Leadership through creative engineering

SCOTT

OUTBOARD MOTORS

SERVICE MANUAL

1960

905-9475

FOREWORD

This manual has been prepared to provide the information necessary to properly maintain, adjust, and repair 1960 model Scott outboards manufactured by the Marine Products Division of the McCulloch Corporation.

Individual sections are devoted to each engine, by horsepower, and the necessary step by step repair instructions are supplemented by photos and illustrations. For complete parts breakdown and exploded views of various assemblies, showing relative position of each component part in an assembly, refer to the parts catalog for the particular engine being repaired.

In some instances, the disassembly and assembly instructions are almost identical for two engines. In order to avoid needless repetition, we will refer to the section which covers the identical repair, giving only the important differences between the two assemblies.

The General Information, Operating Principles, and Powerhead Repair sections contain basic information common to all of the engines, as well as important instructions on propping, painting, rental, fuels, etc. Be certain to carefully read these sections before repairing a motor.

leadership through creative engineering

SCOTT

OUTBOARD MOTORS

-A McCULLOCH PRODUCT-

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SECTION I

GENERAL INFORMATION

INTRODUCTION

GENERAL INFORMATION

This section is designed to provide the dealer with information that will add to and supplement his knowledge of servicing the motors he sells. Top servicing of outboard motors not only encompasses actual repair and maintenance of the engine but also includes such things as boat rigging, providing the customer with information on propellers, performance, maintenance, etc.

PUTTING THE CUSTOMERS ENGINE INTO SERVICE

A large part of the dealer's responsibility, when selling a new motor, is to make certain the motor is ready to perform as expected. The small amount of time necessary to ready a new engine for the customer's use can mean repeat sales at a later date as well as potential sales to a satisfied customer's friends. The customer's first impression and experience with his new motor will, to a great extent, determine his future satisfaction with the product.

All Scott motors are thoroughly inspected and "Test Run" before leaving the factory. However variations in temperature and handling conditions during transit may affect the appearance and operation of the motor. To prevent having the customer obtain an engine that is in other than perfect condition, we recommend that the following points be carefully checked before putting each new engine into service.

Check

1. Condition of finish (Motor, tank, etc.)
2. All bolts, screws, etc. for tightness.
3. Limit switch adjustment.
4. Synchronous adjustment.
5. Tilt function.
6. Pivot function.
7. Reverse lock adjustment.
8. Shift Linkage adjustment.
9. Lower unit lubricant.
10. Choke (Electric and manual).
11. Starter (Electric and manual).
12. Manual primer bulb.

After the engine has been checked according to the preceding list, it is wise to place the engine in your test tank and run it for a period of time checking the following points.

Check (In Test Tank)

1. Starting (Electric and manual).
2. Cooling pump.
3. Bailer pump.
4. Carburetor adjustment (high and low speed).
5. Maximum and Minimum RPM (With test prop).

By following the preceding suggestions you can be assured that your customer will be satisfied with his purchase.

MOTOR INSTALLATION

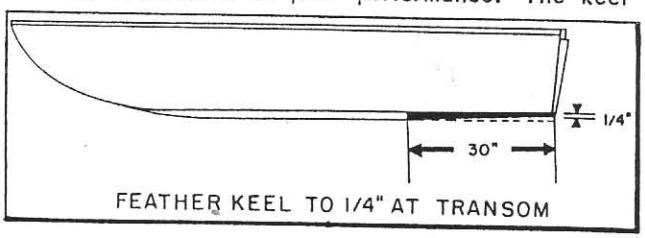
When installing the customer's motor, remember, that in order to obtain optimum performance the motor and boat must work together as a combination. Examine each of the following points when installing your customer's motor.

Boat – In many cases, poor performance, although thought to be caused by the motor has been traced to the boat. Before installing your customer's motor it is generally wise to check the customer's boat for the following conditions.

1. Check the condition of the hull. Straight line boat bottoms have proven fastest and most efficient. However many boats are not perfectly true and have a hook or curve built in, or developed usually just forward of the transom. A curve in the hull will cause the boat to plow and a hook will cause the boat to porpoise. These conditions should be corrected if the boat and motor are to function properly.

2. Check the hull finish. A rough finish on the hull will create excess drag resulting in loss of speed and power. For best performance the hull should be smooth.

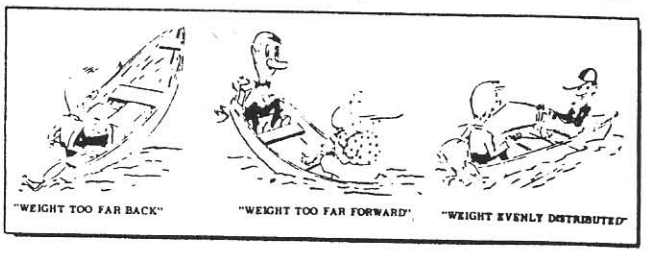
3. Keel – A deep square ended keel will permit air bubbles to flow back to the propeller, causing cavitation or poor performance. The keel

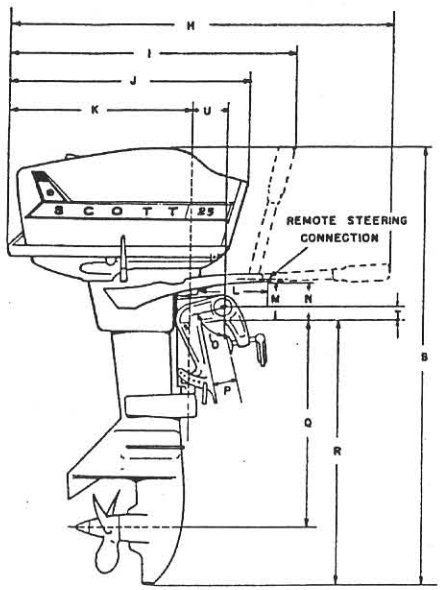


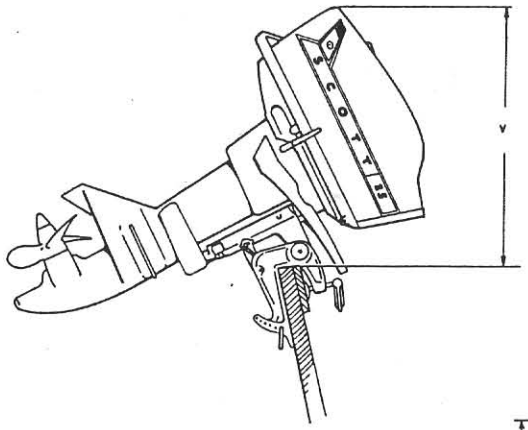
FEATHER KEEL TO 1/4" AT TRANSOM

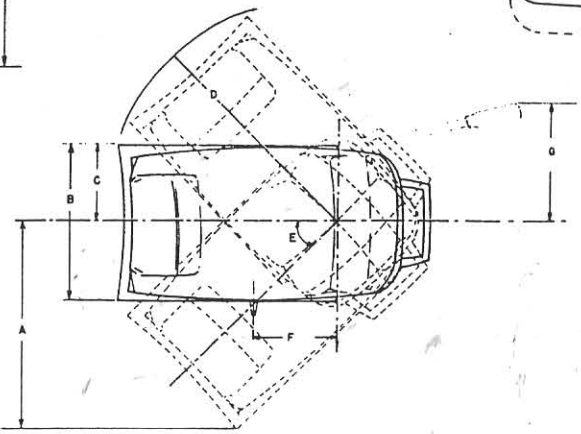
should be tapered from one-eighth to one-quarter of an inch at the transom to about 30 inches forward.

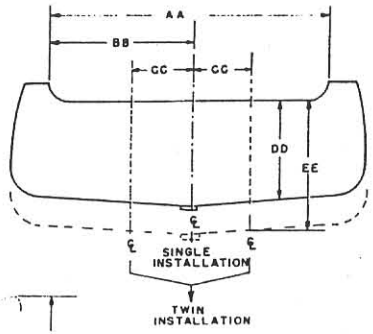
4. Weight Distribution – Some boats are so sensitive to weight distribution that with motors of medium power weight must be shifted forward to make the boat plane on top of the water. In others











"MOUNTING DIMENSION CHART"

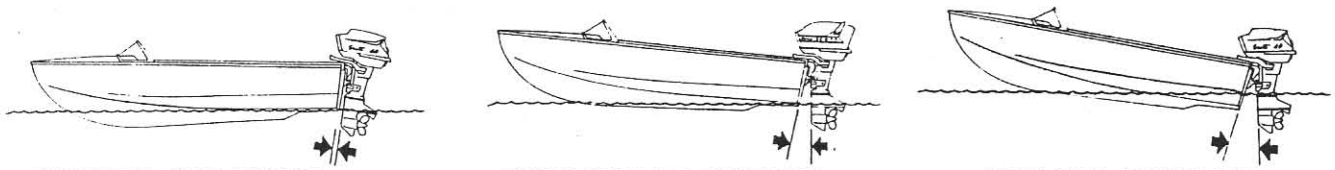
MODEL	OBC. CERT. H.P.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	AA		BB		CC		DD		EE	
																								S	T	S	T	S	T	S	T	S	T
A3FB	12	13-1/2	11-1/2	5-3/4	15-1/2	45°	2	8-1/4	29-1/2	22	21	15	7	3	1-3/4	70°	2	21	25-1/2	41	1-9/32	4-1/4		20	40	10	20	–	10	–	15	–	–
A3GB	25*	15-1/2	13	6-1/2	17-1/2	45°	3-1/2	8-1/2	37-1/2	27	25	16-3/4	8-3/4	4-1/4	2-1/2	70°	2-1/4	22	27-1/4	44-1/2	1-1/16	4-7/8	29"	24	46	12	23	–	12	–	15	–	–
**D3GB	25LS*	15-1/2	13	6-1/2	17-1/2	45°	3-1/2	8-1/2	37-1/2	27	25	16-3/4	8-3/4	4-1/4	2-1/2	70°	2-1/4	27	32-1/4	49-1/2	1-1/16	4-7/8	29"	24	46	12	23	–	12	–	–	–	20
A3HB	40*	17-1/2	17-1/4	8-5/8	20-1/2	40°	3-1/2	–	–	–	27-1/4	19	9	4	3-1/4	70°	2-1/4	24	29-1/2	48	1-1/16	5	23½"	30	58	15	26	–	12½	–	15	–	–
**B3HB	40LS*	17-1/2	17-1/4	8-5/8	20-1/2	40°	3-1/2	–	–	–	27-1/4	19	9	4	3-1/4	70°	2-1/4	29	34-1/2	53	1-1/16	5	23½"	30	58	15	26	–	12½	–	–	–	20
C3JB	60	17-1/2	17-1/4	8-5/8	20-1/2	40°	3-1/2	–	–	–	27-1/4	19	9	4	3-1/4	70°	2-1/4	24	30	49-1/2	1-1/16	5	31"	30	58	15	26	–	12½	–	15	–	–
**D3JB	60LS	17-1/2	17-1/4	8-5/8	20-1/2	40°	3-1/2	–	–	–	27-1/4	19	9	4	3-1/4	70°	2-1/4	29	35	54-1/2	1-1/16	5	31"	30	58	15	26	–	12½	–	–	–	20

* Manual and Electric Starting Models

** Extended Shaft Models

NOTE:

1. The "F" dimension will appear on opposite side in the case of 1960 40 H.P. and 60 H.P. motors.
2. The "M" and "N" dimensions will vary with motor tilt.



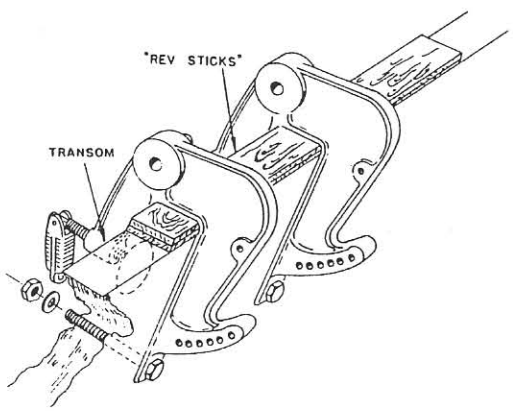
INSUFFICIENT ANGLE, BOW DIGS | CORRECT ANGLE, TOP PERFORMANCE | EXCESS ANGLE, TRANSOM DRAGS

weight must be shifted aft. As weight distribution is an individual problem you must experiment with each rig to determine correct weight distribution.

Motor – Once it has been determined that the boat is in good condition the next step is to install the motor. Following is a list of factors that will affect the overall performance of the boat and motor combination. We recommend that each of these factors be thoroughly checked when installing the customer's motor.

1. Transom Height – Scott motors are designed to operate on 15" or 20" transoms. This distance is taken as the vertical distance from the top of the transom to the bottom, or keel of the boat. Generally best performance will be obtained when the propeller operates as shallow as possible without cavitating. Cavitation is caused by operating the engine at too shallow a depth and results in the propeller running wild in a pocket of air. Turbulent water caused by a square end keel may also cause cavitation and should be taken into consideration when mounting the engine.

   When installing the engine consult the "Mounting Dimension Chart" on page 4 of this section. In order to obtain the correct operating depth, place the motor on the transom and determine whether the transom is too high or too low. If the transom is too low shim the engine up using 1/8" or 1/4" shims or "rev" sticks. These



   "rev" sticks are inserted between the transom top and the boat brackets until the motor will cavitate in a turn. When you reach the point where the motor will cavitate excessively, then remove one or two of the "rev" sticks and bolt the engine to the transom.

   If the transom is too high, it will have to be cut down or an extension kit must be installed on the engine to secure top performance. Generally, the anti-cavitation plate will be level or slightly below the keel or bottom of the boat if the engine is installed correctly.

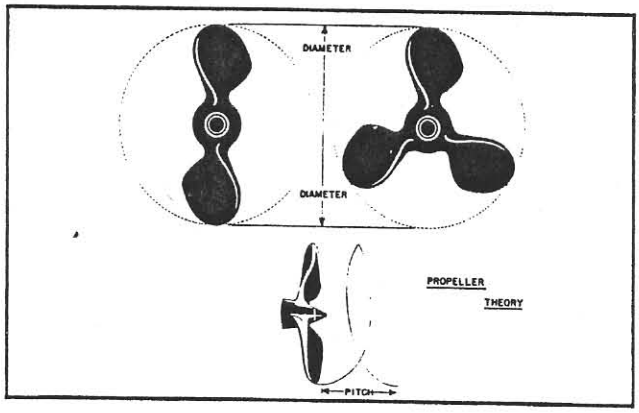
2. Tilt Angle – When operating the boat, the engine must be vertical to the water surface if best performance is to be obtained. If the lower unit is tilted too far away from the transom the bow of the boat will ride too high. If the lower unit is tilted too close to the transom the bow will plow or dig into the water. Changes in the boat load may require a change in the tilt angle.

3. Propeller Selection – After the boat condition and the installation of the motor has been properly accomplished, the last step in setting up the customer's engine for top performance is propeller selection.

   All Scott motors are designed to turn out their rated horsepower at a specified RPM (Revolutions Per Minute) of the motor. As there are naturally slight variations in engines of the same horsepower a full throttle operating range is also given. In order to obtain top full throttle performance from the engine, it must turn within its recommended operating range. When propping an engine consult the serial plate to determine at what RPM it should operate.

   To correctly prop a customer's engine it is necessary to have a selection of propellers to try out on the engine and a tachometer with which to check the RPM.

   Propellers are classified according to diameter, pitch, and blade area. The diameter is twice the distance from the tip of the blade to the center of the hub. Pitch is the theoretical distance the propeller would move if it were turned one revo-



lution in a solid without slippage. For example, a 10" x 13" propeller would have a 10" diameter and a 13" pitch, therefore it would move forward 13" if it made one complete revolution in a solid without slippage. Blade area is simply the number of blades that the propeller has, such as a two blade, three blade, etc.

Bearing in mind that the engine must turn at its recommended RPM if it is to perform properly, apply this general rule when determining the propeller requirements of the customer's rig. For larger boats or increased loads, use a propeller of less pitch and greater blade area such as a three or four blade. For lighter boats or lighter loads, use a propeller of more pitch and less blade area. In all cases the propeller selected must be tested on the motor and must allow the engine to turn at its recommended RPM at full throttle. Increasing the pitch of the propeller will decrease the RPM of the engine. Decreasing the pitch will increase the engine RPM.

10 HOUR CHECK-UPS

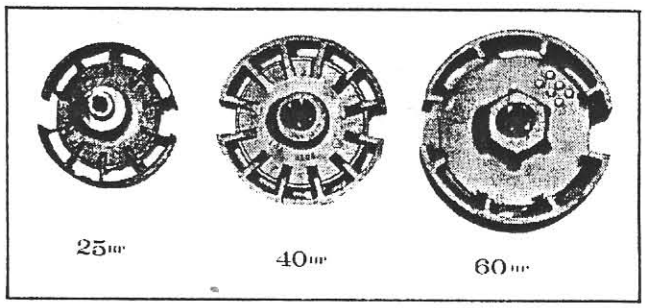
A 10 Hour check-up provides an excellent opportunity for you to check on the performance that your customer is receiving from his new motor. During these check-ups you will be able to correct any minor difficulties which could, if left uncorrected, result in extensive warranty repair.

Although these check-ups require only a small amount of time to perform, they will greatly increase the customer's satisfaction with the product. Also the customer will gain confidence in your ability as a dealer and will become one of the best advertisements that you can have.

Following is a list of things that should be covered during the 10 hour check-up. We also recommend that an on-the-water check be made on the customer's rig under actual operating conditions (large motors only). During this check-up such things as tilt angle, transom height, boat condition, and propeller selection should be examined.

10 Hour Check

1. Ask the customer for comments on performance of the motor.
2. With motor on the bench, follow any lead given by the customer and use the following check list:
   a. Check electric or manual starter – adjust and lubricate.
   b. Clean and adjust breaker points.
   c. Check all magneto parts connections.
   d. Distributor parts connections.
   e. Clean and gap spark plugs.
   f. Clean and check fuel pump filter screen.
   g. Check synchronous control and adjust if necessary.
   h. Check shift – adjust if necessary.
   i. Check reverse lock – adjust if necessary.
   j. Check level of lower unit gear lubricant.
3. With the engine in the test tank follow any lead given by the customer and use the following check list:
   a. Check carburetor – clean and adjust if necessary.
   b. Check all pressure and fuel lines.
   c. Check all gaskets for leaks.
   d. Check for maximum and minimum RPM (With test wheel and tachometer).



MODEL	TEST PROP	MAXIMUM RPM	MINIMUM RPM
3.6 H.P.	Stock prop	3300	400
7.5 H.P.	To be made available	–	–
12 H.P.	To be made available	–	–
25 H.P.	135-9887	5200	500
40 H.P.	136-9887	5200	550
60 H.P.	332-9887	5000	600

NOTE: These readings are average for a new engine. As the engine acquires running time there should be an increase in the maximum reading and a decrease in the minimum reading.

There will be deviation of up to 50 RPM between engines at idle settings. At wide open throttle a motor should come within 100 RPM of the maximum RPM listed or should be above this reading.

e. Check for unusual noises in each gear.

4. With engine again on bench, check these additional items:
   a. Check and tighten all nuts, bolts, etc.
   b. Clean and tighten all electrical connections.
   c. Adjust control tensions to suit customer.
   d. Clean motor finish.
5. Test run and adjust motor on boat (If large horsepower motor).

MOTOR TUNE-UP AND OVERHAUL

Your service department will be called upon numerous times to perform tune-ups or overhauls on customer's motors. Following are the points generally covered in these operations.

Tune-Up – A tune-up is usually performed on an engine that is in fairly good condition. Generally, it involves checking the various exterior engine components, adjustments, lubrication points, and analysing the motor operation. The steps listed under the 10 hour check-up can be used as a guide when performing a tune-up, (see page 6 of this section).

Overhaul – Overhauling the motor or any of its components involves complete tear-down, parts inspection, and repair or replacement of any parts that are worn or damaged. Detailed information on overhauling any of the 1960 models can be found in sections IV through IX of this manual.

When overhauling a motor, keep small parts in separate containers such as paper cups, so that they are not lost or mixed with other parts.

When overhauling the motor first separate main assemblies then proceed to overhaul each assembly. Be sure to clean and inspect all parts replacing those that are worn. Always use new gaskets when assembling a motor.

REFINISHING THE MOTOR

One thing that will greatly enhance the appearance of the motor as well as contribute toward customer satisfaction is the touch-up or refinishing of painted surfaces on the motor, after it has been overhauled.

To refinish outboard motors properly, a spray gun, small compressor, assortment of paints (air dry), thinners, wet-dry sand paper, buffing wheel, and decals are all necessary if a really good job of refinishing is to be obtained.

To Refinish a Motor

1. Remove all old decals, grease, and dirt. Thoroughly sand the motor to remove loose paint and provide a smooth surface.
2. Lacquer should be thinned to consistency of thin milk before painting.
3. Paint engine after it is assembled with the exception of the shroud, this can be painted separately.
4. Spray, using short strokes; never hold the gun in one spot.
5. When installing new decals thoroughly clean the surface before applying the decal.
6. Apply a thin layer of mounting medium, wet the decal and slide it off the paper backing to its correct location on the motor.
7. Smooth out wrinkles in the decal and blot excess water with a clean damp rag.

Touching up the Motor

Use sandpaper to smooth the area that is to be touched up. Thoroughly clean the part to be painted

with a cleaning solvent. Scott-Atwater Engine Cleaner is an excellent solvent for this purpose. Handy, pressured cans of paint are available to match all 1960 colors as well as prior model engines.

The following chart lists the part number for paints that are used on the 1960 line of Scott motors. The handy pressurized touch up cans are available from your distributor or parts jobber under the part number listed. Bulk quantities can be obtained from your local Dupont Duco paint dealer in quart, gallon, and 5 gallon quantities.

MODEL	COLOR	SCOTT TOUCH-UP NUMBER	DUPONT DUCO BULK NO.
25, 40, & 60	Wake White	920-9201	Duco 2214
	Caribbean Yellow	919-9201	2220
	Tropic Blue	922-9201	2440
	Fleet Red	909-9201	2035H
Royal Scott	Imperial Pearl	923-9201	2466L
12 H.P.	Wake White	920-9201	2214
	Fleet Red	909-9201	2035H
7.5 & 3.6	Wake White	920-9201	2214

TRADE-IN MOTORS

Undoubtedly, during the course of your business, you will have occasion to deal with used or trade-in motors. The problem that you will encounter is how to accurately judge what you should allow for these motors.

There are a number of aids which will assist you in establishing fair trading values. Among these are publications such as "Outboard Dealer Trade-In Guide" published by Outdoors, Inc., 103 Guitar Bldg., Columbia, Missouri and "Shelers Outboard Price Pilot", published by the Sheler Publishing Company, Inc., 133 E. Mishawaka Avenue, Mishawaka, Indiana. Consideration should be given to the condition of the motor, demand for second hand motors, possibilities of resale, etc.

There are a number of things that you should look for when determining the value of a used motor. Following is a check list that will aid you in evaluating the condition of a motor.

1. General appearance. Condition of painted surfaces, how much work will be required to refinish it.
2. Will the engine operate? Will it run smoothly at idle and at full speed? Check the acceleration and water pump discharge.
3. Magneto or ignition – Is there a hot spark? Check spark plugs and wiring.
4. Fuel System – Check carburetor linkage for excessive wear. Is the fuel tank dirty or rusty? Does the fuel pump operate satisfactorily?
5. Rings and cylinders – Check cylinder head pressure.
6. Bearings – Rock the flywheel to check for excessive bearing play. Lift lightly on the flywheel to check for excessive crankshaft endplay.
7. Lower Unit – Check end play and gear lash on propeller shaft. Check for seal leaks in lower unit.
8. General Inspection – Inspect for cracks in all castings, including the boat bracket. Check all linkages and connections.

If the motor requires only minor work to make it salable, then the full trade-in allowance should be given. If, however, the motor is in poor condition, the trade-in allowance should be reduced accordingly.

Trade-in motors may be disposed of in numerous ways; among these are direct sales, storewide sales, rentals or volume sale to resort owners. Generally, if the motor has been put in good operating condition and is sold at a reasonable profit, it is wise to give a guarantee against mechanical defect for a period of from 30 to 90 days.

OUTBOARD RENTAL

Rental of outboard motors provides not only additional income; it increases store traffic and brings a prospective customer into your place of business. In many instances the customer who rents a motor and receives satisfactory service will want to purchase a new motor or the motor which he has rented.

Always use new or demonstrator models as rental units, since you can be certain their performance will satisfy the customer and require a minimum amount of maintenance.

Generally the size of the motors that you have available for rental will depend upon the area that you are located. In fishing areas the bulk of your rental motors should be of smaller size, for instance 3.6, 7.5, or 12 H.P. models.

In some areas where water skiing is the sport, you should stock 25, 40, or 60 H.P. models. Whatever size of motors you stock for rental, they should be in good operating condition.

The charges for rental motors will depend upon local competition, however the following chart can be used as a guide to establishing rates.

MODEL	RATE PER DAY	RATE PER WEEK
3.6 H.P.	$ 3.00	$17.50
7.5 H.P.	4.50	25.00
10-12 H.P.	7.50	30.00
25 H.P.	8.00	35.00
40-60 H.P.	13.50	50.00

In many cases the dealer may wish to provide "Ready Mix" fuel. This will assure him that the motor will be operated with the correct fuel mixture thereby cutting down on the maintenance required to keep the motor in good condition.

Generally it is a good idea to provide the customer with a typewritten set of instructions on how to operate the motor. Also it is wise to include a set of safety rules along with these instructions.

FACTORY SERVICE SCHOOL

At each session of the Scott Service School, persons representing dealers from all parts of the United States and Canada attend a 5 day service training course. The purpose of the school is to educate dealers on how to service Scott motors, with special emphasis on the latest, most modern servicing methods and techniques. Dealers attending the school agree unanimously that as a result of their week of service training at the factory, they are able to offer their customers better, more efficient service; that they are able to do a better selling job by using the basic product knowledge gained at the school; and that both of these things contribute greatly to increasing their motor sales.

Each service school class lasts 5 days and every fourth class is a special refresher course for dealers who have attended service school in previous years. The time spent in the school is equally divided between classroom and shop which makes it possible to apply in a practical way what has been learned.

All tools, equipment and reference material necessary are supplied by Scott. Charts, slides and cutaway models are used for instruction in addition to the Service Manual. A complete set of tools is made available to each man during his stay to acquaint him with the best methods of repairing engines. Each class is purposely limited in size to give instructors maximum time for individual instruction. After successfully completing the weeks service training, every serviceman is given a Factory Approved Service Certificate, showing that he has satisfactorily completed the course.

The Scott Service School is free to all Scott dealers and distributor personnel. The only cost to those persons attending the school is for travel to and from Minneapolis and for hotel accommodations (which will be secured by Scott for you at a reduced rate) while at school.

We suggest that you attend the Scott Service School during the next session. Each year you will receive a registration card to be filled out and returned to Scott which will be your registration for the week you choose to attend. Be sure to mail your registration card in early and at least a month before the week you choose to attend. SERVICE BUILDS SALES, and we are certain that attending the Scott Service School will help you attain extra sales and extra profits. Make your plans to attend NOW!

FUEL MIXTURE AND LUBRICATION

All outboard motors require lubrication to prevent wear in their moving parts. In a two cycle engine the gasoline and oil are mixed together to provide fuel and lubrication for the powerhead. Care should be taken to use only Marine White gasoline or in the event that marine white gasoline is not available use only a good grade automotive "regular" gasoline. Do not use "stove white" gas or Ethyl.

As the oil is mixed directly with the gasoline it is necessary to use an oil that will not form harmful deposits or cause spark plug fouling. Scott outboard motor oil has been developed to give the utmost in

motor protection without forming deposits or causing spark plug fouling. It is a straight run mineral oil with a napthenic base. It contains no harmful additives and it mixes readily with gasoline. In an emergency, where Scott outboard motor oil is not available substitute the highest grade, non-detergent, S.A.E. 30 engine oil. Do not use oil with additives.

Following is a chart showing the fuel mixtures for all 1960 motors. When mixing fuel, mix outdoors or in a well ventilated area. Keep tank away from any flame. Pour in part of the gasoline, then add the oil, and the rest of the gasoline. Shake vigorously to insure proper mixing of the gasoline and oil.

MODEL	BREAK IN MIXTURE	NORMAL OPERATING MIXTURE
3.6 H.P.	3/4 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline
7.5 H.P.	1/2 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline
12 H.P.	1/2 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline
25 H.P.	1/2 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline
40 H.P.	1/2 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline
60 H.P.	1/2 pint oil per gallon gasoline	3/8 pint oil per gallon gasoline

SPARK PLUGS

The spark plug is one of the most important parts of any outboard motor electrical system. If the spark plugs are not performing properly, motor performance will be seriously affected. Listed below are som of the causes and cures of *poor* spark plug performance.

CAUSE	CURE
1. Using gasolines or oils whose additives will leave harmful deposits	Change brand of gasoline or oil
2. Operating the motor with too rich a carburetor setting	Readjust carburetor to correct
3. Using a plug of the wrong heat range	Replace with plug recommended by factory
4. Cracked or chipped plug insulator	Replace with new plug
5. Using an improper fuel mixture	Check fuel mixture recommendations and methods of mixing fuel
6. Operating the engine with spark plug improperly gapped	Remove, clean, and regap with feeler gauge to recommended setting

In all cases the preceding conditions will seriously affect the engine performance. If, upon inspection, any of these conditions exist, they should be corrected immediately.

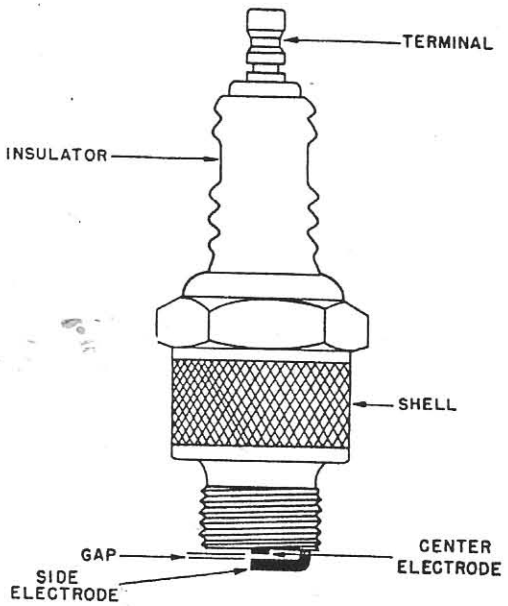
To clean the spark plugs disconnect the lead wires and remove the plugs using a wrench. Never use a pliers to remove the spark plugs. Scrape away any oxide or carbon deposits that may have formed, with a sharp pen knife or a stiff bristled brush. After the deposits have been scraped away blow the plug clean using compressed air. Caution: never sand blast spark plugs as this may cause a change in the plugs heat range due to the removal of its insulation.

When cleaning or replacing plugs periodically make a visual, heat range check of the insulator. The insulator should be a light chocolate color. If the insulator appears light tan or white, the spark plug being used is too hot. If the insulator is dark and greasy the spark plug is too cold and should be changed for efficient operation.

The spark plugs have been properly gapped at the factory; however, after continued use they will require resetting. Check the gap with the proper size feeler gauge. The gauge should slide snugly between the two points. If an adjustment is required bend the outer or side electrode to obtain the proper gap. When installing new plugs always check the gap.

The following chart lists the correct plug and gap for all 1960 motors.

MODEL	SPARK PLUG	GAP
3.6 H.P.	H10J or H10JM	.035
7.5 H.P.	H10J or H10JM	.035
12 H.P.	J6J or J6JM	.035
25 H.P.	J6J or J6JM	.035
40 H.P.	J6J or J6JM	.035
60 H.P.	J6J or J6JM	.035

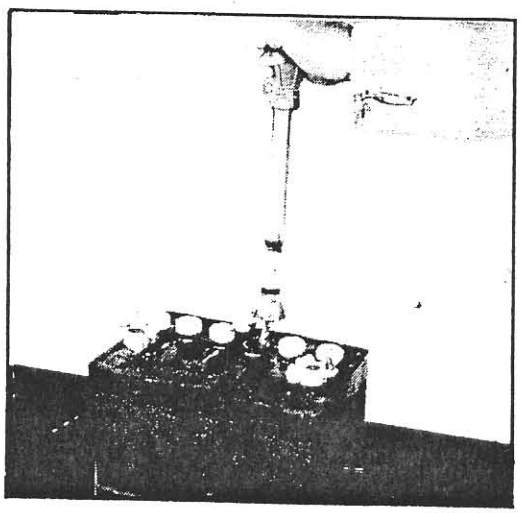


STORAGE BATTERY

The electric starting motors are designed to operate off a 12 volt automotive or marine type battery with a minimum of 11 plates per cell and rating of 60 ampere hours or higher. When installing the customer's battery, be sure that the recommended type battery is used, and make sure it is anchored securely to prevent spillage. The battery should be well ventilated and accessible for checking the water level.

Following are a number of measures that should be initiated to properly maintain the battery:

1. Clean the battery terminals using a solution of baking soda and water. Tighten the terminals securely and apply a mineral base grease to prevent corrosion.
2. Be sure to maintain the manufacturer's recommended water level. Use only distilled or demineralized water when filling the battery.
3. Batteries in storage should be checked and recharged at least every 60 days. Use a hydrometer to check the battery electrolyte. A fully charged battery will give a hydrometer reading of 1.270. A fully discharged battery will give a reading of approximately 1.040.
4. Using the open circuit voltmeter check each of the cells that comprise the battery. If a variation of more than .05 volts exists between cells, the battery should be replaced.
5. Do not allow batteries to stand discharged for any period of time; charge the battery as soon as possible after it has been discharged.
6. When installing the battery cables from the motor be sure to connect the red positive cable to the positive (+) terminal of the battery. Attach the black cable to the negative (–) terminal of the battery. If the cables are reversed, the rectifier will burn up.



SECTION II

OPERATING PRINCIPLES

OPERATING PRINCIPLES

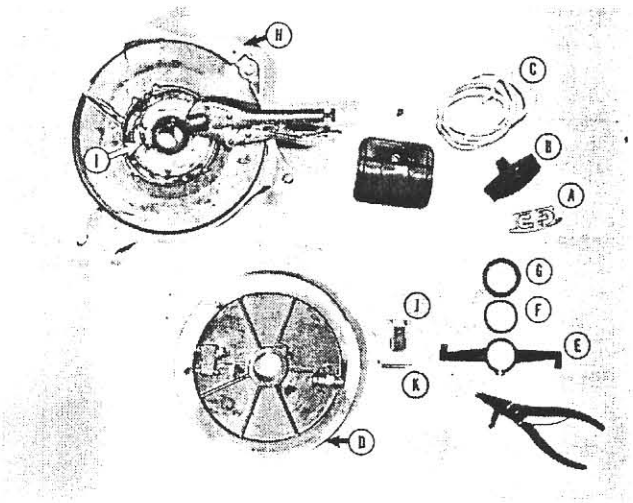
All of the various horsepower engines have a great deal in common. Since they are all two cycle engines they all operate a great deal alike.

We feel that in order to provide effective service the dealer must understand the fundamental operation of each of the major components on the engine. As we have previously stated that all of the engines operate in much the same manner, we will, in the following pages, briefly describe what actually takes place during engine operation. Specific information on the disassembly, maintenance, and repair of the various engines can be found in the respective motor sections of this manual. The following information, which is general in nature, will point out only how the various components, systems, etc., work together to make the two cycle engine operate.

RECOIL STARTERS

The recoil starter used on all models is similar, with the exception that the pawls on the 25, 40, and 60 H.P. models are pinned in position.

Consult the Trouble Shooting Chart on page 123 to determine the cause of any difficulty that might occur.



1.

Disassembly (See figure 1.)

1. Knot the starter cord to prevent the pulley from unwinding, then remove the cord retainer (A) from the starter cord knob (B) by prying with a screwdriver.

2. Remove the knot in the cord (C), then allow the pulley (D) to unwind slowly.

3. Remove the friction spring (E) with the aid of a Truarc pliers. Note: When doing this operation hold the starter with the pulley away from you to avoid injury if the pulley should spring out of the housing.

4. Remove the thrust washer (G) and the wave washer (F).

5. Carefully separate the pulley from the top housing (H), being careful that the recoil spring (I) remains in place.

6. If the recoil spring must be removed, use a vise pliers to prevent it from unwinding during removal.

7. Unwrap the starter rope from the pulley, being careful to observe the method by which it is attached to the pulley and the direction that it is wound in the pulley.

8. The pawls (J) on the larger horsepower models are held in place by the pawl pins (K). Remove the pins by driving them out with a punch. On the smaller motors the pawls can be removed as the friction spring is removed.

Assembly

To assemble the manual starter reverse the procedure listed under Disassembly. Be sure to check the following points:

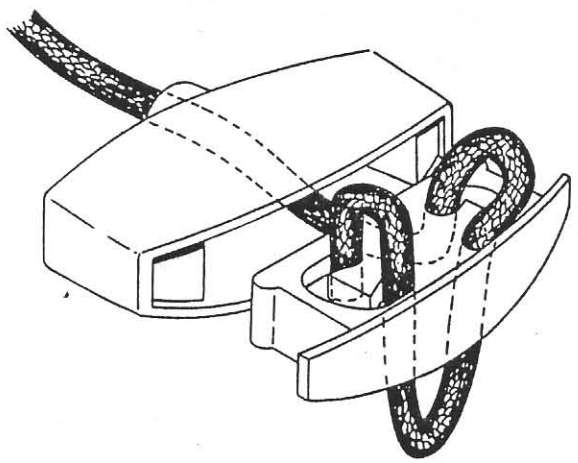
1. Be sure the eye in the recoil spring is seated over the pin in the starter housing.

2. Wind the rope onto the pulley in a counterclockwise direction, when looking at the pawl side of the pulley.

3. Place the pulley in the starter housing making sure the inside end of the recoil spring locates on the pin or hook on the pulley hub.

4. Wind the pulley one full turn counterclockwise, when looking at the pulley from the pawl side, then thread the rope through the housing and knot it.

5. When replacing the cord retainer see figure 2.



2.

FUEL SYSTEM

All of the various models, with the exception of the 3.6 H.P. model, have basically similar fuel systems. The components that make up the fuel system are the:

1. Remote Fuel Tank
2. Fuel Pump
3. Carburetor
4. Manifold
5. Reed Valves

The 3.6 H.P. model has all of these components, with the exception of the remote tank and the fuel pump. This model utilizes a gravity fuel flow to the carburetor from a tank mounted on the engine.

The following information will point out how the fuel system operates.

Fuel Tank – Remote

The fuel tank is of the non-pressurized type, and it requires a fuel pump to pump fuel to the carburetor. Attached to the tank is the fuel line and the primer bulb.

As fuel is drawn from the tank air must be allowed to enter, otherwise a vacuum would be created as the fuel level in the tank drops. For this purpose, the tank is vented.

3.

On the 40 and 60 H.P. models the fuel line disconnects at the tank and the air vent is located at the tank fitting. As the fuel line is connected to the tank a spring loaded plunger is depressed and the tank is automatically vented. Disconnecting the fuel line will allow the plunger to pop out, thereby closing the vent. On the other models the vent is simply a screw located on the fill cap. When the engine is to be started, this screw must be opened to allow air to enter the tank.

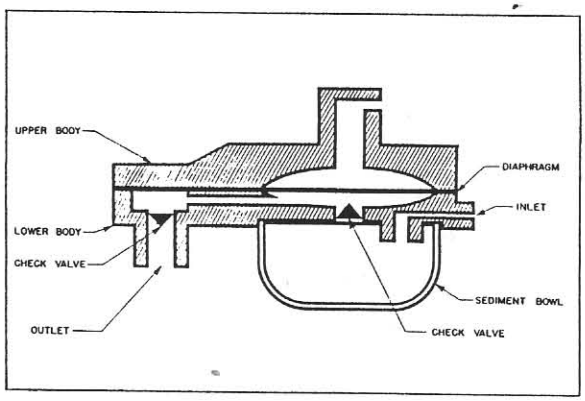
Fuel Tank Maintenance

All fuel tanks should be periodically drained and flushed clean using a fresh fuel mixture. If rust or varnish has formed on the tank interior, drain the tank and fill it with a non-flammable solvent. Place a handful of brass or aluminum nuts and bolts in the tank. Shake vigorously, then drain and flush the tank with a fresh fuel mixture. If the tank should be damaged so that it is leaking, it can in many cases, be repaired by soldering the damaged area.

CAUTION! Before attempting to solder a damaged tank, all traces of fuel and vapor must be removed. To do this, drain the tank and fill it with water. Repeat this several times until you are sure that all vapors have been displaced from the tank. Using a neutralizer, such as carbon tetrachloride, to minimize fire hazards is also a good idea. After you are absolutely sure all fuel and vapors have been removed, solder the damaged area by flowing solder into the affected area.

FUEL PUMP

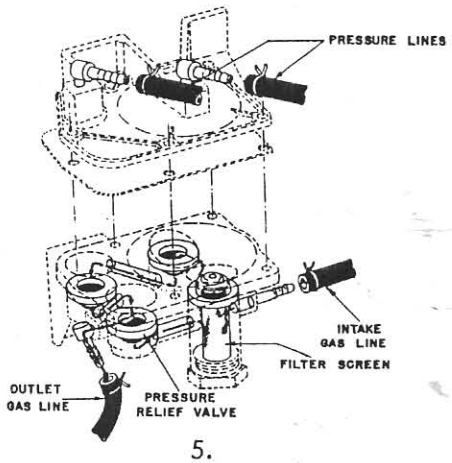
The fuel pump draws fuel from the remote tank and pumps it on to the carburetor. On all models the basic components are the pump body, diaphragm, check valves, fuel, and pressure lines. Basically, all of the fuel pumps operate in the following manner. See Illustration.



4.

1. The primer bulb draws fuel from the tank and moves it up to the fuel pump and carburetor in preparation for starting.
2. The vacuum and pressure created by the piston moving in the cylinder is transferred to the pump by the pressure line. This causes the diaphragm in the pump to move up and down drawing fuel into the pump and then pumping it into the carburetor, or in the case of a two stage pump, into the next stage, then into the carburetor.
3. As the fuel pump is a vacuum type, there must be no air leaks, otherwise the system will not function.

4. Check valves permit the fuel to flow only toward the carburetor.



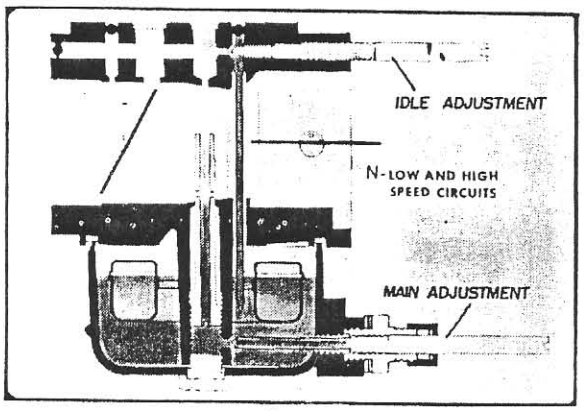
5.

For specific repair information on each fuel pump, consult the appropriate motor section.

CARBURETORS

The carburetor acts like a mixing chamber to combine the correct proportions of fuel and air to provide a combustible mixture for the cylinders. Fuel is pumped into the carburetor bowl by the fuel pump: the amount of fuel which enters the bowl is regulated by a float, which activates an inlet valve. As the float reaches a predetermined level the valve will close. As the carburetor draws fuel from the bowl, the float will drop until the inlet valve again opens, allowing more fuel to enter the bowl. The 7.5 H.P. model uses a diaphragm in place of the float; however, it operates in much the same way. Fuel entering the carburetor body will force the diaphragm outward until the inlet valve is closed. As fuel is drawn by the carburetor, the diaphragm will move inward until the inlet valve is again opened.

As the piston moves toward the spark plug, air is drawn through the carburetor and into the crankcase. In order to draw fuel from the bowl and mix it with this incoming air, a restriction called a venturi has been built into the carburetor air horn. This restriction is simply a reduction in the internal diameter of the air horn. As air is drawn into the carburetor, the venturi causes the air to increase in velocity. The resulting increase in air velocity causes a difference



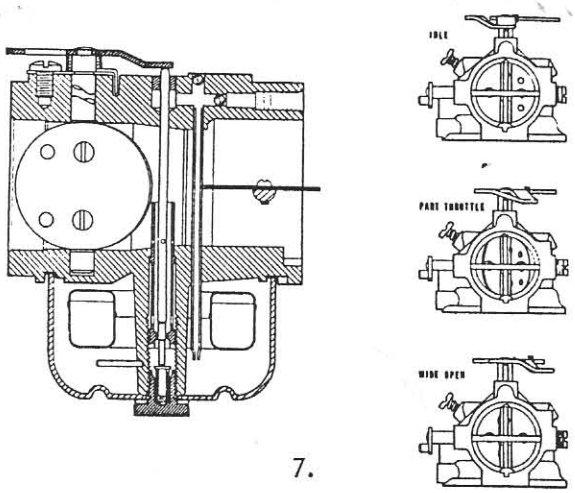
6.

in air pressure between the bowl and the air horn. Due to this difference in air pressure fuel is drawn from the bowl and is forced into the air stream where it is atomized with the incoming air.

During idle operation the throttle valve is closed; consequently, the air rushing through the holes in the throttle valve will draw fuel through the idle outlet which is located between the valve and the manifold. As the throttle is opened a greater quantity of air will pass through the carburetor and a greater quantity of fuel will be drawn from the bowl until at high speed fuel will enter the air horn from both the high speed jet and the idle outlet.

To insure that the correct proportion of fuel is fed into the air horn, the idle and high speed systems have adjustment screws which will regulate the amount of fuel that can enter the air horn. The idle adjustment must be made with the engine idling in gear and the high speed adjustments must be made with the engine at full throttle to insure accuracy of the adjustments. Once the idle and high speed adjustments have been made the engine will receive the correct amount of fuel at all speeds.

The 40 and 60 H.P. carburetors have the conventional idle screw adjustment; however, the high speed ad-



7.

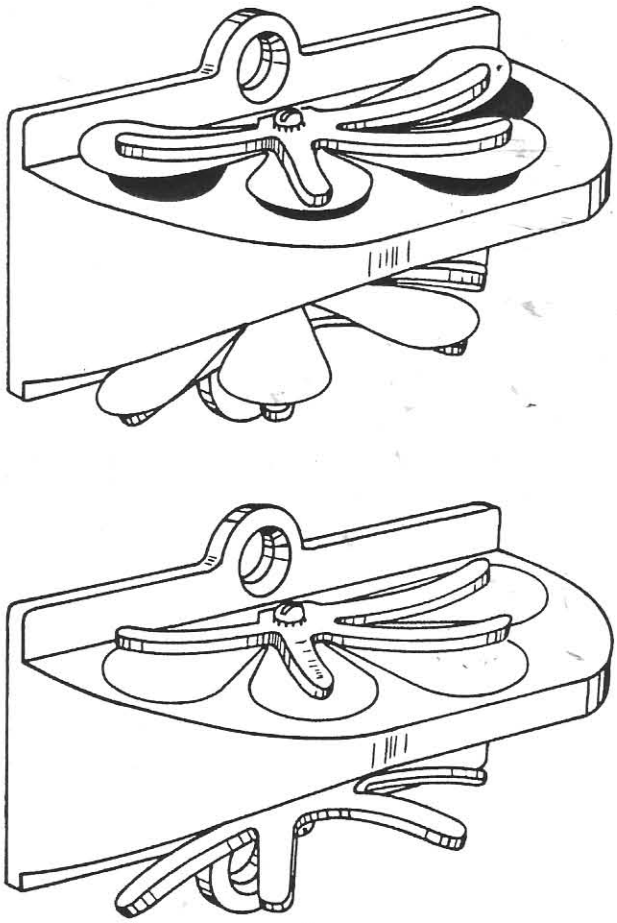
justment screw has been replaced with a fixed jet and a stepped metering rod. This arrangement allows closer control of fuel at both high speed and intermediate engine speeds. The metering rod is spring loaded against a cam which is attached to the throttle shaft. As the throttle is opened, the metering rod will move upward, allowing more fuel to enter the air horn. For specific information on adjusting the throttle cam see the 40 and 60 H.P. motor sections.

MANIFOLDS AND REEDS

After the fuel is mixed with air in the carburetor it passes into the manifold, which equally distributes the fuel to the cylinders.

As the piston moves toward the spark plug a partial vacuum is created in the crankcase. Fuel is then

drawn from the manifold, through the reed valves and into the crankcase. As the piston begins to move toward the crankcase a back pressure is created



8.

which closes the reed valves, thereby preventing fuel from being forced back into the manifold. The fuel, having no other place to go, will then move through the intake passage and into the cylinder through the intake port. The same process is repeated as the piston once again moves toward the cylinder on its compression stroke.

ELECTRICAL SYSTEMS

We have explained how fuel is transferred from the fuel tank to the combustion chamber. When the fuel has entered the combustion chamber and has been compressed by the piston we must then provide a means whereby the fuel mixture will be ignited. This is accomplished by a part of the electrical system called the ignition system.

There are two types of ignition systems used on the 1960 models. These are the magneto and battery ignition systems. All of the manual starting models have the magneto ignition whereas the electric starting models have a battery type ignition. Following is a description of how each of these systems operate.

MAGNETO IGNITION

In the magneto ignition system, magnetism is used to generate the voltage required to cause the spark which will ignite the fuel mixture.

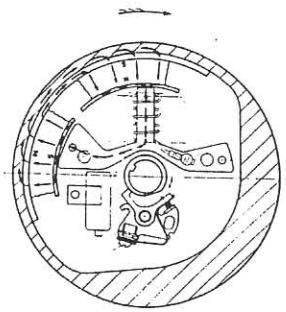
Magnetism and electricity are closely related. An, time electricity flows through a wire we set up a magnetic field around that wire. If this magnetic field is disturbed by increasing or decreasing the strength of the field or if we change the direction of the magnetic field, we create an electric voltage in any nearby conductor.

When a piece of iron or one of its alloys is charged with electricity, in order to form a permanent magnet, certain changes take place within the metal that cause the magnet to have two distinct ends, which are called poles. These poles are called the south and the north poles of the magnet. The direction in which the magnetic field will flow is from the north pole to the south pole.

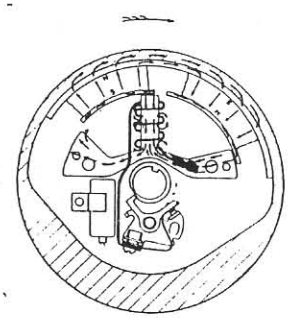
As the magnetic field will readily flow through iron, a laminated iron core is used to provide a controlled pathway through which the magnetic field can flow. The magnets are placed in the flywheel so that opposite poles will always line up at the ends of the core, and so that the north pole will alternately line up at each end as the flywheel rotates. This causes the magnetic field to change direction as each succeeding set of magnets line up with the core.

The ignition coil is mounted to the core. The coil has a primary winding which consists of a number of turns of heavy wire and a secondary winding which consists of a greater number of turns of finer wire. The primary is grounded at one end and is attached to the breaker points and condensors at the other. The secondary is also grounded at one end and is attached directly to the spark plug at the other.

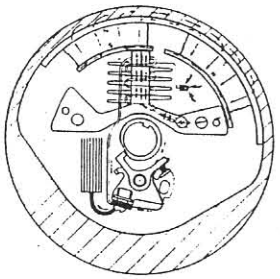
When the magnets are lined up with the core, the magnetic field will flow through the core from the north pole to the south pole. See figure 9. As the flywheel continues to revolve, the strength of the magnetic field will drop slightly; this in turn creates a primary voltage. As the next set of magnets line up with the core, the voltage in the primary sets up its own magnetic field which resists the change in magnetic flow through the core. See figure 10.



9. MAGNETISM IS ESTABLISHED THROUGH COIL



POINTS ABOUT TO OPEN 10.



11. POINTS JUST OPENED

The points will then open and the current will cease to flow through the primary winding; this results in a surge of magnetism through the core which induces a voltage in the secondary of sufficient strength to bridge the gap at the spark plug. See figure 11.

During the interval when the points open, the condenser acts as a reservoir for current which would otherwise tend to arc across the points. Once the points are opened, the current in the condenser will be discharged back through the primary which contributes toward the change in the magnetic field.

BATTERY IGNITION

The battery ignition system differs from the magneto ignition system in that a battery provides the electricity to fire the plugs. To acquaint you with how the battery ignition system operates we will follow the circuit from beginning to end, explaining what takes place in each component. The increment drawings in this manual will aid you in tracing the circuit.

With the ignition switch in the "ON" position, current will flow from the battery to the starter solenoid terminal, then through the ignition switch to the ballast. The ballast is simply a resistor whose function is to supply a smooth flow of electricity to the ignition coils. Also, it prevents ignition points from burning when the key is left in an "ON" position with the points closed and the engine not running.

The ignition coil contains two separate windings of insulated wire, which are connected in different circuits. The primary windings consist of a number of turns of heavier wire and is connected to the ballast and the breaker points. The secondary windings consist of a great many turns of fine wire and is connected to ground and to the spark plug. As both the spark plug and the secondary are grounded, a complete circuit is formed.

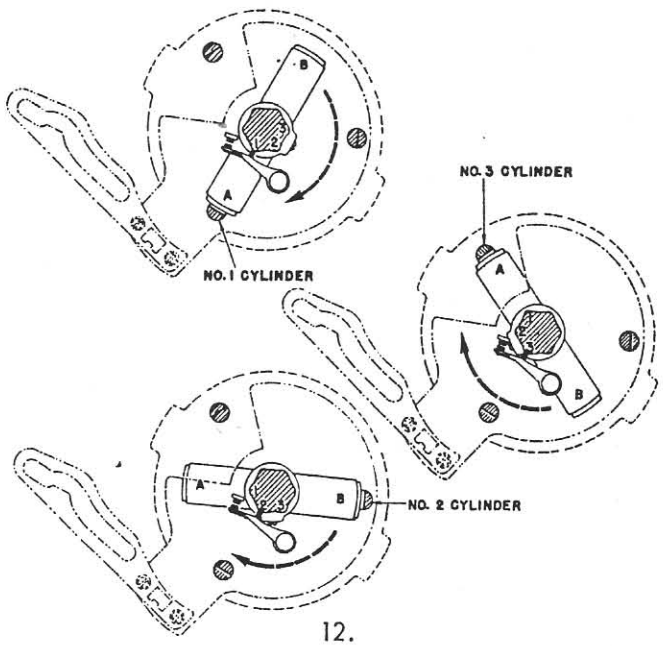
The breaker points are activated by a cam on the crankshaft or distributor shaft. As the shaft rotates the breaker points will open and close in relation to the position of the piston in the cylinder. When the piston reaches the top of its compression stroke, the cam will cause the breaker points to open.

When the points are closed, current will flow from the ballast, through the primary windings of the ignition coil, through the points, to ground, and back to the battery. As the current passes through the primary, a magnetic field is formed around the primary and secondary windings. When the piston reaches the top of its stroke the breaker points open and current ceases to flow through the primary. This causes the magnetic field to collapse, cutting across the turns of wire in the secondary. The collapse of the magnetic field induces a high voltage in the secondary windings that is strong enough to jump the gap at the spark plug electrodes. When the plug fires, it ignites the compressed fuel mixture in the cylinder.

The condenser prevents the current from arcing across the points as they are opened. As the points open the current will flow into the condenser momentarily and then will discharge back through the primary thereby aiding in the rapid collapse of the magnetic field. The 25 and 40 H.P. electric starting models have two sets of ignition coils, breaker points and condensers, one for each cylinder. Each of these groups act independently of the other and operate in the manner just described.

The high voltage required by the spark plugs is induced in the same manner for the 60 H.P. model as for the 25 and 40 H.P. models. The 60 H.P. model does differ from the 25 and 40 H.P. models in that an automotive distributor is used which enables one coil, breaker point, and condenser to provide the firing impulse for all three cylinders.

This distributor runs at one half engine speed. One complete revolution of the engine crankshaft is equal to a one half revolution of the distributor shaft. This



12.

relationship explains the six lobe ignition cam. As the engine crankshaft makes one revolution, requiring 3 firing impulses, the distributor shaft rotates one half turn and 3 lobes of the cam have broken the points the required 3 times. This same relationship explains the two throw distributor rotor. Refer to figure 12. With a properly timed engine, throw A is in position for current to bridge the air gap between it and the number 1 cylinder contact post as the points are opened by lobe 1 (a reference number only) of the cam. As number 2 lobe on the cam opens the points, throw B is in position for current to bridge the air gap between it and the number 2 cylinder contact post. As number 3 lobe on the cam opens the breaker points, throw A is in position for current to bridge the air gap between it and number 3 cylinder contact post. This completes one ignition cycle. At the moment, the points are open once more, the crankshaft has made one complete revolution, and the distributor shaft has made half a revolution. The same sequence is repeated by the other three cam lobes as the engine crankshaft makes another complete revolution.

STARTER CIRCUIT

All of the various engines must be turned over initially before the ignition and fuel systems can begin to operate. On the electric starting models, the electric starter motor engages the ring gear on the flywheel and turns it over until the engine fires. Here is how the starter circuit operates:

When the ignition key is turned to the "start" position, current will flow from the battery, to the ignition switch, and to both the ignition and solenoid terminals. From the solenoid terminal the electricity will then flow through a throttle and a shift microswitch which is placed in the circuit as a safety measure. Both of these switches must be closed in order for the starter motor to operate. They are adjusted so that they will close only when the shift is in neutral and the throttle is retarded to the start position. From the limit switches current will then flow through a coil in the starter solenoid, to ground and back to the battery. The current passing through the coil causes the coil to act like a magnet and close the gap between two terminals on the solenoid. Attached to these two terminals are the cables from the positive terminal of the battery and the cable that leads to the starter motor. As soon as these terminals are bridged, current will flow to and activate the starter motor which will turn the engine over. When the engine starts and the key snaps back to the "ON" position, current will no longer flow through the solenoid coil and the circuit will be broken between the battery and the starter motor.

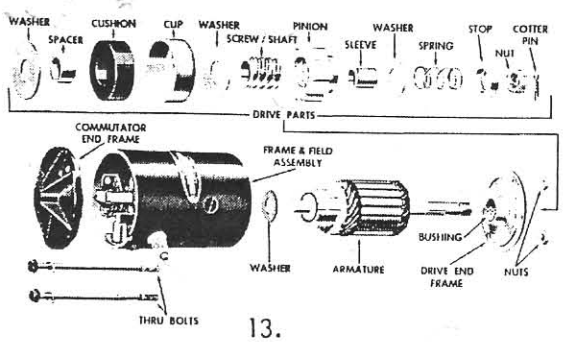
The starter solenoid enables us to avoid running heavy current through the ignition switch. On the 25 H.P. model the throttle microswitch has been eliminated and only the shift microswitch is used.

The service required on the electric starter motor is the same for all models. Following is detailed information on servicing starter motors.

STARTER MOTOR SERVICE

Mechanical Features

All outboard engine cranking motors consist of two major sub-assemblies, the frame and field assembly, and the armature and drive assembly which also includes the drive and frame. The field coil set, with insulated brush attached, is held in position by the pole shoes which are attached to the motor field frame by means of the pole shoe screws. The insulated and ground brush holders are riveted to the motor field frame. This constitutes the frame and field assembly. (Fig. 13.)

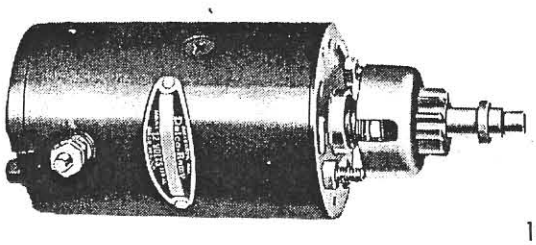


13.

The armature and drive assembly consists of the armature, drive end frame, and the drive mechanism. The 12 volt armature contains 10 three turn coils. The armature coils are connected to the commutator either by soldering or hot staking. The armature is supported by bronze bearings, one in the commutator and frame, one in the drive end frame, and one in the starter bracket on the 60 H.P. motor. The "thru" bolts pass through both the commutator and drive end frames and are threaded into the starter bracket casting on the 40 and 60 H.P. motors. On the 25 H.P. motor the "thru" bolts are attached to spacers which are then bolted to the starter bracket. Replacement motors which are shipped from the factory without the bracket have a standard nut on each "thru" bolt, in order to hold the assembly together. These nuts should be removed and the "thru" bolts threaded into the starter bracket when replacing the starter on the motor.

The commutator end and frame of some motors are dipped in sealing paint after assembly to protect them from splash and moisture when in operation on outboard engines.

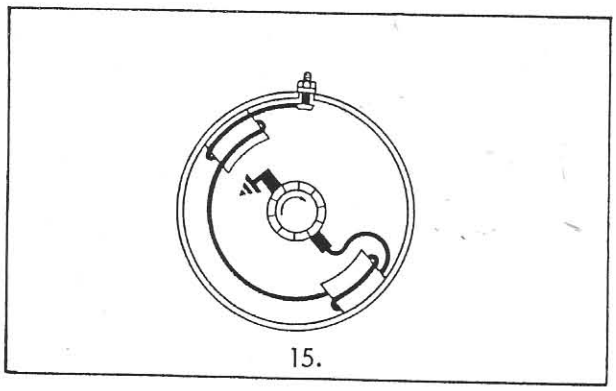
The type of drive used on the cranking motor is referred to as the Delco-Remy Inertia Type Drive. See Fig. 14. The drive assembly is mounted on the armature shaft which has external spiral splines that



14.

match the internal splines in the drive assembly. When the cranking motor is not operating, the pinion is in a disengaged position. As soon as the cranking motor switch is closed, the armature begins to rotate, picking up speed rapidly. The pinion, however, does not pick up speed instantly and as a result the screw shaft turns within the pinion. This forces the pinion to move laterally toward the end of the shaft and into mesh with the flywheel ring gear. As the pinion moves into mesh with the ring gear it reaches the pinion stop. Since it can travel no further, it is forced to rotate with the armature, thus turning the flywheel and cranking the engine.

The field coils are connected so that the input current flows through all the field coils in series to a single insulated brush. The circuit is completed through the armature to the ground brush which is connected to the motor frame. (See Fig. 15.)



15.

The shock of engagement of the pinion and flywheel ring gear is absorbed by the rubber cushion. After the engine has started, the flywheel spins the drive pinion more rapidly than the armature shaft is turning, and the pinion is backed out of mesh with the flywheel ring gear. The drive return spring keeps the pinion from drifting into mesh with the flywheel ring gear while the engine is running and aids in disengaging the pinion.

CRANKING MOTOR MAINTENANCE

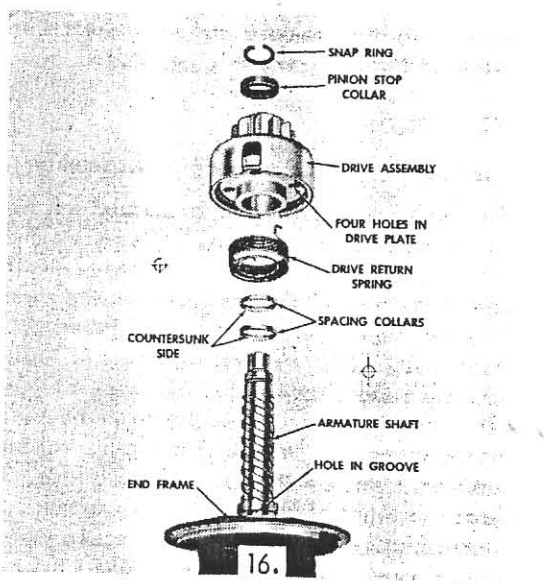
Periodic Inspections

The outboard engine cranking motor is designed to be corrosion resistant and requires very little maintenance. However, to insure satisfactory operation, periodic inspections should be made to make sure the mounting and wiring connections are tight and in good condition. All wiring connections should be clean and tight. These inspections should also include the connections to the battery and return circuit, as loose or dirty connections anywhere in the circuit will cause high resistance and reduced cranking efficiency. If, when mounting and wiring connections are kept in good condition, the motor responds instantly and cranks the engine when the switch is closed, the motor may be considered to be in satisfactory condition and disassembly is unnecessary.

Lubrication

The bronze bearings of the cranking motor are graphite and oil impregnated and ordinarily require no added lubrication.

They should be lubricated only when the motor is disassembled for some reason, at which time a few drops of light engine oil may be placed on each bearing before reassembly. Care should be taken that no oil reaches the commutator. The spiral splined shaft of motors with Delco-Remy drives (Fig. 16.) should be lubricated periodically with a few drops of 30 or 10W30 oil.



16.

CRANKING SYSTEM FAILURES

First of all, an inspection should be made (as described in Periodic Inspections) to be sure there are no loose or badly corroded connections in the circuit. If the connections and wiring are found to be in a satisfactory condition, the battery should be checked to determine its stage of charge. If the battery is charged and battery voltage is reaching the cranking motor without any excessive losses in the wiring and connections, the trouble can probably be attributed to either the engine or the cranking motor itself. However, if the battery is charged but there is no current flow to the motor at all, the trouble is probably either in the starting switch or the starter solenoid. This can be determined by wiring around or by-passing each switch with a heavy jumper of some kind. Excessive friction in the engine from tight bearings or pistons, or from heavy oil obviously makes the engine much harder to crank. However, if the engine is known to be in a normal condition, and the rest of the cranking system is found to be satisfactory, the cranking motor should be removed for further checking.

DISASSEMBLY

Normally, the cranking motor should be disassembled only so far as is necessary to make repair or replacement of the defective parts.

To disassemble the outboard engine cranking motor, first remove the cranking motor from the engine, then remove the "thru" bolts and the commutator end frame. Next, remove the armature with the drive end frame and the drive assembled on it from the frame and field assembly.

To disassemble the Delco-Remy drive from the armature, slide a standard half-inch pipe coupling or other metal cylinder on to the shaft so the end of the coupling or cylinder butts against the edge of the pinion stop collar, then tap the end of the coupling to drive the stop collar towards the armature and off the snap ring. Remove the snap ring from the groove in the shaft, then remove the drive, spring, and space collars in the order shown (Fig. 16.)

SERVICING

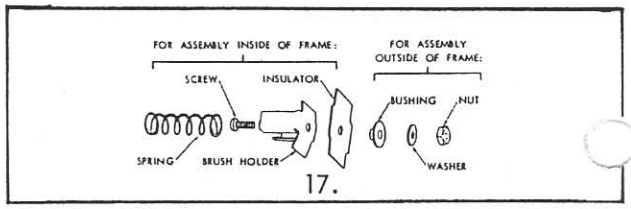
Checking the Frame and Field Assembly

The frame, field, and brush assembly can be checked for open circuit or grounded circuit by means of a test lamp. To test for open circuit on 12-volt models, place one point of the test lamp on the terminal and the other point on the insulated brush. If the test lamp fails to light, an open circuit is indicated. A grounded field circuit can be located by placing one test point on the insulated brush or on the terminal and the other test point on the frame, making certain contact is made with the metal surface. The test lamp will light if the circuit is grounded. The insulated brush holder should be checked with the test lamp to make certain it is insulated from the frame. The brush supports should also be inspected to make sure there is no binding on the brushes and no broken brush springs.

There is no satisfactory field test for shorted field coils, and if this condition is suspected, the field coil assembly should be replaced and the motor retested to see if the performance improves.

Disassembly of the Frame and Field

If the frame and field assembly is found to be defective, it may be disassembled, if necessary, to locate the trouble. The first step is to remove the pole shoe screws. This may be accomplished by placing the frame in a vise (being careful not to clamp it tightly enough to distort the frame). The pole screws may then be removed with a Phillips screw driver, using an adjustable wrench to turn the screw driver. (See Fig. 14) Next, remove the terminal nut and insulating washers. Then the field coil set is free to be removed. Disassembly is now complete except for the brush holders. It is unnecessary to remove the brush holders from the frame except when defective, or when replacing the ground brushes. Removal is accomplished by cutting off the rivets with a cold chisel or by drilling them out. Replacement brush holders are available complete with screw, washer, and nut for attaching to the frame. (See Fig. 17.) Brush springs are also available for

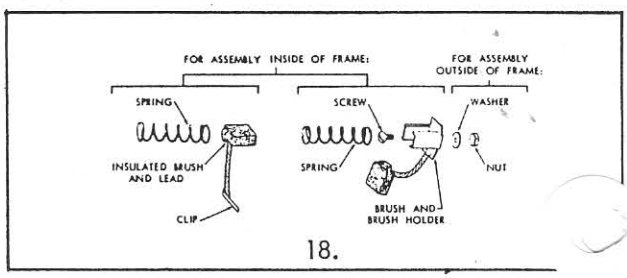


17.

replacement. To remove the brush spring from the holder, first compress one side of the spring with a small screw driver until the spring flips out of its seat. Then turn the spring clockwise until it comes out of the holder.

Replacement of Brushes

If it becomes necessary to replace the brushes in the cranking motor, the frame and field must be disassembled as described in the preceding section. Replacement brush sets are available which contain the insulated brush with a flexible lead attached and ground brush holder with brush and lead attached, along with the necessary screws, washers, and nuts for attaching to the frame. (See Fig. 18.)



