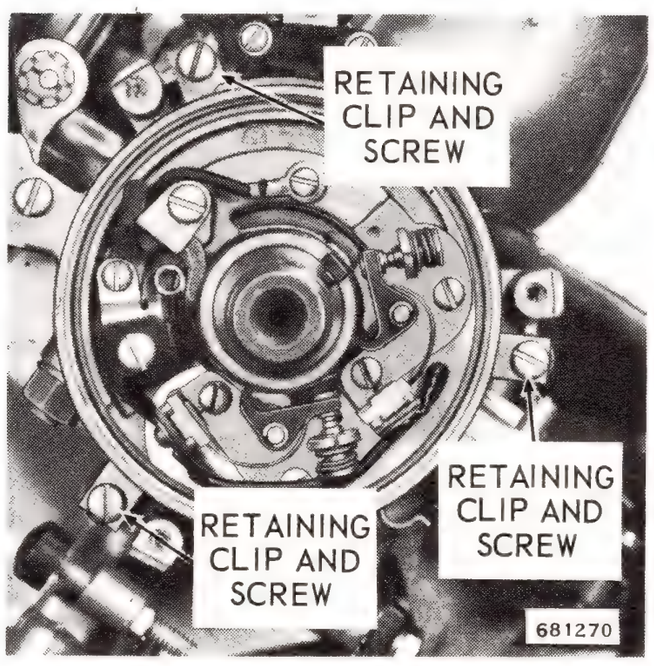


Figure 4-15. Breaker Plate Retaining Clips

Figure 4-16. Cleaning Spark Plug Seat

and a standard V-4 motor ignition coil. Connect the coil to the ignition analyzer as for the coil test. Connect a separate test lead with suitable clips to the secondary terminal of the coil (by-pass the MA-12 resistor adapter when using the Stevens Model MA-75 ignition analyzer) and to the conductor of the component being tested (lead terminals on distributor cap, rotor arm, spark plug high tension lead). Probe the entire insulated surface of the component being tested with the grounded test probe. See Figures 4-17 and 4-18.

Arcing will be apparent wherever the insulation has broken down, due to moisture or carbon trails.

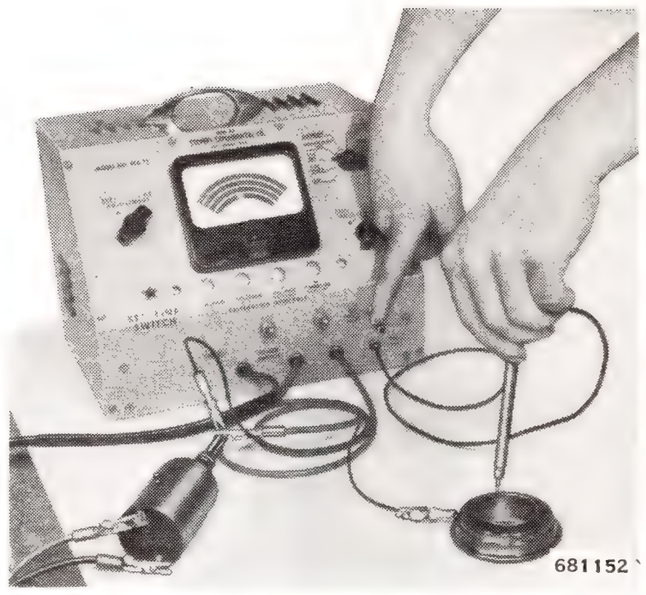


Figure 4-17. Leakage Test on Rotor

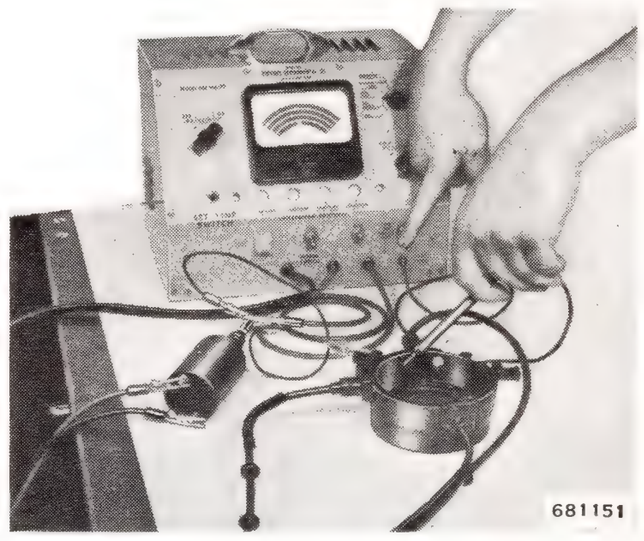


Figure 4-18. Leakage Test on Distributor Cap and High Tension Leads

DISTRIBUTION CHAMBER

It is very important that the stator retaining screws be tight. This will assure positive location and prevent dirt from entering the distribution chamber. The ventilating screens in the distributor cap should be kept free from dirt to assure proper ventilation.

REASSEMBLY AND ADJUSTMENT OF DISTRIBUTOR

The breaker base has a cast-in brass bushing which rotates, with very close tolerance, on the upper bearing and seal assembly as the spark is advanced or retarded. Check carefully for dirt, chips, or damage which may cause difficulty in rotating the breaker base.

Install reverse cut-off spring, using Shell EP-2 or OMC TYPE D grease. Oil and assemble the retainer to the breaker base and attach assembly to crankcase with three retainer clips and screws. See Figure 4-15. Install breaker point sets. See Figure 4-14.

Set both breaker point sets to .010" (.012" for new points). See Figure 4-19. Install the rotor, wave washer (see Figure 4-13), and distributor cap making sure cap is properly seated. Install stator with screws dipped in Loctite Screw Lock and torque to 48 to 60 inch lbs. See Figure 4-20.

If flywheel key has been removed, reassemble to crankshaft with outer edge vertical. See Figure 4-21.

Check crankshaft and flywheel tapers for any traces of oil. This assembly must be perfectly dry. Swab tapered surfaces with solvent and blow dry with compressed air. Inspect both tapers for burrs and nicks.

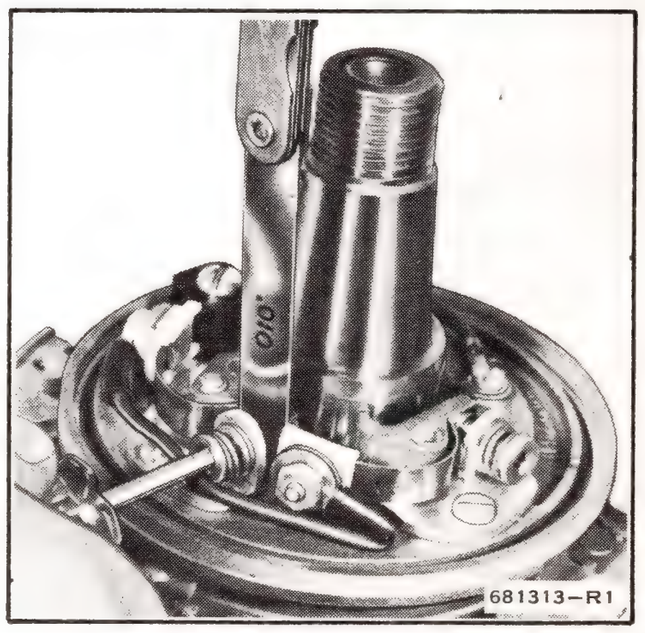


Figure 4-19. Setting Points

CAUTION

DO NOT permit solvent used to clean tapers to wash oil out of oiler wick.

Replace flywheel and tighten nut to torque specified in Section 2.

Timing adjustment is made with a timing light. See Figure 4-22. If timing is not correct, a re-adjustment of the full advance stop screw is required. See Figure 4-10.

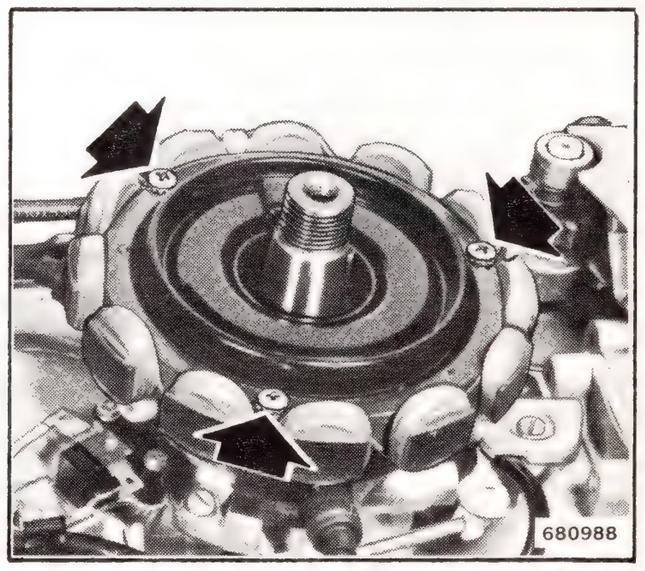


Figure 4-20. Stator Screws

SYNCHRONIZING CARBURETOR AND DISTRIBUTOR LINKAGE

a. Mark on throttle cam must align with center of cam follower roller just as roller makes contact with cam. See Figure 4-24.

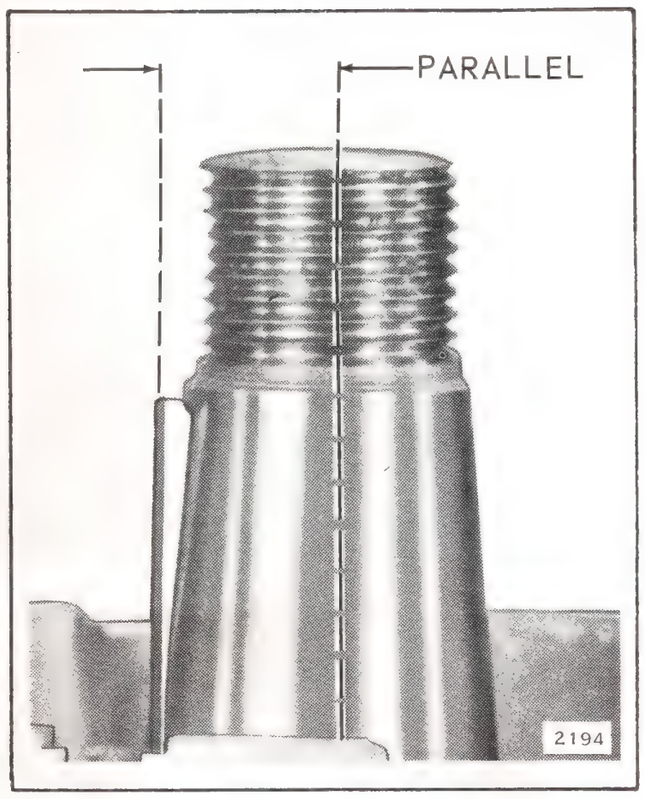


Figure 4-21. Correct Flywheel Key Position

b. With distributor base and throttle lever at full throttle position against their stops, the carburetor throttle shaft must also be against its full throttle stop. Adjust if required by turning throttle cam yoke on throttle control rod. See Figure 4-24.

SAFETY SWITCHES ADJUSTMENT

A safety switch is mounted on the cylinder, and engages a cam on the distributor base.

The motor can be started at low throttle in gear or in neutral. To adjust switch, loosen adjustment screw. See Figure 4-23. Connect a continuity light between the switch lead and ground. To adjust switch, loosen adjustment screw. Set starting circuit switch to close on ramp of cam. See Figure 4-23. A "click" can be heard when the switch closes. Tighten screw after adjustment is made. The switch is normally open and must close to permit starting.

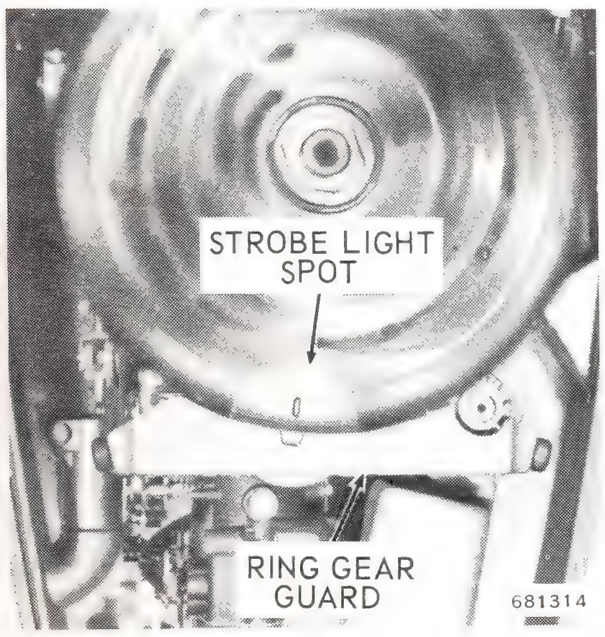


Figure 4-22. Flywheel Timing

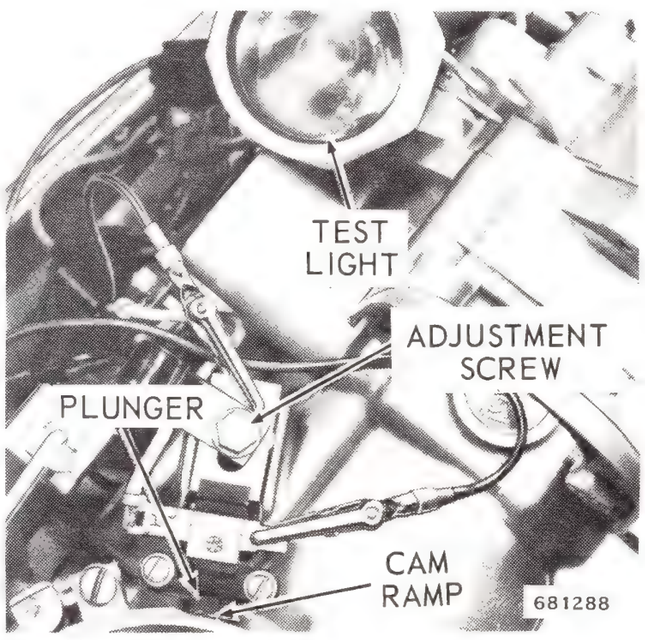


Figure 4-23. Safety Switch Adjustment

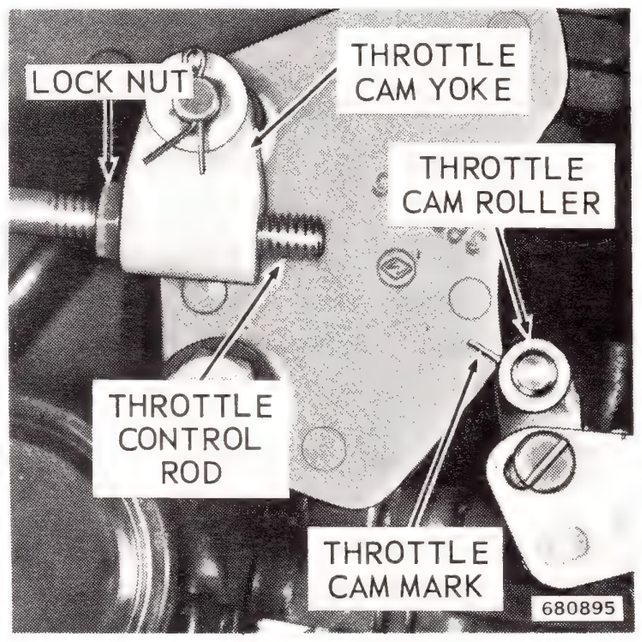


Figure 4-24. Throttle Cam Adjustment

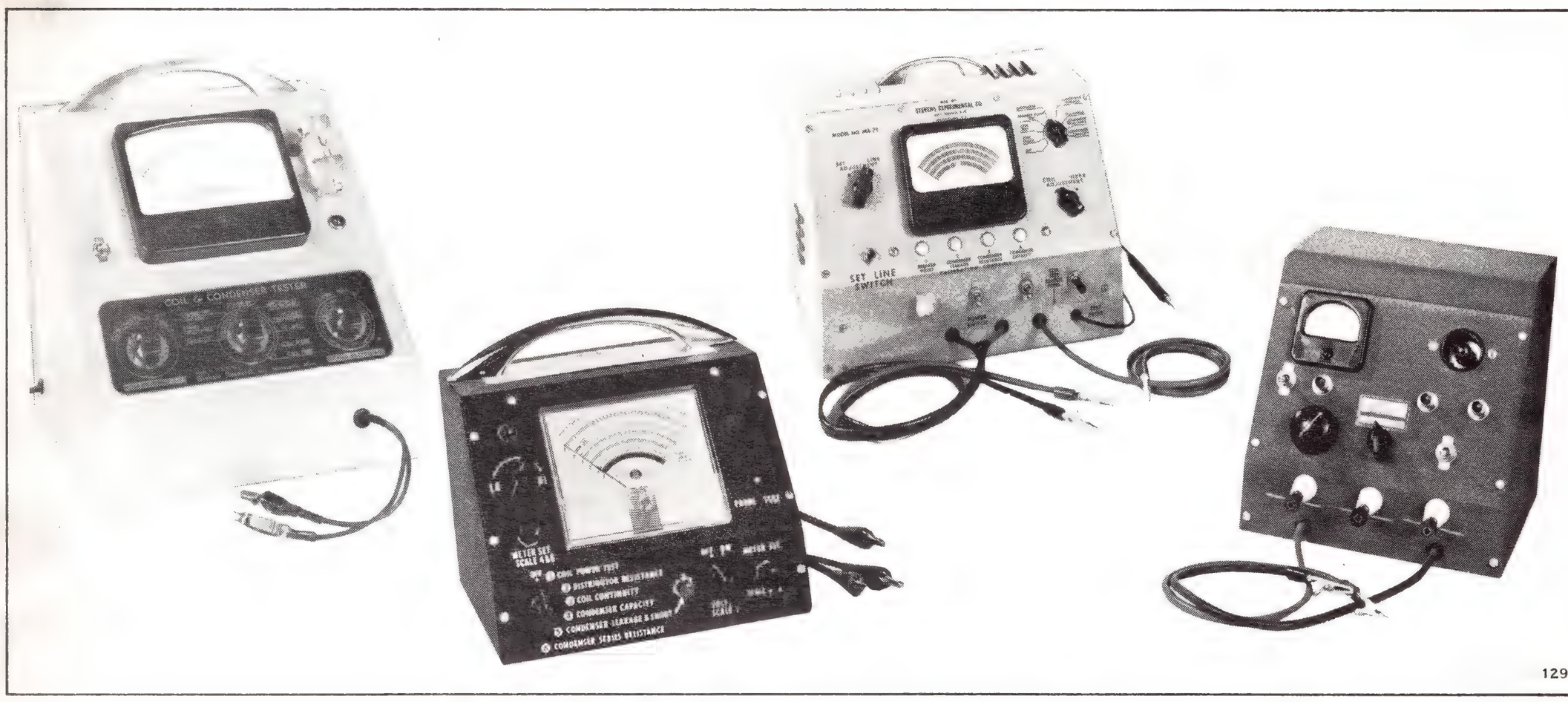


Figure 4-25. Ignition Analyzers

SECTION 5
POWER HEAD

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DESCRIPTION

The power head consists of the cylinders, pistons, rods, crankshaft, and crankcase. The power head has three horizontally mounted cylinders. Alternate firing order is used so that each cylinder delivers one power impulse per crankshaft revolution. See pages 5-2 and 5-3 for two stroke theory.

THEORY OF OPERATION

Two-cycle engines used on outboard motors require only two piston strokes - one up, one down, to effect a crankshaft revolution and to complete the exhaust-intake-compression-ignition sequence that produces power. In a two-cycle engine, ignition of the fuel-air mixture occurs as the piston reaches the top of each stroke. The explosion drives the piston downward. Toward the end of the downward stroke, ports which lead to the exhaust system are uncovered. The exhaust gases flow into these ports, thus reducing the pressure in the cylinder. At almost the same time, intake ports are opened. These ports connect with the crankcase where a fuel and air mixture has been induced by carburetion. The downward motion of the piston compresses this mixture in the crankcase and forces it through the intake ports into the cylinder. The inrushing charge of the fuel-air mixture helps in ejecting the last of the exhaust gases from the cylinder. See Figure 5-1A, Fuel Intake and Exhaust.

As the piston begins its upstroke, it closes the intake and exhaust ports and begins to compress the fuel and air mixture trapped in the cylinder. The upward travel of the piston also reduces the pressure in the crankcase compartment. The resulting reduced atmospheric pressure opens leaf valves which admit additional air and fuel from the carburetor into the crankcase, thus preparing the next cylinder charge. See Figure 5-1B, Compression Stroke.

At the top of the piston stroke, the compressed fuel-air mixture is ignited by a timed spark and the cycle begins anew. In an outboard motor engine running at full throttle, this cycle may be repeated 4000 or more times every minute. See Figure 5-1C, Power Stroke.

CROSS-FLOW AND LOOP SCAVANGING PRINCIPLES

Cross-flow means that the fresh fuel mixture enters the combustion chamber through the intake (transfer) ports and flows across the top of the piston and out the exhaust ports, pushing the burned gases ahead of it. In order to efficiently clear the combustion chamber of the burned gases, a deflector dome type piston is necessary to deflect the charge up and around the combustion chamber. See Figure 5-2.

The 55 HP model is a loop-scavanged engine and incorporates an almost flat piston dome with a slightly curved contour. Two intake ports are slanted upward and facing each other. This directional effect forces the two incoming charges to impinge on one another and flow upward and around the smooth dome shape in the combustion chamber, then down and out the exhaust ports on the adjacent side of the cylinder wall. The flow pattern of the incoming fresh fuel laden gases very effectively "drive" the burned exhaust gases from the cylinder. This results in a clean and powerful "charge" ready to be compressed and burned as the piston reaches the top of its stroke. See Figures 5-3 and 5-4.

Windows in the piston of this loop scavanged engine allow the fuel mixture to enter the cylinder from the crankcase through a smooth unbroken transfer passage, correctly designed for best efficiency.

CRANKCASE AND CYLINDERS

A split crankcase and cylinder assembly simplifies power head servicing. The cylinder heads are combined in one casting.

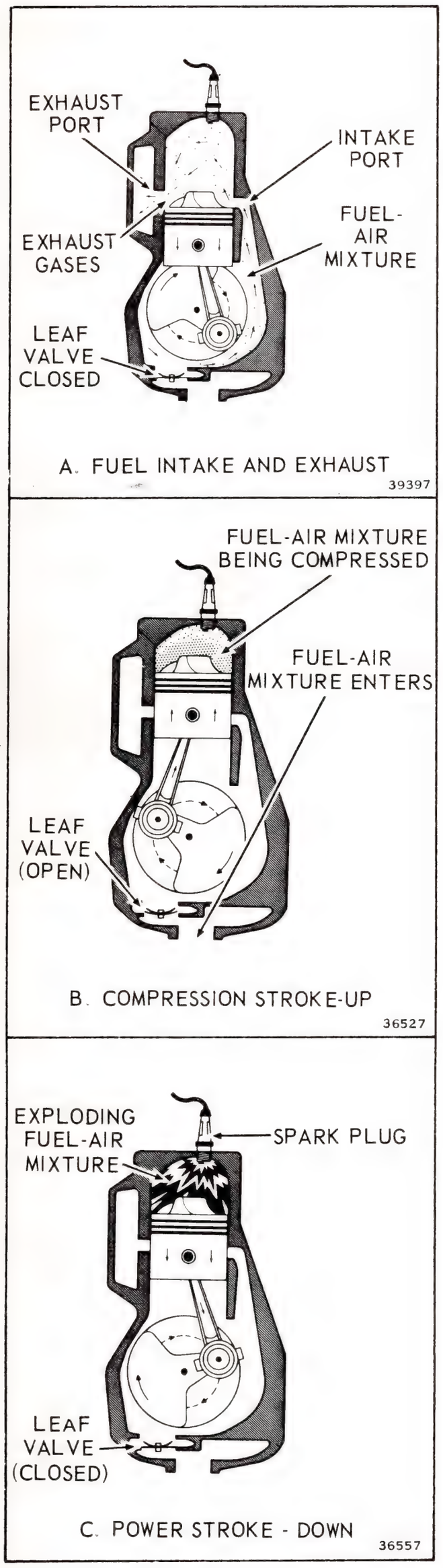


Figure 5-1. The Two Stroke Cycle with Cross-Flow Scavanging

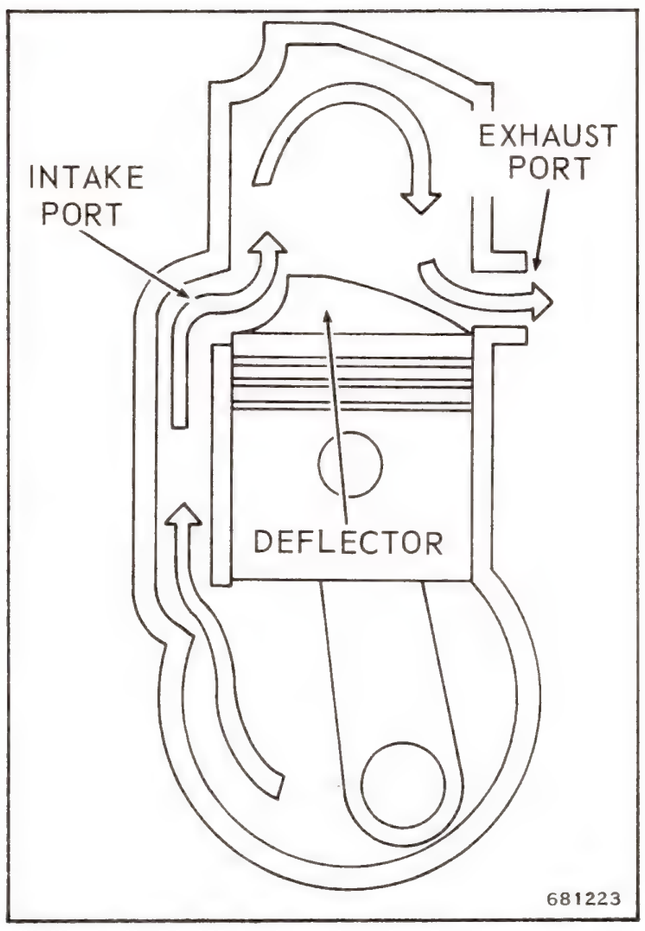


Figure 5-2. Cross-Flow Scavanging

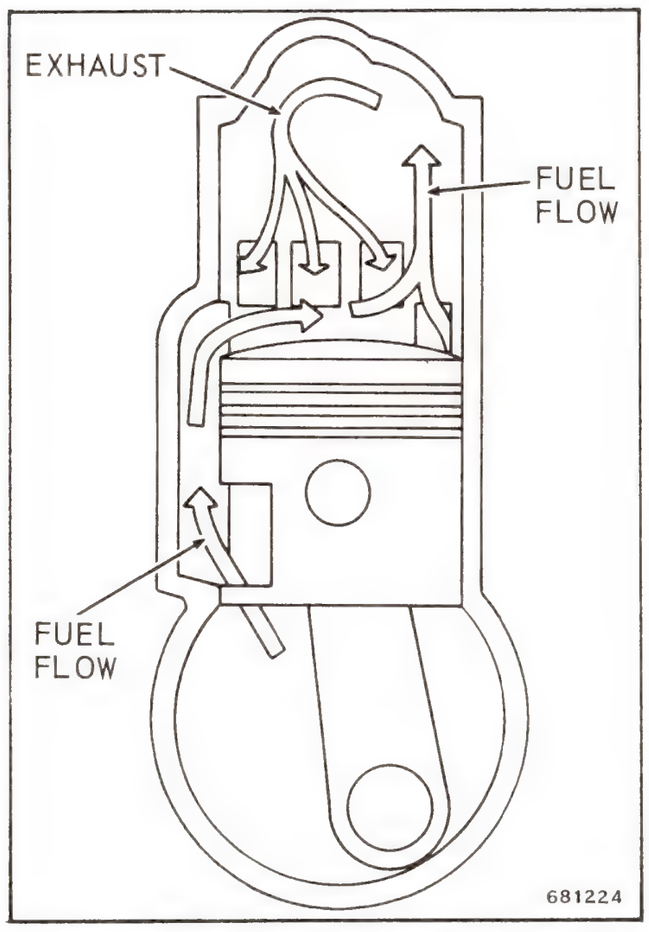


Figure 5-3. Loop Scavanging

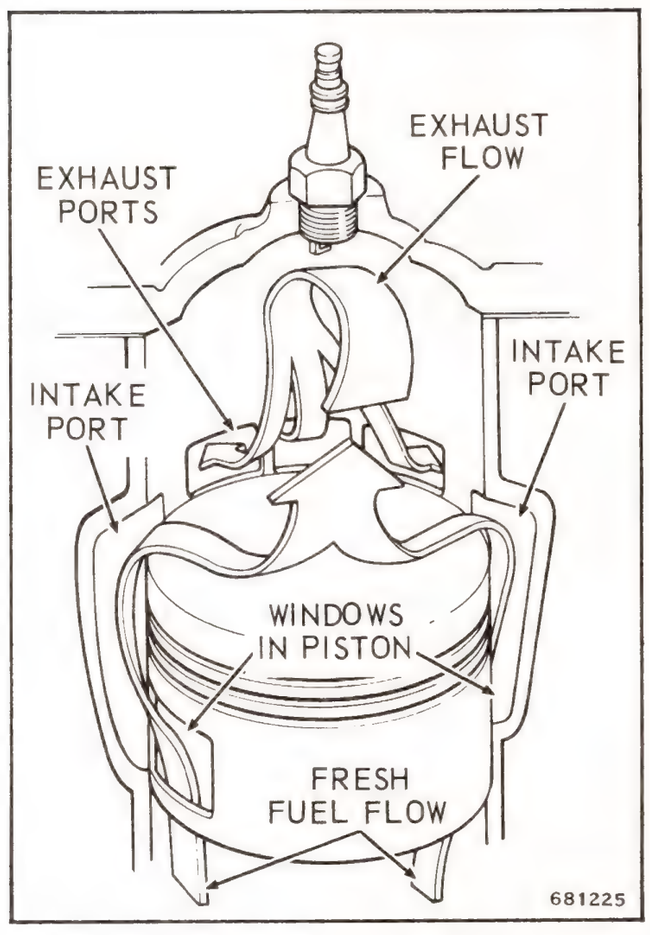


Figure 5-4. Loop Scavanged Cylinder

PISTONS

The pistons, with the piston rings, receive the force of combustion in the cylinder head, so it is necessary that both the pistons and piston rings be properly fitted to form a seal between the piston head and cylinder walls. To retain maximum power within the cylinder above the piston head, the cylinder must be perfectly round and the piston rings correctly seated in their grooves.

CONNECTING RODS

The connecting rods provide linkage between the piston and crankshaft. Connecting rod bearings include a roller bearing at the wrist pin, and a split cage roller bearing at the crankshaft. The crankshaft is of the three-throw type and is supported by four main bearings. A single row roller bearing is used at the upper journal. Split cage roller bearings at the center journals are aligned to the cylinder block by dowel pins. A ball bearing at the bottom journal absorbs the radial and vertical thrust loads of the crankshaft.

COOLING SYSTEM

Water for engine cooling is supplied by a two-stage pump containing a rubber impeller. At low speeds, the pump operates as a full displacement pump. At higher speeds, the impeller blades bend back under the increased water pressure and the pump becomes a centrifugal action pump. See Figure 5-5 and 6-3.

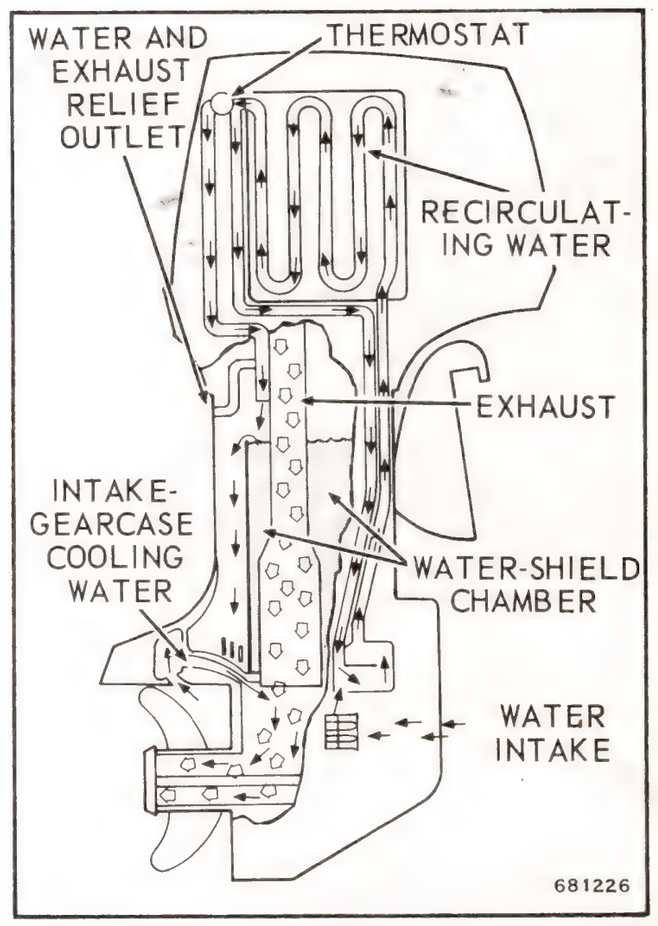


Figure 5-5. Cooling and Exhaust Systems

THERMOSTAT OPERATION

The thermostatically controlled cooling system contains the pressure valve, spring, and the thermostat. The circulation of water through the cooling system by the water pump and the ratio of coolant discharge to intake is controlled by the balanced action between the pressure control valve and the thermostat. See Figure 5-6 and 6-13.

