EVINRUDE

SERVICE • REPAIR HANDBOOK

1.5 to 35 hp • 1965-1978

10010100

CONTENTS

CHAPTER ONE

GENERAL INFORMATION

This service and repair handbook includes the latest service information for Evinrude 2-stroke outboard motors between 1.5 and 35 hp from 1965 through 1978.

MANUAL ORGANIZATION

Chapters One through Ten provide information for all 1.5 through 33 hp models through 1975. The Supplement at the end of this handbook covers all 1976-1978, 2-35 hp models (the 35 hp model was introduced in 1976). To service any late model motor, use the specifications in the supplement along with the step-by-step procedures in the pertinent chapters in the front of this book.

All procedures are given in the most practical sequence. Complex and lengthy operations are described step-by-step and are thoroughly illustrated. Installation and assembly procedures are given where they differ from removal and disassembly procedures. Notice is given at the head of each subsection requiring the use of special tools, and alternate methods or tools are identified where substitutes are possible. Italic notes of caution or operation emphasis appear throughout the text to ensure safety and working efficiency.

Each of the chapters gives detailed instructions for disassembly, inspection, reassembly, and operating adjustments of the components. These procedures will help you service a specific system, or overhaul the engine.

The exploded views illustrate the correct sequence of all parts as well as a listing of the parts needed for replacement. These can be of considerable help as a reference during disassembly and reassembly.

U.S. standards are used throughout and are accompanied by metric equivalents in parentheses where such reference might have practical value.

In many cases, measurement and performance specification ranges for assemblies, subassemblies, and parts overlap from model to model. Where possible, single values are given in the procedures that satisfy the specifications for all models. Specification ranges are tabulated for each specific model in the appropriate chapter.

MODELS

There are far too many models of Evinrude motors to list separate procedures for each. The various maintenance and overhaul functions are therefore referenced by engine horsepower output.

Usually the model number gives some clue as to the displacement of the engine and the year it was made. If in doubt about the year and model of your engine, refer any questions to a dealer. The horsepower for Johnson motors should be given somewhere on the motor cover or dealer plate.

Specifications and clearances are given in **Tables 1 through 8** at the end of the chapter.

SERVICE HINTS

The procedures used in this manual avoid the use of special tools and test equipment wherever possible. When necessary, special tools and test equipment are illustrated, either in actual use or alone. Special tools may be ordered and purchased through dealers. However, a well-equipped mechanic may find it possible to substitute similar tools or make new ones to fulfill a requirement.

Recommendations are occasionally made to refer a service task to a dealer or specialist in a particular field. In these cases, work will probably be done more quickly and economically than if the owner perfoms it personally.

When you order parts from the dealer or other parts distributor, always order by engine and chassis number. Write the numbers down and carry them in your wallet.

Throughout this manual, keep the following conventions in mind: "front" refers to the front of the boat, "left" and "right" or "port" and "starboard" refer to a person sitting in the boat facing forward. The abbreviation TDC means top-dead-center of a piston within a cylinder. BTDC means before top-dead-center; ATDC means after top-dead-center.

In procedural steps, the term "replace" means to discard a defective part and replace it with a new one. "Overhaul" means to remove, disassemble, inspect, measure, repair, or replace defective parts, reassemble, and install major systems and parts.

All dimensions and capacities are expressed in units familiar to an American mechanic. Metric measurements may also be given, as appropriate. Metric tools are not required to work on the various engines.

The terms NOTE, CAUTION, and WARNING have specific meaning in this book. A NOTE provides additional information to make a step or procedure easier or clearer. Disregarding a NOTE could cause inconvenience, but would not cause damage or personal injury.

A CAUTION emphasizes areas where equipment damage could result. Disregarding a CAUTION could cause perament mechanical damage; however, personal injury is unlikely.

A WARNING emphasizes areas where personal injury or even death could result from negligence. Mechanical damage may also occur. WARNINGS are to be taken seriously. In some cases serious injury or death has been caused by mechanics disregarding similar warnings.

STANDARD PRACTICES

Experienced mechanics observe certain practices as a matter of course. Some of the following items are precautionary, others provide hints.

1. Disconnect battery positive (+) cable before repair operations in the vicinity of electrical connections, or those requiring electrical disconnections.
2. Be aware of flame or spark sources when working near a charging battery, or other areas involving volatile fluids, such as the fuel system.
3. Use the proper cleaning solution. External parts can be cleaned with solvent, unless they include rubber. Rubber parts can be cleaned with alcohol (or clean hydraulic brake fluid). Hot water and detergent is an excellent cleaning solution for the internal metal parts.
4. Tag all similar internal parts for location, and mark all mating parts for position. Record number and thickness of any shims upon disassembly.
5. Protect finished surfaces from physical damage and corrosion.
6. Frozen or very tight bolts and screws can often be loosened by soaking with penetrating oil then sharply striking the bolt head a few times with a hammer and punch (or screwdriver for screws). Use heat as a last resort, and be cautious of warping, removing temper, or melting any adjacent parts.