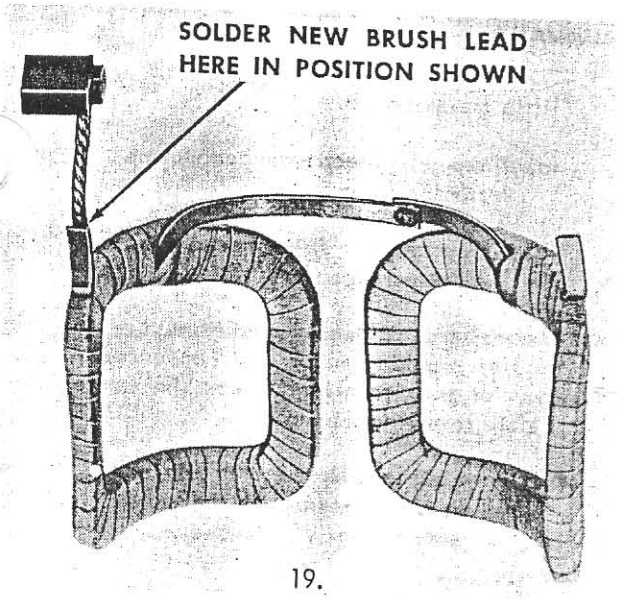
18.

To replace the insulated brush, first cut off the old brush lead at the point where it is attached to the field coils. The end of the coil must then be prepared for soldering on the new brush lead assembly. It is recommended that the lead be soldered to the back side of the coil so that excessive solder will not rub the armature. The end of the coil should be thoroughly cleaned by filing or grinding off the old brush lead connection. Varnish should be removed only as far back as is necessary to make the solder connection.

Using rosin flux, the leads may then be soldered to the field coils making certain that they are in the right position to reach the brush holders. See Fig. 19. Do not overheat the leads as the solder will run on them and they will no longer be flexible.

To replace ground brush assembly, first remove the old brush holder as described in the preceding section, then attach the new assembly to the frame with the screw, washer, and nut included in the package. After tightening the nut, peen the screw with a hammer so that the nut cannot vibrate loose dur operation of the engine.

When the field coil and brush assembly is reassembled in the frame, the frame and field assembly should



19.

be rechecked with a test lamp to make sure that the soldered connection is not touching the frame, thus grounding the fields.

Armature Servicing

The armature should be checked for opens, short circuits, or grounds as explained in the following paragraphs. If the armature commutator is worn, dirty, out of round or has high mica, the armature should be put in a lathe so the commutator can be turned true. The mica should then be undercut 1/32 of an inch deep, and the slots cleaned to remove any trace of dirt or copper dust. As a final step in this procedure the commutator should be sanded lightly with No. 00 sandpaper to remove any burrs left as a result of the undercutting procedure.

Open circuited armatures often can be saved where the open is obvious and repairable. The most likely place for an open to occur is at the commutator bars as a result of excessively long cranking periods.

Long cranking periods overheat the cranking motor so that the solder in the connections melts and is thrown out. The consequent poor connections then cause arcing and burning of the commutator bars as the cranking motor is used. If the bars are not too badly burned, repair can often be affected by resoldering the leads in the bars (using rosin flux) and turning down the commutator in a lathe to remove the burned material. The mica should then be undercut.

Short circuits in the armature are located by use of a growler. When the armature is revolved in the growler with a steel strip such as a hacksaw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located. Copper or brush dust in the slots between commutator bars sometimes produces shorts between bars which can be eliminated by cleaning out the slots.

Grounds in the armature can be detected by the use of a test lamp and test points. If the lamp lights when one test point is placed on the commutator with the other point on the core or shaft, the armature is grounded. Grounds often occur as a result of insulation failure which is often brought about by overheating of the cranking motor produced by excessively long cranking periods.

Servicing Other Parts

The drive end or commutator end frames should be replaced if they are broken or distorted in any way. The bronze bushing in the drive end frame may be pressed out and replaced if worn excessively, but if the commutator end bearing is worn, it is necessary to replace the complete commutator end frame assembly.

REASSEMBLY

To reassemble the cranking motor, simply replace the parts in reverse of the disassembly procedure. The frame and field assembly should be completed first and checked with a test lamp to make sure no grounds or opens have been established in the assembly procedure. If brush holder assemblies have been replaced, make certain they are tight and will not vibrate loose. It should be noted that the pole shoes are notched on one end to accomodate the bulky connections at the field coils. It is important that the notched ends be placed at the lead ends of the coils so the pole shoes can be tightened up properly and will not drag the armature.

When the frame and field assembly is complete, the drive end frame and drive should be reassembled to the armature. If the drive is a Delco-Remy drive as shown in Figure 16, reassemble it as follows:

1. Lubricate the splined portion of the armature with 30 or 10W30 oil.

2. If the two spacing collars (thrust washers) have been removed from the shaft, install these two collars on armature shaft with countersunk side towards end frame.

3. Place drive return spring on armature shaft with small diameter of spring towards end frame.

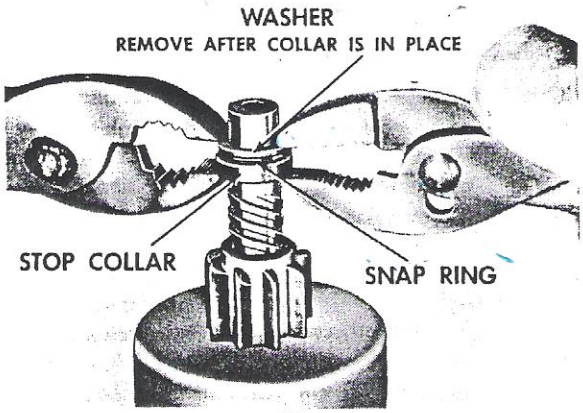
4. Install first turn of small end of spring in groove of shaft next to end frame. Hook the tip of the end of spring in the hole at bottom of groove. *Do not distort spring.*

5. With spring in the free position, hold spring out of the way while drive is assembled on shaft back against thrust washers. Then wind up free end of spring 3/4 turn and hook it into the nearest hole provided in the drive plate. Four holes are provided. Be sure the spring is securely hooked into the drive plate.

6. Slide pinion stop collar onto shaft with cupped surface facing away from drive.

7. Install snap ring in groove at end of shaft. Squeeze snap ring (with pliers) so it fits well into groove.

8. Position pinion stop collar next to snap ring and assemble a washer (use a standard automotive cranking motor thrust washer if available) next to other side of snap ring. See Figure 20. Use two pairs of pliers at the same time (one pair on either side of shaft) to grip stop collar and washer. Stop collar will rotate freely when properly assembled.



20.

9. Rotate drive against pinion stop and relieve any turns which may be overlapping other turns. When the spring is properly assembled, the drive should return snappily from the engaged position.

With the drive end frame and drive assembled to the armature, insert the armature into the frame and field assembly being careful not to damage the commutator or brushes. The commutator end frame should then be replaced and the thru bolts inserted. If the armature does not turn freely, it may be necessary to align the pole shoes by prying into position with a screwdriver. (Do not damage the field coils.) Occasionally the pole shoes get slightly out of line in the tightening procedure and will drag the armature if not aligned. The motor should always be tested after it is reassembled. (On some motors standard nuts must be placed on the thru bolts before testing.)

If the motor has been previously sealed, it should be resealed before placing it back in service. Liquid neoprene (commercially available from several sources) should be brushed on wherever the original seal has been broken – around the commutator end frame, the thru bolt heads, the terminal, the pole shoe screws, and the screws which attach the brush holders (if brush holders have been replaced).

SUMMARY

1. Outboard engine cranking motors require very little maintenance.

   (a) Keep all electrical connections tight corrosion free.

   (b) Lubricate the drive mechanism periodically with a few drops of light engine oil.

2. Remember that many conditions besides a defective cranking motor may cause cranking failures or poor cranking. Check the whole system before removing the motor.

3. Never disassemble the cranking motor any further than is necessary. If the motor cranks the engine satisfactorily, disassembly is unnecessary.

4. Do not operate the cranking motor continuously for more than 30 seconds without pausing to let it cool for at least two minutes. The motor is not designed for continuous operation and serious damage may result.

GENERATING CIRCUIT

All of the electric starting models have an alternator generator. This generator will maintain the battery charge and enable the operator to power various electrical accessories.

The output of the alternator generator is 4 to 6 amps for the 25 and 40 H.P. models, and 18 to 20 amps for the 60 H.P. model. Basically the generator operates in the same manner for all of the electric starting models. However, due to the high output of the 60 H.P. alternator, a voltage regulator has been added to prevent overcharging of the battery. The following information will point out how the alternator generator operates.

The generator coils are mounted on a laminated iron core beneath the flywheel. Current is induced in the alternator coils in the same general manner as in the magneto ignition. The magnetic field passing through the core is constantly changing as the flywheel is rotated due to the placement of the permanent magnets imbedded in the flywheel. This causes an alternating current to form in the coils, the strength of this current depending upon the number of coils used in the system. Since the battery uses direct current, the alternating current coming from the coils is passed through a selenium rectifier which allows current to pass through it in only one direction. From the rectifier, the direct current is fed back through the leads coming from the positive terminal of the battery, thereby charging the battery.

The 60 H.P. models uses 12 generating coils in order to obtain higher generator output. The 12 coils are divided into 4 groups, each containing 3 coils which

are connected in series. All four groups of coils are connected together in a parallel hookup, however, the output of three of these groups passes through the voltage regulator before passing through the rectifier. If the battery is fully charged, the regulator will break the circuit so that the three groups of coils will not charge the battery. One group of coils constantly charges the battery. If the battery charge is low the regulator will close the circuit so that the three groups of coils will add their output to the fourth group of coils. The approximate output of each of these groups of coils is 4½ to 5 amps per group.

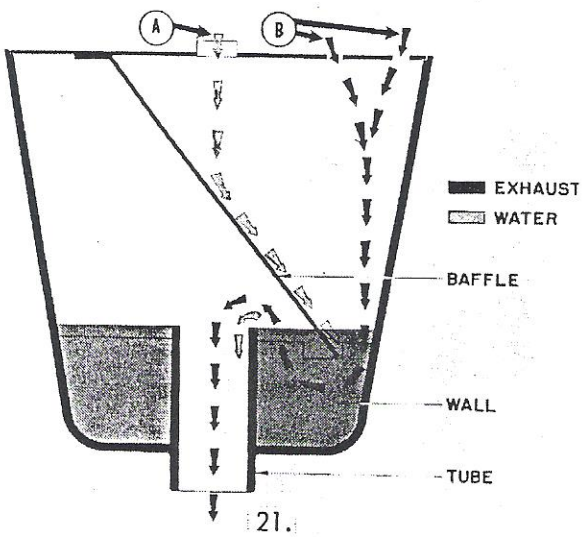
CHOKE CIRCUIT

As an added convenience, the engine can be choked at the starter panel. Current is taken from the battery terminal of the ignition switch. It flows through the choke switch, through the choke solenoid coil, mounted on the engine, to ground and back to the battery. The current passing through the coil creates a magnetic field which will pull the plunger assembly upward, raising the choke bar and choking the engine. When the choke button is released current will cease to flow through the solenoid coil. This causes the magnetic field to collapse and the plunger to drop.

IDLE RELIEF

The idle relief facilitates starting and low speed operation by alleviating exhaust back pressure. All models from 7.5 to 60 H.P. have a similar idle relief system.

As shown in Figure 21 exhaust gases and coolant water from the powerhead are deflected downward into the idle relief chamber by the baffle plate. Due



21.

to the placement of the outlet tube a determined level of water is maintained and the surplus is expelled through the outlet tube. Exhaust gases entering the idle relief are forced to pass through this water before being expelled from the engine.

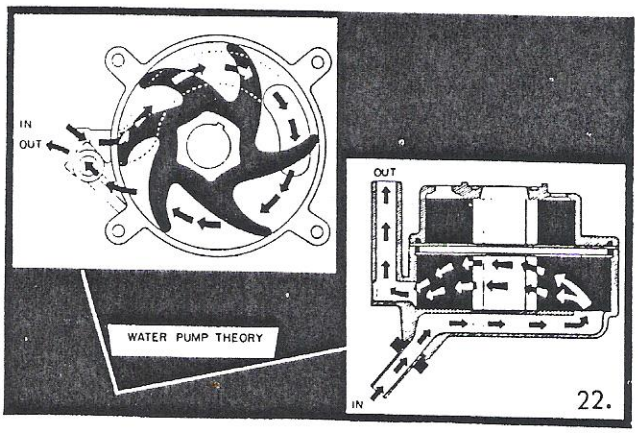
During starting and low speed operation the level of water in the lower motor casing is much greater than the amount present in the idle relief, hence the exhaust gases will pass through the idle relief and be expelled. As the boat goes on a plane, the level of water will drop in the lower motor casing until the bulk of the exhaust gases are expelled through the lower exhaust outlet. A small amount of exhaust gas will continue to be expelled through the idle relief even at high speeds.

As the motor is slowed down the level of water in the lower motor casing will increase until at low speed the bulk of exhaust gases will again be expelled through the idle relief.

WATER AND BAILER PUMP OPERATION

The 7.5 H.P. through 60 H.P. motors are equipped with separate water and bailer pumps. They have separate water intake lines and discharge exits which prevent bilge water in the bailer system from circulating in the engine cooling system..

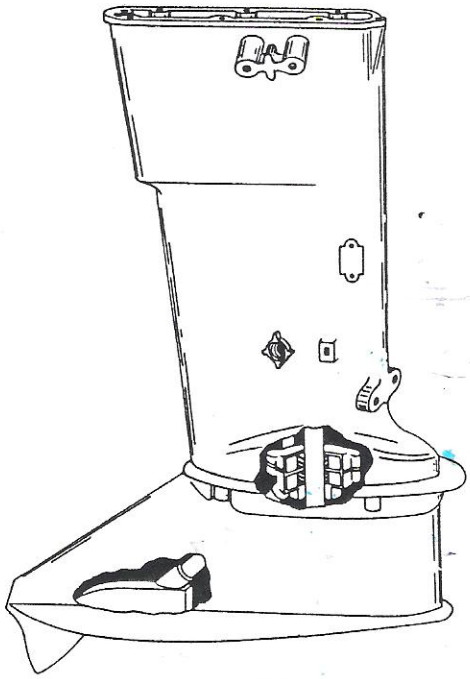
Both pumps operate off the engine driveshaft which turns the impellers in the pump bodies. The pumps in the 12 through 60 H.P. motors are designed with the driveshaft hole off-center which causes the impeller blades to flex in one portion of the pump body. This flexing action causes the pump to act as a displacement pump at low speeds. At high speeds, the pump acts as a centrifugal pump.



22.

The 7.5 H.P. engine is operated in the same manner: only the design of the impellers and pumps differ. Rather than having an off-center driveshaft hole, there is a flat spot on the pump wall which flexes the impeller blades.

The water pump obtains its coolant water supply from the intake (directly beneath the anti-cavitation on the 12 H.P. through 60 H.P. motors and at the sides of the lower unit on the 7.5 H.P. motor) and pumps the coolant water up to the powerhead where it circulates between the exhaust cover plate , in the water jacket around the cylinders, and through the cylinder head. It is then discharged into the idle relief chamber and the lower motor casing.



23.

The bailer pump draws bilge water through the bailer foot into the bailer pump and discharges the bilge water into the lower motor casing, where it is carried away by the engine exhaust.

You will note that there is a small bleed hole(s) in the stainless steel plate(s) between the water pump and bailer pump body. This small hole(s) allows a small amount of water to "bleed" into the bailer pump from the water pump and lubricates the bailer impeller when bilge water is not present in the bailer pump.

SECTION III

POWERHEAD REPAIR

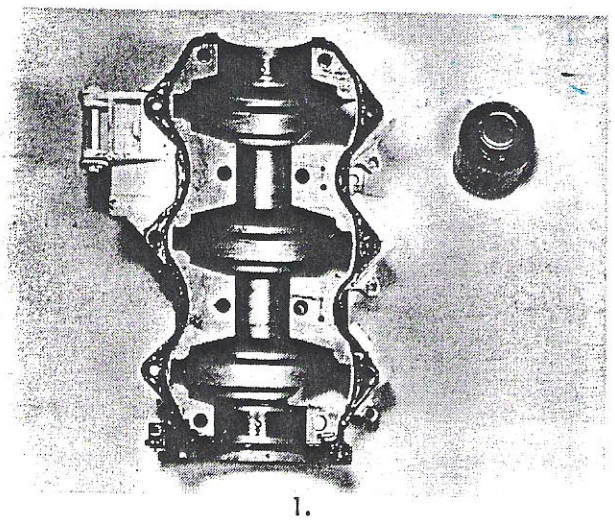
POWERHEAD REPAIR – GENERAL

The powerheads of all model motors are similar in a great many respects in regard to the disassembly, assembly, and inspection of various components. This section will explain the procedures to be followed with these various components. You must be thoroughly familiar with the information in this section before initiating a powerhead repair.

BLOCK AND CRANKCASE

The block and crankcase assemblies on all models are matched assemblies and must be replaced as such. The cylinder sleeves are cast with the block and therefore cannot be replaced. However, if the cylinder walls show slight evidence of damage, they can be cleaned up to .005" with a finishing hone (all models).

Always thoroughly clean the mating surfaces of the block and crankcase before assembling. Then apply a moderate amount of EC847, an adhesive produced by Minnesota Mining and Manufacturing, or Permatex No. 3 along the rubber seal in the groove in the crankcase. See Figure 1. Use caution when making



1.

this adhesive application by carefully avoiding check valves. Be especially careful not to allow the adhesive to flow into bearings.

"B" BLOCKS – 60 AND 40 H.P. MODELS

When the letter "B" appears at the end of the serial number on a 60 or 40 H.P. motor, C3JB – 0000B as an example, the cylinders are bored .030" oversize and use corresponding oversize pistons and rings. If the cylinder walls are damaged on motors with this "B" designation, they can be cleaned up with a finishing hone .005". If honing does not clean up the cylinder then both the crankcase and block will have to be replaced.

If the serial number on a 60 or 40 H.P. motor does not end with the letter "B", C3JB-0000 as an example, the cylinders can be bored .030" oversize and .030" oversize pistons and rings are available. Refer to your parts catalog for correct parts numbers.

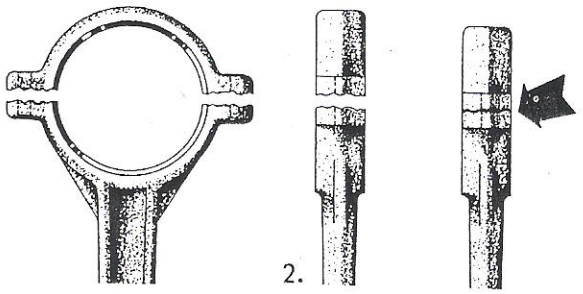
Oversize pistons and rings are not available for any other model engines.

As the powerhead is disassembled, examine the components for the following conditions:

1. Damaged seals and gaskets.
2. Carbon deposits – Scrape clean and/or wire brush.
3. Pistons – If surfaces are pitted, scored or cracked, replace the piston – Thoroughly clean ring grooves – Inspect wrist pin bearing. Rings – Replace if worn excessively or unevenly.
4. Connecting rods – inspect for straightness, cracks, uneven wear, replace rods, bearings and cages, if the rod shows the evidence of the above.
5. Crankshaft – Inspect machine surfaces for signs of pitting or uneven wear; replace damaged crankshafts.
6. Main bearings and crank pin bearings – If bearings are pitted, show signs of excessive rust, or bind or catch when rotated, replace the bearings. Surface rust can be removed from crank pins with crocus cloth.
7. Ball bearings – Inspect for items in number 6. Hold the outer race and move the inner race in and out, if there is excessive play, replace the bearing.
8. Block and crankcase – Inspect for visible cracks, damaged machined surfaces (clean up on a surface plate – use a 120 grit emery cloth). If the damage is severe, the parts must be replaced. Inspect water passages for obstructions. Carefully examine all lubrication and scavenging check valves.

SPECIAL DISASSEMBLY AND ASSEMBLY INSTRUCTIONS

As a powerhead is disassembled, the components of each cylinder must be kept separate and marked so that these components are replaced in the cylinder from which they were removed. The best method is to keep the parts in containers marked for a particular cylinder. This same procedure should be used with caged main bearings.



2.

Connecting Rods

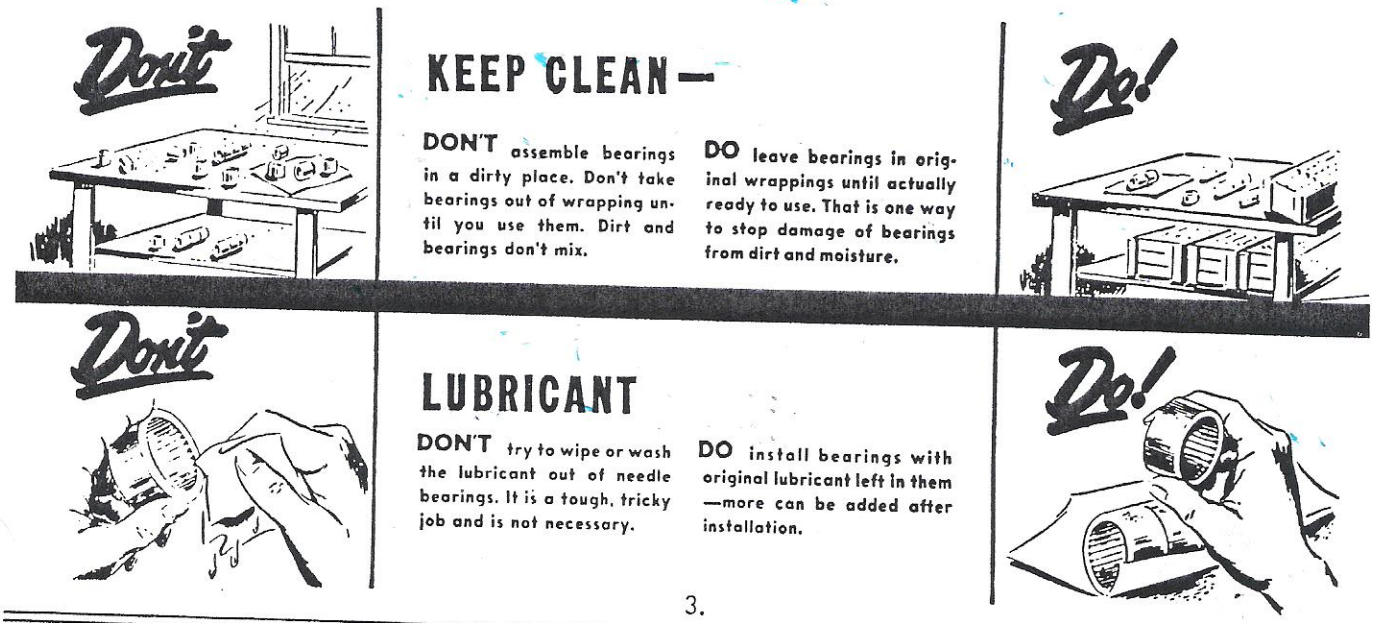
During the manufacturing process the crank pin end of all connecting rods are split by a method called "fracturing". This results in a fractured fit between the main part of the rod, and the rod cap. This fractured fit makes it imperative that the rod and cap are carefully matched together when being assembled. See figure 2.

When correctly assembled, the lines of fracture almost disappear. Always torque rod cap screws as specified.

It is also important that rods are installed with the word "top", which appears in the channel in each rod, facing toward the top or flywheel end of the motor. Installed in this manner, oil will collect in the rod channel and flow into an oil hole to lubricate either the crank or wrist pin bearings.

Caged Roller Bearings

The crank pin bearings, on all models except the 3.6 H.P., are caged bearings and must be kept separate in the same manner as connecting rods. Do not inter-change cages or rollers. These parts can be replaced in sets only.



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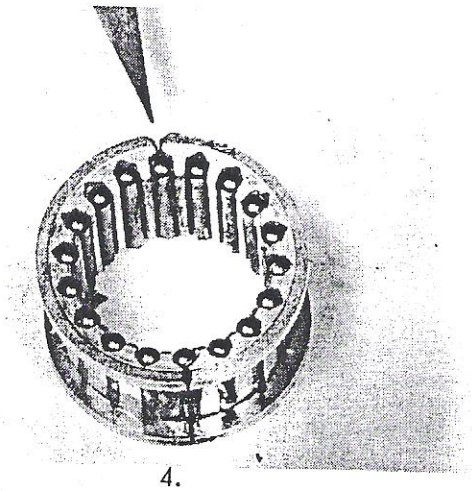
When assembling bearings and cages, use grease to hold the rollers in place. Also, and most important, carefully match cage halves by mating the identifying ground corners of each cage half. See fig. 4.

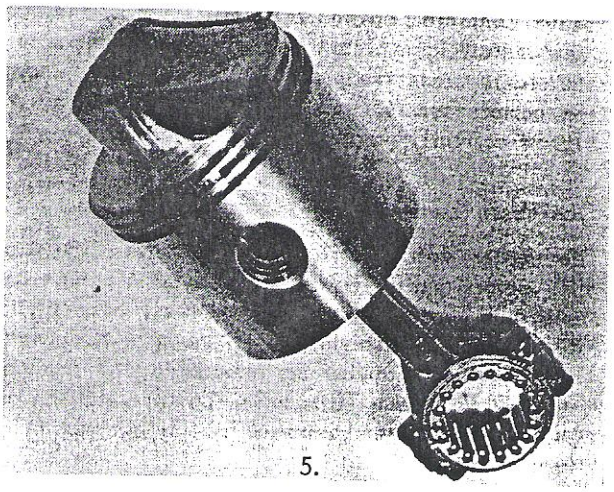


4.

One roller fits into each slot in the bearing cage and one roller between each end of the cage halves. ee fig. 5.

Caged main bearings and split bearing races – See fig. 6.

The 60, 40, 25 and 12 H.P. models use caged center main bearings (2 on the 60 H.P. model) with a bearing race which is split during the manufacturing process by the same method as connecting rods, "fracturing". This results in a fractured fit between the two halves of the bearing race, and makes it imperative that the two halves of the race be carefully matched together when being assembled. When correctly assembled, the lines of fracture almost disappear. Always secure the bearing race with the provided retaining ring.



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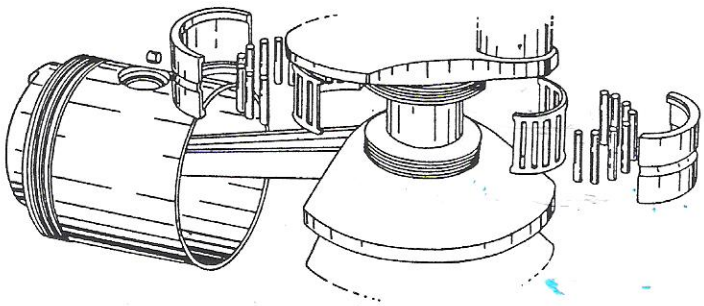
The rollers for main bearings are placed around the outside of the cage and are easily held in place by using grease. One roller fits into each slot in the bearing cage and one between each end of cage halves.

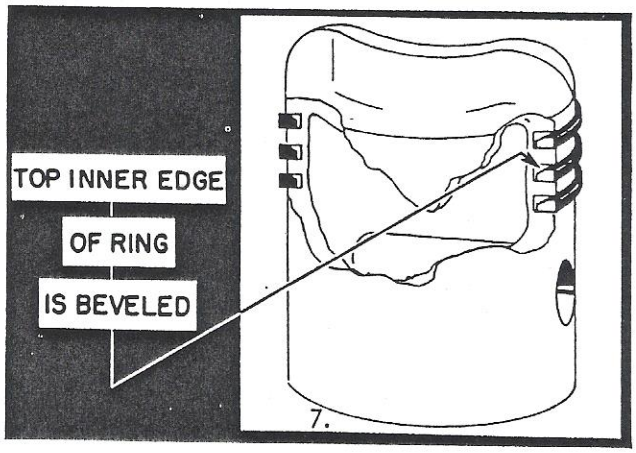


6.

Always locate the center main bearing(s), as well as top and bottom main roller bearing on the pin which is fitted into the crankshaft journals.

Pistons and Rings

The pistons and rings used on all models are permanent mold pistons with the same basic configuration. They all use cast iron rings. You will note a beveled inner edge on all rings. This beveled edge must face toward the dome of the piston, as shown in figure 7.

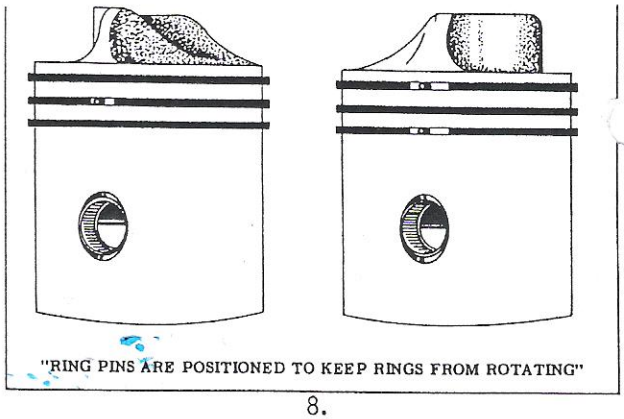


7.

when installed correctly. It is also necessary that the rings be located with the pin(s) in each ring groove centered between the split ends of the rings when installing a piston in the cylinder. If force is required to press the piston into a cylinder, when a ring compressor is used, the rings probably are not aligned correctly with the pins. See fig. 8.

Crankshaft Bearing Seals

The center main bearing seal(s) on the 60 and 40 H.P. motor is affected by grooves cut in the crankshaft and is called a labyrinth seal. See fig. 9. After a period of use the center crankshaft journal(s) will evidence grooves corresponding to the labyrinth seal grooves. This is a normal condition and unless the grooves become too deep should not arouse concern.



8.

The top and bottom crankshaft bearing seals are rubber on all models (25 H.P. uses a graphite bottom bearing seal) and should always be closely inspected. Replace seals which are in other than perfect condition.

Powerhead Assembly Test

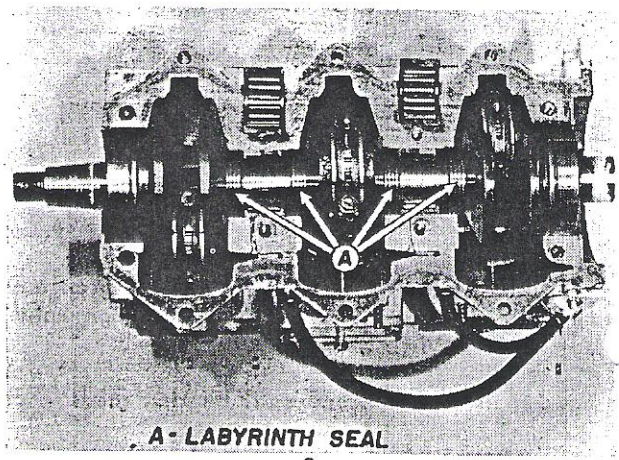
When the block and crankcase have been assembled rotate the crankshaft manually. If all bearings, rings, etc., have been installed correctly, you should be able to rotate the crankshaft easily. If any catching or binding is noted, the powerhead should be disassembled and thoroughly checked.

SCAVENGING SYSTEMS

The scavenging systems on all models (3.6 excepted) is the method used to either pump lubrication to bearings (7.5) or drain off and discharge the heavy, unburned portion of the fuel mixture (60, 40, 25, 12, 7.5).

The 60, 40, and 25 H.P. models utilize gravity flow to deep "V" sections of the intake manifold and tilted reed boxes to collect and drain off the excess oil. When it collects in the deep "V" 's, it flows through check valves and is discharged into the lower motor casing and carried away by the exhaust.

It is very important to inspect the scavenging lines and check valves when a powerhead is disassembled. Refer to the powerhead section of each particular engine for the location of the scavenging system.

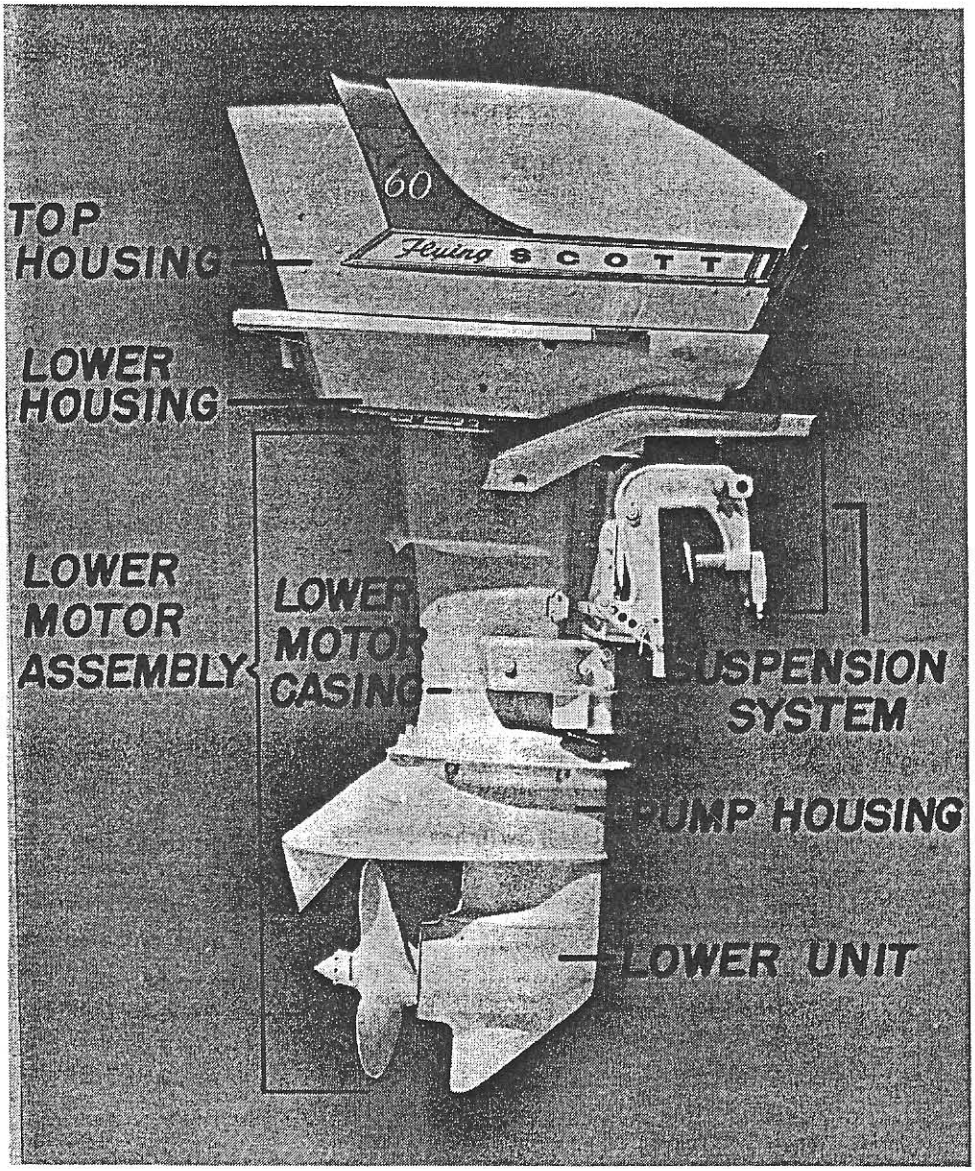


9.

SECTION IV

60 H.P. MODEL

INTRODUCTION



Horsepower O.B.C. Certified	60 H.P. @4800 RPM
Normal Full Throttle Range	4400 to 5200 RPM
Number of Cylinders	3
Bore and Stroke	3 1/8" X 2 3/4"
Piston Displacement	63.27 Cu. In.
Gear Ratio	16:25
Weight	170 lbs.
Fuel Tank Capacity	6 gal. (Remote Tank)
Fuel Mixture	
Break-In	1/2 Pint Oil to 1 gallon gas
Normal Operation	3/8 Pint Oil to 1 gallon gas
Initial Carburetor Setting	
Main	Fixed Jet
Idle	2½ Turns Open (counterclockwise) from fully closed
Spark Plugs	Champion J6JM Gapped .035"
Recommended Breaker Point Setting	.015"
Generator Output	18-20 Amps
Lower Unit Lubrication	S.A.E. #90 E.P.

60 H.P. MODEL

When servicing the 60 H.P. model, separate major assemblies first, then proceed to overhaul or repair ...h assembly.

...nation on how the various systems operate can ...round in the Operating Principles section, along with valuable information on installing the motor, overhaul and painting instructions, etc.

Following are detailed instructions for trouble shooting, maintenance, adjusting, and disassembly of the various engine components. For convenience these instructions are divided into groups, each of which pertains to a major assembly or system on the engine. These major assemblies or systems are as follows:

1. Housing
2. Electric System
3. Fuel System
4. Powerhead
5. Suspension System
6. Lower Motor Assembly

HOUSING

The 60 H.P. housing is divided into two halves, the hood and the lower housing. Following are instructions on maintaining and disassembling these assemblies.

...e hood is constructed of fiberglass and will usually require no maintenance. It can be painted with touch-up spray in the event that it shows signs of wear. If it should be damaged slightly it can be repaired using a fiberglass repair kit. Emblems, bumpers, and hook brackets are available and these items can be replaced if necessary.

Lower Housing

The lower housing is constructed of aluminum and is mounted to the motor adaptor plate. Normally it will require no maintenance other than refinishing if it shows signs of wear. The molding and latch assembly can be replaced if necessary.

Disassembly and Assembly

1. Remove the hood, then remove the screws which secure the powerhead to the adaptor plate.
2. Disconnect the fuel line, battery, and junction box leads from the powerhead.
3. Lift the powerhead assembly off the driveshaft.
4. ...emove the screws which secure the lower housing to the adaptor plate.
5. Remove the remote control bracket.
6. Remove the roll pin from the hood latch lever, then remove the bushing and hook assembly. To remove the latch spring, drill out the rivet with a suitable sized drill.
7. If the moldings should require replacement use E. C. 847 adhesive to cement the moldings in place.
8. To reassemble, reverse steps 1 through 7.

ELECTRIC SYSTEM

The electrical system is comprised of four separate circuits; these are:

1. Ignition circuit
2. Starter circuit
3. Generating circuit
4. Choke circuit

For information on how each of these circuits operate consult page 16, Operating Principles section.

When initiating repairs on any electrical system check each circuit individually from start to finish. In order to trace each circuit start at the point where the circuit receives its power and follow the circuit, checking the operation of each component, until it returns to the power source.

The increment drawings will be very helpful in tracing each circuit. Electricity leaves the battery from the positive terminal and will flow through the various circuits if the pathway is complete so that it can flow back to the negative terminal.

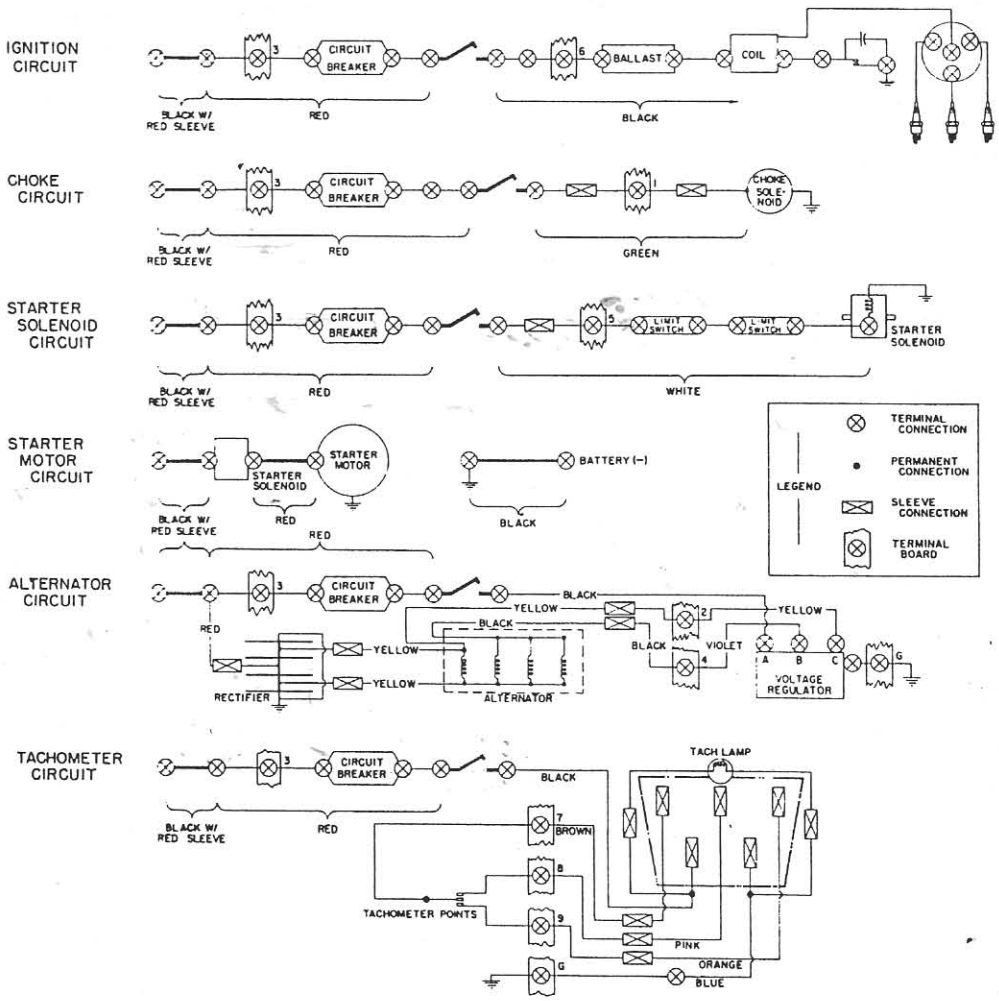
IGNITION CIRCUIT

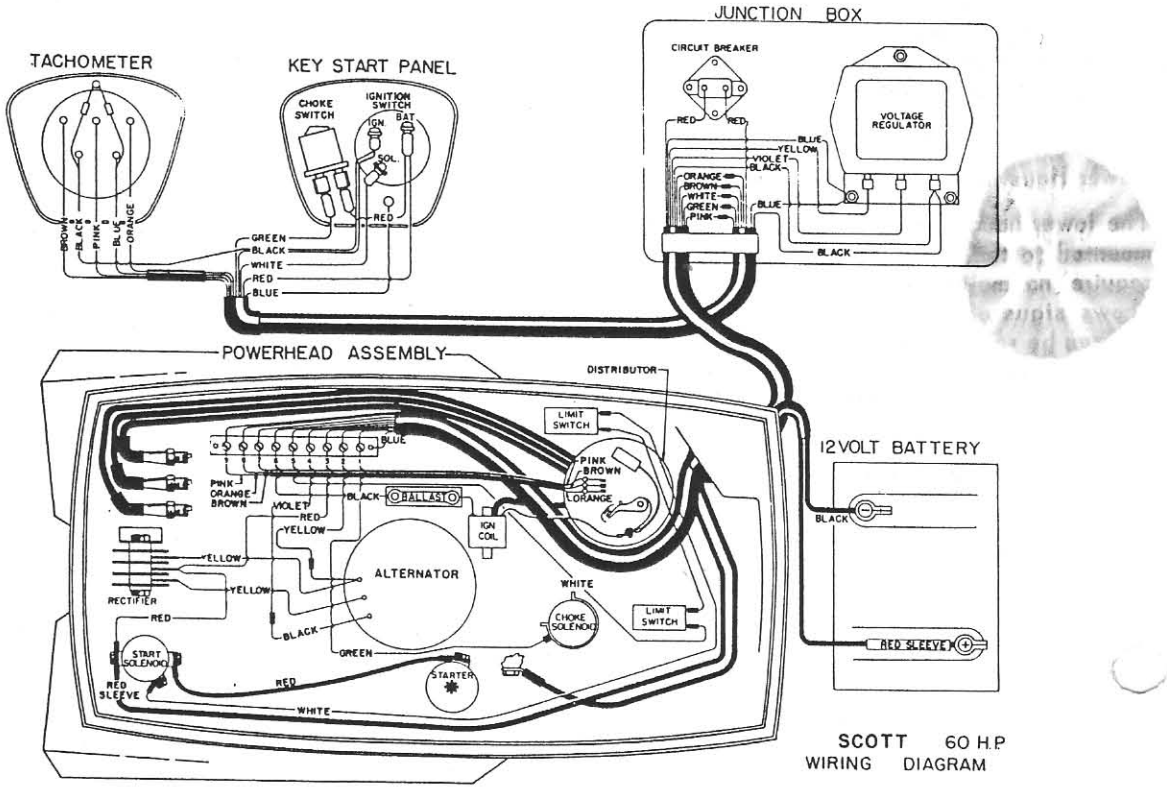
Following is a list of the components that make up the ignition circuit which are listed in the order that they should be checked when trouble shooting the circuit.

1. Circuit breaker.
2. Ignition switch.
3. Ballast.
4. Ignition coil.
5. Distributor.
   a. Ignition breaker points.
   b. Condenser.

Failure of the ignition system to operate as it should will result in the engine operating poorly or not at all. Listed below are causes of ignition difficulty; these conditions should be chec...ed and corrected if they exist.

SCOTT 60 HP
WIRING DIAGRAM





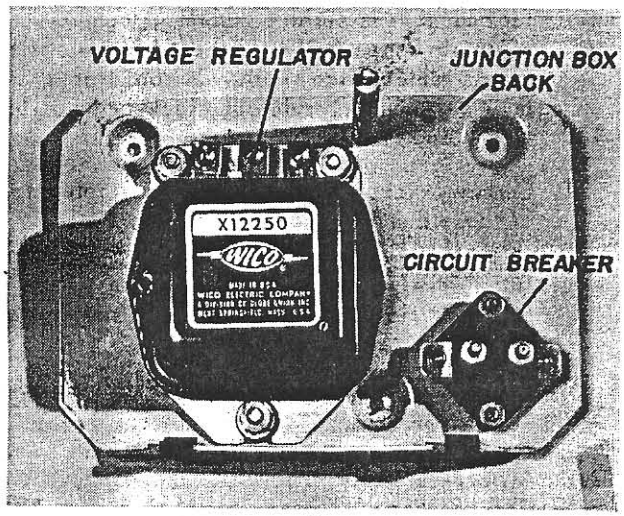
1. Loose connections.
2. Faulty switches, ballast, and condenser.
3. Dirty, pitted, or improperly gapped breaker points.
4. Hairline cracks or carbon tracks in the distributor housing which allow the electricity to flow to ground.
5. Rotor ends or terminals pitted.
6. Carbon brush spring weak or brush is worn so that it does not maintain positive contact with the rotor.
7. Spark plugs fouled, improperly gapped, or of the wrong type.
8. Engine is improperly synchronized or timed.

To maintain the ignition circuit, periodically clean and retighten all connections. Clean and inspect the ignition breaker points and spark plugs, regap if necessary to recommended settings. The 60 H.P. model uses Champion J6JM plugs gapped at .035 inch.

Inspect and clean the rotor ends and terminals with a fine tooth file. Check the brush in the bottom of the distributor housing for wear and check its spring for proper tension. The timing and synchronization should be checked and readjusted if necessary.

Circuit Breaker

The circuit breaker is of the automatic reset type. If the ignition key is left in the "ON" position and the engine is not running it will break the circuit and prevent damage to the rest of the circuit. When the



3.

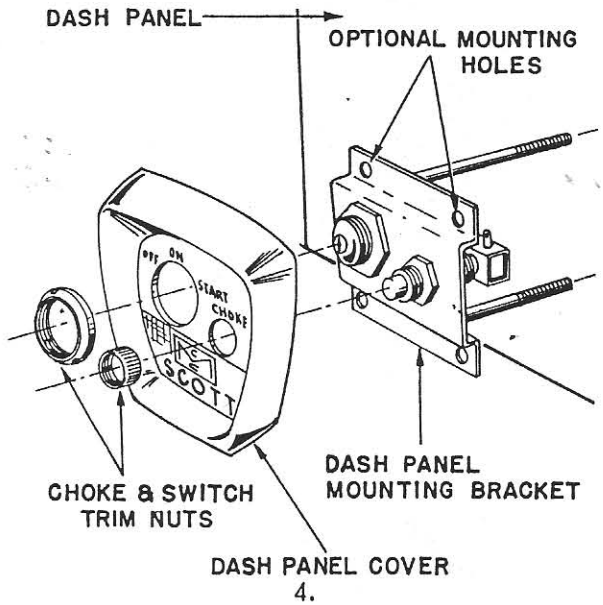
key is turned off, the circuit breaker will automatically reset itself. As this is a sealed unit the entire circuit breaker will need to be replaced if it should not function. If there is no electricity at the battery terminal of the ignition switch then the circuit breaker should be replaced.

Disassembly and Assembly

1. Remove the junction box cover.
2. Disconnect the circuit breaker leads.
3. Remove the circuit breaker mounting screws.
4. Reverse steps 1 through 3 to install the circuit breaker. Attach the leads to the same terminals as they were previously connected.

Ignition Switch

The ignition switch is a sealed unit which must be replaced if it should become inoperative. To check the operation of the switch use a jumper wire. With one end of the wire grounded, touch the ignition and solenoid terminals with the key in the "ON" and the "START" position. You should receive a spark at the ignition terminal only with the key in the "ON" position and at both terminals with the key in the "START" position. If you do not receive a spark, replace the switch.



4.

Disassembly and Assembly

1. Remove the ignition and choke switch trim nuts.
2. Remove the nut from the mounting bracket and disconnect the switch lead wires from their terminals.
3. Reverse steps 1 and 2 to install the switch. Consult the wiring diagram when attaching the switch wires to their terminals.

Ballast

The ballast is located on the powerhead. For information on its operation in the circuit, see Operating Principles section.

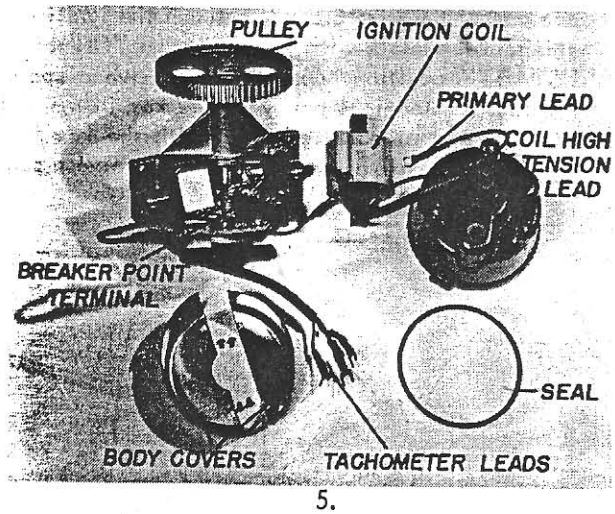
The ballast requires no maintenance, occasionally it should be checked according to the procedure listed in section X of this manual. There is little that can go wrong with the ballast other than a break

in its circuit. If this occurs, the engine will not run. To replace the ballast disconnect both leads from the ballast terminals, then remove the ballast. Reverse this procedure to replace the ballast.

Ignition Coil

The ignition coil is a sealed unit which requires no maintenance other than occasional cleaning and retightening of its leads. If it does not operate as it should the engine will receive a weak spark, or no spark at all. Instructions for testing the ignition coil can be found in section X.

Disassembly and Assembly



5.

1. Remove the primary lead from the bottom terminal of the ballast which is mounted on the exhaust cover plate.
2. Unplug the spark plug lead wires and coil high tension lead from the distributor cap.
3. Remove the coil mounting screws and coil.
4. Disconnect the three tachometer leads from the terminal board and the harness clamp from the powerhead.
5. Slip the timing belt up and off the distributor pulley. Do not pry off with any sharp instruments. It will slip off easily with thumb pressure.
6. Remove the distributor mounting screws and shims. Do not allow the weight of the distributor to rest on the spark advance cam.
7. Remove both distributor body covers.
8. Loosen the small clip holding the coil primary lead to the distributor body, then disconnect the primary coil lead from the breaker terminal and withdraw the lead from the distributor and tach wire grommet.

NOTE: See section X to test the coil.

Assembly

Reverse the order of disassembly. Be certain to allow enough slack in the coil breaker lead to permit full travel of the distributor stator plate, but do not permit excess wire to remain in the distributor body. See page 36 to properly replace timing belt and distributor.

Distributor

Information on how the distributor operates can be found in the Operating Principles section. The distributor usually requires only periodic maintenance. However, the maintenance and checks, which follow must be carefully performed to adjust the engine for top performance.

1. Check tachometer point air gap. Tachometer points are gapped at .013 – .018. Worn or pitted tachometer points should be replaced; do not attempt to file contacts clean. Do not clean tachometer points with compressed air at any time. See Page 40 for adjustments.

2. Inspect ignition points. If worn, burned, or pitted, replace; do not file points and expect them to operate efficiently. When reinstalling points be certain that the contact surfaces are in alignment. Always test the condenser, then the coil and ballast when replacing points to remedy point failures. Ignition breaker points should be set at .015" air gap. See "Point Adjustment".

3. In some instances, the high voltage surge in the secondary circuit will establish carbon tracks which cause this circuit to follow a path to ground other than across the spark plug gap. These carbon tracks can be identified as a black, burned path across insulating material such as on the distributor rotor or the distributor cap. If it is surface carbon, it can be scraped off with a pen knife. If the carbon track reoccurs, replace the part. Carbon tracks which form in hairline or larger cracks cannot be removed and the part must be replaced.

   Carbon tracks can usually be attributed to one of these causes:

   a. Too wide a spark plug gap.

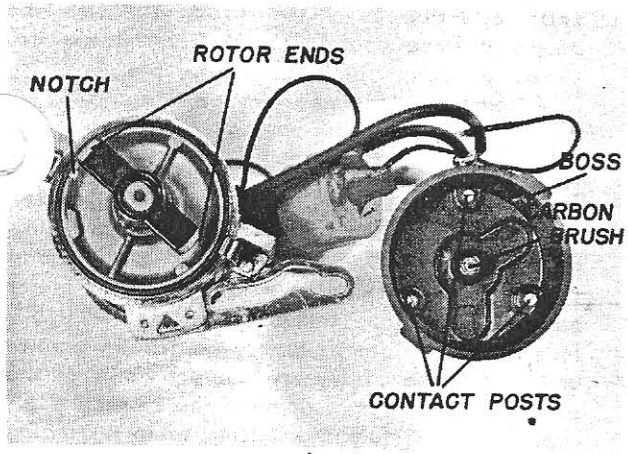
   b. Dirt, moisture, carbon, or corrosion in the distributor.

   c. Loose connections, broken or frayed lead wires.

   Always carefully check for all the above conditions to remedy the problem of carbon tracks.

4. Inspect the rotor ends and contact posts in the distributor for pits. If not excessively pitted, they can be cleaned up with a fine toothed file. Replace, if badly pitted.

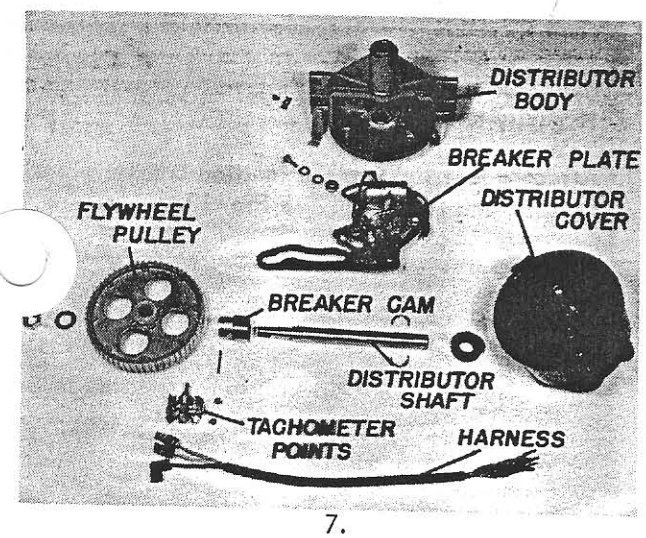
5. Be sure the carbon brush is protuding far enough to make positive contact with the rotor and the



6.

brush spring is installed correctly and is in good condition. Replace, if the brush spring does not maintain tension on the brush.

Distributor – Disassembly (Includes Tachometer Point Assembly)



7.

1. Repeat the steps under coil disassembly.

2. Remove the condenser and ignition breaker points.

3. Remove the stator hold down screw directly in front of the tach point assembly, the three tach leads and the tach point assembly.

4. Remove the distributor cap. (Do not force clips open, remove clip screws). The rotor need be removed only if it requires replacement or if the distributor shaft seal is worn and needs replacement.

5. Remove the lock nut securing the distributor pulley, and the pulley key.

   Drive the roll pin out of the integral tach and ignition breaker point cam. Be careful not to mar either cam surface.

7. The distributor shaft, including the bottom seal and cam, can now be removed by pressing the shaft directly down and out of the distributor body.

8. Remove the two remaining stator hold down screws, if further disassembly is required. If the lock ring on the bottom end of the distributor shaft requires replacement, separate the two ring halves at a lock point. To replace, locate unlike ends of the lock ring opposite each other in the shaft ring groove and snap together.

Assembly

Reverse the order of disassembly replacing damaged or worn parts, and follow these special instructions:

1. When replacing the stator plate, apply a small amount of Lubriplate on each stator plate screw. Be certain the stator is assembled in the following order: Spacers between the distributor body and the stator plate, then the flat washer, wave washer and stator hold down screws. Locate the flat washer and wave washer down on the shoulder of the stator screw so that they will not be damaged as the stator screws are tightened down.

2. Be careful not to mar the cam surface when installing the cam roll pin.

3. Install the pulley lock nut with the triangular markings facing up and center punch the depression of each mark to achieve positive locking action.

4. Be sure that the condenser ground wire does not interfere with full travel of the stator plate.

5. The ignition breaker point pivot pin is also a locating pin and must be inserted into the corresponding hole in the stator plate. The pivot pin end of this assembly must always be mounted under the condenser mounting clamp so that the point assembly is mounted flush with the breaker plate.

6. Thread the tachometer lead wires into place in the distributor prior to mounting the tachometer point assembly. See Page 40 for spring contact travel adjustment and lead wire connections.

7. Install the distributor cap by aligning the boss in the cap with the notch in the lower distributor body. Be sure the "O" ring is in place. Note the spark plug wire number sequence on the bottom of the cap. Number 1, top cylinder; number 2, center; number 3, bottom. See fig. 6.

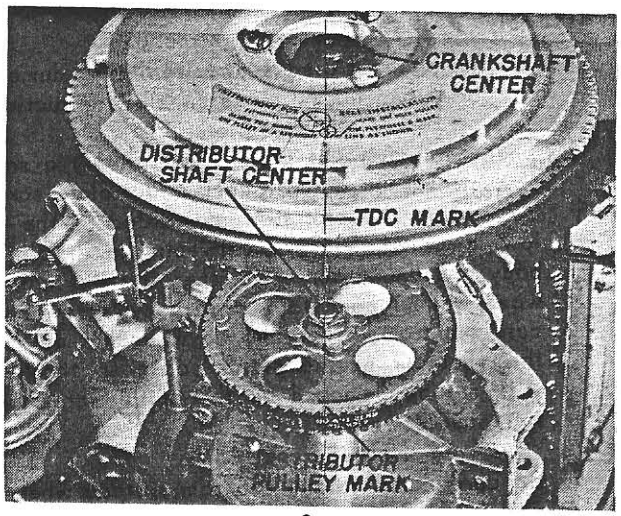
   Adjustments – (1) Spark timing and installing the timing belt; (2) point air gap; (3) spark advance cam; and (4) synchronization.

All of these adjustments are inter-dependent and must be performed or checked in the above sequence when reassembling an engine. When performing normal maintenance adjustments, check the sequence of adjustments, if the particular adjustment you have performed does not correct a motor problem.

Spark Timing and Timing Belt Installation

1. Remove all three spark plugs to easily rotate the flywheel.

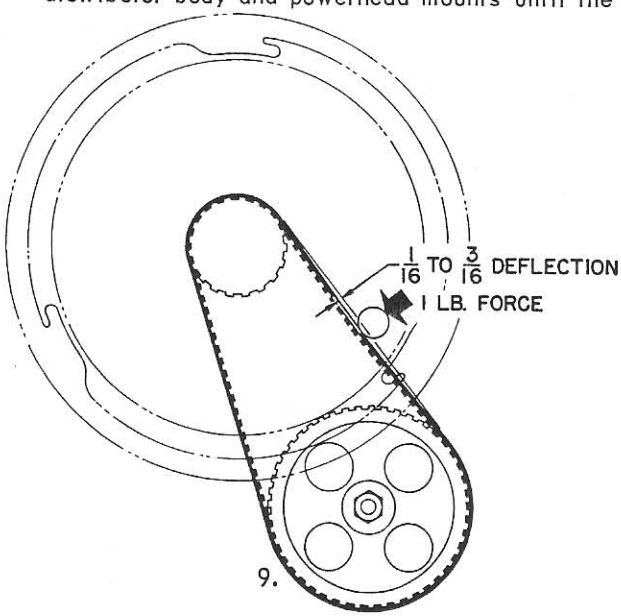
2. Place the mark on the distributor pulley, the center of the distributor shaft, and the TDC mark



8.

on the flywheel and the center of the crankshaft in line and slip the timing belt into the distributor pulley. Be careful not to disturb the position of the flywheel or distributor pulley. Do not force the timing belt on with any instrument; it can be easily installed using the hands only. See figure 8 and the diagram on the flywheel cover.

3. Place shims of equal thickness between the distributor body and powerhead mounts until the belt deflection is 1/16" to 3/16" with one pound of force applied to the belt midway between pulleys. Shims are available in .005, .0142, and .025 thicknesses. See figure 9.



9.

Point Adjustment

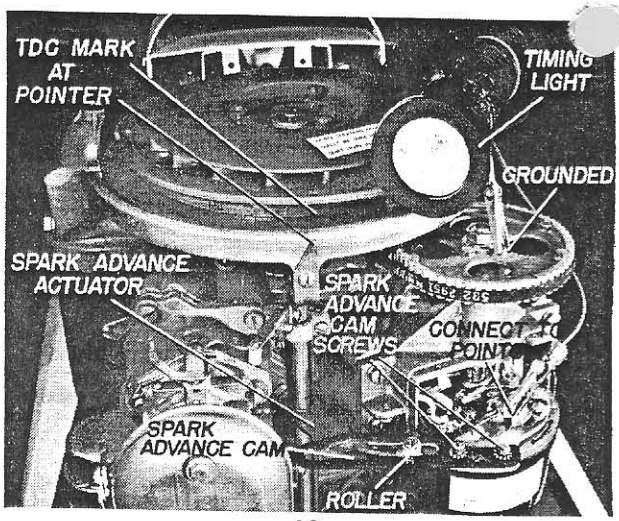
1. Rotate the distributor shaft until the breaker arm is at the highest point on a cam lobe (any of the six). Set the air gap between the point contact faces at .015" with the proper feeler gauge. If the gap is more or less than .015", loosen the 2 point assembly hold down screws and adjust the stationary contact point of the assembly in or out to achieve the correct .015" gap. Do not disturb the setting when tightening down the screws.

Spark Advance Adjustment

Adjustment of the spark advance cam places the breaker plate, and consequently the breaker points, in the proper relationship to the breaker cam.

1. With the distributor properly installed on the engine, rotate the flywheel until the flywheel TDC mark is aligned with the pointer on the flywheel guard. Remove all three spark plugs to easily turn the flywheel.

2. Attach a test light to the ignition breaker point terminal and to ground. See Fig. 10.



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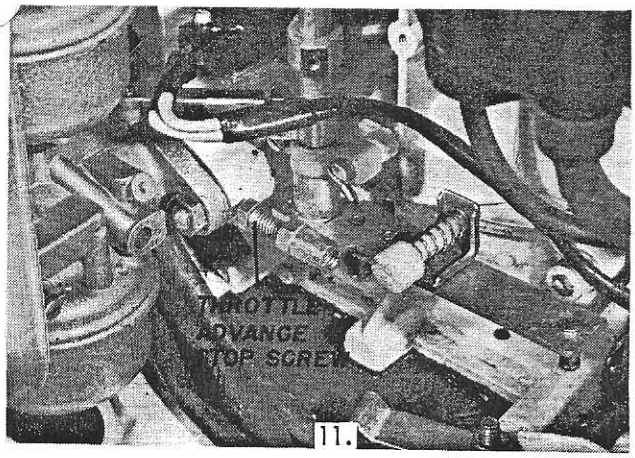
3. With the spark advance cam screws loose, position the spark advance cam so that its TDC mark intersects the center of the spark advance roller. See Fig. 10.

4. Securely hold the throttle advance arm and the spark advance cam in the above position, move the breaker plate until the points just break open. This exact moment will be indicated the test light going out. Tighten the spark vance cam mounting screws.

5. To check this adjustment, place the throttle

lever at the fully advance position. The spark advance roller should stop short of the end of the spark advance cam by from 1/16" to 3/16". If it travels to the end of the cam, turn the throttle advance stop screw (See Fig. 11.) out



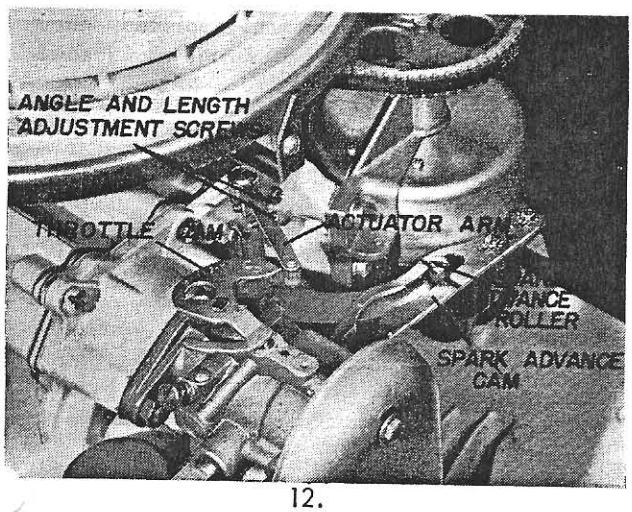
11.

until it stops within 1/16" to 3/16" from the end of the cam. Rotate the flywheel until the 31° mark on the flywheel passes the pointer on the flywheel guard. The points will again break, indicated by the timing light going out, and the ignition spark is correctly timed to fire the spark plugs at 31° before top dead center at wide open throttle.

Synchronization of Throttle Opening to Spark Advance

Synchronization is the word used to denote the proper relationship of throttle opening to spark advance and must be carefully adjusted to maintain smooth intermediate operation. A "flat spot" while accelerating indicates incorrect synchronization. Use the following steps to perform this adjustment:

1. With the angle and length adjustment screws loose on the throttle actuator arm, position the spark advance cam so that its TDC mark intersects the center line of spark advance roller. See Fig. 12.



12.

2. Securely hold the spark advance cam and the spark advance roller in the above position; move the top throttle actuator arm towards the throttle cam, using both angle and length adjustments, until the roller on the actuator arm touches the throttle cam at the TDC mark on the throttle cam. Tighten the angle and length adjustment screws securely. See Fig. 12.

Repeat this procedure with the remaining actuator arms. Tighten angle and length adjustments as each actuator arm is positioned correctly.

When all three actuator arms have been correctly adjusted, advance the throttle lever slowly. All three actuator arm rollers should contact and just begin to move the throttle cams at the same time as the throttle actuator roller leaves the TDC position on the spark advance cam.

STARTER CIRCUIT

The 60 H.P. model has a 12 volt electric starting system. A small cranking motor turns the engine over in preparation for starting. Information on how the starter circuit operates can be found in the Operating Principles section.

The starter circuit is comprised of the following components:

1. Ignition switch.
2. Throttle and shift limit switches.
3. Starter solenoid.
4. Starter motor.

All of the various components, with the exception of the starter motor, are sealed units and must be replaced if they become inoperative.

Ignition Switch

Information on the testing, removal, and replacement of this switch can be found in the explanation of the ignition circuit in this section.

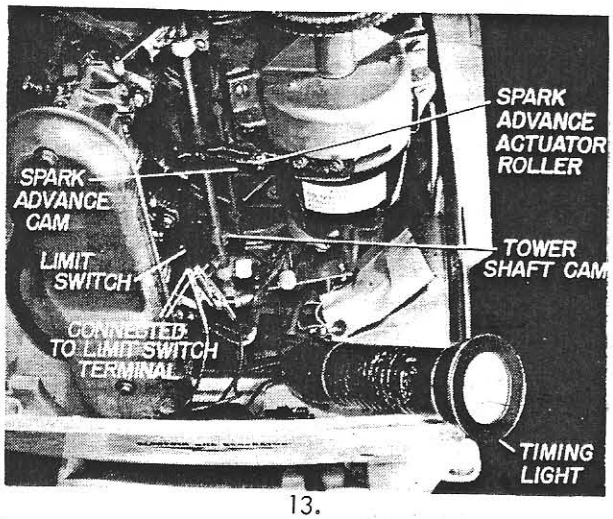
Throttle and Shift Limit Switches

The throttle and shift limit switches must be correctly adjusted if they are to control the starter circuit.

Loosen the shift limit switch mounting bracket screws and adjust the switch so that its plunger is depressed ONLY with the engine in neutral.

The throttle limit switch is activated by a cam on the throttle towershaft. It prevents the engine from being started with the throttle advanced above a high idle. To adjust this switch a test light must be used with the leads attached as shown in Fig. 13. Use the following procedure to make this adjustment:

1. Move the speed control so that the right side of the spark advancer is at the TDC mark on the spark advance. See Fig. 13.



13.

2. Adjust the cam on the throttle tower shaft so that the light is on at this point but goes out immediately when the spark is advanced.

This allows the engine to be limited to approximately 2000 RPM when starting.

Limit Switch Replacement

To replace either the throttle or shift limit switches:

1. Disconnect the leads from both terminals of the switch.
2. Remove the bracket mounting screws, then separate the switch from its bracket.
3. To replace the switch secure it to its bracket, then mount the bracket to the engine. Proceed to adjust the switch.

Starter Solenoid

If the starter will not turn the motor over, check to see if the starter is receiving power. In the event that it is not, test the starter solenoid. For test instructions consult section X .

Solenoid Removal and Replacement

1. Disconnect the wires from the solenoid terminals.
2. Remove the solenoid from the powerhead and separate it from its bracket.
3. When replacing the solenoid consult the wiring diagram to attach the solenoid leads to their proper terminals.