When the power head and cooling system temperatures reach 145°F., the thermostat opens, allowing heated water to pass through the water discharge. The drop in cooling system pressure caused by the opening of the thermostat causes the pressure valve to close, preventing the cooling system water from being recirculated through the water pump

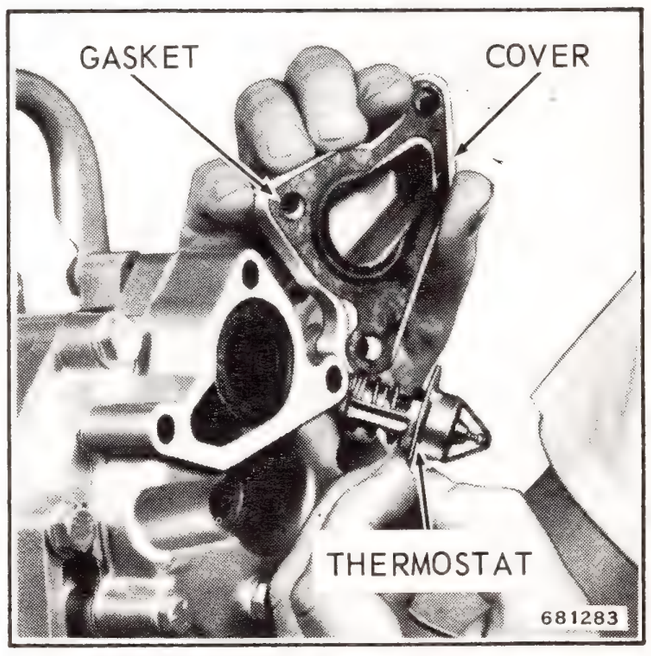


Figure 5-6. Thermostat

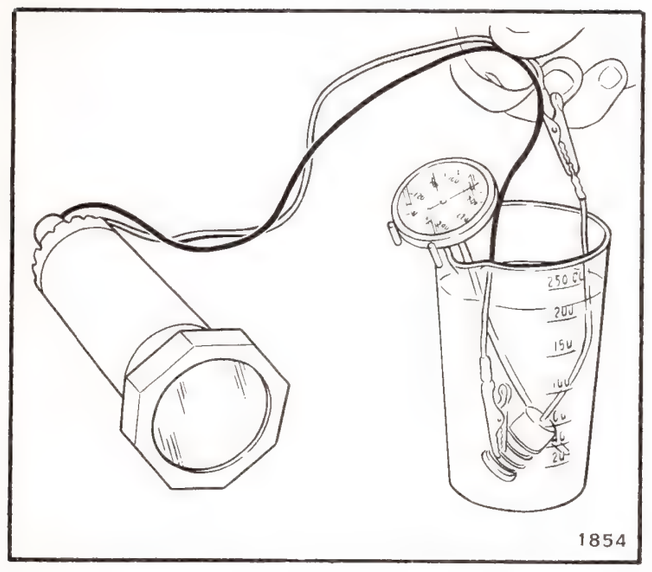


Figure 5-7. Checking Heat Switch

and causing fresh water to be drawn through the water intake. This action provides perfect water jacket temperatures in any water and any weather.

TEMPERATURE SWITCH

A heat switch, installed in the top of the cylinder head, is in series with a warning light on the control panel. Should an irregularity develop in the cooling system and cause abnormal water jacket temperatures, the switch closes the warning light circuit. The switch may be checked by submerging it in hot oil. Using a test light to check the contacts and a thermometer to check oil temperature, the contacts should be found to close at a temperature of 211°F. ± 6° and open at 175°F. ± 7°. See Figure 5-7.

CHECKING MOTOR TEMPERATURE

The Markal Thermomelt Stik, a heat sensitive stick similar to a crayon which melts on contact with a surface at a specific temperature, is used to measure power head temperature.

The motor is best checked when operating on a boat. If this is not possible, run the motor in a test tank for at least five minutes, at a maximum speed of 3000 rpm. Mark the surface to be checked with the Stik. The mark will appear dull and chalky. When the surface temperature reaches the temperature rating of the Stik, the mark will melt, becoming liquid and glossy in appearance. On some painted surfaces on which the Stik will not leave a mark, it will be necessary to hold the Stik against the surface. See Figure 5-8.

Two Thermomelt Stiks are necessary to check a motor - a 125° F Stik and a 163° F Stik. With the motor at operating temperature, the 125° mark should melt and the 163° mark should not melt.

If the 125° mark does not melt after a reasonable length of time, the thermostat is stuck open and the motor is running too cold. If the 163° mark also melts, the cooling system is not functioning properly, allowing the motor to overheat. Check for a worn pump assembly or restrictions in the cooling system. See Trouble Check Chart, Page 2-8, e, f, and g.

Figure 5-8. Checking Motor Temperature

REMOVAL OF POWER HEAD

a. Remove carburetor, leaf plate assembly, fuel pump and filter, and fuel hoses as described in Section 3.

b. Remove flywheel, stator, distributor, and safety switch as described in Section 4. Remove electric starter by disconnecting red cable and

Figure 5-9. Throttle Control Lever and Cam

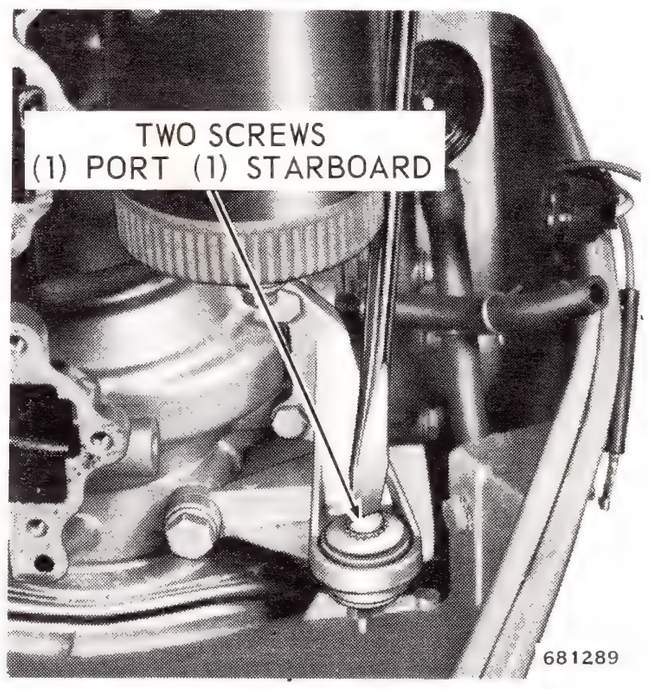


Figure 5-10. Power Head Bracket to Lower Motor Cover Screws

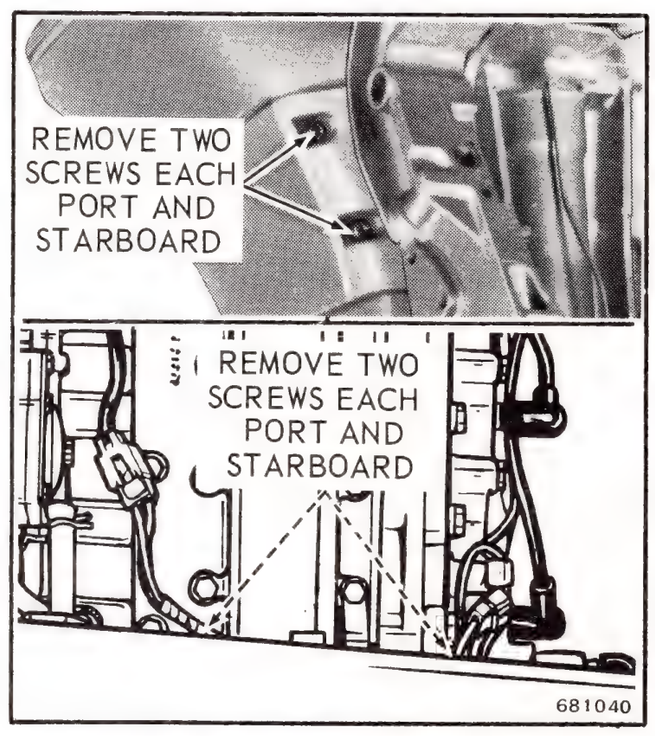


Figure 5-11. Front and Rear Exhaust Cover Removal

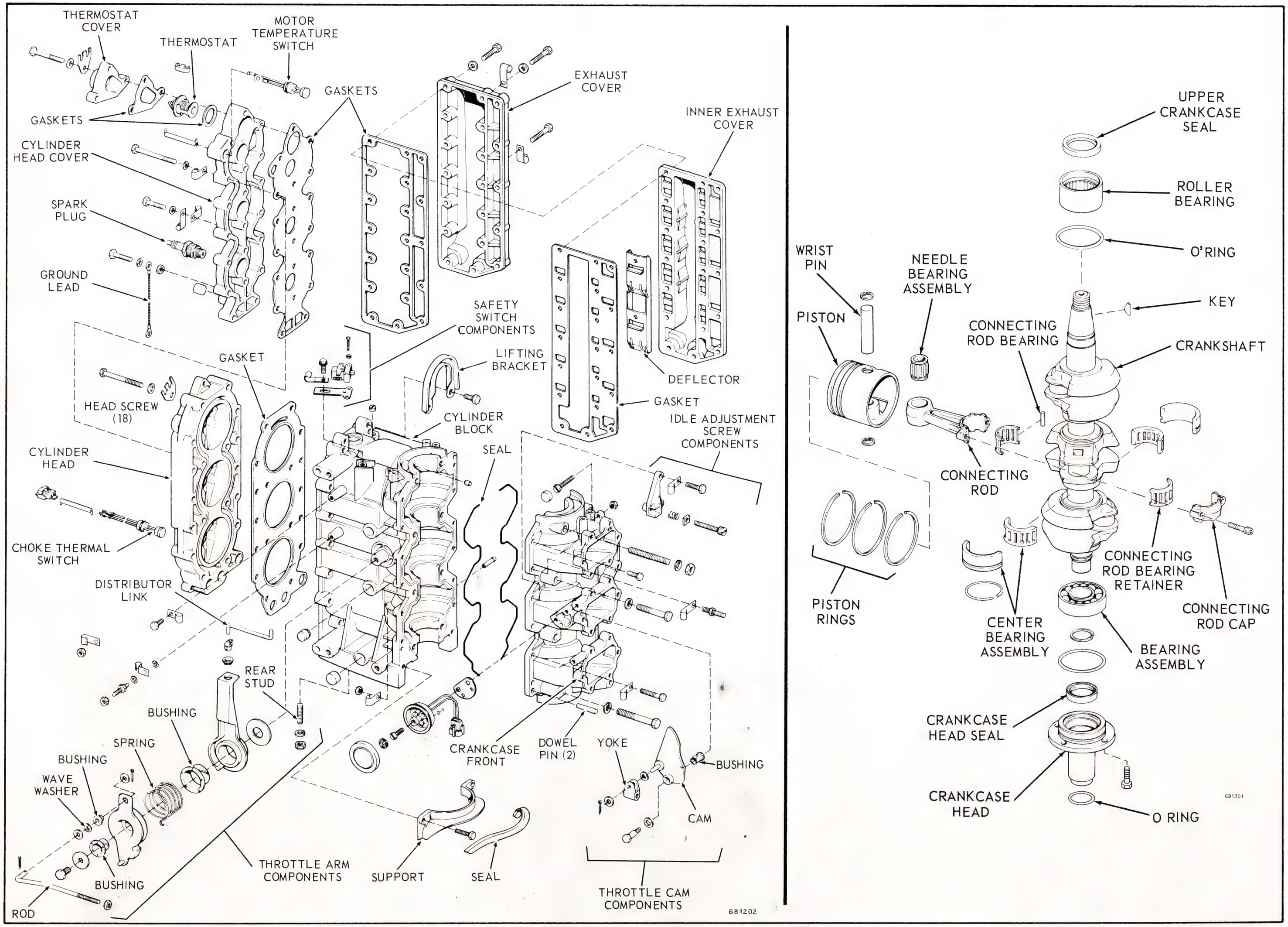


Figure 5-12. Power Head Components

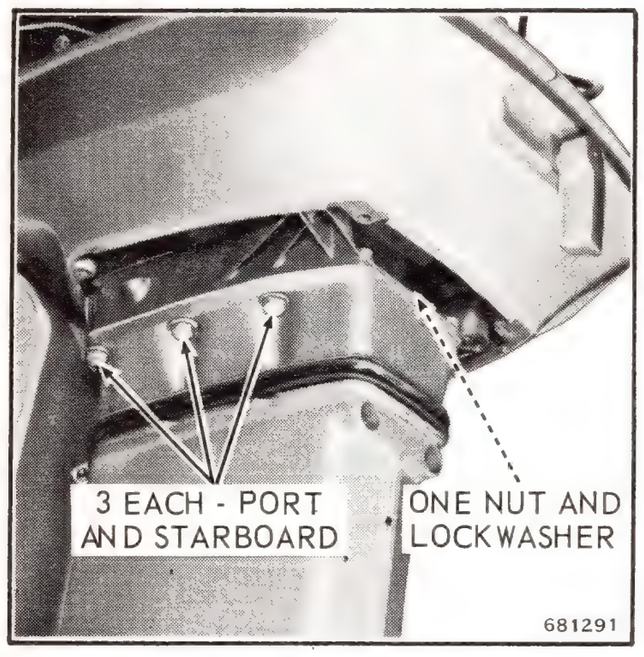


Figure 5-13. Power Head Attaching Screws

removing three screws. Push the red cable and grommet thru crankcase web.

c. Disconnect wiring connectors and disengage wiring from clamps. Disconnect power head ground cable. Remove two screws and amplifier complete with wiring intact.

d. Remove throttle control lever and throttle cam. See Figure 5-9.

e. Remove crankcase front bracket to lower motor cover screws. See Figure 5-10.

f. Remove front and rear exhaust cover screws. See Figure 5-11.

g. Remove aft nut and washer from stud in power head. Remove six screws attaching power head to exhaust housing and adapter assembly. See Figure 5-13.

Lift power head from adapter and place on bench for disassembly.

DISASSEMBLY OF POWER HEAD

NOTE

To simplify reassembly and wiring installation, lay out the various screws and clamps in order of their proper location. See Figure 5-12.

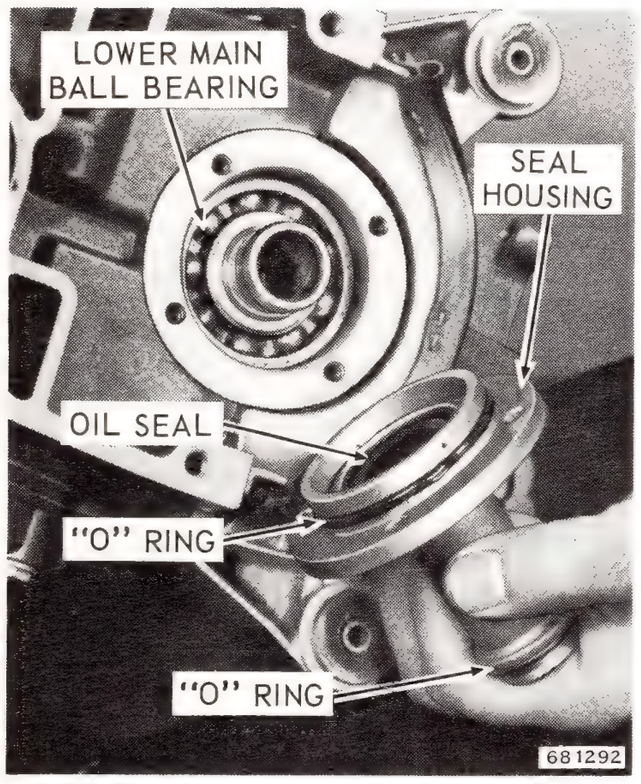


Figure 5-14. Lower Main Bearing Seal Housing

a. Remove the lower main bearing seal housing. See Figure 5-14.

b. Remove cylinder head and cylinder head gasket. NOTE: If necessary to service temperature switch, remove cylinder head cover and gasket.

c. Drive out two taper pins from back to front of crankcase. See Figure 5-15. Remove eight small and four large hex head screws and nuts attaching crankcase to cylinder block. See Figure 5-16.

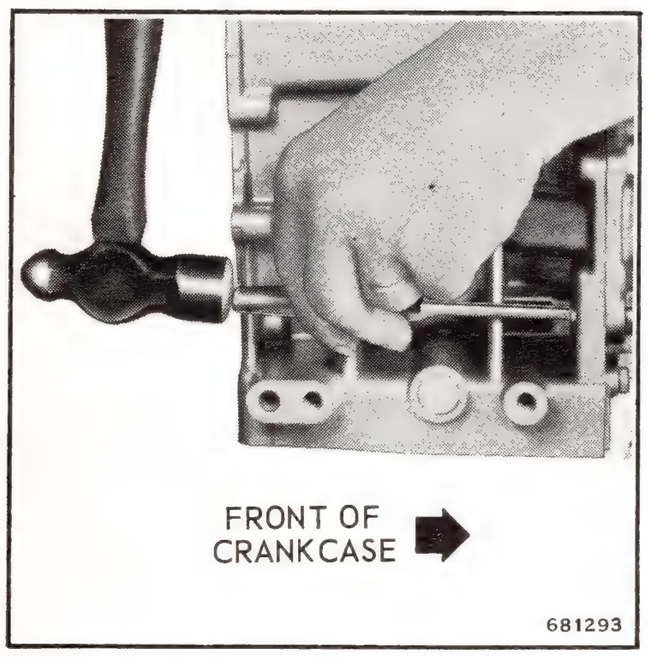


Figure 5-15. Driving Out Taper Pin

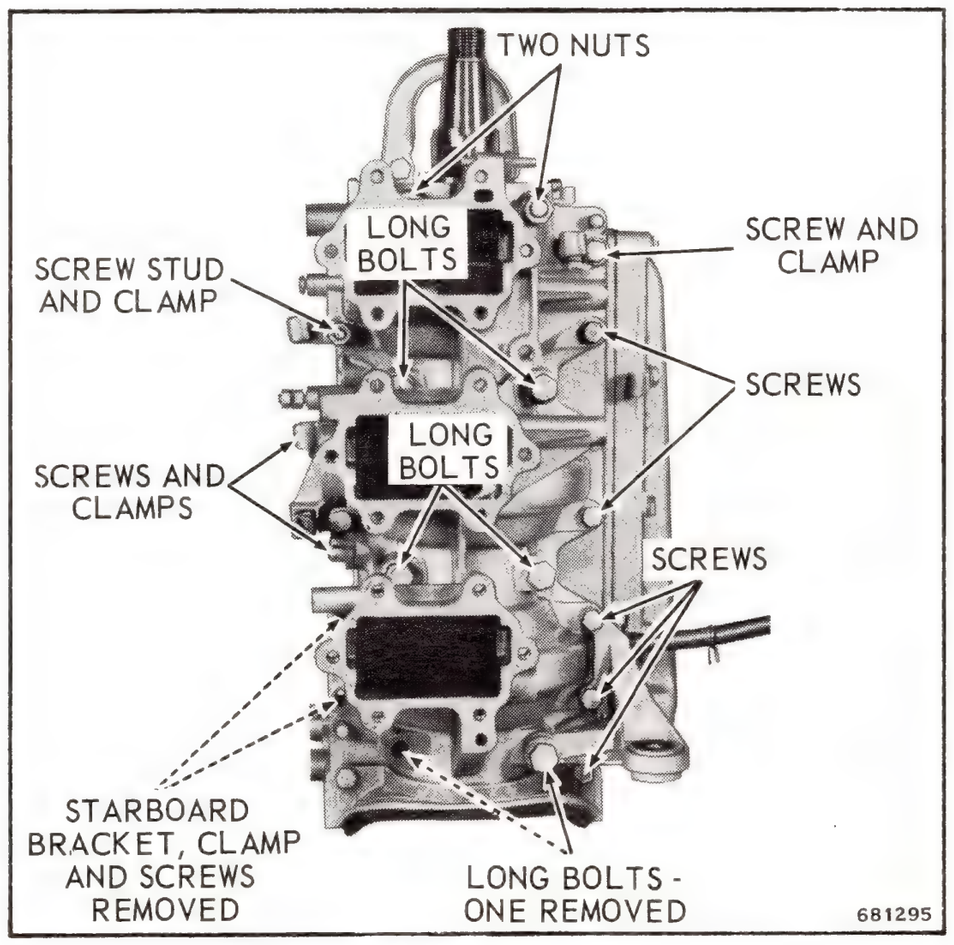


Figure 5-16. Crankcase Screws and Nuts

Tap crankshaft with rawhide mallet to break seal between crankcase and cylinder. Lift crankcase from cylinder block.

d. Use a 5/16 inch, 12 point socket to remove connecting rod screws. Remove rod caps and roller bearings. See Figure 5-17. NOTE: 16 rollers are used at each rod bearing.

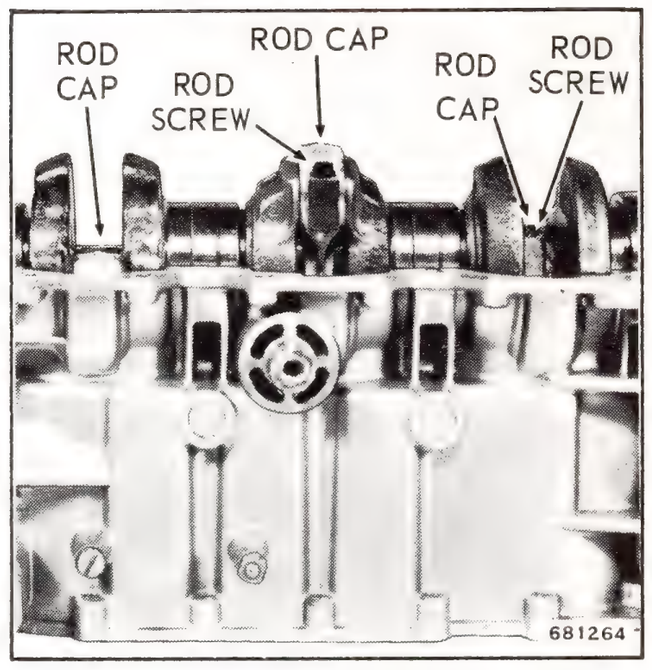


Figure 5-17. Connecting Rods Exposed

CAUTION

Pistons, connecting rods, bearing retainers, bearings, 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.

e. Lift crankshaft from cylinder block. Reinstall matched caps on connecting rods and remove pistons and rods from cylinders.

f. Lift retaining rings out of grooves and slide aside to remove the two crankshaft center main roller bearings for cleaning and inspection. The top main bearing and seal assembly with "O" ring slides off. If necessary to remove the bottom main bearing, remove retaining using a Truarc pliers (Special Tool #307429, see Figure 5-19) and use a puller to remove bearing.

i. Remove the rings from the pistons by prying the ends loose enough to grip them with pliers and then breaking them away from the piston. DO NOT try to save the rings. Install a complete set of new rings on every power head service job.

j. Remove wrist pin retaining rings, using Truarc No. 1 pliers (Special Tool #303857). See Figure 5-20. Wrist pin is float-fitted to the connecting rod and piston. Slide wrist pin through to free piston from connecting rod. Avoid losing wrist pin roller bearings.

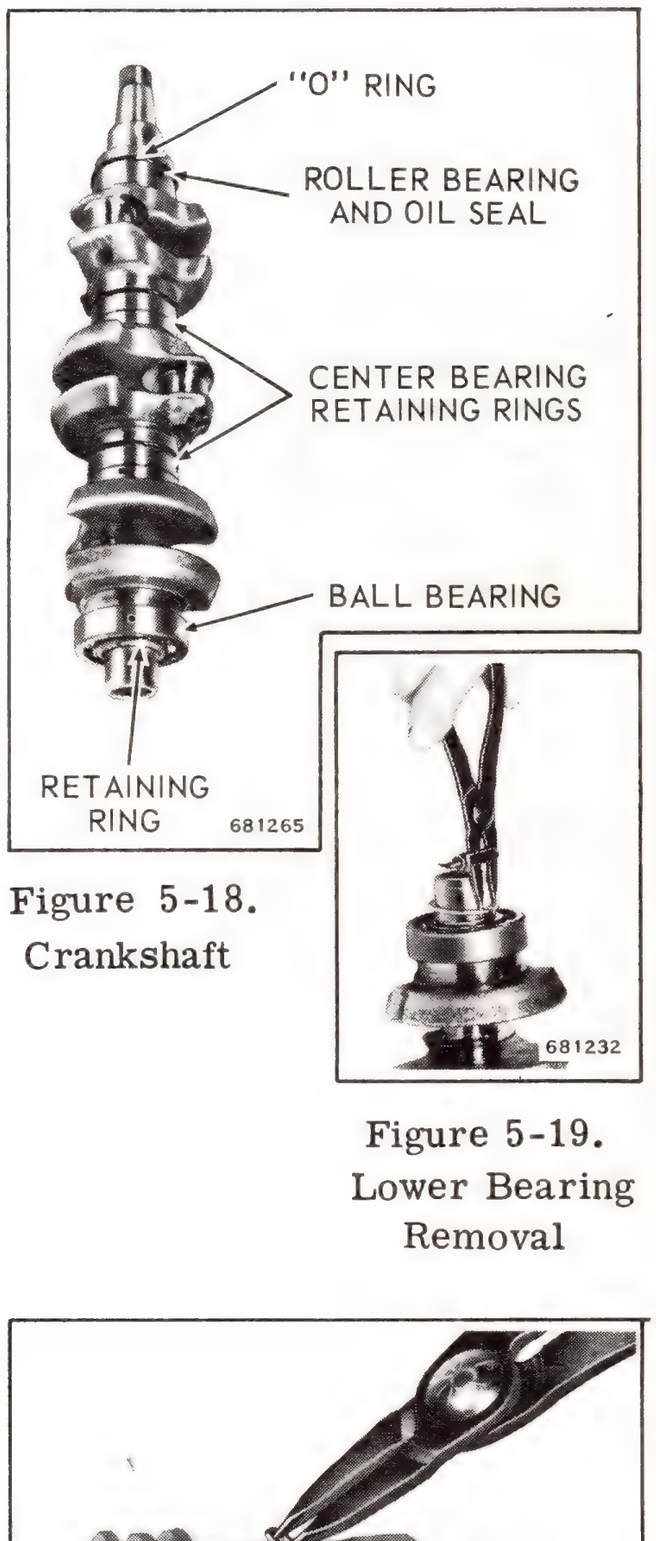


Figure 5-18. Crankshaft

Figure 5-19. Lower Bearing Removal

CLEANING, INSPECTION AND REPAIR

CYLINDER BLOCK AND CRANKCASE

Check cylinder walls for excessive wear and check cylinder ports for carbon accumulation. Cylinder walls wear in various degrees, depending on lubrication and conditions under which the motor is operated. Major portion of wear is in the port area and the area covered by ring travel.

Check cylinder for size and wall straightness by using an inside micrometer. Refer to Section 2 for specified dimensions. Replace cylinder block, or rebore block for oversize pistons if wear is in excess of .003". Pistons and ring sets are available .020" oversize.

NOTE

If your shop is not equipped to rebore cylinder blocks, write our Service Department about our reboring service.

Carbon accumulation in the exhaust ports restricts the flow of exhaust gases and has considerable effect on performance of the motor. Carefully scrape carbon from cylinder heads and exhaust ports with scraper or other blunt instrument. Exhaust ports and all exhaust passages must be free from carbon deposits to insure maximum performance.

Figure 5-20. Removing Piston Pin Retaining Ring

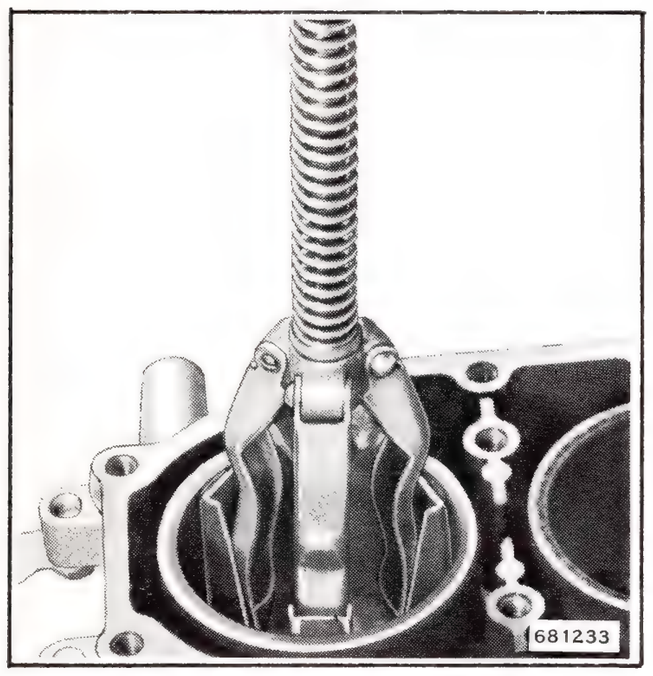


Figure 5-21. Honing Cylinder Wall

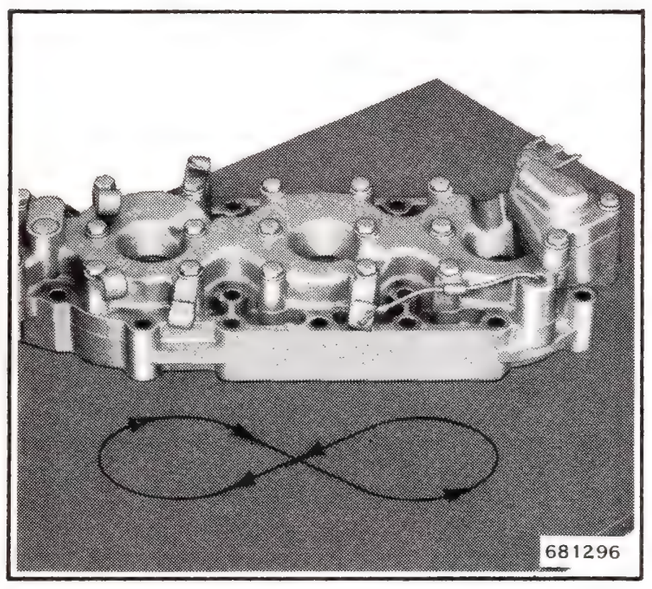


Figure 5-22. Surfacing Cylinder Head

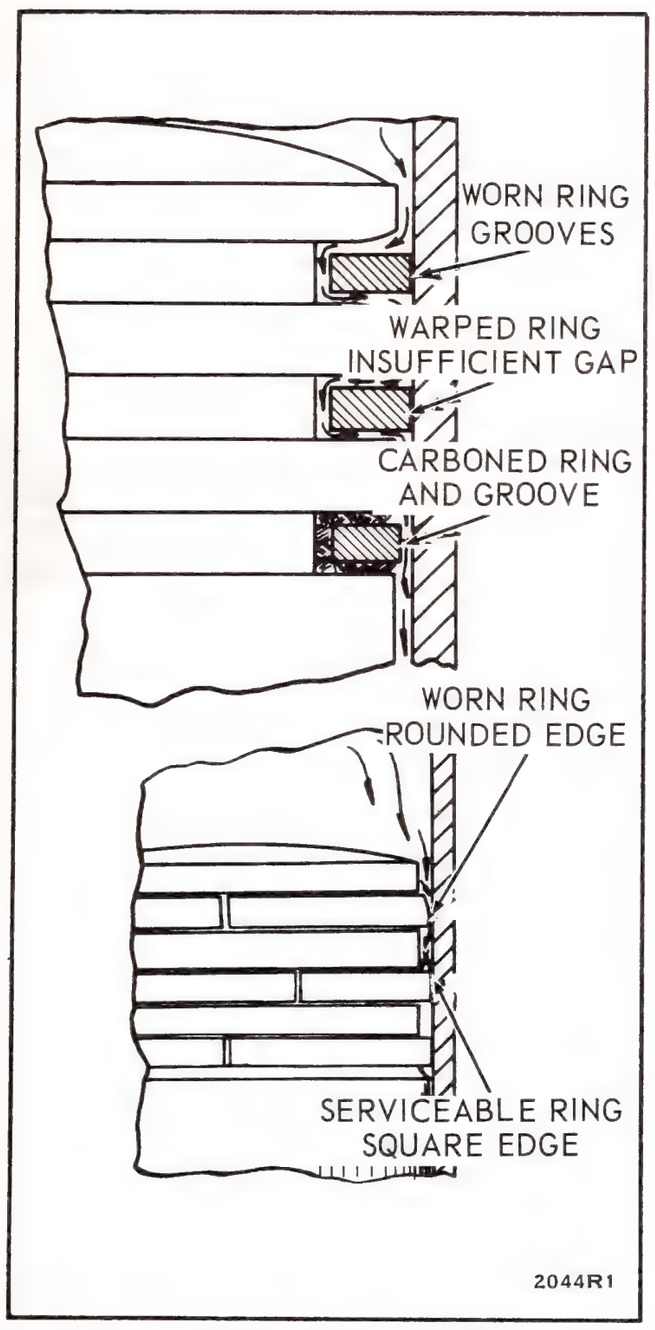


Figure 5-23. Piston and Ring Condition

CAUTION

DO NOT scratch cylinder head gasket surface of cylinder. Use surface plate to surface this area.