7. No parts, except those assembled with a "press fit," require unusual force during assembly. If you encounter difficulty in disassembling or assembling a part, determine the reason before proceeding. Be patient.

8. Cover all openings after removing parts or subassemblies to keep dirt, small tools and parts, etc., from falling in.

9. When assembling 2 parts, start all fasteners required, then tighten evenly.

10. If a part requires replacement, always take old parts to the dealer, when practical, for comparison to replacement part.

SAFETY HINTS

Professional mechanics can work for years and never sustain a serious injury. If you observe a few rules of common sense and safety, you can enjoy many safe hours servicing your own engine. You could hurt yourself or damage the motor if you ignore these rules.

1. Never use gasoline as a cleaning solvent.

2. Never smoke or use a torch in the vicinity of flammable liquids such as cleaning solvent in open containers.

3. Never smoke or use a torch in an area where batteries are being charged. Highly explosive hydrogen gas is formed during the charging process.

4. If welding or brazing is required on the engine, remove the fuel tank to a safe distance, at least 50 feet away. Welding on gas tanks requires special safety procedures and must be performed only by someone skilled in the process.

5. Use the proper sized wrenches to avoid damage to nuts and injury to yourself.

6. When loosening a tight or stuck nut, be guided by what would happen if the wrench should slip. Protect yourself accordingly.

7. Keep your work area clean and uncluttered.

8. Wear safety goggles during all operations involving drilling, grinding, or use of a cold chisel.

9. Never use worn tools.

10. Keep a fire extinguisher handy and be sure it is rated for gasoline and electrical fires.

TOOLS

Shop Tools

For proper servicing, you will need an assortment of ordinary handtools. As a minimum, these include:

1. Combination wrenches
2. Sockets
3. Plastic mallet
4. Small hammer
5. Snap ring pliers
6. Pliers
7. Phillips screwdrivers
8. Slot (common) screwdrivers
9. Feeler gauges
10. Spark plug gauge
11. Spark plug wrench

Special tools necessary are shown in the chapters covering the particular repair in which they are used.

Electrical system servicing requires a voltmeter, ohmmeter, or other device for determining continuity, and a hydrometer for battery equipped engines.

Advanced tune-up and troubleshooting procedures require a few more tools.

1. *Hydrometer* (**Figure 1**). This instrument measures state of charge of the battery, and tells much about battery condition. Such an instrument is available at any auto parts store and through most larger mail order outlets. A satisfactory one costs less than $3.

2. *Multimeter or VOM* (**Figure 2**). This instrument is invaluable for electrical system troubleshooting and service. A few of its functions may be duplicated by locally fabricated substitutes, but for the serious hobbyist, it is a must. Its uses are described in the applicable sections of this book. Prices start at around $10 at electronics hobbyist stores and mail order outlets.

3. *Compression gauge* (**Figure 3**). An engine with low compression cannot be properly tuned and will not develop full power. A compression gauge measures engine compression. The one shown has a flexible stem, which enables it to reach cylinders where there is little clearance. Inexpensive ones start around $3, available at auto accessory stores or by mail order from large catalog order firms.