Starter Motor

The starter motor for all of the electric starting models is basically the same, specific information on servicing the starter motor can be found on page 18 of the Operating Principles section.

The starter motor should be shimmed out so that the the teeth on the drive gear will be .030" from bottoming between the teeth on the flywheel ring gear when the gears are in mesh. The amount of shims required can be determined by a visual inspection of the flywheel ring gear. If the wear between the teeth indicates deep wear, shim the starter motor out until a second visual inspection, after using the starter motor, reveals that the drive gear is .030" from bottoming with the flywheel ring gear.

Starter Motor Removal

1. Disconnect the starter lead wire.
2. Remove the bolts which secure the starter bracket to the powerhead.
3. To separate the starter motor from its bracket, remove the two thru bolts.
4. See page 18, Operating Principles section for further service and disassembly instructions.
5. Reverse the above procedure to replace the starter motor.

GENERATING CIRCUIT

Information on how the generating circuit operates can be found in the Operating Principles section.

The generating circuit consists of the following components:

1. Generating coils
2. Voltage regulator
3. Selenium rectifier

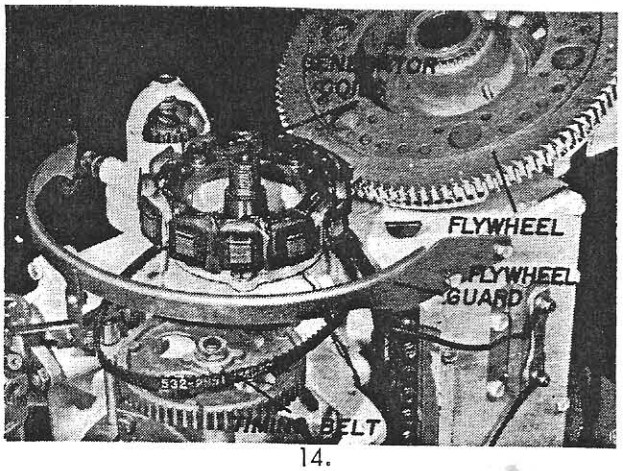
Following is specific information on servicing each of these components.

Generator Coils

If the battery runs down for no apparent reason, check the generator coils according to the test procedure on page 135. If coil replacement is necessary the entire coil assembly must be replaced. Minor external wiring breaks can be resoldered in some cases.

Coil Removal and Replacement

1. Remove the flywheel using a flywheel puller.
2. Disconnect the alternator leads, and hold down clamps.
3. Remove the coil assembly. ***NOTE:*** When replacing the coil assembly, be sure the timing belt is in position prior to securing the coil assembly to the powerhead. See page 36 to properly install the timing belt.
4. To replace the coil assembly reverse steps 1 – 3. Be sure the tab on the lock washer is bent correctly to prevent the coil mounting screws from vibrating loose.



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Voltage Regulator

If the alternator fails to maintain the battery charge and if the coil assembly and rectifier meet the test specifications for these components, then the probable cause of the difficulty is the voltage regulator. If the regulator fails to operate then it should be replaced. The regulator contacts can be cleaned by removing the regulator cover and drawing a piece of paper between the points.

Removal and Replacement

1. Remove the junction box cover.
2. Disconnect the leads from the regulator terminals.
3. Remove the regulator mounting screws.
4. To replace the regulator reverse steps 1 – 3. Consult the wiring diagram on page 32 when attaching the lead wires to the regulator.

Selenium Rectifier

The operation of the selenium rectifier is explained in the Operating Principles section. The rectifier can be tested according to the test instructions on page 139. If it is inoperative, it must be replaced. When attaching the battery leads to the battery be sure the cable with the red sleeve is attached to the positive battery post, otherwise the rectifier will burn up. Minor chips off the plates can be closed using a non-conductive sealant such as Gylthol.

Removal

1. Disconnect the three rectifier leads.
2. Remove the rectifier and bracket assembly.
3. Separate the rectifier from its bracket.
4. Reverse the above procedure when replacing the rectifier.

CHOKE CIRCUIT

The operation of the choke circuit is described in the Operating Principles Section. The choke circuit is comprised of the choke switch and the choke solenoid. The choke switch is a sealed unit which must be replaced if it should become inoperative. The choke solenoid is repairable and parts are available to repair this component in the event that it should fail. No maintenance is required other than replacement of damaged parts and inspection to see that lead wires are properly connected.

Choke Switch

The choke switch is of the push button type and is mounted on the key start panel. If this switch does not operate the engine will not be choked.

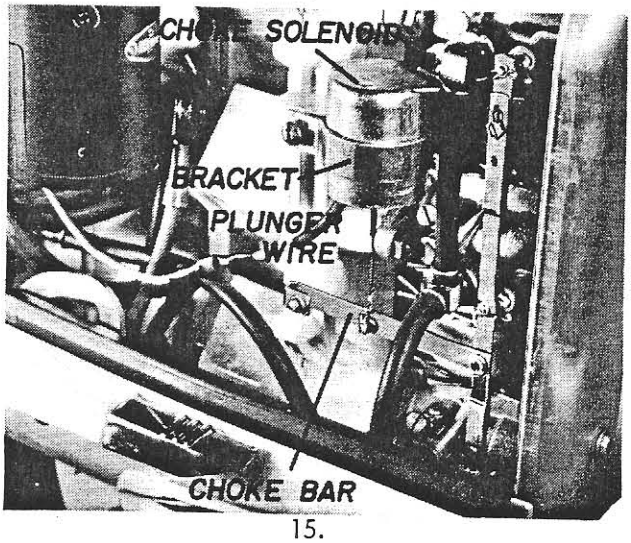
Removal

1. Remove the choke and ignition switch trim nuts from the key start panel.
2. Remove the choke switch mounting nut.
3. Disconnect the choke switch leads.
4. Reverse the above steps to replace the switch.

Choke Solenoid

There is little that can go wrong with the choke solenoid; however, the coil, plunger, washer, and retaining ring can be replaced if necessary.

Disassembly and Assembly



15.

1. Disconnect the solenoid lead and the wire, which is attached to the choke bar.
2. Loosen the mounting screws and slide the assembly out of its bracket.
3. Remove the retaining ring, washer, and plunger assembly.
4. To assemble reverse steps 1–3. Note: When replacing the solenoid, slide the coil into the mounting bracket and attach the plunger wire to the choke bar. Slide the coil upwards in the bracket until the plunger wire is taut but not actuating the choke bar.

INTERNAL WIRING HARNESS

The internal wiring harness, when attached to the various component terminals, completes the circuits required to enable the electrical system to function. These wires are bound together to make a neat installation and they are color coded to aid in identifying where they should be attached. If an electrical failure occurs and the components are in operating order, then check the internal wiring harness using a test light to determine if there are any internal breaks in the leads. If a short in the harness is discovered, replace with a new harness immediately. To replace the harness:

1. Disconnect the leads from the throttle and shift limit switches.
2. Disconnect the leads from the terminal strip.
3. Disconnect the lead from the top terminal of the ballast.
4. Disconnect the violet and yellow knife connectors from the alternator leads.
5. Disconnect the red lead from the rectifier.
6. Disconnect the green lead from the choke solenoid.
7. Disconnect the red and white leads from the starter solenoid.

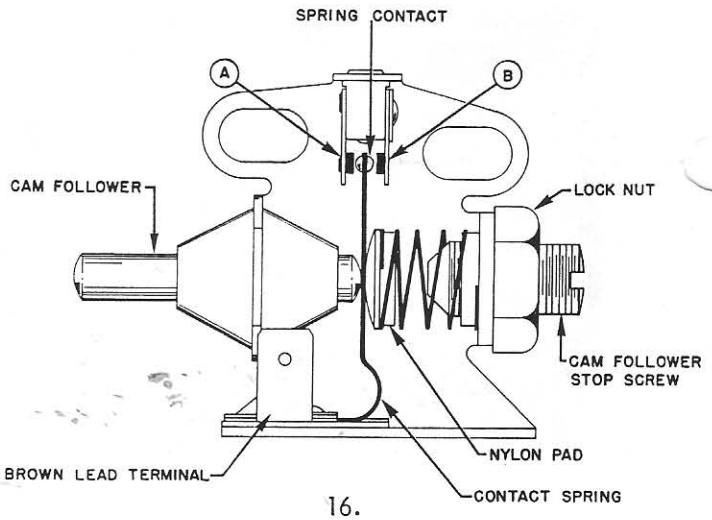
To replace the harness reverse steps 1–7. Use the wiring diagram.

TACHOMETER

The tachometer movement is a sealed unit and cannot be repaired in the field. If difficulties are encountered, a careful inspection should be made for loose connections and leads, correct contact point air gap, and for proper adjustment of the cam follower and stop screw.

Do not attempt to remove the tachometer movement. Service Aids will be sent out explaining the procedure to follow, if the tachometer requires additional repairs.

1. Point air gap – Depress the cam follower and with the proper feeler gauges check the air gap between the stationary contact and the spring contact. Bend rivet contact A in or out and adjust the air gap to within .013" to .015". Replace the assembly, if the points are worn or pitted. See figure 16.
2. Cam Follower stop screw adjustment – (if cam follower stop screw is loose). Place a .025" to .027" shim or feeler gauge between the contact spring and the nylon pad. (Be careful not to bend the contact spring.) Push the cam follower in until the spring contact just touches rivet contact B. Holding the preceding position, adjust stop screw until the spring contact just breaks away from rivet contact B. Without disturbing the stop screw, tighten the stop lock nut securely. Remove the shim or feeler gauge. See Fig. 16.



16.

Installing the tachometer assembly and adjusting the spring contact travel is accomplished in the following manner:

1. Install the tachometer assembly, including the fiber cam follower, in the distributor body and tighten the mounting screws enough to allow lateral movement of the tachometer assembly.
2. Rotate the distributor shaft until the cam follower is on the high point of one of the two cam lobes.
3. Place a .010 shim or feeler gauge between the cam follower and the cam.
4. Slide the tachometer assembly toward the cam until cam follower has depressed the nylon pad enough to be stopped by the stop screw. Securely tighten the mounting screws.
5. Always connect the brown lead to the single terminal on the assembly. The other two leads may be connected to either the A or B terminals. See the increment drawing to trace this circuit.

NOTE: Never clean the tachometer point assembly with compressed air. The air pressure will twist the point contact spring.

FUEL SYSTEM

The fuel system is comprised of the following components:

1. Tank.
2. Fuel pump.
3. Carburetor.
4. Manifold and Reeds.

Information as to how the fuel system operates can be found in the Operating Principles section.

Following is specific information on servicing the fuel system.

FUEL TANK

The 60 H.P. model has a remote fuel tank which is automatically vented when the fuel line is attached to the tank fitting.

Information on the cleaning and repair of the tank can be found in the Operating Principles Section. Following are the step by step instructions for completely disassembling and assembling the fuel tank.

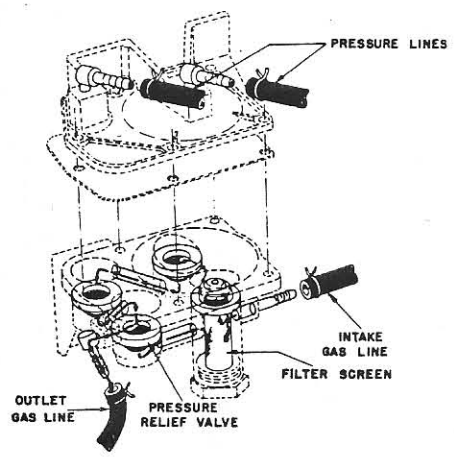
Disassembly and Assembly

1. Disconnect the fuel line from the tank.
2. Remove the fill cap and pour all of the fuel out of the tank.
3. Remove the screws securing the tank outlet assembly to the tank.
4. Separate the outlet tube and screen assembly from the outlet fitting.
5. The fuel line, primer bulb, and check valves assembly can all be removed by opening the clamps which secure the hoses to these fittings.
6. To reassemble the tank reverse steps 1 – 5.

FUEL PUMP

The 60 H.P. motor has a two stage fuel pump which is operated by crankcase pressure. Detailed information on how the fuel pump operates can be found in the Operating Principles Section.

A system of check valves prevents the fuel from flowing back toward the tank. At the point where

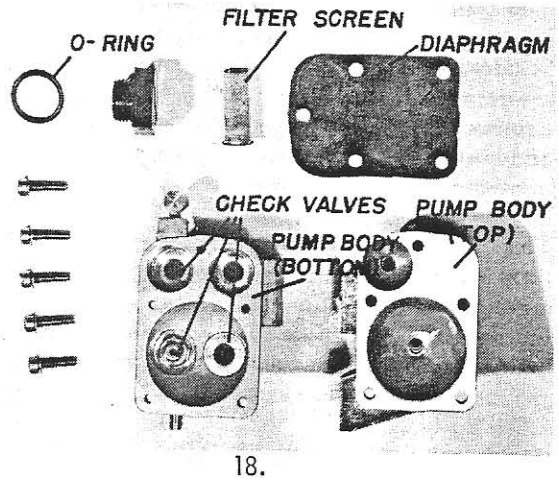


the fuel leaves the fuel pump a check valve has been installed that will open if the pressure on the carburetor becomes too great, (over 4 pounds per square inch). Fuel then will be recirculated through through the pump, thereby reducing the excessive pressure. The main causes of fuel pump difficulty are:

1. Ruptured diaphragm.
2. Faulty check valves.
3. Plugged sediment screen.
4. Loose pressure line connections and fuel line connections.

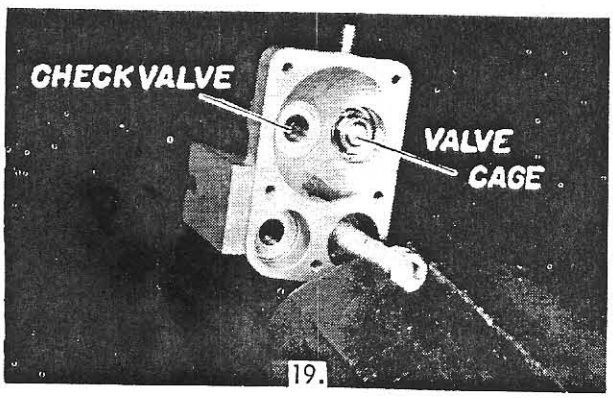
The only maintenance required by the fuel pump is occasional cleaning of the sediment screen and replacement of a worn or damaged diaphragm or check valve.

Removal and Disassembly



18.

1. Disconnect the fuel and pressure hoses.
2. Remove the mounting screws and fuel pump from the powerhead.
3. Remove the large nylon screw, sediment screen, and O ring.
4. Remove the pump body screws and separate the pump halves.
5. Remove the diaphragm and check for punctures and wear. Replace if necessary.
6. Examine the check valves. If one needs replacement use a punch to flatten the valve cage. With a 7/16" 20 thread, N.F. Bottom Tap, thread the inner portion of the check valve. Insert the correct bolt and tighten until the valve comes loose or work the valve loose using a vise.



19.

Assembly

Reverse steps 1-6 to assemble the fuel pump. ***Note:*** When replacing the check valves they should be pressed in using an arbor press and a metal sleeve which can be inserted into the valve cavity and whose inside diameter will clear the valve cage. If done carefully they may also be pounded into the body. Be careful not to damage the cage when when replacing check valves. ***Note:*** Always check the spring tension of the valves to be certain that the only one which offers more resistance is the by-pass valve in the last or outlet chamber.

CARBURETOR

The 60 H.P. motor utilizes three fixed, high-speed jet, carburetors to regulate the fuel-air mixture that is fed into the combustion chamber. These carburetors are similar to previous models, with the exception that the high speed system uses a fixed jet and metering rod arrangement rather than the conventional screw adjustment.

The portion of the throttle cam that contacts the metering rod acts as a cam and allows the rod to move, in the jet portion of the nozzle, as the throttle is opened. The steps on the rod are designed to increase the amount of fuel admitted to the engine as the metering rod moves upward.

During idle and part throttle, the economy or larger step on the rod is in the jet orifice. At wide open throttle operation the smallest step on the metering rod is in the orifice. The two step metering rod allows closer control over the part throttle operation. Also, by partially reducing the throttle opening, greater fuel economy will be realized. Carburetor problems can usually be traced to the following conditions:

1. Clogged or restricted carburetor passages, or dirt in inlet needle and seat assembly.
2. Improper idle adjustment.
3. Improper throttle cam adjustment.
4. Improper float adjustment.
5. Bent metering rod.

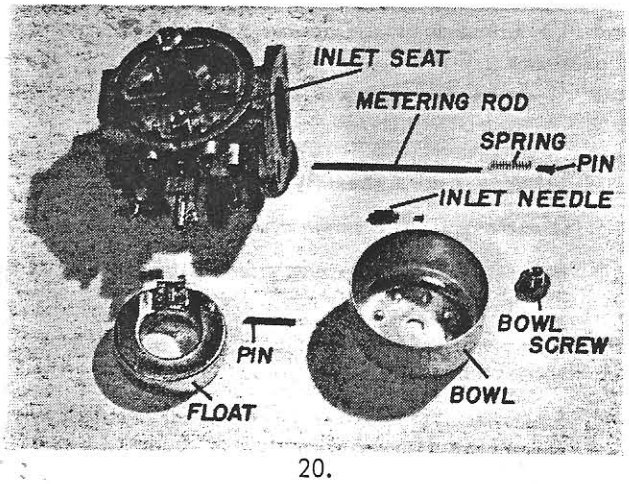
If, upon inspection, any of these conditions exist, they should be corrected immediately. Maintenance of the carburetor involves periodic removal, disassembly, and cleaning. Follow the instructions for disassembly and thoroughly clean all the parts in Scott-Atwater Engine Cleaner or some similar cleaning solution. Blow the air passages clear with compressed air. ***Caution:*** The float assembly must be removed prior to cleaning the carburetor with compressed air.

Removal

1. Remove the baffle plate.
2. Disconnect the choke linkage.
3. Disconnect the fuel lines.
4. Remove each carburetor.

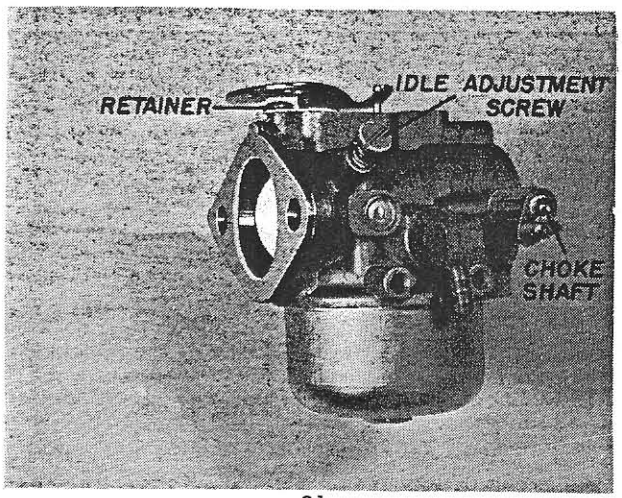
Disassembly

1. Turn the throttle lever arm until the metering rod pops up. Remove the metering rod.
2. Remove the carburetor bowl screw, metering rod pin, spring, bowl, and gasket.



20.

3. Remove the float pin, float, and inlet needle and seat assembly.
4. Remove the idle adjustment screw.
5. Remove the throttle shaft retainer screw, then remove the throttle valve. Lift the throttle shaft out of the carburetor body.
6. Remove the choke shaft valve, then remove the cotter hairpin and spring from the end of the choke shaft. The choke shaft can now be removed from the carburetor body.



21.

Assembly

Reverse the steps listed under Disassembly. Following are special instructions that should be observed when assembling the carburetor:

1. Throttle Shaft.

   a. Note the position of the spring and retainer on a new assembled carburetor. Place the spring and retainer in this position on the throttle shaft and insert the shaft into the carburetor body. Be sure the straight end of the spring is located in the hole in the carburetor body.

   b. Rotate the throttle shaft counterclockwise approximately 1/2 turn, until the hole in the throttle cam is directly above the retainer screw hole. Holding the throttle shaft in this position replace the retainer screw.

   c. Holding the throttle in the previously mentioned position, place the throttle valve in the carburetor barrel with the two holes in the valve on the left, and the markings on the butterfly facing toward you, when looking through the barrel from the manifold end. Replace the valve screws using Loctite to prevent them from vibrating loose.

2. Choke Shaft.

   a. Insert the throttle shaft into the carburetor body with the actuating arm on the same side of the carburetor as the idle adjustment screw.

   b. Slide the spring over the end of the choke shaft so that the inside end of the spring is in the slot in the end of the shaft and the outside end of the spring slides into the hole in the carburetor body.

   c. Replace the cotter hairpin on the end of the shaft.

   d. Rotate the choke shaft approximately 1/2 turn. Insert the choke valve into the carburetor barrel so that the smallest notch in the valve is on top, and the markings on the valve face toward the manifold end of the carburetor. Replace the valve screws using Loctite to prevent them from vibrating loose.

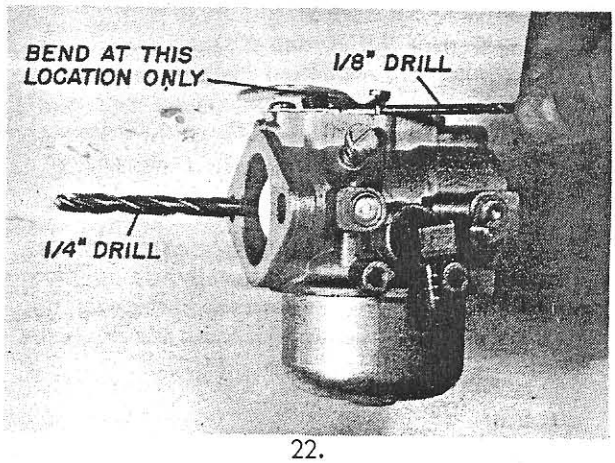
3. When replacing the carburetor bowl, torque the bowl screw to 35–40 inch pounds.

Adjustments:

Various adjustments are required if the carburetor is to perform as it should. The following information deals with these adjustments and should be carefully examined.

1. Metering rod cam adjustment – The adjustment of the metering rod cam is important since the position of the steps on the metering rod must be "timed" to coincide with the opening of the throttle butterfly.

   Insert a 1/4" float level gauge or twist drill between the edge of the throttle butterfly and the bore of the carburetor. With the butterfly in this position, the metering rod should protrude 1/8" measured from the machined surface of the carburetor body to the top of the metering rod. If any adjustment is required, bend the cam at the bend nearest the throttle shaft to maintain the 1/8" dimension. See Fig. 22.

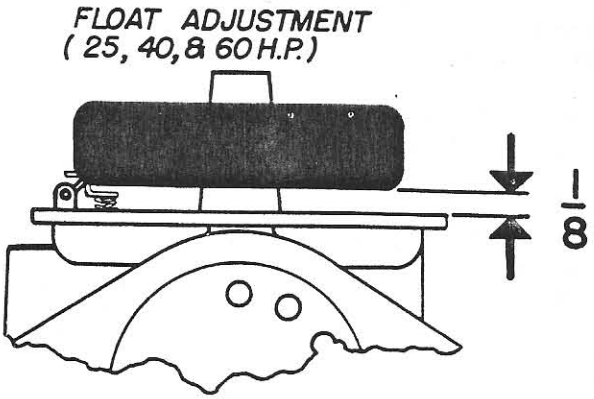


22.

2. Idle Adjustment – Each motor is shipped from the factory with the carburetor already adjusted. However, due to changes in atmospheric conditions and through usage, it may become necessary to readjust each carburetor. To do this, start the motor and allow it to warm up for a few moments, then shift into forward gear and retard the throttle to the idle position. The initial idle setting is approximately 2 1/2 to 3 turns open from the fully closed position.

   Starting with the top carburetor, turn the yellow idle adjustment screw clockwise until the motor coughs, then turn the idle screw counterclockwise until the motor just begins to speed up. Repeat this procedure for each carburetor until smooth idling is obtained.

3. Float Adjustment – In order to provide the carburetor with a constant controlled supply of fuel, it is necessary to adjust the float level. With the carburetor off the motor, remove the



23.

carburetor bowl. Holding the carburetor with the float on top, the distance between the lower side of the float and the outer flange of the carburetor body should be 1/8".

To adjust the float level bend the tab which presses against the inlet needle until the 1/8" measurement is obtained.

4. Metering Rods – All 40 and 60 H.P. engines are shipped with a "standard" metering rod which will give optimum performance from sea level ***up to*** 4000 feet. At altitudes ***above*** 4000 feet we recommend the use of a special "high altitude" metering rod to obtain maximum performance.

   All 40 and 60 H.P. metering rods have been stamped with a Carter number to aid in their identification. The following list gives the metering rod part number, its type, and the number that will be stamped on the rod.

60 H.P.

Metering Rod	Type	Stamped
C3JB-721	Standard	75-1481
A3JB-721	High Altitude	75-1506

40 H.P.

Metering Rod	Type	Stamped
C3HB-721	Standard	75-1508
A3HB-721	High Altitude	75-1510

Do ***not*** use the high altitude metering rods on engines operating below 4000 feet, as these rods can cause pre-ignition at the lower altitudes.

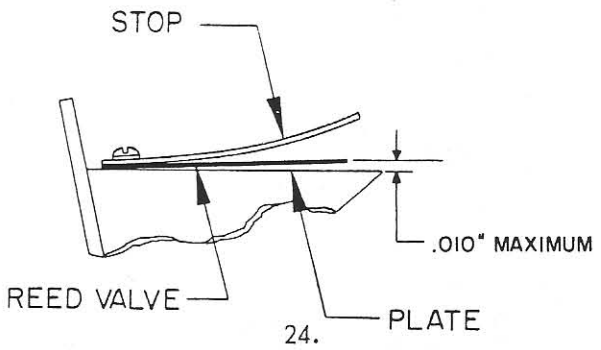
MANIFOLD AND REEDS

The fuel-air mixture from the three carburetors is fed directly into the intake manifold. In the intake manifold an interconnecting tube allows each cylinder to draw fuel, as required from the supply present in the manifold. This allows equal distribution of fuel to the cylinders at all speeds.

Each cylinder has its own reed valve which opens and closes as the piston moves in the cylinder. As the piston moves on its compression stroke the reed valve is opened, allowing fuel to enter the crankcase. As the piston moves downward on its power stroke the valve is closed preventing fuel from re-entering the manifold.

The reed valves are V shaped to allow the fuel mixture to enter the crankcase without hesitation. Reed stops limit the opening of the reeds and their curvature permits the reed to bend evenly without fatiguing the metal. The reeds should seat flat against the surface of the reed box, however, a gap of up to .010 is permissable.

Following are the most common difficulties that are encountered with the manifold and reeds:



24.

1. Faulty manifold and reed gaskets.
2. Bent or distorted reeds or reed stops.

Disassembly

1. Remove the shroud, carburetors, and disconnect the choke solenoid.
2. Remove the screws in the manifold, which face toward the carburetors.
3. Remove the three bolts which thread into the rear of the manifold. The manifold can now be separated from the powerhead.
4. Separate the manifold and manifold cover.
5. Remove the reed valves.

Assembly

To assemble, reverse the procedure listed under Disassembly. ***Note:*** If the reeds or reed stops are bent or distorted, DO NOT attempt to straighten; replace with new reeds and/or stops if necessary. When reassembling be sure all gaskets are in place and bolts are tightened according to sequence.

POWERHEAD

The 60H.P. powerhead consists of the cylinder head, block and crankcase, pistons, rings, connecting rods, crankshaft, and necessary bearings and seals.

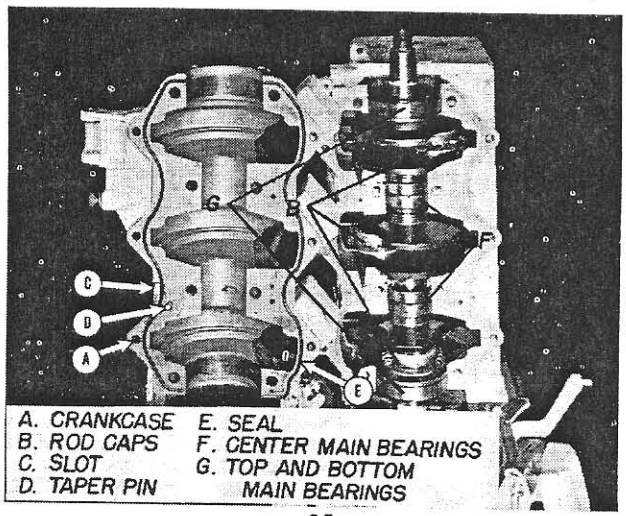
There is relatively little that can go wrong with the powerhead. In most cases, faulty engine performance can be attributed to malfunction of the fuel or electrical systems. In cases where engines perform poorly, consult the trouble shooting chart on page 128 of this manual. Then thoroughly check the fuel and electrical systems before initiating repairs on the powerhead.

Before attempting any repairs on the powerhead, carefully read the Powerhead Repair Section in this manual.

Disassembly - For specific instructions in removing any of the following components, other than the powerhead, refer to the appropriate parts of this section.

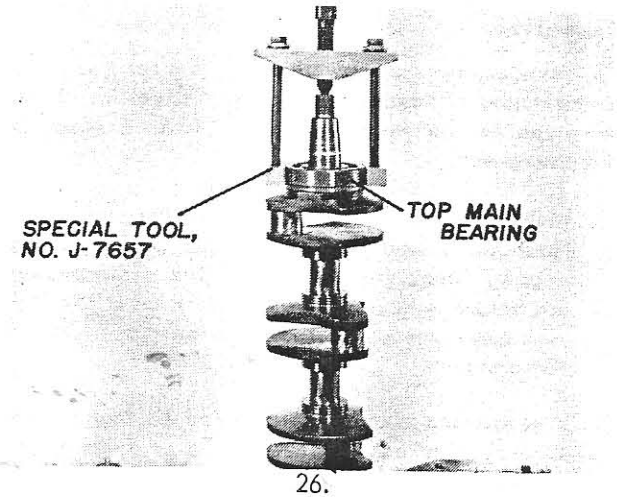
1. Disconnect the battery leads, fuel line, and junction box leads at the terminal strip.

2. Remove the flywheel and alternator.
3. Remove the distributor, ignition coil, rectifier, starter solenoid, starter, fuel pump, and ballast.
4. Remove the Allen screws which secure the powerhead to the adapter assembly. Be sure the screws partially hidden by the motor support and shift handle are removed.
5. Lift the powerhead off the driveshaft, then carefully remove the carburetors, manifold, and reed assemblies.
6. Remove the cylinder head, intake, exhaust, and water cover plates.
7. Separate the cylinder head and head cover plates.
8. Remove the upper and lower bearing cap assemblies.
9. Remove the crankcase bolts and separate the crankcase and block. See figure 25.

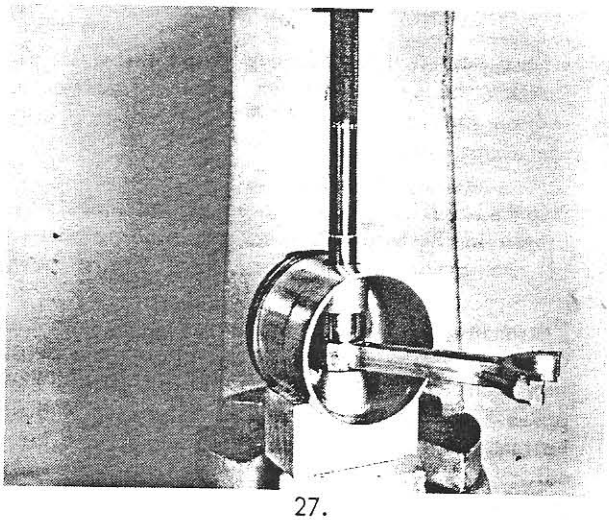


25.

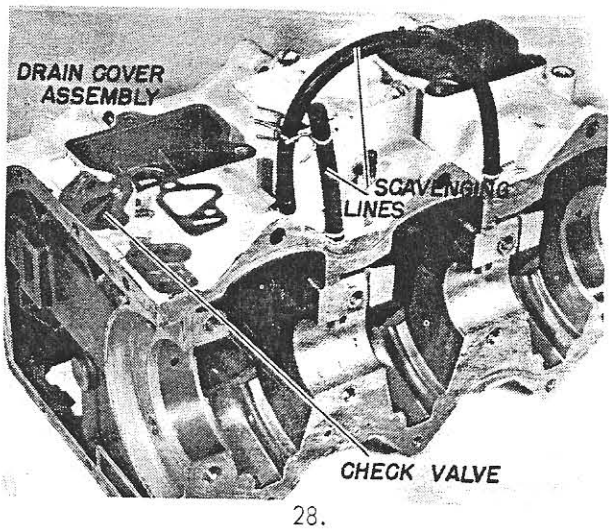
10. Carefully remove the center main bearings, keeping the parts from each in separate, marked containers.
11. Carefully remove the rod caps and bearing assemblies, keeping the parts in separate containers, marked according to the cylinder from which they were taken.
12. Remove the crankshaft, use special tool No. J-7657 to remove the top and bottom main bearing assemblies. See figure 26.
13. Remove the rod and piston assemblies keeping the parts separated according to cylinders. Use a ring expander to remove the piston rings. Use special tool No. J-7654 to press out the wrist pins and wrist pin bearings. See figure 27.



26.


27.

14. Detach the scavenging lines and remove the drain cover assembly, and check valves. See figure 28.



28.

15. Special tool No. J-7841 can be used to remove hose fittings from the block.

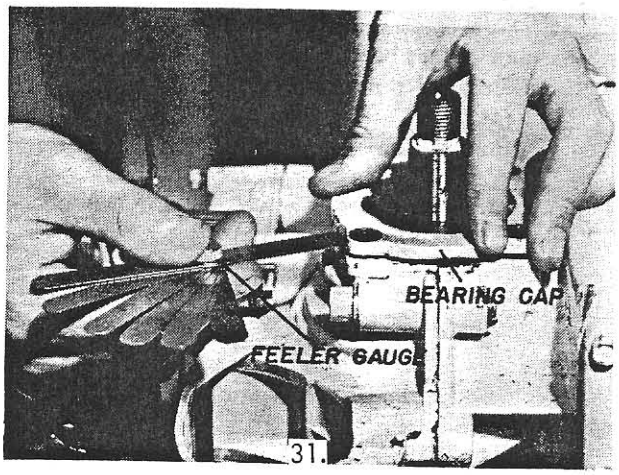
This completes the steps necessary to completely disassemble the powerhead.

Mate the ground corners of each cage half. Be certain the rod cap and rod are carefully matched, then torque the rod cap screws to 180 inch pounds. Rotate the bearing. If there is any binding or catching, check your assembly procedure.

8. Apply a moderate amount of EC 847, or a similar sealant, along the outside edge of the rubber seal in the groove in the block. Be certain not to allow the sealant to flow into check valves or the bearing.

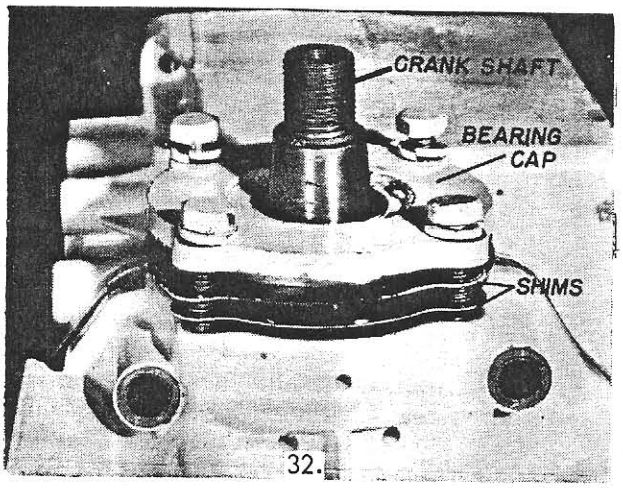
9. Follow the tightening sequence illustrated, and torque the main bearing screws to 300 inch pounds and the crankcase screws to 150 inch pounds.

10. After the crankcase bolts are secured, replace the lower bearing cap and tighten its screws. This limits any downward travel of the crankshaft. Properly assembled, the crankshaft should have .010" end play, plus or minus .002". To establish correct end play, position the upper bearing cap and hold firmly in place. See figure 31. With a feeler gauge, measure the dis-



31.

tance between the bearing cap and the block. To this dimension add .010" plus or minus .002". Add this total number of shims to obtain correct end play, then secure the upper bearing cap in place. See figure 32.



32.

11. Follow the tightening sequence and torque the cylinder head bolts to 275 inch pounds.

12. Rotate the crankshaft manually, with the spark plugs removed. It should turn smoothly; if it does not, check your assembly procedure.

MOTOR SUSPENSION SYSTEM (60 and 40 H.P. Models)

The motor suspension system consists of the handle mount and pivot tube, pivot bracket, boat brackets, right and left yokes, tilt and reverse lock mechanisms, tilt stop and guide, and rubber cushion mounts.

The suspension system supports the powerhead and lower motor assemblies and secures the motor to the boat. The rubber cushion mounts isolate motor vibrations from the transom of the boat and provide quieter motor operation.

The pivot bracket contains the tilt lock mechanism which prevents the motor from raising out of the water when the motor is decellerated rapidly. This is a spring loaded tilt lock which will release automatically when approximately 250 inch pounds of force are applied to the lower unit, thus protecting the engine when an underwater object is struck.

To tilt the motor, place the shift lever in forward, depress the tilt lock lever, and raise the motor up until the tilt stop engages.

To return the motor to the vertical position, pull forward on the tilt stop and slowly lower the motor to the vertical position. The reverse lock will engage automatically.

Along with the spring loaded reverse lock, there is a shift actuated reverse lock which engages the tilt pin and prevents the engine from raising out of the water when operating in reverse gear.

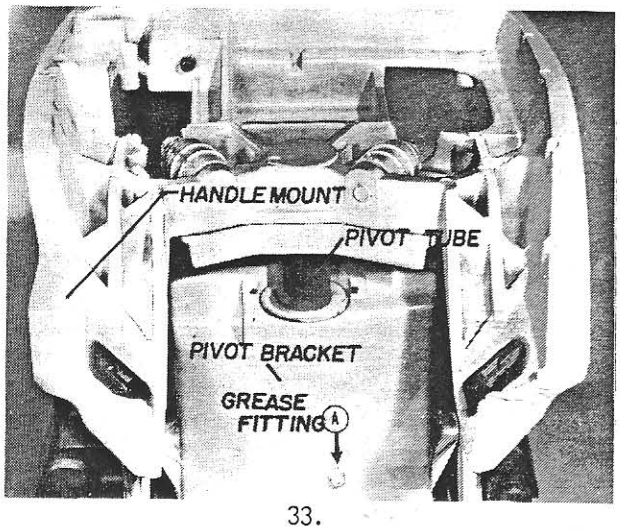
The suspension system requires periodic checks of the fasteners for tightness and the condition of rubber mounts. Lubricate the pivot tube frequently by applying Lubriplate, or a similar lubricant, at the grease fitting located on the pivot bracket. See fig. 33.

Disassembly

1. To disassemble the boat brackets, remove the safety chain link, pivot bolt, tilt pin, tie bar, tilt guide and stop assemblies, and the clamp pad assemblies. See figure 34.

2. To remove the reverse lock hook disconnect the two actuating springs and spread the ends apart to remove it from the dowels.

3. To disassemble the tilt lock, remove the lever,



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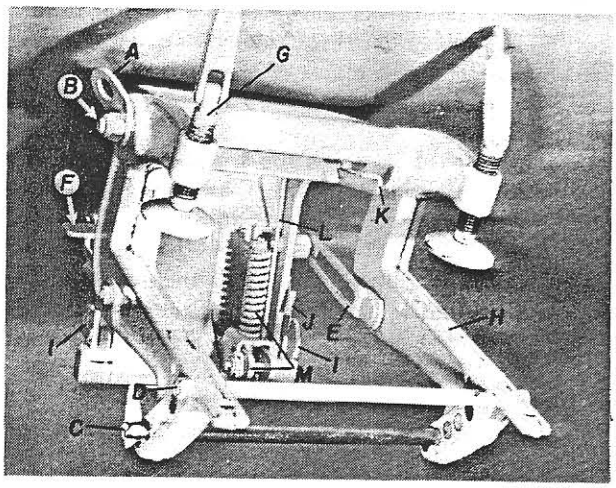
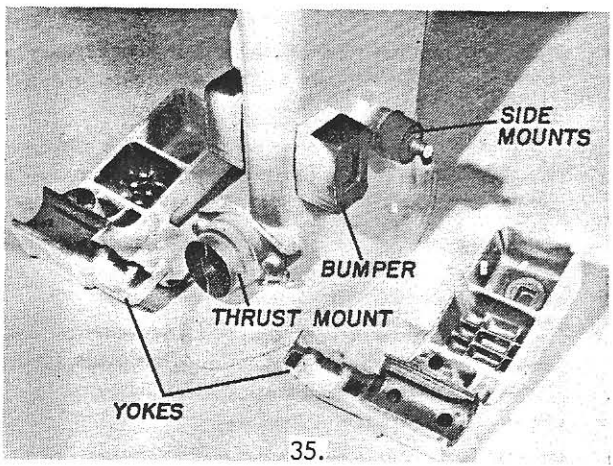


A	SAFETY CHAIN LINK	H	BOAT BRACKET
B	PIVOT BOLT	I	REVERSE LOCK HOOK
C	TILT PIN	J	SPRING
D	TIE BAR	K	LEVER
E	TILT GUIDE	L	PULL ROD
F	TILT STOP	M	TILT LOCK
G	CLAMP PAD		

34.

pull rod, spring and rod spring, pawl, hook, hinge pin, spring, and arm.

4. Remove the yokes, lower bumpers, lower side mounts, and lower thrust mount. See figure 35.



35.

5. Slide the pivot bracket off the pivot tube.

6. Loosen the upper thrust mounts, remove the side mount bolts, remove the handle mount and pivot tube, remove the side mounts; separate the handle mount and pivot tube.

Assembly

To assemble the suspension system reverse the procedure listed under Disassembly. Follow the special instructions listed below:

1. The rubber mounts should be torqued to the following specifications when reinstalled:

   a. 1/4'' – 20 studs – 20–30 inch pounds

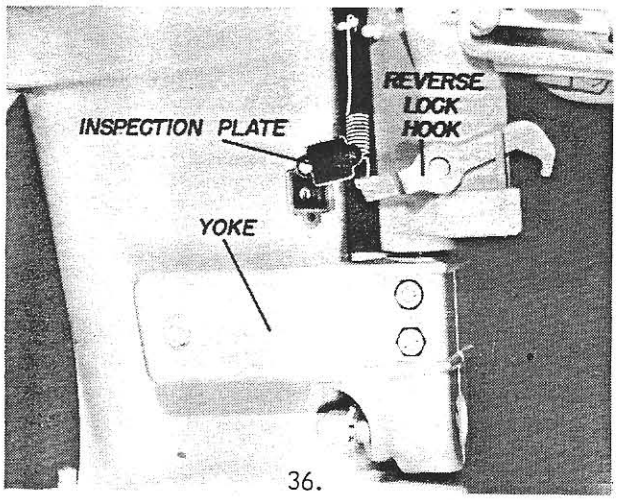
   b. 3/8'' – 16 studs – 98–110 inch pounds

   c. 1/2'' – 13 studs – 240–290 inch pounds

2. Inspect the pivot bracket bearing and seals. Be sure the bearings are lubricated and the seals are in good condition.

3. The three bolts which secure the two halves of the yoke should be torqued to the following specifications: See figure 36.

   a. (2) front bolts – 245 inch pounds



36.

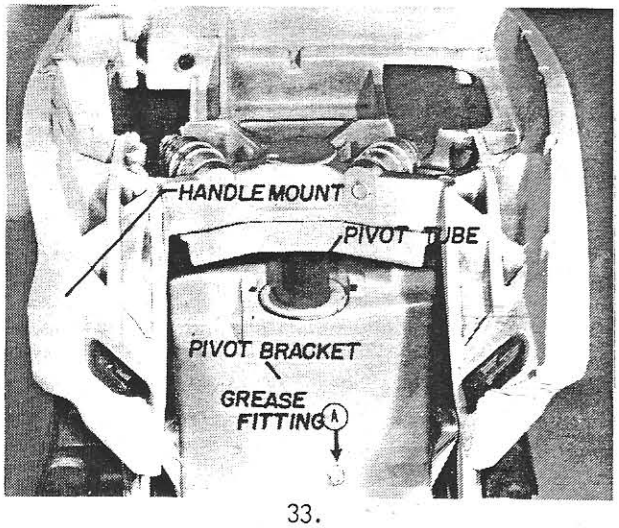
   b. rear bolt – 295 inch pounds

4. When reassembling the tilt lock be sure to check the following things:

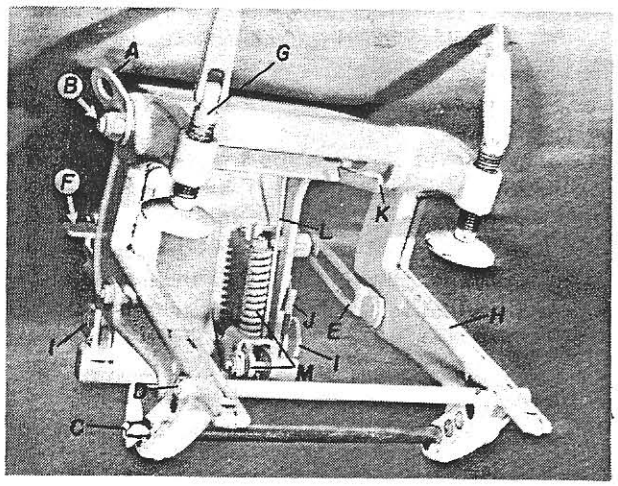
   a. The pawl is installed so that the nylon washers are on each side.

   b. Hinge pin spring is installed so that the tension forces the hook to lock on the tilt pin.

   c. When installing the tilt lock lever thread the Allen screw through the pivot bracket, then place the washer, spacer, wave washer, second washer and nut, in order on the screw.



33.

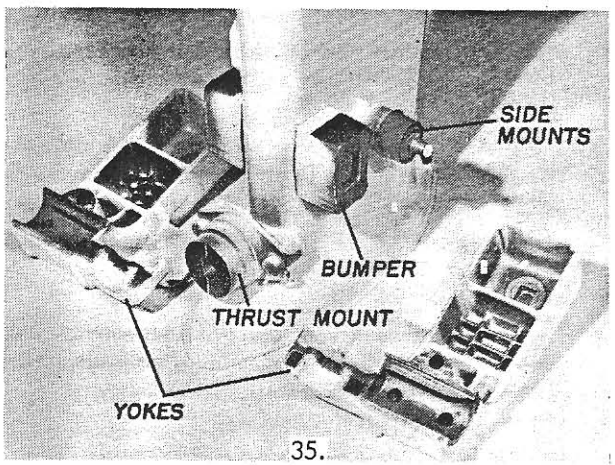


A	SAFETY CHAIN LINK	H	BOAT BRACKET
B	PIVOT BOLT	I	REVERSE LOCK HOOK
C	TILT PIN	J	SPRING
D	TIE BAR	K	LEVER
E	TILT GUIDE	L	PULL ROD
F	TILT STOP	M	TILT LOCK
G	CLAMP PAD		

34.

pull rod, spring and rod spring, pawl, hook, hinge pin, spring, and arm.

4. Remove the yokes, lower bumpers, lower side mounts, and lower thrust mount. See figure 35.



35.

5. Slide the pivot bracket off the pivot tube.

6. Loosen the upper thrust mounts, remove the side mount bolts, remove the handle mount and pivot tube, remove the side mounts; separate the handle mount and pivot tube.

Assembly

To assemble the suspension system reverse the procedure listed under Disassembly. Follow the special instructions listed below:

1. The rubber mounts should be torqued to the following specifications when reinstalled:

   a. 1/4" – 20 studs – 20–30 inch pounds

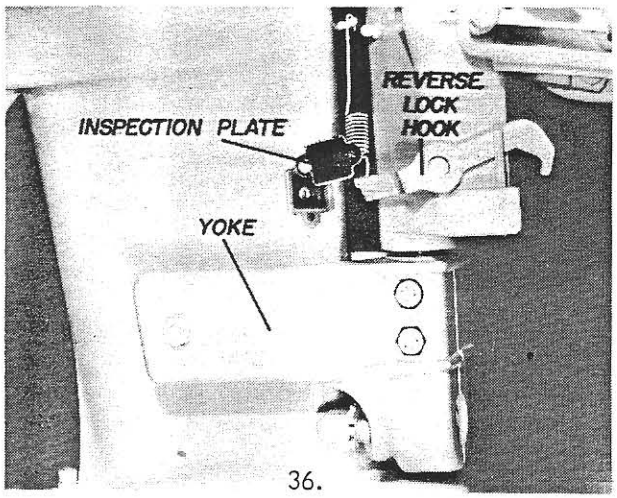
   b. 3/8" – 16 studs – 98–110 inch pounds

   c. 1/2" – 13 studs – 240–290 inch pounds

2. Inspect the pivot bracket bearing and seals. Be sure the bearings are lubricated and the seals are in good condition.

3. The three bolts which secure the two halves of the yoke should be torqued to the following specifications: See figure 36.

   a. (2) front bolts – 245 inch pounds



36.

   b. rear bolt – 295 inch pounds

4. When reassembling the tilt lock be sure to check the following things:

   a. The pawl is installed so that the nylon washers are on each side.

   b. Hinge pin spring is installed so that the tension forces the hook to lock on the tilt pin.

   c. When installing the tilt lock lever thread the Allen screw through the pivot bracket, then place the washer, spacer, wave washer, second washer and nut, in order on the screw.

d. Hook the spring rod to the tilt lock hook and arm, then place its spring, washer, and nut on the threaded end. Tighten the nut until approximately 2 1/2 threads are visible above the nut.

e. When installing the tilt stop, the straight end of the spring should be located in its hole in the boat bracket. Wind the spring so that its tension will snap the stop into the notch when the engine is fully tilted.

5. To obtain the desired tilt friction, tighten the pivot bolt.

LOWER MOTOR CASING

The lower motor casing houses the water and bailer lines, driveshaft, upper shift mechanism, and idle relief. It also provides the necessary support between the powerhead and lower unit.

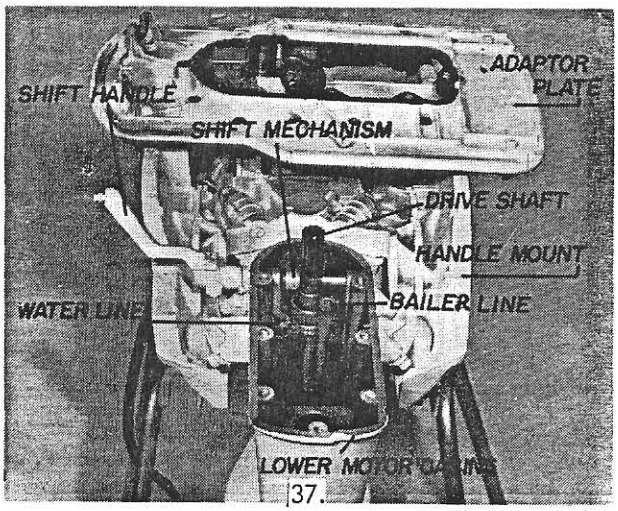
The lower motor casing requires only visually inspecting the exterior casing and machined surfaces for cracks. If the casing is severely damaged it should be replaced. If the water and bailer systems fail to operate as they should, the lines and seals should be checked for leaks.

In most cases the shift mechanism will be affected only by damaged or broken parts. If the motor fails to shift properly, remove the inspection plate to determine whether the shift rod coupling is tight. If it is, remove the powerhead and adaptor plate to inspect the shift mechanism.

The idle relief facilitates starting by reducing exhaust back pressure. Operation of the idle relief is explained in the Operating Principles section.

Disassembly

1. Remove the fuel line, battery leads, and junction box leads from the powerhead.
2. Remove the screws which secure the powerhead to the adaptor plate, then remove the powerhead.



37.

3. Remove the lower housing and adaptor plate.
4. Remove the inspection plate, then remove the bottom screw in the shift rod coupling.
5. Separate the pump housing from the lower motor casing.
6. Detach the handle mount and both yokes from the lower motor casing.
7. Remove the upper and lower side mounts, snubbers, and lower thrust mount.
8. Remove the reverse lock spring, rod, and mount.
9. Remove the pin which secures the actuator to the shift lever shaft. Slide the actuator and upper shift rod assembly off the shaft. Detach the actuator and coupling from the upper shift rod.
10. Withdraw the shift lever and shaft from the lower motor casing. Separate the shift lever and shaft.
11. Remove the water and bailer lines and seals.
12. Remove the idle relief assembly.

Assembly

To reassemble the lower motor casing, reverse the steps listed under disassembly. Following are points that should be checked upon assembling the lower motor casing.

1. When installing the water and bailer line, make sure that the bottom seals are in place and that the upper seals are firmly positioned in the adaptor plate.
2. The split side of the shift rod coupling should face the rear of the engine if correctly installed. Be sure the coupling screws are tightened securely and that the screw body rests in the notch in the shift rod.
3. Be sure the idle relief assembly is tightened securely.
4. Torque the pump housing to lower motor casing screws to 140 inch pounds. Torque the adaptor to lower motor casing screws to 250 inch pounds. Torque the 2 front bolts, at the yoke, to 245 inch pounds. Torque the rear bolt, at the yoke, to 295 inch pounds.
5. Properly assembled, the shift lever should be in the vertical position, with the engine in neutral.

PUMP HOUSING

The pump housing serves as a support between the lower motor casing and the lower unit. It contains the water and bailer pump assemblies, water pick-up cup, driveshaft, a driveshaft bearing and seal.

The pump housing itself requires only visual inspection of its machined surfaces and the driveshaft seal and bearing. Water in the lower unit or lubricant

leaking from any of the drain holes in the lower unit can be an indication the driveshaft seal is leaking. However, if replacing the pump housing driveshaft seal does not remedy the problem, see the following section on the lower unit for other possible causes.

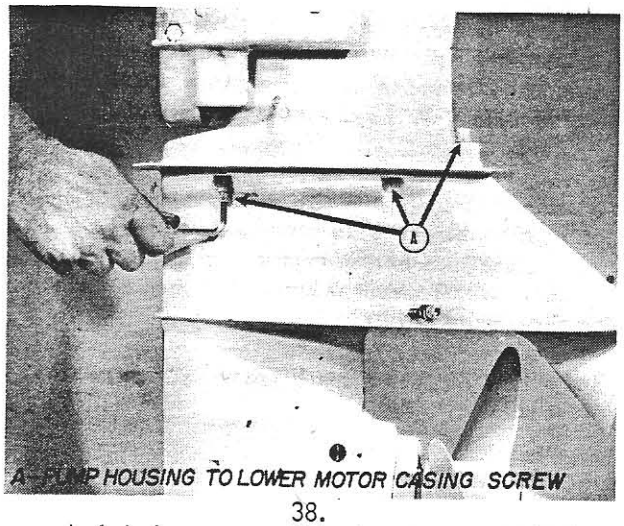
The water and bailer pumps are made of a silicon bronze alloy and have a stainless steel cup pressed into each cavity to assure long life under the most adverse conditions. You will note that each water pump mounting boss and a small adjacent area of the pump is covered with vinyl tape. This vinyl tape acts as a shield between the aluminum pump housing and the silicon bronze pump and prevents electrolysis. When assembling the water pump, be certain that this tape is in place and in good condition.

Always check for the "telltale" stream of water squirting out of the hole on the port side of the powerhead adaptor. A strong, steady stream indicates that the pump is in working order. Absence of the "telltale" stream indicates that either the pump is not working or there is an obstruction in the water system.

Always closely inspect all water line seals and the "O" ring seals in the pump assembly. Replace any that appear to be slightly damaged or show signs of deterioration. They are relatively inexpensive parts; yet if one fails, it can result in serious engine damage. See the Operating Principles Section for an explanation of how the water and bailer systems function.

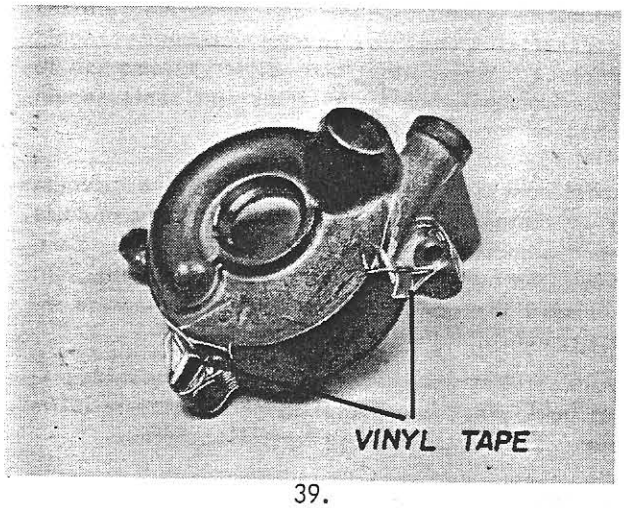
Disassembly

1. Drain the lower unit by removing the drain and vent plugs.
2. Place the shift lever in neutral position and remove the small inspection plate on the starboard side of the lower motor casing. See fig. 36.
3. ***Remove the lower screw*** from the shift rod coupling and move the shift lever to the reverse position.
4. Remove the five Allen head screws securing the pump housing to the lower motor casing. See fig. 38.
5. Rotate the entire pump housing just a fraction to break the seal between the two pumps and the water and bailer lines.
6. Pull the entire assembly down and out of the lower motor casing.
7. Slide the rubber boot off the upper part of the driveshaft by working it loose with your thumbs.
8. Remove the water inlet cup.
9. Remove the four pump assembly mounting screws.
10. Lift the bailer pump up and off the driveshaft taking care not to damage the seal in the drive-



38.

shaft hole as you slide the pump over the boot groove or splines. The bailer impeller will come off with the bailer body. Be careful not to lose the impeller drive pin located in the flat in the driveshaft.



39.

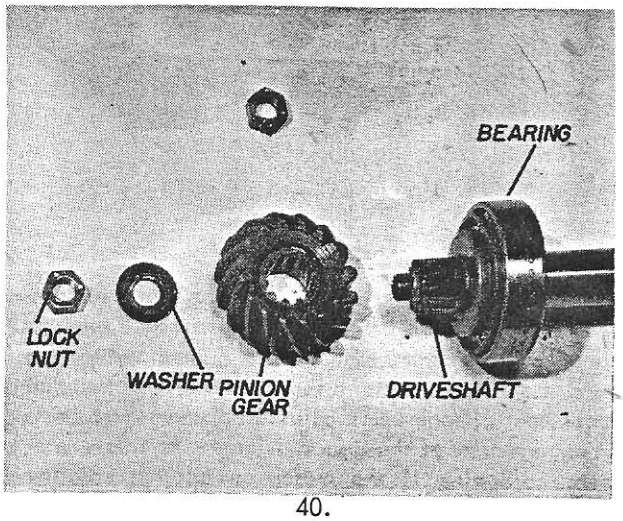
11. Remove the "O" ring seals, separator plates, and water pump impeller. Be careful not to lose the impeller drive pin.
12. The water pump body along with the copper water inlet line can now be removed. Be careful not to damage the seal in the driveshaft hole as you slide the pump over the boot groove or splines.
13. Remove the ***three*** stud nuts securing the pump housing to the lower unit. One stud nut is plainly visible at the top of the housing. The other two are located down in the housing.
14. The pump housing and lower unit can now be separated by pulling them apart.
15. Pull the driveshaft, with its pinion gear, bearing and cup, down and out of the pump housing.
16. The caged needle bearing in the upper pump housing driveshaft hole can be removed by using tool No. J-7655.

17. Remove the lock nut from the driveshaft and press the driveshaft out of the pinion gear and bearing.

Assembly

Reverse the order of disassembly following these special instructions:

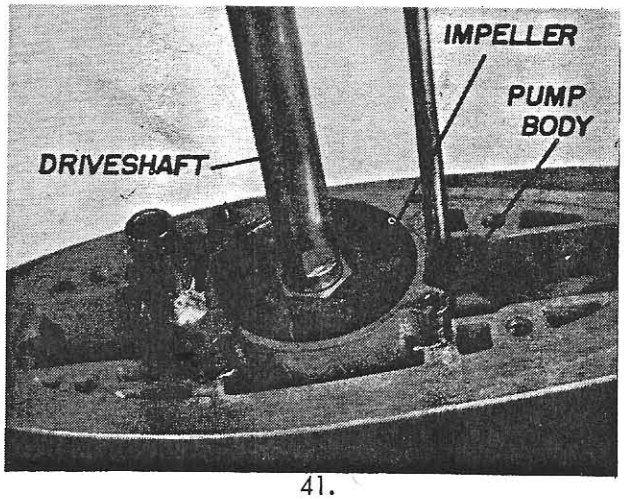
1. Always replace both pinion bearing and cup as a set. Do not replace individually.
2. Insert the pinion bearing on the driveshaft with the taper toward the top of the driveshaft. Press the bearing down on the driveshaft until the



40.

pinion gear can be guided in place by the tapered splines on the driveshaft. Then press the pinion gear and bearing onto the driveshaft as a unit. This will correctly position the bearing on the driveshaft.

3. Apply Loctite or a similar locking agent to the driveshaft stud; install the flat washer, a new lock nut, and torque the nut to 160 inch pounds.
4. Be sure the "O" ring seal is installed around the pinion bearing cup.
5. With the driveshaft and pinion gear installed in the pump housing, replace the lower unit and secure it in place.
6. Be certain the vinyl tape is in place on the water pump body as shown in fig. 39.
7. Slide the water pump body (including the copper inlet line) in position in the pump housing.
8. Place the impeller drive pin in position in the lower flat in the driveshaft (hold it in place with a little grease), and install the water pump impeller with the word "TOP", located on the impeller blades, visible. The word "TOP" should face toward the open portion of the pump.
9. The round separator goes on next and should be flush with the top surface of the impeller.
10. Place the large "O" ring seal on top of the



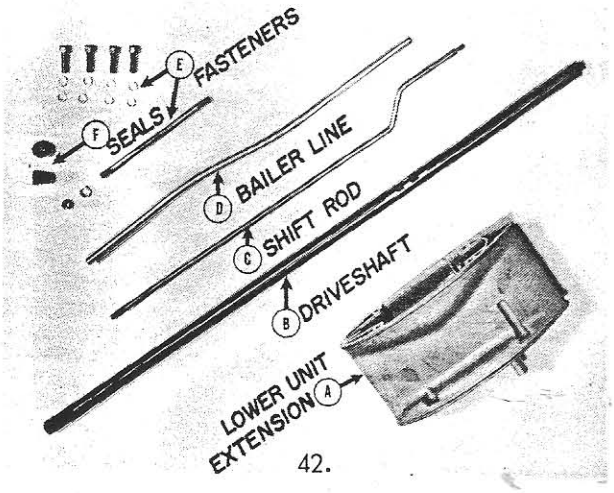
41.

round separator plate, then slide the remaining separator plate in place.

11. The bailer impeller must be installed with the letter "T", stamped in the impeller hub, toward the bailer cavity. The letter "T" should not be visible. The letter "T" should face toward the bailer cavity.
12. Fit the small "O" ring seal into the groove around the stainless steel insert of the bailer body.
13. Place the impeller drive pin in its flat in the driveshaft and slide the bailer assemblies into place and securely fasten the entire pump assembly to the pump housing.
14. Slide the rubber driveshaft boot in place, grease the driveshaft splines, and guide the driveshaft into the lower motor casing. Be certain the boot fits snugly around the bushing in the powerhead adapter.
15. Secure the pump housing to the lower motor casing and connect the upper and lower shift rods.
16. With the engine in an upright position, refill the lower unit with EP No. 90 outboard gear lubricant. Fill through the drain hole until lubricant flows from the vent hole. Replace the vent plug, then the drain plug. The capacity is 15 ounces.

EXTENSION KIT INSTALLATION – See fig. 42.

1. Disassemble the pump housing, including ***removal*** of the lower unit, as previously described.
2. Assemble the pump housing, using the extension driveshaft. Replace the lower shift rod with the one from the kit and assemble the lower unit and pump housing.
3. Install the lower bailer line seal and the aluminum waterline extension in the extension body. Do not press the aluminum water line extension completely down into the extension body and leave approximately 1/4" protruding above the



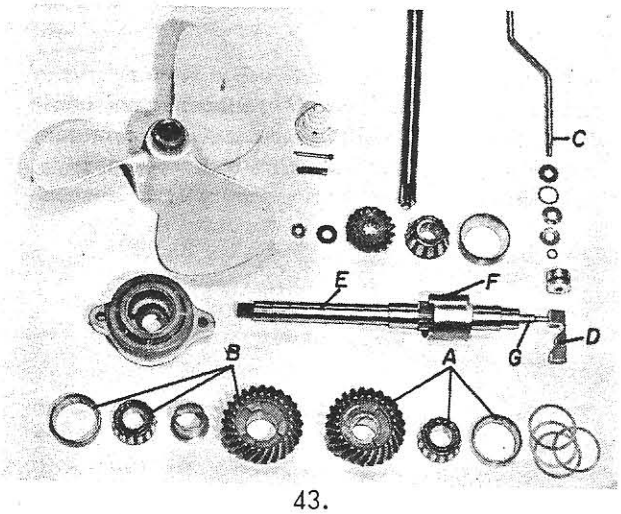
42.

top surface of the extension body.

4. Thread stud (E) into the pump housing and assemble the lower unit and pump housing with 4 Allen screws.
5. Install the extension bailer line through the grommet in the bracket in the lower motor casing and guide the top end into the seal in the powerhead adaptor. This top seal must be in place or the bailer will not operate.
6. The entire assembly can now be assembled to the lower motor casing. Be certain all seals and the rubber boot on the driveshaft are in place.

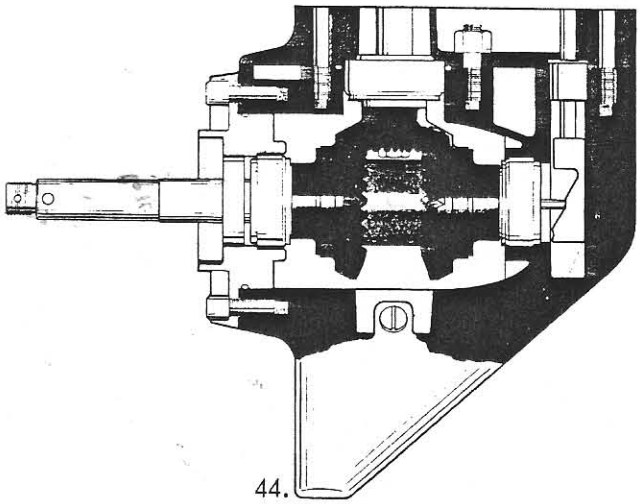
LOWER UNIT (60 and 40 H.P.)

The lower unit contains the forward gear bearing and cup (A), the reverse gear bearing and cup, (B), along with the lower shift rod (C), cam selector (D), propeller shaft (E), clutch dog (F), propeller shaft plunger (G), and the necessary seals, washers, etc. See fig. 43.



43.

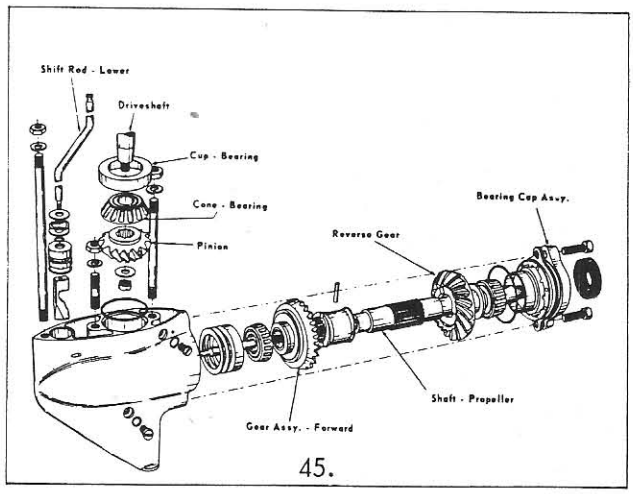
The lower unit utilizes a horizontal shifting mechanism. The clutch dog is moved into and out of engagement with the gears by the propeller shaft plunger. The plunger's position is determined by its location on the cam selector. The clutch dog is spring loaded into forward gear and the plunger is in the deepest indentation of the cam selector. In neutral the plunger is riding in the middle indentation of the cam selector. In reverse, the plunger is riding in the bottom and smallest indentation of the cam selector. See fig. 44.


44.

The most important, and most obvious, maintenance check is to be sure the lower unit has an adequate supply of lubricant (EP No. 90 gear lube) at all times. Equally important is to be certain that the remote control hook-up is adjusted properly to assure full engagement of the gears. Along with this check try to determine if the motor operator is shifting correctly. A positive, sharp motion should always be used to shift gears. An engine should never be eased into gear.

The continued presence of an excess amount of water in the lower unit lubricant or lubricant leaking from the lower unit drain holes or around the propeller shaft seal, requires a close inspection of all seals, including the top seal in the pump housing. Replace all suspect seals.

Disassembly

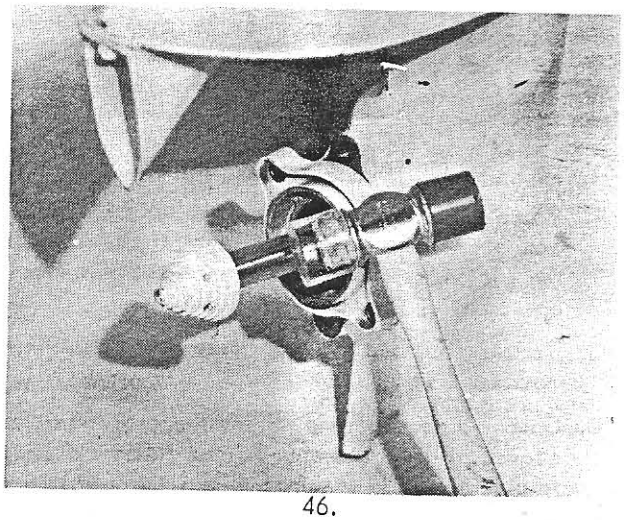


45.