With continued operation of the motor, the cylinder walls will take on a glaze which reduces the effectiveness of the seal between the piston rings and the cylinder walls. The result will be reduced compression and a decrease in performance of the motor. Before reinstalling the pistons, break the glaze by using a fine cylinder hone to refinish cylinder walls. A few up and down motions of the tool should be sufficient to remove cylinder wall glaze. See Figure 5-21. Blow out all oil passages and drains.

GASKET SURFACES

Remove all traces of dried cement, using trichlorethylene or lacquer thinner. Check all gasket faces for flatness. Under certain conditions, gasket faces may warp or spring, particularly where thin sections or flanges are employed and are subect to temperature changes.

To check for flatness, lay a sheet of No. 120 emery cloth on a surface plate or piece of plate glass. Place the part to be surfaced on the emery cloth and move slowly back and forth several times in a figure 8 motion, exerting evenly distributed, light pressure. See Figure 5-22. Lift part from surface plate to observe results.

If the surface is actually warped or sprung, high spots making contact with the surface plate will take on a dull polish, while the low areas will have retained their original state. To insure flatness over the entire surface, continue surfacing until the entire gasket surface has been polished to a dull luster. Finish surfacing with No. 180 emery cloth.

CRANKSHAFT BEARINGS AND SEALS

a. All areas where the bearings are to be serviced should be kept free from accumulations of oil and dirt to avoid contaminating the bearings.

b. Place bearings in a wire basket and immerse in a solvent such as Solvasol. Tank should have a screened false bottom to prevent settlings from being stirred up into the bearings. Agitate basket frequently until grease, oil, and sludge are thoroughly loosened and can be flushed out. Bearings that contain especially heavy carbon deposits or hardened grease should be soaked in a separate container of solvent.

c. Using a spray gun with air filter and a clean solvent, flush each bearing until all dirt and residue are removed. Blow solvent out of bearings, using dry, filtered air, being careful not to spin bearings by force of air.

d. Since dry bearings rust rapidly, lubricate them at once in light, clean oil. Rotate them a few times and, after draining the excess oil, place them in a covered container until assembly.

e. Discard bearings which show any of the following:

(1) Rusted rollers or raceways.

(2) Fractured ring. This may be caused by forcing a cocked bearing off a shaft, or by too heavy a press fit.

(3) Worn, galled, or abraded surfaces. These may be caused by too loose a fit, or bearing locked by dirt and turning on shaft or in housing.

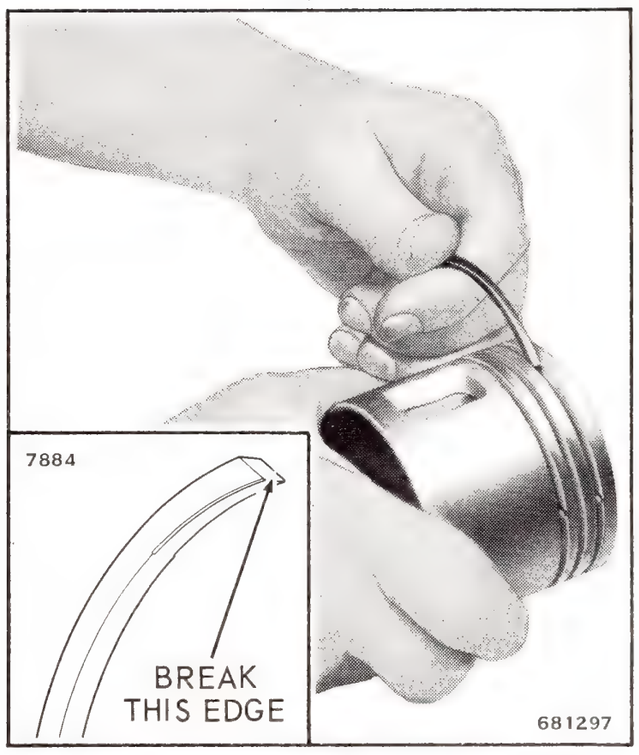


Figure 5-24. Cleaning Carbon from Ring Grooves

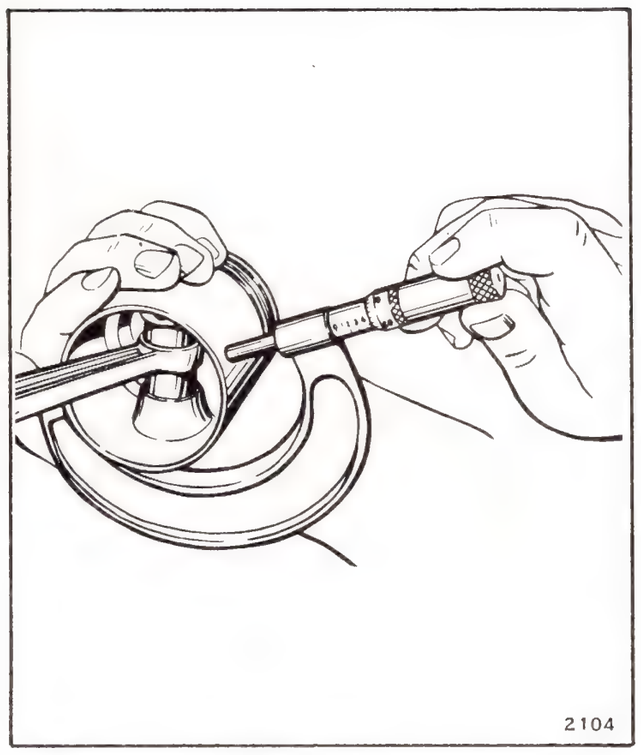


Figure 5-25. Check Piston Skirts for Roundness

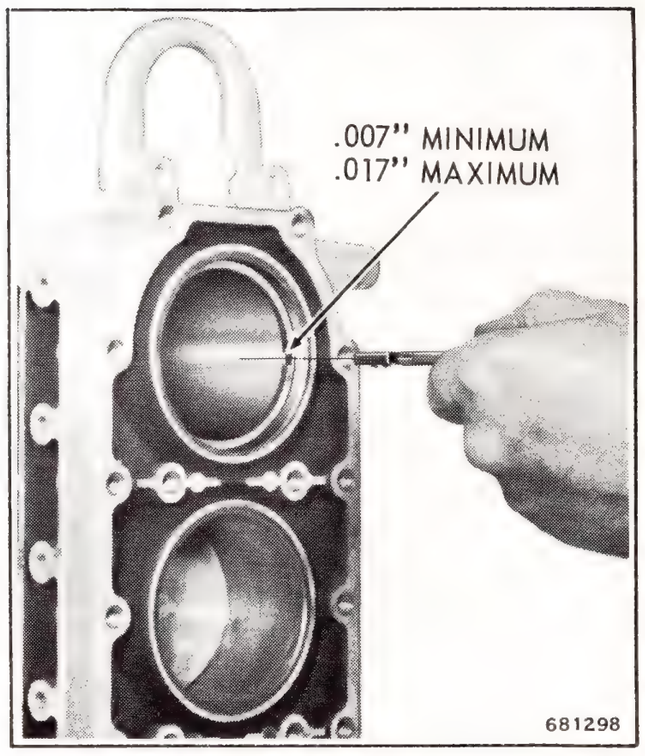


Figure 5-26. Checking Ring Gap in Cylinder

(4) Badly discolored rollers and races. This is usually due to an inadequate supply of lubricant. Moderate discoloration is not a cause for discard.

f. Replace top crankcase bearing seal and "O" ring.

g. Lower crankcase seal should be replaced and any parts of this assembly should be replaced if damaged or worn.

PISTONS

Check the pistons for roundness, excessive skirt wear, and scoring. See Figure 5-25. Carefully remove carbon deposits from inside piston head. Inspect the ring grooves for carbon accumulation, excessive wear, or damage to the ring seats. Carefully scrape carbon from the ring grooves, making certain that carbon clinging to the bottom and sides of the grooves has been thoroughly removed without scratching or otherwise damaging the grooves. A tool for cleaning ring grooves can be made by breaking an old ring, grinding the edge and breaking the lower sharp edge. Care must be taken to prevent damage to lower ring land. See Figure 5-24. Check piston for size and roundness, using a micrometer. See Figure 5-25. Piston skirt must be perfectly round and not scratched. Correct sizes are given in Section 2.

Before installing new piston rings, check gap between ends of ring by placing ring in its respective cylinder bore, then pushing the ring down in the bore slightly with the bottom of the piston to square it up. Discard and replace with another new ring if gap is excessive. See Figure 5-26. Check each ring in its respective ring groove for evidence of tightness or binding by rolling the ring around the piston ring groove. See Figure 5-27. Check for groove side clearance with feeler gage. See Figure 5-28. Correct gap and side clearances are given in Section 2.

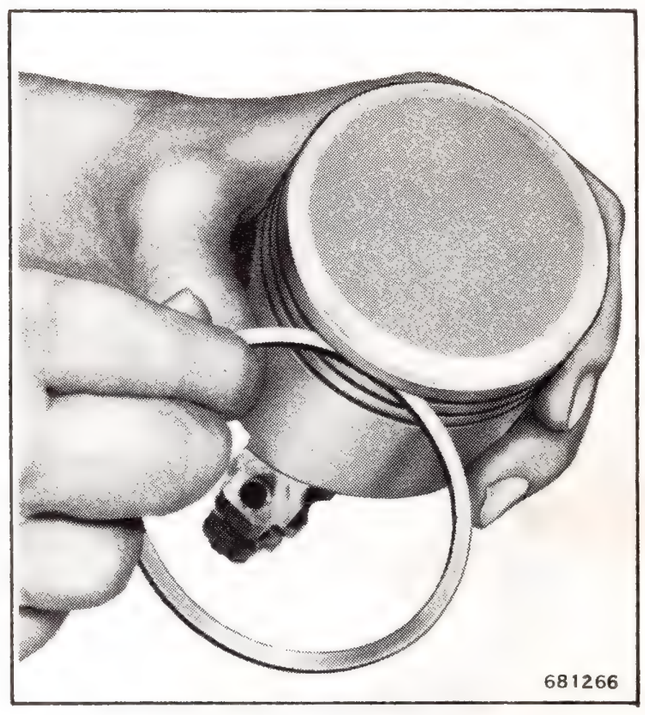


Figure 5-27. Checking Fit of Ring in Groove

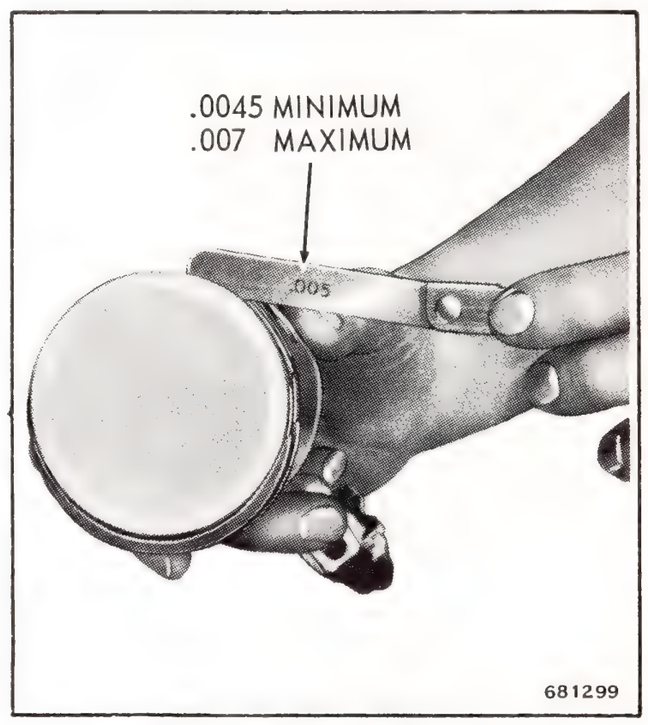


Figure 5-28. Checking Groove Side Clearance

REASSEMBLY OF POWER HEAD

Proceed slowly. Make no forced assemblies unless press fits are called for and make no "dry" assemblies. Be sure all parts to be assembled are clean and free from dirt and grit. Perfectly good cylinder walls, pistons and rings can be ruined in a few minutes of operation unless all forms of grit are removed before assembly. Work in clean surroundings and with reasonably clean hands. Coat all bearing surfaces, cylinder walls, etc., with clean oil before assembly.

NOTE

Always use new gaskets and seals throughout when reassembling the power head. Make certain all oil holes and passages are open.

Figure 5-29. Correct Piston and Rod Assembly

PISTONS, WRIST PINS AND CONNECTING RODS

a. The relative positions of pistons and connecting rods must be considered when assembling pistons to rod. Pistons must be installed in cylinders with side of piston marked UP facing up. See Figure 5-29. Oil hole in connecting rod must be toward top of motor. See Figure 5-30.

b. Apply coat of oil to wrist pin, making sure surface is clean. Place a drop or two of oil in each pin hole in the piston. Apply OMC needle bearing grease to retain (10) rollers in wrist pin bearing retainer.

c. Insert wrist pin through piston and connecting rod.

d. Replace retaining rings, lettered side out, making certain they come to rest securely in the groove provided for this purpose.

PISTON RINGS

Install the piston rings on each piston. Spread each ring with a ring expander just enough to slip it over the head of the piston and down into place. Be sure the rings fit freely in the piston ring grooves. The ring grooves are pinned to secure the position of the rings, primarily to prevent ends of the rings from catching on the edges of the ports in the cylinders but also to assure staggering of the ring gaps.

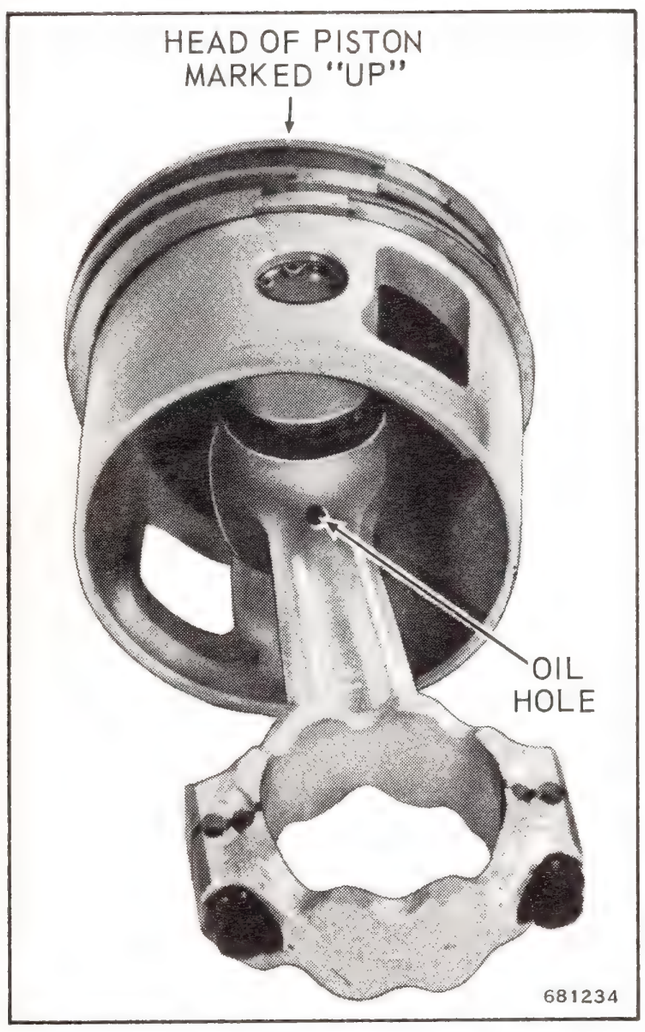


Figure 5-30. Oil Hole in Connecting Rod

PISTON AND CONNECTING ROD INSTALLATION

Coat pistons and cylinder bores with oil and install piston and connecting rod assemblies, being sure to match each assembly with the cylinder it was removed from. The side marked UP on the top of the piston must face the top of the power head. See Figure 5-29. Make certain that the rings are correctly positioned in their grooves with respect to the groove pins. Damaged pistons and broken rings may result from imperfect alignment of the ring and piston dowel pin. The use of automotive type ring compressing tools should be avoided, as these frequently cause damaged pistons and broken piston rings through imperfect alignment of the ring gap and piston dowel pin. The use of Special Tool #308479 (for standard size rings and pistons only) is recommended. Using one hand to push the piston into the cylinder, use the free hand to guide the connecting rod into place and to align the rod with respect to the crankshaft.

CRANKSHAFT

a. Replace journal bearings on crankshaft. Place "O" ring in position on upper bearing and install a new oil seal with lip facing in.

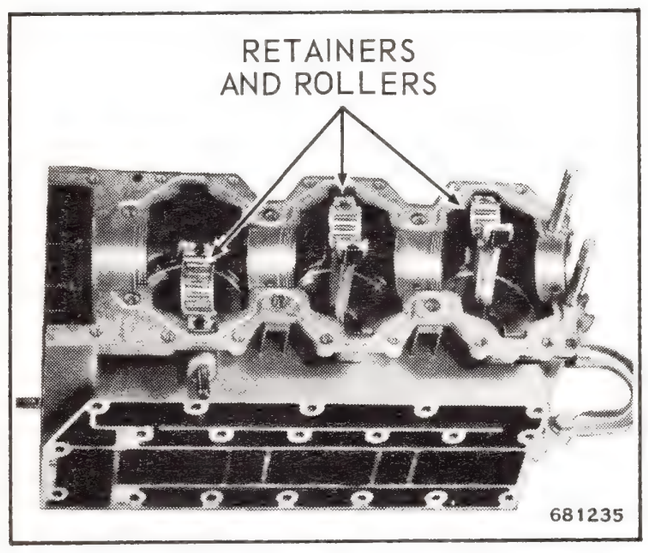


Figure 5-31. Installing Roller Bearings

b. Remove rod caps from connecting rods. Apply a coat of OMC Needle Bearing Grease (Part Number 378642) to connecting rod bearing area. Place one retainer half and 7 roller bearings on each rod. See Figure 5-31.

c. Place crankshaft in position on cylinder block, aligning top and two center main bearings with dowel pins in cylinder block.

d. Apply a coat of OMC Needle Bearing Grease to crankpins. Install 2 roller bearings and remaining retainer half on each crankpin. Place the remaining 7 roller bearings in each retainer. See Figure 5-32.

NOTE

16 rollers are used in each roller bearing.

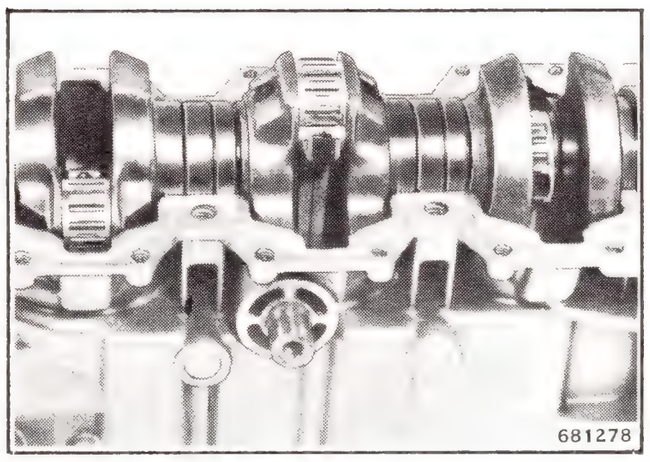


Figure 5-32. Roller Bearings and Retainers

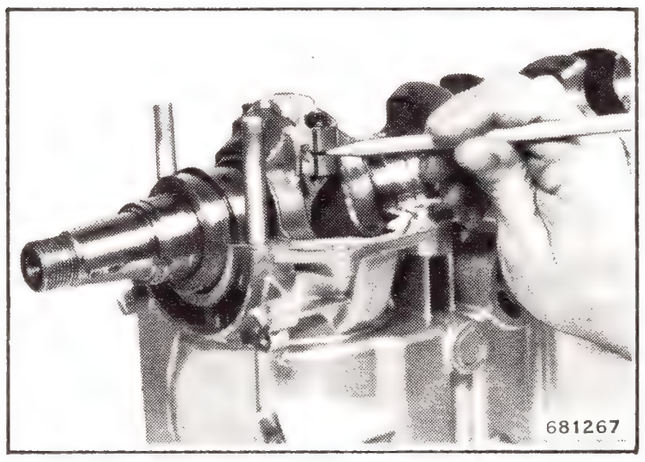


Figure 5-33. Rod and Cap Alignment

e. With roller bearings in place, attach connecting rod caps. Connecting rod caps are not interchangeable with those of other rods, neither may the caps of the same rods be turned end for end. To assist correct assembly, small raised dots are provided on matching sides of rod and cap. Draw a pencil over chamfered corners on both sides of rod to make certain that cap and rod are aligned at this point. If not aligned, chamfered corners can be felt with the pencil point. See Figure 5-33. Misalignment will affect free normal action of the rollers, and will result in major damage. See Figure 5-34.

f. Tighten connecting rod screws to torque specified in Section 2, using a torque wrench. Rods and bearings should float on crankpins.

CRANKCASE AND CYLINDER

a. The crankcase face is grooved for installation of a rubber seal. The new seal should be seated into the grooves and cut somewhat longer than actually necessary to obtain a good butt seal at both ends against the crankcase bearing. Run a fine bead of Sealer 1000 in groove to secure seal in position while trimming. With thumb pressure, force seal to outer edge of groove. After cement has set, trim ends with a sharp knife, allowing approximately 1/32 inch of the seal to extend beyond edge of machined surface for sufficient butt or terminal seal.

b. Apply a thin line of Sealer 1000 to crankcase face. DO NOT overcement; excess will squeeze over to foul oil channels, etc. See Figure 5-35.

c. Position crankcase on cylinder block, and install screws finger tight. Replace crankcase taper pins, driving in carefully with a hammer.

d. Check for binding between the crankshaft and the bearings or connecting rods by rotating the crankshaft with the flywheel. See Figure 5-36.

e. Tighten all crankcase screws to torque specified in Section 2.

f. Install cylinder head, using a new gasket and automatic choke thermal switch if removed. Tighten cylinder head bolts to specified torque, following the sequence shown in Figure 5-37.

NOTE

Re-torque cylinder head screws after motor test has been completed and motor has cooled off. See Section 2.

g. If removed, reinstall cylinder head cover, using a new gasket.

h. Install exhaust covers, using new gaskets. Install all screws to specified torque. Section 2.

i. Install new upper main bearing oil seal and "O" ring.

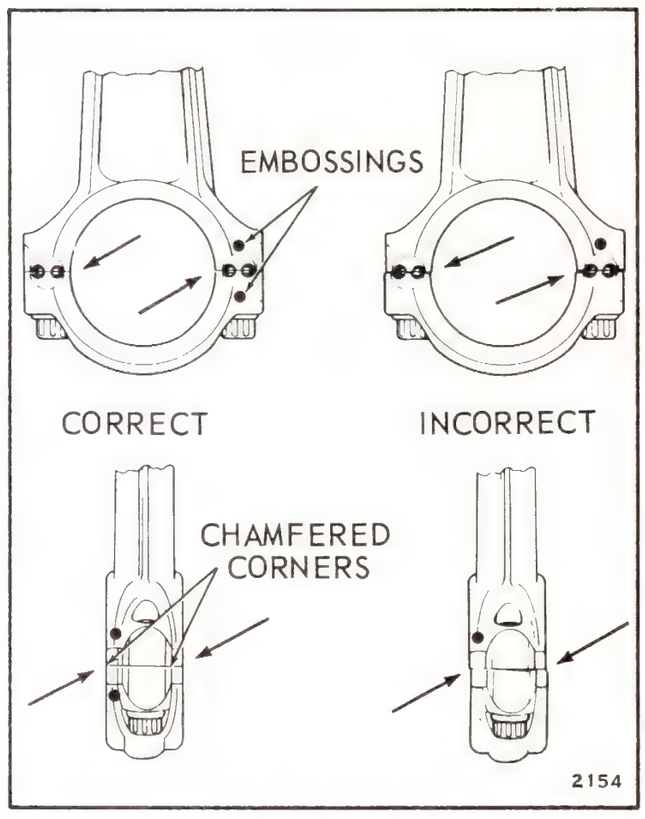


Figure 5-34. Correct and Incorrect Alignment

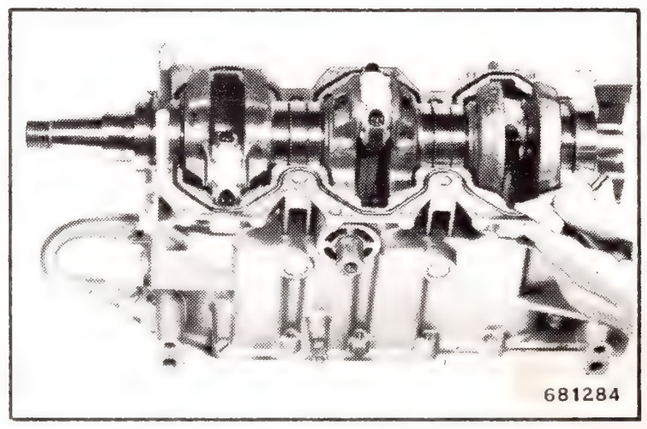


Figure 5-35. Apply Sealer 1000

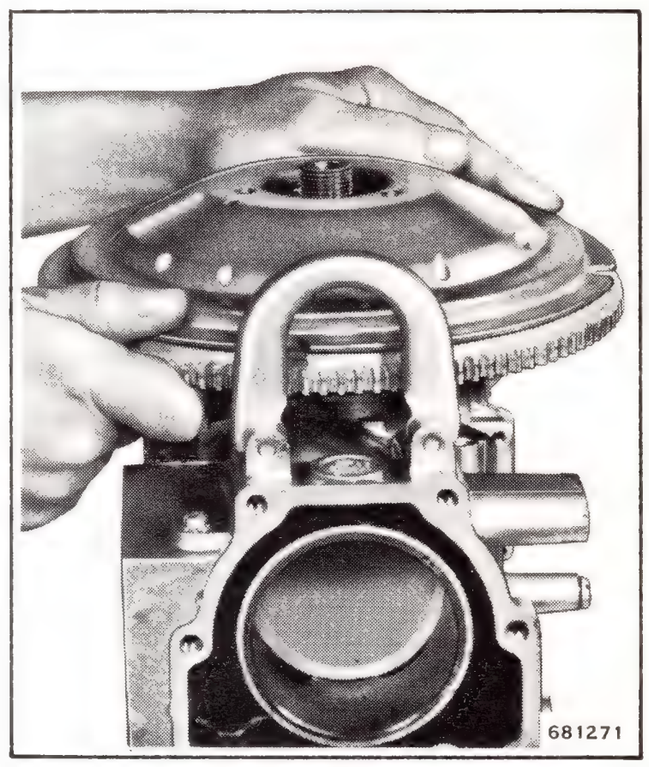


Figure 5-36. Check for Binding

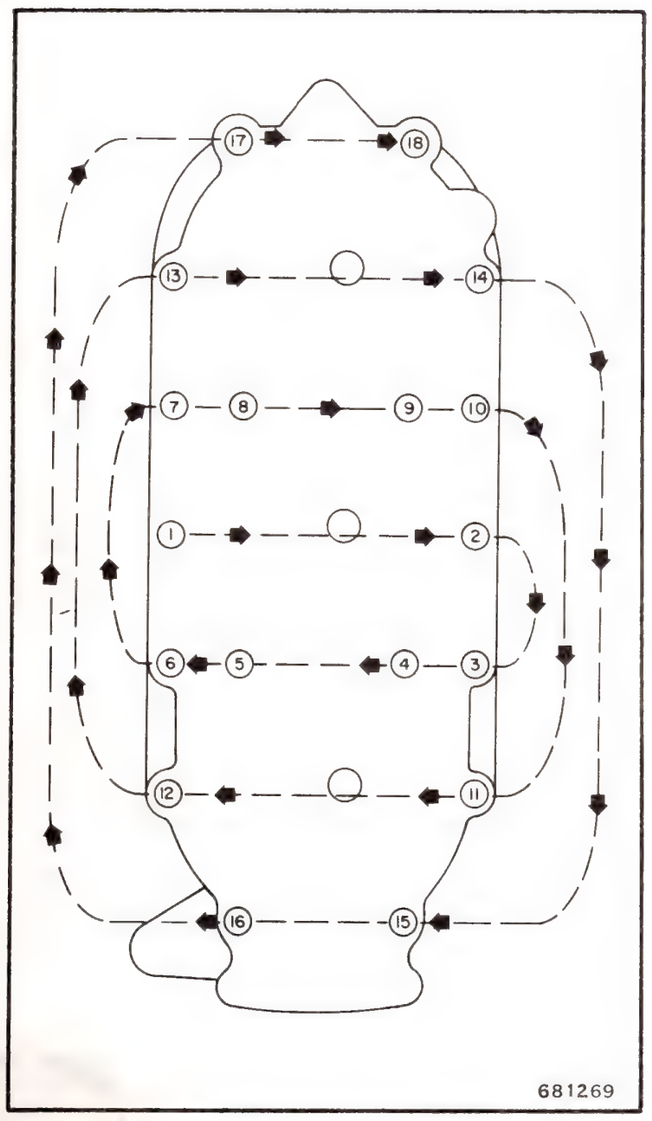


Figure 5-37. Cylinder

INSTALLATION OF POWER HEAD

a. Make sure that gasket surfaces of power head and adapter assembly are clean. Place new gasket in position.

b. Place power head on adapter, using care to avoid damaging the splines of the crankshaft and driveshaft. Rotating the power head slightly clockwise as it is lowered onto the exhaust housing will engage the splines. Align cylinder block stud with hole in adapter.

c. Replace six screws and nut and washer. Insert lower head bracket to lower motor cover screws. Tighten all screws to torque specified in Section 2.

d. Install front and rear exhaust covers.

e. Replace throttle control arm and throttle cam.

f. Replace intake manifold, carburetor and other components of fuel system as described in Section 3.

g. Replace distributor, safety switch and other components of ignition system, stator, and flywheel as described in Section 4. Install vacuum switch, if removed.

h. Install amplifier and connect wiring connectors. Connect power head ground wire. Feed starter red cable through hole in crankcase web and insert grommet in web. Install starter and connect cable.

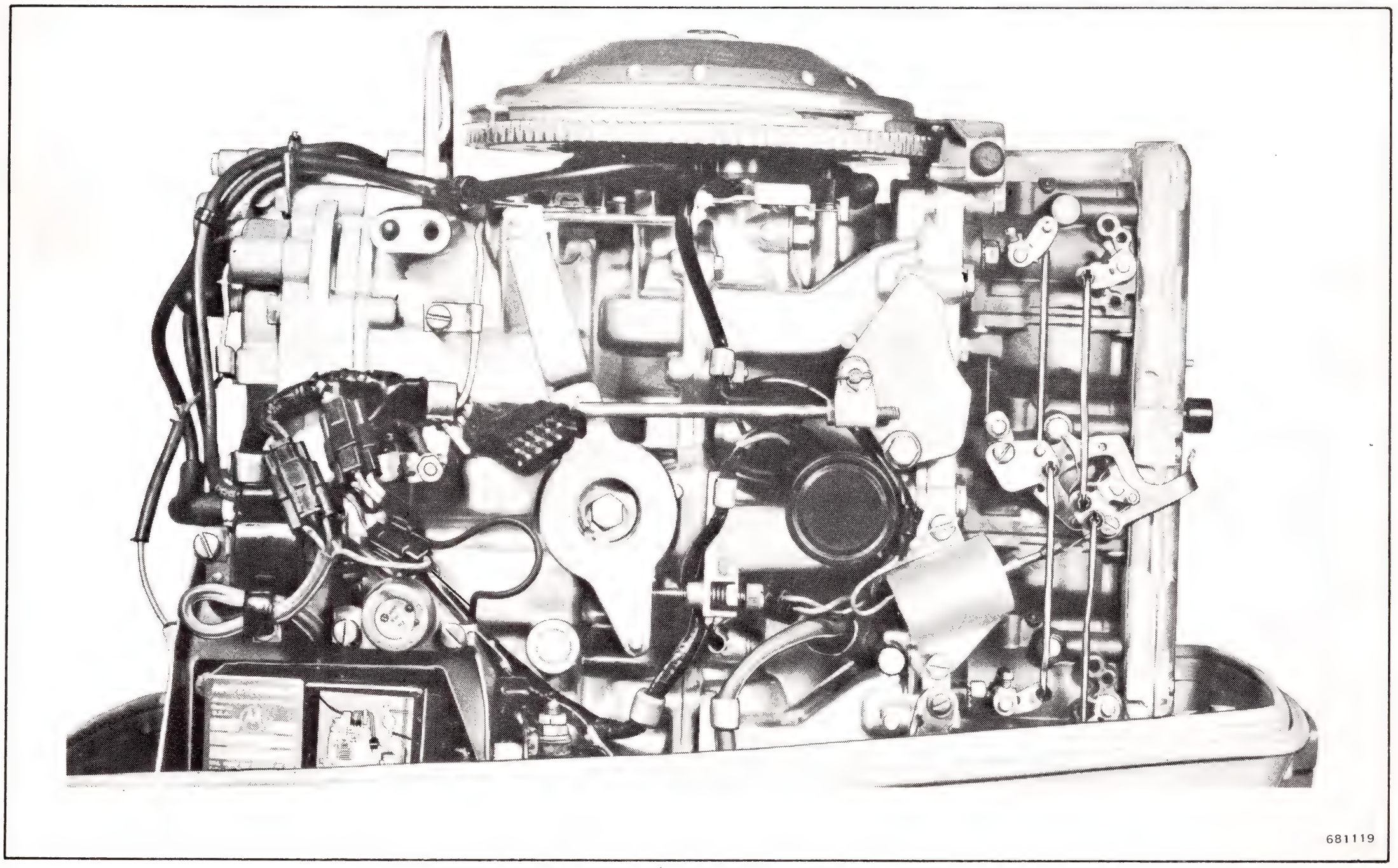


Figure 5-38. Starboard Wiring, Clamps and Linkage

BREAK-IN

Be sure that when an engine is returned to service after an overhaul, the owner is advised to follow break-in procedures exactly. See inside front cover and page 2-6 for correct fuel mixture.

For the first 5 to 10 minutes, operate engine at a fast idle. Check operation of water pump. For remainder of first hour, do not operate engine over 3000 rpm (approximate) or one-half throttle (approximate).

NOTE

With easy planing boats, it would be desirable to bring the boat into planing position with full power and then immediately reduce the throttle setting to approximately 3000 rpm (one-half throttle). BE SURE boat maintains planing attitude at this throttle setting.

During second hour, bring boat into planing attitude and reduce power to 4000 rpm (approximate) or three-quarters 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 (4000 rpm - three-quarters throttle).

Avoid continuous full throttle operation for extended period during the next few hours.

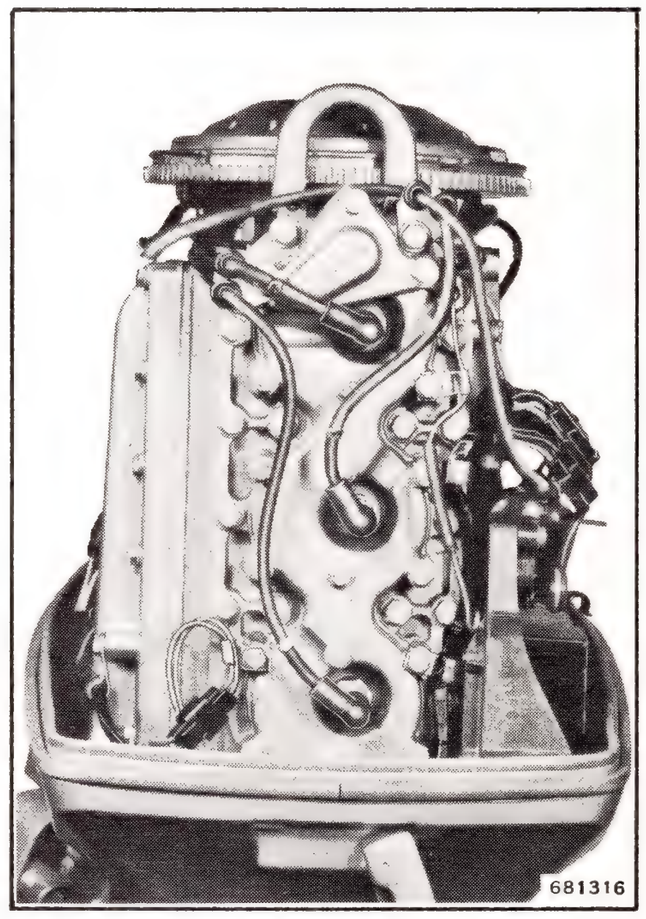


Figure 5-39. Aft View, Wiring and Clamps

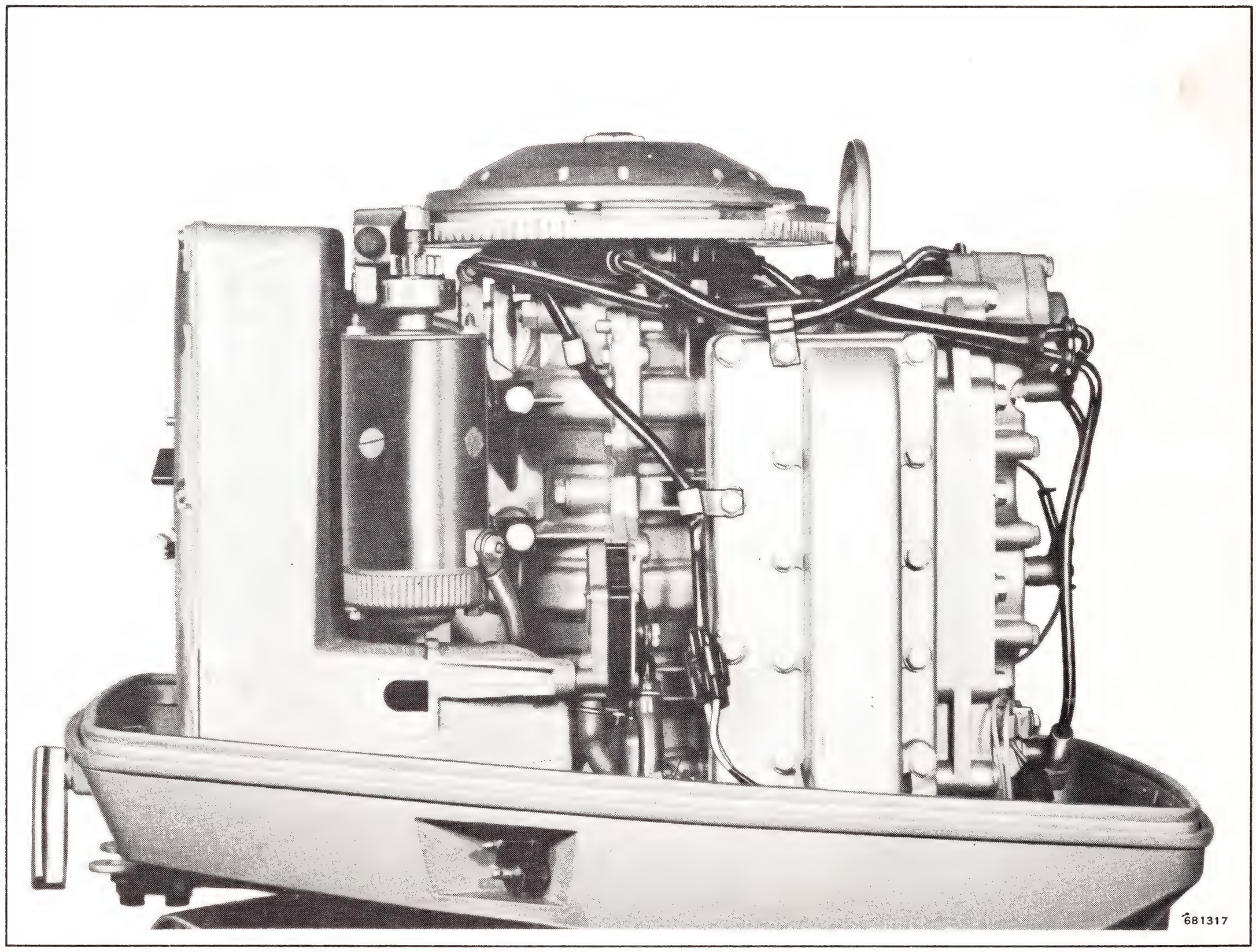


Figure 5-40. Port Side, Wiring and Clamps

SECTION 6
LOWER UNIT

TABLE OF CONTENTS

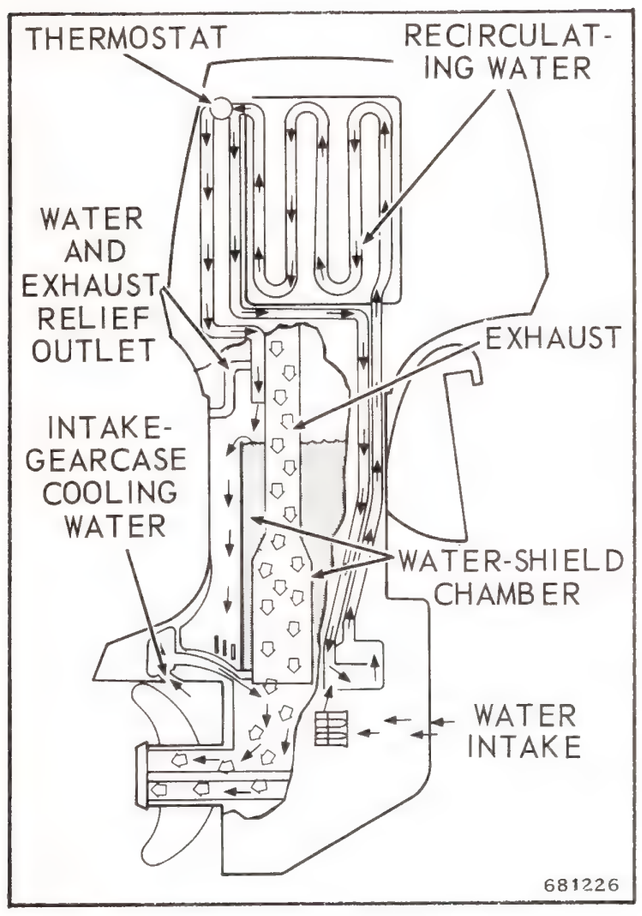


Figure 6-1. Cooling and Exhaust Systems

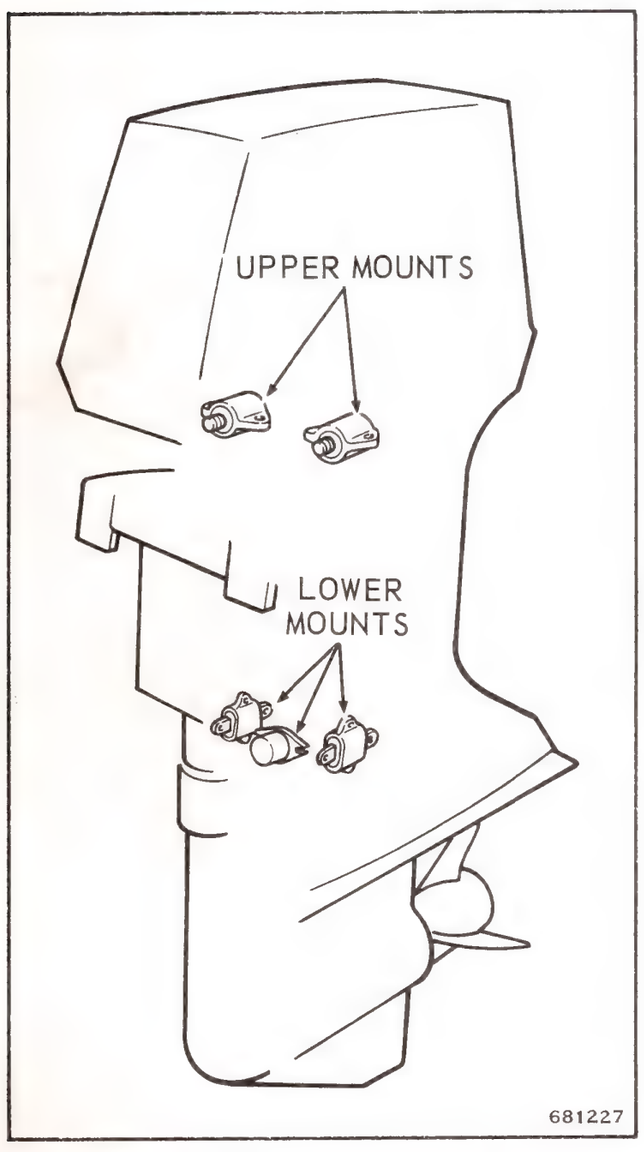


Figure 6-2. Isolation Mount Arrangement

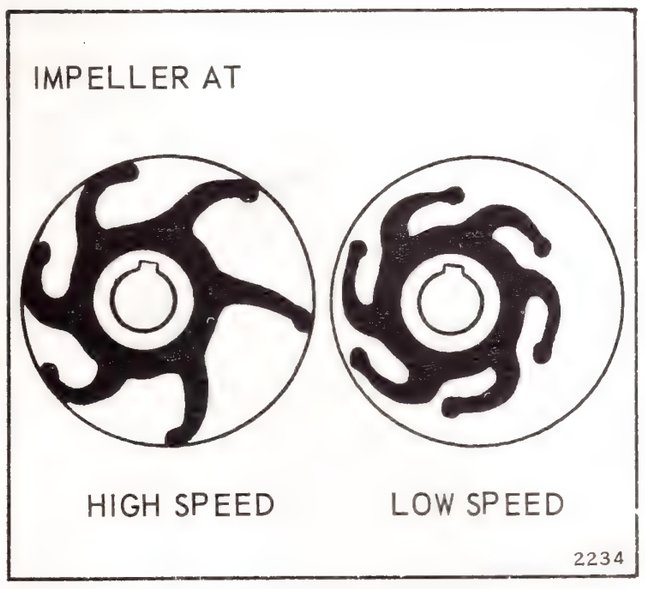


Figure 6-3. Impeller Positions

DESCRIPTION

EXHAUST HOUSINGS

The 55 HP model features a "wet sleeve" exhaust system consisting of an inner and an outer housing with a water chamber in between. The water discharged from the engine cooling system fills the space between the exhaust housings and maintains a specified level when the engine is running. See Figure 6-1. The water drains out when the engine is stopped and tilted above the water line. This chamber of water serves as an effective silencer, quiets the exhaust relief, and cools the outer housing and lower rubber mounts.

Exhaust gases are discharged underwater through the propeller hub for efficient silencing and performance. Water inlets in the trim tab scoop up water and direct it back into the exhaust chamber to cool exhaust gases through the propeller.

RUBBER MOUNTS

The outboard isolation system consists of five rubber mounts designed and located for efficiency. See Figure 6-2. In addition, the motor covers are rubber mount isolated from the power head and exhaust housing adapter.

EXHAUST RELIEF

Normally, exhaust gases are conducted down through the inner exhaust tube and out through the underwater exhaust outlet. However, in starting, water in the underwater outlet creates back pressure. This can cause hard starting. Exhaust relief is provided by an outlet in the water discharge passage above the waterline. Since no water is discharged until after the motor is started, the exhaust gases will initially be discharged through the water discharge and exhaust relief outlet. See Figure 6-1. In normal operation, a fine spray of water issuing from the exhaust relief outlet is an indication of proper water circulation.

WATER PUMP

Water for cooling the power head is circulated by the water pump, located at the top of the upper gearcase and driven directly by the driveshaft. The pump consists of a synthetic rubber impeller which is keyed to the driveshaft, and the pump housing which is offset from center with respect to the driveshaft. Because the housing is offset, the impeller blades flex as they rotate, varying the space between them. The pump inlet port, located in the stainless steel plate which forms the lower part of the pump housing, is open to the blades when the space between them is increasing. The pump outlet port, in the impeller housing, is open to the blades when the space between them is decreasing. Thus at low speeds the impeller works as a displacement pump. At higher speeds, water resistance keeps the blades from flexing, and the pump acts as a circulator, enough water being provided by the forward motion of the motor through the water. See Figure 6-3. Heavy duty water pumps are available for service in extremely sandy or silty waterways.

GEARCASE

The gearcase and electric-hydraulic shift consist of:

1. The driveshaft and pinion gear;
2. The forward and reverse driving gears;
3. The propeller shaft;
4. The clutch dog;
5. Vacuum switch.

6. The hydraulic pump and selector valve;

7. The gearcase lubricant;

8. The selector valve solenoid operated by battery current and controlled from the remote control unit switch.

The hydraulic pump mounted in the forward end of the gearcase and driven by the forward gear utilizes the gearcase lubricating oil to supply the force needed for shifting. The solenoids operate the pump valve which directs the hydraulic force to place the clutch dog in the selected position. See Figures 6-4, 6-5, and 6-6.

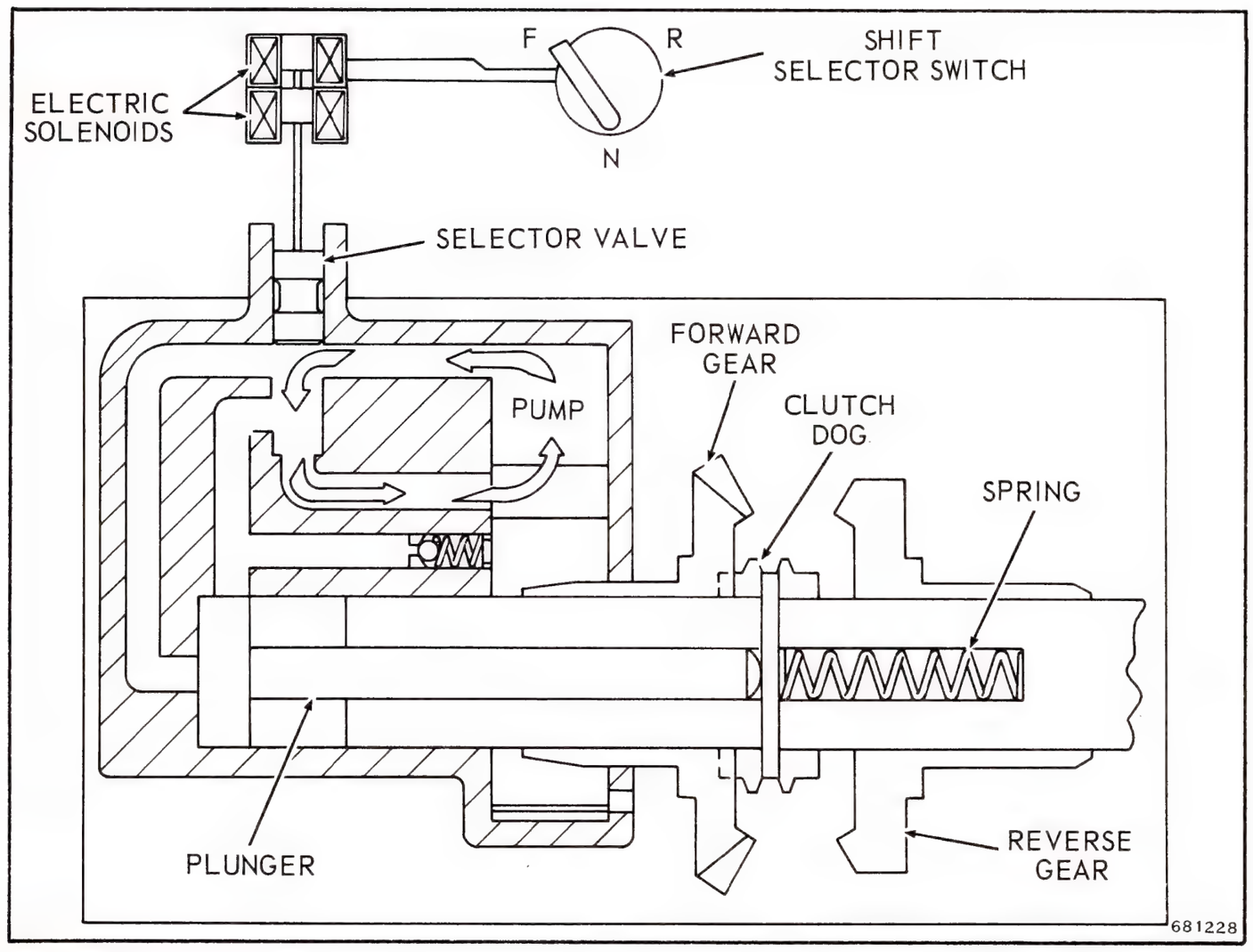


Figure 6-4. Shift in Forward Gear

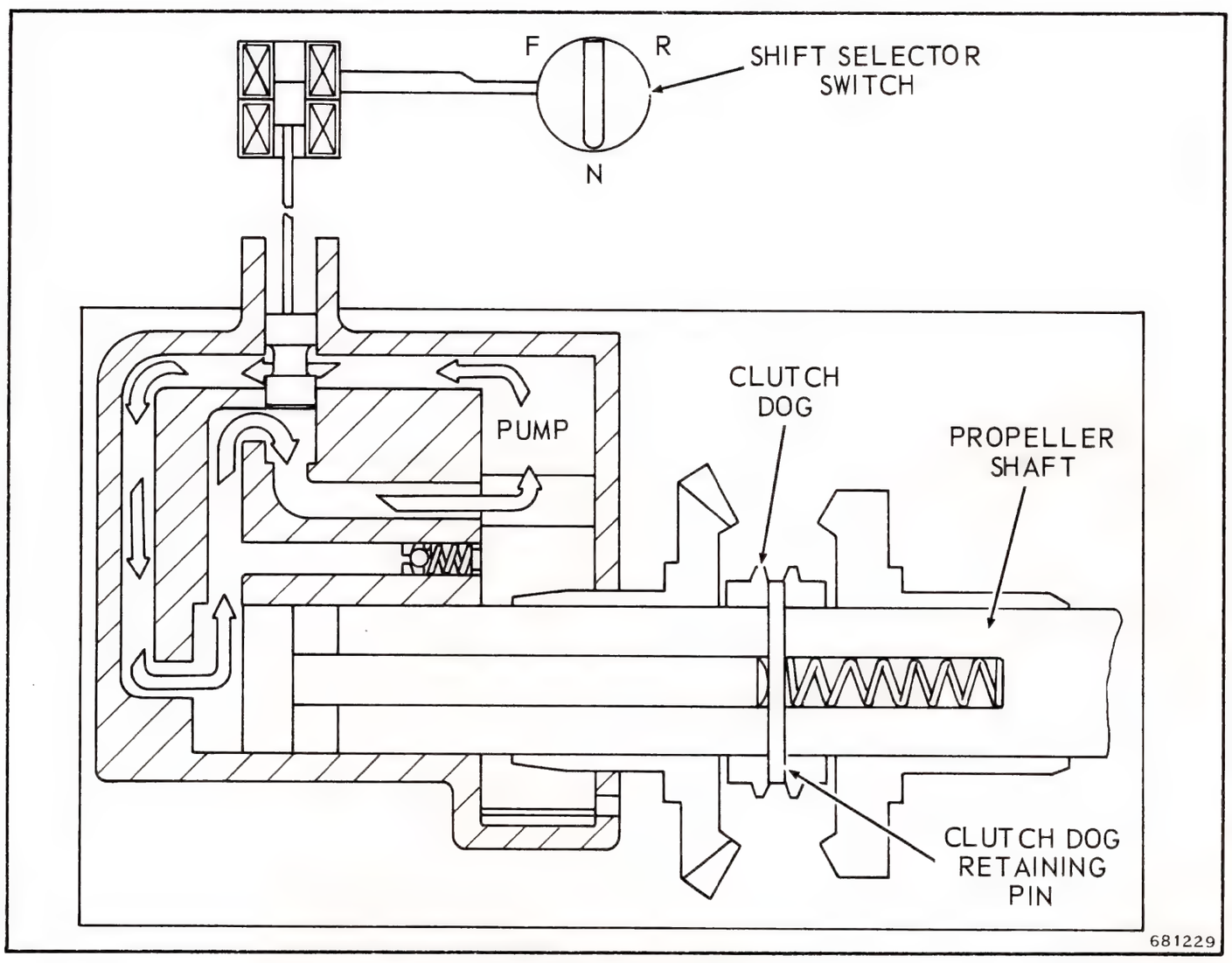


Figure 6-5. Shift in Neutral

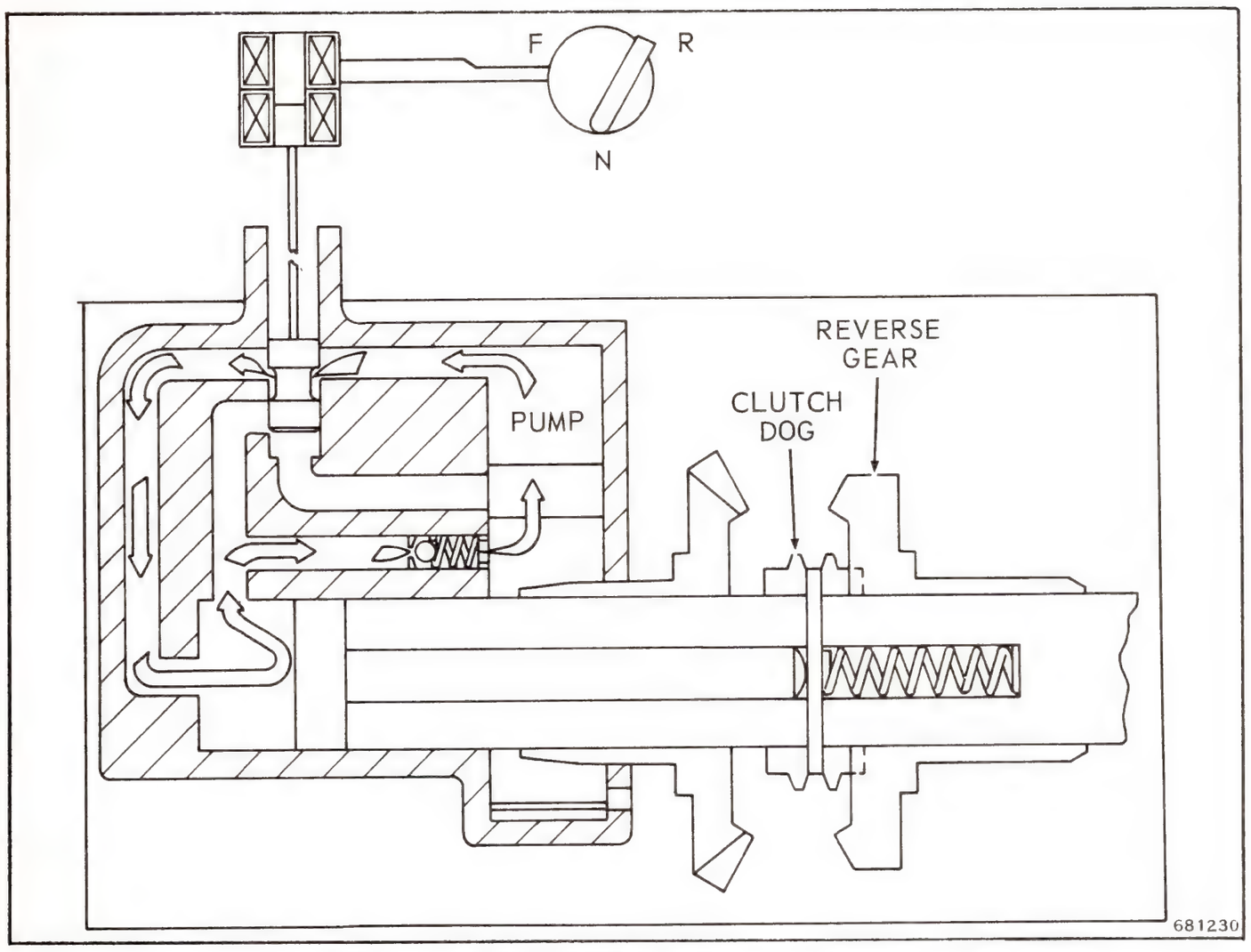


Figure 6-6. Shift in Reverse Gear

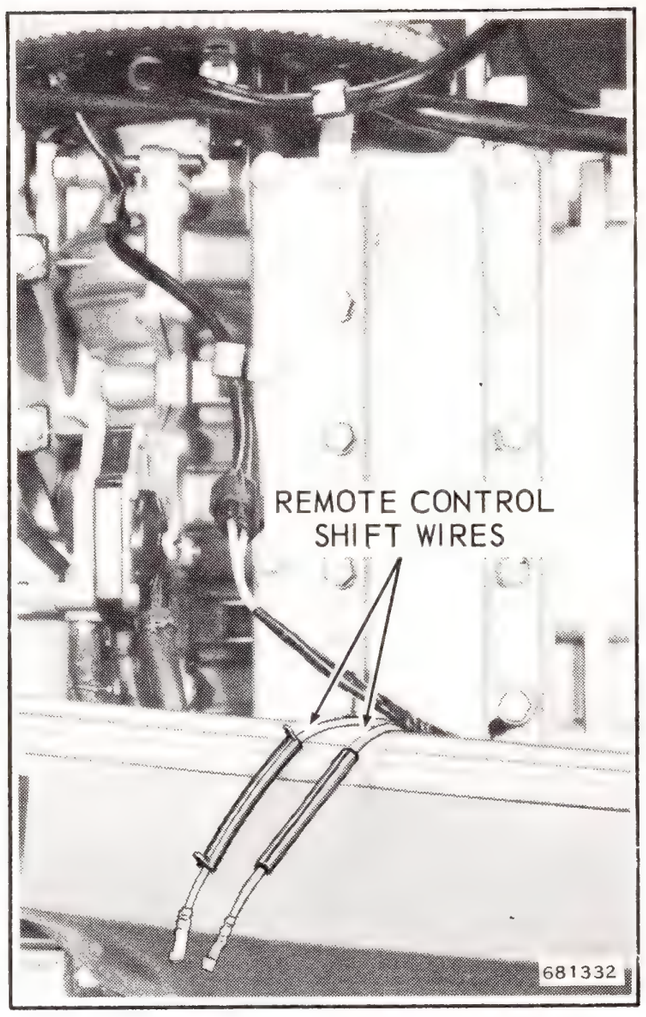


Figure 6-7. Disconnect Shift Wire Terminals

REMOVAL OF GEARCASE

The gearcase assembly may be removed from the exhaust housing and power head as follows:

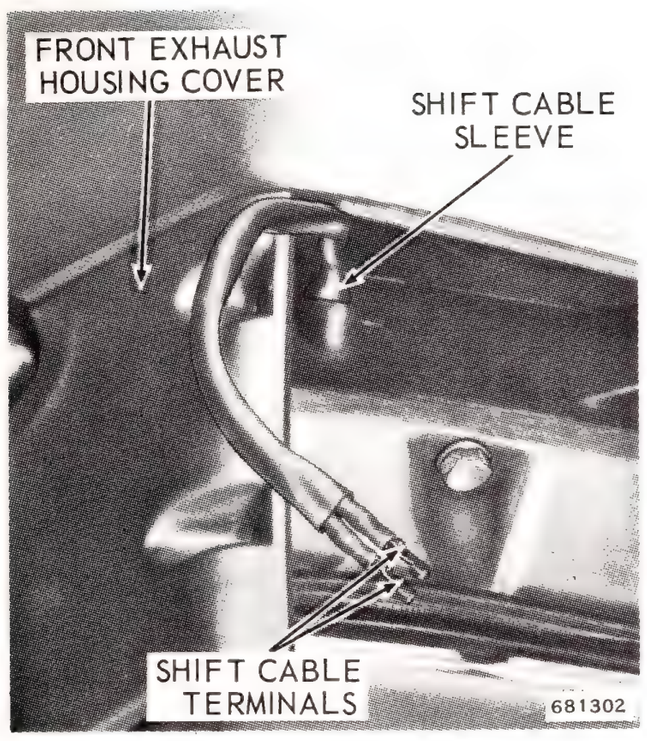


Figure 6-8. Shift Cable Sleeve

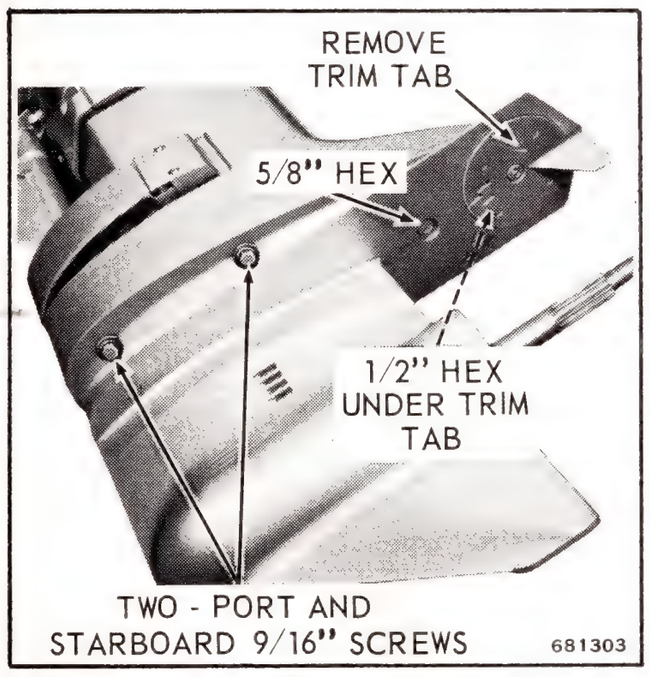


Figure 6-9. Gearcase Screws

a. Disconnect spark plug wires.

b. Drain lubricant from gearcase.

c. Slide back the insulating sleeve on the shift cable wires so the terminals between the shift cable and motor cable can be disconnected. Terminals are located on port side adjacent to power head exhaust bypass cover. Disconnect terminals. See Figure 6-7.

d. Remove four screws from front exhaust cover and 2 aft inside of lower motor cover and remove rear exhaust cover. See Figure 6-8. Apply oil or liquid soap to cable sleeve and push down through hole in exhaust housing.

e. Scribe mark on gearcase and adjustable trim tab so it can be reinstalled in the same position. Remove Allen screw and trim tab. See Figure 6-9.

f. Using a 1/2 inch socket and short extension, remove screw from inside of trim tab cavity. See Figure 6-9.

g. Using a 5/8 inch thinwall socket, remove countersunk screw. See Figure 6-9.

h. Remove four 9/16" screws (2 each port and starboard). See Figure 6-9.

i. Remove gearcase assembly and cable from exhaust housing. Take care to avoid damaging shift cable. Do not lose plastic water tube guides. These are used to guide tubes into pump grommets during reassembly.