1. Repeat the section on disassembly of the pump housing, leaving out those steps dealing with replacing the pinion gear.

2. Remove the propeller; replace the propeller nut.

3. Remove the two bearing cap screws and ***tap*** the propeller nut with a mallet to disengage the bearing cap from the lower unit body. (Do not strike the ears on the bearing cap.) See fig. 46.



46.

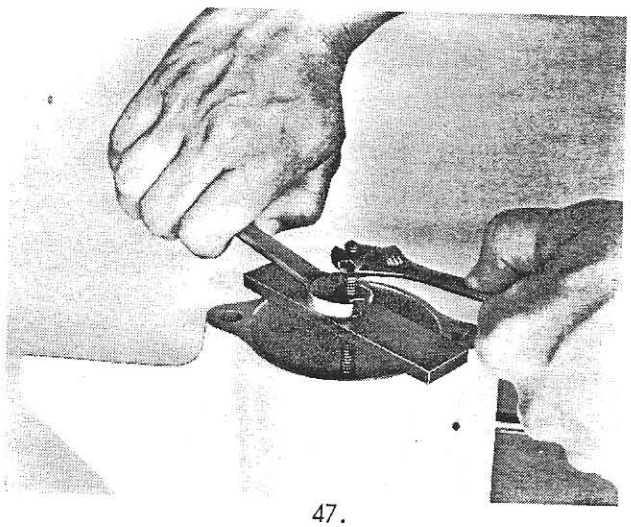
4. The propeller shaft and gear assembly can now be removed from the lower unit.

5. To remove either of the gears or bearings, support the gear nearest the bearing to be removed and press out the propeller shaft.

6. To remove the clutch dog, remove the forward gear, bearing, and the plunger. Using tool No. J-7533 to compress the propeller shaft spring, drive out the roll pin holding the clutch dog in place on the shaft.

7. Unscrew the lower shift rod to replace it or the cam selector.

8. Use tool No. J-7656 to remove the forward gear bearing cup. See fig. 47.



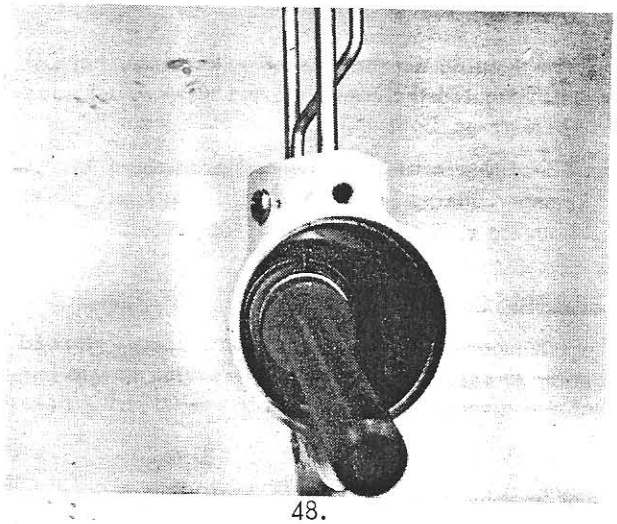
47.

9. Use tool No. J-7656 to remove the reverse gear bearing cup from the bearing cap.

Assembly

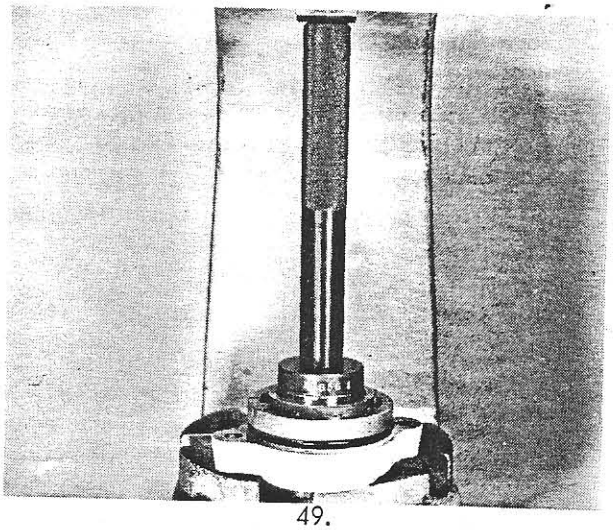
Reverse the order of disassembly following these special instructions:

1. To install the forward gear bearing cup, always use the shims which come with the new bearing assembly and seat the cup squarely in place using tool No. J-7656. See fig. 48.



48.

2. To install the reverse gear bearing cup in the bearing cap, always use the shims which come with the near bearing assembly and seat the cup squarely in place using tool No. J-7656. See fig. 49.



49.

3. Install the clutch dog (using tool No. J-7533 to compress the plunger spring) with the square teeth facing toward the threaded end of the propeller shaft. Secure the clutch dog with a new roll pin.

4. Slide the reverse gear, marked with a stamped "R" on the face of the clutch ring, into place, then press the reverse gear bearing on the prop shaft until it bottoms on the shoulder on the prop shaft.

5. To install the forward gear and bearing, follow

the same procedure as for the reverse gear and bearing. The forward gear is marked with an "F" stamped on the face of the clutch ring.

6. If the selector cam or shift rod have been removed, install the selector cam in the lower unit then thread the shift rod into the selector cam until it bottoms. Back off until the shift rod is in position to fit into the pump housing. Be certain the seals and washers are placed on the shift rod in the order shown in fig. 45.

7. The bearing cap can now be installed, but DO NOT tighten the bearing cap screws. Just snug them down. Both 40 and 60 H.P. motors.

8. The lower unit can now be assembled to the pump housing. Torque the lower unit pump housing stud nuts to 275 inch pounds.

BEARING CAP ASSEMBLY – 60 H.P. ONLY

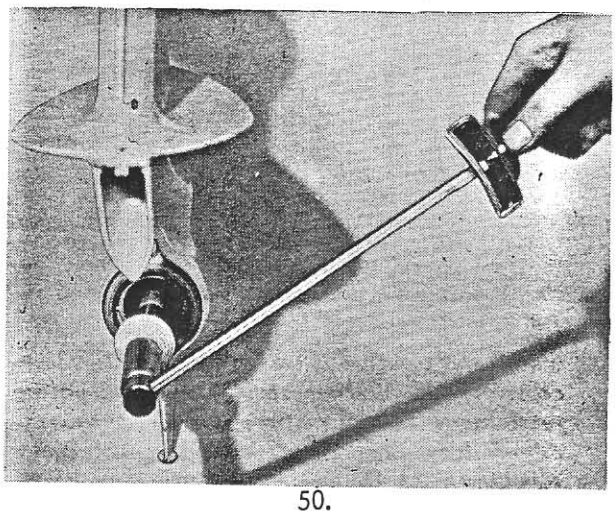
The following procedures must be closely followed in order to establish the correct pre-load on the forward and reverse gear bearings in the 60 H.P. lower unit.

1. Place the shift lever in neutral position.

2. With a feeler gauge, determine the gap between the bearing cap and the lower unit midway between the Allen screws. Add shims that equal the determined gap under each ear of the bearing cap. Horseshoe shims are available in thicknesses of .001", .002", .003", and .005".

3. Torque the bearing cap screws to 250 inch pounds.

4. With the shift in neutral, obtain a torque reading off the prop shaft as shown in fig. 50. The torque reading should be 7 to 11 inch pounds



50.

with the prop shaft seal in place. If the reading is over 11 inch pounds, loosen the bearing cap, add shims (equal thicknesses behind each ear); torque the bearing cap screws to 250 inch pounds, and test again. If the reading is below 7 inch pounds, repeat the same procedure as above, but remove shims until the prop shaft torque reading falls within the 7 to 11 inch pound range.

Without the prop shaft seal in place the procedure is the same but the allowable torque is 5 to 9 inch pounds.

BEARING CAP ASSEMBLY – 40 H.P. ONLY

The 40 H.P. bearing cap must be assembled according to the following procedure to obtain .000 to .005" end play for the forward and reverse gear bearings.

1. Place the shift handle in neutral.

2. Place bearing cap in position without shims and snug up the screws finger tight. Measure the gap between the bearing cap and lower unit and add this thickness of shims.

3. Torque the bearing cap screws to 250 inch pounds.

4. Obtain a torque reading off the prop shaft as shown in fig. 50. Refer to the following chart to determine the required thickness of shims to be added.

As an example:

If distance between bearing cap and lower unit is .010, add .010" shims. If the torque reading is 13 to 14 inch pounds, add shims equal to .017". Shims are available in .001", .002", .003", and .005" thicknesses.

5. Loosen the bearing cap screws and install an equal amount of shims (the thickness of which were determined in step four) under each ear of the bearing cap and torque the bearing cap screws to 250 inch pounds.

6. Take another torque reading off the prop shaft. The reading should not be above 2 inch pounds, which is the amount of resistance offered by the prop shaft seal.

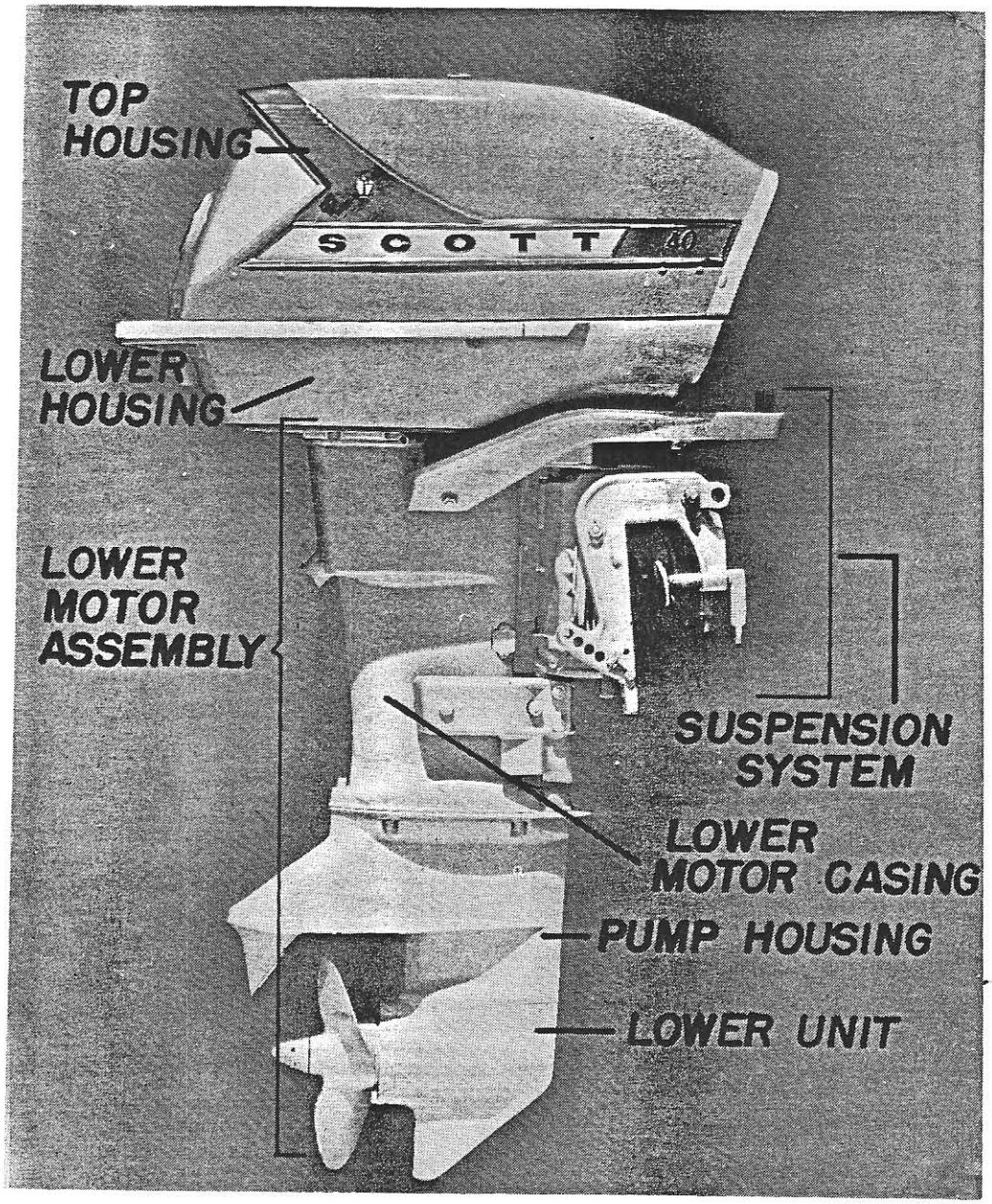
Under no circumstances should there be over .005" of end play.

TORQUE READING OBTAINED	SHIMS TO BE ADDED
8" lbs. min.	.014
9" lbs. – 10" lbs.	.015
11" lbs. – 12" lbs.	.016
13" lbs. – 14" lbs.	.017
15" lbs. – 16" lbs.	.018
17" lbs. – 18" lbs.	.019
19" lbs. – 20" lbs.	.020
21" lbs.	.021
22" lbs.	.022
23" lbs.	.023
24" lbs. – 25" lbs.	.023

SECTION V

40 H.P. MODELS

INTRODUCTION



Horsepower O.B.C. Certified	40 H.P. @4800 RPM
Normal Full Throttle Range	4400 to 5200 R PM
Number of Cylinders	2
Bore and Stroke	3 1/8" X 2 3/4"
Piston Displacement	42.18 Cu. In.
Gear Ratio	14:23
Fuel Tank Capacity	6 gal.
Fuel Mixture	
Break-In	1/2 Pint Oil to 1 gal. gas.
Normal Operation	3/8 Pint Oil to 1 gal. gas.
Initial Carburetor Setting	
Main	Fixed Jet
Idle	2½ Turns Open (counterclockwise) from closed position
Spark Plugs	J6JM Gapped .035"
Recommended Breaker Point Setting	.020"
Generator Output	5 to 6 Amps
Lower Unit Lubrication	S.A.E. #90 E.P.
Propeller Diameter and Pitch	10" X 12 1/2" (3-Blade)

40 H.P. MODEL

When servicing the 40 H.P. models, separate major assemblies first then proceed to overhaul or repair each assembly.

Information on how the various systems operate can be found in the Operating Principles Section. In some cases disassembly instructions for the 40 H.P. model are identical to the instructions given for the 60 H.P. model. To avoid needless repetition refer to the appropriate part of the 60 H.P. section to obtain these instructions.

For convenience we have divided the section into various parts, each of which pertain to a major assembly or system on the engine. Following is a list of these parts in the order that they will appear in this section.

1. Housings
2. Electric Systems
3. Fuel System
4. Powerhead
5. Suspension system
6. Lower motor assembly

TOP HOUSING

The top housing is constructed of fiberglass. To remove the housing, depress the levers on each side then lift the housing off the engine. The various emblems, brackets, etc., can be removed and replaced if necessary. When removing parts which are riveted, drill the rivets out.

If the housing is slightly damaged, it can be repaired using a fiberglass repair kit. For instructions on painting the housing, consult the General Information section.

LOWER HOUSING

The lower housing is constructed of aluminum. Instructions on painting or touching up the housing can be found in the General Information section. Replacement parts are available should replacement of parts be necessary.

Disassembly

1. Disconnect the intake fuel line, battery and terminal strip leads. On manual starting models disconnect the stop switch leads and disconnect the manual choke linkage.
2. Remove the screws which secure the powerhead to the adaptor plate, then remove the powerhead.
3. Remove the screws which secure the housing to the adaptor plate.
4. Remove the remote control bracket and the grommets from the front of the housing.
5. On manual starting models remove the stop switch assembly.
6. Drive the pin out of the hood release lever, then remove the hook, spacer, and washer.

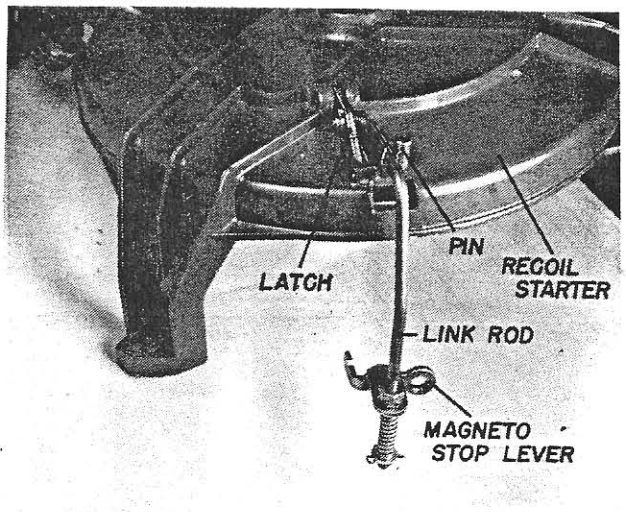
Assembly

To assemble the housing reverse the preceding steps. Use EC 847 adhesive to cement the moldings in place.

RECOIL STARTER (Manual Starting Models)

The steps for completely disassembling the recoil starter are basically the same for all models. Consult the Operating Principles section for disassembly and assembly instructions.

Starter Removal – See fig. 1.



1.

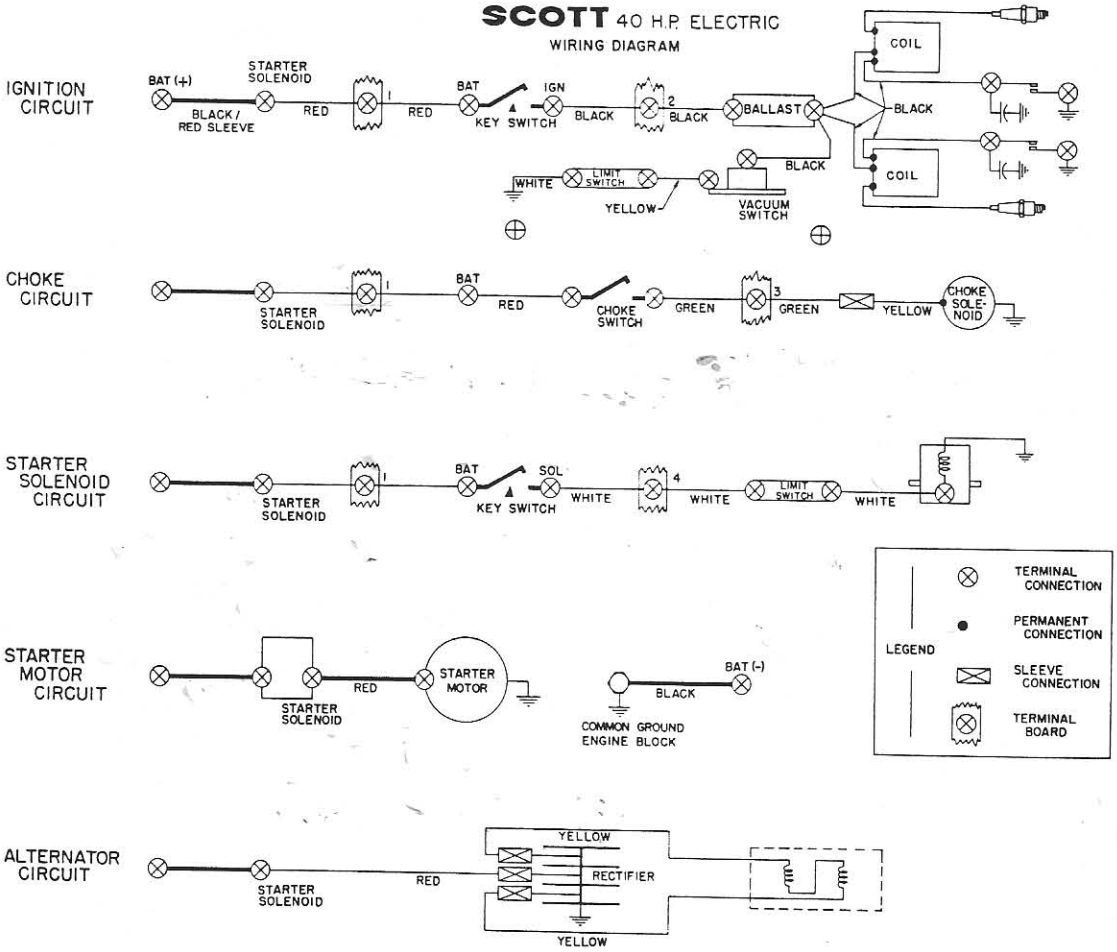
1. Drive out the pin which secures the latch to the starter housing.
2. Remove the cotter pin, latch, and spring from the link rod.
3. Separate the link rod from the magneto stop lever.
4. Remove the starter mounting screws.
5. Remove the starter mounting brackets, if necessary.

Starter Replacement

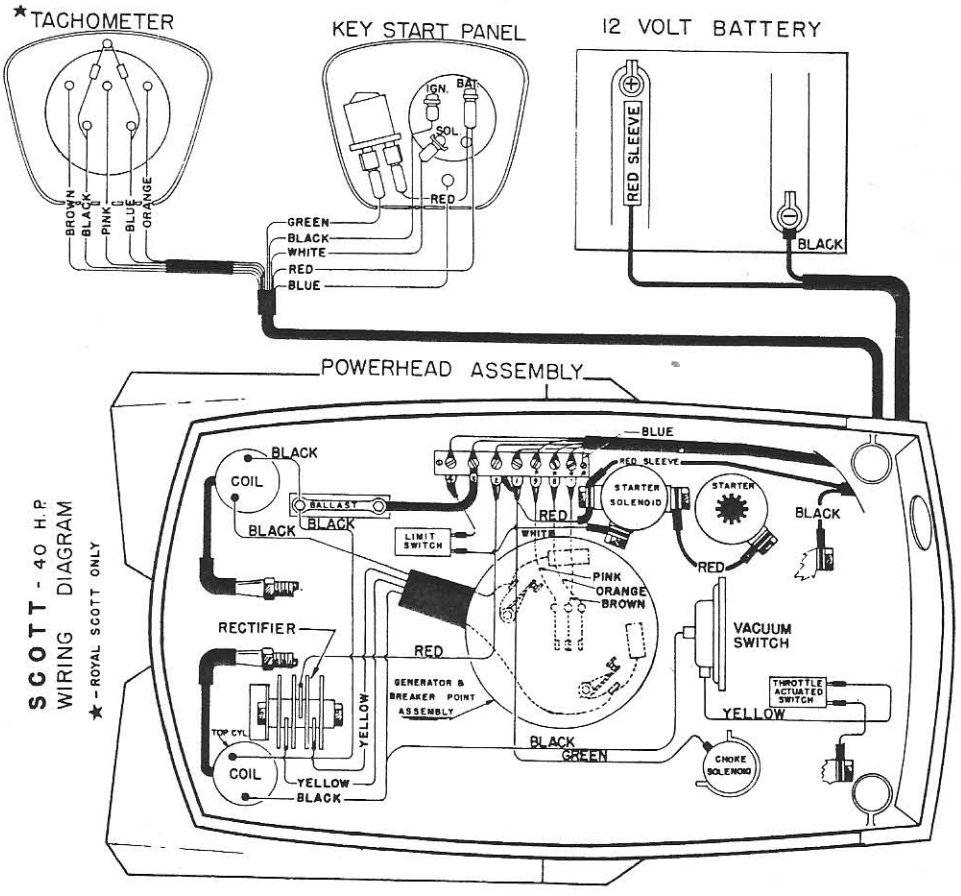
Reverse the preceding steps to install the starter on the engine.

The starter lock assembly should be adjusted so that the latch will engage the pulley teeth only in forward and reverse gear. To make this adjustment, thread the nut on the link rod either up or down.

Adjust the magneto stop lever so that it will come into contact with the stator plate limiter only in neutral gear. To make this adjustment turn the nut on the lock rod either up or down. This adjustment limits the throttle advance in neutral gear.


SCOTT 40 H.P. ELECTRIC
WIRING DIAGRAM
IGNITION CIRCUIT
BAT (+)
STARTER SOLENOID
BLACK / RED SLEEVE
RED
BAT
IGN
KEY SWITCH
BLACK
BALLAST
COIL
WHITE
LIMIT SWITCH
YELLOW
VACUUM SWITCH
CHOKE CIRCUIT
CHOKE SWITCH
GREEN
CHOKE SOLENOID
STARTER SOLENOID CIRCUIT
SOL
STARTER MOTOR CIRCUIT
STARTER MOTOR
COMMON GROUND ENGINE BLOCK
ALTERNATOR CIRCUIT
RECTIFIER
LEGEND
TERMINAL CONNECTION
PERMANENT CONNECTION
SLEEVE CONNECTION
TERMINAL BOARD

2.


★TACHOMETER
KEY START PANEL
12 VOLT BATTERY
IGN.
BAT
SOL
RED SLEEVE
BROWN
BLACK
PINK
BLUE
ORANGE
GREEN
BLACK
WHITE
RED
BLUE
POWERHEAD ASSEMBLY
COIL
BALLAST
LIMIT SWITCH
STARTER SOLENOID
STARTER
RECTIFIER
GENERATOR & BREAKER POINT ASSEMBLY
VACUUM SWITCH
THROTTLE ACTUATED SWITCH
CHOKE SOLENOID
TOP CYL.
SCOTT - 40 H.P. WIRING DIAGRAM
★ - ROYAL SCOTT ONLY

3.

40 H.P. ELECTRICAL SYSTEM (Electric Starting Models)

The electrical system consists of four separate circuits as follows:

1. Ignition circuit.
2. Starter circuit.
3. Choke circuit.
4. Generating circuit.

For information on how each of these circuits operate, consult the Operating Principles section.

When initiating repairs on the electrical system, inspect each circuit individually from start to finish. Start at the power source and follow the circuit, checking the operation of each component, until it returns to the power source.

The increment drawing will be very helpful in tracing each circuit. Power leaves the battery from the positive terminal and must have an unbroken pathway so that it can return to the negative terminal, if the circuit is to function.

IGNITION CIRCUIT

A general explanation as to how the ignition system functions can be found in the Operating Principles section.

Following are the components that comprise the ignition system listed in the order that they should be checked when tracing the circuit.

1. Ignition switch.
2. Ballast.
3. Ignition coils.
4. Breaker Plate.
   a. Ignition points.
   b. Condenser.
5. Vacuum and throttle switch.

Check the following points as possible causes of ignition difficulty:

1. Loose connections.
2. Faulty switches, ballast, coils, or condensers.
3. Dirty or improperly gapped breaker points (must be gapped at .020").
4. Wrong plug, fouled, or improperly gapped spark plugs.
5. Improper synchronization or timing.

To maintain the ignition system, periodically check and tighten all wire connections. Clean the points by sliding a piece of paper back and forth between the points. The points should be gapped to exactly .020" using a feeler gauge. Rotate the flywheel so that the breaker arm rests on the high point of the breaker cam. Loosen the mounting screws and insert the gauge between the points. Pivot the point assembly so that the breaker arm rests firmly against the cam. Tighten the mounting screws, then remove the feeler gauge. J6JM Champion spark plugs should be used on all 40 H.P. models. They should be gapped to .035".

Ignition Switch

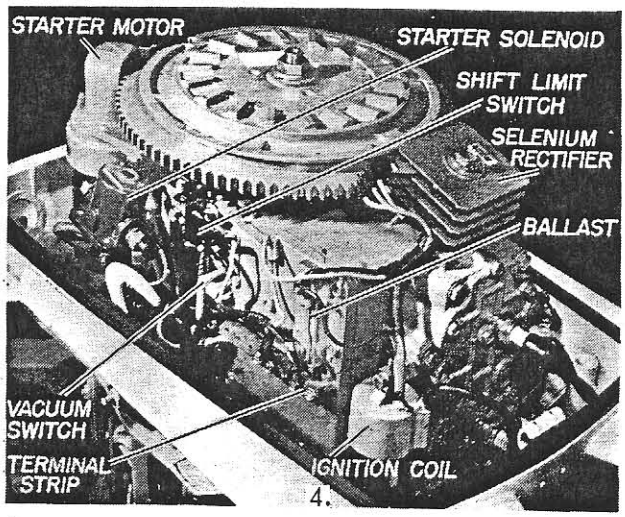
Use a test light to check the switch continuity in the various positions. With the key in the "ON" position there should be continuity between only the battery terminal and the ignition terminal. With the key in the "Start" position there should be continuity between the battery terminal and both the ignition and solenoid terminals.

Removal and Replacement

1. Remove the ignition and choke switch trim nuts.
2. Remove the nut from the mounting bracket and disconnect the switch lead wires.
3. Reverse steps 1 and 2 to install the switch.

Ballast

The ballast is mounted on the powerhead. To test the ballast-refer to the test instructions on page 139. When replacing the ballast be sure the correct leads are attached to the ballast terminals; see wiring diagram.



4.

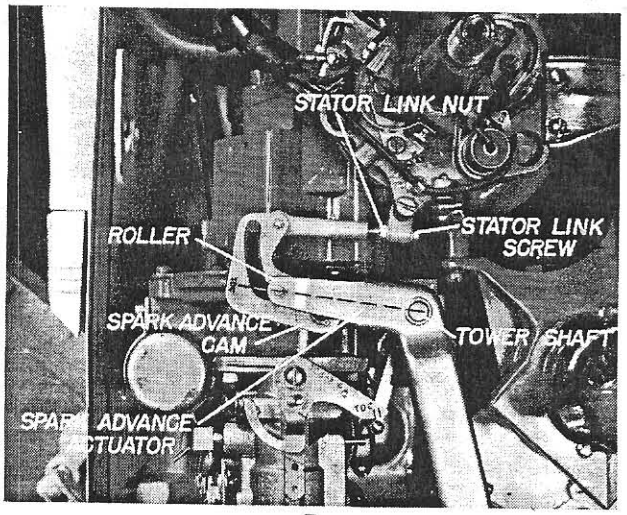
Disassembly and Assembly

1. Disconnect the ballast leads.
2. Remove the ballast.

Ignition Coils

There are two ignition coils, one for each cylinder. They are mounted on the powerhead and should be checked according to the instructions on page 135. They are a sealed unit and must be replaced if they should fail.

1. Place the shift lever in the neutral position and move the speed control lever as far toward the "fast" position as possible. This places the stator against the stator stop.
2. Loosen the nut on the stator link and turn the stator screw in or out until the TDC mark on the spark advance cam, the center of the roller on the spark advance actuator, and the center of the tower shaft are aligned. See fig. 7.



7.

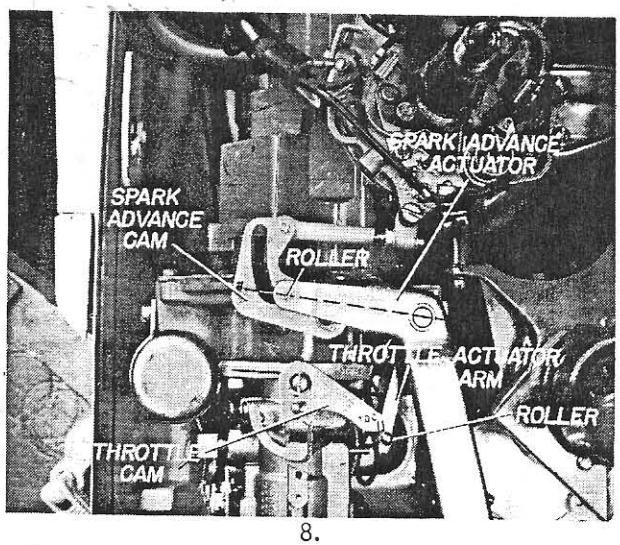
3. Tighten the nut.
4. This is how to check the adjustment. (Electric starting models only). Some engines have flywheels with two "advance" marks on them and some have only one.
   a. On engines with two advance marks approximately 3/8" apart on the flywheel, the points will break when the right hand advance mark is approximately 1/16" to the left of the pointer on the flywheel guard, as the flywheel is rotated with the spark advance lever at "fast". This indicates that the points are breaking at 33° before top dead center as required.
   b. On engines with two advance marks approximately 3/16" apart, the points will break when a mark is on each side of the pointer as the flywheel is rotated with the spark advance lever at "fast". This indicates that the points are breaking at 33° before top dead center as required.
   c. On engines with one advance mark on the flywheel, the points will break when the mark is approximately 1/16" to the left of the pointer on the flywheel guard as the flywheel is rotated with the spark advance lever at "fast". This indicates that the points are breaking at 33° before top dead center as required.

This point can best be determined by using a timing light, with the engine running.

SYNCHRONIZATION (Electrical and Manual Starting Models)

This adjustment must be performed using the following procedure. The engine must be timed correctly to properly perform this operation.

1. With the angle and length adjustments loose on the throttle actuator arm, align the TDC mark on the spark advance cam, the center of the roller on the spark advance actuator, and the center of the throttle tower shaft on a line. See fig. 8.



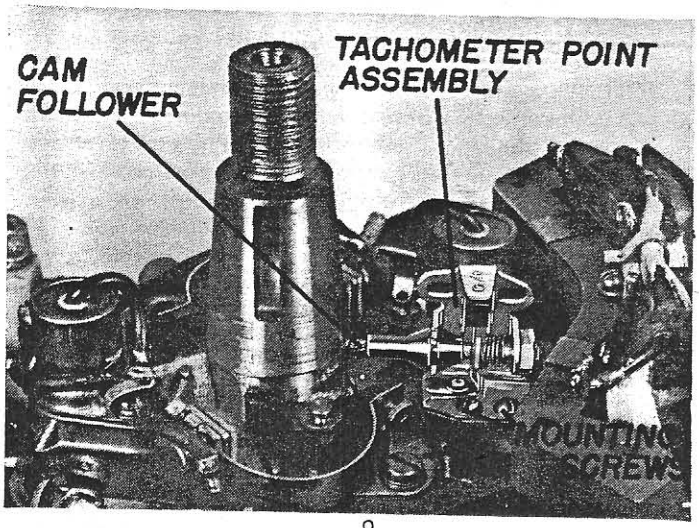
8.

2. Move the throttle actuator arm toward the throttle cam, using both angle and length adjustments, until the roller touches the first mark on the cam. Tighten the length adjustment screw.
3. Move the throttle actuator arm, using the angle adjustment only, until the second mark on the throttle cam bisects the center of the roller. See fig. 7. Repeat this procedure with the other carburetor. This just cracks the throttle valve slightly as is necessary for easy starting and smooth acceleration on the 40 H.P. engine.

Tachometer (Royal Scott)

The Royal Scott Model comes equipped with a tachometer to measure engine RPM. A set of contact points are mounted on the breaker plate. The points are activated by the cam on the crankshaft and require two contacts to operate the tachometer. For information on adjusting the tachometer points consult the 60 H.P. Section. To replace the tachometer points remove the flywheel, disconnect the tach lead wires and remove the mounting screws. When attaching the lead wires to the tachometer points be sure to attach the brown wire to the single contact and connect the other lead wires to the twin terminals. To mount the tachometer assembly to the dash panel drill a 3 5/8" hole in the panel. Remove the "U" clamp from the back of the tachometer assembly,

insert the tach body into the hole and replace the "U" clamp. The terminals on the back of the tachometer are marked according to the color of the wires that will be attached to the terminals.



9.

STARTER CIRCUIT

For information on how the starter circuit operates consult the Operating Principles section of this manual. The starter circuit is comprised of the following components:

1. Ignition switch
2. Shift limit switch
3. Starter solenoid
4. Starter motor

The ignition switch, shift limit switch, and starter solenoid are sealed units which must be replaced if they should become inoperative.

Ignition Switch

See the Ignition Circuit for instructions on the ignition switch.

Shift Limit Switch

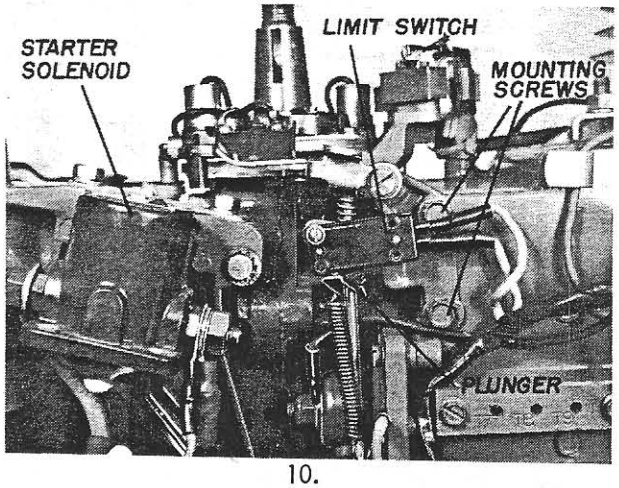
The shift limit switch must be adjusted so that its plunger is fully depressed with the engine in neutral. To make this adjustment loosen the switch mounting screws. Place the shift lever in neutral, then locate the switch so that the plunger is fully depressed. If the plunger is not fully depressed, the starter motor will not operate. See Fig. 10.

Removal and Replacement

1. Disconnect the switch lead wires.
2. Remove the switch mounting screws.
3. To replace the switch reverse steps 1 and 2.

Starter Solenoid

If the starter motor will not crank the engine over, then the starter solenoid should be checked to see if it is operating as it should. Test instructions are



10.

given in section X for testing the starter solenoid. If the solenoid is inoperative, it must be replaced as it is a sealed unit.

Replacement

1. Disconnect the solenoid lead wires.
2. Remove the solenoid.
3. When replacing the solenoid consult the wiring diagram to attach the lead wires.

Starter Motor

The starter motor is basically the same for all electric starting motors.

For detailed information on disassembling and servicing the starter motor, consult the Operating Principles section of this manual.

Starter Motor Removal

1. Disconnect the lead wires.
2. Remove the mounting bracket screws.

CHOKE CIRCUIT

The 40 H.P. model utilizes a choke circuit that is identical to that of the 60 H.P. model. For information on the choke circuit refer to the 60 H.P. section.

GENERATING CIRCUIT

Information on how the generating circuit operates can be found in the Operating Principles section.

The generating circuit consists of the following components:

1. Coil and core assembly
2. Selenium rectifier

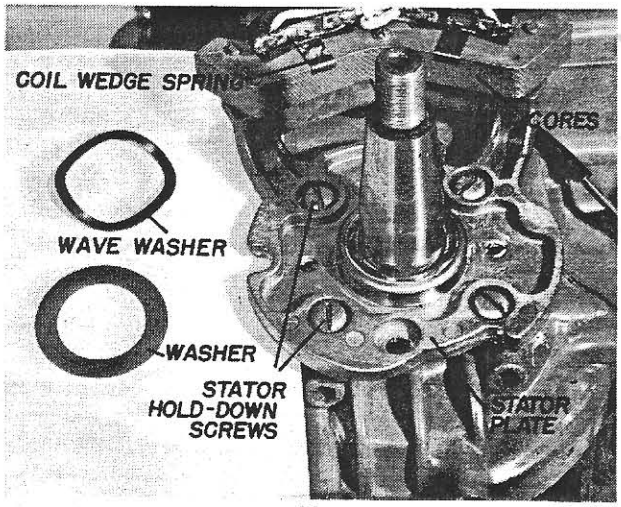
Coil and Core Assembly

The coil and core assembly is located beneath the flywheel. Instructions for testing this assembly

can be found in section X. If the coils become inoperative they must be replaced. A break in the wiring, at the coil terminals, can be repaired by soldering. Output of the generator is 4 to 6 amps.

Disassembly

1. Remove the flywheel using a flywheel puller.
2. Remove the breaker plate.
3. Disconnect the coil lead wires, then pry up on the coil wedge spring. Remove the nylon retainer and coils.
4. Remove the stator plate and cores. See fig. 11.



11.

Assembly

To assemble the generator reverse the steps listed under disassembly. Pay close attention to the following special instructions:

1. Use Loctite to prevent the stator hold-down screws from vibrating loose.
2. The coil wedge spring should lock over the edge of the core assembly to hold the coils firmly in place. See fig. 11.
3. The coil lead wires should be routed beneath the stator plate and retained to prevent them from coming into contact with the flywheel.
4. Check the breaker (and tachometer on Royal Scott models) point settings after you have replaced the breaker plate.
5. The flywheel nut should be torqued to 975 inch pounds.

Selenium Rectifier

The rectifier is mounted on the powerhead and is connected to the generator. No maintenance or adjustments are required by the rectifier. To test the regulator operation consult section X of this manual. Information on how the rectifier operates can be found in the Operating Principles Section. If the rectifier is defective it must be replaced.

Removal

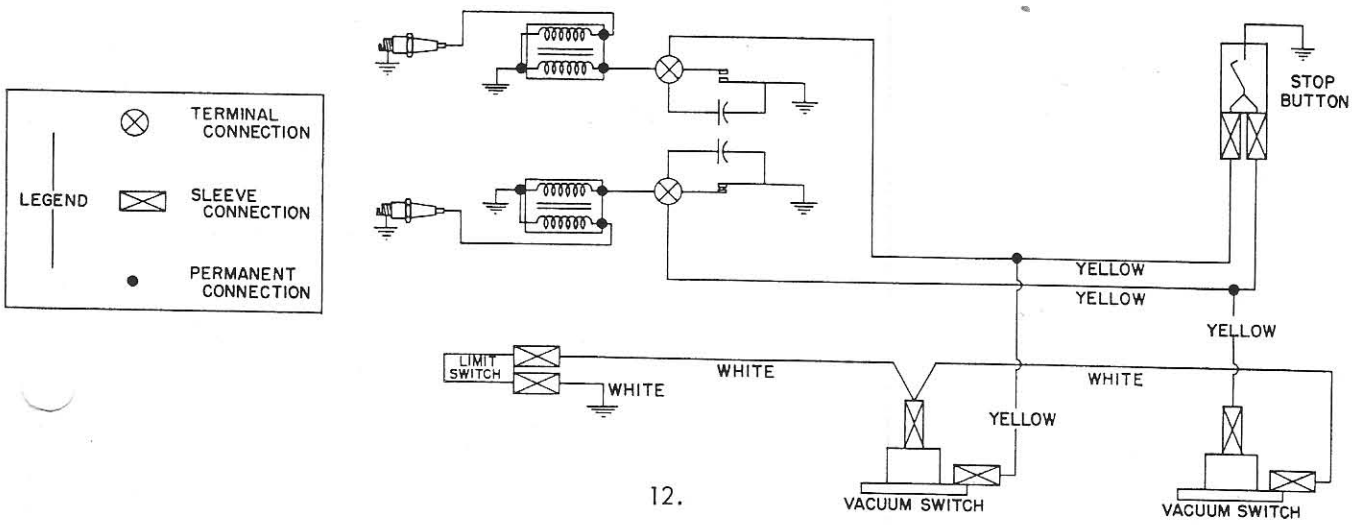
1. Disconnect the rectifier lead wires.
2. Remove the rectifier and separate it from its mounting bracket.
3. To replace the rectifier reverse steps 1 and 2. Attach the yellow lead wire to the terminals marked with yellow paint. Attach the red lead to the terminal marked with red paint.

IGNITION SYSTEM (Manual Starting Models)

The 40 H.P. manual starting model has a magneto ignition system. For information on how this system operates, consult the Operating Principles section.

The ignition system consists of the flywheel, stator plate (which contains the breaker points, condensers, and ignition coils), spark plugs, vacuum switches, throttle switch, and stop switch.

SCOTT 40 HP MANUAL
WIRING DIAGRAM



12.

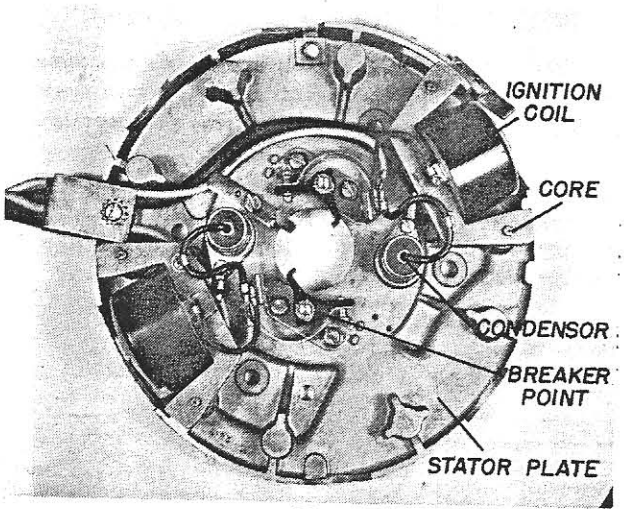
The most common causes of ignition difficulty are:

1. Dirty or improperly gapped breaker points or spark plugs.
2. Loose connections.
3. Faulty coil or condenser.
4. Wrong spark plug or incorrect spark plug gap.
5. Engine improperly synchronized or timed.

Information on how each component can be tested can be found in section X. To maintain the ignition system periodically check all electrical connections for tightness. Clean the breaker points, by drawing a piece of paper between the contacts. Rotate the flywheel until a breaker arm rests on the high points of the cam. Loosen the mounting screws and insert a .020 feeler gauge between the point contacts. Pivot the points assembly so that the breaker arm rests against the cam, then tighten the mounting screws. The points should now open to .020".

Disassembly (Magneto)

1. Remove the manual starter.
2. Remove the flywheel.
3. The breaker points, coils, or condenser can now be removed by disconnecting their lead wires and removing their mounting screws or clip, in the case of the ignition coil.



13.

4. Remove the felt cam wiper and its bracket.
5. To remove the stator plate, remove the screws which secure it to the stator hold-down plate. The magneto adapter plate can now be removed if necessary.

Assembly

To assemble the magneto reverse the preceding steps. Follow these special instructions:

1. Use Loctite to prevent the stator hold-down screws from vibrating loose.
2. Gap the breaker points.
3. Torque the flywheel nut to 975 inch po

Spark Timing

For information on timing the engine, see Electrical System (Electric Starting Models).

Synchronization

See Electrical System (Electric Starting Models).

Vacuum and Throttle Switches

Information on the operation of the vacuum and throttle switches can be found in the part of this section which deals with the electric starting models. Two vacuum switches are used on the manual starting model. Each of these switches are attached to a set of breaker points and operate in the same manner as described under electric starting models. Consult the wiring diagram when attaching the switch lead wires.

Manual Stop Switch

Located on the front housing is the manual stop switch. This is a push button type switch which is connected to both sets of breaker points. De sing the switch will ground the breaker points, pping the engine. The switch is a sealed unit which must be replaced if it becomes faulty.

Replacement

1. Disconnect the switch lead wires.
2. Remove the knob.
3. Remove the mounting nuts, then separate the switch from its bracket.
4. To replace the switch reverse the preceding steps.

FUEL SYSTEM – Manual and Electric Models

Although there are only two carburetors on the 40 H.P. engine, the component parts and assemblies in the fuel system operate in exactly the same manner as those in the 60 H.P. fuel system. With the exception of the carburetors and the fuel lines, all fuel system parts are inter-changeable between the 40 and 60 H.P. engines.

Follow the 60 H.P. maintenance, adjustment, and disassembly procedures explained in sect n IV with this exception: it is always necessar re-move the top carburetor in order to change metering rods on the 40 H.P. engine.

See the 40 H.P. "Electrical System" section to properly synchronize the carburetors.

Powerhead

The 40 H.P. powerhead consists of the cylinder head, block and crankcase, pistons, rings, connecting rods, crankshaft, and necessary bearings and seals.

There is relatively little that can go wrong with the powerhead. In most cases, faulty engine performance can be attributed to malfunction of the fuel or electrical systems. In cases where engines perform poorly, consult the trouble shooting chart on page 128 of this manual. Then thoroughly check the fuel and electrical systems before initiating repairs on the powerhead.

Before attempting any repairs on the powerhead, carefully read the Powerhead Repair Section in this manual.

Disassembly

For specific instructions in removing any of the following components, other than the powerhead, refer to the appropriate parts of this section.

1. Manual Starting Models

   A. Remove the shift lock, recoil starter, starter brackets, and flywheel.

   B. Carefully remove the magneto to avoid damaging the point assemblies. Remove the stator hold down and adaptor plate assemblies.

   C. Remove the vacuum switches.

2. Electric Starting Models

   A. Disconnect the battery leads, fuel line, and electric wiring leads at the terminal strip.

   B. Remove the flywheel, breaker plate, and stator assembly.

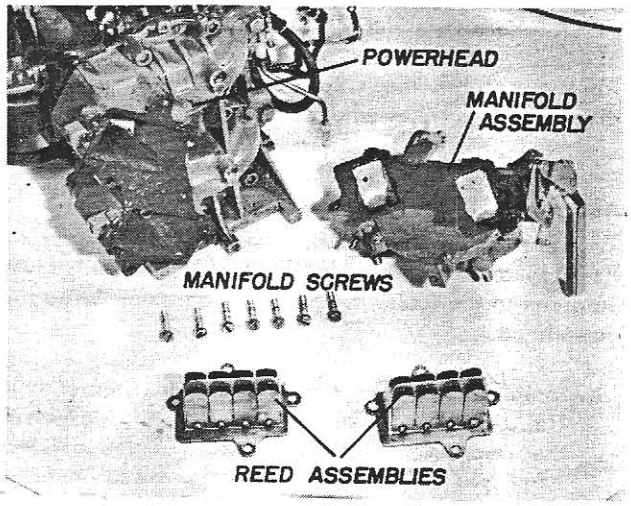
   C. Remove the ignition coil, rectifier, starter solenoid, starter, fuel pump, ballast, vacuum switches, throttle switch, and limit switch.

3. Both Models

   A. Remove the Allen screws which secure the powerhead to the adaptor plate. Be sure the screws partially hidden by the motor support and shift handle are removed.

   B. Lift the powerhead off the driveshaft, then carefully remove the carburetors, manifold, and reed assemblies. See fig. 14.

   C. Remove the cylinder head, intake, exhaust, and water cover plates.

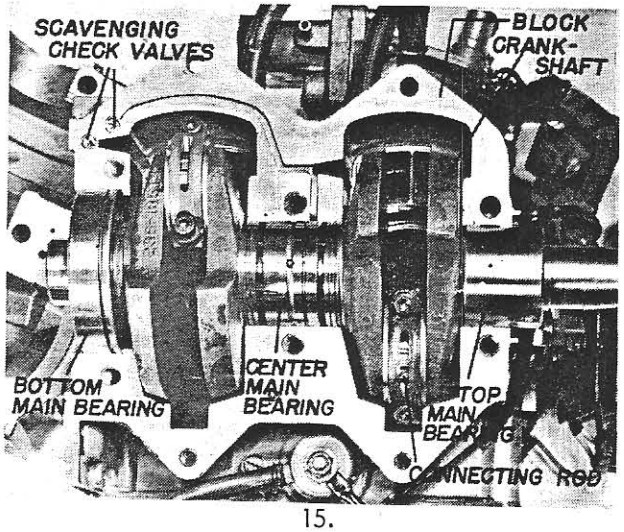


14.

   D. Separate the cylinder head and head cover plates.

   E. Remove the lower bearing cap assembly.

   F. Remove the crankcase bolts and separate the crankcase and block. See figure 15.



15.

   G. Carefully remove the center main bearing, keeping it in a separate, marked container.

   H. Carefully remove the rod caps and bearing assemblies, keeping the parts in separate containers, marked according to the cylinder from which they were taken.

   I. Remove the crankshaft, use special tool no. J-7657 to remove the bottom main bearing assembly.

   J. Remove the rod and piston assemblies, keeping the parts separated according to cylinders. Use a ring expander to remove the piston rings. Use special tool no. J-7654 to press out the wrist pins and wrist pin bearings.

K. Remove the scavenging check valves.

This completes the steps necessary to completely disassemble the powerhead.

Assembly

To reassemble the powerhead, reverse the steps listed under Disassembly. Special attention should be given to the following points when assembling the powerhead.

1. Install the wrist pin bearings with special tool No. J–7654 so that the lettering on the end of the bearing faces the outside of the piston. Wrist pin bearings should be pressed in until the race is almost even with the boss on the inside of the piston. Be careful not to distort the piston when installing the bearings.

2. Piston rings should be installed so that the inside beveled edge faces the top or dome of the piston. The rings should also be installed so that the locating pin in the piston groove is centered in the open portion of each ring.

3. Use special tool No. J–7654 to press the wrist pin through the connecting rod. Visually center the rod on the wrist pin. Be careful not to distort the shape of the piston.

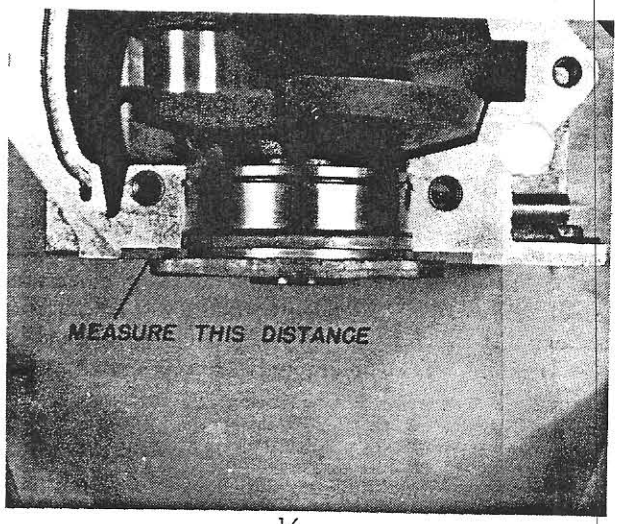
4. Use the No. J–7519 ring compressor and install the piston in the block, so that the sloping portion of the piston dome faces the exhaust port. The side of the rod marked "Top" should face toward the flywheel when in operating position.

5. Press the bottom main bearing on the crankshaft using tool No. J–7657. Install the bearing on the shaft by hand until it is aligned. Then press the bearing on the crankshaft until it bottoms. The lettering on the race should face out.

6. When replacing the center main bearing, be sure to locate the bearing on the pin located in the journal. The rollers are assembled in the slots around the outside of the bearing cage. One roller to each slot and one roller between each end of the cage halves. When placing the bearings in the cage use grease to hold them in place. The bearing race is fractured, so be sure the two matching halves are carefully assembled together.

7. When securing the connecting rods to the crankshaft use grease to hold the bearings in place. Mate the ground corners of each cage half. Be certain the rod cap and rod are carefully matched, then torque the rod cap screws to 180 inch pounds. Rotate the bearing. If there is any binding or catching, check your assembly procedure.

8. Before securing the crankcase to the block assembly, determine the quantity of shims required



16.

to provide the correct amount of crankshaft end play. To do this position the lower bearing cap and hold firmly in place. With a feeler gauge, measure the distance between the bearing cap and the block. If this distance is:

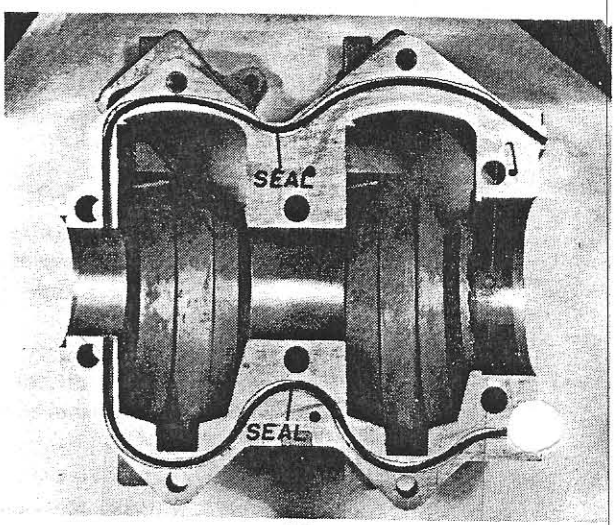
.000 to .002 add no shims
.002 + add .002 shims
.003 + add .003 shims
.004 + add .004 shims
.005 + add .005 shims, etc.

9. Apply a moderate amount of EC847, or a similar sealant along the outside edge of the rubber seal in the groove in the crankcase. Be certain not to allow the sealant to flow into check valves or the bearing.

10. Torque the main bearing screws to 300 inch pounds and the crankcase screws to 150 inch pounds.

11. Secure the lower bearing cap in place.

12. Torque the cylinder head bolts to 220 inch pounds.



17.

13. Rotate the crankshaft manually with the spark plugs removed. It should turn smoothly; if it does not, check your assembly procedure.

SUSPENSION SYSTEM

The procedure for disassembly and assembling the 40 H.P. suspension system is the same as for the 60 H.P. model. See the 60 H.P. section for instructions on repairing this part.

LOWER MOTOR CASING

Disassembly and assembly instructions are the same for the 40 and 60 H.P. models. For these instructions consult the 60 H.P. section.

PUMP HOUSING

Information on how the water and bailer pump operate can be found in the Operating Principles section of this manual. For disassembly and assembly instructions consult the 60 H.P. section.

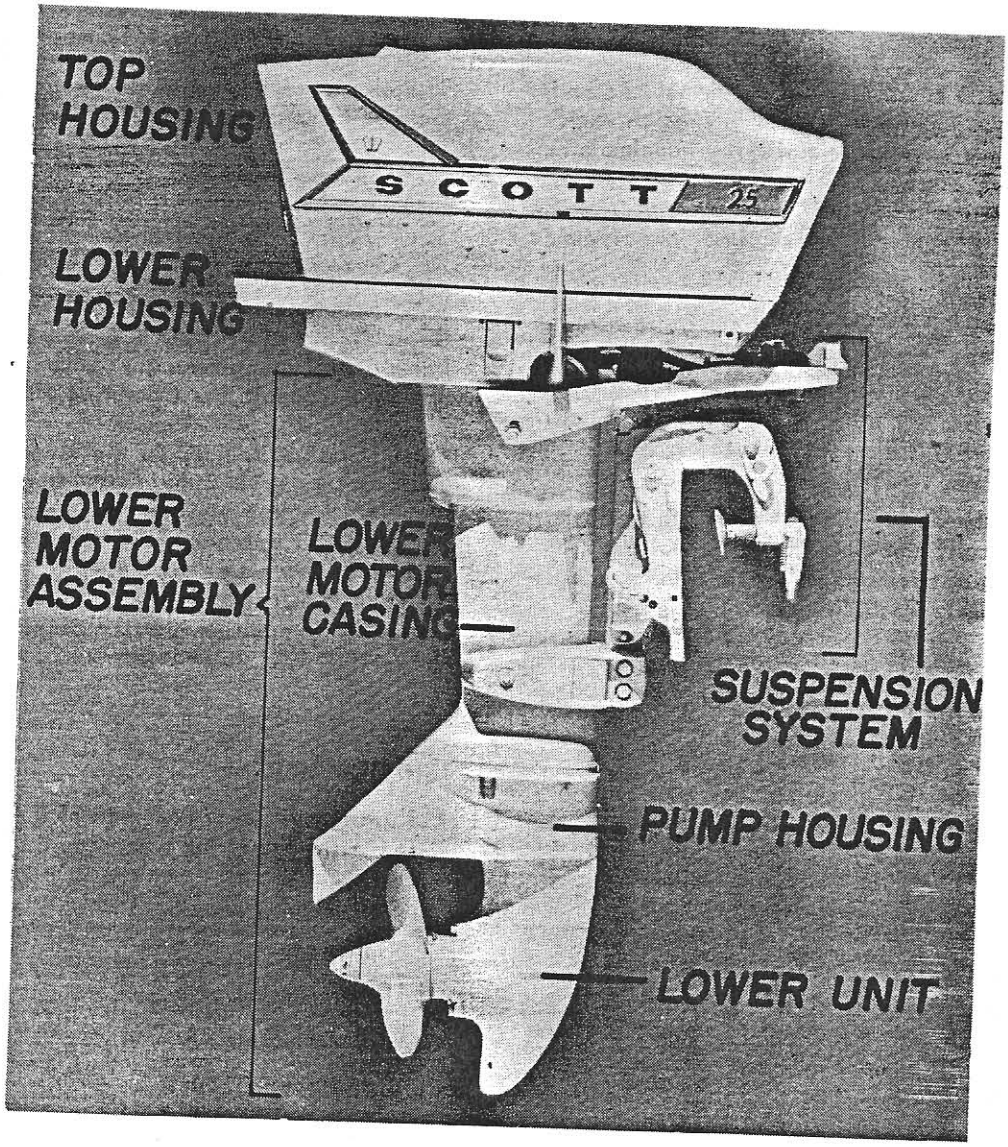
LOWER UNIT

The procedure and shimming requirements for the lower unit bearing cap are different for the 40 and 60 H.P. models. All other disassembly and assembly steps are the same. Consult the 60 H.P. section for information on the lower unit.

SECTION VI

25 H.P. MODEL

INTRODUCTION



Horsepower O.B.C. Certified	25 H.P. @4800 RPM
Normal Full Throttle Range	4400 to 5200 RPM
Number of Cylinders	2
Bore and Stroke	2 51/64 X 2 7/16
Piston Displacement	29.97 Cu. In.
Gear Ratio	15:23
Fuel Tank Capacity	6 gal.
Fuel Mixture	
Break-In	1/2 Pint oil to 1 gal. gas.
Normal Operation	3/8 Pint oil to 1 gal. gas.
Initial Carburetor Setting	
Main	3/4 Turns Open (counterclockwise) from closed position
Idle	
Spark Plugs	SAME
Recommended Breaker Point Setting	Champion J6JM
Generator Output	.020''
Lower Unit Lubrication	5 to 6 Amps
Propeller Diameter and Pitch	S.A.E. #90 E.P.
	9'' X 10'' (3 blade)

Top Housing

The top housing is constructed of fiberglass. To remove the top housing, lift up on the latches on each side of the lower housing and lift the housing off the engine. The various emblems, brackets, etc., can be removed and replaced, if necessary. When removing parts which are riveted, drill the rivets out.

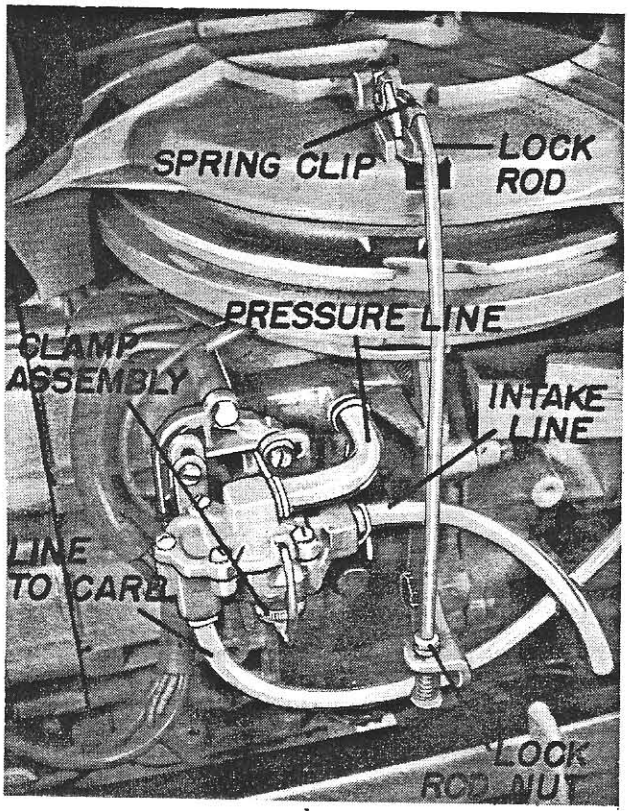
If the housing is slightly damaged, it can be repaired using a fiberglass repair kit. For instructions on painting the housing, consult the General Information section.

Recoil Starter

The steps for completely disassembling the recoil starter are basically the same for all models. Consult the Operating Principles section for disassembly and assembly instructions.

Removal

1. Remove the spring clip securing the starter lock rod to the starter lock. See fig. 1.



1.

2. Remove the three mounting bolts securing the starter housing to the powerhead. The starter housing can be lifted directly off the engine.

Reverse the removal procedure to install the recoil starter and adjust the lock rod nut so that the starter lock engages the starter pulley only in reverse or forward gear.

ELECTRIAL SYSTEM – (Electric Starting Models)

The electrical system consists of four separate circuits as follows:

1. The ignition circuit.
2. Starter circuit.
3. Choke circuit.
4. Generating circuit.

For an explanation of how each of these circuits operates, consult the Operating Principles section.

When initiating repairs on the electrical system, inspect each circuit individually from start to finish. Start at the power source and follow the circuit, checking the operation of each component, until it returns to the power source. The increment drawing on page 71 illustrates each circuit from the power source (the positive battery terminal) through the circuit to the negative battery terminal.

IGNITION SYSTEM

Following are the components of the ignition system listed in the order that they should be checked.

1. Ignition switch.
2. Ballast.
5. Ignition coils.
4. Breaker points.
5. Condenser.
6. Spark plugs.

Carefully check the following points as possible causes of ignition difficulty:

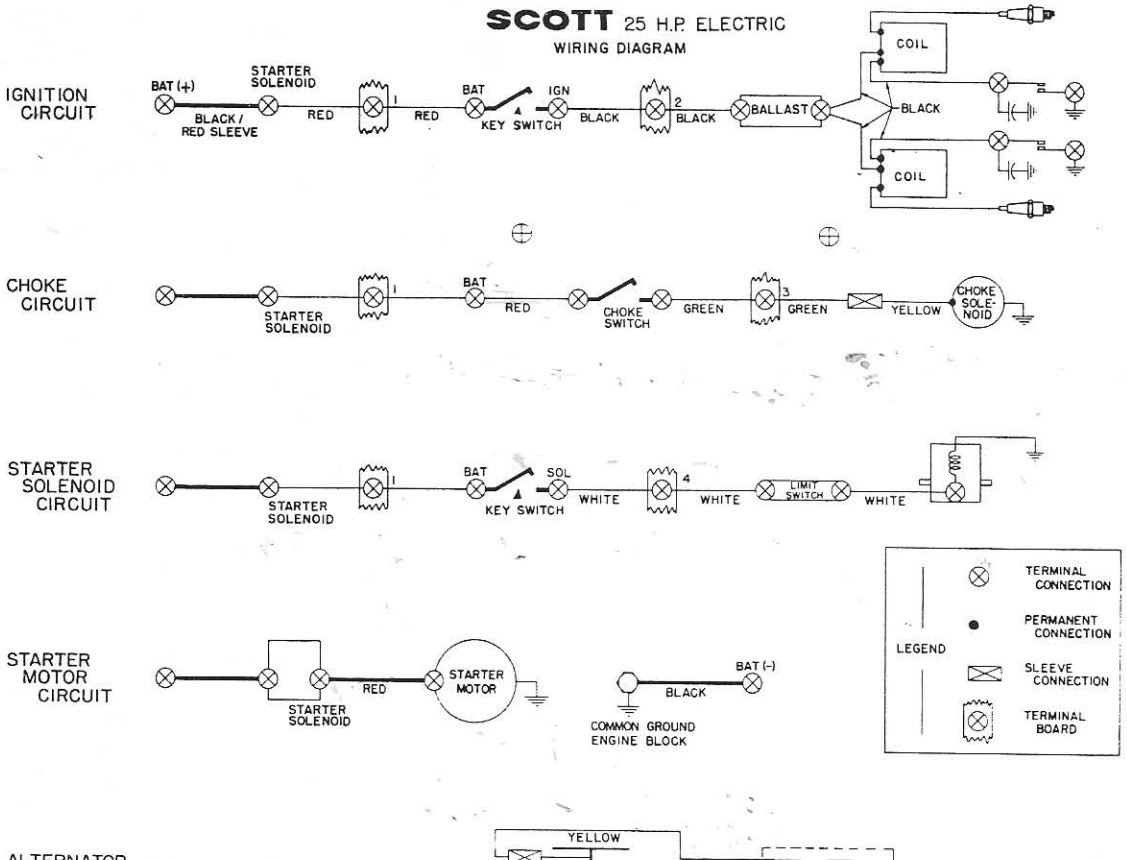
1. Loose connections.
2. Faulty ignition switch, ballast, coils or condensers.
3. Dirty or improperly gapped breaker points (must be gapped at .020").
4. Wrong plug, fouled, or improperly gapped spark plugs. (Must be gapped at .035").
5. Improper synchronization.

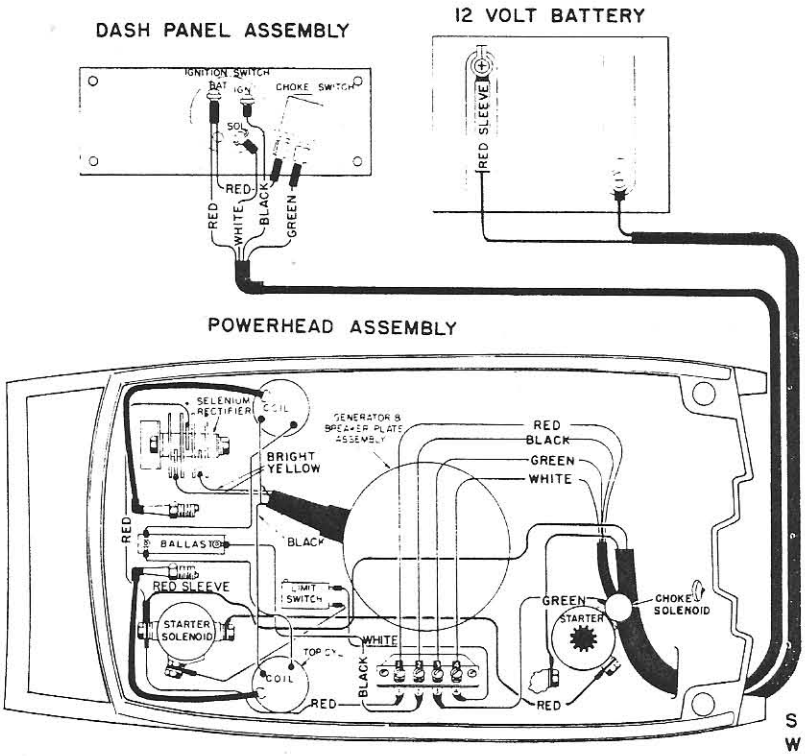
The amount of spark advance is pre-determined on the 25 H.P. engine and cannot, nor is not meant to be adjusted.