REMOVAL OF EXHAUST HOUSING AND ADAPTER

a. Remove power head. See Section 5 for instructions.

b. Remove two screws retaining lower motor cover to exhaust housing adapter. See Figure 6-11. Remove lower motor cover assembly.

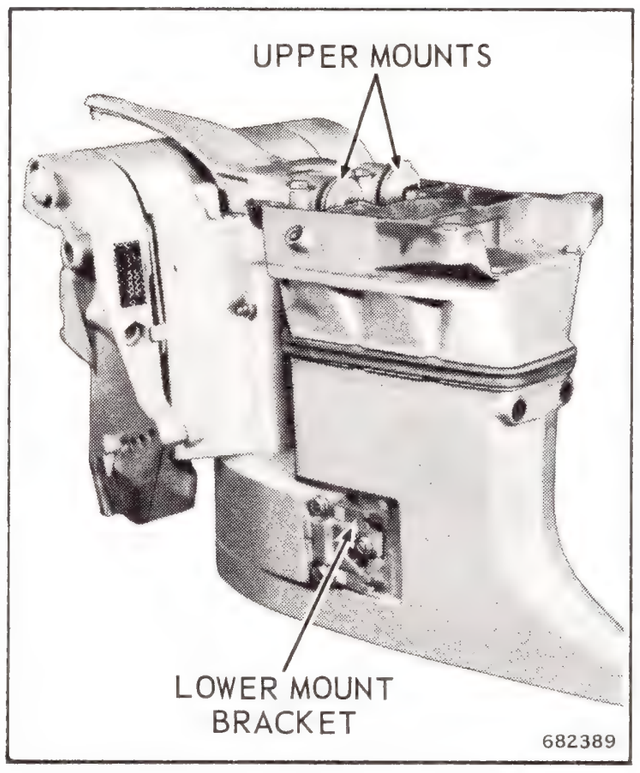


Figure 6-10. Upper and Lower Rubber Mounts

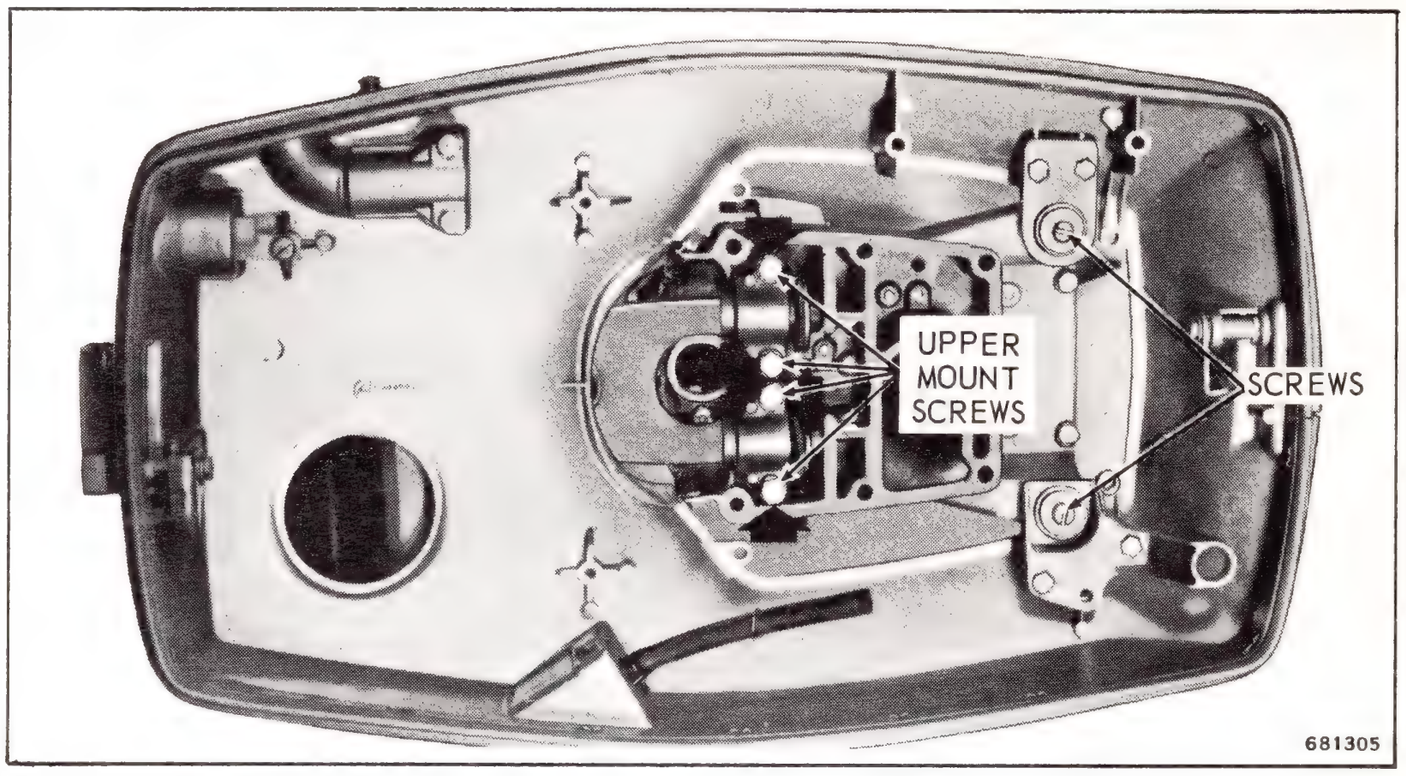


Figure 6-11. Lower Motor Cover Screws

c. The exhaust housing and adapter assembly, which carries the power head, is rubber mounted to the swivel bracket assembly. To release the exhaust housing, remove port and starboard lower mount covers. See Figure 12. Remove rubber mount bolts, two each port and starboard. See Figure 10. Remove upper mount screws (see Figure 6-11), and remove exhaust housing and adapter assembly.

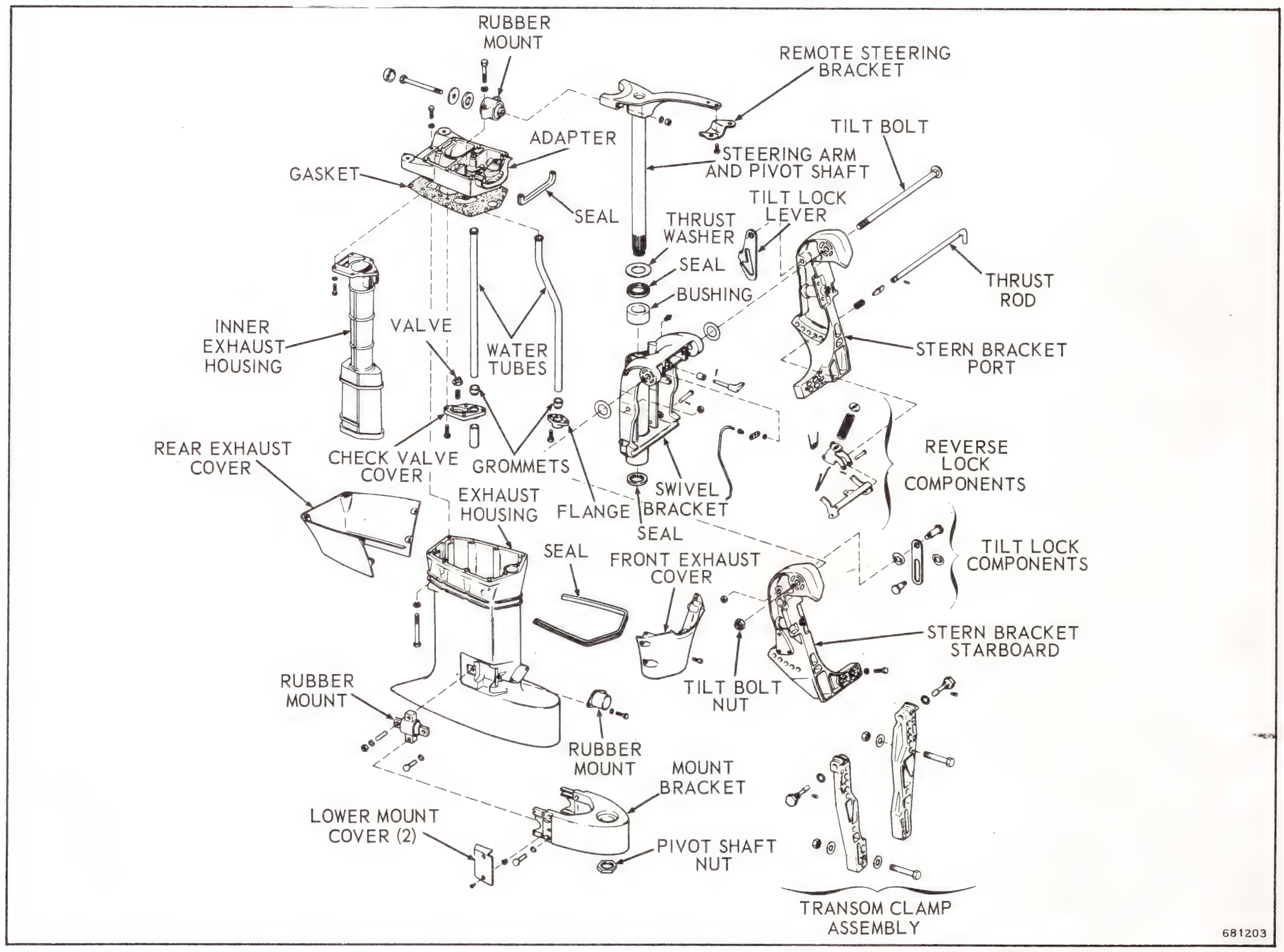


Figure 6-12. Exhaust Housing, Adapter, Stern and Swivel Brackets

d. Remove four screws and lift adapter, inner exhaust tube, and water tube assembly from exhaust housing. See Figure 6-13.

e. If necessary to remove water tubes, remove screws attaching water tube flanges to adapter. See Figure 6-13 insert. Inner exhaust tube and gasket can be removed from adapter if necessary by removing five screws.

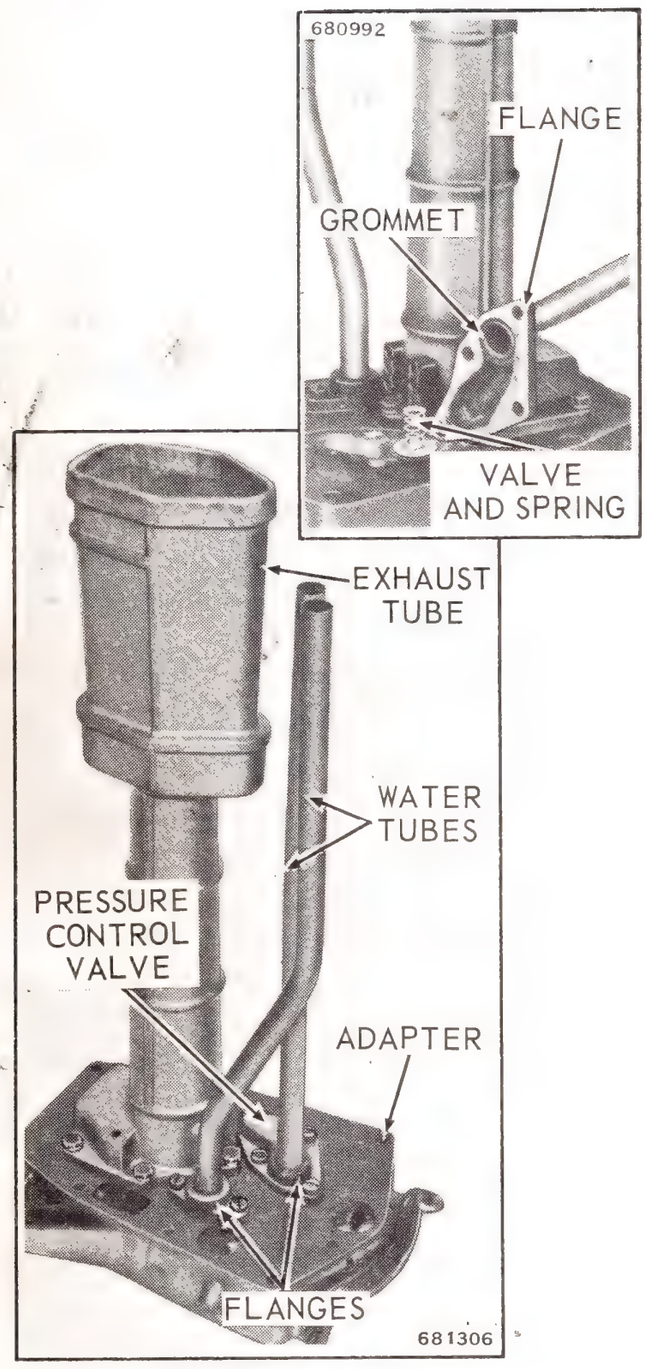


Figure 6-13. Inner Exhaust Tube, Water Tubes and Adapter

DISASSEMBLY OF STERN AND SWIVEL BRACKETS

a. Remove staked 1-1/2" nut from bottom of pivot and steering shaft assembly. See Figure 6-14. Withdraw shaft from lower bracket. NOTE: Shaft is splined to bracket. See Figure 6-15.

b. Upper and lower seals in swivel bracket may be driven out. Upper bronze bushing slides out.

c. Remove the thrust rod and retainer, and the thrust rod spring from the stern bracket. Remove screws attaching tilt levers to stern bracket.

d. Remove two screws fastening port and starboard stern brackets. Remove tilting shaft bolt, nut, and washers from top of stern brackets. See Figure 6-12.

DISASSEMBLY OF GEARCASE

a. Drain gearcase. Remove propeller nut, washers and propeller. Remove shift cable from clamps around pump housing. See Figure 6-16.

b. Remove four screws and slide impeller housing and impeller off of driveshaft.

c. Remove impeller drive key and impeller plate. Remove four upper driveshaft bearing housing screws.

d. Remove four screws, solenoid cover and wave washer. Disconnect shift cable leads. See Figure 6-18. Lift solenoids and plunger assembly from gearcase. See Figure 6-19.

e. Remove four bearing housing screws using a long 1/4" Allen wrench. Using a slide hammer with a hooked end, pull bearing housing from gearcase. See Figure 6-20.

f. Remove thrust washer and thrust bearing. See Figure 6-21.

g. Remove two Truarc rings using a Truarc pliers. See Figure 6-22.

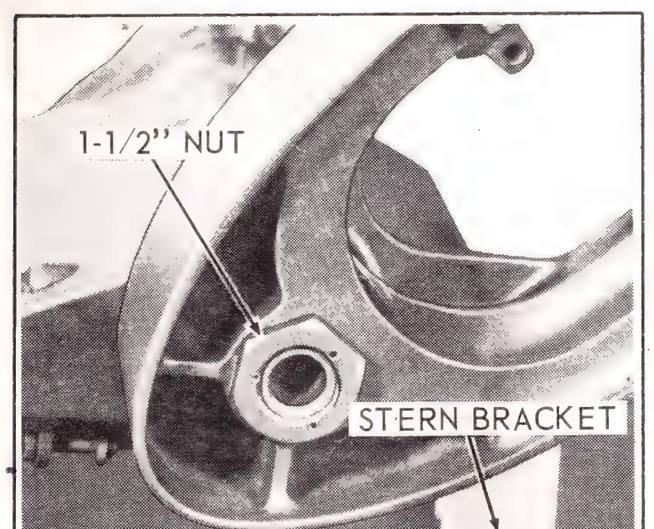


Figure 6-14. Pivot Shaft and Stern Bracket Assembly

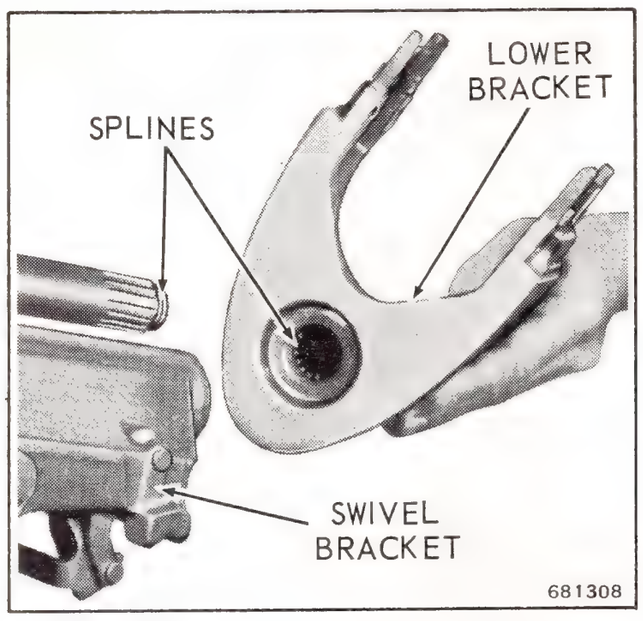


Figure 6-15. Pivot Shaft Splines

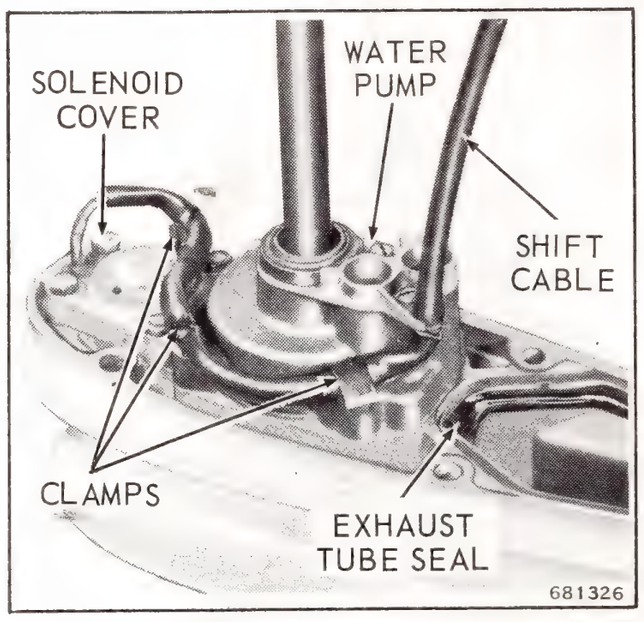


Figure 6-16. Shift Cable Clamps and Routing

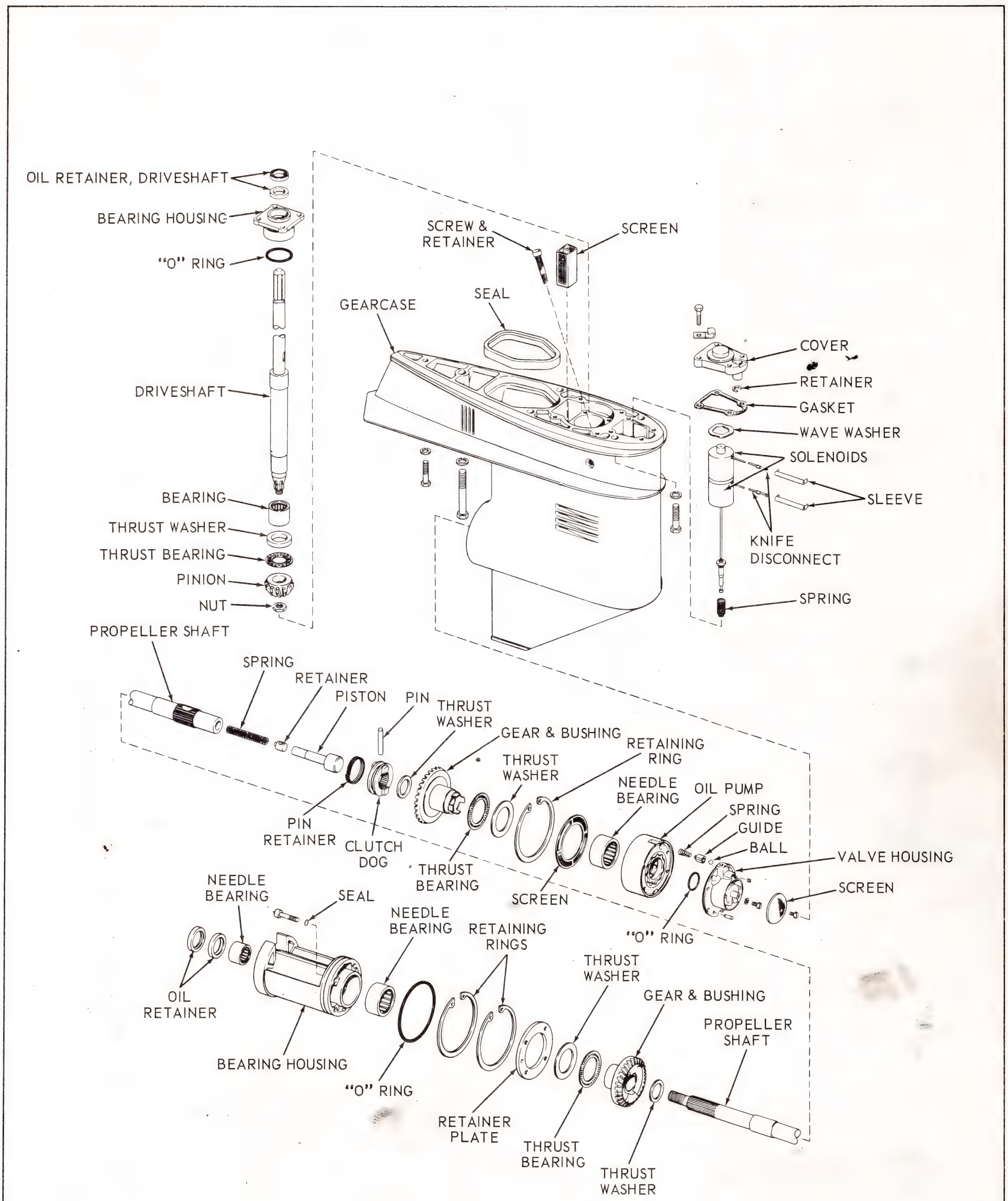


Figure 6-17. Gearcase Assembly

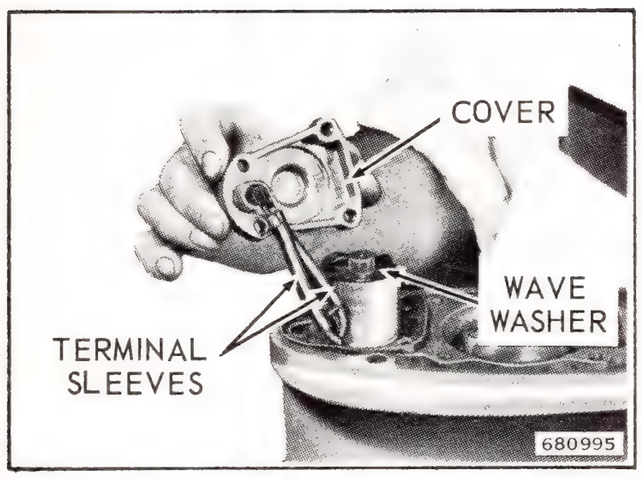


Figure 6-18. Shift Cable to Solenoid Lead Terminals

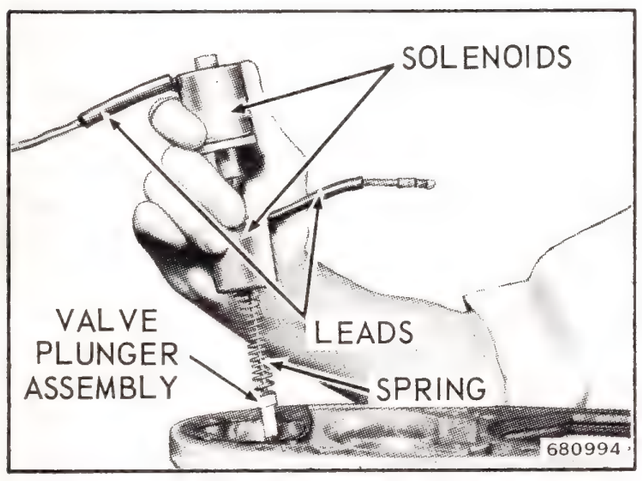


Figure 6-19. Solenoid and Valve Plunger Assembly

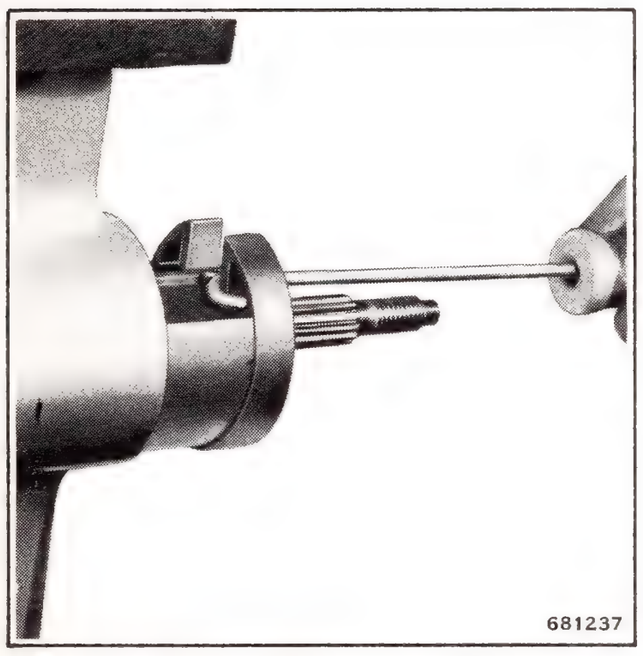


Figure 6-20. Removing Propeller Shaft Bearing Housing

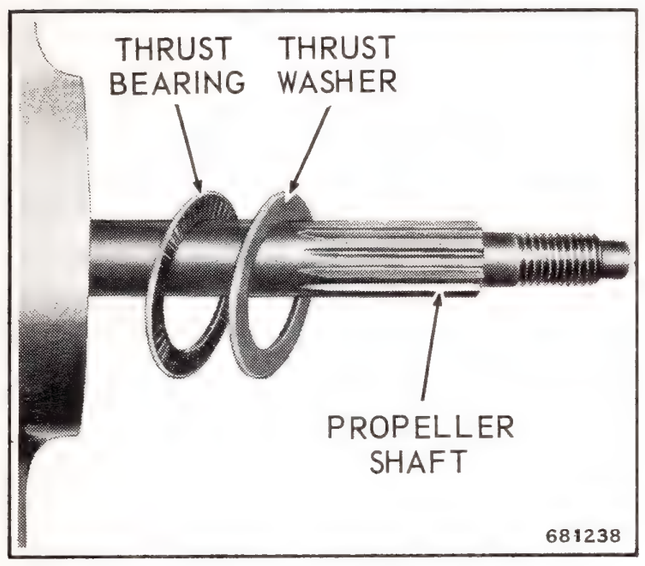


Figure 6-21. Thrust Washer and Bearing

h. Withdraw propeller shaft, retainer plate, reverse gear, thrust washer, and clutch dog. See Figure 6-23. Gear and bushing are an assembly.

i. Remove the pinion locknut from the bottom of the driveshaft by using Driveshaft Holding Socket (Special Tool #312752), Figure 6-24. With the locknut removed, remove pinion gear thrust bearing and washer. Pull the driveshaft out of the gearcase.

j. Remove forward gear.

k. Remove Truarc ring retaining pump housing with Truarc pliers. Remove screen. See Figure 6-17.

l. Remove oil pump from gearcase. See Figure 6-25.

m. If necessary remove lower driveshaft bearing. See Figure 6-26.

PROPELLER SHAFT BEARING HOUSING

Oil seals can be removed by driving them out. Bearings may be removed in the same manner, if necessary.

OIL PUMP

a. Remove piston from oil pump.

b. Remove screws and lockwashers, and lift cover from pump housing.

c. Remove screw and screen from cover.

d. Remove check valve and spring and pump gears. See Figure 6-27.

WATER PUMP HOUSING

Remove two screws and seal housing. Press out seal.

CLEANING, INSPECTION AND REPAIR

a. Clean all parts with cleaning solvent such as solvasol and dry with compressed air.

b. Discard all oil seals, "O" rings, and gaskets. Discard the upper pinion bearing, the upper driveshaft bearing, and the propeller shaft housing bearings if these have been removed.

c. Examine the rubber motor mounts and replace if deteriorated or damaged.