Ignition Switch

The ignition switch, mounted on the starter panel, activates the starter and ignition circuits. If the switch is determined to be faulty, it must be replaced.

SCOTT 25 H.P. ELECTRIC
WIRING DIAGRAM





SCOTT 25 H.P.
WIRING DIAGRAM

Disassembly and Assembly

1. Remove the trim nuts and mounting nuts.
2. Disconnect the leads from the switch terminals.
3. Replace the switch with a new one and reverse steps 1 and 2. Connect the wires to the switch terminals according to the wiring diagram on page 71.

Ballast

The ballast is mounted on the exhaust cover plate. To test the ballast, refer to the instructions on page 139.

Ignition Coils

The two ignition coils are mounted on the cylinder head. The starboard coil serves the top cylinder and the port coil serves the bottom cylinder. If a coil is found to be faulty, it must be replaced as an assembly.

To replace a coil, disconnect all leads to the coil and remove the entire coil from the cylinder head.

Breaker Points and Condensers

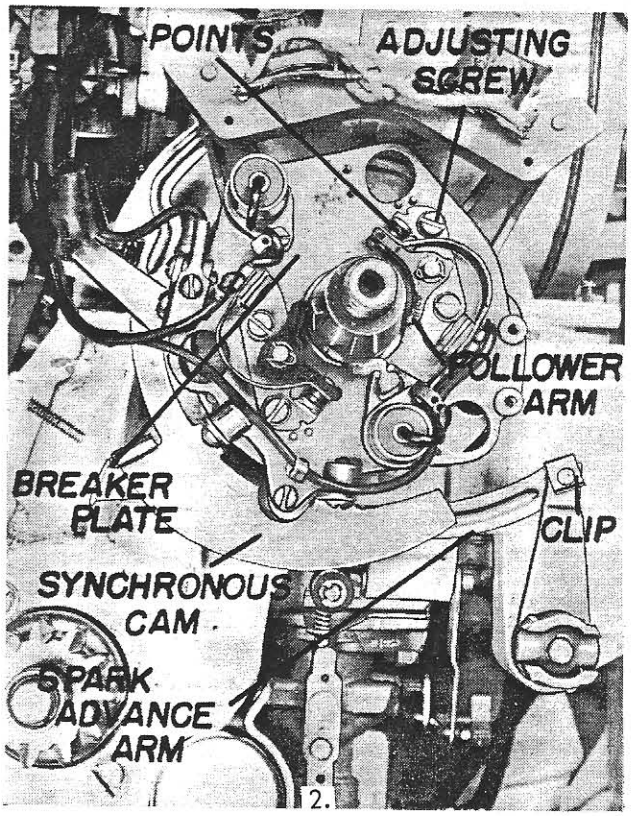
The breaker points and condensers are mounted on the breaker plate directly beneath the flywheel. If a check of the external electrical components does not correct an ignition problem, the flywheel must be removed to inspect and test the points and condensers.

Flywheel Removal

1. Remove the flywheel guard.
2. Attach a flywheel puller and snug the puller down by tightening the center bolt, then rap the bolt sharply with a mallet. Repeat this procedure until the flywheel breaks loose from the crankshaft.
3. Remove the flywheel and key.
4. To install the flywheel, insert the key in the slot in the crankshaft, slide the flywheel in place on the crankshaft, and torque the flywheel nut to 975 inch pounds.

First, check the points for the correct air gap. They should be set at exactly .020'' when the point cam follower arm is riding on the high point of the cam ground into the crankshaft. If they are not set at .020'', use the following procedure to adjust the air gap.

1. Rotate the crankshaft until the point cam follower arm is riding on the high point of the cam on the crankshaft. See fig. 2.
2. Loosen the adjusting screw, fig. 2, and, using the correct feeler gauge, set the points at .020'' and tighten the adjusting screw. Repeat this procedure on the other set of points.



The breaker points may be cleaned by drawing a piece of paper between the points. If they are burned or pitted the entire point assembly must be replaced. Do not clean points with a file or sand paper. Also replace the condenser, as burned or pitted points can usually be traced to a faulty condenser. The condenser can be tested as explained on page 136.

STARTER COMPONENTS AND CIRCUIT

The starter circuit consists of the following components:

1. Starter solenoid.
2. Ignition switch.
3. Starter limit switch.
4. Starter motor.

Consult the Operating Principles section for an explanation of the starter circuit and disassembly and assembly instructions of the starter motor.

Carefully check the following points as possible causes of starter difficulty:

1. Loose connections.
2. Faulty ignition switch.
3. Inoperative starter solenoid.
4. Starter limit switch not properly adjusted.

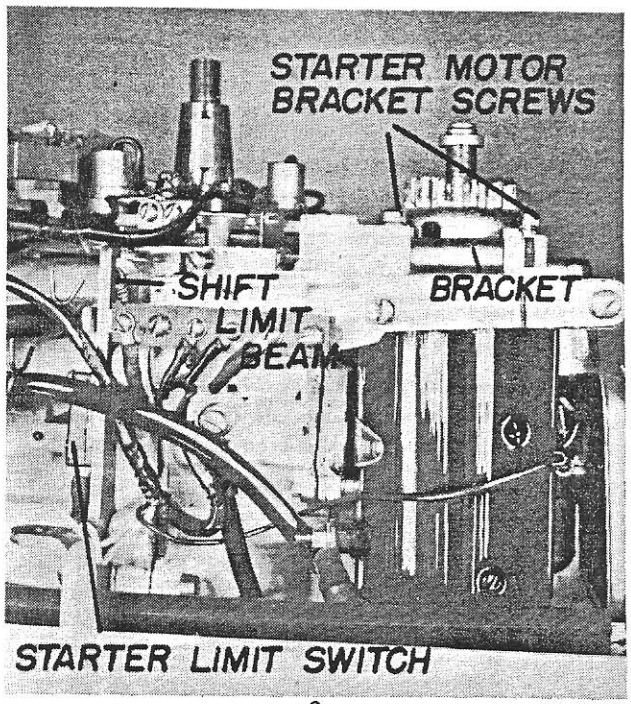
5. Inoperative starter motor.
6. Weak battery.

Starter Solenoid

The starter solenoid is a sealed unit and must be replaced, if it fails. If the starter circuit does not function, inspect this solenoid circuit beginning at the ignition switch. If the solenoid requires replacement, disconnect all leads and remove the solenoid from the engine. Consult the wiring diagram on page 71 to properly connect wires to the new solenoid.

Starter Limit Switch

The starter limit switch, fig. 3, prevents starting



3.

the engine in either forward or reverse gear. In neutral the white button in the limit switch should be depressed by the copper plate mounted behind the switch, thereby completing the circuit to the starter solenoid. In forward or reverse gear, the white button should not contact the copper plate. To adjust the limit switch, bend the copper plate in or out, depending what adjustment is required.

Starter Motor

An explanation of starter motor operation, repair, and complete disassembly is covered in the section on Operating Principles. To remove the starter motor, disconnect both leads and remove the bracket in fig. 3. Then remove the flywheel guard and the two screws securing the starter motor to the bracket which is part of the crankcase. See fig. 3. The starter motor can be pulled down and away from the motor.

CHOKE CIRCUIT

Consult the Operating Principles section for an explanation on how this component operates. The choke circuit consists of the choke switch on the dash panel and the choke solenoid mounted next to the starter motor. If testing for continuity reveals either component to be faulty, they must be replaced.

To replace the choke switch, remove the trim nut and mounting nut and disconnect the leads from the terminals on the switch. Replace with a new switch and connect the leads according to the wiring diagram on page 71. Disconnect the lead wire to the choke solenoid, loosen the mounting screws, and remove the solenoid.

When installing a new solenoid, place the solenoid in its bracket, attach the plunger wire to the choke butterfly arm, and position the solenoid so that the plunger wire is taut with the choke butterfly completely open. Then tighten the mounting screws, connect the solenoid lead wire and test the choke solenoid to see if the choke butterfly closes completely.

GENERATOR AND GENERATING CIRCUIT

Consult the Operating Principles section for an explanation on how this circuit operates. This is an alternator generator and consists of the flywheel with permanent magnets, two generating coils, and rectifier.

Generating Circuit

Information on how the generating circuit operates can be found in the Operating Principles section.

The generating circuit consists of the following components:

1. Coil and core assembly.
2. Selenium rectifier.

Coil and Core Assembly

The coil and core assembly are located beneath the flywheel. Instructions for testing this assembly can be found in section X. If the coils become inoperative, they must be replaced. A break in the wiring, at the coil terminals, can be repaired by soldering. Output of the generator is 4 to 6 amps.

Breaker Plate and Coil and Core Assembl Electric Models

Disassembly

1. Remove the flywheel as previously described.

2. Disconnect the breaker plate primary leads at the knife disconnects near the coils. Also remove the breaker plate ground lead from the fuel pump and the two yellow leads at the rectifier.

Remove the synchronous cam and spark advance arm. See fig. 2.

4. Press down and rotate the breaker plate in the clockwise direction simultaneously until the breaker plate springs free, then lift it up and off the crankshaft being careful not to damage the breaker point cam follower arms.

5. Remove the 3 alternator hold down screws.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Apply Loctite or a similar locking agent to the three alternator hold down screws. Be certain the spacer is placed under the core before replacing the screw securing the core to the powerhead.
2. Align the large wave washer, then the large flat washer on the crankshaft. Apply Lubriplate to the washer surfaces.
3. Place the breaker plate in position; press down on the breaker plate and turn counterclockwise simultaneously.

Adjust the point gap to .020".

5. Be certain the small bushing is inserted in the hole of the spark advance arm.
6. Torque the flywheel nut to 975 inch pounds.

IGNITION SYSTEM (Manual Starting Models)

The 25 H.P. manual starting model has a magneto ignition system. For information on how this system operates, consult the Operating Principles section.

The ignition system consists of the flywheel, stator plate (which contains the breaker points, condensers, and ignition coils), stop switch and spark plugs.

The most common causes of ignition difficulty are:

1. Dirty or improperly gapped breaker points.
2. Loose connections.
3. Faulty condensers or coil.
4. Wrong spark plugs or improperly gapped plugs.
5. Engine not synchronized.

Information on how each ignition component can be tested can be found in section X. To maintain the ignition system, periodically check all electrical connections for tightness. Clean the breaker points by drawing a piece of paper between the point contacts. Check the point air gap; it should be .020".

Point Adjustment

To adjust the points it is necessary to remove the manual starter and flywheel.

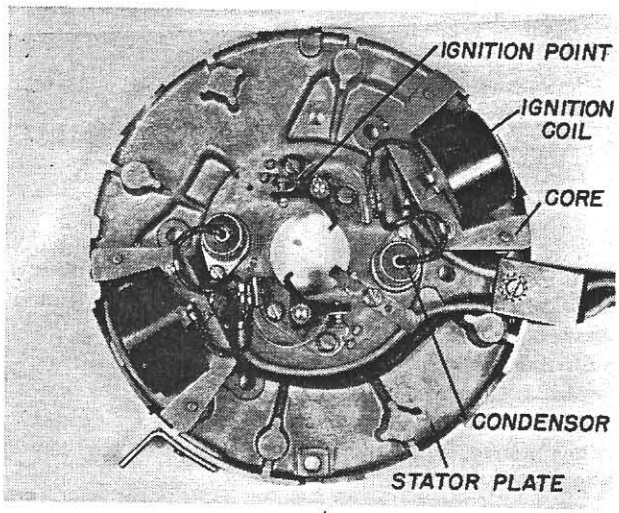
1. Remove the manual starter.
2. Repeat steps 2 and 3 under electric starting models.

With the flywheel removed, rotate the crankshaft until a breaker arm rests on the high point of the cam on the crankshaft. Loosen the point mounting screws and insert a .020" feeler gauge between the point contacts. Pivot the point assembly so that the breaker arm rests against the cam, then tighten the mounting screws. The points should be adjusted to .020". When replacing the flywheel, be certain to torque the flywheel nut to 975 inch pounds.

Magneto

Disassembly

1. Remove the starter housing and the flywheel, as explained previously in this section.
2. Remove the clip from the end of the spark advance arm. See fig. 2 .
3. Disconnect the spark plug leads and the leads at the stop switch.
4. Remove the 4 stator plate hold down screws and lift the stator plate off the engine, being careful not to damage the breaker point arms.
5. Remove the stator hold down plate and the synchronous cam.



4.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Apply a small amount of Lubriplate to the synchronous cam and retaining ring mating sur-

faces and to the flat and wave washers.

2. Use Loctite, or a similar locking agent, on the synchronous retainer hold down screws.

3. Align the large wave washer, then the large flat washer on the crankshaft, then install the breaker plate.

4. Be careful not to damage the breaker point arms as you slide the breaker plate into position.

5. Align the threaded steel inserts in the synchronous cam with the corresponding holes in the breaker plate. Apply Loctite, or a similar locking agent, to the four breaker plate hold down screws and secure the breaker plate. Check the point adjustment.

6. Torque the flywheel nut at 975 inch pounds.

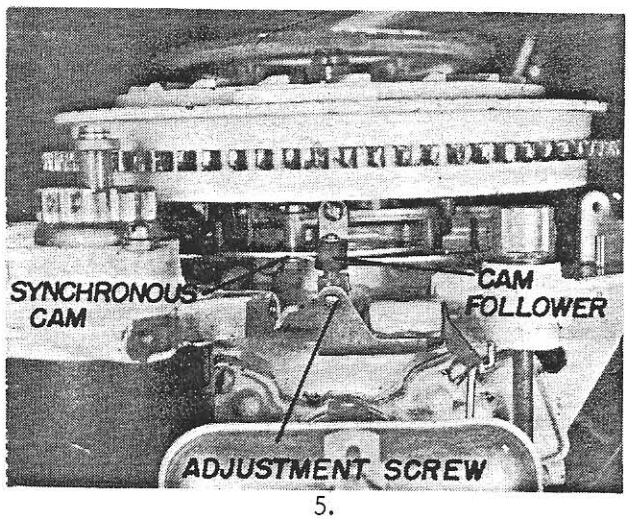
SYNCHRONIZATION – (Manual and Electric Models)

This adjustment must be performed using the following procedure.

1. Place the shift in neutral position.

2. Advance the throttle until the magneto (manual models) or breaker plate (electric models) hits the neutral stop.

3. The roller on the cam follower should just touch the synchronous cam and begin to open the throttle at this point. Thread the adjusting screw in in or out to adjust properly. See fig. 5.



5.

FUEL SYSTEM

The 25 H.P. fuel system consists of a remote non-pressurized fuel tank, single stage fuel pump, carburetor, intake manifold, and reed valves.

Fuel Tank

Specific information on cleaning and repairing the fuel tank can be found in the Operating Principles section.

Fuel Pump

The operation of the fuel pump is explained in the Operating Principles section. Periodic cleaning of the sediment bowl and screen as well as inspection of the diaphragm and check valves is all the maintenance required for this pump. Also examine the fuel and pressure lines for breaks or signs of deterioration.

Disassembly

1. Disconnect all fuel and pressure lines and remove the fuel pump from the engine. See fig. 1.
2. Remove the sediment bowl clamp assembly and the sediment bowl, washer, and screen.
3. Remove the screws holding the two halves of the pump together; separate the halves and remove the diaphragm.
4. If it is necessary to remove either of the check valves, use a small punch and tap them out from the disc side of the valve. New check valves must be used as replacements.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Thoroughly clean the pump and sediment screen in a solvent.
2. Replace the diaphragm or sediment bowl gasket if they show signs of deterioration.
3. Examine all fuel lines and replace if necessary.
4. Be certain to attach the breaker plate ground lead when installing the pump assembly.

CARBURETOR

The operation of the carburetor is explained in the Operating Principles section. Possible causes of carburetor difficulty are:

1. Improper float adjustment.
2. Worn inlet needle and seat.
3. Dirty or obstructed carburetor passages.
4. Improper carburetor adjustments.
5. Worn gaskets.
6. Worn high-speed needle gaskets or packing.

To properly maintain the carburetor, periodically check adjustments. Occasionally the carburetor should be disassembled and cleaned in a solvent and the float level checked. The carburetor can be cleaned with compressed air, but ONLY if the float and inlet needle and seat have been removed.

Disassembly

1. Electric models.
   A. Remove the electric starter.

B. Disconnect the choke solenoid and the manual choke linkage.

2. Manual Models.

A. Disconnect the choke actuating arm from the carburetor.

3. Both Manual and Electric Models.

A. Remove the two stud nuts securing the carburetor to the intake manifold.

B. Remove the carburetor and at the same time slip it loose from the link rod to the synchronous control.

C. Remove the intake baffle plate.

D. Back the high-speed needle out, then remove the packing nut and the high-speed needle together.

E. Remove the carburetor bowl nut and bowl.

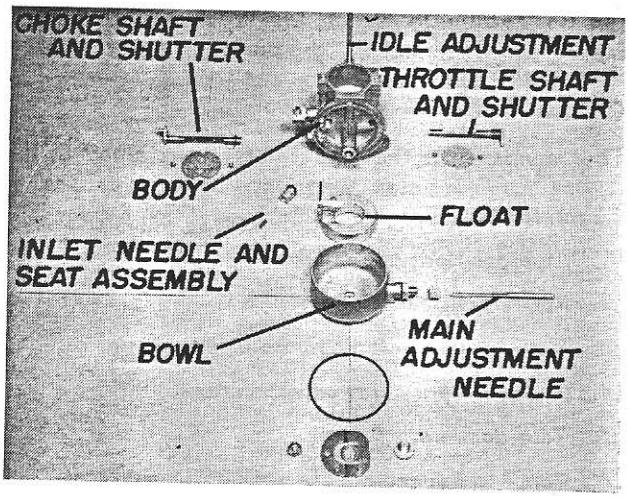
F. To remove the float, slide out the hinge pin, being careful not to drop the float or the inlet needle.

G. The inlet seat can also be removed at this time and the high-speed jet.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Set the float at 11/64" by bending the tab which regulates the travel of the inlet needle.



6.

2. Be certain the bowl gasket is in position and carburetor to manifold gasket.

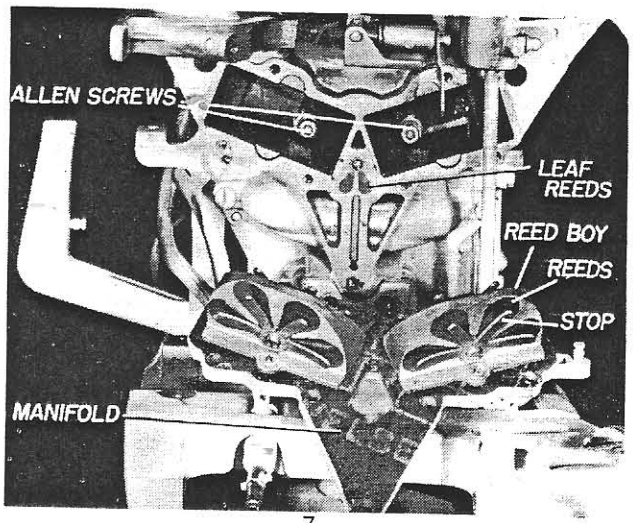
3. Install the link rod to the synchronous control as you install the carburetor to the intake manifold.

4. Adjust synchronization as explained in the ignition section.

MANIFOLD AND REED VALVES

The operation of the manifold and reed valves is explained in the Operating Principles section.

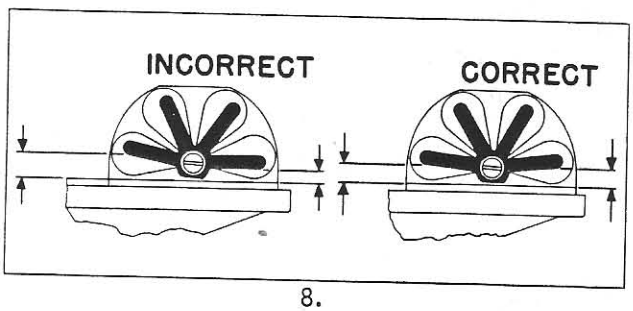
The manifold is designed in a "V" shape to form the scavenging system in the 25 H.P. engine. When removing the manifold and reed valves, always inspect the leaf reeds and the drain holes behind the leaf reeds shown in fig. 7 .



7.

These two components require visual inspection of the machined surfaces as well as the condition of of the reeds, stops and boxes. If the reeds or the stops are distorted, always replace with new parts; do not attempt to straighten them. The reeds may stand open .010 of an inch from the face of the reed box but no more.

When installing reeds and stops, be certain they are centered. See fig. 8 .



8.

Disassembly

1. Electric Models.

A. Remove the electric starter and choke solenoid.

2. Both Manual and Electric Models

A. Remove the carburetor.

B. Remove the screws securing the manifold to the powerhead.

C. The reed boxes and reeds can now be removed.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Be certain the reeds and stops are correctly centered as previously explained and illustrated.
2. Always use new gaskets when assembling the manifold and reed boxes.

POWERHEAD

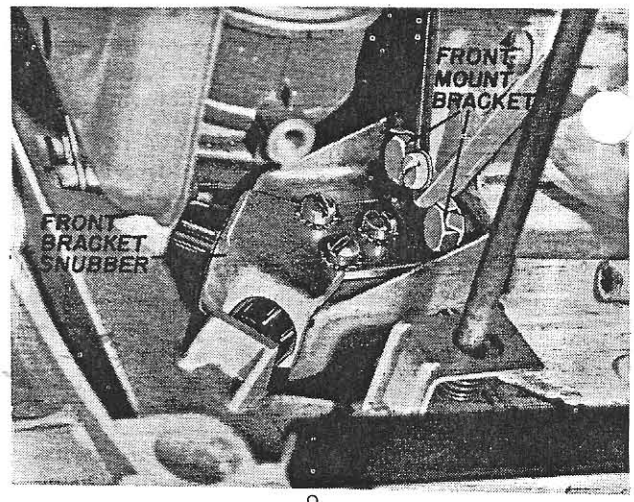
The 25 H.P. powerhead consists of the cylinder head, block and crankcase, pistons, rings, connecting rods, crankshaft, and necessary bearings and seals.

There is relatively little that can go wrong with the powerhead. In most cases, faulty engine performance can be attributed to malfunction of the fuel or electrical systems. In cases where engines perform poorly, consult the trouble shooting chart on page 128 of this manual. Then thoroughly check the fuel and electrical systems before initiating repairs on the powerhead.

Before attempting any repairs on the powerhead, carefully read the Powerhead Repair section in this manual.

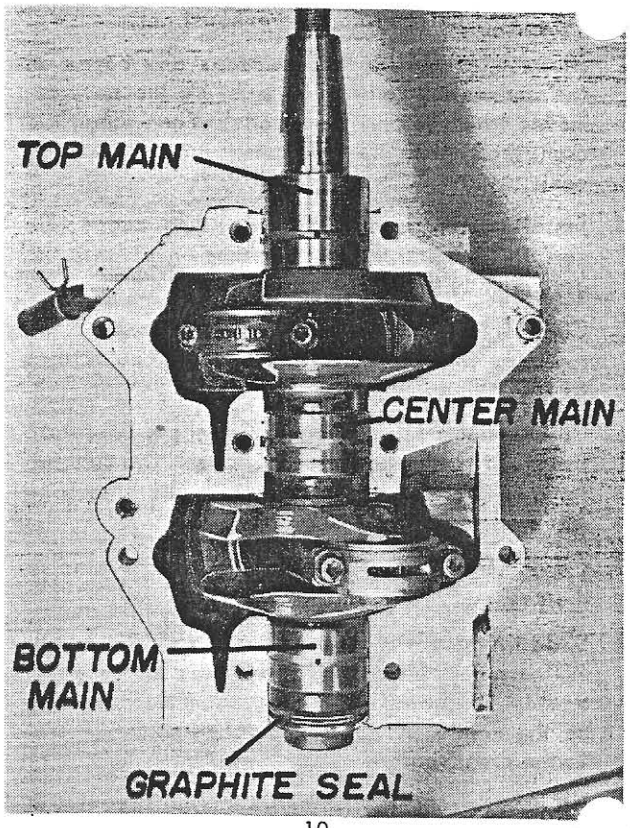
Disassembly

1. Electric Starting Models
   - A. Remove the flywheel and electric starter.
   - B. Remove the breaker plate and the stator plate.
   - C. Disconnect the two white leads from the starter limit switch on the shift limit beam.
2. Manual Starting Models
   - A. Remove the manual starter.
   - B. Remove the flywheel, breaker plate, synchronous cam retaining ring, and the synchronous cam.
3. Both Manual and Electric Models
   - A. Remove the carburetor. Disconnect the throttle tower shaft by removing the clamp screw shown in fig. 15 .
   - B. Disconnect the intake fuel line from the fuel pump.
   - C. Remove the shift limit beam. See fig. 3.
   - D. Remove the front mount bracket snubber and the two bolts securing the front mount bracket to the powerhead. See fig. 9 .
   - E. Remove the 12 screws securing the powerhead to the lower motor casing.
   - F. Lift the powerhead up and off the engine.
   - G. Remove the fuel pump (electric models - remove the coils, ballast, starter solenoid, rectifier, all wiring, and the tip up handle bracket).



9.

   - H. Remove the intake manifold and cylinder head.
   - I. Remove the ten screws securing the crankcase to the block. Be sure to remove the two Allen screws which are exposed when the intake manifold and gaskets are removed. See fig. 7 .
   - J. Pry the block and crankcase apart utilizing the slot on the lower port side of the block and crankcase. Do not pry at any other point.



10.

   - K. Remove the rod caps, bearings and cages, *Keeping Them In Separate Containers* marked *TOP* and *BOTTOM* cylinder.

Remove the crankshaft and the rest of the rod bearings, placing the bearing in the appropriate container. The rods and caps cannot be interchanged nor can the bearings and cages.

L. With the cylinder head removed, slide the pistons out of the cylinder. Mark the pistons and place them in the same container as their matching cap, etc.

M. The center main bearing can be removed by removing the wire retainer. The bottom main bearing can be removed by first removing the "E" ring retaining the graphite seal.

N. The intake and exhaust ports can be exposed by removing their respective cover plates.

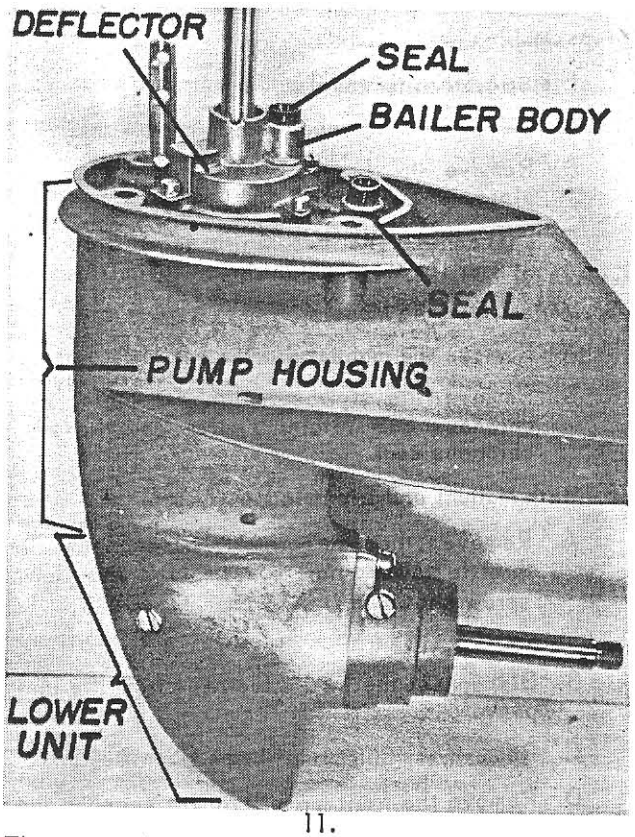
Assembly

Reverse the order of disassembly and follow these special instructions:

1. Assemble the center main bearing on the crankshaft using the same race, bearing cage, and bearings. Use grease to hold the bearings in place while assembling. Match the fractured halves of the bearing race and carefully replace the wire retainer.
2. Slide the piston and connecting rods into the appropriate cylinder with the sloping side of the piston dome facing the exhaust ports.
3. Place one half the rod bearings and cages on the connecting rods (they must be the ones removed from the particular rods). Then place the crankshaft, with its center bearing in place, in position.
4. Install the remaining bearings and cages. Be certain to match the cage halves by placing the ground ends together.
5. Carefully match the fractured surfaces of the rod caps to the rods and torque the cap screws to 180 inch pounds.
6. Rotate the bearing cages; they should rotate freely. If they catch or bind, check the rod cap for a mismatch with the rod or the bearing cage not mating correctly.
7. Locate the crankshaft bearings on the pins in their respective journals.
8. Slide the graphite seal in place, then the rubber "O" ring seal, washer, and spring lock the assembly in place by sliding the retaining ring on the crankshaft until it catches in the groove in the crankshaft.
9. Place the long rubber seals in the grooves in the crankcase and apply a thin coating of EC847 along the edge of the seal. ***Caution:*** Do not apply in quantities which will allow the sealant to seep into the bearings when the crankcase is compressed.
10. Torque the crankcase to block screws to 150 inch pounds. Torque the head bolt screws to 150 inch pounds.
11. Do not re-use old gaskets when assembling the cylinder head, intake or exhaust covers, manifold, carburetor, etc. Always replace with new gaskets.
12. Use a new lower motor casing to powerhead gasket and apply EC847, or a similar sealing agent, between the lower motor casing and the gasket.
13. Apply grease to the driveshaft splines and fasten the powerhead to the lower motor casing and to the front mounting bracket. The front snubbers, fig. 9, should be snug against the handle mount. Adjust the snubber bracket accordingly.
14. Install the remaining assemblies as explained in their particular section.

Pump Housing and Lower Unit

The pump housing serves as a support between the lower motor casing and the lower unit. It contains the water and bailer pump assemblies, driveshaft, and a driveshaft bearing and seal. See fig. 11.



11.

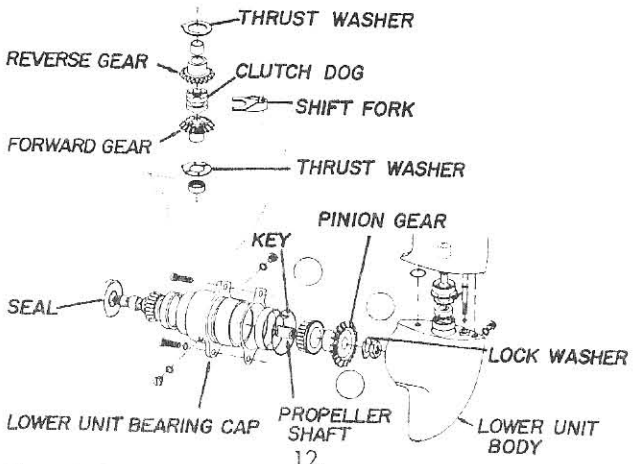
The pump housing itself requires only visual inspection of its machined surfaces and the driveshaft seal and bearing. Water in the lower unit or lubricant leaking from any of the drain holes in the lower unit can be an indication that the driveshaft seal is leaking. However, if replacing the pump housing driveshaft seal does not remedy the problem, check

the lower shift rod seal and the seals in the lower unit.

The water and bailer pumps are made of a silicon bronze alloy and have a stainless steel cup pressed into each pump cavity to assure long life under the most adverse conditions. You will note that each water pump mounting boss and a small adjacent area of the pump is covered with vinyl tape. This vinyl tape acts as a shield between the aluminum pump housing and the silicon bronze pump and prevents electrolysis. When assembling this water pump, be certain this tape is in place and in good condition.

Always closely examine all water line seals and "O" ring seals in the pump assembly. Replace any seals that appear to be slightly damaged or show signs of deterioration.

The lower unit on this model engine utilizes a vertical shift operation. A fork attached to the lower shift rod determines the position of the clutch dog on the splined lower part of the driveshaft. The clutch dog is moved down and engages the lower, or forward gear, when the shift lever is moved to the forward position. When the shift lever is moved to reverse, the clutch dog is moved upward and engages the upper or reverse gear. See fig. 12.

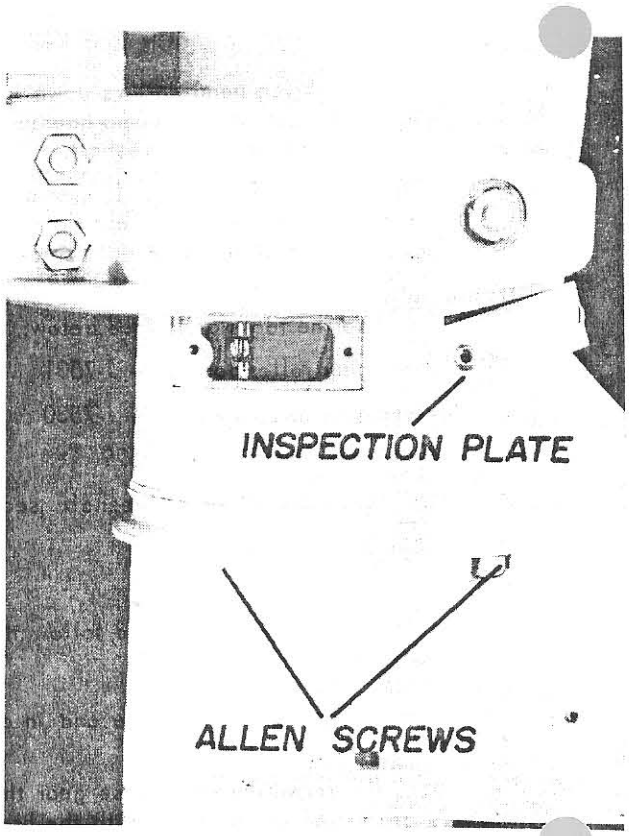


12.

The shift mechanism can be adjusted by removing the bearing cap and observing the position of the clutch dog in relation to the forward and reverse gears. If correctly positioned, the clutch dog should be midway between the two gears with the shift lever in neutral position. Should adjustment be required, remove the inspection plate from the lower port side of the motor casing. Remove the two screws connecting the upper and lower shift rods. Turn the lower shift rod in the appropriate direction which will move the shift fork either up or down and thereby adjust the position of the clutch dog.

Disassembly

1. Remove the inspection plate from the lower port side of the lower motor casing and remove the two screws fastening the upper and lower shift rods. See fig. 13. (Early models remove one screw.)
2. Remove the four Allen head screws securing the pump housing to the lower motor casing. See fig. 13.



13.

3. Pull the pump housing and lower unit down and out of the lower motor casing. Drain the lower unit.
4. Remove the two screws securing the lower unit bearing cap. The bearing cap assembly can be pulled out of the lower unit.
   A. The prop shaft along with the pinion gear and two thrust bearings can be removed from the bearing cap in the following manner:
      1. Bend the washer, under the pinion nut, flat and remove the pinion nut, gear, and key.
      2. Press the prop shaft, seal, and reverse thrust bearing out of the bearing cap. Press the prop shaft from the pinion gear end.
      3. The front and rear bearing cups can be removed and installed using tools No. J-7533-1 and No. J-7533-2. Replace bearings and cups in SETS only.
      4. When assembling the bearing cap pinion gear, tighten the pinion gear nut until there is a slight drag when the prop shaft is turned. Do not allow end play or excessive pre-load on the bearings. Bend the washer up around the pinion gear nut.

5. Remove the pump assembly mounting screws and slide each pump off separately, taking care not to damage the seals in the driveshaft holes of the pumps as they pass over the splines of the driveshaft. Be certain to remove the impeller drive pins from the slots in the driveshaft.
6. Remove the two Allen head screws down in the pump housing to separate the pump housing and lower unit or to remove the driveshaft.
7. At this point, the reverse gear (upper gear in the lower unit) and the forward gear (lower gear in the lower unit) can be lifted out of position.
8. If the following bearings or seals require replacement, use the tools described below:
   A. Forward gear roller bearing – J-7531
   B. Reverse gear roller bearing – J-7530
   C. Pump housing bushing – J-7529
   D. Pump housing, upper driveshaft seal – J-7552

Assembly

Reverse the order of disassembly and follow these special instructions:

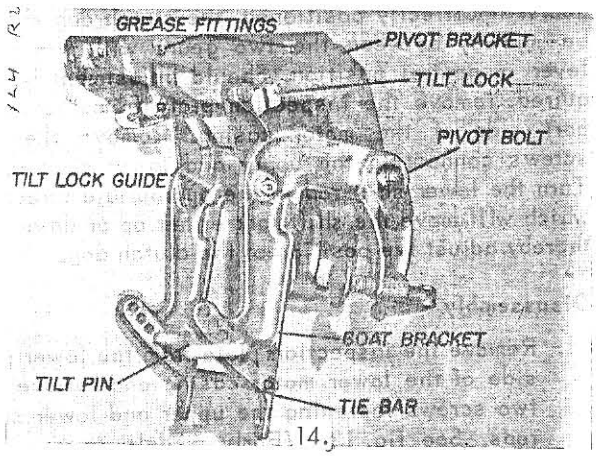
1. Be certain all seals are in place and in good condition.
2. Be certain the forward and reverse gear thrust washers are keyed in position, with the bronze surface facing out.
3. Install the shift rod, shift fork, and gears, then align the clutch dog in the unit and insert the driveshaft.
4. When assembling the lower unit and pump housing, be certain the thrust washer, driveshaft retainer ring, and all seals are in place. See fig. 12.
5. Use Glyptol, or a similar locking agent, on the pump housing to lower unit Allen head screws and torque the screws to 200 inch pounds.
6. Guide the water pump into position and install the impeller with the word "Top" visible. The word "Top" should be toward the open end of the water pump. Be certain that the vinyl tape is fastened to the water pump mounting bosses.
7. Position the round separator plate and large "O" ring seal in the water pump body, then slide the remaining separator plate into position.
8. Install the bailer impeller with the word "Top" toward the pump cavity. The word "Top", on the impeller blades, should not be visible. Fit the small "O" ring seal in the groove around the bailer pump cavity.
9. Guide the bailer assembly in place. Be certain the impeller drive pin is in place.
10. Secure the assembly to the pump housing.
11. On early models, be certain the deflector, covering the bailer outlet hole, is in place. See fig. 11.
12. Guide the entire assembly into the lower motor casing. Be certain the water and bailer lines mate correctly with the seals in the water and bailer pump. Torque the pump housing to lower unit screws to 200 inch pounds.
13. After securing the pump housing to the lower motor casing, and connecting the upper and lower shift rods, test for full clutch dog engagement by placing the shift in full forward and full reverse. If the clutch dog does not fully engage one or the other gear, remove the two shift rod coupling screws and turn the lower shift rod in the appropriate direction to adjust. In neutral position the clutch dog should be centered and not touch either gear.
14. With the engine in an upright position, fill the lower unit with EP No. 90 outboard gear lubricant. Fill through the "Fill" plug until lubricant reaches the level of the "Fill" plug hole. The capacity is 7 ounces.

MOTOR SUSPENSION SYSTEM

The motor suspension system consists of the handle mount and pivot tube, pivot bracket, boat brackets, right and left yokes (lower mount brackets), tilt and reverse lock mechanisms, tilt lock, and rubber suspension mounts.

The suspension system supports the powerhead and lower motor assembly and secures the motor to the boat. The rubber cushion mounts isolate motor vibrations from the transom of the boat and provide quieter motor operation.

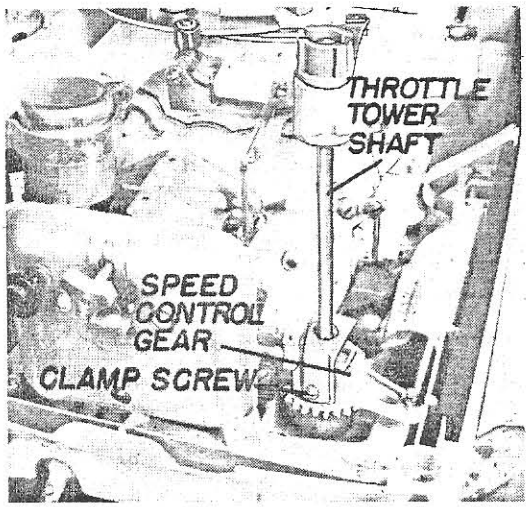
The pivot bracket contains the reverse lock mechanism which prevents the motor from raising out of the water when operating the motor in reverse or decelerating rapidly. This is a spring loaded reverse lock which will release automatically when 150 inch pounds of force are applied to the lower unit, thus protecting the engine from damage when an underwater object is struck.



14.

To tilt the motor, depress the reverse lock release lever, and raise the motor up until the tilt lock, fig. 14 , engages. To return the motor to the vertical position, pull forward on the tilt lock and slowly lower the motor to the vertical position. The reverse lock will engage automatically.

The suspension system requires periodic checks of the fasteners for tightness and the condition of the rubber cushion mounts. Lubricate the pivot tube and bracket every 30 to 60 days by applying Lubriplate, or a similar lubricant, at the grease fittings located on the starboard side of the pivot bracket. See fig. 10.



15.

Disassembly

1. Disconnect the tower throttle shaft from the speed control gear. See fig. 15.
2. Remove the carburetor, as explained in the powerhead section.
3. Disconnect the fuel line from the coupling on handle mount.
4. Remove the front bracket snubber and the two bolts securing the front bracket to the powerhead. See fig. 9.
5. Remove the nuts from the side rubber mounts of the handle mount and remove the lower yokes and the nut securing the lower thrust mount to the pivot tube.
6. The entire assembly can now be pulled down and away from the rest of the engine.
7. Remove the tilt lock and the tilt guide. See fig. 14.
8. Remove the pivot bolt. See fig. 14.
9. If the reverse lock mechanism requires repair, remove the upper and lower grease fittings and the fiber bushing.
10. Drive the two anchor pins out and the reverse lock mechanism can now be removed.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. If the reverse lock mechanism has been completely disassembled, thread the spring tension nuts on the hooks until thirteen (13) threads only are visible. This will establish the correct amount of tension on the reverse lock.
2. Be certain the spring on the tilt lock spring locks the tilt lock into the locked position when the pivot bracket is tilted up.
3. Refer to the torque chart on page 143 when securing all of the suspension components.

LOWER HOUSING

In the event it becomes necessary to remove the lower housing, the powerhead must be removed as previously described. Then remove the housing to lower motor casing mounting screws and slide the housing back and off the lower motor casing. Assemble in the reverse order of disassembly.

LOWER MOTOR CASING

The lower motor casing contains the bailer and coolant water lines, the upper shifting mechanism, and the idle relief chamber. It will ordinarily need to be removed only for replacement if it becomes damaged.

Disassembly

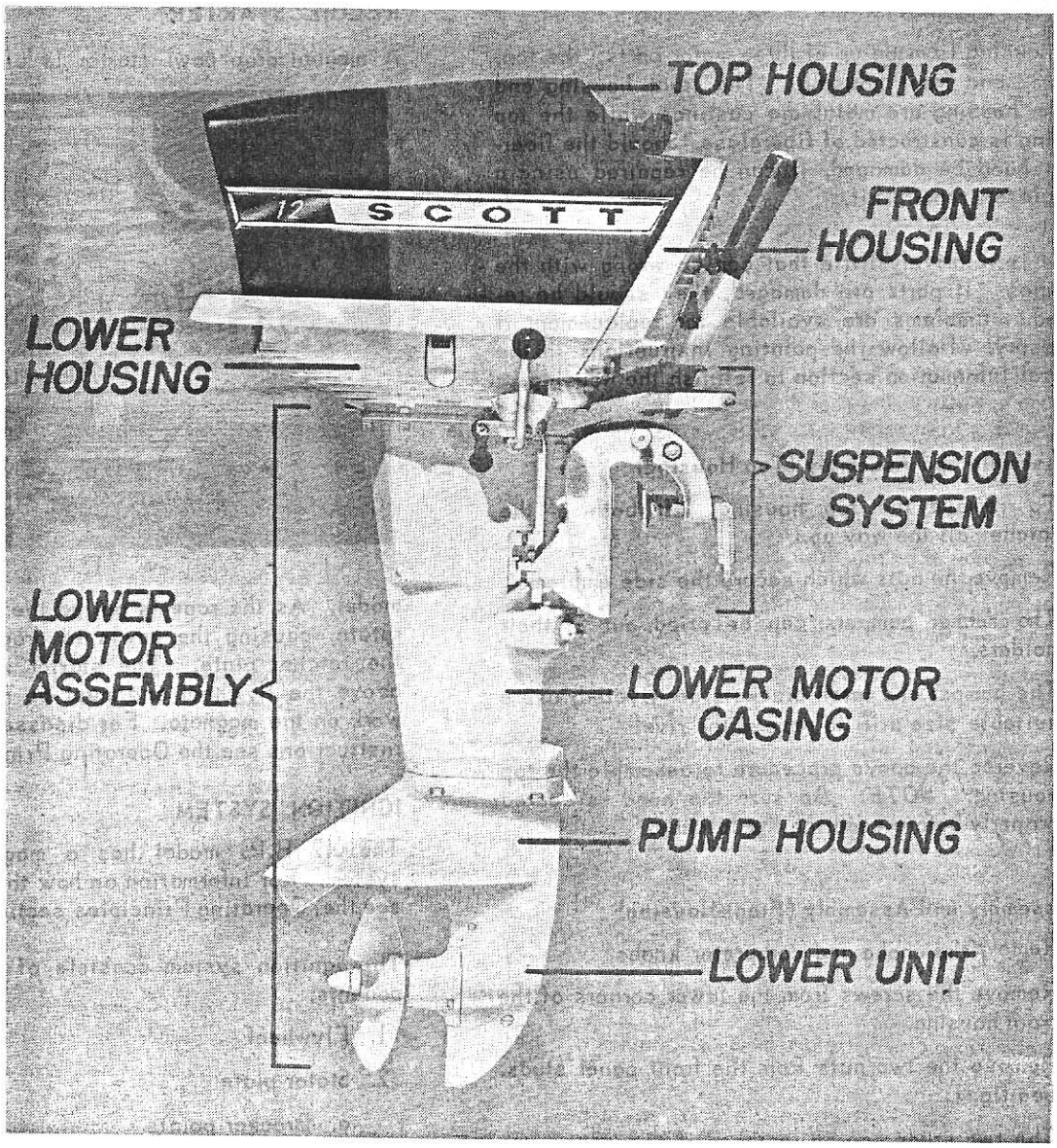
1. Remove the inspection plate on the lower side of the lower motor casing and disconnect the upper and lower shift rod. See fig. 13.
2. Remove the four Allen head screws securing the pump housing to the lower motor casing and pull this assembly down and out of the lower motor casing. See fig. 13.
3. Remove the powerhead and lower housing as previously described.
4. Disconnect the lower motor casing from the upper and lower rubber mounts.
5. Remove the shift mechanism, water lines, and rubber mounts.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Be sure to install the water line securely in the recessed slot in the upper motor casing.
2. Use a new lower motor casing to powerhead gasket.
3. Lubricate the seals in the water and bailer pumps. Guide the lower unit and pump housing into the lower motor casing, being certain the water and bailer lines fit snugly into the rubber seals in the two pumps.
4. Torque all rubber mount fasteners as specified in the torque chart on page 143.

SECTION VII
12 H.P. MODEL



Horsepower O.B.C. Certified	12 H.P. @4800 RPM
Normal Full Throttle Range	4400 to 5200 RPM
Number of Cylinders	2
Bore and Stroke	2 1/4" X 2 1/16"
Piston Displacement	16.4 Cu. In.
Gear Ratio	13:21
Fuel Tank Capacity	6 gal.
Fuel Mixture	
Break-In	1/2 Pint oil to 1 gal. gas.
Normal Operation	3/8 Pint oil to 1 gal. gas.
Initial Carburetor Setting	
Main	3/4 Turn Open (counterclockwise) from fully closed position
Idle	1 Turn Open (counterclockwise) from fully closed position
Spark Plugs	Champion J6JM Gapped .035"
Recommended Breaker Point Setting	.020"
Lower Unit Lubrication	S.A.E. #90 E.P.
Propeller Diameter and Pitch	6 1/2 X 7 1/2" (3 blade)

HOUSINGS

The housing is made up of three major parts; the top, bottom, and front housing. The front housing and bottom housing are metal die castings while the top housing is constructed of fiberglass. Should the fiberglass hood be damaged, it can be repaired using a fiberglass repair kit.

There is relatively little that can go wrong with the housings. If parts are damaged, they should be replaced. Emblems are available for replacement if necessary. Follow the painting instructions in the General Information section to refinish the housings.

Disassembly and Assembly (Top Housing)

1. To remove the top housing, lift both of the latches all the way up.
2. Remove the nuts which secure the side emblems.
3. The rubber bumpers can be pried out of their holders.
4. The bumper and latch brackets are riveted; use a suitable size drill to remove the rivets.
5. Reverse the above procedure to assemble the top housing. ***NOTE:*** Be sure the hood is seated properly before securing the latches.

Disassembly and Assembly (Front Housing)

1. Remove the choke and carburetor knobs.
2. Remove the screws from the lower corners of the front housing.
3. Remove the two nuts from the front panel studs. See fig. 1.
4. The two studs can be replaced if necessary; use Loctite when assembling.
5. To assemble reverse the preceding steps. Use EC 847 to secure the rubber molding in place.

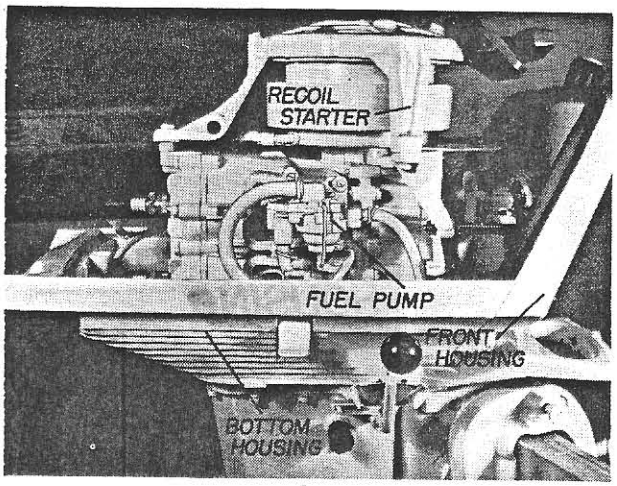
Disassembly and Assembly (Bottom Housing)

1. Remove the screws which secure the housing to the powerhead adapter plate.
2. Remove the two screws which secure the front housing to the bottom housing.
3. Remove the rubber bumpers.
4. To remove the latch assembly, remove the pin and spring from the latch. Remove the pin which secures the hook to the lower housing.
5. The rubber cushions are cemented in place with adhesive EC 847.

To assemble the bottom housing, reverse the preceding steps. Be sure the hook spring on the latch assembly applies tension so that the hook will contact the bracket on the top housing.

RECOIL STARTER

A manual drop pawl starter is used on the 12 H.P.



1.

model. As the rope is pulled the friction pulley will rotate, causing the pawls to drop down and engage the ratchet plate. The starter is mounted directly above the flywheel and must be removed in order to work on the magneto. For disassembly and assembly instructions see the Operating Principles section.

IGNITION SYSTEM

The 12 H.P. model has a magneto type ignition system. For information on how this system operates, see the Operating Principles section.

The ignition system consists of the following components:

1. Flywheel
2. Stator plate
   a. Breaker points
   b. Condensers
   c. Ignition coils
3. Spark plugs

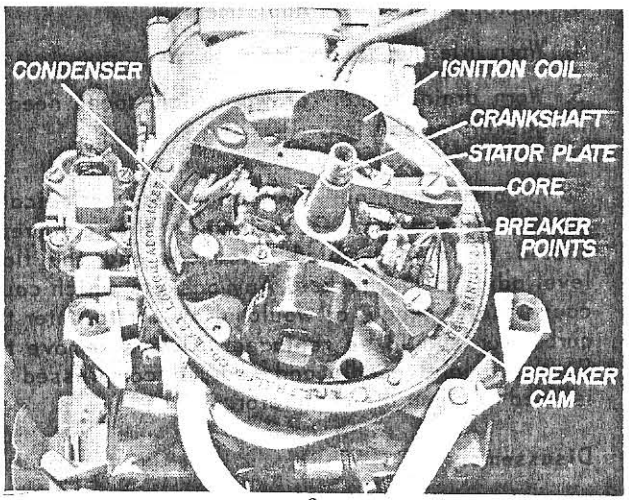
The most common causes of ignition difficulty are:

1. Dirty or improperly gapped breaker points or spark plugs.
2. Loose connections.
3. Damaged coil or condenser.
4. Wrong spark plugs.
5. Engine not synchronized.

Specific information on testing each component can be found in section X. Normal maintenance involves periodic cleaning and gapping of the plugs and breaker points. With the starter and flywheel removed rotate the crankshaft until the breaker arm rests on the high point of the breaker cam. Loosen the breaker point mounting screw and insert a .020" feeler gauge between the points, then tighten the

mounting screws. Recheck to see that the feeler gauge will slide snugly between the points. Repeat this procedure for the other set of points.

The recommended spark plugs for the 12 H.P. model are Champion J6JM plugs gapped at .035". Connections should be checked for tightness.



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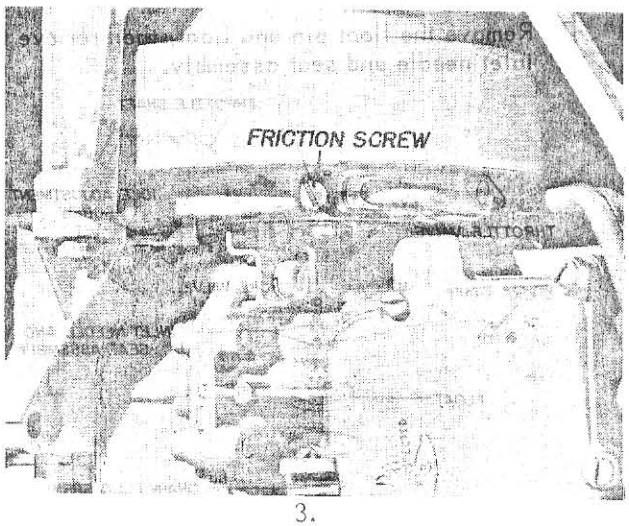
Disassembly

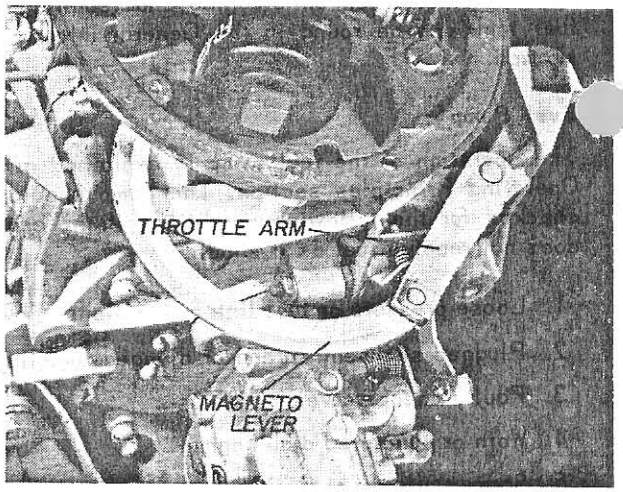
1. Remove the manual starter.
2. Use a flywheel puller to remove the flywheel. Attach the puller to the flywheel, then snug up on the center bolt, tap sharply with a mallet if necessary. Repeat this process until the flywheel comes loose.
3. Remove the breaker cam, then loosen the stator



3.

friction screw. See fig. 3. Disconnect the spark plug leads and magneto lever. See fig. 4. Lift the stator assembly off the engine.

4. The breaker points, coils, and condensers can be removed and replaced if necessary. Be sure to connect the lead wires exactly as they were before the stator plate was disassembled. If the coil cores need replacement, the stator plate must also be replaced.



4.

Assembly

1. Replace the breaker points, coils, and condensers and lead wires.
2. Place the stator plate on the engine and secure the tension screw. Place the breaker cam on the crankshaft so that the end of the cam with the arrow, is on top.
3. Gap the breaker points.
4. Connect the magneto lever to the throttle arm.
5. Place the flywheel key in the crankshaft slot, then replace the flywheel, washer, and nut. Be sure to torque the flywheel nut to 500 inch pounds.
6. Replace the ratchet plate and manual starter.

This completes the steps necessary to assemble the stator assembly. No other ignition adjustments are necessary. A stop attached to the powerhead limits the maximum spark advance. The hold down tension screw regulates the tension on the stator plate. This screw should be adjusted so that the throttle can be advanced smoothly and will not "creep" from vibration.

FUEL SYSTEM

The fuel system consists of the following components:

1. Tank.
2. Fuel pump.
3. Carburetor.
4. Manifold.
5. Reed valves.

Information on how these components function can be found in the Operating Principles section.

Maintaining the fuel system involves periodic cleaning, inspection, and readjustment of the various components.

Fuel Tank

Specific information on cleaning and repairing the fuel tank can be found in the General Information section.

Fuel Pump

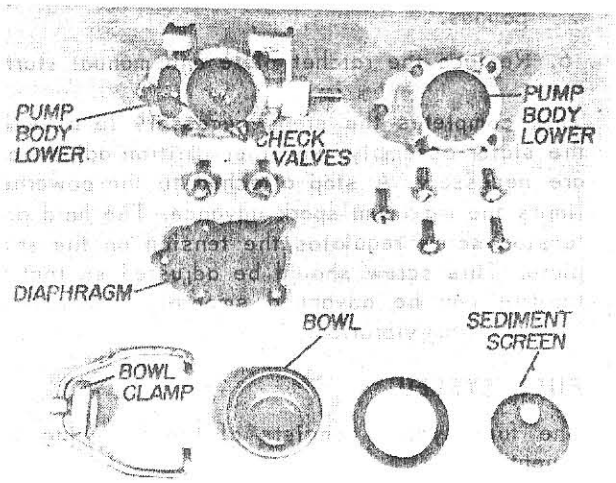
The operation of the fuel pump is explained in the Operating Principles section. The pump should be checked for the following conditions if the engine does not receive fuel as it should.

1. Loose pressure or fuel line connections.
2. Plugged sediment screen or plugged fuel lines.
3. Faulty check valves.
4. Worn or punctured diaphragm.
5. Screws which hold the pump halves together are loose.

To properly maintain the fuel pump, the sediment screen should be cleaned occasionally. All connections should be tightened, and the diaphragm inspected for wear. The pump body screws should be retightened if necessary.

Disassembly and Assembly

1. Disconnect the fuel and pressure lines.
2. Remove the mounting screws.
3. Remove the sediment bowl clamp, bowl, gasket, and sediment screen. See fig. 5.



5.

4. Separate the pump body halves, then remove the diaphragm.
5. The check valves can now be punched out and the hose fittings removed if necessary.
6. To reassemble the pump, reverse steps 1 – 5. Be sure that the check valves are replaced so that the fuel will flow toward the carburetor and the valves are seated properly in the pump body. Be sure all screws are tight and the diaphragm has no leaks.

Carburetor

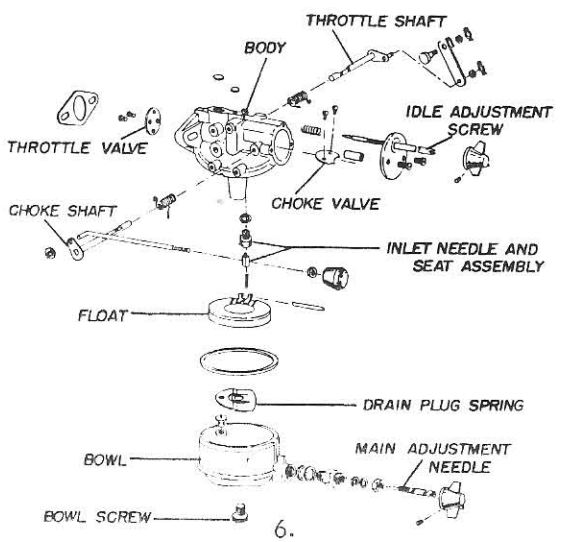
The operation of the carburetor is explained in the Operating Principles section. Possible causes of difficulty are:

1. Dirty or obstructed carburetor passages.
2. Improper carburetor adjustments.
3. Improper float level adjustment.
4. Worn inlet needle and seat.
5. Worn drain gasket, or worn high speed needle gaskets or packing.

To properly maintain the carburetor, periodically check adjustments. Occasionally the carburetor should be disassembled, cleaned, and the float level adjustment checked. Any gaskets which could cause fuel leakage, or would allow air to enter the carburetor should be replaced. Always remove the float and inlet needle and seat, if compressed air is used to clean the carburetor.

Disassembly

1. Remove the idle, high speed, and choke knobs.
2. Disconnect the fuel line and throttle linkage.
3. Remove the front housing.
4. Remove the nuts which secure the carburetor to the manifold.
5. Remove the baffle plate, idle, and main adjustment screws.
6. Remove the bowl screw, bowl, drain plug, and spring.
7. Remove the float pin and float, then remove the inlet needle and seat assembly.



6.

8. If it is necessary to remove the throttle or choke valves, be sure that both valves are replaced so that the stamping on the valves faces toward the manifold on the throttle valve, and toward the baffle plate on the choke valve.

Also, the notched portion of the choke valve should be on the *bottom* when the valve is closed and the holes in the throttle valve should also be on the *bottom* when it is in the closed position.

Once the valve screws have been removed they cannot be reused. Apply Loctite to the valve screws to prevent them from vibrating loose when they are replaced.

9. To reassemble the carburetor, reverse steps 1 – 8.

CARBURETOR ADJUSTMENTS

Idle Adjustment

The recommended factory idle setting is one turn open counterclockwise from the closed position. With the engine warmed up and the throttle at idle and the shift lever in forward, lean the engine until it coughs, then open the idle screw slightly until smooth idling is obtained.

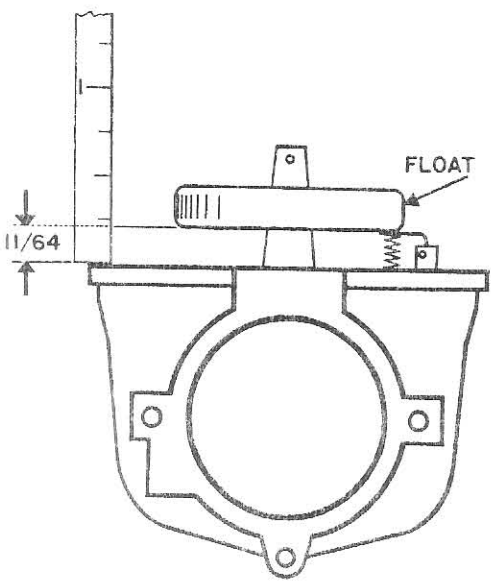
High Speed Adjustment

With the engine in forward and the throttle all the way open, adjust the high speed needle until smooth operation is obtained. The recommended high speed setting is 3/4 turn open, counterclockwise, from the fully closed position.

Float Adjustment

The carburetor must be removed from the engine. Then remove the high speed needle and the float bowl. Holding the carburetor in an upside position, carefully bend the tab on the float until a measurement of 11/64" is obtained between the lower edge of the float and the top edge of the carburetor body. See fig. 7.

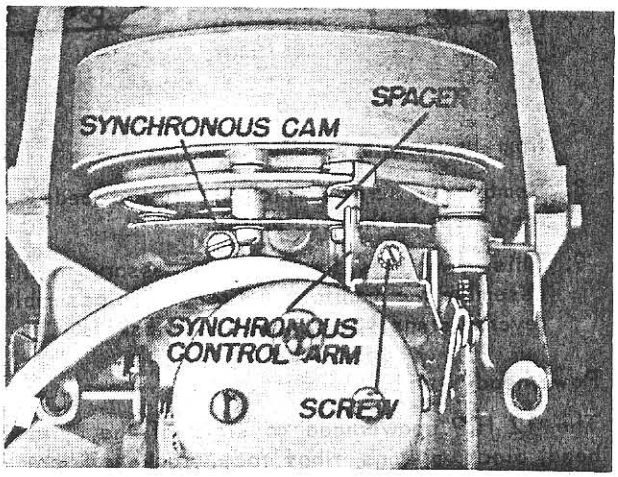
CARTER FLOAT ADJUSTMENT



7.

Synchronization

In order for the engine to operate properly, the opening of the throttle valve must be synchronized to the advance of the spark. In order to make adjustment, turn the twist grip until the synchronous control follower lines up in the center of the first spacer on the synchronous control cam. At this point the follower should just begin to touch the cam. Turn the adjusting screw until the follower just touches the cam at this point. See fig. 8.



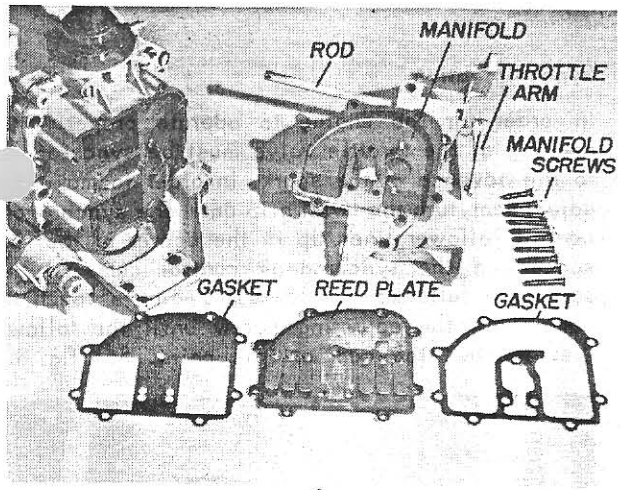
8.

Manifold and Reeds

The operation of the manifold and reeds is described in the Operating Principles section. There is relatively little that can go wrong with these components. In some cases a leaky manifold gasket can cause poor engine performance. The reeds are designed to lie flat against the reed plate. If they do not lie flat against the plate, they should be replaced. Do not attempt to straighten reeds by bending. The reed stops are designed with a uniform curvature which prevents the reeds from becoming "metal fatigued". The reed stops should be replaced if they are bent or distorted.

Disassembly and Assembly

1. Remove the carburetor knobs.
2. Remove the front housing, then disconnect the fuel line and throttle linkage.
3. Remove the carburetor.
4. Disconnect the magneto link from the throttle arm.
5. Remove the manifold screws, then separate the manifold, reed plate, and manifold gaskets. See fig. 9 .
6. To further disassemble the manifold, drive the pin out of the throttle arm, then remove the arm, bushing, spring, washers, E ring, and rod.
7. To remove the cam follower assembly, remove the nuts and screw which secure the follower to the manifold, then separate the follower arm



9.

from the throttle linkage.

8. Remove the screws which secure the reeds and reed stops to the reed plate.

9. This completes the steps necessary to disassemble the manifold and reeds. To assemble, reverse steps 1 – 8, using new gaskets.

Powerhead

The 12 H.P. powerhead consists of the cylinder head, block, pistons, rings, rods, crankshaft, crankcase, scavenging system, bearings, and seals.

Relatively little can go wrong with the powerhead. In most cases poor engine performance can be attributed to malfunction of either the electrical or fuel systems. If an engine performs poorly, consult the trouble shooting chart on page 128 to determine the possible causes of this difficulty. Thoroughly check the fuel and ignition systems before initiating repairs on the powerhead.

Before attempting any repairs on the powerhead read the Powerhead Repair section of this manual.

Disassembly

For instructions on removing the various components that are attached to the powerhead, consult the appropriate parts of this section.

1. Remove the hood, carburetor knobs, and front housing.

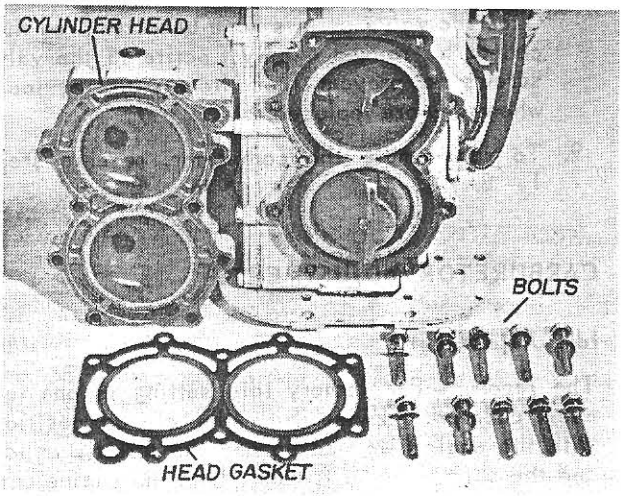
2. Remove the spark plugs, fuel pump, carburetor, manifold, and reeds.

3. Remove the flywheel nut and washer, then attach a flywheel puller to the flywheel and remove it by snugging up on the center bolt and rapping the center bolt until the flywheel breaks loose from the crankshaft.

4. Remove the breaker cam, then loosen the stator hold down screw and carefully remove the stator plate.

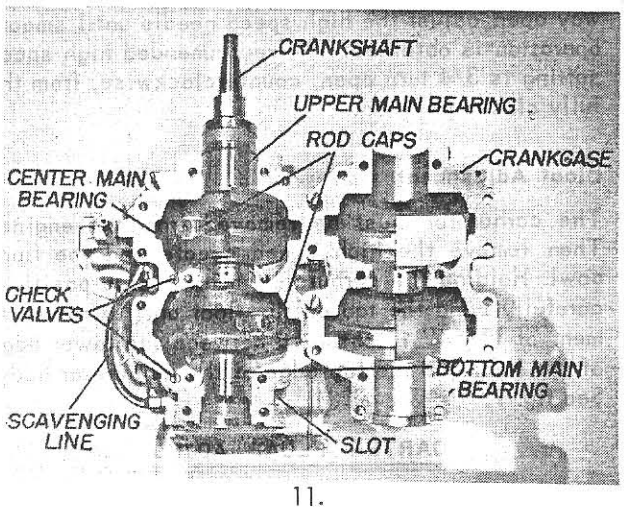
5. Remove the screws which secure the powerhead to the powerhead adaptor plate and handle mount, then carefully lift the powerhead off the driveshaft.