Figure 6-22. Remove Two Truarc Rings

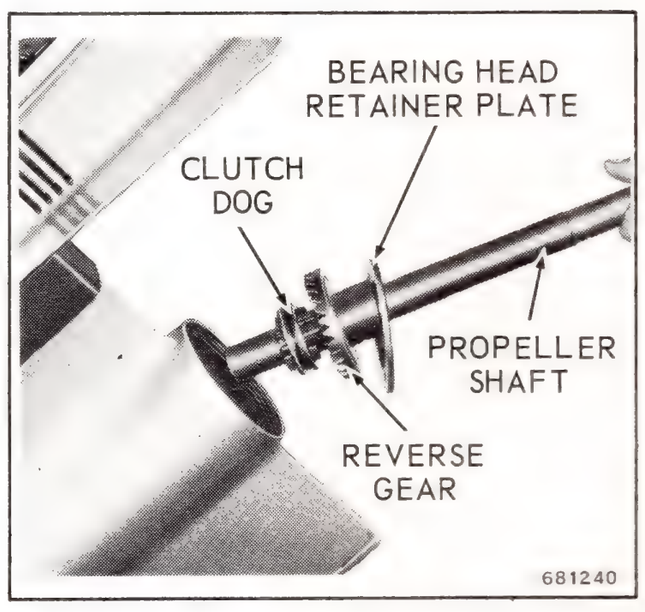


Figure 6-23. Removing Propeller Shaft

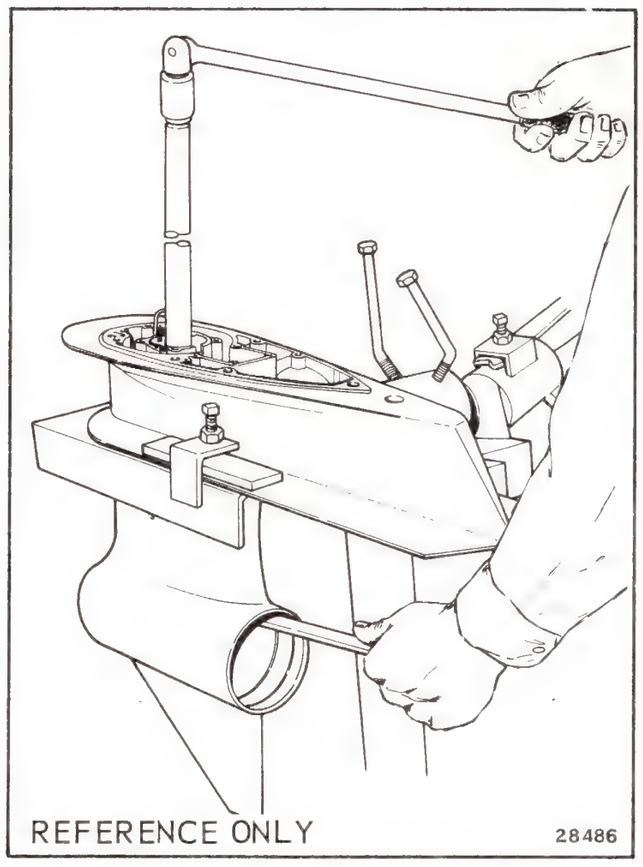


Figure 6-24. Remove Pinion Locknut

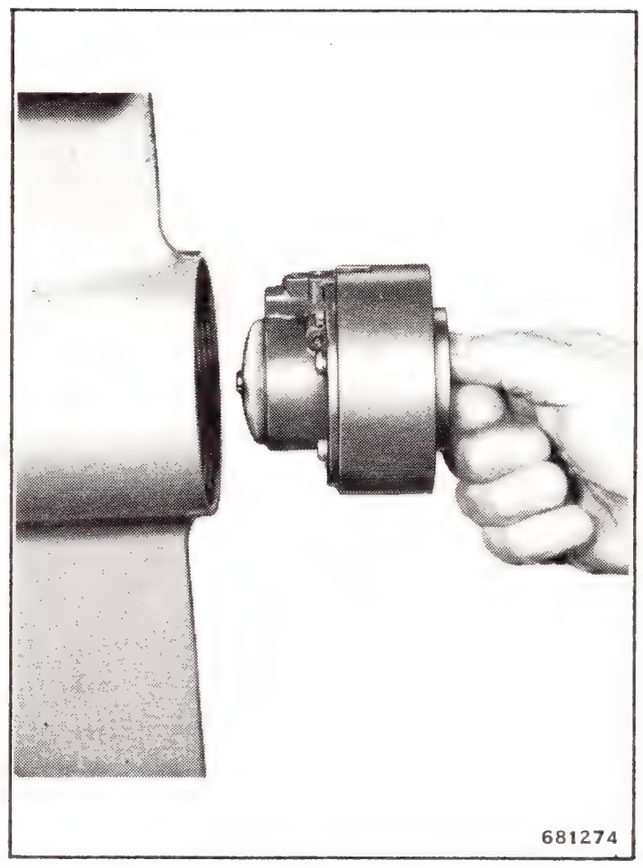


Figure 6-25. Removing Oil Pump

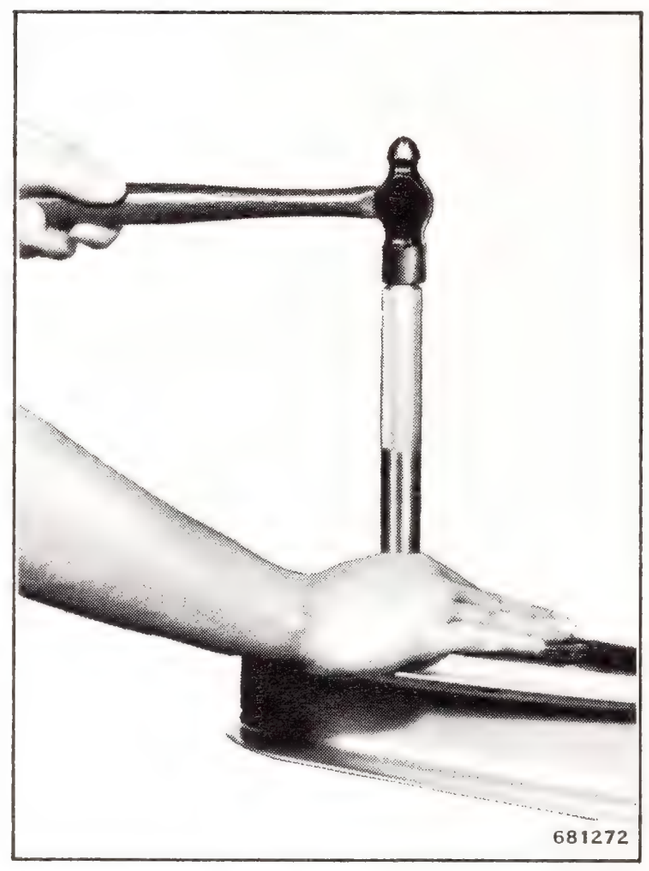


Figure 6-26. Remove Driveshaft Lower Bearing

d. Inspect driveshaft splines for wear. A lower unit bent from striking a submerged obstruction can cause extensive damage to driveshaft splines. Replace shaft if worn.

e. Inspect propeller for nicks, broken blades, and cracks. DO NOT attempt to weld cracked or broken propellers. Remove minor nicks with a file. Note that the aft side of the propeller is flat while the other side is rounded. File blades accordingly to retain shape. Check pitch on propeller pitch block. See Special Service Tool Catalog for proper fixture to check pitch of propeller. To straighten bent blades, use a piece of leather strap or belting under the part of the blade that touches the fixture. Rap high part of blade smartly with a No. 3 rawhide mallet. The leather allows a slight overbend to correct for the blade's tendency to spring back. See Figure 6-28.

f. Inspect gearcase for nicks on the machined surfaces. Remove nicks and re-surface faces on a surface plate. Start with Number 120 emery cloth and finish with Number 180 emery cloth. Re-surface and inspect exhaust housing in like manner. Replace if bent. Check parallelism on plate with a surface gage and scriber. A drill press table will also serve, using the spindle as a gage. See Figure 6-30. DO NOT attempt to straighten if bent; replace it.

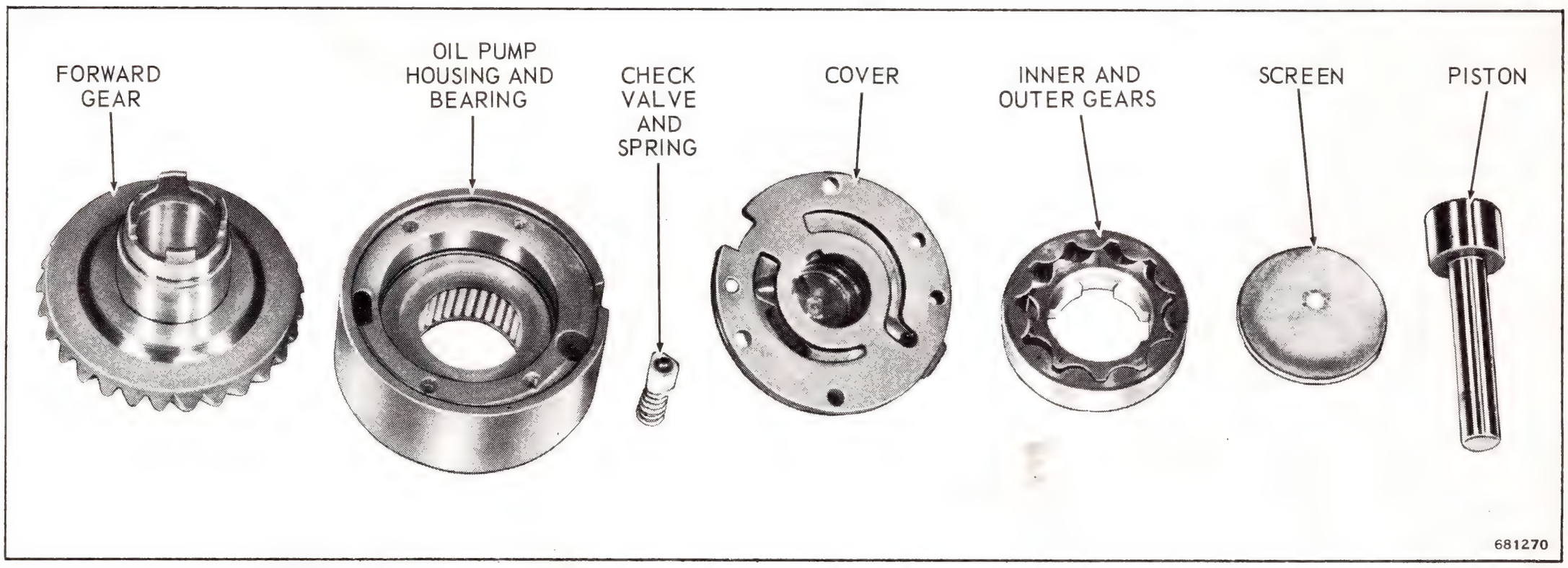


Figure 6-27. Oil Pump Disassembled

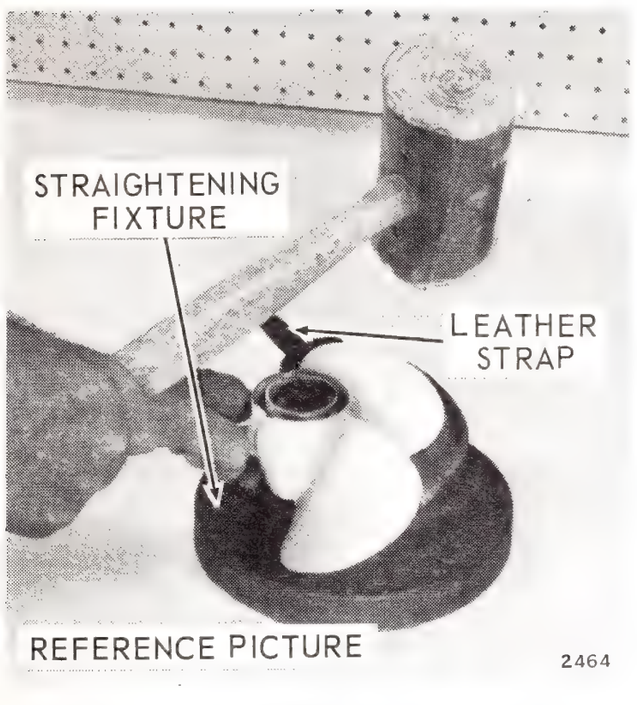


Figure 6-28. Re-pitching Propeller

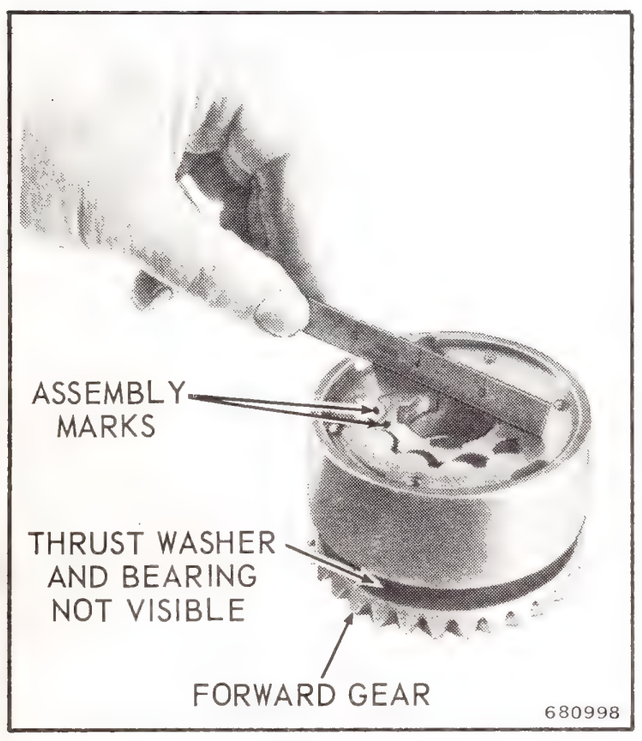


Figure 6-29. Checking Pump Gear Installation

NOTE

A bent exhaust housing may cause upper driveshaft splines to wear excessively, and may also damage crankshaft splines.

g. Inspect water tubes for obstructions or kinks which may restrict water flow.

h. Inspect water pump impeller and replace if vanes are damaged or worn excessively. Inspect pump housing for scoring and replace if damaged. Inspect impeller housing plate and replace if scored or pitted.

i. Check water intake screen and clean if plugged.

j. Check oil pump screen and clean if plugged.

k. Inspect drive gears, pinion gear, and thrust washers and bearings for wear. Replace if worn.

l. Wash needle bearings in solvent. Oil bearings immediately with clean light spindle oil to prevent rusting. Inspect bearings as described in Section 5, Power Head.

m. Check the solenoid coil windings and shift cable leads for continuity using an ohmmeter. Solenoid windings should read 5 to 6 ohms resistance on low ohm scale.

REASSEMBLY OF GEARCASE

a. If removed, install roller bearing in oil pump housing using bearing installer (Special Tool #314641). See Figure 6-31.

b. Install check valve in smaller end of spring and install in oil pump housing. See Figure 6-17.

NOTE

A mark is stamped on one side of both oil pump gears. Pump must be assembled so that both marks on gears are on the same side. See Figure 6-29.

c. Install pump gears in housing. See Figure 6-29. Surfaces of pump gears and pump housing must be parallel when forward gear, thrust bearing, and washer are installed. See Figure 6-29.

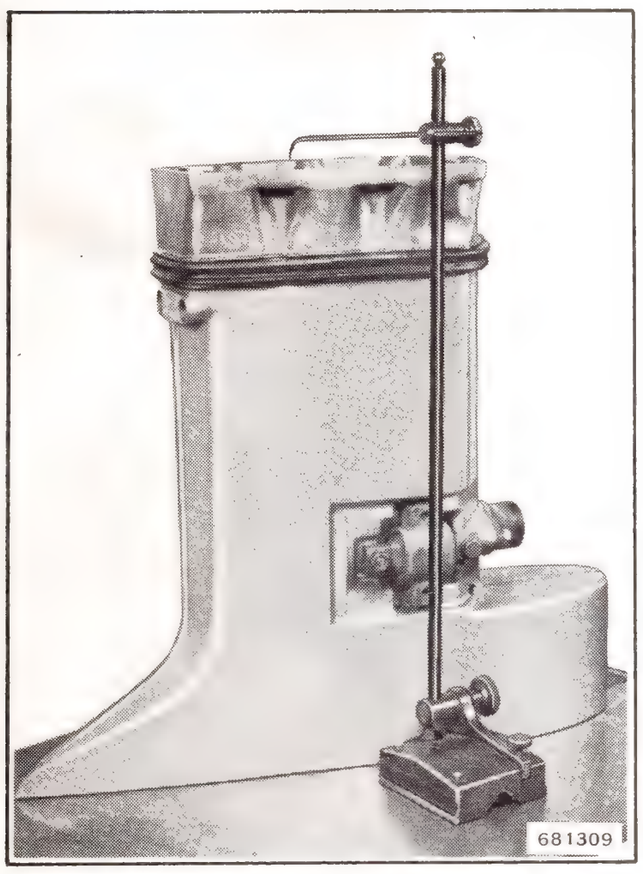


Figure 6-30. Checking Parallelism

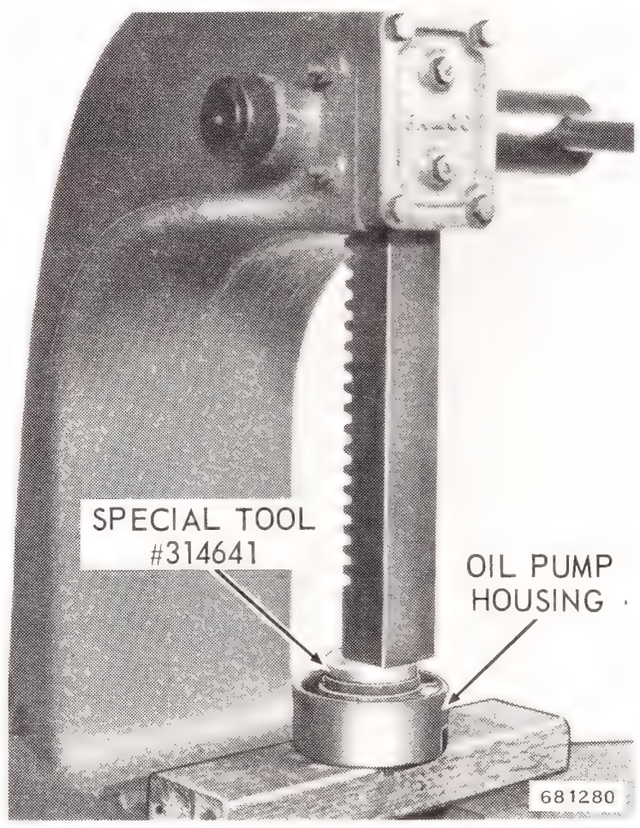


Figure 6-31. Installer Oil Pump Roller Bearing

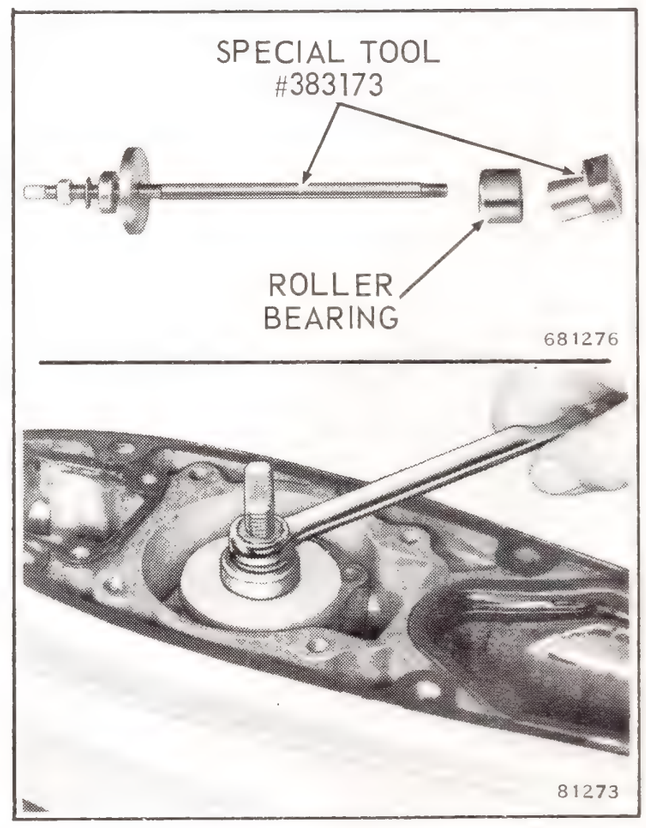


Figure 6-32. Installing Lower Driveshaft Bearing

d. Install pump cover, gasket and shaft and tighten screws to torque specified in Section 2.

e. Install screen on cover.

f. Note: Forward end of pump has a locating pin. Pump must locate in a pin hole in gearcase to be seated properly. Install pump in gearcase, locate on pin, and seat pump as far forward as it will go. Unless properly seated, solenoid plunger assembly will not fit into pump valve.

g. Install large screen against pump. Loops on screen face out. Install Truarc retaining ring FLAT SIDE TOWARD PUMP using Truarc Pliers.

h. Install lower driveshaft bearing using bearing installer (Special Tool #383173). See insert Figure 6-32. Place bearing on driver lettered side of case toward driver. Place bearing and driver in position in gearcase. Insert tool with large washer, bearing, washer, and nut through top of gearcase. Thread rod into driver. Using a wrench, tighten nut to draw bearing into gearcase.

i. Install thrust washer, bearing and forward gear as an assembly. See Figure 6-17.

j. Install driveshaft, thrust washer, bearing, and pinion gear using a driveshaft holding socket (Special Tool #312752). Torque nut to 40-45 foot-pounds.

k. If removed, install new bearings in propeller shaft bearing housing. For large bearing, use Special Tool #314641 (See Figure 6-34); for small bearing, use Special Tool #314642. See Figure 6-33. Install oil seals back to back (one seal lip facing out and one seal lip facing in) using seal installer (Special Tool #314643). See Figure 6-33.

l. If clutch dog has been removed from propeller shaft, install as follows. Insert spring and retainer in propeller shaft. Install clutch dog on shaft. Note "PROP END" marking on clutch dog. Depress spring and retainer and insert pin. Secure pin with retainer spring. See Figure 6-35.

m. Assemble reverse gear and propeller shaft bearing housing retainer plate to propeller shaft. Insert propeller shaft and components into gearcase. See Figure 6-36.

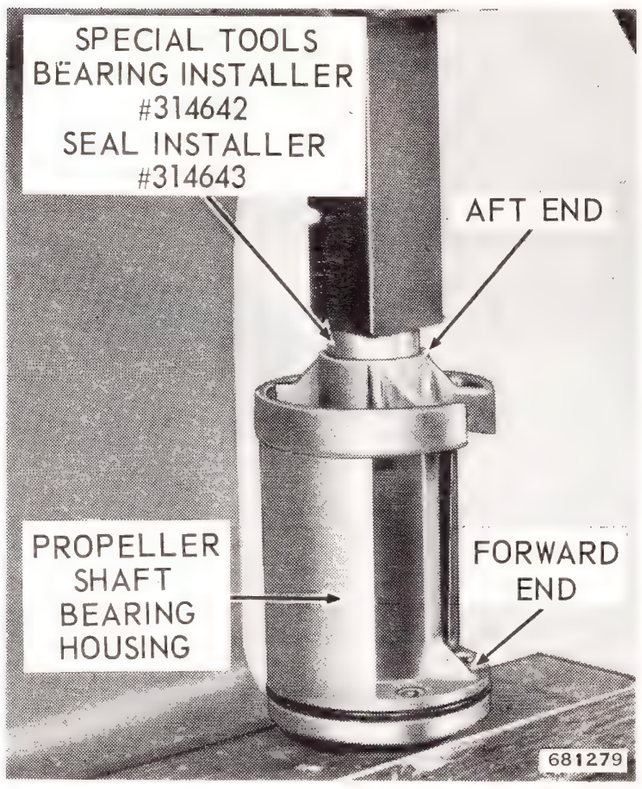


Figure 6-33. Installing Gearcase Head Aft Bearing and Seals

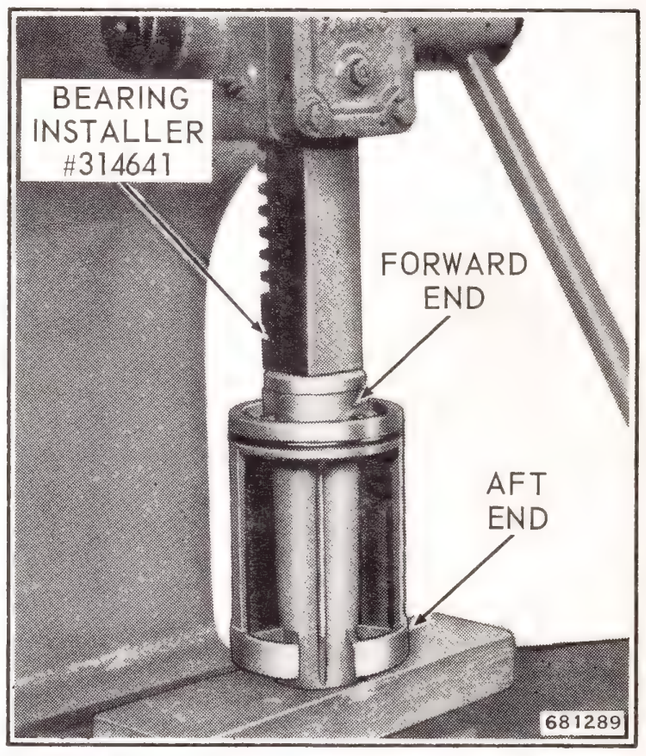


Figure 6-34. Installing Gearcase Head Forward Bearing Seals

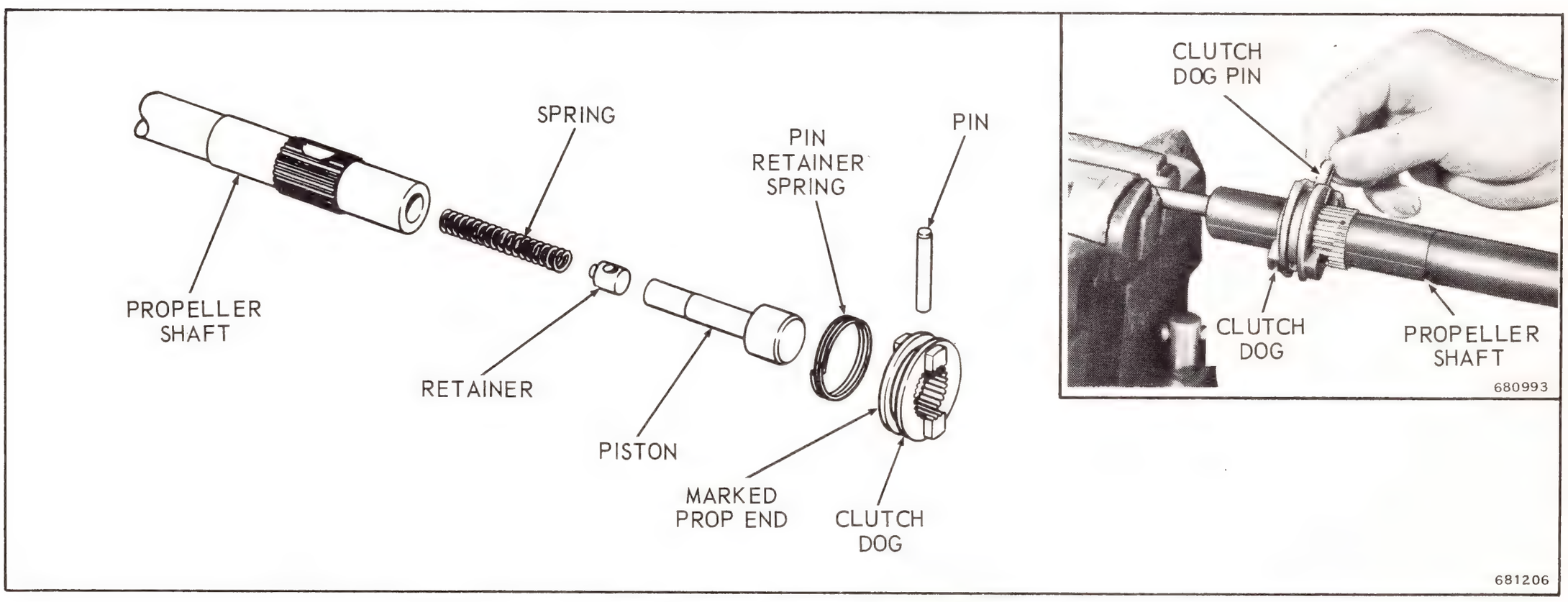


Figure 6-35. Clutch Dog, Pin and Spring

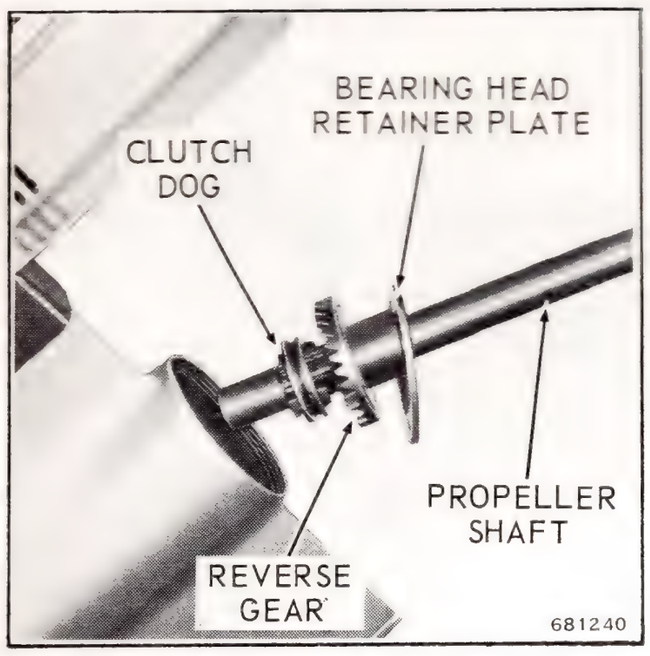


Figure 6-36. Installing Propeller Shaft

n. Install two Truarc rings in gearcase using Truarc pliers.

o. Install thrust bearing and thrust washer on reverse gear. See Figure 6-17.

p. Install propeller shaft bearing housing with bottom marking down (see Figure 6-17) and secure with four Allen screws dipped in Perfect Seal #4. Tighten to torque specified in Section 2.

q. Install new seal in driveshaft bearing housing using seal driver (Special Tool #314640). Install new "O" ring on housing.

r. Install driveshaft bearing housing with screws dipped in Perfect Seal #4 and tighten to torque specified in Section 2.

s. Install solenoid assembly, making certain plunger valve enters oil pump body. DO NOT FORCE. See Figure 6-19.

t. Apply perfect seal #4 to both sides of solenoid cover gasket and place on gearcase. Connect shift cable leads and slide sleeves over terminals. Position leads down in gearcase, place wave washer on top of solenoid, and install solenoid cover.

u. Apply Sealer 1000 to bottom edge of impeller plate and install plate. Insert impeller drive key in driveshaft.

v. Install new oil pump seal in impeller housing cover. Insert water tube extension in pump and new grommets. Attach cover to impeller housing.

w. Install impeller over key in driveshaft with either side up if installing a new impeller.

x. Install pump housing using seal protective sleeve. Oil impeller blades and rotate driveshaft clockwise while sliding housing over impeller. Secure pump housing with screws dipped in Perfect Seal #4 and tighten to torque specified in Section 2. Route shift cable around water pump and secure in clamps. See Figure 6-16.

y. Lubricate propeller shaft and install propeller. See Figure 6-37.

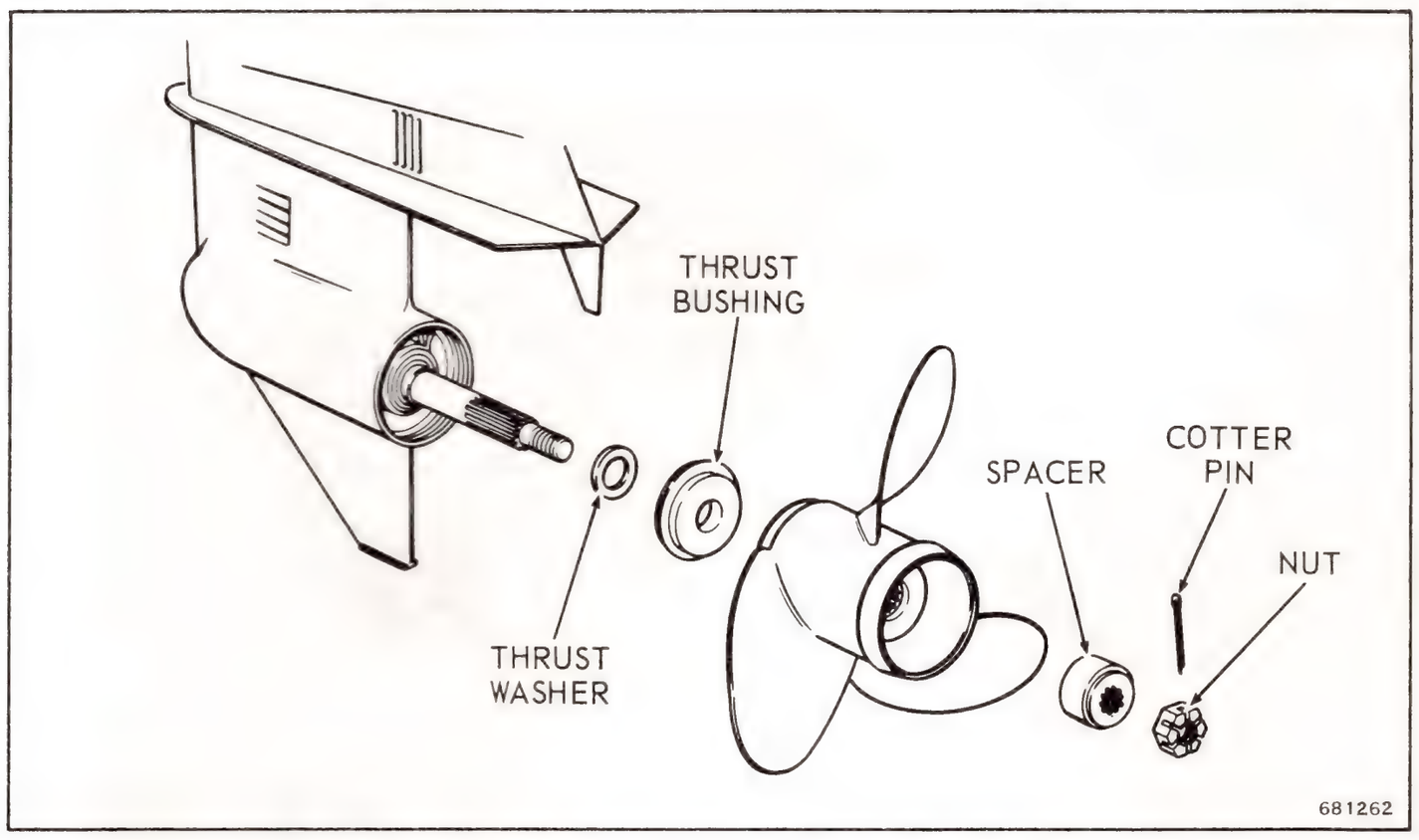


Figure 6-37. Propeller Installation

REASSEMBLY OF STERN AND SWIVEL BRACKETS

a. Install pivot shaft bushing and new seals.

b. Assemble stern bracket to swivel bracket.

c. Assemble pivot shaft and steering arm to swivel bracket. Arm faces forward and lower clamp bracket faces aft. Install nut, tighten securely, and stake. See Figure 6-14.

REASSEMBLY OF EXHAUST HOUSING AND ADAPTER

a. If removed, install water tubes and water pressure control valve, using new grommets. Be sure tubes are aligned properly with water pump.

b. Apply Perfect Seal #4 to faces at exhaust housing and adapter. Using a new gasket, install adapter assembly to exhaust housing. Dip screws in Perfect Seal #4 and tighten to torque specified in Section 2.

c. Install exhaust housing and adapter assembly to swivel bracket, and tighten all screws to torque specified in Section 2.

d. Attach lower motor cover to adapter.

e. Install power head as described in Section 5.

INSTALLATION OF GEARCASE

a. Place "O" ring on driveshaft. Apply Perfect Seal to both sides of gasket and position on gearcase.

b. Slide plastic guides just on to end of water tubes in exhaust housing.

c. Apply oil or liquid soap to upper end of shift cable sleeve.

d. Insert a length of wire with terminals through shift cable hole in adapter and attach to gearcase shift cable terminals.

e. Carefully install gearcase making sure water tube guides guide tubes into pump grommets while pulling shift cable through exhaust housing and adapter assembly. Rotate flywheel clockwise to align driveshaft and crankshaft splines.

f. Dip screws in Perfect Seal #4 and tighten to torque specified in Section 2.

g. Install trim tab and align with scribe marks made at disassembly.

h. Connect shift cable leads and install rear exhaust cover.

i. Fill gearcase with OMC Type "C" lubricant. See Figure 6-38.

j. Touch up finish with spray enamel in a matching color.

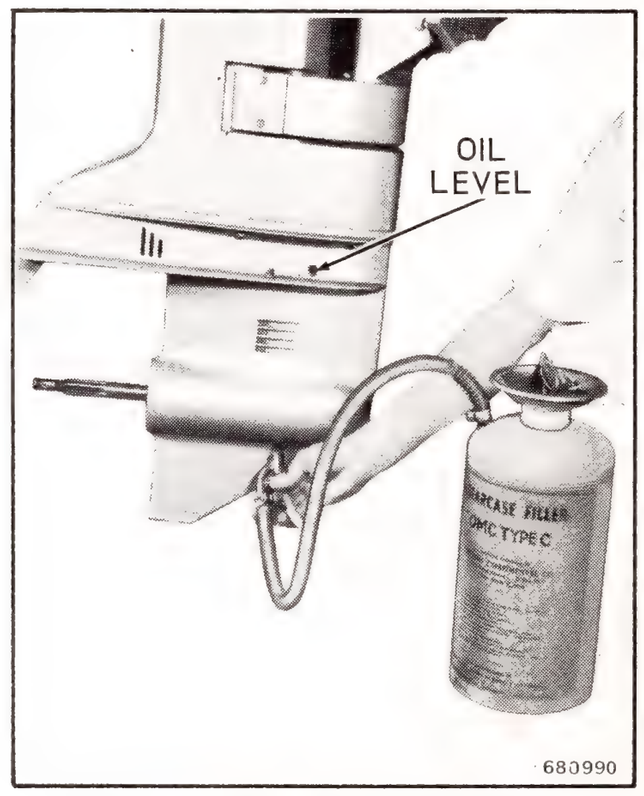


Figure 6-38. Gearcase Tube

TRIM TAB ADJUSTMENT

If replacing trim tab, a running adjustment may be required to achieve best steering results. If boat steers hard to starboard, adjust trim tab to port. If boat steers hard to port, adjust tab to starboard. See Figure 6-39.

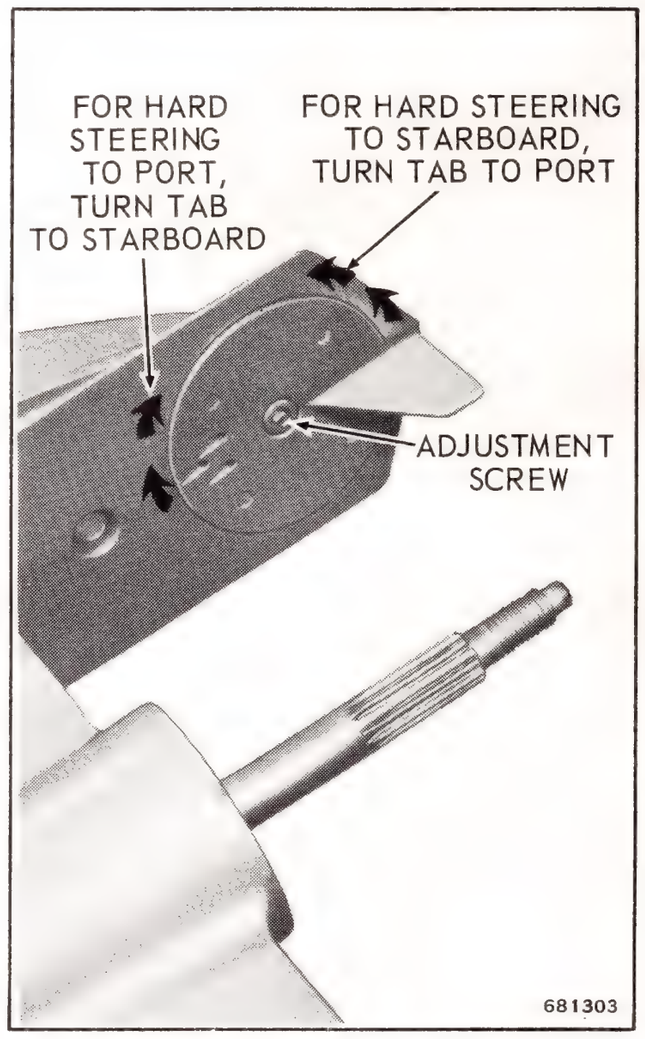


Figure 6-39. Trim Tab Adjustment

SECTION 7
ELECTRICAL SYSTEM

TABLE OF CONTENTS

DESCRIPTION

The complete electrical system is made up of the ignition system, the starter system, the alternator charging system, and the storage battery. Also included are the instrument and cable group. See Figure 7-1. This section will cover the starter system and the charging system, and battery maintenance.

TROUBLESHOOTING THE ELECTRICAL SYSTEM

Trouble in the electrical system often is first evidenced by failure of the starter to operate, and may be caused by failure of any one or more of the components covered in this section. If the ammeter does not indicate charging with the engine running, or if the battery fails to retain enough charge to consistently start the engine, the first things to check are the condition of the battery, polarity of the battery, and electrical connections throughout the circuit. A large percentage of electrical circuit as well as component failures are caused by loose or dirty electrical wiring connections, especially in the starter circuit. Battery maintenance and charging system troubleshooting are covered below. Starter system troubleshooting is included in the Trouble Check Chart in Section 2.

BATTERY SPECIFICATIONS

For best performance, we recommend a 12-volt, 60 ampere hour battery, or better, with a minimum of 2 minutes cold starting capacity at 300 amperes discharge, zero degrees Fahrenheit, and a 10 second voltage reading of 7.5 volts.

The important thing to remember is that a customer's complaint about poor electric starting may be traceable to a battery with specifications not conforming to these recommended specifications.

CAUTION

Correct battery polarity is extremely important. The battery MUST be connected so its negative (-) post is connected to ground. If the positive (+) post is connected to ground, the rectifier diodes may be damaged.

BATTERY TESTING

The condition of the battery cells may be checked quickly and accurately by the following "light load test" procedure. See Figure 7-2.

a. Before starting the test, add water as necessary to bring the electrolyte to the proper level.

b. Place load on battery by holding starter switch on for 3 seconds. It makes no difference whether starter turns engine or not. However, if engine starts, turn off ignition to stop engine immediately.

c. Turn on an 8 to 10 ampere load by turning ignition switch to "ON" position and turning on lights or other accessories. After 1 minute, with 8 to 10 ampere load still on, read individual cell voltages of battery with voltmeter having .01 volt scale division.

NOTE

After testing, close openings made in sealing compound by the probes of the voltmeter.

If any cell reads 1.95 volts or more, and the difference between the highest and lowest cell is less than .05 volt, battery is good and sufficiently charged.

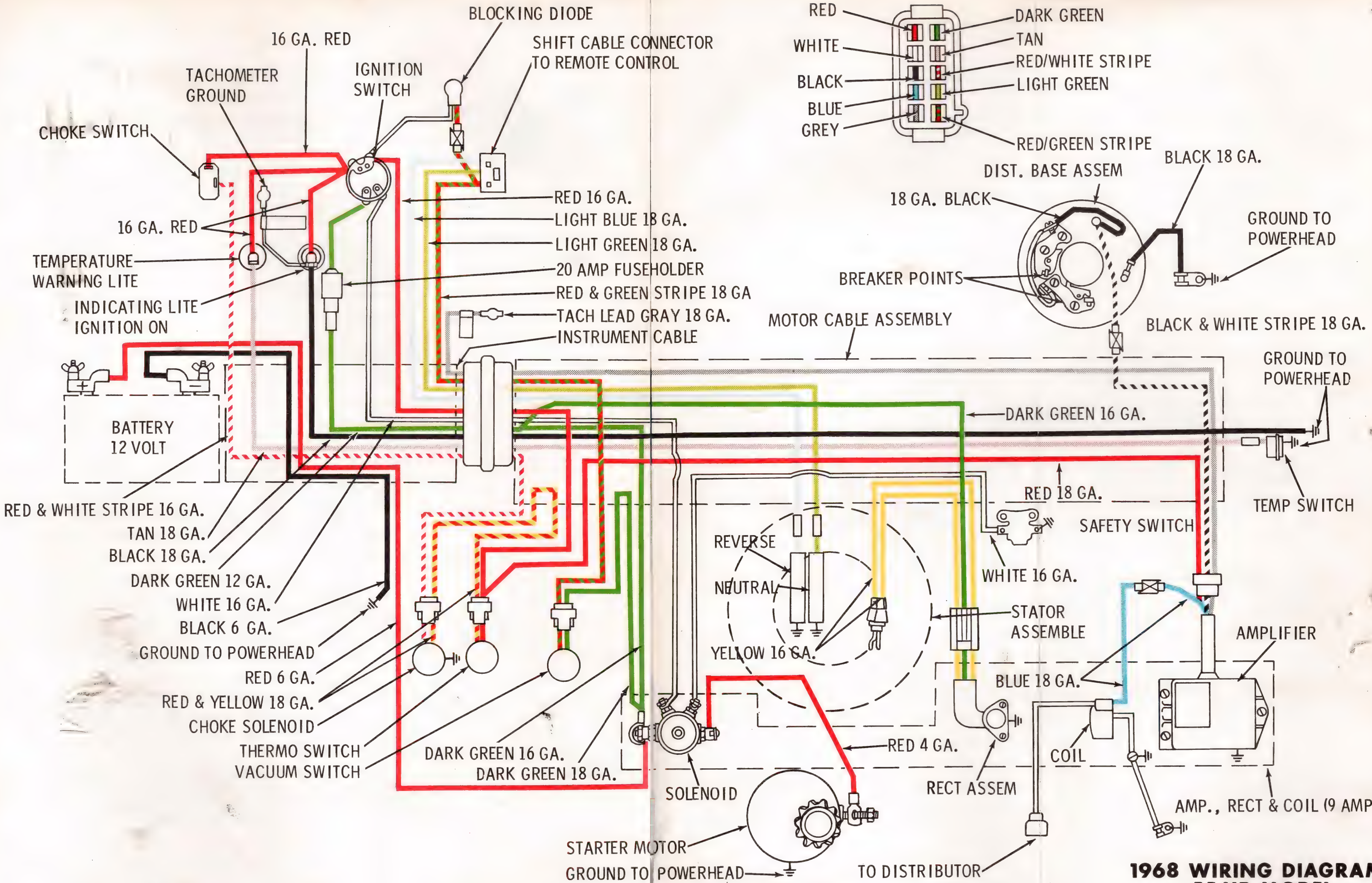


Figure 7-1. Electrical System Schematic

1968 WIRING DIAGRAM
55 HP MODEL

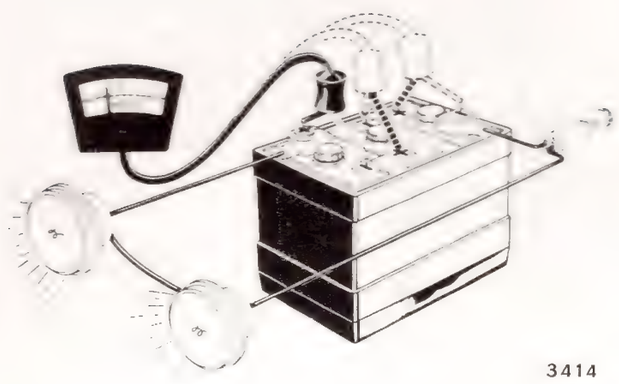


Figure 7-2. Light Load Test

If cell readings are both above and below 1.95 volts and the difference between the highest and lowest reading is less than .05 volt, the battery should be fully recharged for good performance.

If any cell reads 1.95 volts or more but there is a difference of .05 volt or more between the highest and lowest cell, the battery should be replaced.

If the reading for all cells is less than 1.95 volts, the battery is too low to test properly; however, this does not necessarily indicate a defective battery. A battery in this condition should be boost charged but not fully charged at this time, and the "light load test" repeated using the 8 to 10 ampere load during the test.

If the battery is found to be good after boosting, it should be fully recharged before returning it to service. If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after second boost charge should be replaced.

BATTERY CHARGING

Boost charge 12-volt batteries at 50 amperes for 20 minutes (1000 ampere minutes). If the charger will not give this rate, charge for an equal number of ampere minutes at best rate available. DO NOT boost battery more than this amount for the "light load test".

If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125° F., or when gassing becomes excessive. Failure to do so may harm the battery.

If the battery is to be slow charged, adjust electrolyte to proper level by adding water, then charge the battery at 5 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three intervals of one hour and all cells are gassing freely. Plenty of time must be allowed for slow charging. Charge periods of 24 hours or more are often required.

BATTERY CARE

The battery should be kept charged at all times. The state of charge should be checked by making specific gravity readings with a battery hydrometer. It is suggested that specific gravity readings and checking for replacement of water be made every two weeks. If the battery has been standing for 30 days, it should be recharged before being placed into service to assure reliable starting. Charge battery up to the specific gravity recommended by the battery manufacturer.

The specific gravity of the battery electrolyte should be checked with a battery hydrometer, preferably one that has a built-in thermometer and correction chart. No other method should be used to determine the charge condition of a battery. Note also that a hydrometer reading is not accurate if water has been recently added, due to the fact that the water has not had a chance to mix with the electrolyte.

The proper water level should be maintained at all times. If water is added in freezing weather, the battery should be charged to full charge at once. Only pure distilled water or water approved for battery use should be added to the battery to replace water lost through evaporation. Never add acid except when acid has been lost by spilling.

Install the battery near the motor. For mounting the battery, use a frame securely fastened to the boat. A loose battery may shift in the boat, damaging itself or other equipment. Tighten hold-down nuts evenly until battery is secure. If hold-down nuts are too tight, distortion and damage to battery case will result.

CAUTION

Correct battery polarity is extremely important. The battery MUST be connected so its negative post (-) is connected to ground. If the positive post is connected to ground, the rectifier diodes will be damaged.

STARTER SYSTEM

DESCRIPTION

The electric starting system consists of the starter motor, starter and choke switches, starter and choke solenoids, safety switch, and the necessary cables and wires with their connectors. The starter motor supplies cranking power to the motor, converting electrical energy from the battery into mechanical power which is transmitted through the drive pinion gear and the flywheel ring gear. The starter switch controls the operation by activating the starter solenoid which makes and breaks the circuit between the battery and starter motor.

The starter solenoid closes the circuit through a movable contact disc which strikes two terminal contacts that are connected to the starter motor circuit. The solenoid winding contains many turns of wire which, when energized by the starter switch, exert a magnetic pull on the solenoid plunger, causing it to move the contact disc against the terminal contacts. See Figure 7-3. The operation of the choke solenoid is basically the same except that it activates the choke valve through a spring. Operation of the choke solenoid is discussed in detail in Section 3, Fuel System.

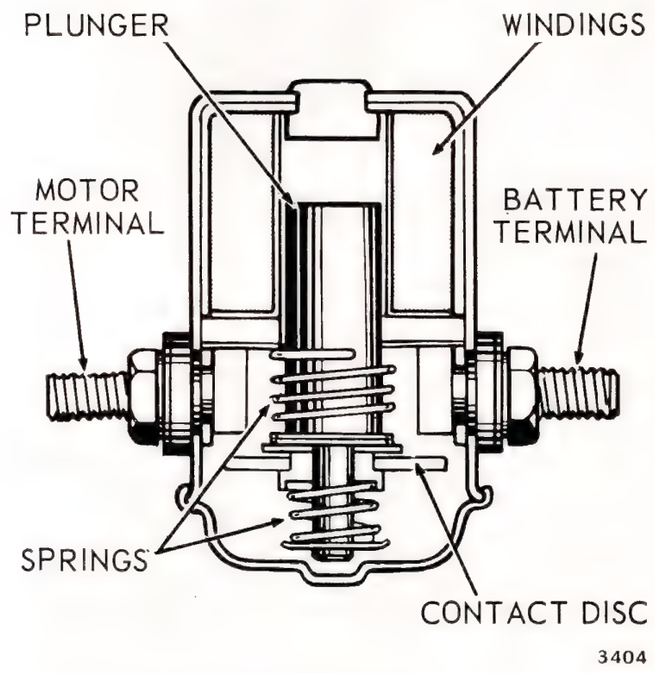


Figure 7-3. Starter Solenoid

The starter motor drive pinion is disengaged when at rest and is made to mesh with the flywheel ring gear by the rotation of the starter motor armature. After the motor has started, the starter pinion is driven faster than the starter motor shaft and moves down the screw shaft out of mesh with the flywheel. See Figure 7-4.

The safety switch opens the starter circuit, preventing accidental engaging of the starter motor, whenever the throttle lever is set beyond start position. The switch is operated by a plunger which rides on a cam on the distributor base. Adjustment of the safety switch is covered in Section 4, Ignition.

REMOVAL OF STARTER

Due to the construction of the starter motor, maintenance operations are generally limited to periodic checking for looseness of mounting. Unless it is certain that the starter motor requires attention, do not remove it for overhaul. A thorough check should be made of the battery, cables, starting solenoid, and switch as outlined in the Trouble Check Chart in Section 2. Check the starter motor by using the no load test. With 10.0 volts applied to the starter motor, maximum current should be 60.0 amperes and minimum speed should be 8000 rpm. See Figure 7-5. Remove starter motor for test as follows:

a. Disconnect lead from starter motor.

b. Remove air silencer as described in Section 3.

c. Remove three starter mounting screws. See Figure 7-6.

DISASSEMBLY OF STARTER

a. Remove two thru-bolts from starter motor.

b. Remove retaining ring, sleeve, spring, and pinion gear.

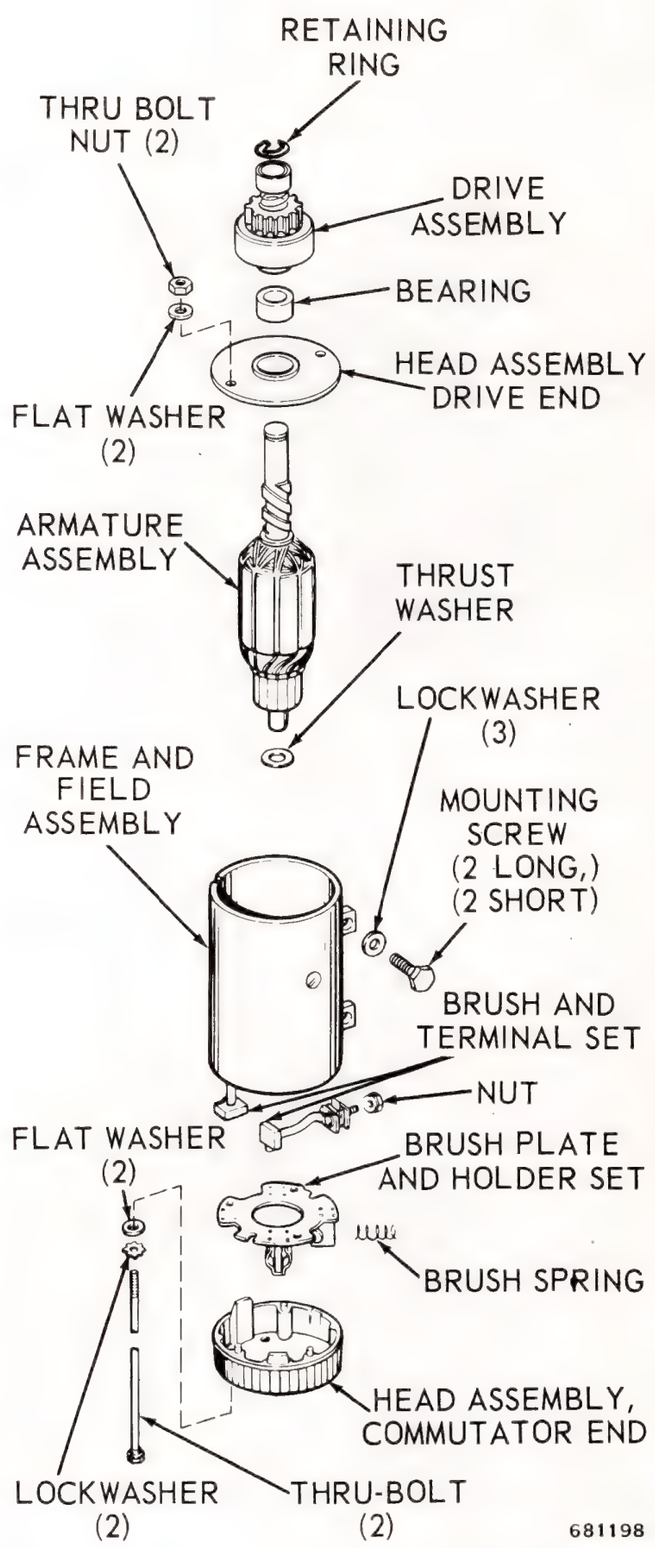


Figure 7-4. Starter Components

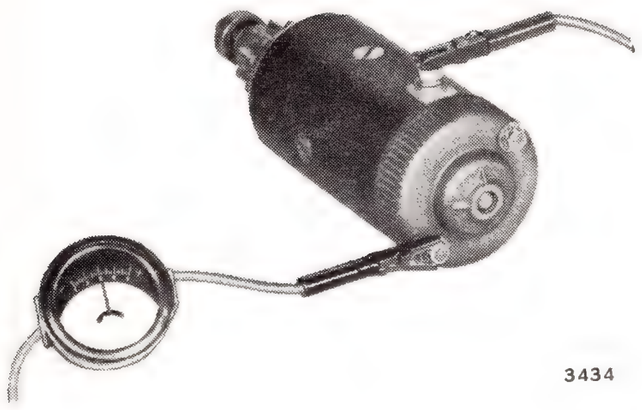


Figure 7-5. Starter Motor Test

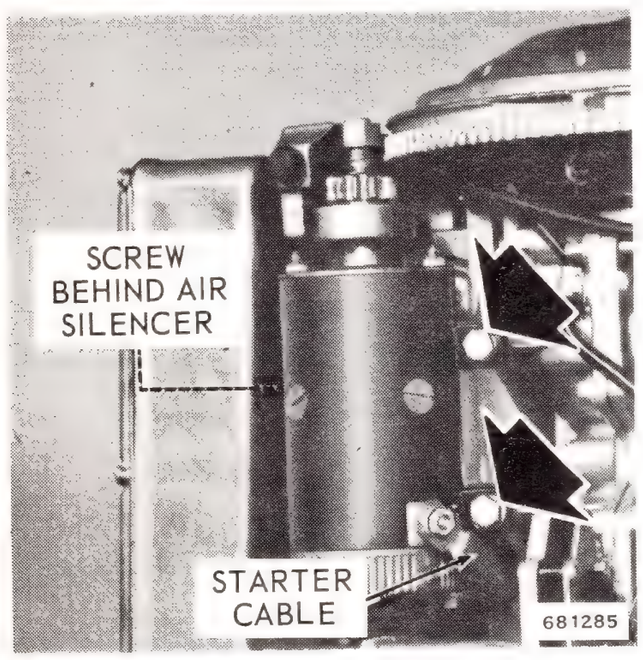


Figure 7-6. Location of Starter Screws

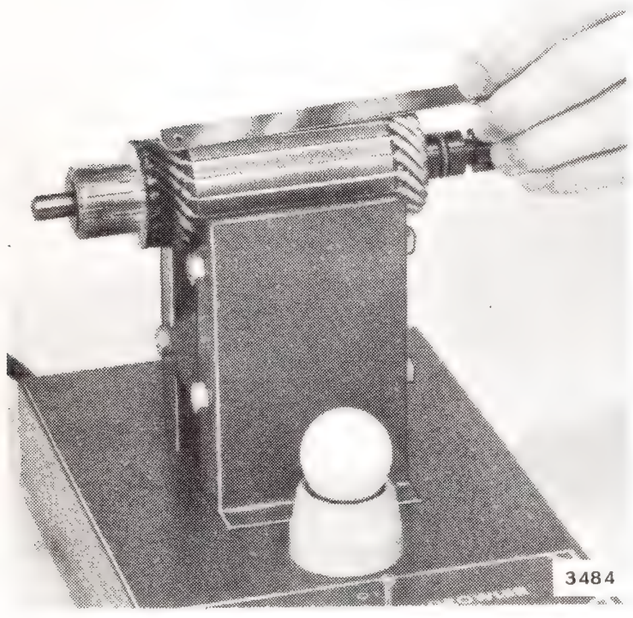


Figure 7-7. Checking Armature on a Growler

Figure 7-8. Checking Armature for Grounding

c. Remove drive end head, taking care to avoid damaging bearing in head.

d. Remove commutator head by tapping lightly with a rubber mallet. Remove brushes and spring from holder. Lift armature from frame and field assembly. See Figure 7-4.

CLEANING, INSPECTION AND REPAIR

a. Inspect the brushes; replace if one-half worn, damaged, or cracked. Replace brush springs if weak.

b. Clean commutator with Grade 00 sandpaper. If commutator surface is unevenly worn or pitted, turn on a lathe. Remove any trace of oil from commutator.

c. Check the armature on a growler for shorted turns. See Figure 7-7. Check armature for grounding by using a test light or meter. See Figure 7-8. Inspect armature insulation for indications of overheating or damaged windings. Clean off any deposits of carbon or foreign matter which may contribute to later failure of the windings.

d. Using a test light, check field windings for continuity between field brush lead and frame of motor (ground). See Figure 7-9.

e. DO NOT clean the starter drive assembly while the starter motor and drive are installed on the power head. The cleaning agent will drain into the starter motor, washing dirt from the drive into the starter bearings, commutator, etc. After disassembling the drive, clean each part with a grease solvent and inspect for wear or distortion.

f. If the pinion does not properly engage the flywheel, the pinion and screw shaft assembly may be worn distorted, or dirty. Locate cause of binding and correct before completing assembly.

g. The starter solenoid is a sealed unit and is serviced only as an assembly. To test the solenoid, operate the starter switch, or apply 12 volts from a separate battery. See Figure 7-10. The solenoid plunger should give an audible click as it operates. The solenoid must be replaced as a unit if defective.

REASSEMBLY OF STARTER

a. Lubricate the armature shaft and drive screw threads each with one drop of SAE No. 10 oil. This lubrication should be very light as the oil may capture dust and form a gum, restricting the operation of the drive.

b. To facilitate reassembly of the starter motor, insert brushes and brush spring in holder, and tie in place with fine wire or string. Assemble brush holder and armature to frame and field assembly, and remove string or wire. See Figure 7-11.

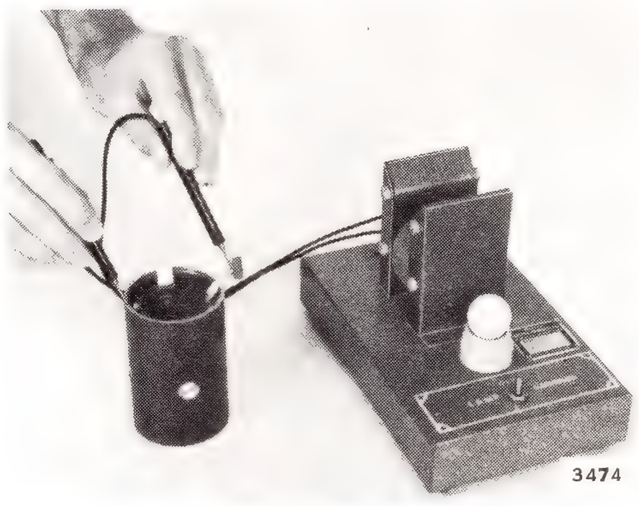


Figure 7-9. Checking Field Continuity

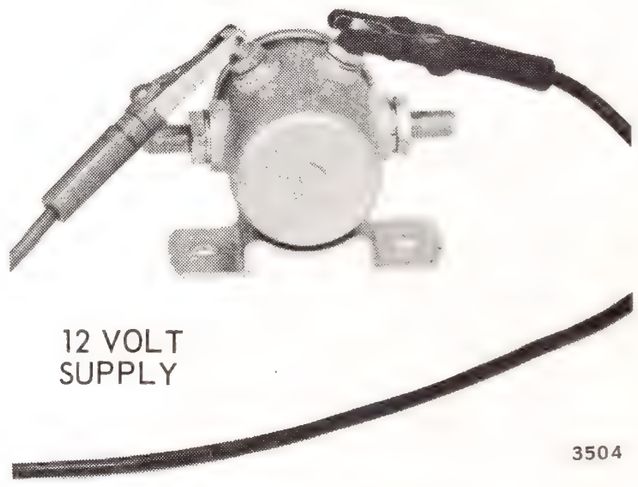


Figure 7-10. Checking Solenoid Coil

c. Replace commutator and drive end heads and secure with thru-bolts, washers, and nuts to complete starter motor assembly.

d. Check starter motor with no load test. With 10 volts applied to the motor terminals, maximum current should be 60.0 amperes and minimum speed should be 8000 rpm. See Figure 7-5.

INSTALLATION OF STARTER

a. Place starter in position against crankcase, and attach three screws.

b. Reconnect starter motor lead.

c. Reinstall air silencer as described in Section 3.