6. Remove the cylinder head, intake cover plates, water and exhaust cover plates, and gaskets. See fig. 10.



10.

7. Remove the crankcase bolts, then carefully pry the crankcase halves apart by inserting a screwdriver in the slot provided. See fig. 11.



11.

8. Remove the rod cap screws and carefully remove the rod caps, bearings, and cages. Keep these parts in separate containers marked according to the cylinder from which they were removed.

9. The crankshaft can now be removed and the main bearings and seals can be removed from the crankshaft. The seals in the top and bottom main bearings can be removed by carefully tapping on them from the inside with a dowel rod. An "O" ring seal in the top main bearing can also be removed.

10. Withdraw the rod and piston assembly from each cylinder, keeping these parts separated according to cylinder.

11. Remove the piston pin lock springs, then press the wrist pin out of the connecting rod. See "Powerhead Repair" section.

12. Use a ring expander to remove the piston rings. The rings are located in the ring groove by a single locating pin which is driven in from the top of the piston through the ring grooves.

13. The scavenging check valves can be removed by unscrewing them from the block. The lube line can be removed by opening its clamp and pulling the line off the fittings. See fig. 11.

This completes the steps necessary to completely disassemble the powerhead. Examine all the various parts for the conditions outlined in the Powerhead Repair section.

Assembly

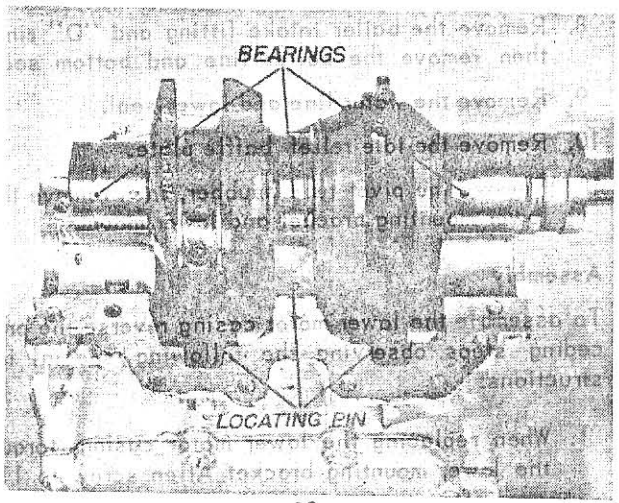
To assemble the powerhead, reverse the steps listed under disassembly. Special attention should be given to the following points:

1. Be extremely careful when pressing the wrist pin into the piston and rod. The rods should be installed so that the side marked "TOP" faces toward the top of the engine when installed in the block.

2. When installing the piston rings be sure that the beveled inside edge of the rings faces the dome of the piston. The rings should be installed so that the locating pin is centered in the open portion of each ring.

3. Use a ring compressor to install the pistons in the block. The sloping side of the piston must face toward the exhaust port.

4. Be careful not to damage the top and bottom main bearing seals when installing them on the crankshaft. When installing the crankshaft in the block, the holes in the bearing races should be fitted over the locating pins in the block journals to prevent the bearings from turning. See fig. 12.



12.

5. The connecting rod cap screw should be torqued to 80 inch pounds. Be sure that the rod and its cap are properly mated before torqueing the screws.

6. Apply Permatex sparingly to the block and crankcase halves. Sealant must not enter the check valve or bearings.

SUSPENSION SYSTEM

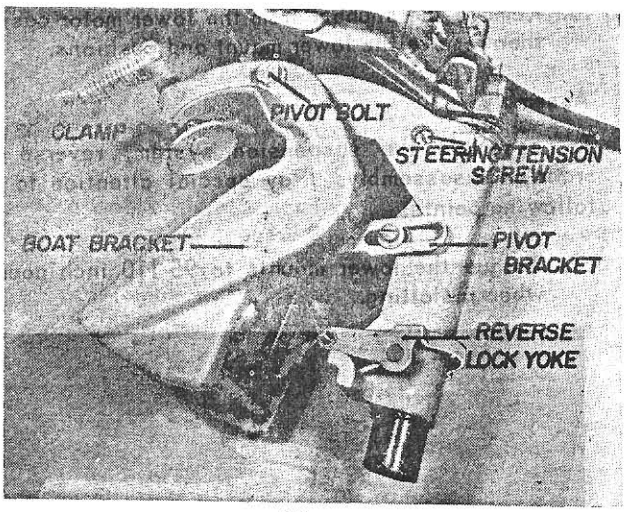
To maintain the suspension system, periodically apply grease to the zerk fitting located on the pivot bracket. A lubricant such as Lubriplate No. 603-AA should be used for this purpose. If any screws or bolts have loosened, due to vibration, they should be retightened. When tightening the pivot bolt and tension screws, tighten only as much as is necessary to insure smooth, vibration-free performance, along with ease in steering and tilting the motor. The reverse lock actuator located on the shift rod coupling should be adjusted so that the reverse lock yoke will be depressed only when the engine is in reverse gear.

Disassembly

1. Remove the crosspiece and pivot bolt; then remove the tilt pin, spring and shaft. Separate the boat brackets.

2. Drive the pin out of the clamp screw clevis, then thread the clamp screw out of the boat bracket and separate the screw and its handle.

3. Remove the tilt lock knob and nut, then remove the plunger and spring.



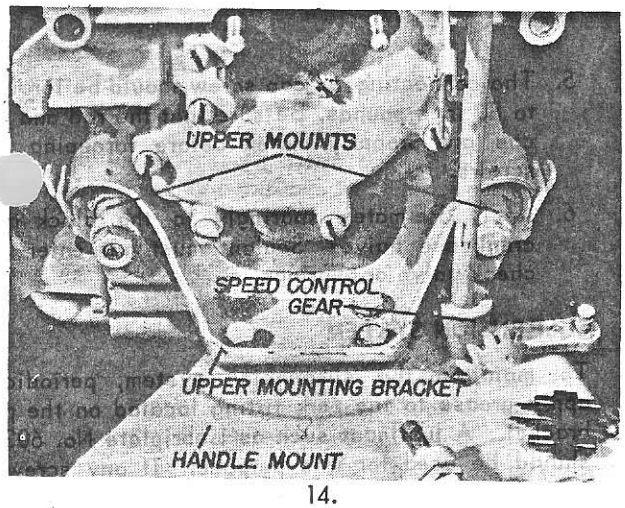
13.

4. Remove the front housing and disconnect the fuel line from the coupling.

5. Remove the four bolts which secure the upper mounting bracket to the handle mount. See fig. 14.

6. Remove the two nuts from the lower mou[illegible] bracket and loosen the Allen screw.

7. Push the throttle control arm upward, at the same time tilt the handle mount away from the lower motor casing and pull the pivot tube out of the



14.

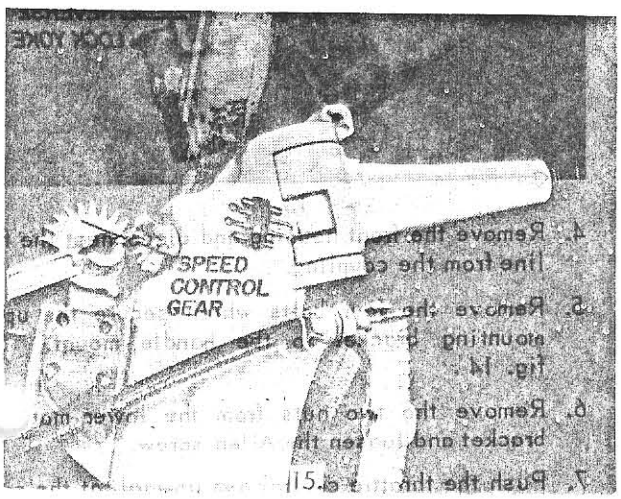
lower mounting bracket.

8. Loosen the tension screw at the top of the pivot bracket, slide the pivot tube out of the bracket.
9. Remove the fuel coupling from the handle mount.
10. Remove the throttle control gears, and shaft, from the handle mount. Remove the speed control gear.
11. Remove the tension nut from the steering arm handle, then remove the steering arm shaft and gear.
12. Remove the pin and bolt which secures the steering arm to the handle mount.
13. Remove the reverse lock yoke from the pivot bracket.
14. Remove the upper mounts.
15. Remove the snubber from the lower motor casing, then remove the lower mount and cushions.

Assembly

To assemble the suspension system, reverse the order of disassembly. Pay special attention to the following points.

1. Torque the lower mounts to 95-110 inch pounds when installing.



2. Tighten the steering handle tension nut so that it will operate smoothly and will not creep from vibration.
3. With the twist grip in the fast position the speed control gear should mate as shown in figure 15.
4. Tighten the pivot bracket tension screw only as tight as required to hold its position and yet allow free steering.
5. When the handle mount and pivot tube assembly is reinstalled on the engine, tighten the lower mounting bracket Allen screw to 110 inch pounds.

LOWER MOTOR CASING

The lower motor casing houses the upper shift mechanism, water and bailer lines, and driveshaft. It also serves as a support between the pump housing and the powerhead.

If the shift mechanism is damaged or if the water or bailer lines should develop leaks, the lower motor casing will need to be removed and inspected. See the Operating Principles section for information on how the idle relief operates.

Disassembly

1. Disconnect the lower shift rod from the coupling.
2. Loosen the lower mounting bracket screw.
3. Remove the screws which secure the lower motor casing to the adaptor plate, then pull the lower motor assembly downward.
4. Separate the pump housing from the lower motor casing.
5. Drive the pin out of the shift rod actuator, then remove the shift lever.
6. Unscrew the shift rod coupling from the upper shift rod, then remove the upper shift rod and actuator. Separate the actuator from the upper shift rod.
7. Remove the shift detenet, then press out the shift lever bushing.
8. Remove the bailer intake fitting and "O" ring, then remove the bailer line and bottom seal.
9. Remove the water line and lower seal.
10. Remove the idle relief baffle plate.
11. Remove the pivot tube snubber, then remove the lower mounting bracket and lower mounts.

Assembly

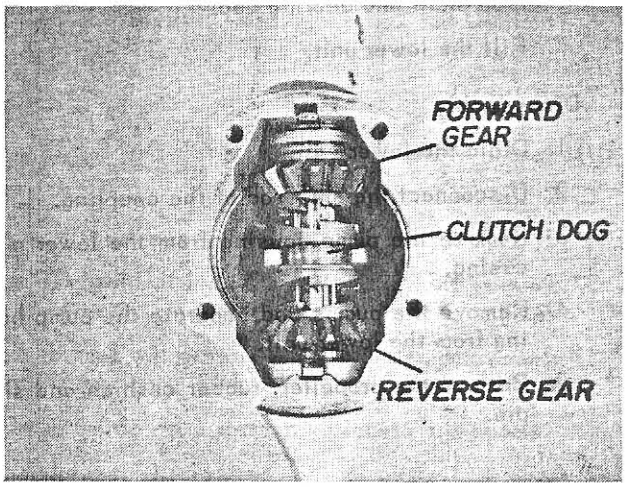
To assemble the lower motor casing reverse the preceding steps observing the following special instructions:

1. When replacing the lower motor casing, torque the lower mounting bracket Allen screw to 110

inch pounds.

2. To adjust the shift travel:

   a. Drain the grease from the lower unit.



16

   b. Remove the prop nut, propeller, shear pin, and bearing cap.

   c. Place the shift handle in neutral and observe whether the clutch dog is centered between the forward and reverse gears.

   d. If the clutch dog is not centered, loosen the shift rod coupling screws and thread the coupling up or down on the upper shift rod until the clutch dog is centered, then retighten the coupling screws.

   e. Replace the prop shaft and bearing cap assembly, being sure to torque the bearing cap screws to 75 inch pounds.

   f. Replace the shear pin, propeller, washer, prop nut, and cotter pin.

3. To adjust the reverse lock mechanism:

   a. Place the shift handle in reverse.

   b. Loosen the shift rod coupling screws and move the actuator so that the reverse lock yoke will be fully depressed.

   c. Retighten the coupling screws and test to see that the yoke is depressed only when the engine is in reverse gear. Slight repositioning of the actuator may be necessary to accomplish this.

PUMP HOUSING

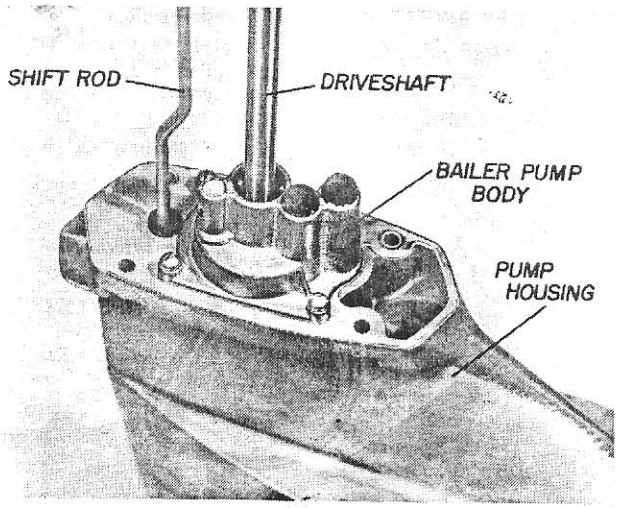
The pump housing secures the lower unit to the lower motor casing. Also it houses the water and bailer pumps. The housing itself requires only visual inspection of its surfaces. Worn or leaking water and bailer pump seals will adversely affect the performance of the pumps. If the engine overheats and no water is discharged from the idle relief or if the bailer pump fails to operate, disassemble the pumps and inspect the seals and impellers.

For information on how the pumps operate, consult the Operating Principles section.

Disassembly

1. Disconnect the lower shift rod from the coupling. Remove the pump housing to lower motor casing screws, then carefully pull the pump housing downward.

2. Remove the bailer body assembly being careful not to lose the impeller pin. Remove the bailer



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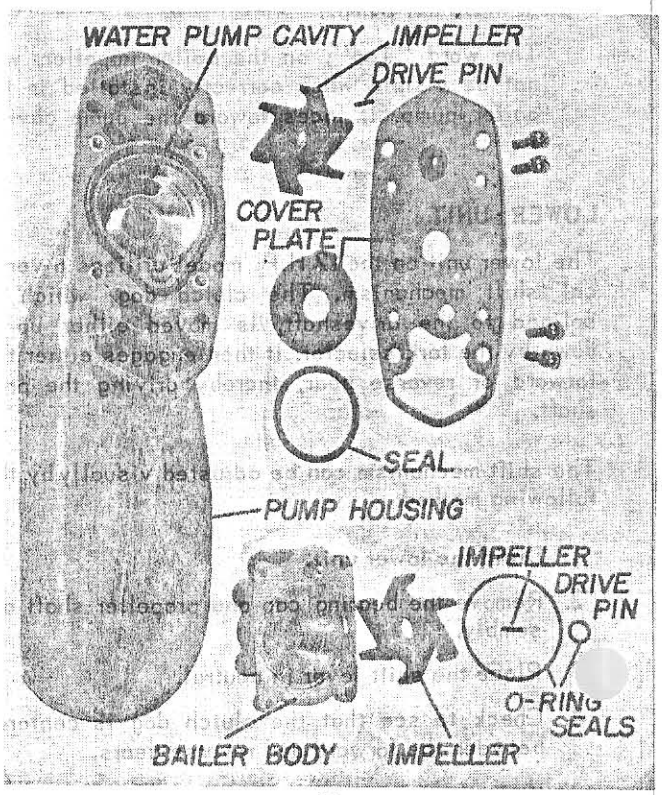
impeller and seals from the bailer cavity.

3. Remove the cover plate.

4. Remove the two seals and smaller cover plate.

5. Remove the water pump impeller and pin.



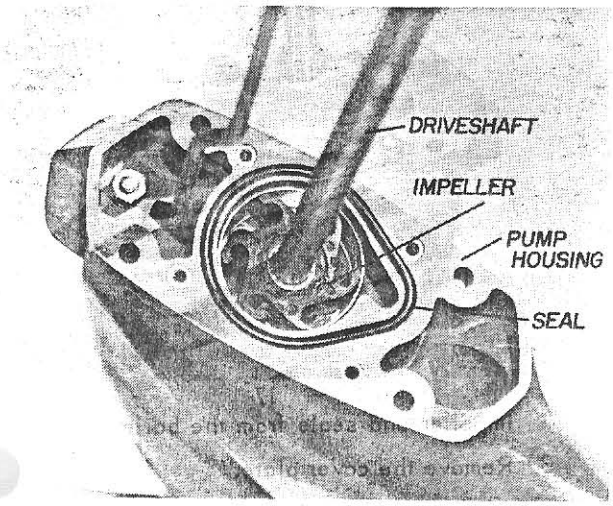
18

6. Remove the water inlet cover.
7. The driveshaft dowel can now be driven out and replaced if necessary.

sembly

Reverse the preceding steps to assemble the pump housing. Pay attention to the special instructions given below.

1. Be sure all seals are in place when assembling the pump housing.
2. Be sure the impeller drive pins are installed in the slotted portion of the driveshaft.
3. The impellers must be installed so that the side with the word "Top" on it faces the power-



19.

head. The word "Top", on the water pump impeller, will be visible when correctly installed in the water pump.

The word "Top", on the bailer impeller, will not be visible when correctly installed in the bailer pump. It faces toward the pump cavity.

LOWER UNIT

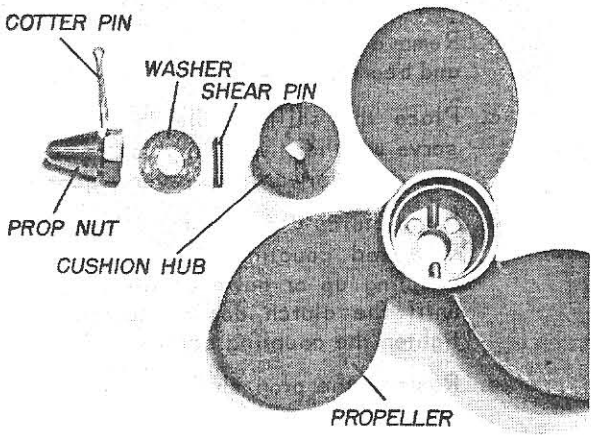
The lower unit on the 12 H.P. model utilizes a vertical shift mechanism. The clutch dog, which is splined to the driveshaft, is moved either up or down by the fork selector. It then engages either the forward or reverse gear, thereby driving the prop shaft.

The shift mechanism can be adjusted visually by the following method:

1. Drain the lower unit.
2. Remove the bearing cap and propeller shaft assembly.
3. Place the shift lever in neutral.
4. Check to see that the clutch dog is centered between the forward and reverse gears.
5. If the clutch dog is not centered, loosen the shift rod coupling screws and thread the coupling up or down on the shift rod until the clutch dog is centered.
6. Tighten the coupling screws, then replace the prop shaft and bearing cap.
7. Fill the lower unit.

Disassembly

1. Drain the lower unit.
2. Disconnect the shift rod at the coupling.
3. Remove the pump housing from the lower motor casing.
4. Remove the pumps and separate the pump housing from the lower unit.
5. Remove the propeller, rubber cushion and shear pin.



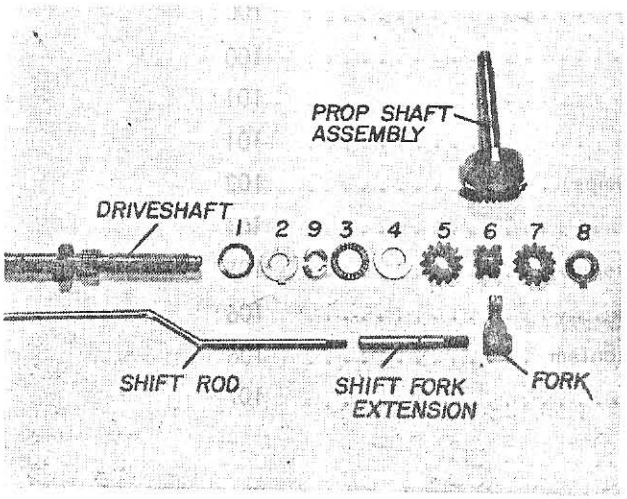
20.

6. Remove the bearing cap assembly and gasket.
7. Remove the bearing retainers, then press the prop shaft assembly out of the bearing cap.
8. Press the bearing and seal out of the bearing cap.
9. Remove the retaining ring and press the ball bearing assembly off the prop shaft gear. Drive the pin out of the prop shaft gear and remove it from the prop shaft.
10. Remove the split driveshaft retainer, then pull the driveshaft, seal, and inner bearing races out of the lower unit. Remove the seal and retaining ring, then press the inner race off the driveshaft.
11. Remove the forward and reverse gears, clutch dog, shim, thrust bearing, and races. Press the upper driveshaft bearing out of the lower unit body. Remove the lower driveshaft bearing.
12. Unscrew the shift rod from the shift fork extension, then remove the extension and fork.

Assembly

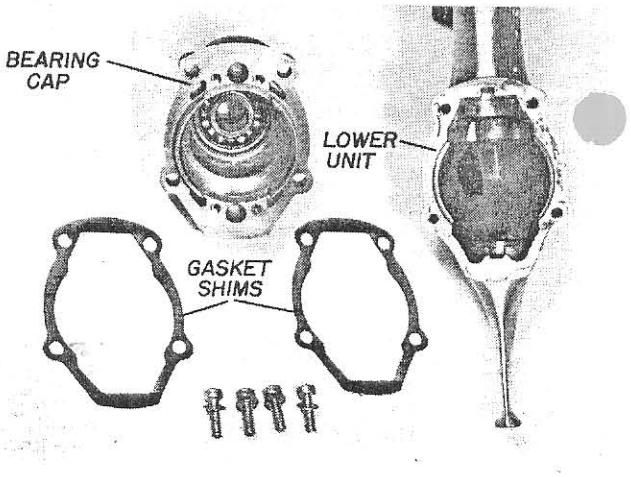
To assemble the lower unit, reverse the preceding steps. Pay close attention to the following special instructions:

1. Be certain all seals are in place and are in good condition. The lower unit driveshaft seal should be pressed into the lower unit until it bottoms.
2. If the upper driveshaft shim needs replacement, replace with the same thickness.
3. The clutch dog, forward, and reverse gears are marked to aid in assembling the lower unit. The forward gear is marked with the letter "T", while the reverse gear is marked with the letter "R". One end of the clutch dog is marked with the letter "T". When assembling the lower unit, the forward gear should be at the top of the lower unit cavity and the end of the clutch dog marked "T" should face toward the forward gear.
4. Place the driveshaft partially into the lower unit, then place parts 1 – 8, in order, on the driveshaft. See fig. 21. Part 9 on the picture



is the driveshaft retainer and is placed on the driveshaft between parts 2 and 7. Parts 3 and 4 slide over the retainer and hold it in place.

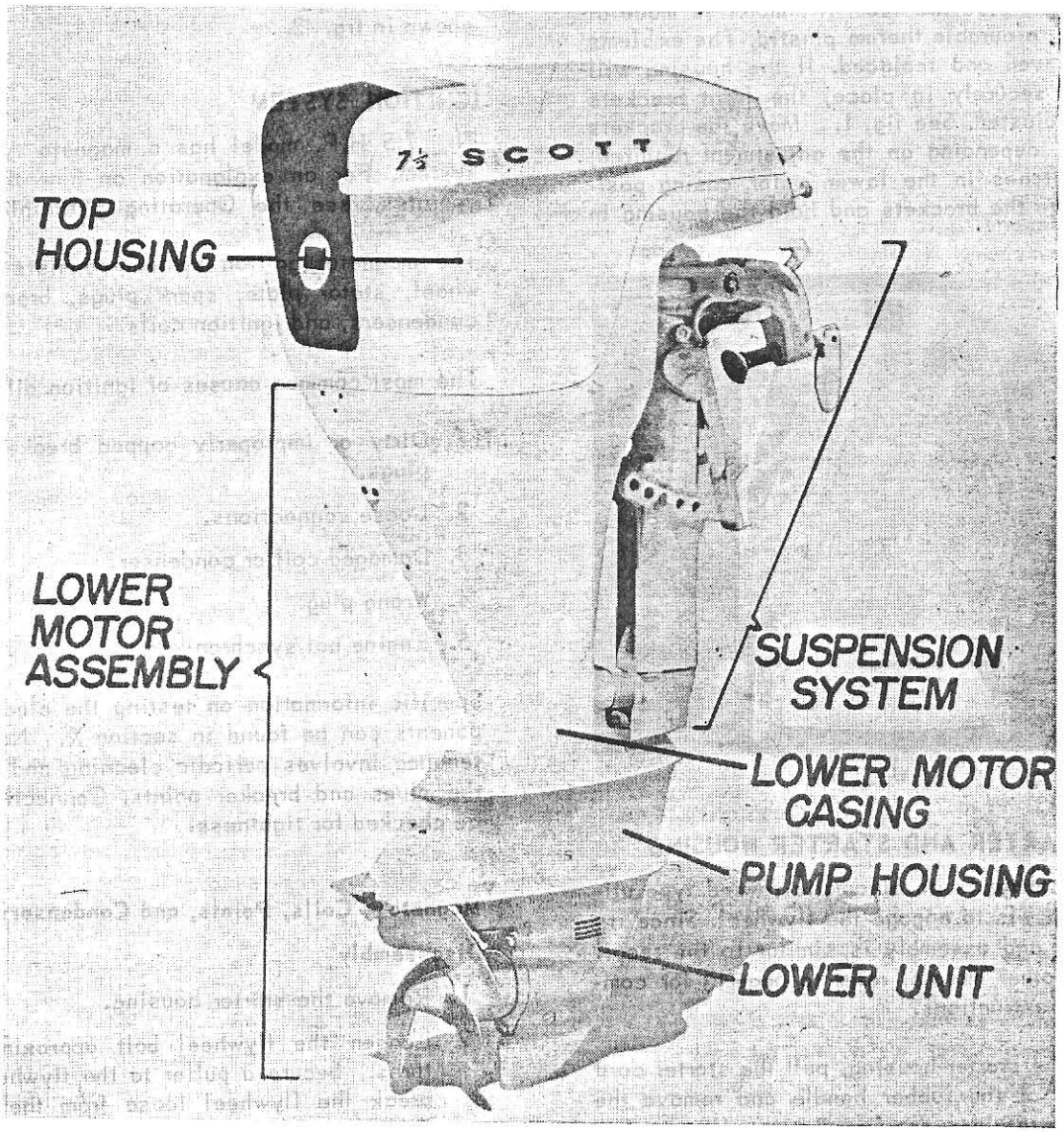
5. The bearing cap gasket comes in two thicknesses; .010, and .015". It acts as a shim to provide proper gear mesh between the prop shaft gear and the forward and reverse gears. Always replace with gaskets of the same thickness. If a new bearing cap is installed it will be necessary to determine the necessary thickness of the bearing cap gasket. To do this, start with a .010" gasket. With the bearing cap installed, test for proper gear mesh. If the prop shaft turns hard, increase the gasket thickness until hard turning is no longer evident. With the proper amount of shims, the prop shaft should turn freely without excessive prop shaft gear lash.



6. Torque the bearing cap screws to 75 inch pounds.
7. See the pump housing part of this section to properly assemble the pumps.
8. Lay the engine on its rear carrying handle and fill the lower unit to capacity with EP No. 90 outboard gear lubricant.

SECTION VIII

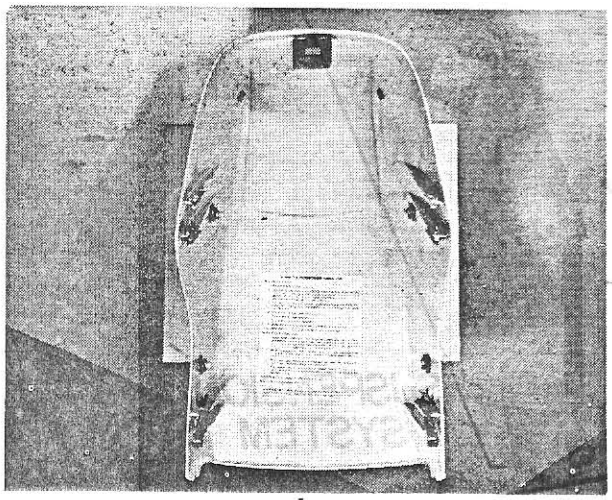
7.5 H.P. MODEL



Horsepower O.B.C. Certified	7.5 H.P. @4500 RPM
Normal Full Throttle Range	4200 to 4800 RPM
Number of Cylinders	2
Bore and Stroke	1 15/16" X 1.7"
Piston Displacement	10.0 Cu. In.
Gear Ratio	17:25
Fuel Tank Capacity	3 1/2 gal.
Fuel Mixture	
Break-In	1/2 Pint oil to 1 gal. gas.
Normal Operation	3/8 Pint oil to 1 gal. gas.
Initial Carburetor Setting	
Main	1 Turn Open (counterclockwise) from fully closed position
Idle	3/4 Turn Open (counterclockwise) from fully closed position
Spark Plugs	Champion H10JM gapped .035"
Recommended Breaker Point Setting	.020"
Lower Unit Lubrication	S.A.E. #90 E.P.
Propeller Diameter and Pitch	6" X 7" (3 blade)

TOP HOUSING

The top housing on the 7.5 H.P. motor is made of "Implex A", a durable thermo plastic. The emblems can be removed and replaced. If the housing will not remain securely in place, the front brackets should be adjusted. See fig. 1. Move the brackets up or down, depending on the adjustment required, until the latches in the lower motor casing positively engage the brackets and hold the housing in position.

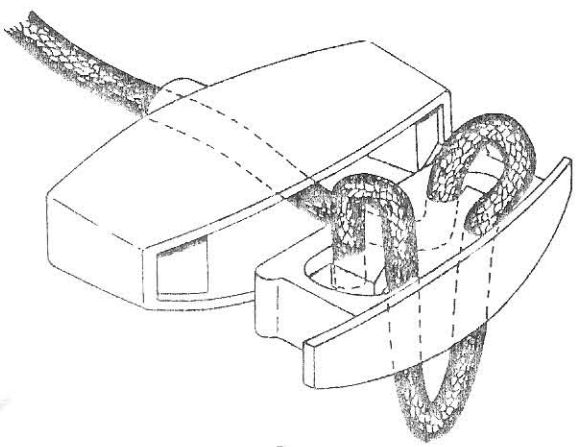


1.

RECOIL STARTER AND STARTER HOUSING

The recoil starter is an automatic rewind type utilizing drop pawls to engage the flywheel. Since its disassembly and assembly is similar to the recoil starters on other motors, refer to page 13 for complete repair instructions.

To remove the starter housing, pull the starter cord retainer out of the rubber handle and remove the cord from the retainer, see fig. 2; tie a knot in the cord. Remove the fasteners securing the three legs of the starter housing to the powerhead and lower motor casing. Lift the starter off the motor. If further disassembly is required see page 13.



2.

Reverse the procedures above to install the starter housing. String the starter cord in the retainer, as shown in fig. 2.

IGNITION SYSTEM

The 7.5 H.P. model has a magneto type ignition system. For an explanation on how this system operates, see the Operating Principles Section.

The magneto ignition system consists of the flywheel, stator plate, spark plugs, breaker points, condensers, and ignition coils.

The most common causes of ignition difficulty are:

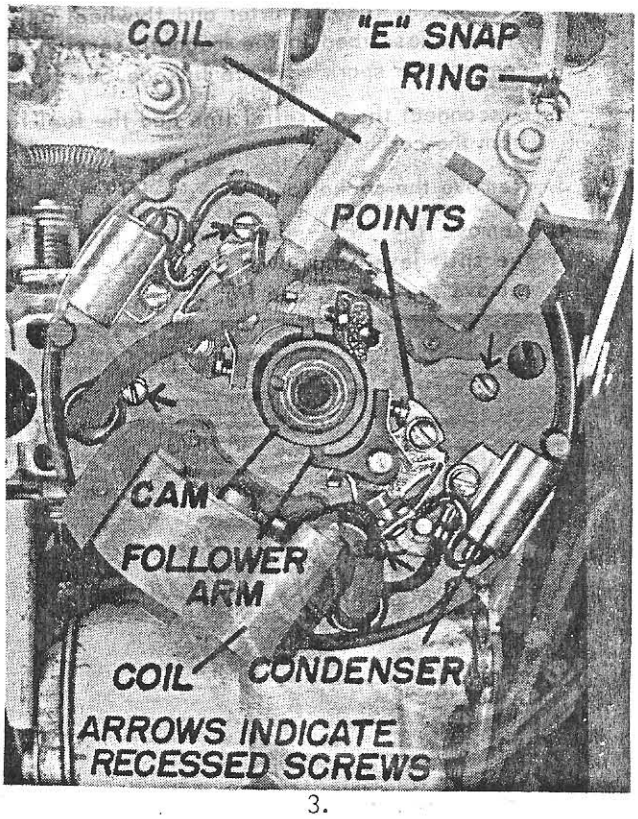
1. Dirty or improperly gapped breaker points or plugs.
2. Loose connections.
3. Damaged coil or condenser.
4. Wrong plug.
5. Engine not synchronized.

Specific information on testing the electrical components can be found in section X. Normal maintenance involves periodic cleaning and gapping of the plugs and breaker points. Connections should be checked for tightness.

Magneto – Coils, Points, and Condensers

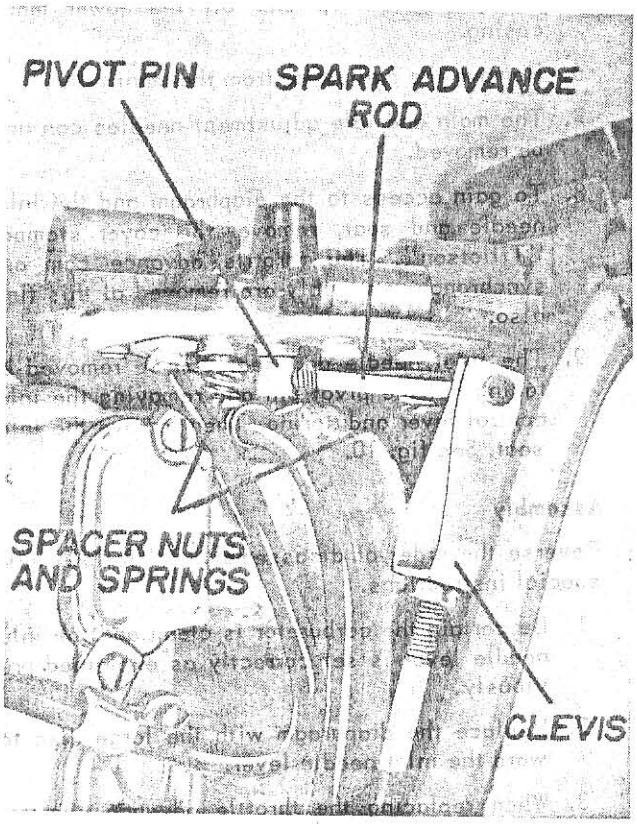
Disassembly

1. Remove the starter housing.
2. Loosen the flywheel bolt approximately three turns. Secure a puller to the flywheel and just break the flywheel loose from the crankshaft. Then remove the puller and the flywheel nut; the flywheel can now be lifted off the crankshaft.
   A. The breaker points, or condensers, can now be replaced without further disassembly of the magneto. To remove either part, disconnect lead wires attached to the part and remove the screws securing the part to the breaker plate.
   B. When replacing breaker points, be certain to gap the points at .020". This is accomplished by rotating the crankshaft until the point follower arm is at the high point of the cam on the crankshaft. Loosen the screw directly in front of the contact points and adjust the point gap to .020" using the proper feeler gauge. See fig. 3.
3. Remove the "E" snap ring securing the spark advance linkage together. See fig. 3.
4. Remove the breaker cam from the crankshaft. See fig. 3.
5. Remove the four (4) recessed screws, figure



3.

3 , and the spacer nuts with tension springs, figure 4 . The stator plate can now be lifted off the engine.



4.

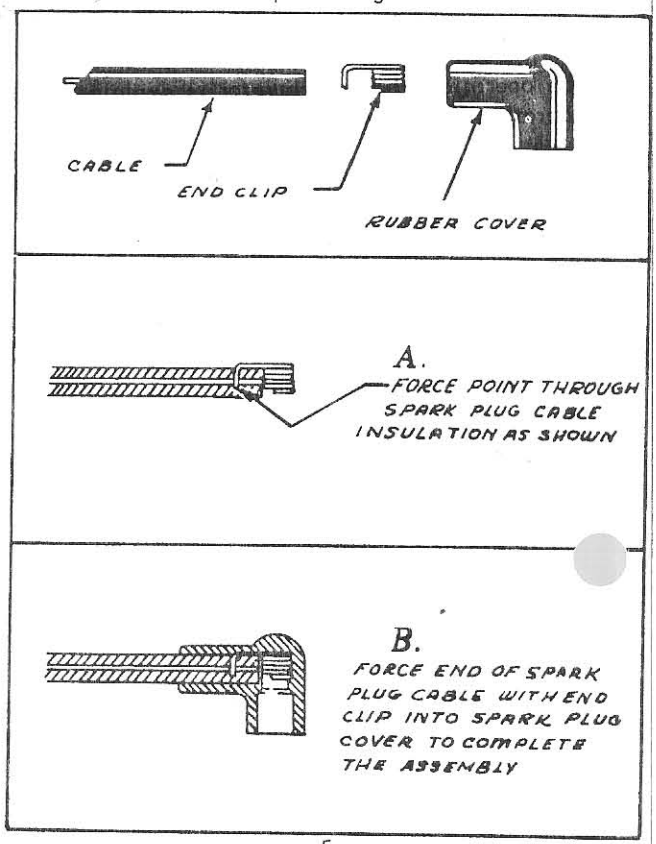
6. Coil Removal.

A. Disconnect the coil leads and cut the spark plug lead wire (if the coil is in operating condition remove the rubber cover and clip from the spark plug end of the wire), to remove the spark plug lead from the stator plate.

B. Bend the two (2) retaining clips flush with the core and tap the coil off the core with a mallet.

7. Coil Installation (New Coil)

A. Remove the rubber cover from the spark plug end of the spark plug lead wire along with wire clip. See fig. 5.



5.

B. Slide the spark plug lead wire through the grommet in the stator plate and replace the wire clip and rubber cover. See fig. 5.

C. Place the two clips in position on the core and press the coil fully on the core. Bend the clips in place to secure the coil.

8. If the spark plug lead requires replacement, it can be pulled out of the coil and a new one threaded into place. Use a non-conductive adhesive where the wire enters the coil.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Be certain all leads are secure and the en. assembly is free of dirt and grease.

2. Guide the spacer nuts into the holes in the stator plate retainer (be sure the springs are on the nuts) and fasten the stator plate securely.

3. If the spark advance rod has been removed, see fig. 4, it should be threaded into the pivot pin on the stator plate until two threads are exposed.
4. Be certain to torque the flywheel bolt to 400 inch pounds.

FUEL SYSTEM

The fuel system consists of the non-pressurized remote fuel tank, fuel pump, diaphragm type carburetor, intake manifold, and reed valves.

Fuel Tank – See page 14 for disassembly and repair.

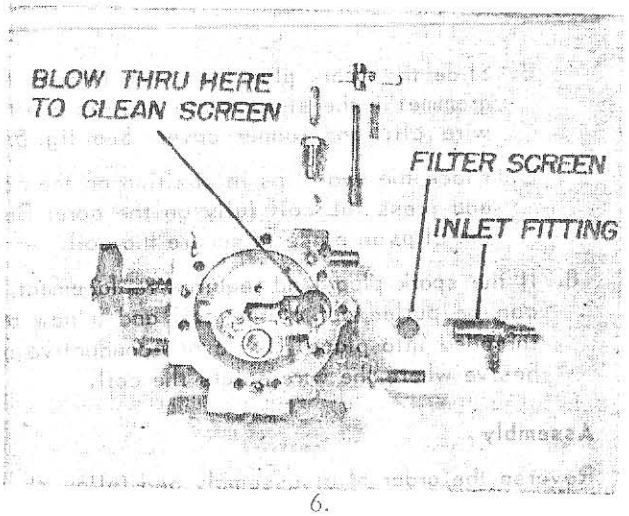
CARBURETOR

The operation of the carburetor is explained in the Operating Principles Section.

Possible causes of carburetor difficulties are:

1. Improper inlet needle lever adjustment (corresponds to float adjustment on other type carburetors).
2. Worn inlet needle and seat.
3. Obstructions in the fuel passages.
4. Improper carburetor adjustments (low and high speed needles).
5. Damaged diaphragm.
6. Loose hose connections.
7. Air bleed valve or connections loose.
8. Intake filter screen clogged.

The carburetor should be cleaned regularly in a solvent and by blowing compressed air in the fuel passages. ALWAYS remove the inlet, lever, needle and seat before cleaning. There is a filter screen

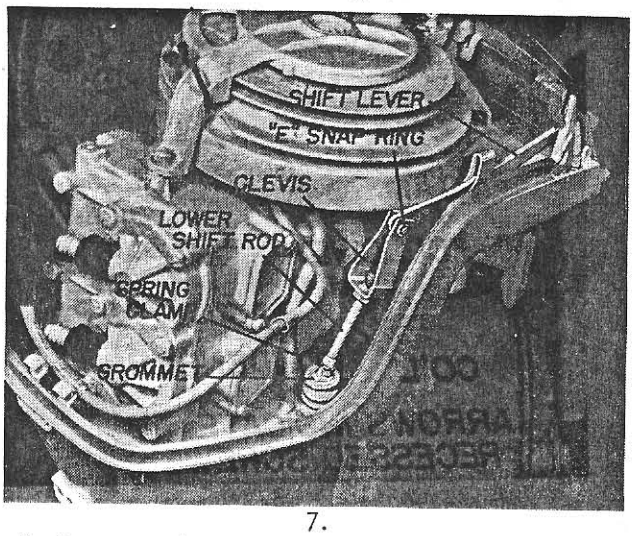


6.

directly behind the intake fitting which should be cleaned by directing air into the inlet seat hole. Always check the inlet needle lever adjustment prior to assembling the carburetor.

Disassembly

1. Remove the recoil starter and flywheel as previously described in the magneto section. Disconnect the spark advance linkage. See fig. 3.
2. Disconnect the air relief line and the fuel lines from the carburetor.
3. Remove the choke rod.
4. Remove the "E" snap ring and pin securing the shift lever and lower shift rod clevis; also remove the clevis. See fig. 7.



7.

5. Remove the eight (8) screws securing the powerhead to the lower motor casing and lift the powerhead up and off the lower motor casing.
6. Remove the carburetor from the manifold.
7. The main and idle adjustment needles can now be removed.
8. To gain access to the diaphragm and the inlet needle and seat, remove the cover stamped "Tillotson". The throttle advance cam and synchronous assembly are removed at this time also.
9. The inlet needle and seat can be removed by taking out the pivot pin and removing the inlet control lever and spring. Then remove the inlet seat. See fig. 10.

Assembly

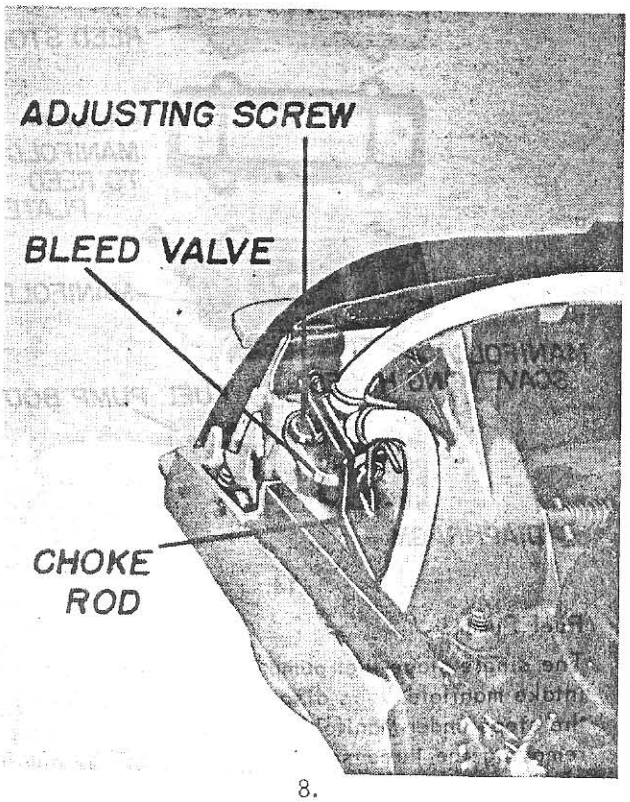
Reverse the order of disassembly and follow these special instructions.

1. Be certain the carburetor is clean and the inlet needle lever is set correctly as explained previously.
2. Replace the diaphragm with the large disc toward the inlet needle lever.
3. When replacing the throttle advance cam and synchronous assembly, adjust the assembly so that the throttle butterfly is completely closed.
4. Use a new carburetor to manifold gasket.

5. Connect the fuel lines as illustrated in fig. 15.
6. When installing the powerhead, guide the shift rod through the sleeve on the powerhead flange and be sure the water line with its rubber seal fits snugly into the inlet hole in the powerhead. Use a new powerhead to lower motor casing gasket. Be certain the sleeve clip is in place.
7. Adjust carburetion and synchronize the throttle opening to spark advance as explained previously.

Carburetor Adjustments

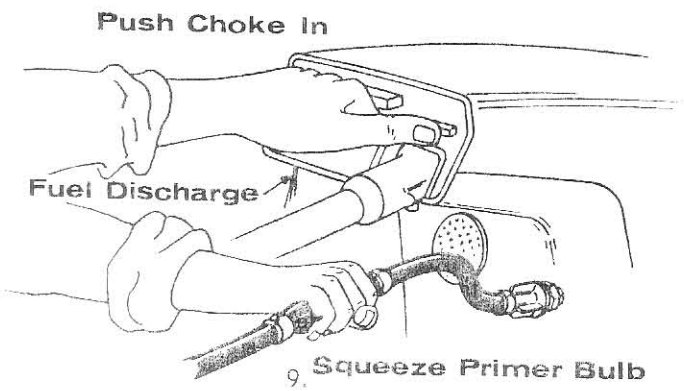
Prior to starting the 7.5 H.P. motor it is necessary to purge or bleed the fuel system of excess air. On early model motors a bleed valve is located



8.

directly behind the choke knob. See fig. 8. To purge the fuel system on motors with this valve:

1. Depress the choke button and hold.

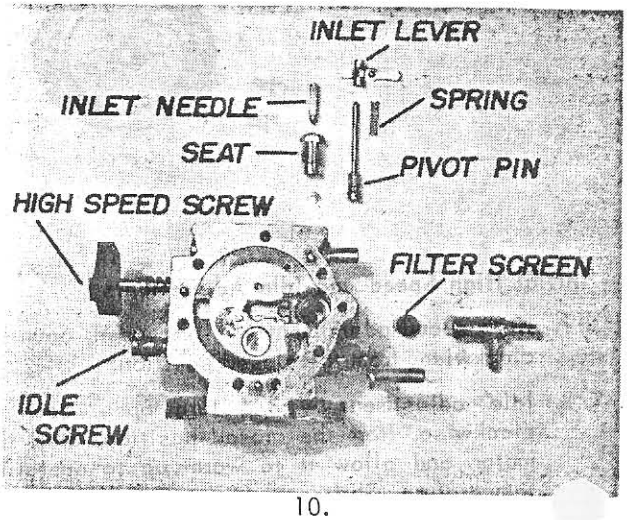


9.

2. Squeeze the primer bulb until a SOLID stream of fuel is discharged from the fitting located beneath the shift lever.
3. Maintain pressure on the primer bulb until the choke knob is released.

This bleed valve can be adjusted in the following manner:

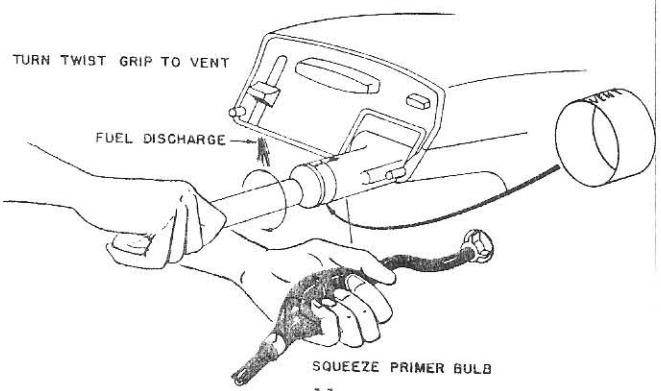
1. Depress the choke knob and hold.
2. Loosen the adjusting screw, shown in fig. 8. and slide the valve toward the choke knob until it stops; secure the adjusting screw.



10.

3. When the choke knob is released, there should not be any contact between the stop on the choke rod and the stem in the bleed valve. If there is, back the valve off slightly.

On later model motors the bleed valve is located on the inside, starboard side of the lower motor casing directly beneath the spark advance linkage. Follow this procedure to purge the air with the valve located in this position.



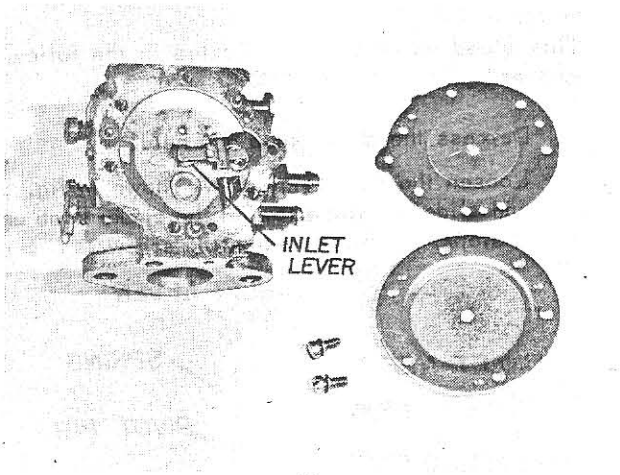
11.

1. Turn the twist grip handle clockwise to "VENT" position and hold.
2. Squeeze the primer bulb until a SOLID stream of fuel is ejected from the fitting located beneath the shift lever.

3. Maintain pressure on the primer bulb while turning the twist grip handle off the "VENT" position.

Inlet Needle Lever Adjustment

The inlet needle lever should be just level with bottom of the carburetor body. See figure 12.



12.

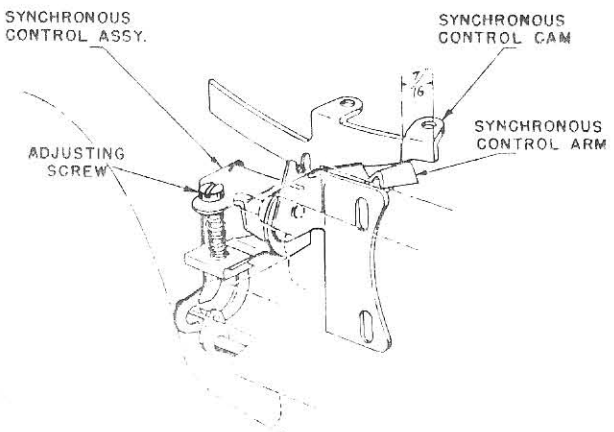
Initial High Speed and Idle Adjustments

1. High speed adjustment – 1 turn open, counter-clockwise, from the closed position.
2. Idle adjustment – 3/4 turn open, counter-clockwise, from the closed position. Start the motor and allow it to warm up to operating temperature. Shift into forward gear and open the throttle all the way. Adjust the high speed adjustment until smooth operation is obtained. Retard the throttle to the slow position and adjust the idle adjustment until smooth idling is obtained.

After the idle adjustment has been made, try accelerating the motor. If it does not accelerate smoothly, open the high speed adjustment slightly.

Synchronization

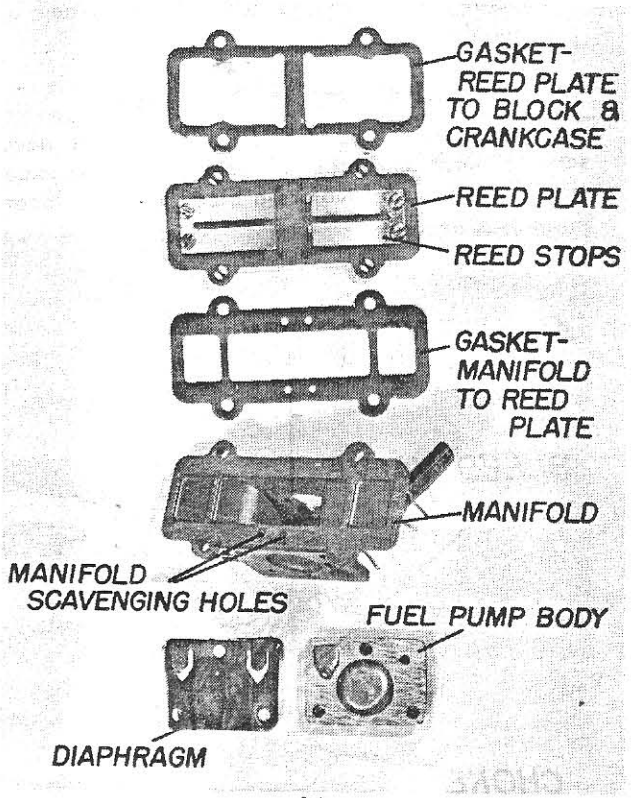
Adjusting the opening of the throttle valve relative to the amount of spark advance.



13.

1. Turn the twist grip handle to the slow position.
2. Advance the throttle and watch for the point of contact between the synchronous cam and cam follower. See figure 13. The cam follower should just begin to open the throttle valve at the point shown in figure 13.

FUEL PUMP – INTAKE MANIFOLD AND REED VALVES



14.

Fuel Pump

The single stage fuel pump is an integral part of the intake manifold. It is disassembled by following the the steps under Manifold and Reed disassembly plus removing the three screws securing the bottom half of the pump to the manifold. See figure 14. Its operation is explained in the Operating Principles section.

The fuel pump should be checked for the following conditions if the engine is not receiving adequate fuel.

1. Loose pressure or fuel line connections.
2. Obstructed fuel lines.
3. Worn or punctured diaphragm.
4. Loose screws holding the pump together.

Disassembly

1. Remove the starter housing, flywheel, and carburetor as previously described.

2. Disconnect all fuel and pressure lines from the fuel pump and manifold.

3. Remove the manifold from the powerhead along with the reed valves, plate, and gaskets.

4. Remove the fuel pump cover from the bottom of the intake manifold.

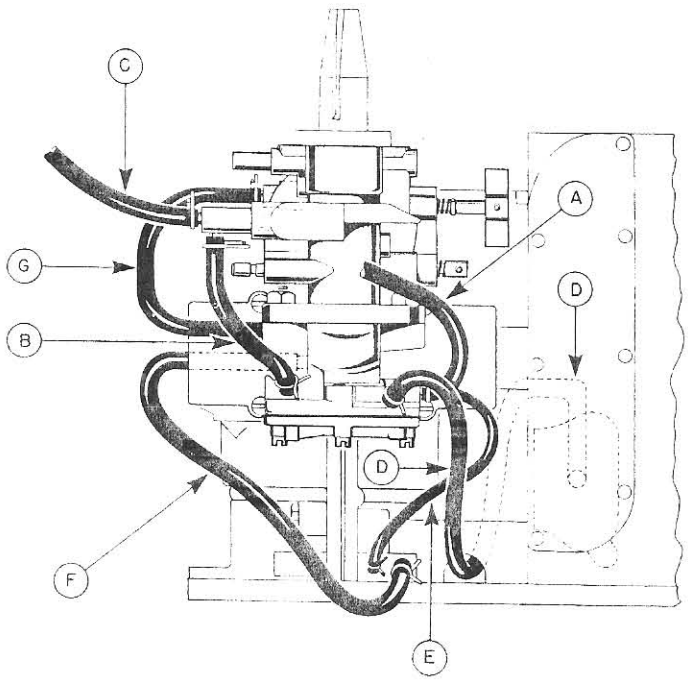
Assembly

Reverse the order of disassembly following these special instructions and the special assembly instructions given for the assembly of other components removed.

1. Clean the fuel pump and all fuel and scavenging passages thoroughly.

2. Use new gaskets between all separated parts.

3. Attach all fuel, pressure, and scavenging lines as illustrated in figure 15.



A	INTAKE FUEL LINE (TO FUEL COUPLING)
B	FUEL PUMP TO CARBURETOR
C	AIR BLEED LINE TO BLEED VALVE
D	CRANKCASE TO FUEL PUMP PRESSURE LINE
E	MANIFOLD SCAVENGING LINE
F	CENTER MAIN SCAVENGING LINE
G	TOP MAIN TO MANIFOLD SCAVENGING LINE

15.

Manifold and Reeds – See figure 14.

The operation of the manifold and reeds is described on page 100. There is relatively little that can go wrong with these components. However, always check for leaky manifold gaskets and distorted reeds or stops.

The reeds are designed to lay flat against the reed plate and if they are open, the reeds should be replaced. To assure a flat fit against the reed plate, there is a slight bend in the reeds near their mounting holes which spring loads the flat.

The reed stops are designed with a uniform curvature which prevents the reeds from becoming "metal fatigued". Do not attempt to bend or straighten reed stops, they must be replaced if damaged. The reed stop openings should be 1/4" from the top of the of the stop to the reed plate.

Disassembly and Assembly

1. Remove the starter housing, flywheel, and powerhead as previously described.

2. Remove the carburetor.

3. Remove the manifold from the powerhead.

4. To assemble, reverse the order of disassembly, using new gaskets.

POWERHEAD

The 7.5 powerhead consists of the cylinder head, block and crankcase, pistons, rings, connecting rods, crankshaft, and necessary bearings and seals.

There is relatively little that can go wrong with the powerhead. In most cases faulty engine performance can be attributed to malfunction of the fuel or electrical systems. When an engine performs poorly, consult the trouble shooting chart at the back of the manual. Then thoroughly check the fuel and electrical systems before initiating repairs on the powerhead.

Before attempting any repairs on the powerhead, carefully read the Powerhead Repair Section in this manual.

Disassembly

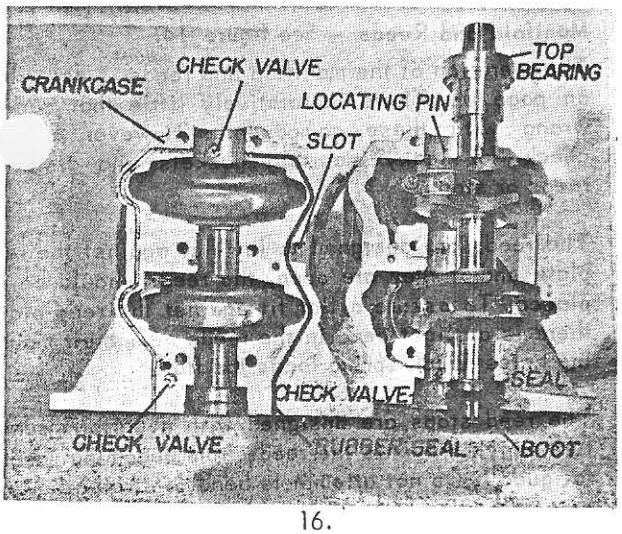
1. Remove the starter housing, flywheel, magneto, carburetor (carburetor includes removal of the powerhead), and the intake manifold as previously described. Also remove the scavenging lines.

2. Remove the cylinder head.

3. Remove the intake and exhaust cover plates.

4. Remove the six (6) bolts securing the block and crankcase together. The block and crankcase can be separated by prying them apart utilizing

the slot shown in figure 16. Be careful not to mar the surfaces of the block and crankcase.



16.

5. Remove the rod caps, bearing cages, and bearings. Keep them in separate containers marked according to the cylinders from which they were removed.

6. The pistons and rods can now be pushed out of the block.

7. To replace a rod, remove the wrist pin retaining rings, and press the wrist pin out of the piston and rod. Be careful not to distort the shape of the piston. See "Powerhead Repair" section.

8. The scavenging check valves, shown in figure 16, can now be taken out and inspected.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Install the pistons and rod assemblies in the cylinder from which they were removed with the sloping side of the piston dome facing the exhaust ports.

2. Place the correct cage half and bearings in each connecting rod (use grease to hold the bearings in place).

3. Place the crankshaft in position on the rods.

4. Install the remaining bearings in the correct cage halves and position them in place. Be certain the cage halves are correctly matched.

5. Carefully match the proper rod caps and rods. Torque the rod cap screws to 65 inch pounds. Rotate the bearing cage. If it does not rotate freely, check your method of assembly.

6. Slide the magneto retaining ring onto the upper crankshaft bearing and slide the bearing on the crankshaft.

7. Position the crankshaft in the journals and locate the top bearing on the pin in the top journal. Be certain the top seal and the bottom seal and boot are in place.

8. Apply a moderate amount of EC847, or a similar sealing agent, along the outside edge of the rubber seal in the face of the crankcase. Caution must be exercised to prevent sealant from flowing into bearings or into scavenging check valves.

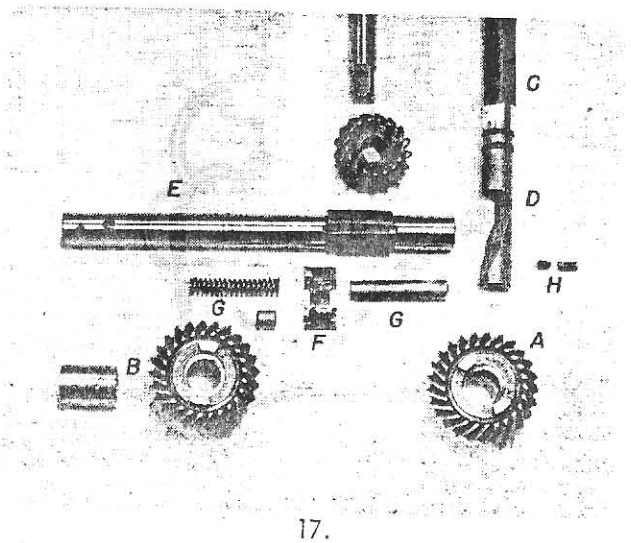
9. Position the crankcase on the block using the dowels in the crankcase, and bolt the block and crankcase together; apply 100 inch pounds of torque to these bolts.

10. Assemble the remainder of the components following the special instructions pertaining to each particular component.

11. Use new gaskets at all times when assembling the powerhead.

LOWER UNIT (Includes water and bailer pumps)

The lower unit contains the forward gear and bearing (A), the reverse gear and bearing (B), the lower shift rod (C), cam selector (D), propeller shaft (E), clutch dog (F), propeller shaft plunger and spring (G), and detent pin (H), along with the necessary seals, washers, etc. See fig. 17.



17.

This lower unit utilizes a horizontal shifting mechanism. The clutch dog is moved into and out of engagement with the gears by the propeller shaft plunger. The plungers position is determined by its location on the cam selector. The clutch dog is spring loaded into forward gear and the plunger is in the deepest indentation on the cam selector. In neutral the plunger is riding in the middle indentation on the cam selector, in reverse gear the plunger is riding in the bottom and smallest indentation of the cam selector. The most important, and most obvious, maintenance check is to be sure the lower unit has an adequate supply of lubricant.

As the lower unit is disassembled, carefully inspect all seals including the driveshaft seal. Replace all seals which are in other than perfect condition.

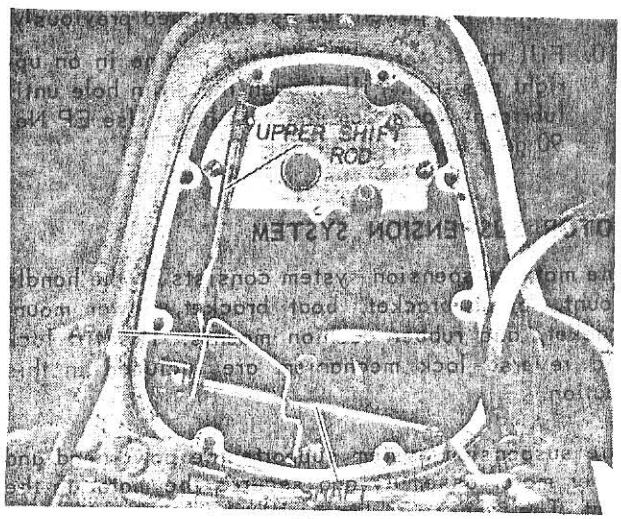
By removing the shift lever up and down you will feel a definite "catch" in neutral gear which is caused by the detent pin in the lower unit acting against the cam selector. When this catch is felt, the shift lever should be in neutral position indicated on the front panel. If it is not, adjust by turning the upper shift rod clevis up or down as required. See fig. 17.

The water and bailer pumps are located at the top of the lower unit. Their operation is explained in the Operating Principles section. Follow the first six steps under "Lower Unit and Pump Assemblies" to repair water and bailer pumps.

LOWER UNIT and PUMP ASSEMBLIES

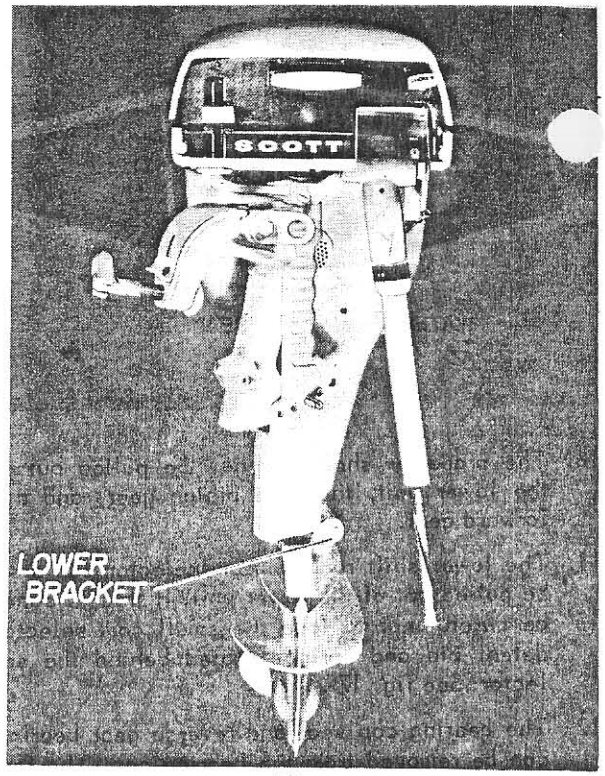
Disassembly

1. Remove the starter housing, flywheel, and the powerhead as explained previously.
2. Disconnect the lower shift rod from the actuator. See fig. 18 .



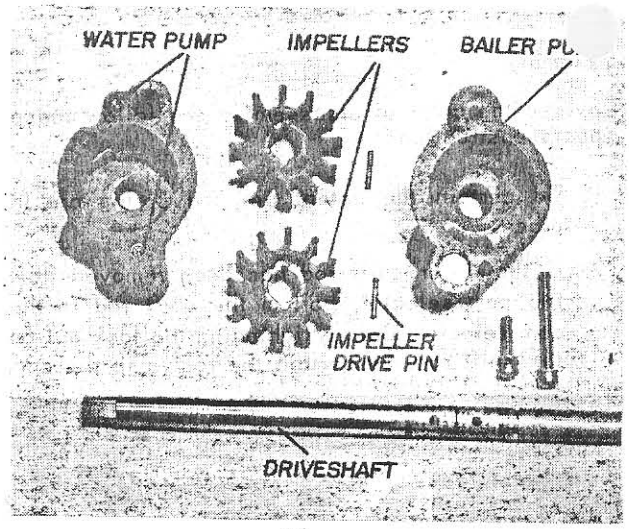
18

3. Disconnect lower suspension bracket, then remove the two lower motor casing to lower unit bolts. See fig. 19 .
4. Pull the lower assembly straight down and out of the lower motor casing. Drain the lower unit.
5. Remove the bailer pump by pulling it up and off the driveshaft. Take care not to lose the impeller drive pin. See fig. 20 .
6. Work the stainless steel separator plate up the driveshaft, then pull the driveshaft up until the water impeller drive pin is exposed. Pull the drive pin out, then pull the driveshaft up and out of the lower unit.
7. The separator plate and water pump can now be removed.



19

This is as far as the lower unit must be disassembled in order to work on the lower pumping system.

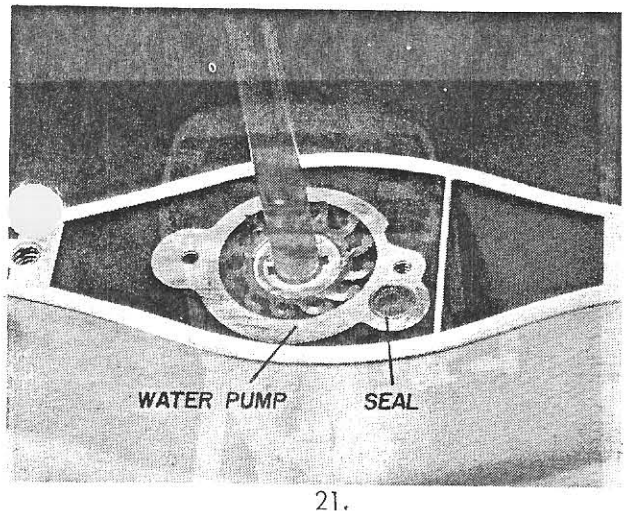


20

Assembly is accomplished in the reverse order of disassembly.

The impellers are inter-changeable and need only be carefully installed in the pump cavity to prevent damage to the impeller blades. Also be certain all seals are in place and in good condition. The water pump has two tapped holes which identify it from the bailer pump. See fig. 21 .