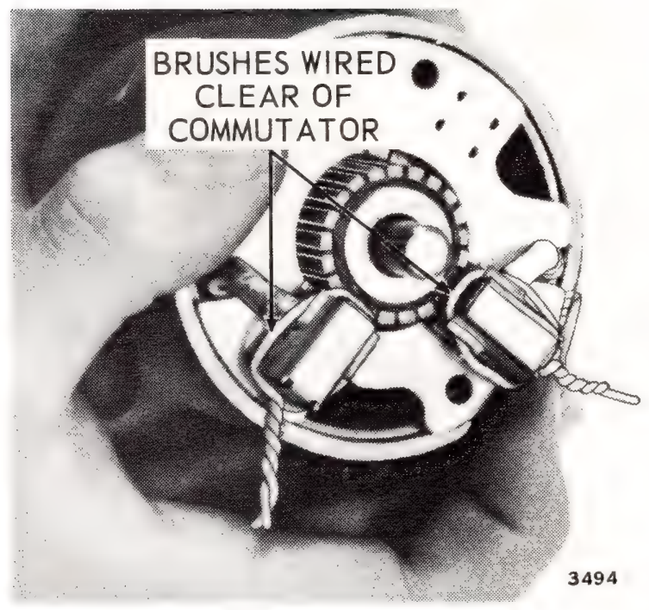


Figure 7-11. Reassembling Starter

9 AMPERE ALTERNATOR CHARGING SYSTEM

DESCRIPTION

The charging system consists of the alternator, the rectifier diodes which change the alternating current output of the alternator to direct current, and the battery itself.

The alternator is made up of two parts - the flywheel with cast-in magnets, and the stator assembly which is bolted to the crankcase. The stator assembly is made up of a circular field winding and 12 coils wound over a laminated iron core. Around this assembly the flywheel turns, inducing alternating current in the coils.

The rectifier assembly converts the alternating current to direct current. The rectifier is mounted on the amplifier bracket. See Figure 7-12.

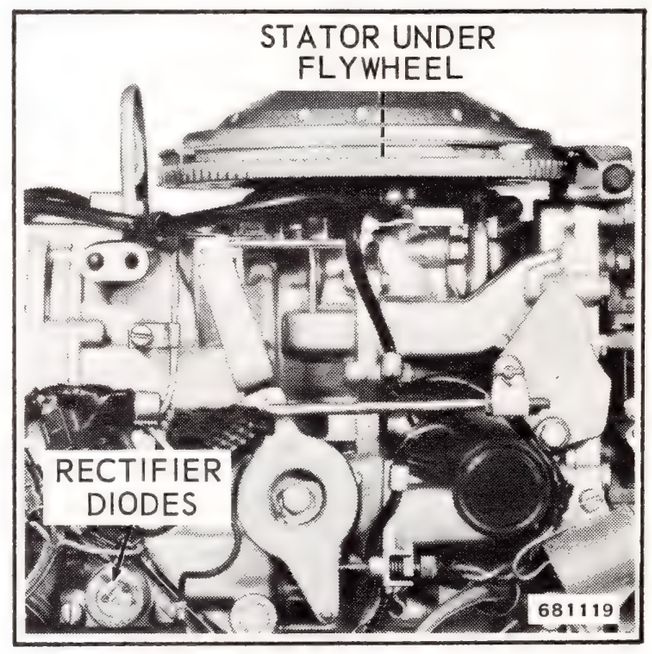


Figure 7-12. Charging System Components

TROUBLESHOOTING THE CHARGING SYSTEM

Failure in the charging system will usually show up when the battery becomes undercharged. To determine the cause of trouble, check first the condition of the battery, and electrical connections throughout the circuit. A visual inspection may be all that is required to locate the trouble. Check the following before proceeding with electrical testing.

CAUTION

Disconnect battery leads before tightening or changing connections on dash instruments or any part of the charging circuit.

a. Battery. See "Battery Testing", "Battery Care", and "Battery Maintenance" in this Section.

b. Wiring. Check for corroded or loose connections, and check and tighten all connections. Check for worn or frayed insulation.

c. Check battery polarity. CHECK FOR DAMAGE TO RECTIFIER DIODES as described under "Checking Rectifier Diodes".

d. Electrical load. Excessive electrical load from too many accessories will run battery down.

If a visual inspection of the electrical system shows all components to be in good condition, an electrical inspection will be necessary to determine which component of the charging system is the cause of trouble. See Figure 7-13.

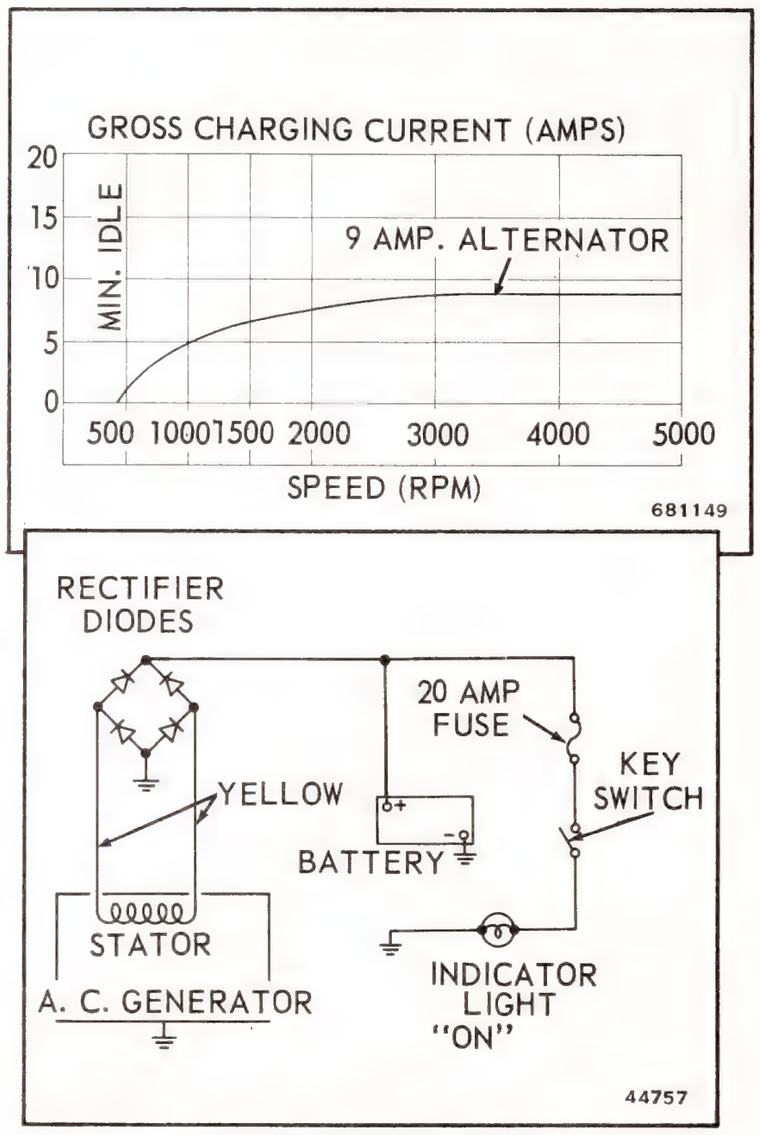
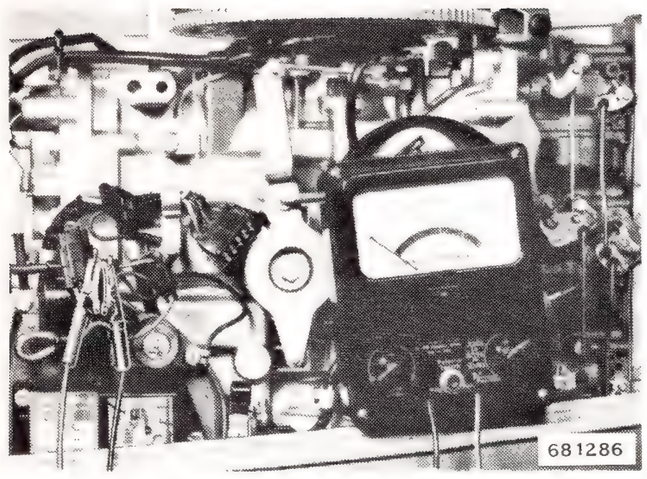


Figure 7-13. Charging System Schematic

CHECKING RECTIFIER DIODES

To check the diodes, place test meter in the "HI" ohms position. This is basically a continuity test.



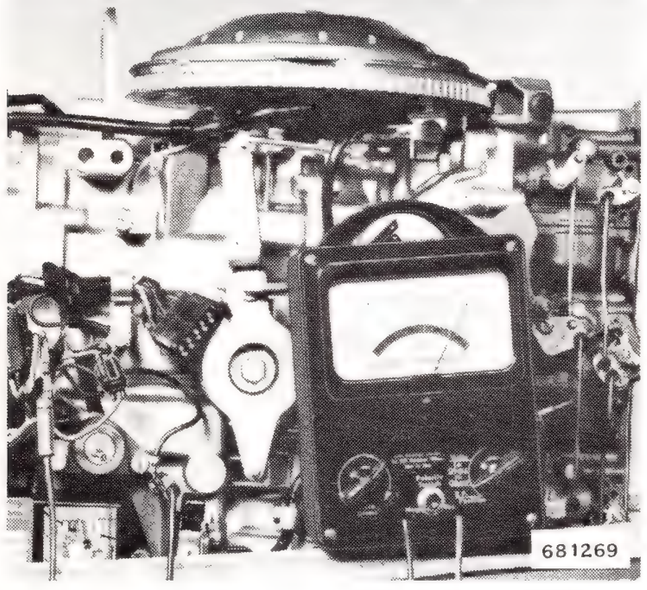


Figure 7-14. Checking Rectifier Diodes

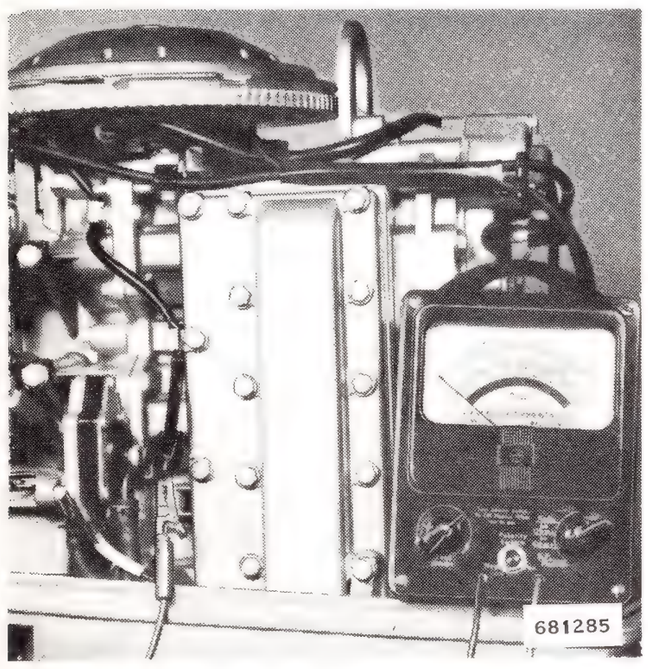


Figure 7-15. Checking Alternator Stator

A test light may be used in place of a meter. Under no circumstances use any test meter or instrument with more than a 12-volt source.

Disconnect the diode yellow and green leads at the connector. Connect ohmmeter (HI ohms scale) or test light red lead to one of the diode terminals and the meter or test light black lead to ground. See Figure 7-14. Note the meter reading, then reverse the test leads, and again note meter reading. An infinite (very high) reading in both checks indicates the diode is open. A zero reading in both checks indicates the diode is shorted. A normal diode will show a reading in one direction and no reading in the other direction. If a test light is used, light should show with connections in one direction only. Repeat the test procedure for the other diodes by connecting the test leads between the other diode lead and ground.

To check stator windings, disconnect the yellow leads at the power head. Connect the red meter lead to either yellow lead and black lead to ground to check for shorts. An infinite reading on HI ohms scale indicates the windings are good.

Connect the ohmmeter (LO ohms scale) between the two yellow leads. A reading of .75 ohms ± .2 indicates the windings are good, and an infinite reading indicates the windings are open. See Figure 7-15.

REPLACEMENT OF ALTERNATOR

If windings are found to have failed, the stator assembly must be replaced. Proceed as follows:

a. Remove flywheel, using flywheel puller (Special Tool #378103). See Section 5.

b. Disconnect stator lead. Remove three screws and lift stator from power head. See Figure 7-16.

c. Place new stator in position being sure that distributor cap is properly seated and attach with three screws dipped in Loctite Screw Lock. Tighten to a torque of 48 to 60 inch-pounds. Reconnect stator lead connectors.

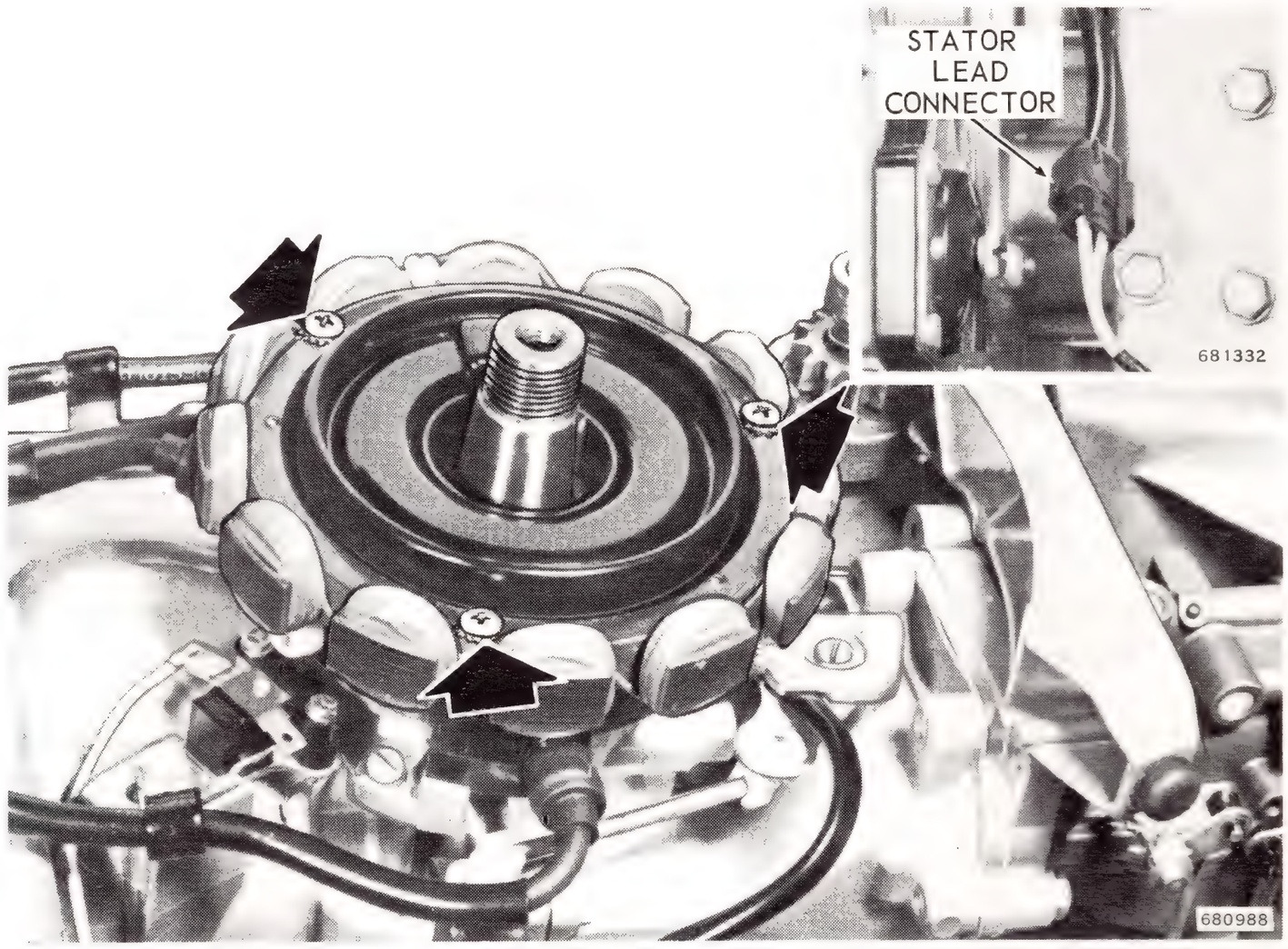


Figure 7-16. Removing Alternator Stator

CHARGING CIRCUIT CHECKS

Where To Look	Cause	What To Do	Result
	UNDERCHARGED BATTERY		
BATTERY	1. Defective battery or worn out battery	Check state of charge	
	2. Low electrolyte level	Add water	
	3. Corroded terminal connections	Clean with wire brush and coat with petrolatum	
	4. Loose terminal connections	Tighten securely	
	5. Excessive electrical load	Check total current draw in circuit	
WIRING	1. Corroded or loose connections	Clean and tighten connections	
	2. Short or ground in leads to stator	Check leads for defective lead insulation or connectors. Stator leads are yellow.	
	3. Ground in other parts of circuit	Check for worn through insulation and check diodes	
RECTIFIER	Low output	Disconnect rectifier leads and check each diode on HI ohms scale	High reading on one check and no reading on another, diodes OK Zero reading both checks, shorted diode Infinite reading both checks, open diode
ALTERNATOR	Defective stator winding	Connect ohmmeter between the two yellow leads at the alternator Connect ohmmeter from either yellow lead at alternator to ground	Low OHMS Scale 9 AMP stator .75 OHMS ±.2 High OHMS scale Should read infinity
	OVERCHARGED BATTERY		
ALTERNATOR	Extensive running without accessories	Turn on some accessories during extensive running	

SECTION 8
REMOTE CONTROL

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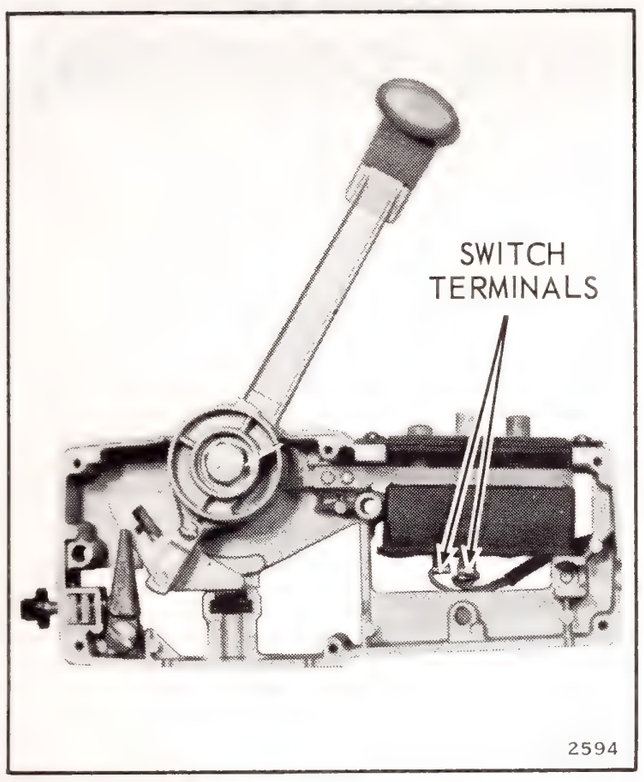


Figure 8-1. Remote Control with Cover Removed

DISASSEMBLY

The remote control is a simple mechanism and will be found to be relatively trouble-free. See Figure 8-1. It may occasionally be necessary, however, to disassemble the remote control to clean off salt water deposits, or to check the operation of the pushbutton switch. Proceed as follows:

a. Remove side plate. Disconnect shift cable from switch terminals. See Figure 8-1.

b. Remove throttle friction spring and adjusting screw. See Figure 8-2.

c. Detach remote control housing from boat.

d. Remove casing guide from throttle lever. Slide cable trunnion from housing.

e. Remove throttle lever pivot screw. Lift throttle lever from housing. See Figure 8-2.

f. Remove two screws attaching selector switch bracket to housing. Lift switch from housing. See Figure 8-3.

g. Remove idle adjustment screw, idle lever screw, and idle lever.

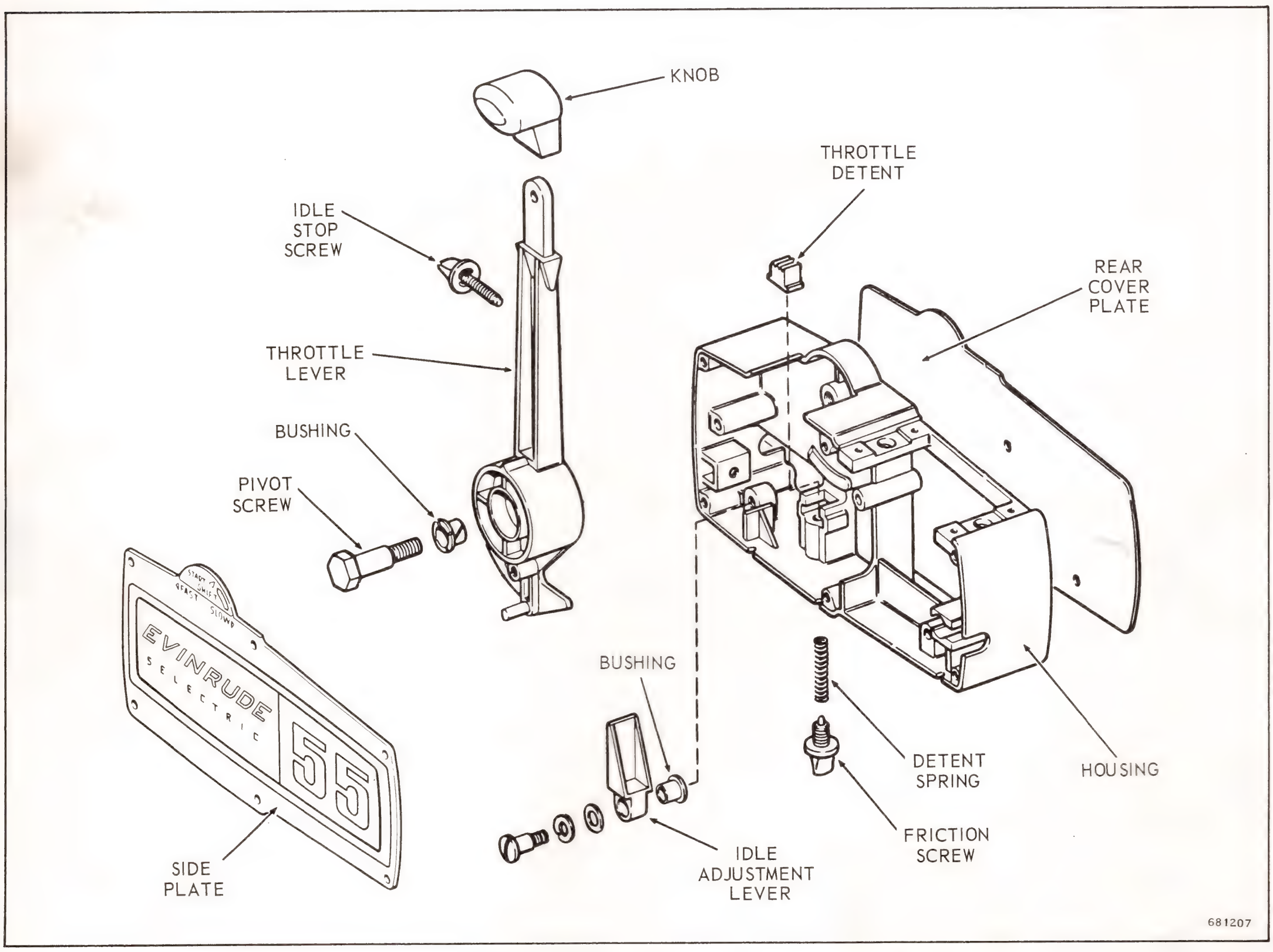


Figure 8-2. Remote Control Assembly View - Housing and Throttle Lever

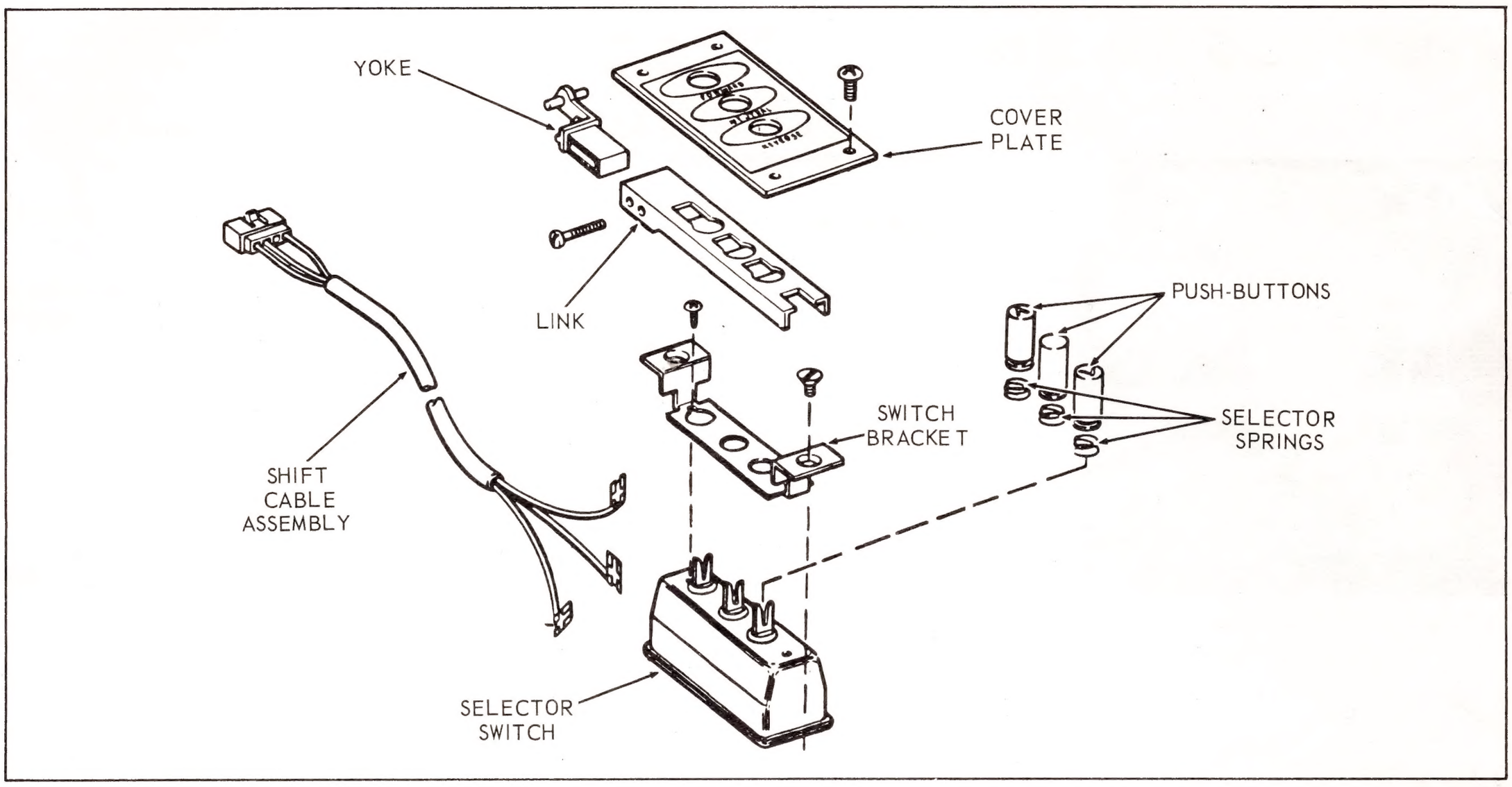


Figure 8-3. Assembly View - Selector Switch

CLEANING, INSPECTION AND REPAIR

a. Wash all parts (except switch) in solvent to remove any deposits. Dry thoroughly, then wipe with an oily rag to leave a protective film.

NOTE

The 55 HP Triumph push button control switch differs in its construction from the one used in the Selectric Shift control on other 1968 engines.

b. Disconnect the remote control switch cable at its connector.

c. Connect a test light or continuity meter between the (red lead) terminal and Neutral (green lead) terminal. Operate push buttons from forward to neutral position. The circuit must indicate open in forward and closed in neutral.

d. Leave the test light or continuity meter connected between the (red lead) terminal and (green lead) terminal. Operate push buttons from neutral to reverse position. The circuit must indicate closed in both neutral and reverse.

e. Connect the test light or continuity meter between the (red lead) terminal and Reverse (blue lead) terminal. Operate push buttons from neutral to reverse position. The circuit must indicate open in neutral and closed in reverse.

It will be noted that for reverse operation of the gearcase both the (blue and green lead) are energized activating both solenoids in the gearcase.

f. If a malfunction is indicated, replace the push button switch or shift cable assembly.

NOTE

Work switch several times in each test position when testing to make certain it is consistant in its operation.

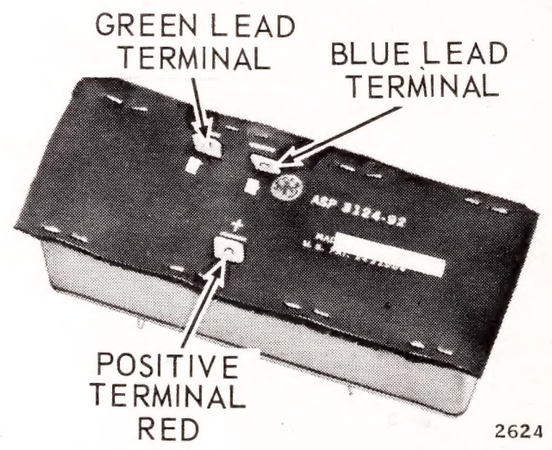


Figure 8-4. Location of Switch Lugs, Bottom View

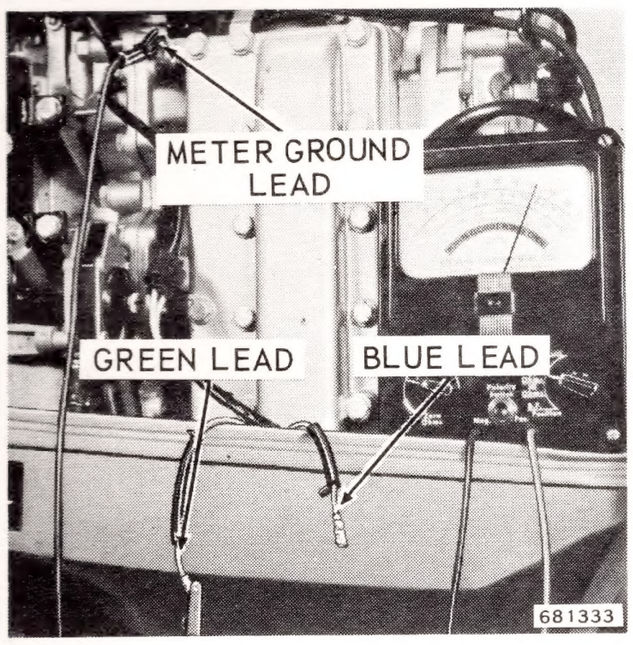


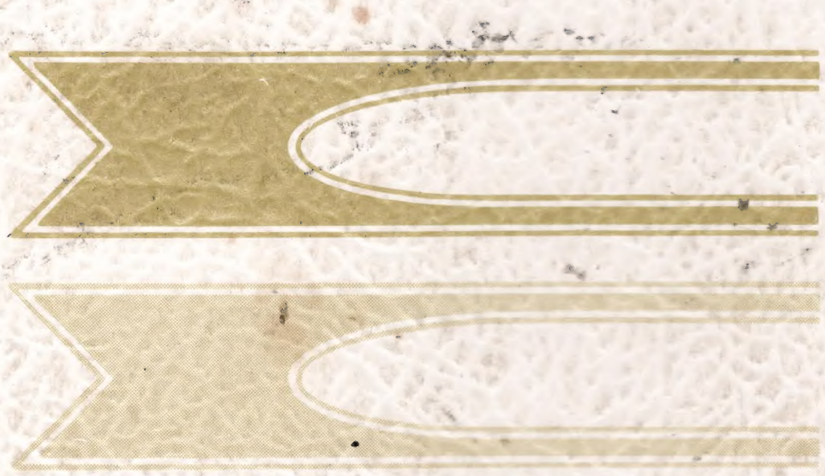
Figure 8-5. Checking Remote Control Operation

g. If switch should be defective and replacement necessary, pry off forward, neutral, and reverse buttons. Lift off springs.

h. Remove two screws attaching switch to bracket. Reassemble components to new switch.

REASSEMBLY

a. Reassemble all components in the reverse order of disassembly. Attach remote control to boat, replace shift cable and throttle cable connections, and check adjustment of throttle cable.



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