8. Remove the propeller.
9. Remove the bearing cap screws and slide the bearing cap off the prop shaft.



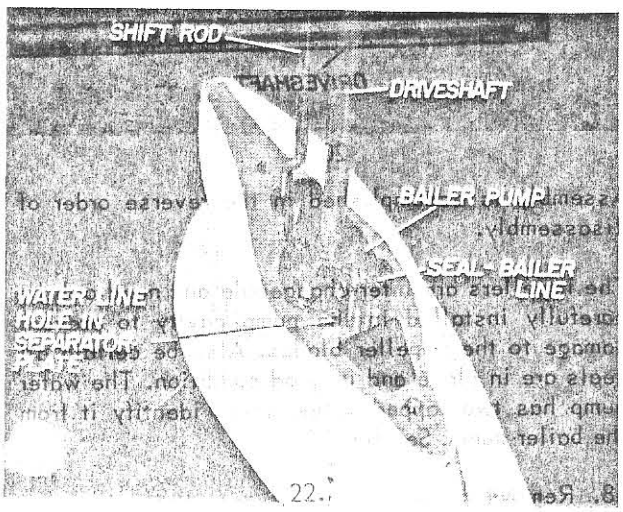
21.

10. The propeller shaft can now be pulled out of the lower unit, then the pinion gear, and the forward gear.
11. The lower shift rod and cam selector can also be pulled out of the lower unit. If this is done, be careful not to lose the small cam selector detent pin and spring located behind the selector. See fig. 17.
12. The bearing cap seal and reverse gear bearing can be removed from the bearing cap. The forward gear bearing and lower driveshaft bearing can also be removed.
13. To remove the clutch dog, compress the spring in the prop shaft and slide the clutch dog out of the slot in the prop shaft.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. Be certain the detent pin and spring are in place.
2. If the lower shift rod has been removed from the cam selector, bottom the shift rod in the cam selector. Before tightening the lock nut on the shift rod, be certain the rod is in the correct relationship to the cam selector as shown in fig. 22 and both seals are in place.



22.

3. Insert the cam selector into its recess in the lower unit until it touches the detent pin, then depress the detent pin and slide the cam selector all the way into its recess.
4. Install forward gear (gear with the pressed fit bearing sleeve) in the lower unit, then place the pinion gear in position.
5. Place the cam selector plunger in the prop shaft with the tapered end out and install the prop shaft.
6. Slide the reverse gear (gear with loose bearing sleeve) on the prop shaft and install the bearing cap. Use caution when installing the bearing cap to prevent pinching the "O" ring seal.
7. Follow the special instructions previously given to properly install the water and bailer pumps.
8. Install the lower unit assembly in the lower motor casing. ***Caution:*** Check the water and bailer line connections at the pump. The bailer line must fit snugly into the seal of the bailer pump and the water line must protrude through the separator plate into the water pump. There is no lower seal on the water line.
9. Install the powerhead as explained previously.
10. Fill the lower unit with the engine in an upright position. Fill through the drain hole until lubricant flows from the vent hole. Use EP No. 90 gear lube at all times.

MOTOR SUSPENSION SYSTEM

The motor suspension system consists of the handle mount, pivot bracket, boat bracket, lower mount bracket, and rubber cushion mounts. The tilt lock and reverse lock mechanism are included in this section.

The suspension system supports the powerhead and lower motor assembly and secures the motor to the boat. The rubber cushion mounts isolate motor vibrations from the boat and provide quieter motor operation.

The boat bracket contains the reverse lock mechanism which prevents the motor from raising out of the water when operating in reverse or decelerating rapidly. This is a spring loaded reverse lock which will release automatically to protect the motor when an underwater object is struck.

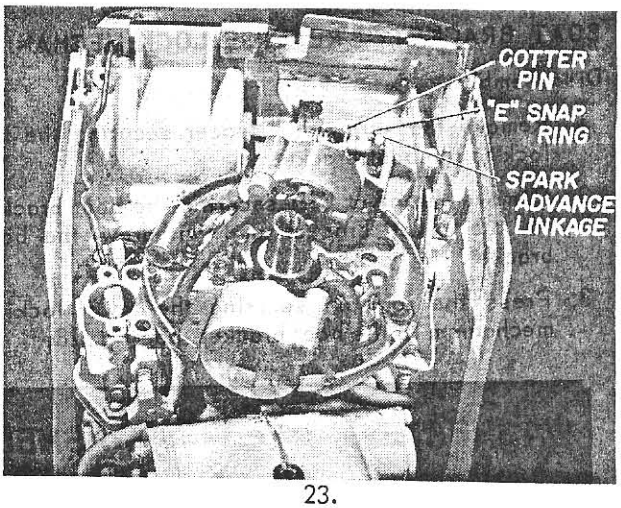
To tilt the motor, press down on the release lever, and raise the motor up until the tilt lock engages. To return the motor to the vertical position, press down on the tilt lock and slowly lower the motor to the vertical position. Press down and to the right on the release lever to engage the reverse lock.

The suspension system requires periodic checks of the fasteners for tightness and the condition of the rubber cushion mounts. The pivot bracket should be lubricated every 30 to 60 days by applying Lubriplate, or a similar lubricant, to the pivot points at each end of the pivot bracket.

HANDLE MOUNT AND STEERING HANDLE ASSEMBLY

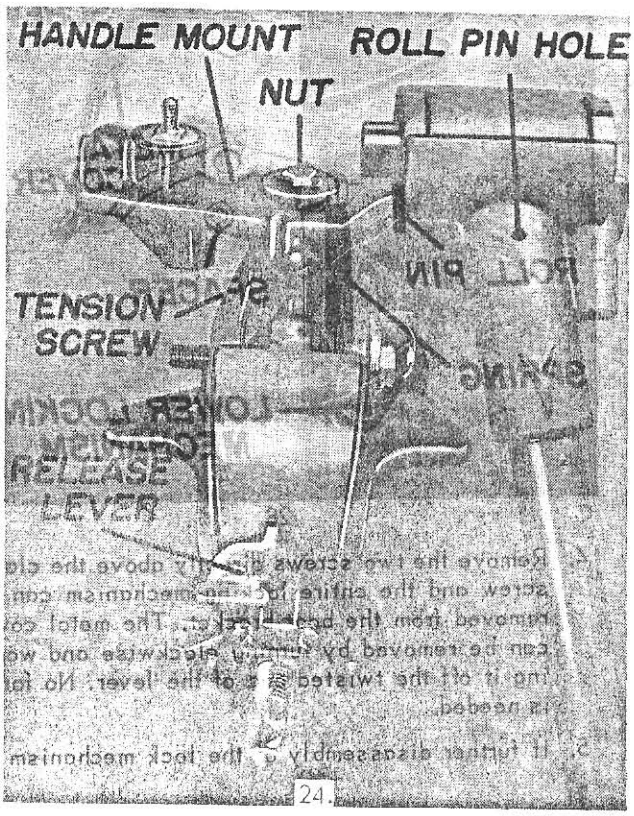
Disassembly

1. Disconnect the spark linkage, remove the cotter pin and linkage shown in fig. 23 .



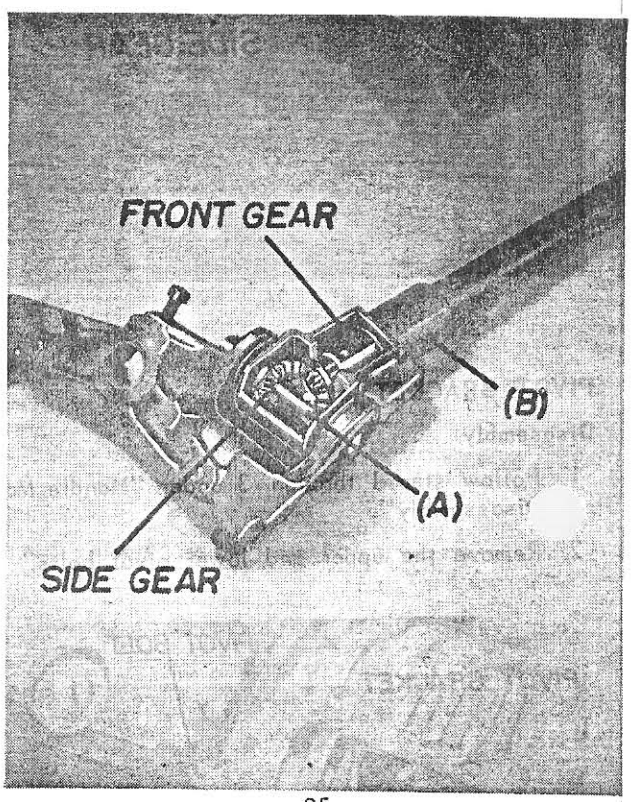
23.

2. Remove the two (2) lower mount nuts and the two (2) nuts securing the lower motor casing to the handle mount.



24.

3. Lift the motor up and off the handle mount.
4. Loosen the steering tension screw and remove the handle to pivot bracket nut. See fig. 24.
5. To remove the steering handle and gear, align the roll pin securing the handle to the front gear through the hole shown in fig. 24 , and drive the roll pin out with an appropriate punch.
6. Pull the steering handle straight out and the front gear can be removed. See fig. 25.
7. Remove bolt (A) and the side gear and bushing. The steering handle housing (B) can now be removed. See fig. 25.



25.

Assembly

Reverse the order of disassembly and follow these special instructions:

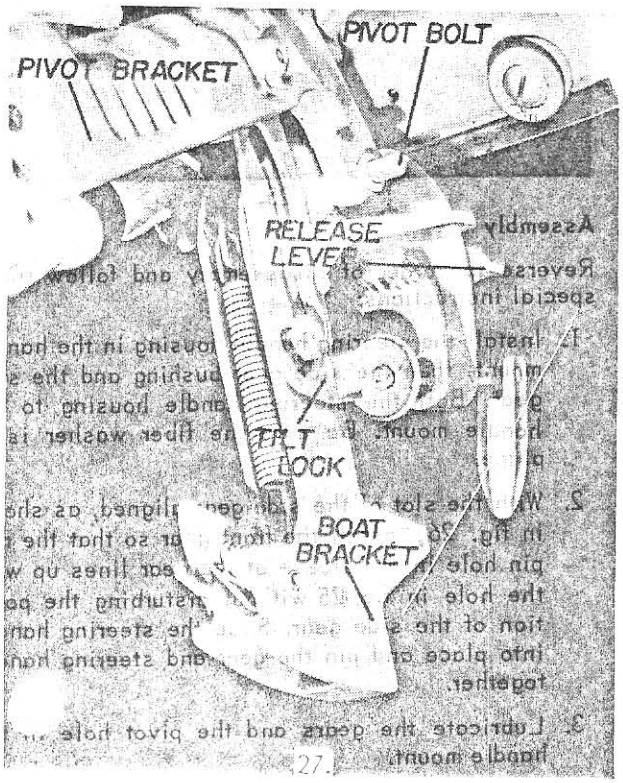
1. Install the steering handle housing in the handle mount, then the side gear bushing and the side gear. Bolt the steering handle housing to the handle mount. Be sure the fiber washer is in place.
2. With the slot of the side gear aligned, as shown in fig. 26, install the front gear so that the roll pin hole in the sleeve of the gear lines up with the hole in fig. 25 without disturbing the position of the side gear. Slide the steering handle into place and pin the gear and steering handle together.
3. Lubricate the gears and the pivot hole in the handle mount.
4. Torque the nuts and bolts according to the torque chart on page 143 as you continue the assembling.

26.

PIVOT BRACKET

Disasembly

1. Follow step 1 through 3 under "Handle Mount Disassembly".
2. Remove the upper and lower pivot bolts.



27.

3. Remove the tilt lock. See fig. 27.
4. Move the reverse lock up to the open position and remove the boat bracket pivot bolt. See fig. 27, and withdraw the boat bracket from the pivot bracket.

Assembly

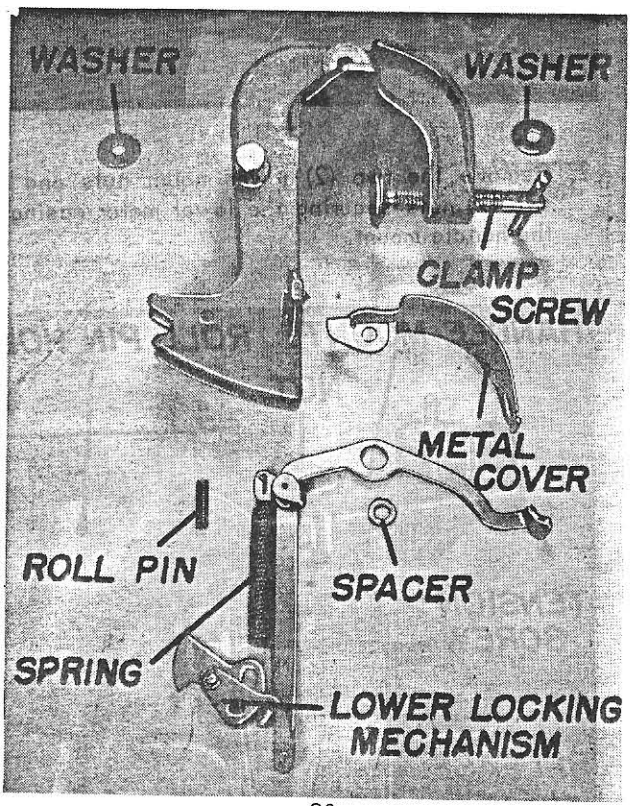
Reverse the order of disassembly and follow these special instructions:

1. Install the boat bracket by aligning the holes in the pivot bracket, boat bracket, two washers, and the reverse lock mechanism with a drift pin. Replace the pivot bolt.

BOAT BRACKET – REVERSE LOCK MECHANISM

Disassembly

1. Remove the screw and spacer securing the tilt lock to the boat bracket.
2. Remove the pivot bolt securing the boat bracket to the pivot bracket and withdraw the boat bracket.
3. Press the roll pin securing the lower locking mechanism to the boat bracket. See fig. 28.



28.

4. Remove the two screws directly above the clamp screw and the entire locking mechanism can be removed from the boat bracket. The metal cover can be removed by turning clockwise and working it off the twisted end of the lever. No force is needed.
5. If further disassembly of the lock mechanism is

required, remove the lock tension spring before proceeding.

Assembly

Reverse the order of disassembly and follow these special instructions:

1. If the lock tension spring has been removed, install it as shown in fig. 28 before assembling the locking mechanism in the boat bracket.
2. Lubricate the moving parts of the mechanism.
3. Align the lower locking mechanism using a drift pin, and press in the roll pin securing the lower lock mechanism to the boat bracket.
4. Install the boat bracket by aligning the holes in the pivot bracket, boat bracket, two washers, and the reverse lock mechanism with a drift pin. Replace the pivot bolt.
5. Refer to the torque chart on page 143 to properly torque all fasteners.

LOWER MOTOR CASING

The lower motor casing houses the water and bailer lines, the upper shifting mechanism, idle relief assembly, top housing latches, throttle advance arm, and the fuel system bleed valve. The front panel assembly is mounted on the lower motor casing. The lower motor casing also provides support between the powerhead and the lower unit.

The casing and its components require only visual inspection to determine if their condition warrants replacement, unless obviously damaged.

The latches can be replaced by removing the lower screws securing the front panel to the lower motor casing and pulling the lower part of the panel out and at the same time pulling the release button out. Drive the roll pin out securing the latch to the lower motor casing and the spring and latch can be replaced. Reverse the foregoing procedure to install a new latch. The panel and release button should be pressed into place together. When the panel is flush, press hard on the release button to engage the slot in the button with the latch.

The front panel can be removed by removing the choke rod, disconnecting the shift lever, and pulling out, removing the starter handle (tie a knot in the starter cord to prevent it from being pulled into the starter), remove all the screws securing the panel to the lower motor casing. Pull the lower part of the panel out along with the latch release buttons, then slide the panel up and off the lower motor casing. Reverse the procedure to install the panel and be certain the molding on either side of the shift lever slot is held securely in place.

Disassembly

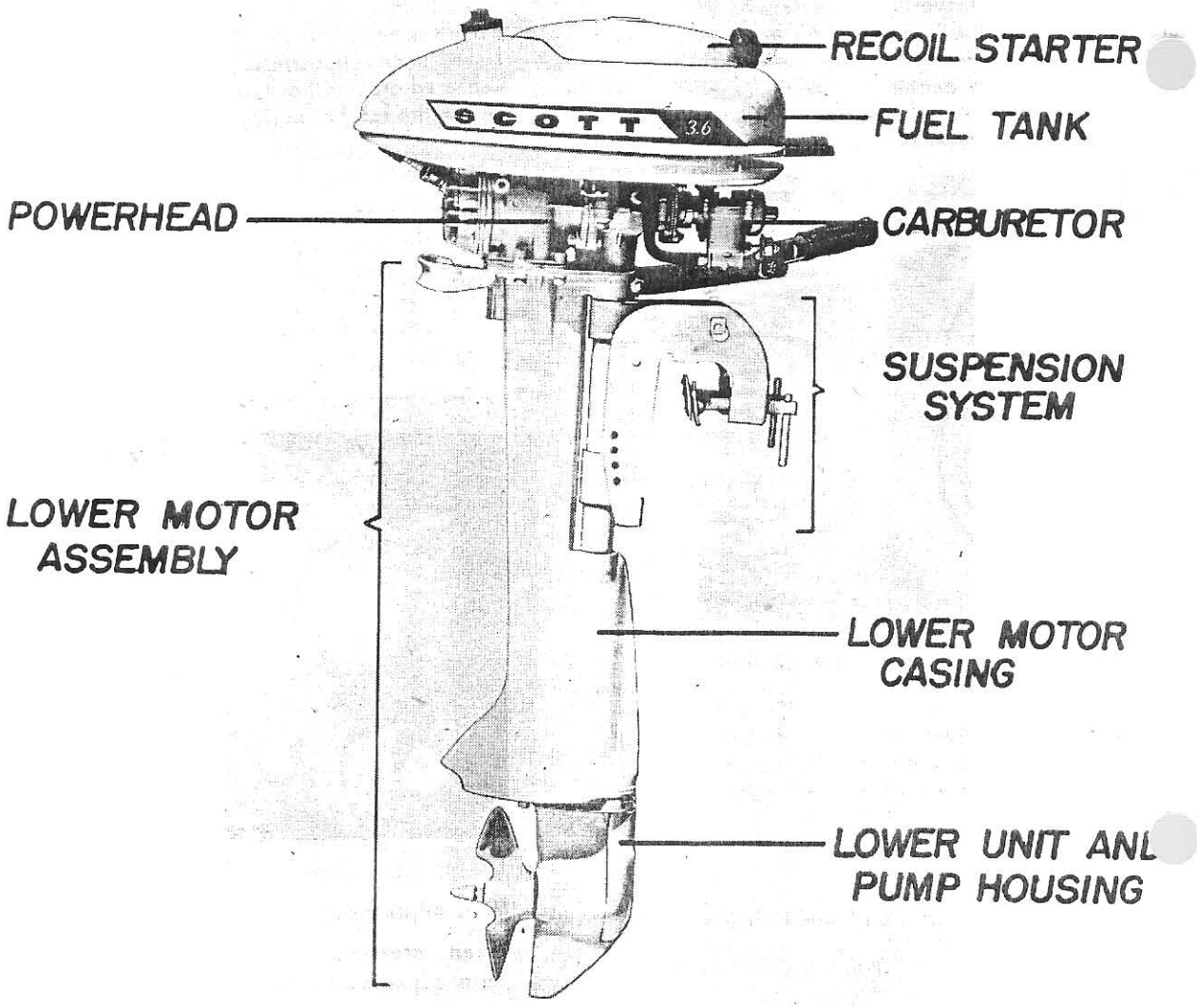
1. Remove the manual starter, flywheel, powerhead, lower unit, and the pivot bracket as explained previously in this section.

This one step completely exposes the lower motor casing and the water and bailer lines, idle relief, and upper shift mechanism can be replaced if necessary.

2. Assemble in the reverse order of disassembly. Refer to the appropriate section to replace each assembly.

SECTION IX

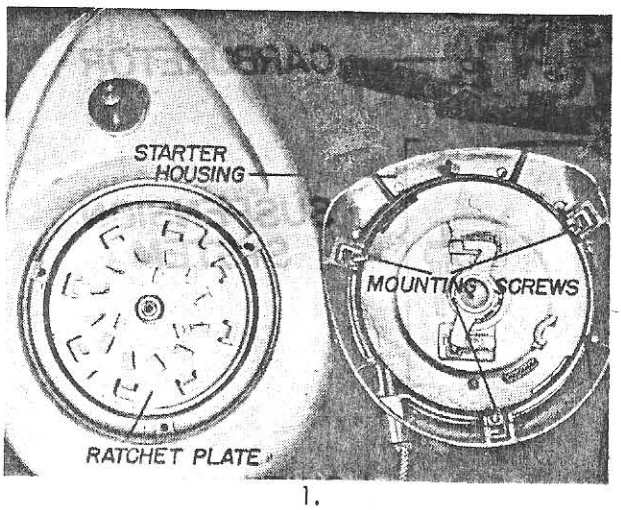
3.6 H.P. MODEL



Horsepower O.B.C. Certified	3.6 H.P. @4000 RPM
Normal Full Throttle Range	3600 to 4400 RPM
Number of Cylinders	1
Bore and Stroke	2 1/8" X 1 3/4"
Piston Displacement	6.23 Cu. In.
Gear Ratio	13:21
Fuel Tank Capacity	8 pints
Fuel Mixture	
Break-In	3/4 Pint oil to 1 gal. gas.
Normal Operation	3/8 Pint oil to 1 gal. gas.
Initial Carburetor Setting	
Main	Set main knob to No. 6
Idle	1/2 to 3/4 Turn Open (counterclockwise) from fully closed position
Spark Plugs	Champion H10JM gapped .035"
Recommended Breaker Point Setting	.020"
Lower Unit Lubrication	Texaco "Moropa"
Propeller Diameter and Pitch	7 1/2" X 6" (2 blade)

RECOIL STARTER

For disassembly instructions on the recoil starter see the Operating Principles section. To remove the starter, remove the three screws which secure the starter to the fuel tank. An auxilary starter pulley is located directly beneath the recoil starter. The starter must be centered over the crankshaft if it is to operate correctly. To center the starter remove the snap cap from the top of the starter hous-



1.

ing and loosen the fuel tank mounting screws. Using a starter centering pin, part No. 509-4146, insert the pin through the pivot bolt hub and move the fuel tank until the pin drops into the hole in the end of the crankshaft, then retighten the tank mounting screws.

FUEL SYSTEM

The fuel system is made up of the following parts:

1. Fuel tank
2. Carburetor
3. Manifold and reeds

For information on how each of these components operates, consult the Operating Principles section.

Fuel Tank

The 3.6 fuel tank is a gravity feel type which is mounted directly above the powerhead. Specific information on the servicing and repair of the tank assembly can be found in the Operating Principles section of this manual.

Disassembly

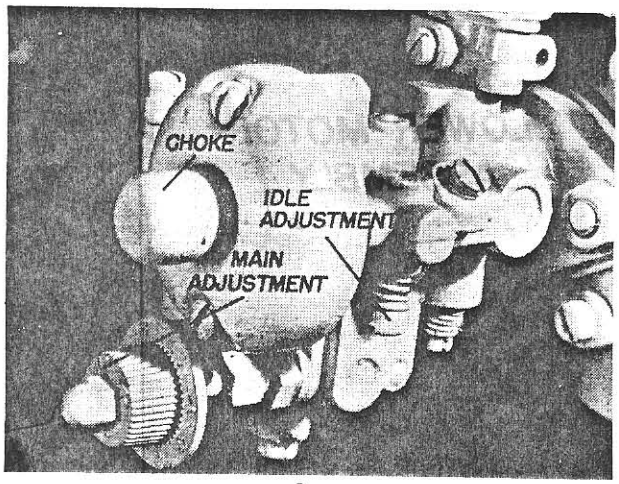
1. Remove the four screws which secure the lower skirt to the fuel tank spacers.
2. Remove the recoil starter.
3. Disconnect the fuel line from the carburetor, then remove the spacer nuts and lockwashers which secure the tank to the mounting brackets.
4. The tank and lower skirt can now be removed from the engine. The tank shut-off valve and fill cap assembly can be removed, if necessary.

Assembly

To assemble the fuel tank reverse the procedure listed under Disassembly. Be sure that the tank is centered around the flywheel and its height is 3/16" below the ratchet pulley.

Carburetor

The operation of all the carburetors is basically similar and is described in the Operating Principles section. The 3.6 model uses a Tillotson AJ series side bowl carburetor. Following are instructions on making the various adjustments required by the carburetor.



2.

Main Adjustment

When starting the engine turn the numbered main adjustment knob to the number 6.

Idle Adjustment

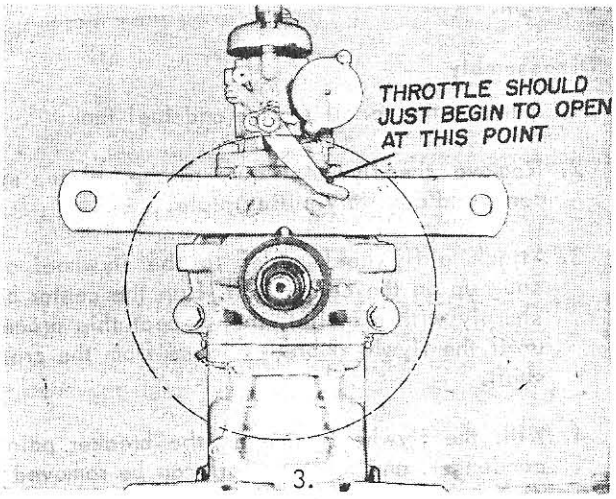
The idle adjustment is preset at the factory; however, due to changes in atmospheric pressure it may require resetting. With the engine warmed up and the throttle in the "slow" position turn the idle screw toward the closed position until the best idling position is found. This setting will generally be from 1/2 to 3/4 turn open from the fully closed position.

Float Adjustment

No float adjustment is required other than making sure that the spring clips which secure the float to the inlet valve shaft are in place.

Synchronization

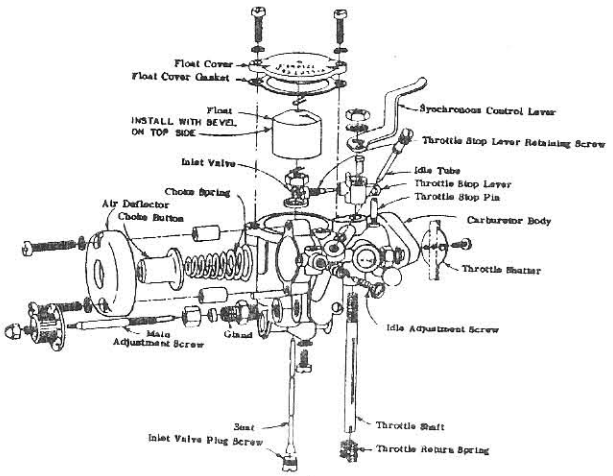
In order for the engine to operate properly, the opening of the throttle valve must be synchronized with the advance of the spark. To make this adjustment, loosen the nut on the carburetor throttle shaft. Advance the magneto lever until the pin on the bottom edge of the stator plate comes into con-



3.

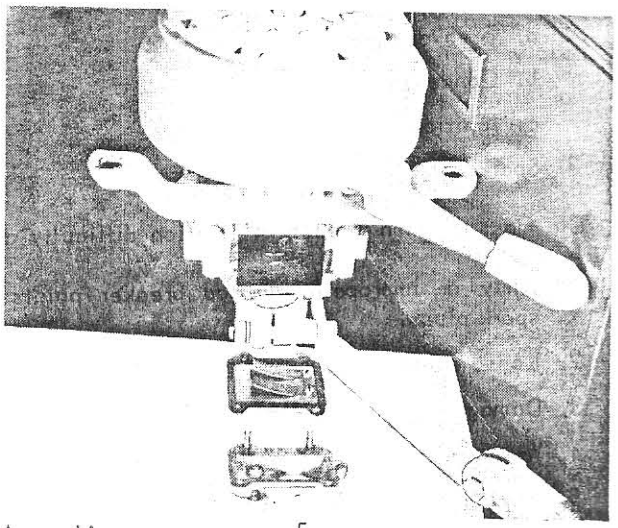
tact with the end of the throttle cam. The cam should then be pivoted so that the pin follows the straight edge of the cam but does not open the throttle until it reaches point A, as shown in figure 3. At this point the throttle will just begin to open.

Disassembly: AJ Carburetor



4.

1. Remove the fuel line and the two nuts which hold the carburetor to the intake manifold.
2. Remove the carburetor from the manifold. Remove the main adjustment screw by unscrewing the packing nut from the fuel bowl and then unscrewing the adjustment screw.
3. Remove the choke assembly by taking out the two screws found at the front of the air horn.
4. Remove the idle adjustment screw. Remove the idle tube.
5. Remove the two screws holding the float bowl cover in place and remove cover and gasket. Turn the carburetor over and remove the drain screw and the intake valve plug screw.
6. To remove the float, unsnap the upper clip from the inlet needle and push the inlet valve down flush with the top of the float. The float can now be carefully lifted out.
7. Remove the clip on the inlet valve shaft. Remove the inlet valve.
8. With a socket wrench, remove the inlet valve seat from inside the float bowl.
9. If it is necessary to remove the throttle valve and shaft, remove the screw holding the valve to the shaft. Disengage the spring from the throttle shaft and the shaft can be removed from the carburetor body.


5

Assembly

To assemble the carburetor reverse the order of disassembly. No float adjustments are required when assembling the carburetor. Tighten the packing nut on the main adjustment screw so that a slight effort is required to turn the screw. This will prevent leakage when the adjustment screw is turned.

Manifold and Reeds

No maintenance is required by the manifold and reeds other than checking these parts for faulty operation. Gaskets must be in good condition and must be replaced if they show signs of leakage or if the manifold is removed from the engine. The reed valves must seat flat against the reed plate. If the reeds or reed stops are bent or distorted they must be replaced. Do NOT attempt to straighten reeds or reed stops by bending. If the manifold has been damaged it should be replaced.

Disassembly

1. Disconnect the fuel line and remove the nuts which secure the carburetor to the manifold.
2. Remove the screws which secure the skirt to the fuel tank brackets.
3. Remove the screws which secure the manifold to the crankcase, then remove the manifold, gaskets, and reed assembly.

Assembly

Reverse the steps listed under disassembly. Be

sure to replace the manifold and reed plate gaskets when assembling the engine.

IGNITION SYSTEM

The 3.6 model has a magneto type ignition. For information on how the magneto operates, consult the Operating Principles Section.

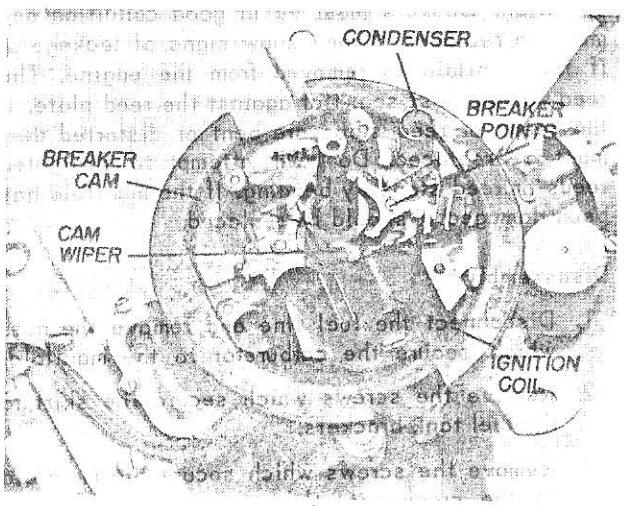
The ignition system consists of the following components:

1. Flywheel
2. Stator plate
   a. Breaker points
   b. Condenser
   c. Ignition coil
3. Spark plug

The most common causes of ignition difficulty are:

1. Dirty or improperly gapped breaker points or spark plugs.
2. Loose connections.
3. Damaged coil or condenser.
4. Wrong plugs.
5. Engine not synchronized.

Specific information on testing the ignition coil and condenser can be found in section X. Normal maintenance involves periodic cleaning and gapping of the plugs and breaker points. With the starter, flywheel, and spark plug leads removed, rotate the crankshaft until the breaker arm rests on the high point of the breaker cam. Loosen the breaker point mounting screw and insert a .020" feeler gauge between the points then tighten the mounting screws. Recheck the setting to see that the feeler gauge will slide freely between the points.



6.

The recommended spark plugs for the 3.6 H.P. model are Champion H10JM spark plugs gapped at .035".

Check all electrical connections to be sure that they are tight.

Disassembly

1. Remove the recoil starter and fuel tank.
2. Remove the flywheel nut, ratchet plate, spacers, and auxiliary pulley plate.
3. Attach a flywheel puller to the flywheel and snug up on the center bolt. Rap the center bolt sharply with a mallet, then repeat this process until the flywheel breaks loose from the crankshaft.
4. With the flywheel removed the breaker points, condenser, and ignition coil can be removed by disconnecting their lead wires and mounting screws, or clips, in the case of the ignition coils. Lift the breaker cam off the crankshaft.
5. To remove the stator plate disconnect the spark plug lead, and loosen the stator plate friction screw. Lift the stator plate off the engine.
6. The cam wiper, magneto lever, and synchronous control pin can be removed and replaced if necessary.

Assembly

1. Attach the magneto lever and the synchronous control pin to the stator plate.
2. Replace the breaker points, coils, and condensers, and attach their lead wires.
3. Place the stator plate on the engine and secure the tension screw. Place the breaker cam on the crankshaft so that the end with the arrow is on top.
4. Gap the breaker points.
5. Place the flywheel and key on the engine. Attach the ratchet and pulley plates to the flywheel. Torque the flywheel nut to 400 inch pounds.
6. Replace the fuel tank and recoil starter.

This completes the steps necessary to assemble the magneto. Tighten the tension adjustment screw so that the magneto lever can be advanced smoothly and will not "creep" from vibration.

POWERHEAD

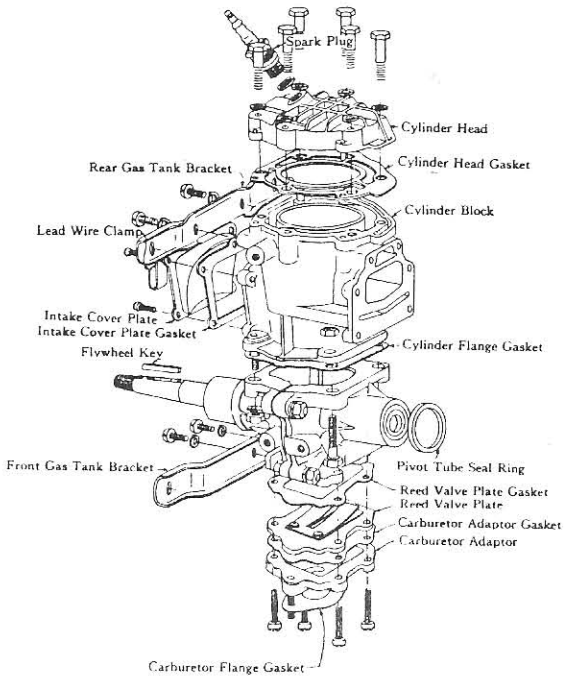
Before initiating any powerhead repairs be sure to read the Powerhead Repair Section in the Operating Principles Section of this manual.

Disassembly

1. Remove the recoil starter, tank and skirt.

2. Using a flywheel puller, remove the flywheel, then remove the magneto breaker cam.
3. Loosen the magneto friction screw, then disconnect the spark plug lead and lift the magneto off the engine.
4. Disconnect the fuel line, then remove the carburetor, manifold, and reed valves.

"3.6 HP MODEL POWERHEAD"

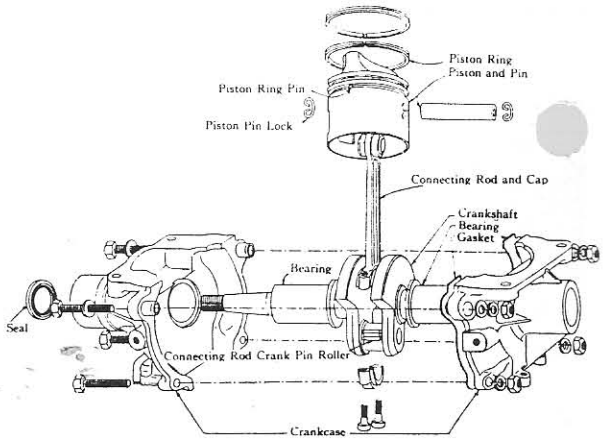


7.

5. Remove the fuel tank mounting brackets and spark plug.
6. Remove the powerhead from the lower motor casing.
7. Remove the cylinder head, then separate the block and crankcase halves.
8. Remove the rod cap, marking it so that it will be assembled in the same position and remove the rod bearings.
9. Use a ring expander to remove the piston rings.
10. Remove the piston pin locks, then press the wrist pin out of the connecting rod and piston.

Assembly

1. Fasten the piston to the connecting rod. Press the wrist pin in until it is about 1/8" beyond the inside boss, then put the rod in place and press the wrist pin in the rest of the way until both piston locks can be pushed in place. If the piston pin locks do not fit tightly, remove and spread them. A long-nose pliers will aid in removing these locks. A loose piston pin lock will rapidly enlarge the groove. A correct fit between the rod and wrist pin will allow the piston to teeter from its own weight.



"3.6 HP CRANKCASE ASSY."

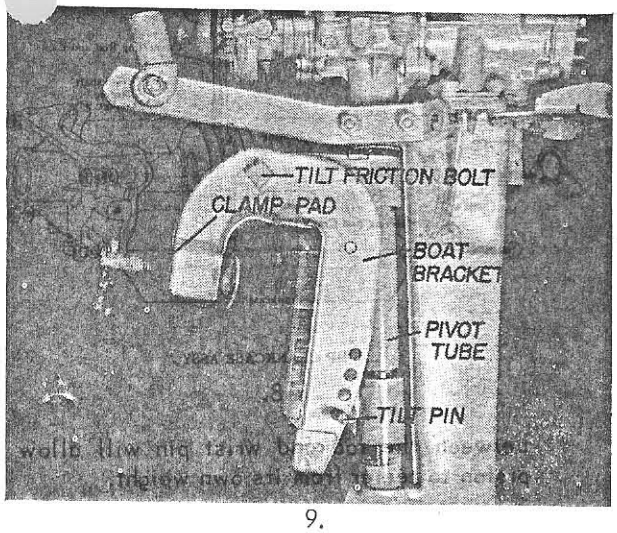
8.

2. To fasten the connecting rod to the crankshaft, coat the rod and cap bearing surfaces with a layer of grease and lay 12 needles in each half. Place the rod on the crankshaft with the piston baffle facing the flywheel end of the shaft. Place the cap in position over the rod so that the marks on cap and rod are on the same side. Properly installed, the weight of the piston will hold it down when the shaft is rotated. Torque the connecting rod cap screws to 75 inch pounds. Properly installed, the side of the rod marked "top" should face toward the flywheel.
3. Place the upper and the lower halves of the crankcase in position on the shaft. Use a new gasket on each side and bolt the halves together.
4. Install rings on piston. Use a ring expander and place the rings on the piston so that the beveled edge of the ring faces the piston dome.
5. Slide the cylinder block over the piston with a new gasket in place. Use care in positioning the rings and compressing them over the pins. The beveled edge of the cylinder liner will help to compress the rings, eliminating the the necessity of ring compressor. Bolt the cylinder block in place.
6. Bolt the head on using a new gasket. Draw up all head nuts to the reasonable tightness and then tighten them individually to a torque reading of 80 inch pounds.
7. Replace the tank brackets, magneto, manifold, reeds, carburetor, tank and manual starter. Torque the flywheel nut to 500 inch pounds.

SUSPENSION SYSTEM

The suspension system consists of the boat brackets, steering handle, clamp screws, pivot tube, and pivot bracket. To properly maintain the suspension

system, periodically grease the pivot tube. Be sure all screws and bolts are tightened securely. Adjust the steering tension screw so that the engine will hold its course and will steer smoothly. In many cases the bracket assemblies can be repaired by welding.



9.

Disassembly

1. Remove the bolts which secure the powerhead to the lower motor casing. Then lift the powerhead off the driveshaft.
2. Remove the two bolts which secure the steering handle assembly to the engine. Separate the grip, handle, and spring.
3. Loosen the steering friction screw, then remove the pivot tube.
4. Remove the tilt pin, clamp pad retainers, and clamp screws. Remove the pivot bolt and spacer then separate the boat bracket and pivot bracket.
5. Remove the steering friction pad, retainer, washer, and friction screw.

Assembly

To assemble the suspension system reverse the steps listed under Disassembly. Be sure to adjust the steering friction screw so that the engine will steer smoothly. Tighten the pivot bolt so that the engine can be tilted freely and will hold its position when tilted.

LOWER MOTOR CASING

The lower motor casing provides the necessary support between the powerhead and the lower unit. It also acts as a housing for the water line and driveshaft.

To maintain the lower motor casing inspect all gaskets and seals, replace if necessary. Inspect the water line for signs of leaks, replace the water line or seals if necessary. Inspect the exterior of the casing for signs of damage, if the casing is damaged it should be replaced. Painting instructions can be found in the General Information section.

Disassembly

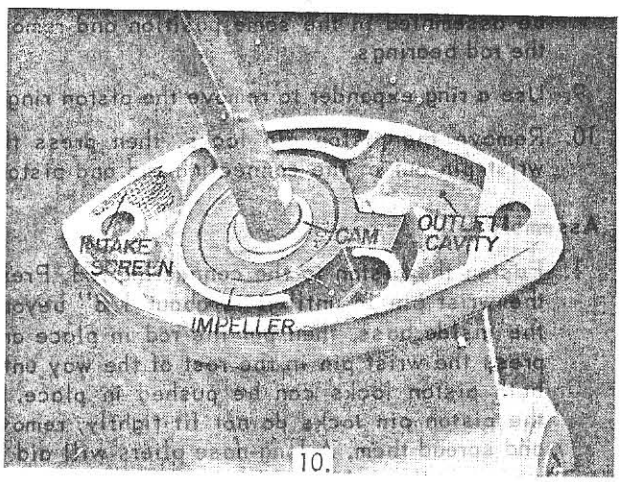
1. Remove the screws which secure the lower motor casing to the powerhead, then lift the powerhead off the lower motor casing.
2. Remove the lower unit vent and grease plugs. Drain the lower unit, then remove the bearing cap.
3. Remove the nuts which secure the lower unit to the lower motor casing and separate these parts.
4. Remove the steering arm.
5. Loosen the steering friction screw, and remove the pivot tube.
6. Remove the cover plate, gasket, and water line seal from the top of the casing.
7. Remove the sleeve and seal from the bottom of the water line, then remove the water line.
8. The lower motor casing to lower unit studs can be removed and replaced if necessary. Apply Loctite to the threads when replacing these parts.

Assembly

Reverse the preceding steps to assemble the lower motor casing. Torque the lower unit bearing cap screw to 75 inch pounds.

LOWER UNIT

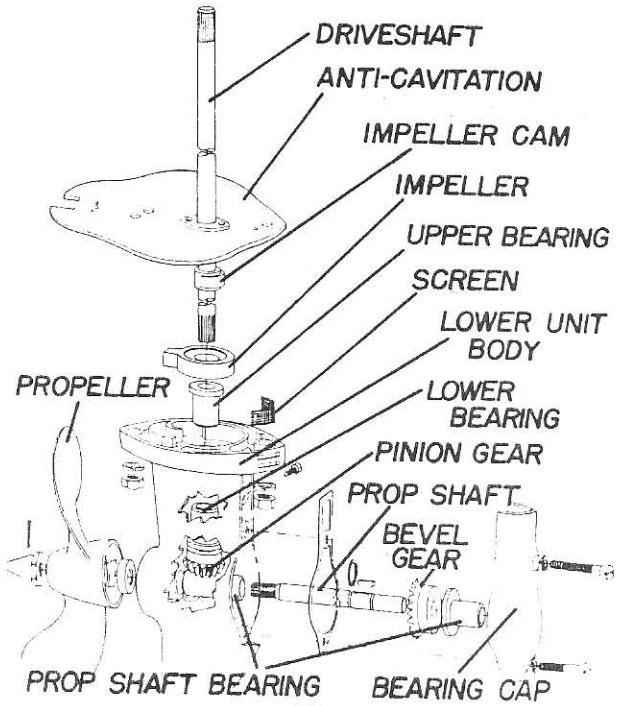
The 3.6 H.P. lower unit is a non-shift type which also houses the water pump. The lower unit should be periodically filled with outboard gear lubricant. Remove the vent and grease plugs, insert the tube snout into the grease plug opening and force grease into the lower unit until grease emerges from the vent opening. Fill in an upright position. The 3.6 H.P. water pump is a displacement type pump which is activated by a cam on the driveshaft. Water enters through the slotted front portion of the lower unit casing and passes through a screen. This screen



10.

should be cleaned of any residue that may have accumulated during previous engine operation. As the impeller moves, water will pass around the impeller into the outlet cavity. When this cavity is filled, the movement of the impeller will then force the water upward into the powerhead. See fig. 10.

Disassembly – See Fig. 11.



11.

1. Remove the vent and grease plugs and drain the lower unit. Remove the propeller nut, propeller, shear pin, and seal.
2. Remove the two bearing cap screws.
3. Remove the nut thus exposed and the corresponding nut on the other side, above the propeller. This allows you to pull off the lower unit, including the driveshaft and anti-cavitation plate.
4. Pull the propeller shaft out. This releases the pinion gear from the driveshaft.
5. Pull out the driveshaft.
6. If it is necessary to replace either the propeller shaft bevel gear or the propeller shaft, the bevel gear can be removed from the propeller shaft by pressing the shaft out of the gear.
7. The water pump cam on the driveshaft is pressed on over a knurl on the shaft. This cam should be pressed on until the measurement from the bottom of the shaft to the bottom of the cam is exactly 3 1/4". If a stainless steel cavity is installed, the measurement should be 3 1/32".

Assembly

1. With the cam in position on the driveshaft, insert the driveshaft into the lower unit body.
2. Slide the pinion gear on the shaft.
3. If the gear has been removed from the propeller shaft, press it back on the shaft over the Woodruff key, against the gear retaining ring.
4. With the bevel gear on the prop shaft, insert the shaft so that the two gears mesh.
5. Replace the water pump impeller. The side marked "TOP" must face upward.
6. Place the anti-cavitation plate over the driveshaft. The side marked "TOP" must face upward.
7. Grease the driveshaft splines.
8. Replace the entire unit on the lower motor casing. It may be necessary to rotate the motor a few degrees to allow the shaft to engage the spline. Bolt in place.
9. Install the bearing cap in place using a new gasket.
10. Replace the propeller.

SECTION X

ACCESSORY INSTALLATIONS, TESTING AND TOOLS

ACCESSORY INSTALLATION, TESTING AND TOOLS

This section is divided into the three parts listed below.

A. Accessory Installation

B. Trouble-shooting and Testing

C. Tools

Part A deals with the steps necessary to install the accessories which are available for Scott motors. Detailed step by step instructions are included along with information on any adjustments that may be required.

Part B includes a trouble shooting chart which will aid in diagnosing engine difficulties. Information on how the engine components can be tested to determine if they are operating properly is included in this part.

Part C pertains to the tools which we feel are necessary to effectively service the 1960 models. A list of these tools is provided so that the dealer will have a guide when ordering new or replacement equipment.

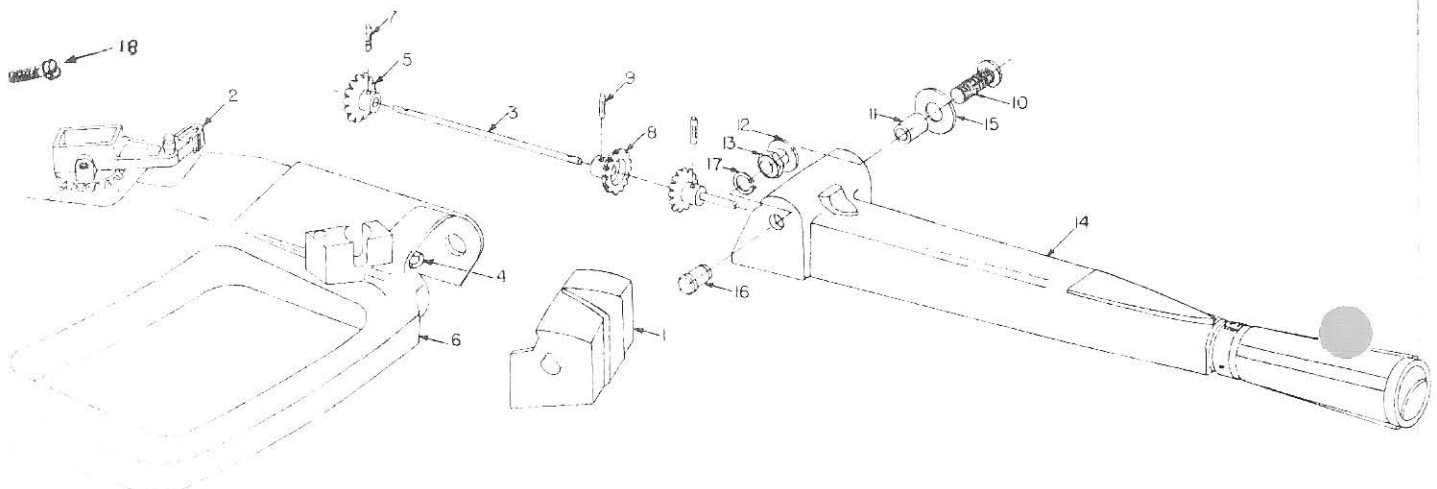
A. ACCESSORY INSTALLATION

INSTALLATION INSTRUCTIONS FOR THE STEERING HANDLE KIT – Part No. 135-9854

The Manual Steering Handle Kit can easily be installed if the illustration and instructions below are closely followed.

To install the Steering Handle, use the following steps:

1. Remove Plastic Insert (1) by pushing sides in and pulling insert down.
2. Remove Motor Hood by lifting up latches on each side.
3. Place Hand Speed Control (2) in STOP position.
4. Insert Shaft (3), provided with the kit, into Bushing (4) until it protrudes on the inside of Motor Support.
5. Insert the heavier of the two Gears (5), provided with the kit, by holding with two fingers and placing with the hole up, on the end of the Shaft (3) that protrudes on the inside of the Motor Support (6).
6. Line up the hole in the Shaft with the hole in the Gear and drive the Pin (7) into this hole until flush with the Gear (5).
7. Place the remaining Gear (8) onto the Shaft (3) which protrudes from the front of the Motor Support (6).
8. Line up the hole in the Gear (8) with the hole in the Shaft (3) and drive the Pin (9) into this hole until flush with the Gear (8).
9. Remove the Screw (10), Bearing Bushing (11), Washer (12), and Nut (13) from the Steering Handle (14).
10. Place the Steering Handle (14) into the recess in the Motor Support (6), making sure the handle is set at the STOP position. Place the Friction Washer (15) between the Steering Handle (14) and the Motor Support (6) as shown in illustration.
11. Insert the Screw (10) and Bearing Bushing (11) into the Motor Support (6) and Steering Handle (14), then place Washer (12) and Nut (13) on Screw (10).
12. Insert the Clevis Pin (16) into the Motor Support (6) and Steering Handle (14), then place the Retaining Ring (17) on Clevis Pin (16) as shown in the illustration.
13. Insert Screw (18) in the hole located at the top of the pivot bracket (1960 models – remove the screw already in place in this hole). Tighten Screw (18) until the desired steering tension is achieved.



INSTALLATION AND OPERATING INSTRUCTIONS FOR THE DOUBLE LEVER REMOTE CONTROL 12, 25, 40 AND 60 OUTBOARD MOTORS FOR 1960

Correctly installed and operated, the double lever control will provide dependable, safe, efficient control of your Scott outboard motor.

Aircraft type offset levers and Tru-Lay push-pull cables are used to provide positive control of the shift and throttle mechanisms.

OPERATING INSTRUCTIONS

Once the control has been installed according to the following instructions, its operation is simple. When starting the motor place the shift lever in "neutral" and the throttle lever slightly above the "slow" position. After the motor starts, move the throttle lever to "slow", then proceed to shift into "forward" or "reverse".

When operating your motor always remember to place the throttle lever in the "slow" position before shifting from one gear to another. Use a POSITIVE MOTION when shifting into "forward" or "reverse", NEVER EASE the motor into gear.

Properly installed and adjusted the shift (offset) lever will be almost vertical, with the motor in neutral. Caution: Avoid shifting rapidly from forward to reverse or vice versa. Hesitate slightly in neutral to allow components to align before completing the shift. Never overspeed the motor while in reverse gear.

The motor should be in the full down position when in operation. A reverse lock will prevent the motor from raising out of the water when operating in reverse.

INSTALLING THE CONTROL BOX AND CABLES

Installation of your double lever control is not difficult. Reading over the instructions once or twice before you actually start to install the control will save you a great deal of time and will help you to avoid any difficulty encountered.

Allow yourself plenty of time when making the installation, don't rush yourself. By paying close attention to the instructions and following them step by step this will be a relatively easy job.

Make sure to allow room for the control levers to swing through their complete arc. Care should be taken not to place cables where they might be stepped on or kinked. Avoid sharp bends when installing the cables.

For purposes of identification we have assigned a letter to each of the four holes in either end of the control box. See diagram 3. Holes A and C are in the throttle side of the control and holes B and D are in the shift side of the control. Diagram 3 shows the end of the control box that faces toward the motor when the control is mounted on the port or starboard side of the boat.

To avoid confusion the ends of the cables that thread into the control box will be called the "control" ends of the cables and the ends that attach to the motor will be called the "motor" ends. The cable that threads into the shift side of the control will be called the "shift" cable and the cable that threads into the throttle side of the control will be called the "throttle" cable.

INSTALLATION INSTRUCTIONS FOR 1960 25 HP MODELS

Your double lever control is shipped ready for installation on the 25 H.P. model. Following are step by step instructions for making this installation:

1. Depending upon which side of the boat you mount your control, thread the remote cables into the holes in the end of the control box that faces toward the motor. Determine whether the throttle cable will need to be the longer or shorter cable. Thread the sleeve of the throttle cable into hole A until its threads are bottomed. Thread the shift cable sleeve into hole B until its threads are bottomed.

2. At the motor ends of both cables thread the anchor balls onto the cable sleeves. Thread the end clips onto the cable ends until the threads are bottomed. Note: Do Not use a pliers to hold or turn the cable as the cable surface could be marred.

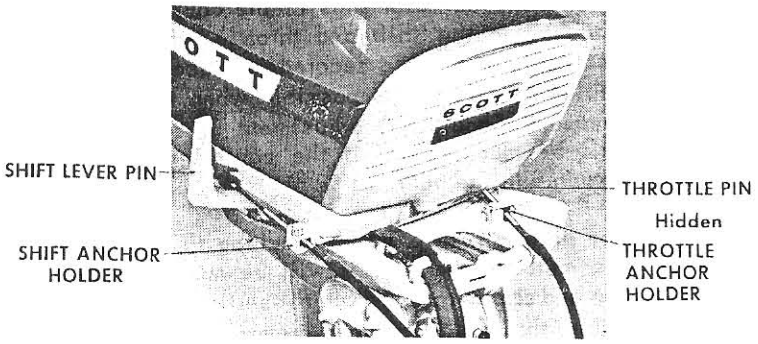
3. Move both control levers back toward the cables. With the cables laid out in a straight line grasp the sleeve of one cable at the motor end, and push in on the cable until it comes into contact with the clevis in the control box. Turning the cable in a clockwise direction thread the cable into the clevis until the threads are bottomed. Repeat this operation for the other cable.

4. Route the cables along the gunwale back to the motor. Avoid any sharp bends.

5. Place the motor in forward gear and retard the throttle all the way to the idle position. At the control box move the shift (offset) lever forward, and the throttle (straight) lever all the way back toward the cables.

6. Being careful not to disturb the control levers, attach the shift end clip to the shift handle pin. Attach the shift anchor holder to the side of the lower hood assembly with the screw provided. After the anchor holder has been secured, thread the anchor ball on the sleeve until it will slide freely into its holder. See picture A.

7. Attach the throttle end clip to the pin on the



PICTURE -A

throttle arm. Then thread the anchor ball until it will slide freely into its holder.

8. After you have threaded the cable and sleeve into the control box and have routed the cables back to the motor and attached them, the next step is to test control adjustment. Check and adjust the control in the following manner:

THROTTLE ADJUSTMENT

A. With the shift lever in forward or reverse gear, hold the control box firmly and move the throttle (straight) lever all the way forward, remove the end clip and check to see that the throttle is fully advanced.

B. Attach the end clip and move the lever all the way back to the idle position. Once again remove the end clip and check to see that the throttle is fully retarded.

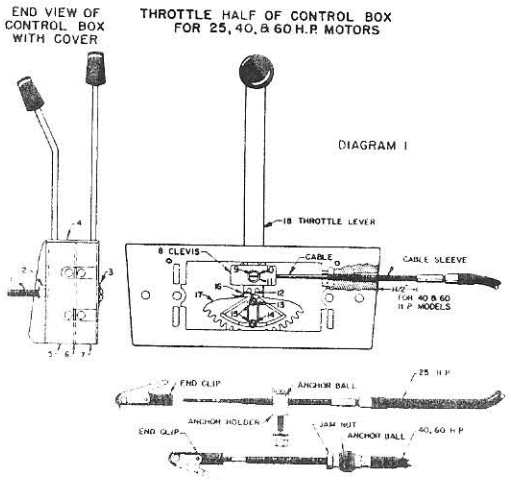
C. If the control lever will fully advance and retard the throttle then no adjustments are necessary. If the throttle is not fully advanced or retarded then the cable travel will need to be increased to correct this.

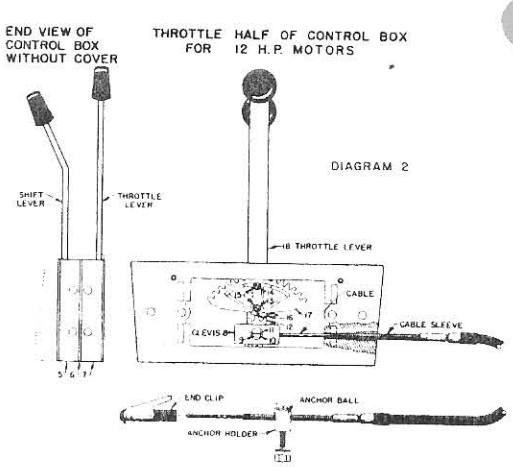
To increase full throttle travel thread the anchor ball toward the end clip. To increase the idle travel thread the anchor ball away from the end clip.

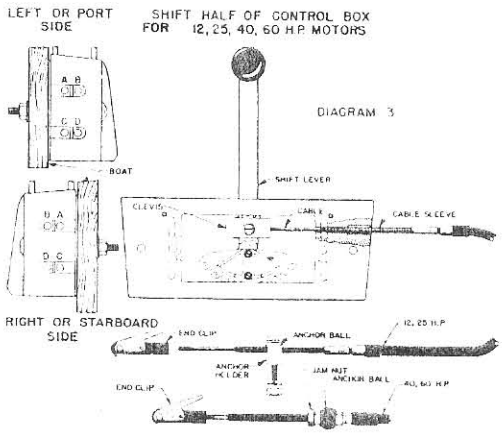
SHIFT ADJUSTMENT

A. Retard the throttle to the idle position. Move the shift (offset) control lever all the way forward. Remove the end clip and check to see that the motor is in full forward gear.

B. Attach the end clip and pull the shift control lever all the way back. *Note:* When the motor is not running it may be necessary to turn the propeller slightly in order to shift into reverse. Check to see that the motor is in full reverse gear.







C. If the control lever shifts the motor into full forward and reverse gear then no adjustments are necessary. If the motor is not shifted fully into one gear then the cable travel will have to be increased for this gear.

To increase the cable travel into reverse, thread the anchor ball away from the end clip.

To increase the cable travel into forward, thread the anchor ball toward the end clip.

D. Properly adjusted the control should shift fully into forward and reverse gear and the lever will be nearly vertical to the box when in neutral gear.

11. After the controls have been accurately adjusted, make sure that the attachments at the motor are made and that the control box is mounted securely to the boat. Be sure when mounting your controls to allow sufficient room for the levers to swing through their complete arc.

12. Instructions for applying the decals are printed on the back of each decal. Position the decals so that their markings correspond to the movement of the levers.

INSTALLATION INSTRUCTIONS FOR 1960 40 AND 60 H.P. MODELS

Your double lever control is shipped ready for installation on the 1960 40 and 60 H.P. models. Following are step by step instructions for making this installation.

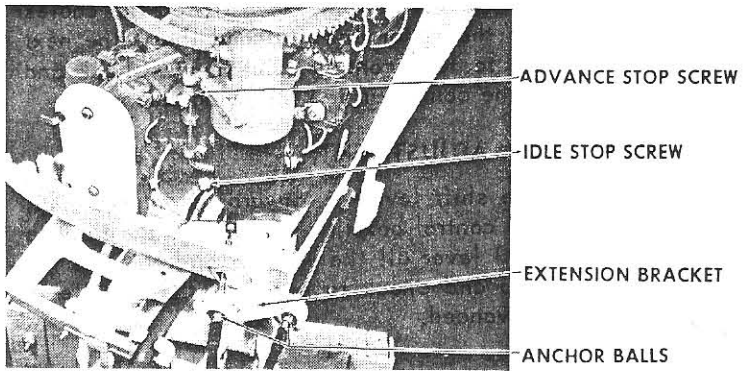
1. Depending upon which side of the boat you mount your control, thread the remote cables into the holes in the end of the control box that face toward the motor. Thread the sleeve of one cable into hole A and the other into hole B to a distance of 1½ inches. (See diagrams 1 & 3.)

2. On the motor ends of both cables secure the anchor ball, jam nut, and end clip; see diagrams 1 and 3. Be sure that the jam nut and end clip are tightened securely. *Note:* When threading the end clip do not use pliers to hold the cable as this may mar the surface of the cable.

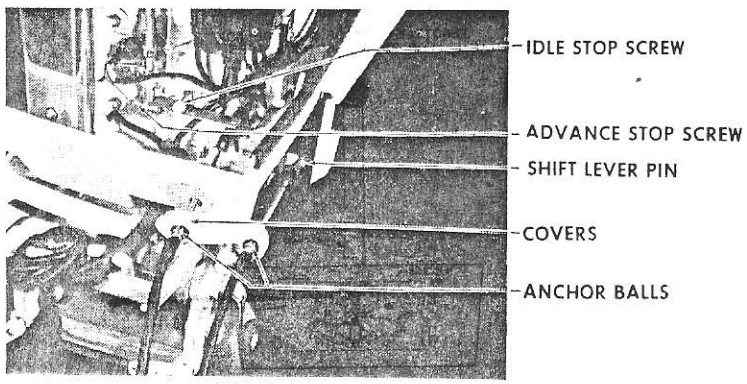
3. Move the shift and throttle control levers all the way back toward the cables. At the motor end of the cables grasp the cable sleeve with one hand and with the other push in on the cable until it makes contact with the clevis in the control box. Turn the end clip clockwise until the cable end is threaded all the way into the clevis. Repeat this operation for the other cable.

4. All of the preceding steps can be accomplished with the cables and control box on the dock or shore. After both cables have been threaded into the clevis the next step is to test for correct adjustment of the control. To test the control box adjustment the motor ends of the cables must be attached to the shift and throttle pins and the anchor balls must be secured in place. Keep the cables as straight as possible when testing adjustment. Should any adjustment be required, it will be much easier if the control box is not mounted to the boat.

5. See picture B or C when attaching the cables to the motor. Generally, it will be much easier if the end clip is removed when inserting the throttle cable through the rubber grommet in the lower hood assembly. When attaching the end clips to the throttle and shift pins make sure that they snap shut and that the metal clip faces toward the carburetor on the throttle cable and is facing up on the shift cable.



PICTURE-B



PICTURE-C

6. After the cables have been attached to the motor and the anchor balls are in place with the covers secured, proceed to test the control adjustment.

THROTTLE ADJUSTMENT

A. Holding the control box firmly, place the shift lever in forward gear and move the throttle (straight) lever all the way forward. At the motor check to see that the advance stop screw is bottomed against the manifold. See Pictures B or C.

B. Move the throttle lever all the way back toward the slow position. At the motor check to see that the idle stop screw is bottomed against the crankcase.

C. If the advance and idle stop screws bottom out as indicated, no adjustments are required. However, if one does not bottom then the cable travel in this position needs to be increased. To regulate the cable travel, loosen the anchor cover. Thread the cable sleeve into the control box to increase the idle travel. Thread the cable sleeve out of the control box to increase the advance travel. Do this until both the idle and throttle stop screws bottom.

SHIFT ADJUSTMENT

A. Holding the control box firmly, with the throttle in the slow position, move the shift (offset) lever all the way forward. (*Note:* It may be necessary to turn the propeller slightly in order to shift into forward and reverse gear.) With the shift control lever in forward go back to the motor and carefully detach the end clip. Note whether the motor is in full forward gear. Attach the end clip.

B. At the control box pull the lever all the way back. At the motor carefully detach the end clip and note whether the motor is in full reverse gear. Attach the end clip.

C. If the motor shifts fully into forward and reverse gear then no adjustments are required. If the motor does not shift fully into one gear then the cable travel will need to be increased in this direction until the motor will shift equally into either gear. To regulate the travel into either forward or reverse loosen the anchor cover. Thread the cable sleeve into the control box to increase the travel into reverse gear. Thread the sleeve out of the box to increase the travel into forward. With the control box properly adjusted the shift control lever will be nearly vertical to the box in neutral gear.

9. After the remote control has been properly adjusted detach the end clips and anchor balls from the motor, being careful not to change the distance that the cable sleeves are threaded into the control box.

10. Route the cables along the gunwale of the boat avoiding any sharp bends. Attach the cables to the motor then proceed to mount the control box. Be sure to allow sufficient room for the control levers to swing through their complete arc.

11. After you have mounted the control box make a final test of its operation. Apply the decals according to the instructions printed on the back of each decal. Position the decals in relation to the travel of the control levers.

INSTALLATION INSTRUCTIONS FOR 1960 12 H.P. MODELS

The Scott double lever control can be adapted for use on 1960 12 H.P. models. Certain changes must be made before the cables are installed. Following are instructions for adapting the control for use with the 12 H.P. model. After the changes in the control box have been made, follow the 12 H.P. "Installation Instructions" to install the control.

CONTROL BOX ASSEMBLY CHANGES

1. Remove the two mounting screws (1), nuts (2), lockwashers (3), box cover (4), and separate the shift half of the control box (5) from the separator (6), and the throttle half (7) of the control box. See Diagram No. 1.

2. Place the throttle half of the control on a flat surface with the open side up and remove the clevis (8), screw (9), clevis pin (10), lockwasher (11), idler gear (12), screws (13) and (14), lockwasher (15), throttle detent (16) and sector gear (17).

3. Replace sector gear (17) and throttle detent (16) over the throttle lever (18) in the position shown in Diagram No. 2.

4. Replace lockwashers (15), screws (13) and (14) in the sector gear and tighten. Center the throttle lever and sector gear on the control box gear train and move the lever all the way to the left.

5. Place the idler gear (12), lockwasher (11) and clevis pin (10) over the remaining hole in the throttle lever, and fasten with screw (9). Place the clevis (8) over the clevis pin, with the thinnest wall of the threaded cable hole towards the idler gear.

6. Reassemble the halves of the control box with the separator between them, replace the box cover and mounting screws. This completes the changes necessary to adapt the control for use with the 12 H.P. model.

INSTALLATION INSTRUCTIONS FOR 1960 12 H.P. MODEL

1. Depending which side of the boat you will mount your control on, thread the remote cables into the holes in the end of the control box that faces toward the motor. Determine whether the throttle cable will need to be the longer or shorter cable. Thread the sleeve of the throttle cable into hole C until its threads are bottomed. See diagram 3. Thread the shift cable into hole B until its threads are bottomed.

2. On the motor ends of both cables thread the anchor balls onto the cable sleeves. Thread the end clips onto the cable ends until the threads are bottomed. *Note:* Do Not use pliers to hold or turn the cable as the cable surface could be marred.

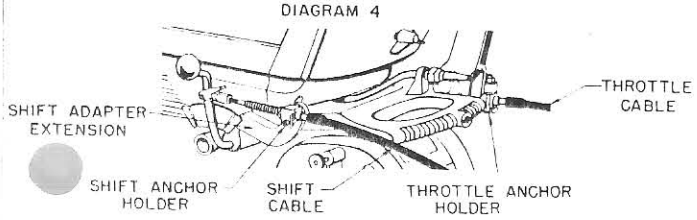
3. Move the shift control lever back toward the cables. Move the throttle lever all the way forward. With the cables laid out in a straight line grasp the sleeve of one cable, at the motor end, and push in on the cable until it comes into contact with the clevis in the control box. Turning the cable in a clockwise direction, thread the cable into the clevis until the threads are bottomed. Repeat this operation for the other cable.

4. Route the cables along the gunwale back to the motor. Avoid any sharp bends.

5. Place the motor in forward gear and retard the throttle all the way to the idle position. At the control box move the shift (offset) lever all the way forward. Move the throttle (straight) lever all the way back toward the cables.

6. Being careful not to disturb the control levers, attach the shift cable end clip to the shift handle pin. Attach the extension bracket and shift anchor holder to the side of the housing. See diagram 4. After the anchor holder has been secured, thread the anchor ball on the sleeve until it will slide freely into its holder.

DIAGRAM 4



7. Fasten the anchor holder to the handle mount. See diagram 4. Attach the throttle end clip to the pin on the throttle arm, then thread the anchor ball until it will slide freely into its holder.

8. After you have threaded the cable and sleeve into the control box and have routed the cables back to the motor and attached them, the next step is to test control adjustment.

THROTTLE ADJUSTMENT

A. With the shift lever in forward or reverse gear, hold the control box firmly and move the throttle (straight) lever all the way forward, remove the end clip and check to see that the throttle is fully advanced.

B. Attach the end clip and move the lever all the way back to the idle position. Once again remove the end clip and check to see that the throttle is fully retarded.

C. If the control lever will fully advance and retard the throttle then no adjustments are necessary. If the throttle is not fully advanced or retarded then the cable travel will need to be increased in either direction until this is corrected. To increase full throttle travel thread the anchor ball away from the end clip. To increase the idle travel thread the anchor ball toward the end clip.

SHIFT ADJUSTMENT

A. Retard the throttle to the idle position. Move the shift (offset) control lever all the way forward. Remove the end clip and check to see that the motor is in full forward gear. Attach the end clip.

B. Pull the shift control lever all the way back. ***Note:*** When the motor is not running it may be necessary to turn the propeller slightly in order to shift into reverse. Check to see that the motor is in full reverse gear.

C. If the control lever shifts the motor into full forward and reverse gear, then no adjustments are necessary. If the motor is not shifted fully into gear then the cable travel will have to be increased for this gear.

To increase the cable travel into reverse, thread the anchor ball away from the end clip.

To increase the cable travel into forward, thread the anchor ball toward the end clip.

D. Properly adjusted the control should shift fully into forward and reverse and the lever will be nearly vertical to the box when in neutral gear.

9. After the controls have been accurately adjusted, make sure that all attachments at the motor are made and that the control box is mounted securely to the boat. Be sure when mounting your controls to allow sufficient room for the levers to swing through their complete arc.

10. Instructions for applying the decals are printed on the back of each decal. Position the decals so that their markings correspond to the movement of the control levers.

OPTIONAL INSTALLATIONS

For dual motor installations one control box is required for each motor. Controls can be conveniently paired to simplify their operation. Remove the covers from both controls. Separate the shift and throttle halves of one control. Discard the middle separator and stack the throttle and shift halves from each box together. See diagram 5. Replace the cover, using longer bolts. To install and adjust the paired controls follow the instructions for single lever controls.

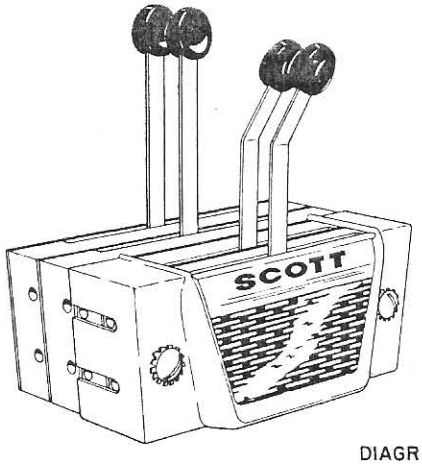


DIAGRAM 5

INSTALLATION AND OPERATING INSTRUCTIONS FOR THE SINGLE LEVER REMOTE CONTROL 12, 25, 40 AND 60 OUTBOARD MOTORS FOR 1960

Correctly installed and operated, the Scott single lever remote control gives you positive one hand control of both throttle and shift operation of the motor. Allow yourself time to read the instructions through to become familiar with the terms used, the diagrams, and the step by step procedures for installation on your particular motor.

Operating Instructions – 12, 25, 40, and 60 H.P. Motors

To start the motor, move the main lever to the neutral position, it will be automatically stopped in neutral by a stop mechanism in the control box. Push forward on the shift release lever and hold it in a forward position momentarily as you move the main lever forward to the start position. The shift release will remain depressed after the initial forward movement of the main lever. Do not advance the main lever beyond the start position when used with the 12 or 60 H.P. motors; this would result in racing the motor and could cause damage to the motor. The 25 and 40 H.P. motors are equipped with an automatic device which limits the throttle advance in the start position. Start the motor; retard the main lever slightly and allow the motor to warm up at a fast idle. Then move the main lever back to the neutral position; the shift release lever will automatically snap back into position and engage the shift mechanism in the box.

To shift to forward gear, move the main lever forward with a POSITIVE MOTION – Do Not Ease Into Gear. The initial lever action engages forward gear. When the leading edge of the main lever is slightly past the "Start" decal the clutch dog and forward gear are fully engaged. Additional forward travel of the main lever increases the throttle opening and consequently the boat speed.

To shift into reverse, retard the main lever until stopped in neutral position; move the lever forward slightly to disengage the neutral stop, and again with a POSITIVE MOTION, move the main lever to the rear. The throttle opening in reverse is limited to prevent excessive speed in reverse gear. However, in an emergency, additional speed can be obtained in the following manner: With the main lever in full reverse, pull up on the shift release lever and the throttle can be advanced for more power and speed. Always use extreme caution if this maneuver becomes necessary. The main lever must be returned to the full reverse position to re-engage the shift release lever.

GENERAL INSTALLATION INSTRUCTIONS – 12, 25, 40, and 60 H.P.

Select a suitable location for the control box which is comfortable for the operator and which will allow the main lever to swing through its complete arc, from full forward to full reverse. To assure ease of operation, cables must be installed without sharp bends, or where they can be kinked, stepped on, or where their operation can be impeded by equipment of any kind. It is especially important that the cables are not hindered as they come from the control box. They must be free to move up and down slightly to adjust to movements of mechanisms within the control box.

40 and 60 HP INSTALLATION INSTRUCTIONS

1. Slide one of the large nylon anchor balls with the brass sleeve completely down on a threaded cable sleeve and fasten securely with a brass jam nut. Thread an end clip onto this cable end until it bottoms. See Diagram 1.
2. Remove the cover plate from the shift side of the box along with the black, nylon, anchor block. See Diagram 1.
3. Thread the anchor block onto the shift cable sleeve exactly two inches. See Diagram 1.
4. Place the anchor block and cable back in the box and start the cable end into the clevis. Turn the cable end clip until the cable bottoms in the clevis. Do not turn the outer covering or threaded sleeve.
5. Repeat 1 through 4 to connect up to the throttle side. Do not replace the shift or throttle side cover plates. See Diagram 2.
6. Route the cables into position to the motor but do not mount the control box on the boat.
7. Remove the covers from the extension bracket on the lower motor housing and install the shift cable anchor in the port side socket and the throttle cable anchor in the socket directly in

front of the engine. The throttle cable must be inserted through the hole and rubber grommet in the lower housing at the same time the anchor ball is placed in the socket. Replace both bracket covers securely. See Diagram 3.

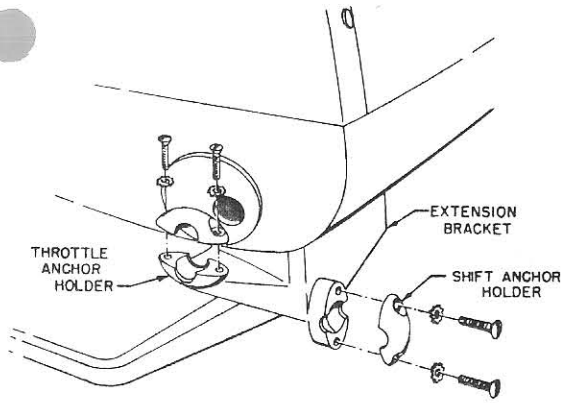


DIAGRAM 3

40 and 60 H.P. ADJUSTMENTS

All adjustments on throttle and shift cable travel must be made at the control box. Always place the main lever in full forward to prevent bending the cables when lifting the anchor block into a position that will allow you to thread the block in either direction.

Cable Adjustment

1. Attach the shift cable end clip to the pin on the motor shift handle. Snap the end clip shut.

REMOTE CONTROL BOX (SHIFT SIDE)

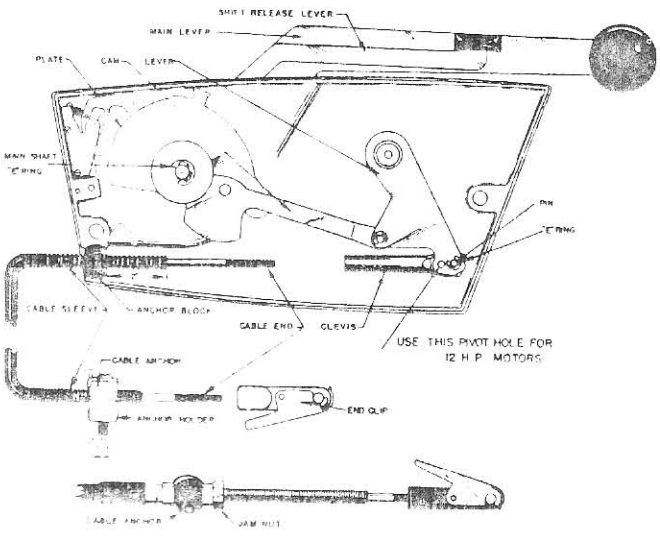


DIAGRAM 1

2. Move the main lever on the control box to the full forward position. Check the motor shift lever for full forward travel. If more travel is needed, thread the anchor block toward the motor end of the cable sleeve.
3. Move the main lever to full reverse. Check the motor shift lever for full reverse travel. If more travel is needed, thread the anchor block toward the control box end of the cable sleeve. If less travel is needed, thread the anchor block toward the motor end of the cable sleeve.

Throttle Cable Adjustment

1. Attach the throttle cable end clip to the pin located in the underside of the throttle lever arm of the motor. Snap the end clip shut.
2. Place the main lever in neutral. The white nylon, idle stop screw should just touch the crankcase on both the 40 and 60 HP motors. If more travel is needed to allow the idle stop screw to touch the crankcase, thread the anchor block toward the box end of the cable sleeve. If the idle stop screw is forced against the crankcase, less travel is required; thread the anchor block toward the motor end of the cable sleeve.
3. The travel should now be in adjustment for full forward throttle. However, check by moving the main lever to full forward and locate the advance stop screw. This is a white, nylon screw which should just touch near the upper carburetor on the 40 HP motor and a brass colored screw which should just touch near the lower carburetor on the 60 HP motor.

When both shift and throttle cables have been adjusted correctly, replace the covers on the box and bolt it in place on the boat.

REMOTE CONTROL BOX (THROTTLE SIDE)

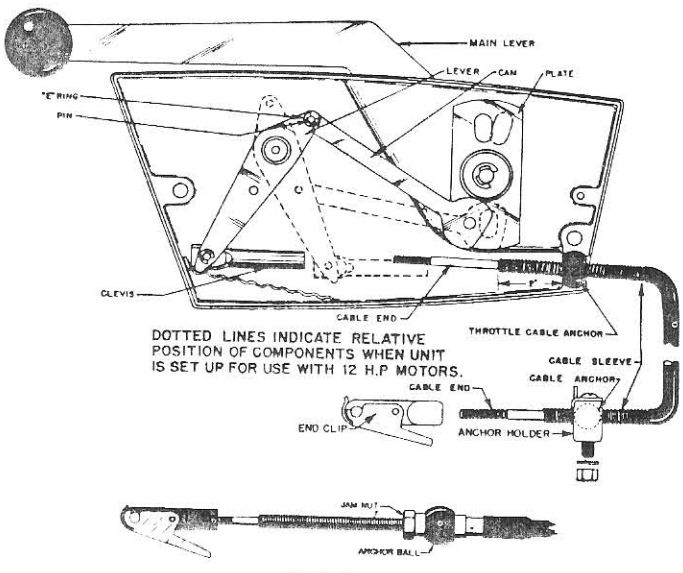


DIAGRAM 2

25 HP INSTALLATION INSTRUCTIONS

1. Fasten the shift anchor holder securely to the shift side of the lower housing. See Diagram 4.

2. Thread one of the small, black, nylon, anchor balls two inches (2") onto a threaded cable sleeve. Thread an end clip onto the cable end until it bottoms.
3. Remove the cover plate from the shift side of the control box and also remove the black, nylon, anchor block. See Diagram 1.
4. Thread the anchor block onto the shift cable exactly two inches (2").
5. Place the anchor block and cable back in the control box and start the cable end into the clevis. Turn the cable end clip until the cable bottoms in the clevis. Do not turn the cable outer covering or threaded sleeve.
6. Repeat steps 2 through 5 to make the connections on the throttle side. See Diagram 2.
7. Route the cables back to the motor and mount the control box on the boat.
8. Place the main lever and the motor shift lever in neutral. Attach the shift cable end clip to the pin on the shift handle. Snap the end clip shut. Adjust the anchor ball until it can slide freely into the shift cable anchor holder.
9. Place the motor throttle lever in the start position. Place the main lever in neutral, attach the throttle cable end clip to the pin on throttle lever. Snap the end clip shut. Adjust the anchor ball so that it can slide freely into the throttle anchor holder located on the front carrying handle. See Diagram 4.

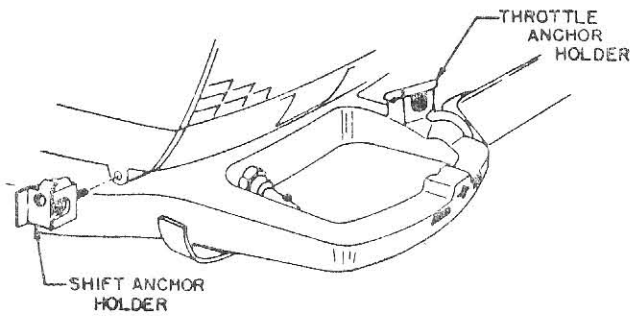


DIAGRAM 4

10. Move the main lever full forward to check for full travel of both shift and throttle. If more travel is needed, thread the anchor ball toward the motor end of the cable. If less travel is needed, thread the anchor ball toward the control box end of the cable.

12 H.P. CONTROL BOX ASSEMBLY CHANGES

The single lever remote control box, as shipped, is assembled for use with the 25, 40, and 60 H.P. motors. In order to adapt the control box for use on the 12 H.P. motor, assembly changes have to be made in the control box. Also, a shift adapter extension must be installed on the shift side of the motor.

Careful attention to Diagrams 1 and 2 will allow you to complete the necessary control box changes in a few minutes.

1. Remove covers from both sides of remote control box by removing the two screws from each side.
2. Place control box on its side with shift side up, side containing start-neutral decal. See Diagram 1.
3. Remove "E" ring, washer and roller from main shaft.
4. Remove plate, cam, and lever as an assembly by lifting up.
5. Remove large wave washer from main shaft.
6. Remove from lever, "E" ring and pin holding clevis.
7. Move clevis ¼ inch to hole closest to cam and reinstall clevis pin and "E" ring. See Diagram 1.
8. Turn box over placing throttle side up, side containing forward-reverse decal. See Diag[illegible].
9. Remove lever, cam, and plate as an assembly by lifting up.
10. Remove "E" ring and pin holding cam to lever.
11. Move cam to hole indicated midway on lever and reinstall pin and "E" ring. See Diagram 2.
12. Turn lever, cam, and plate assembly over, pointing main shaft up.
13. Remove "E" ring and washer from the cam pin which extends through plate slot.
14. Move cam pin and roller to the slot at opposite end of plate and reinstall washer and "E" ring.
15. Line up control lever parts through main shaft hole in the control box and insert main shaft, plate, cam, and lever as an assembly. The open slot in the plate should be toward the top of the control box. See Diagram 2.
16. Turn control box over carefully, placing shift side up.
17. Place the control lever in full forward position.
18. Place a small block of wood under the main shaft to keep lever, cam, and plate assembly on the throttle side fully inserted.
19. Line up control lever parts through main shaft hole and then place large wave washer over the main shaft hole.
20. With the plate positioned so small foot is toward top of control box (See Diagram 1), install plate, cam, and lever assembly. (Spring tension

of shift latch plate should be removed by pressing fast idle lever and placing a screwdriver between levers.)

21. Rotate plate through a small arc and tap lightly till plate drops in place engaging handle cam.
22. Install roller and flat washer on end of the main shaft.
23. Press down hard on washer to compress large large wave washer and install "E" ring on end of main shaft.
24. This completes the assembly changes necessary to adapt the Scott single lever remote control to the 12 HP Scott motor.

12 HP INSTALLATION INSTRUCTIONS

1. Fasten the shift adapter extension in position as illustrated in Diagram 5, securely attach an anchor holder to the end of the extension.
2. Fasten the throttle anchor holder in place as shown in Diagram 5.
3. Repeat steps 2 through 7 from the 25 HP instructions to connect the cables at the control box.
4. After you have routed the cables back to the motor and mounted the control box on the boat, place the main lever in neutral. Attach the shift cable end clip to the pin on the shift lever and adjust the anchor ball on the cable sleeve until it can slide freely into the anchor holder.
5. Place the twist grip speed control at idle. Attach the throttle end clip to the pin on the geared throttle lever. Adjust the anchor ball until it can slide freely into the anchor holder.

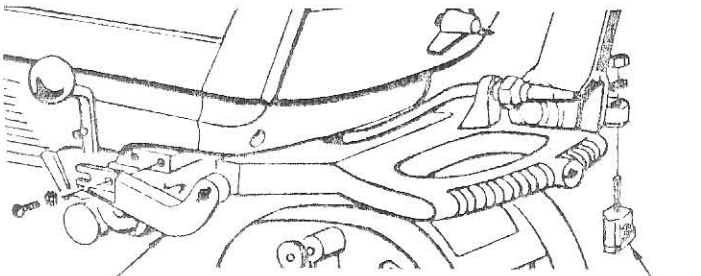


DIAGRAM 5

If slight adjustments are necessary for shift cable travel, thread the anchor ball toward the motor end of the cable for more forward travel and toward the control box end of the cable for less travel. If slight adjustments are necessary for the throttle cable travel, thread the anchor ball toward the motor end of the cable for slower idle and toward control box end of the cable for high speed.

Remote Steering Hook-Up Installation

A remote steering hook-up assembly is included with this kit to assist in the quick connect and disconnect of the remote steering cables to the motor.

Dual Motor Installation

For dual motor installations, a single lever remote control box is required for each motor. The control boxes may be mounted separately or "paired" together, resulting in a handy, compact, single unit. When installing single lever control boxes using either of the above methods, the boxes must first be installed on each motor individually as described in this instruction booklet. If it is decided to mount the control boxes "paired" together, as shown in Diagram 6, extra long mounting screws will be needed. These specially designed mounting screws (part number 10-5855) can be ordered through your nearest authorized Scott outboard dealer.

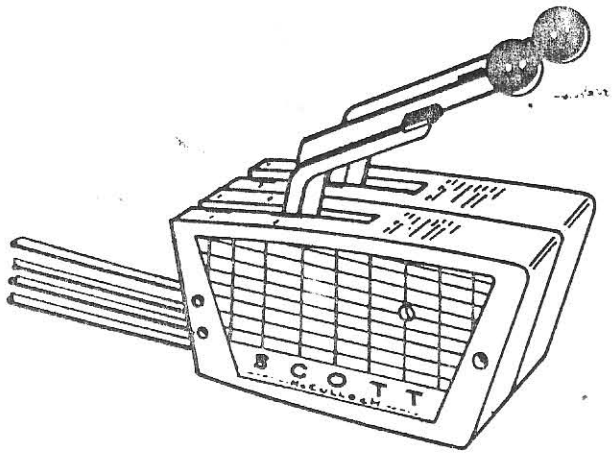


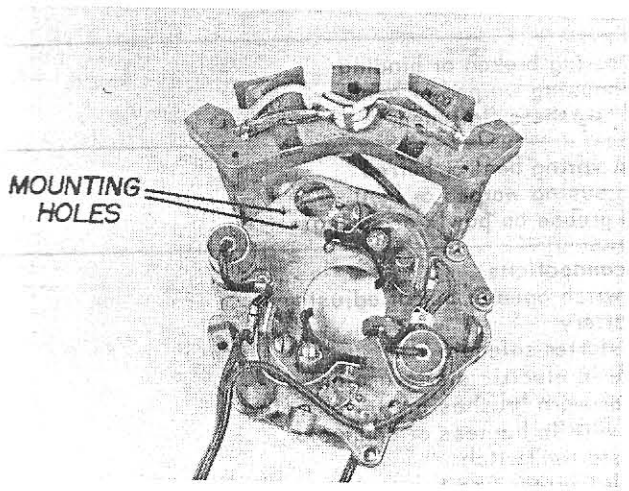
DIAGRAM 6

TACHOMETER INSTALLATION INSTRUCTIONS

A tachometer is included in the purchase price of the 60 H.P. and Royal Scott models. The only requirements for installing the tachometer is to mount the tachometer assembly to the dashboard and attach the lead wires to the various terminals. Consult the wiring diagrams in section IV or V to determine where the various color coded leads attach. To mount the tachometer drill a 3 5/8" hole in the dash panel, insert the tachometer body into this hole, and secure it in position with the "U" clamp. Instructions for adjusting the tachometer point assembly can be found in section IV under "Tachometer".

The Scott tachometer will also be available for the 40 and 25 H.P. Electric starting models. Holes are

already tapped in the breaker plate for the tachometer point assembly. To install the points remove the flywheel then mount the point assembly as shown in the illustration. Adjust the point assembly according to the instructions found in section IV. Route the lead wires so that they will not come into contact



with the flywheel. Attach the brown tachometer lead to the single terminal on the tach point assembly and attach the other lead wires to the two terminals which are side by side.

The tachometer will also be available for the manual starting 25 and 40 H.P. models. Detailed instructions will be included with each kit for these models.

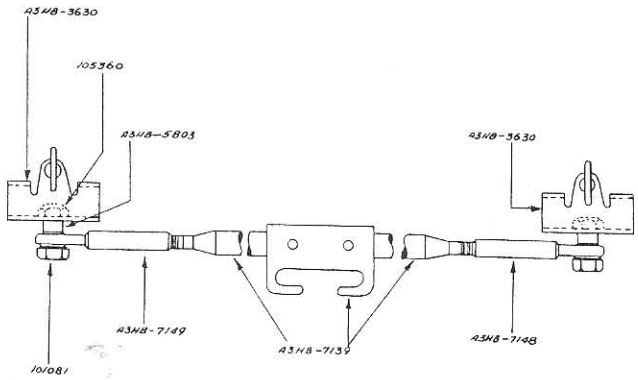
INSTRUCTIONS FOR INSTALLING TWIN INSTALLATION TIE BAR ASSEMBLY

Assembly

The tie bar has been disassembled to facilitate shipment from the factory. Following is a list of the parts required, along with instructions on how to assemble the tie bar.

1	A3-B-7139	Steering Bracket Assembly
2	A3-B-7148	Ball Joint Assembly
2	A3-B-7149	Ball Joint Assembly
2	10-1081	Screws
2	A3-B-5803	Spacers
2	A3-B-3630	Brackets
2	10-5880	Locknuts

With the steering bracket assembly as shown, the threads on the *right* side are left hand threads and those on the *left* side are right hand threads. Each one of the ball joint assemblies have a left hand thread and the other has a right hand thread.



Thread the ball joint assemblies into the steering bracket, then attach the screw, spacer, bracket, and locknut as shown in the illustration.

Installation

The engines should be mounted on the transom so that the distance between the centerline on one engine to the centerline of the other is 25'' for the 40 and 60 H.P. models and 24'' for 25 H.P. models. The centerline of the engine is the mid-point of the distance between the boat brackets. See the mounting dimension chart in section I.

To attach the tie bar to the engines, insert the forks on the brackets into the slots in the motor handle mount. Press in and turn the spring loaded key until the bracket is secured to the engine.

With the tie bar attached to the engines, adjustments for aligning the engines can be made by turning the steering bracket. Normally the engines will operate best when they are parallel or toed in slightly. Each installation should be checked and adjustments made to determine the best operating position.

B. TROUBLE SHOOTING AND TESTING

Trouble shooting is an important part in servicing any outboard motor. Effective diagnosis of the causes of engine difficulty will in most cases appreciably shorten the length of time required to properly service the customer's motor.

Following is a chart which will aid in determining the causes of poor engine performance. Listed are the engine's reaction and the various factors which could cause this reaction.

A. ENGINE REACTION	B. CHECK POINTS
1. Rope comes out but pawls don't engage	a. Friction Spring bent or burred b. Excess grease on pawls or spring c. Pawls bent
2. Manual starter rope doesn't return	a. Recoil spring broken or binding b. Pulley housing warped or bent c. "Wave" washers flattened
3. Clattering manual starter	a. Friction spring bent or burred b. Pulley housing warped or bent c. Excess grease on pawls or spring
4. Electric starter inoperative	a. Loose connections b. Micro switch open or out of adjustment c. Weak battery d. Faulty starter solenoid e. Moisture in electric starter motor f. Broken or worn brushes in starter motor g. Broken wire in harness or connector h. Faulty starter switch i. See High Current Chart
5. Electric starter does not engage but solenoid clicks	a. Loose connections b. Weak battery c. Faulty starter solenoid d. Broken wire in electric harness e. Loose or stripped post on starter motor f. See High Current Chart
6. Hard to start or won't start	a. Engine not primed b. Carburetor adjustments too lean (Not allowing enough gas to engine) c. Carburetor synchronizing assembly out of adjustment d. Motor not being choked to start e. Spark plugs improperly gapped, dirty or broken f. Ignition points improperly gapped or dirty g. Reed valves standing open or pre-loaded shut h. Transfer, head, or reed gasket blown or leaking i. Gas tank air vent not open j. Empty gas tank k. Water or dirt in fuel system l. Weak coil or condenser m. Obstruction in fuel system n. Primary wire not connected to ballast, coils or points o. Engine not timed properly (60 and 40 HP) p. Breaker plate ground wire loose, broken, greasy or missing q. Fuel lines kinked or severely pinched r. Engine not in neutral (opened Micro switch) s. Fuel system not purged of air (7.5 only) t. Faulty ballast u. Start limit not adjusted

A. ENGINE REACTION	B. CHECK POINTS
7. Low speed miss or motor won't idle smoothly and slowly	a. Synchronous control opens throttle too soon during spark advance b. Carburetor idle adjustment c. Spark plugs improperly gapped or dirty d. Reed valves standing open or pre-loaded shut e. Transfer, head, or reed gasket blown or leaking f. Loose or broken ignition wires g. Ignition points improperly gapped or dirty h. Weak coil or condenser i. Plugged crankcase scavenge check valves or lines j. Breaker plate ground wire loose, broken or greasy k. Loose or worn stator plate or top main bearing l. Improper fuel being used (1) Wrong type gas (2) Too much oil (3) Too little oil m. Leaking crankshaft seal top or bottom n. Leaky scavenging valves (60 and 40 manifold)
8. High speed miss or intermittent spark	a. Spark plugs improperly gapped or dirty b. Loose or broken ignition wires c. Ignition point setting improperly gapped or dirty d. Weak coil or condenser e. Water in fuel f. Leaking head or water cover plate gasket g. Heat range of spark plug incorrect h. Engine improperly timed (60 and 40 HP) i. Check the distributor (60 HP only)
9. Coughs, spits, slows	a. Idle or high speed knobs too lean (Throttle cams bent – 60 and 40 HP only) b. Carburetor not synchronized c. Leaking gaskets in induction system d. Float level set too low e. Fuel pump pressure line broken f. Fuel pump not supplying enough fuel because of (1) Punctured diaphragm (2) Check valves stuck open or closed (3) Fuel pump halves not seated properly (4) Fuel lines leak g. Crankcase not properly sealed h. Idle or main carburetor nozzle obstructed i. Improperly seated or broken reeds j. Fuel line obstructed k. Carburetor inlet needle and seat obstructed l. Metering rod sticking m. Scavenging check valves open (60 and 40 HP) n. Inlet needle adjustment (7.5 HP only)

A. ENGINE REACTION	B. CHECK POINTS
10. Vibrates excessively or runs rough and smokes	a. Idle or high speed knobs too rich b. Carburetor not synchronized c. Choke not opening properly (bent linkage) d. Float level too high (carburetor floods) e. Air passage in carburetor obstructed f. Poorly balanced propeller g. Boat clamp screws loose h. Scavenge check valves or lines plugged i. Powerhead not secured tightly to lower motor casing j. See No. 8 k. Inlet needle adjustment (7.5 HP only)
11. Runs well and idles well for a short period of operation, then slows down or stops	a. Weeds or fish line on lower unit or propeller b. Insufficient cooling water (see engine over-heats No. 20) c. Fuel pump check valves inoperative d. Carburetor or fuel pump dirty e. Binding of lower unit gears due to lack of lubrication f. Gas tank air vent not open g. Not enough oil in gas h. Too much preload on lower unit bearings
12. Won't start, kicks back and back-fires into lower motor casing	a. Spark plug wires reversed b. Breaker cam on upside down (12 HP only) c. Flywheel key sheared d. Check timing belt (60 HP only)
13. No acceleration, low top RPM, low muffled sound, hard to start	a. Spark plugs improperly gapped or dirty b. Ignition points improperly gapped or dirty c. Faulty coil or condenser d. Loose or broken ignition wires e. Blown head or water cover plate gasket f. Ignition wires grounded on stator plate g. Fish line or weeds on prop shaft h. Too much preload on lower unit bearings i. Insufficient oil in gas j. Insufficient oil in lower unit k. Improper synchronization l. Improper carburetor adjustments m. Reed valves

A. ENGINE REACTION	B. CHECK POINTS
14. No acceleration, idles good, but when put to full power dies down	a. High speed needle set too lean b. Dirt behind needle and seat c. High speed nozzle obstructed d. Float level too low e. Choke partly closed f. Improper synchronization g. Fuel lines obstructed h. Fuel pump not supplying enough fuel because of (1) Punctured diaphragm (2) Check valves not functioning properly (3) Fuel pump halves not seated properly i. Not enough oil in gas j. Breaker points improperly gapped or dirty k. Metering rod sticking (60 and 40 HP only)
15. Engine runs by using hand primer only at high speed	a. Carburetor adjustments b. Dirt behind needle and seat c. Fuel line obstructed d. Fuel line leaks e. See "h." above f. Float level too low.
16. No power under heavy load	a. Ignition points improperly gapped or dirty b. Ignition stator plate loose c. Ignition timing over advanced d. Wrong propeller e. Faulty carburetion f. Propeller hub slips
17. Cranks over extremely easy on one or both cylinders	a. Low compression (1) Worn rings (2) Scored piston (3) Blown head gasket (4) Loose spark plug (5) Head bolts not tight
18. Engine won't crank over	a. Piston rusted to cylinder wall b. Crankshaft seized to bearings (main or rods) c. Broken connecting rod d. Lower unit gears rusted or broken e. Electric starter binding on flywheel f. Broken crankshaft or driveshaft g. Flywheel seized to ignition coil cores h. Manual start lock improperly adjusted i. Engine improperly assembled after repair – Refer to Powerhead Repair Section

A. ENGINE REACTION	B. CHECK POINTS
19. Motor overheats	a. Motor not deep enough in water b. Pump impellers burned or broken c. Pump cavity buckled d. Seals are burned, cracked, chipped or broken e. Impeller key not in place or sheared f. Plugged water inlet, outlet, or cavity g. Broken, pinched or leaking water lines h. Obstruction in water passages i. Not enough oil in gas or improperly mixed j. Advanced ignition timing. ***DO NOT "TEST" MOTOR OUT OF WATER***
20. Motor stops suddenly – "freezes up"	a. Insufficient cooling water (see motor overheats) b. No lubricant in lower unit gear housing c. No oil in gas or no gas d. Bearings seized e. Rusty cylinders or crankshaft f. Bent or broken crankshaft, driveshaft, or prop shaft g. Gas tank air vent not open h. Engine not assembled properly during repair – Refer to Powerhead Repair Section
21. Knocks excessively	a. Flywheel nut loose b. Manual starter not centered c. Advanced ignition timing d. Worn or loose bearings, pistons, rods, or wrist pins e. Carbon in exhaust ports f. Too much or not enough oil in gas g. Engine not assembled properly – Refer to Powerhead Repair Section h. Flywheel rubbing flywheel guard i. Motor overheating, causing pre-ignition (see motor overheats, No. 20.
22. Bailer doesn't pump or bailer pumps water into boat	a. Bailer inlet or outlet plugged b. Bailer impeller installed upside down c. Bailer lines not in place or seated properly d. Impeller burned or broken e. Seals are burned, cracked, chipped or broken f. Holes in stainless plates plugged g. Impeller key not in place or sheared

A. ENGINE REACTION	B. CHECK POINTS
23. Engine runs – does not turn when in gear	a. Shift lever in neutral b. Broken shear pin c. Improperly adjusted shift linkage or remote controls d. Broken prop shaft, driveshaft, or clutch dog e. Propeller hub loose f. Clutch ring slipping in gear
24. Shifts into one gear only	a. Improperly adjusted remote controls b. Improperly adjusted shift linkage c. Shift rod bent or broken d. Broken gear or clutch dog e. Broken plunger spring (7.5 HP, 40 and 60 HP)
25. Motor runs but boat scarcely moves	a. Fish line or weeds on lower unit b. Obstruction dragging in water c. Engine not deep enough in water d. Broken shear pin e. Bent propeller blades f. Improperly adjusted shift g. Wrong tilt of motor h. Wrong propeller i. Propeller hub loose

TROUBLE SHOOTING THE ELECTRICAL SYSTEMS

It is extremely important that the entire current path is kept in good shape. It will be stated throughout this section that the primary cause of most faulty electrical systems is a corroded or loose connection.

Along with a good set of hand tools for the mechanical work, a repair shop should have a volt meter, amp meter, hydrometer, and an 18" piece of No. 16 insulated jumper wire with alligator clips on both ends. With these pieces of electrical equipment the repairman can use the accompanying charts and trouble shoot all the necessary electric circuits.

BATTERIES:

Batteries are generally rated in ampere-hours capacity. A 60 ampere-hour unit is the minimum recommended size. It must be in good condition and have a specific gravity reading of at least 1.215. This indicates a reasonably good state of charge. If these readings are not met, be certain that the cable clamps are clean and tightly secured.

HIGH CURRENT:

Connect a 0-15 volt meter to the bodies of the two cable clamps, being certain to observe the proper polarity. The meter should read 12 volts. Disable the ignition system by removing the spark plug wires and then press the starter switch. The meter should now read between 10 and 11 volts. If it reads much less, say 6 volts, recheck the hydrometer reading or try a battery that is known to be fully charged. If the meter reads very near 12 volts, continue tracing the circuit below for a high resistance.

The following chart gives a useful step-by-step tracing procedure to be used for locating trouble spots.

- Ⓥ - indicates a 0-15 v. Volt meter, 4th step in tracing.

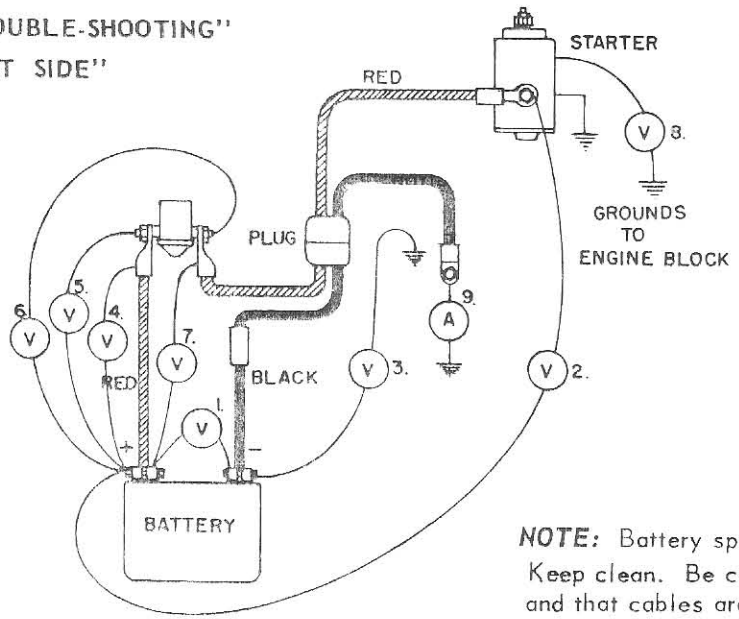
- Ⓐ - indicates a 0-125 a.p. ammeter and shunt.

APPROXIMATE METER READINGS				
STEP NO.	AS HOOKED UP	WITH STARTER BUTTON PUSHED	IF IT READS	CAUSE
1.	12 V.	10 - 11 V.	Below 10 V. 12 V.	Weak Battery Open Circuit (see below)
2.	12 V.	0 - 1	Over 1 V. Below 8 V.	Loose Terminal Open Circuit High Resistance
3.	0 V.	1/2 - 1 V.	Above 1 V.	Loose Terminals or Broken Wire
4.	0 V.	1/2 - 1 V.	Over 1 V.	Loose Terminals
5.	0 V.	1/2 - 1 V.	Over 1 V.	Loose or Corroded Connection
6.	12 V.	1/2 - 1 V.	Over 1 V.	Defective Solenoid
7.	12 V.	1/2 - 1 V.	Over 1 V.	Loose Terminal
8.	0 V.	0 V.	Above 0 V.	Poor Ground
9.	0 Amps.	125 Amp	Well over 125 A.	Starter Motor

NOTE: In step No. 9, a shunt ***must*** be used in the starter line. ***Do not*** connect the small ammeter in series with the line without one.

As an illustration, take step No. 1: Connect a 0-15 volt meter to the bodies of the two cable clamps, being certain to observe the proper polarity. The meter should read 12 volts. Disable the ignition system by removing the spark plug wires and then press the starter switch. The meter should now read between 10 and 11 volts. If it reads much less, say 6 volts, recheck the hydrometer reading or try a battery that is known to be fully charged. If the meter reads very near 12 volts, continue tracing the circuit as in steps 2-9 for a high resistance.

"STARTER SYSTEM TROUBLE-SHOOTING"
"HIGH CURRENT SIDE"



NOTE: Battery specific gravity 1.215 min. Keep clean. Be certain starter turns freely and that cables are not chafed and shorted.

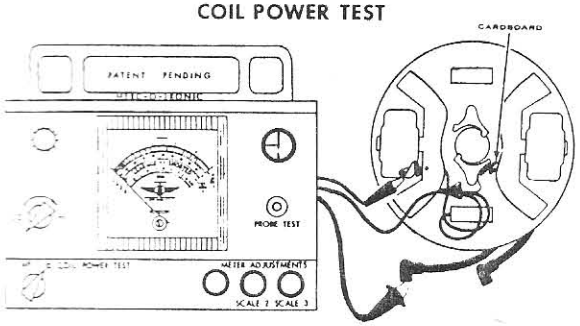
TESTING ELECTRICAL COMPONENTS

Following are instructions for testing the various electrical Components with the Merc-O-tronic Ignition analyzer, Model 88. For information on the operation of this instrument consult the operating manual included with the analyzer.

Specifications for the various components will be provided at a later date.

COIL POWER TEST

MERC-O-TRONIC MAGNETO ANALYZER CHART
COIL POWER TEST



1. It is not necessary to remove magneto assembly from engine or parts from stator plate assembly.
2. Place a piece of cardboard between breaker points to insulate.
3. Connect small black test lead to coil primary ground wire.
4. Connect small red test lead to coil primary lead or breaker point assembly terminal.
5. Connect large red test lead to terminal of spark plug wire.
6. After wiring hookup is made, as shown in the illustrations 6 or 7, the current control knob should be to extreme left, beyond "LO" position.
7. Turn selector switch to position No. 1 ("Coil Power Test").
8. Slowly turn current control knob clockwise and note the current value on Scale No. 1.
9. When it reaches the operating amperage for that particular winding, shown in this manual under Manufacturer's Specifications, stop and note the 5MM spark gap, it should fire steadily.
10. If the spark is faint, intermittent or no spark has occurred at this reading, the coil is defective and must be replaced.
11. If a steady spark occurs below Manufacturer's Specifications, this indicates a very good coil.

COIL HIGH SPEED TEST

12. If the coil is good on Coil Power Test, preceding, perform the High Speed Test.
13. Continue turning the current control knob clockwise to the right, for maximum reading of meter.
14. The spark gap should fire steadily.
15. If the spark is faint, intermittent or no spark occurs, the coil is defective at high speed and must be replaced.

Complete this test as quickly as possible and immediately upon completion, turn selector switch and power control to "OFF" position.

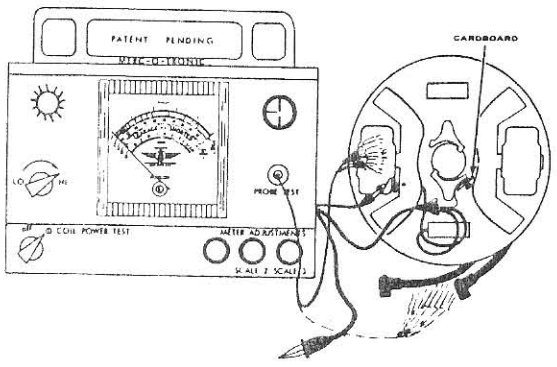
When checking coil on stator plate with crankshaft type high inductance rotating magnet (i.e. Wico, Scintilla and similar type magnetos), be sure rotating magneto is in neutral position (magnets not opposite the coil core).

NOTE: When testing coils off stator plate, it is absolutely necessary that the laminated core be in the coil.

Stator plate with 2 coils mounted, each coil to be checked separately.

COIL SURFACE INSULATION TEST

MERC-O-TRONIC MAGNETO ANALYZER CHART
SURFACE INSULATION TEST WITH PROBE



1. Remove large red test lead from coil secondary, (High Tension lead) see illustration.
2. Small red and black test leads stay connected as previously.
3. Plug insulation test probe into "JACK" on front of tester.

4. Turn selector switch to position No. 1.

5. Turn current control knob to "HI" position for maximum current reading on meter. "Do not exceed meter reading."

6. Pass end of insulation test probe over the insulating surface of the coil and spark plug wires.

7. If coil insulation is cracked, leaking or damaged, a spark discharge will be noted at the cracked or leaking surface.

8. Do not permit test probe to linger too long at any point while conducting this test.

9. Complete test as rapidly as possible, as this is a severe test on a coil.

A faint spark occurring around coil insulation during probing is a corona spark and does not illustrate a defective coil.

COIL CONTINUITY TEST

NOTE: Scale 3 has two scales. The upper number is the number shown on MFG. Specifications or are comparative numbers in place of actual ohm resistance "lower numbers". This is an added feature to later model units starting with Serial No. 4050.

1. Turn selector switch to position No. 3 Coil Continuity.

2. Clip small red and black test lead together.

3. Turn meter adjustment knob for scale No. 3 until meter pointer lines up on set position on right side of scale No. 3.

4. Connect small black test lead to coil ground wire as in previous test.

5. Connect small red test lead to spark plug "high tension" lead.

6. Reading must be between the two values for that particular coil shown in this manual under manufacturer's specifications.

7. Reading of actual resistance in ohms can be obtained by reading lower numbers in same scale.

8. Readings lower than the lowest value under manufacturer's specifications, the secondary winding is shorted.

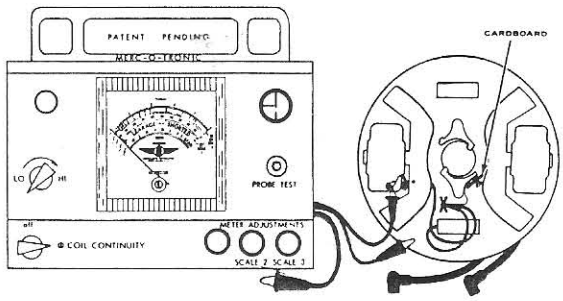
9. Readings higher than the highest value shown in the specifications, the secondary winding is open.

10. In either case, the coil is defective and must be replaced.

COIL GROUND TEST

MERC-O-TRONIC MAGNETO ANALYZER CHART

COIL GROUND TEST



1. Leave small black test lead connected as in Coil Continuity Test.

2. Remove small red test lead from high tension wire and connect it to ground or frame of stator plate. (See wiring hookup,)

3. Turn selector switch to position No. 3 and read Scale No. 3.

4. The meter pointer hand must be on the "ZERO" line at the left.

5. Any meter movement to the right indicates a grounded coil.

6. If there is a meter pointer hand movement to the right, indicating a grounded coil, remove the breaker point terminal screw at "X" on diagram .

7. Remove primary coil wire at this point. If the meter needle remains to the right the trouble is elsewhere.

8. Check condenser for short or grounded breaker points.

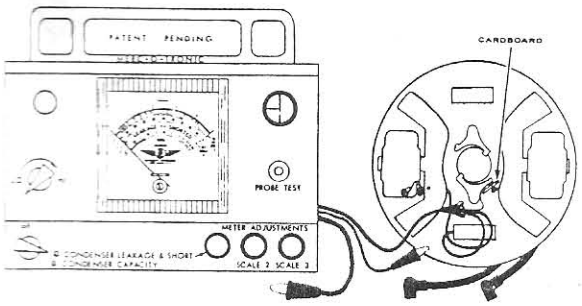
NOTE: When coils are not permanently grounded to lamination, it is possible to check for ground. This type of coil must not indicate any movement of meter point hand.

CONDENSER TESTS

1. Connect small black test lead to stator plate if condenser is mounted, otherwise to body of condenser.

MERC-O-TRONIC MAGNETO ANALYZER CHART

CONDENSER LEAKAGE, SHORT & CAPACITY TEST



2. Connect small red test lead to breaker terminal, or if unmounted, to condenser lead.
3. Leave cardboard between breaker points.
4. To make condenser test, cord must be plugged into 115/125-volt 60-cycle AC outlet.
5. After wiring hookup is made, turn selector switch to No. 4 "Leakage" and short.
6. Depress red button and hold a minimum of 15 seconds. Read Scale No. 4.
7. The meter pointer hand will move to the right and must return within range of the narrow black bar at the left.
8. Any readings to the right of the black bar indicate the condenser is leaking or shorted and must be replaced.

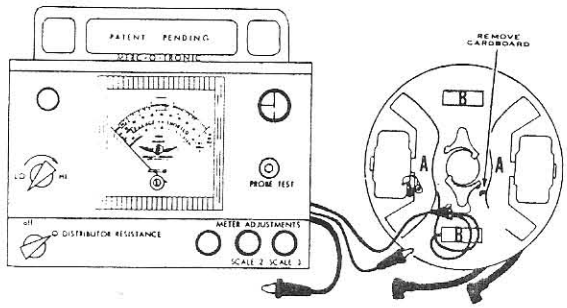
CONDENSER CAPACITY TEST

1. Leave cardboard between breaker points.
2. Place selector switch on position No. 5, condenser capacity.
3. Clip small red and black test leads together and hold down red button.
4. Turn meter adjustment knob on Scale 5 to red, set line scale No. 5 on right side of meter. (This adjustment is for various line voltages throughout the country.)
5. Unclip test leads.
6. Connect small red test lead to breaker terminal or if loose to condenser lead.
7. Connect small black test lead to stator plate if condenser is mounted otherwise to body of condenser.
8. Press red button and read scale No. 5.
9. Condenser must be within manufacturer's specification for this particular motor.
10. If not, replace, as a condenser that is over or under capacity could cause burned breaker points.

BREAKER POINT TEST

MERC-O-TRONIC MAGNETO ANALYZER CHART

BREAKER POINT OR HIGH RESISTANCE IN PRIMARY CIRCUIT TEST

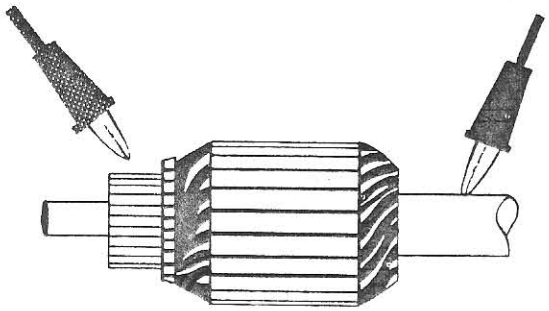


1. Turn selector switch to position No. 2 Distributor Resistance.
2. Clip small red and black test leads together.
3. Turn meter adjustment knob for scale No. 2 until meter pointer lines up with set position on left side of "OK" block on scale No. 2.
4. Unclip small red and black test leads.
5. Connect small red test lead to breaker point terminal.
6. Connect small black test lead to stator plate or any part of engine per illustration.
7. Turn crankshaft until cam allows breaker points to close.
8. The meter pointer must return in the "OK" block.
9. If the meter pointer is in the high resistance band, this indicates that there is foreign matter between breaker points.
10. See note.
11. Breaker assemblies not meeting this test should be replaced.

NOTE: Although breaker points are made of non-corrosive metal a current resisting tough film may form after the engine stands for a period of time, especially if stored in a damp place. This film will cause hard start-

ing of the engine. By running a piece of stiff paper (such as a business card) between the points under tension several times, the film will wear and dirt and oil will be removed from between the breaker points. After cleaning points in the above manner, the meter hand should be in the "OK" block. If not, replace breaker points.

ARMATURE GROUND TEST



Turn selector switch to position No. 3, "Coil Continuity". Attach small black test lead to armature shaft, as shown in illustration above, and use small red test lead to probe commutator copper divisions. If the pointer hand moves across the meter to the right, as the divisions are contacted, the armature is grounded and must be replaced or commutator must be cut down and mica must be undercut. Meter pointer hand should not move during this test.

SPARK TEST

With the selector switch in "OFF" position, disconnect the high tension lead from the spark plug and clip the large red test lead to spark plug lead. Place test probe into red jack and attach opposite end to cylinder block to form ground. Crank engine over and view spark jump through tester's small window. If no spark, indications are that some part of the magneto is defective or lead wire is broken. Repeat process for each spark plug lead wire.

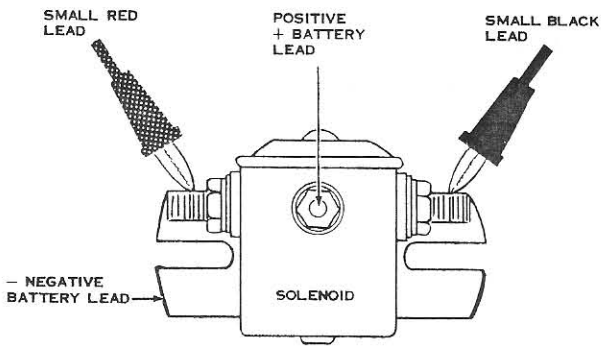
NOTE: If selector switch is in any other position, damage to meter will result.

STARTER SOLENOID TEST

1. Turn selector switch to position No. 3, "Coil Continuity".

2. Connect small red test lead to one large terminal of solenoid, as shown in illustration.

3. Connect small black test lead to other large terminal of solenoid.



4. With a battery of the capacity of the solenoid (6 or 12 volts), place two jumpers leads on battery terminals.

5. Connect positive lead to small terminal or solenoid.

6. Connect negative lead to case or bracket of solenoid for ground.

NOTE: On solenoids with two small terminals, one is a ground and one an energized terminal.

7. Meter pointer hand must move fully to right of meter.

8. If no movement or only partial movement is indicated, the solenoid is defective and must be replaced.

CAUTION: DO NOT CONNECT BATTERY LEADS TO LARGE TERMINALS OF SOLENOID OR METER WILL BE DAMAGED.

CONTINUITY TEST

To test ignition or electrical wires and harness of parts for "open circuits", turn selector switch to position No. 3, "Coil Continuity". Zero out meter. Connect small black test lead to one end of wire and small red test lead to opposite end. Pointer must move fully to the right of meter. If meter pointer hand stays at left, this indicates a broken wire. Move lead wire back and forth while making test.

RESISTANCE TEST

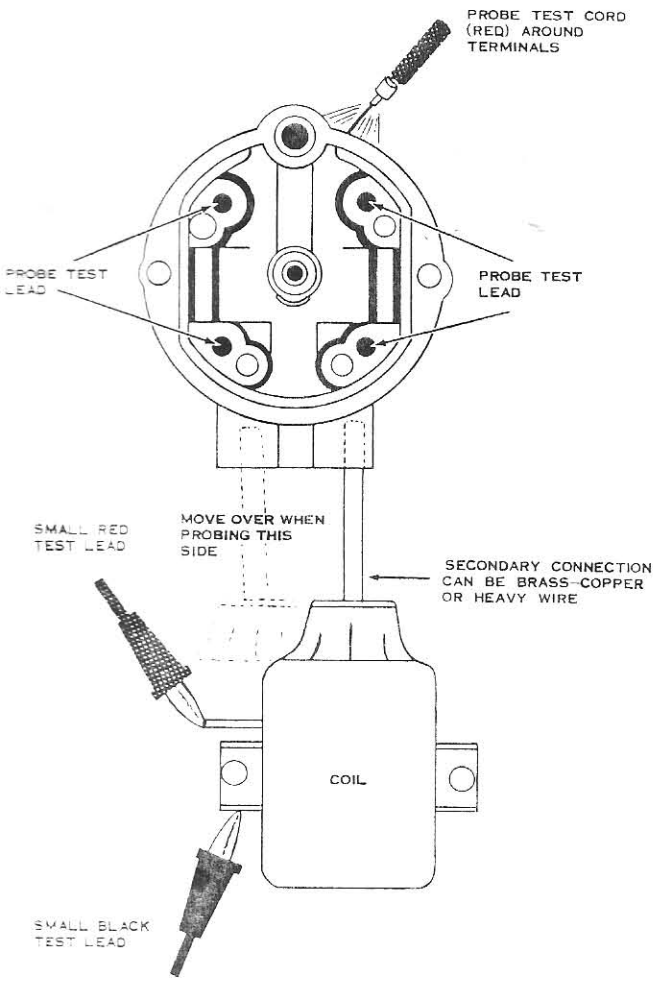
To check an electrical harness and wire terminals to determine if the part is OK, place selector switch on Scale No. 2, "Distributor Resistance". Attach small red test lead to terminal of one end of lead and small black test lead to other end. Meter pointer needle must return to "OK" block. If needle favors right side away from "OK" band it indicates a defective connection inducing a resistance. Repair

connection or replace part.

RESISTOR TEST

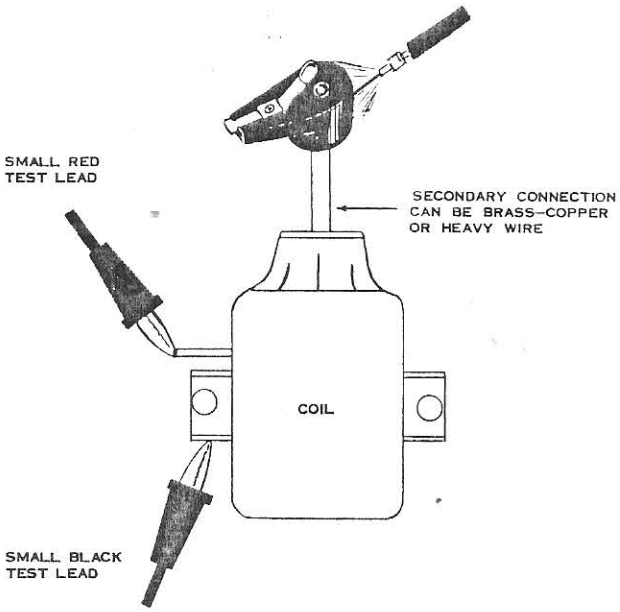
Use scale No. 2 for checking low OHM resistance values. Set selector switch on No. 2, "Distributor Resistance", position. Do not clip test leads together. Turn No. 2 scale meter adjustment knob to adjust meter needle with red line on right side of Scale No. 2. Your meter is now set to check all low OHM values from 0 to 30 OHMS. Clip small red and black test leads to terminals of resistor, as shown in illustration above, and read red figures on Scale No. 2. Replace resistor not meeting the manufacturer's specifications.

HIGH TENSION LEAKAGE CRACK TEST



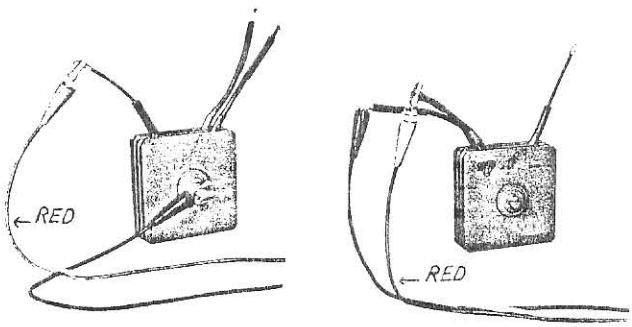
To check for cracks or leakage paths in ignition distributor caps or distributor rotors, clip small red test lead to coil primary lead and black test lead to coil core, as shown in illustration. A used coil is best for this test, since the coil will be used for reducing high secondary voltage. The secondary coil terminal must have a brass or copper lead attached so that it will extend fully into the distributor cap spark plug lead wire outlet to provide the spark for this test. Turn selector switch to position NO. 1, "Coil Power Test", and turn "LO-HI" current control knob to the "HI" position. Place test probe into jack tester and pass other end of test probe over area around distributor contact post. If there is a crack or leakage path, it will show up by following a path in the cap rather than sparking directly to the correct terminal. If the spark path occurs, the cap is defective and must be replaced. There should be no spark jump to any other distributor post other than the one being tested. Repeat this procedure on each contact post of distributor cap.

DISTRIBUTOR ROTOR TEST



Follow distributor cap leakage test procedure, preceding. Place distributor rotor on high tension terminal of coil so that rotor shaft hole rests on coil terminal as shown in figure . Search around distributor rotor with ground test probe. There should be no spark jump at any point. If a heavy spark does occur, it indicates a defective distributor rotor. Replace defective part.

TESTING SELENIUM RECTIFIERS BY MEASURING D.C. RESISTANCE

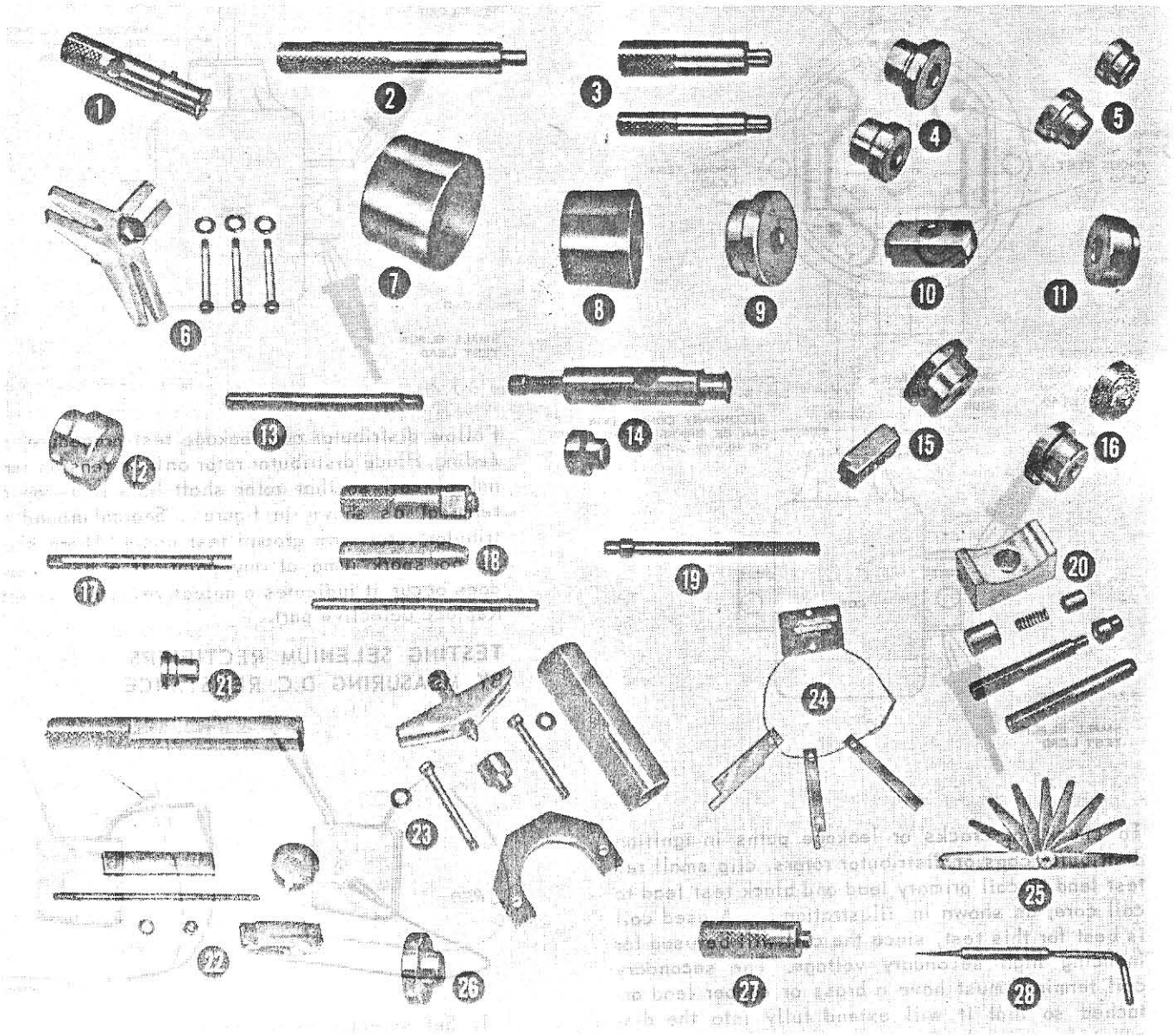


1. Set selector switch on position No. 3, "Continuity".

2. Clip small red and black test leads together and turn meter adjustment knob for Scale No. 3 until meter pointer lines up on set position on Scale No. 3, right side.
3. Connect small red test lead to positive lead on rectifiers.
4. Connect small black test lead to ground stud or lead on rectifier.
5. Note reading of figures on lower band, Scale No. 3.
6. Reverse test leads on rectifier and note readings again.
7. Ratio of two readings should be 10:1 or greater.
8. Remove analyzer test leads and connect to the two alternator leads or lead terminals on rectifier.
9. Note reading of figures on lower band, Scale No. 3.
10. Reverse test leads on rectifier and note readings again.
11. The ratio of the two readings should be no more than 2:1.
12. This is only a preliminary test to determine condition of rectifier. If questionable, as a final test, rectifier should be installed on engine and checked with ammeter while engine is running.

NOTE: This is a true ohm scale, 0 – 20,000 ohms and can be used to test ohm resistance of other electrical components.

C. TOOLS AND EQUIPMENT



KENT MOORE SPECIAL TOOLS

The Kent-Moore Special Tools have been designed to accomplish fast and efficient repair of Scott Outboard Motors. Kent-Moore tools enable the dealer to make repairs with a minimum of time and effort.

Orders for these tools should be mailed to the

KENT-MOORE ORGANIZATION, INC.
28635 Mound Road
Warren, Michigan

Following is a list of the special tools and their part numbers:

1.	J6986	Forward Gear Needle Bearing Remover – 40 H.P.
2.	J7079-2	Driver Handle – 22, 25, 40 and 60 H.P.
3.	J7515	Reverse Gear Assembly Needle Bearing Remover and Installer – 40 H.P.
4.	J7516	Reverse Gear Needle Bearing Remover and Installer – 40 H.P.
5.	J7530	Reverse Gear Bearing Remover and Installer – 22 and 25 H.P.
6.	J7518	Flywheel Remover – 40 and 60 H.P.
7.	J7519	Piston Ring Compressor – 40 and 60 H.P.
8.	J7526	Piston Ring Compressor – 22 and 25 H.P.
9.	J7522	Propeller Shaft Front Bearing Cup Installer – 40 H.P.
10.	J7523	Propeller Shaft Front Bearing Cup Remover – 40 H.P.
11.	J7524	Propeller Shaft Rear Bearing Cup Remover – 40 H.P.
12.	J7525	Propeller Shaft Rear Bearing Cup Installer – 40 H.P.
13.	J7529	Pump Housing Bushing Remover and Installer – 22 and 25 H.P.
14.	J7531	Forward Gear Roller Bearing Remover and Installer 22 and 25 H.P.
15.	J7532	Propeller Shaft Rear Bearing Cup Remover and Installer 22 and 25 H.P.
16.	J7533	Propeller Shaft Forward Bearing Cup Remover and Installer 22 and 25 H.P.
17.	J7534	Propeller Shaft Spring Compressor 60 H.P.
18.	J7552	Upper Drive Shaft Oil Seal Remover and Installer 22, 25 and 40 H.P.
19.	J7553	Shift Lever Shaft Bushing Remover and Installer 22 and 25 H.P.
20.	J7654	Piston Pin and Piston Bearing Remover and Installer 40 and 60 H.P.
21.	J7655	Lower Motor Casing Bearing Remover and Installer 60 H.P.
22.	J7656	Lower Unit Bearing Cup Remover and Installer 60 H.P.
23.	J7657	Crankshaft Bearing Remover and Installer 60 H.P.
24.	J7837	Carburetor Float Level Gauge Set – 22, 25, 40 and 60 H.P.
25.	J7838	Feeler Gauge Set – 22, 25, 40 and 60 H.P.
26.	J7839	Propeller Shaft Seal Installer – 40 and 60 H.P.
27.	J7840	Propeller Shaft Seal Installer – Other Models
28.	J7841	Fitting Remover – 60 H.P.

To provide fast, efficient service the dealer must thoroughly understand the engine and have the tools and equipment necessary to perform the job.

The following list of tools has been compiled to aid the discerning dealer so that he may properly equip to service Scott motors.

This list contains the minimum amount of tools which we feel are necessary to provide effective service. As the service traffic through your shop increases you will undoubtedly find it necessary to add to this list.

TOOLS A GOOD SERVICE DEALER SHOULD HAVE

Quantity	Description
1	Ball Pein Hammer
1	*Flywheel Puller
1	*Ignition Gauge
1	6" Steel Ruler
4	Screwdrivers
1	10" Adjustable Wrench
1	Speed Wrench 3/8 Drive
1	Flex Handle 3/8 Drive
1	Flex Handle 1/2 Drive
2	Tru Arc Pliers No. 2 and No. 4
1	Corbin Pliers
1	Common Pliers
1	Needle Nose Pliers
1	Diagonal Cutter
1	Vise Grip
2	*Piston Ring Compressor
1	Piston Ring Expander
6	3/8 Drive Sockets 5/16, 3/8, 7/16, 1/2, 9/16, 5/8, 7/8
1	3/8 x 3/8 Universal Socket
1	7/8 x 1/2 Drive Socket,
1	1 1/8 x 1/2 Drive Socket
3	Pin Punches 3/32 – 1/8 – 3/16
1	3/8 Drive Socket for 3/16 Allen Bit
1	3/8 Drive Socket for 7/32 Allen Bit
1	3/8 Drive Socket for 5/16 Allen Bit
8	Open End or Box End Combination Wrenches 5/16, 3/8, 7/16, 1/2, 9/16, 5/8, 3/4, 13/16
1 Each	Test Props – 7½ H.P., 16 H.P., 25 H.P., 40 H.P., 60 H.P.
1 Set	Allens (10 in each set)
1	Special Allen 7/32 Long Arm
1	Spark Plug Gauge
1	Offset Screwdriver
1	Mallet
1	Test Tank
1	Ignition Tester
1	Tachometer
1	Impact Driver
1	Torque Wrench In/Lbs.
1 Set	Kent Moore Tools

*Included in Kent Moore Tools for Scott Outboards.

TORQUE SPECIFICATIONS 1960 MOTORS	60 H.P.	40 H.P.	25 H.P.	12 H.P.	7.5 H.P.	3.6 H.
Connecting rod screw	180 in lbs	180 in lbs	180 in lbs	80 in lbs	65 in lbs	75 in lbs
Main bearing screw	300 in lbs	300 in lbs	250 in lbs		70 in lbs	
Crankcase to block screw	150 in lbs	150 in lbs	150 in lbs		100 in lbs	
Cylinder head bolts	275 in lbs	220 in lbs	150 in lbs	80 in lbs	70 in lbs	80 in lbs
Spark plug	250 in lbs	250 in lbs	250 in lbs	250 in lbs	250 in lbs	250 in lbs
Limit beam screw			50 in lbs			
Flywheel nut	975 in lbs	975 in lbs	975 in lbs	500 in lbs	400 in lbs	400 in lbs
Driveshaft nut	160 in lbs	80 in lbs				
Prop shaft in neutral without prop seal	5-9 in lbs	1-4 in lbs				
Prop shaft in neutral with prop seal	7-11 in lbs	3-6 in lbs				
Lower unit bearing cap screws	250 in lbs	250 in lbs	140 in lbs	75 in lbs	120 in lbs	75 in lbs
Lower unit to pump housing nut	275 in lbs	275 in lbs	200 in lbs			
Pump housing to L.M.C. screw	140 in lbs	140 in lbs	200 in lbs			
Powerhead adapter to L.M.C. screw	250 in lbs	250 in lbs			60 in lbs	
Clam shell front bolt (2)	245 in lbs	245 in lbs				
Clam shell rear bolt	295 in lbs	295 in lbs				
Lower Vibration mount bracket screw				110 in lbs		
Carburetor bowl screw	35-45 in lbs	35-45 in lbs	35-45 in lbs	35-45 in lbs		

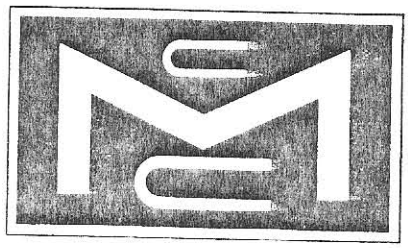
THESE TORQUES MAY BE APPLIED TO THOSE POINTS WHERE NO SPECIFIC TORQUE IS NOTED

Lord mounts, where stud is an integral part of the mount.

Stud Size	Torque
1/4 - 20	20-30 in lbs
3/8-16	95-110 in lbs
1/2-13	240-290 in lbs

Standard Capscrew

Size	Torque
10	25-35 in lbs
12	40-50 in lbs
1/4	60-80 in lbs
5/16	120-140 in lbs
3/8	220-240 in lbs
7/16	340-360 in lbs



McCulloch Corporation

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