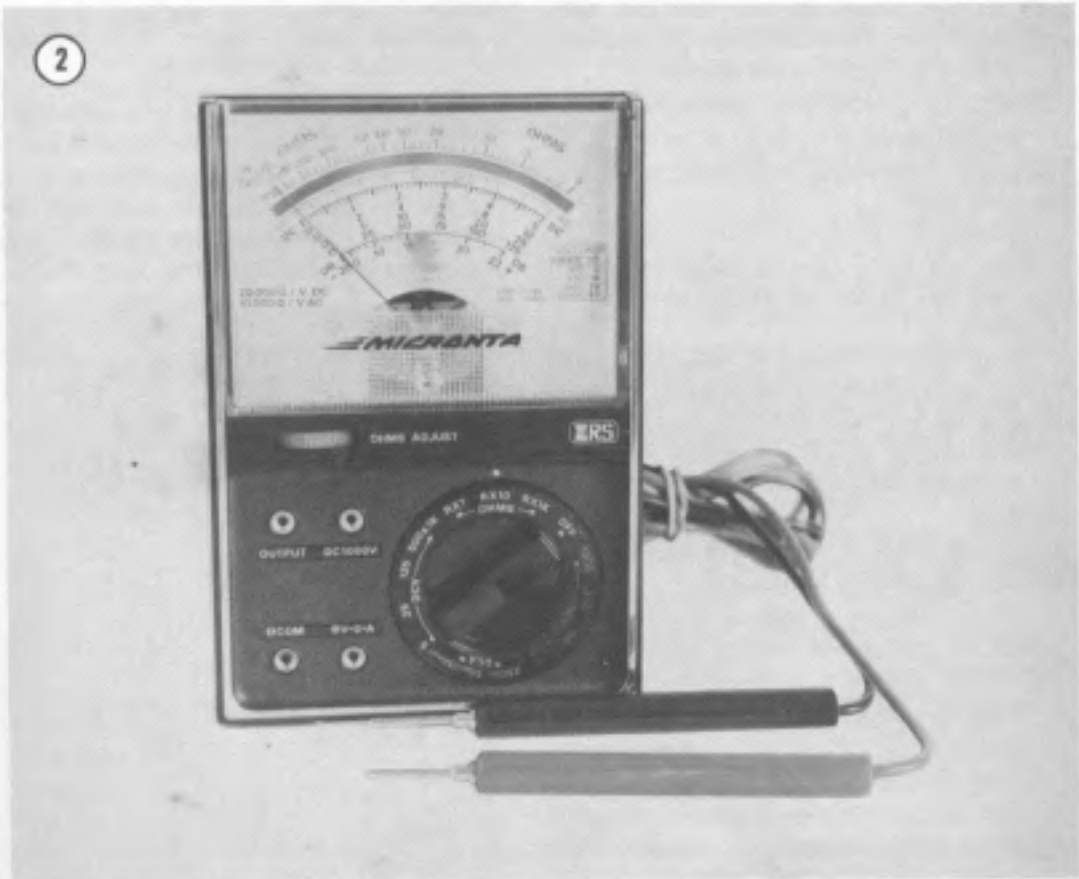
4. *Impact driver* (**Figure 4**). This tool might have been designed with the mechanic in mind. It makes removal of engine cover screws easy, and eliminates damaged screw slots. Good ones run about $15 at larger hardware stores.

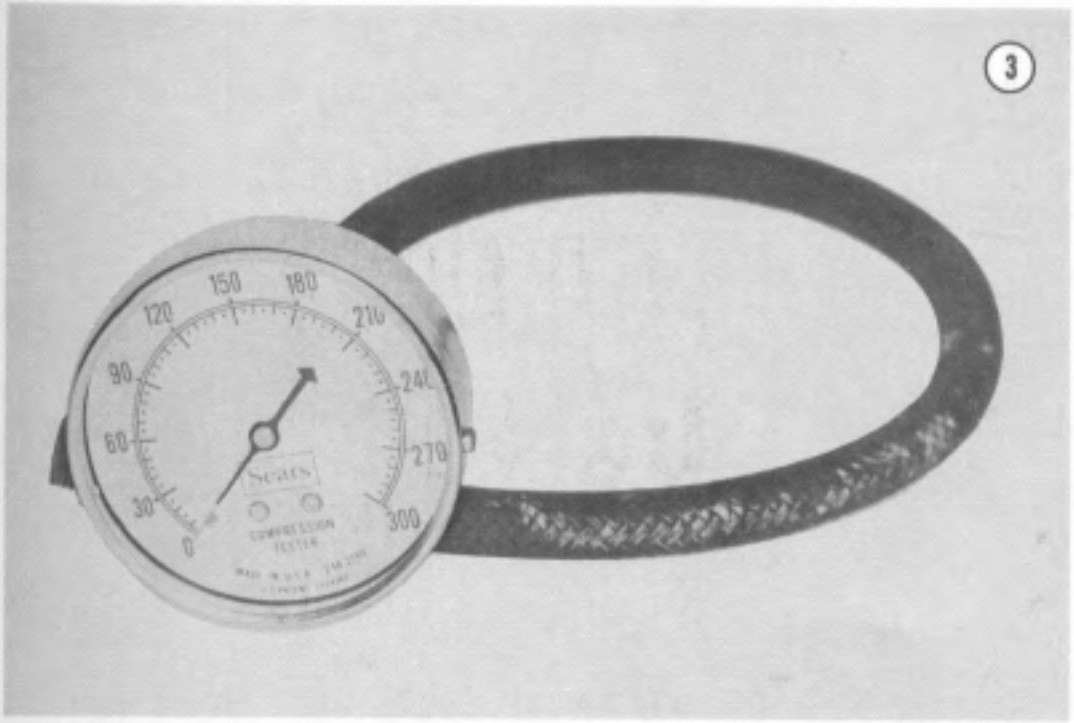
5. *Ignition gauge* (**Figure 5**). This tool measures point gap. It also has round wire gauges for measuring spark plug gap.

A few special tools may also be required for major engine service. They are available at the dealer.

EXPENDABLE SUPPLIES

Certain expendable supplies are also required. These include grease, oil, gasket cement, wiping rags, cleaning solvent, and distilled water. Ask your dealer for the special locking compounds and silicone lubricants which make maintenance simpler and easier. Solvent is available at most service stations and distilled water for the battery is available at most supermarkets.

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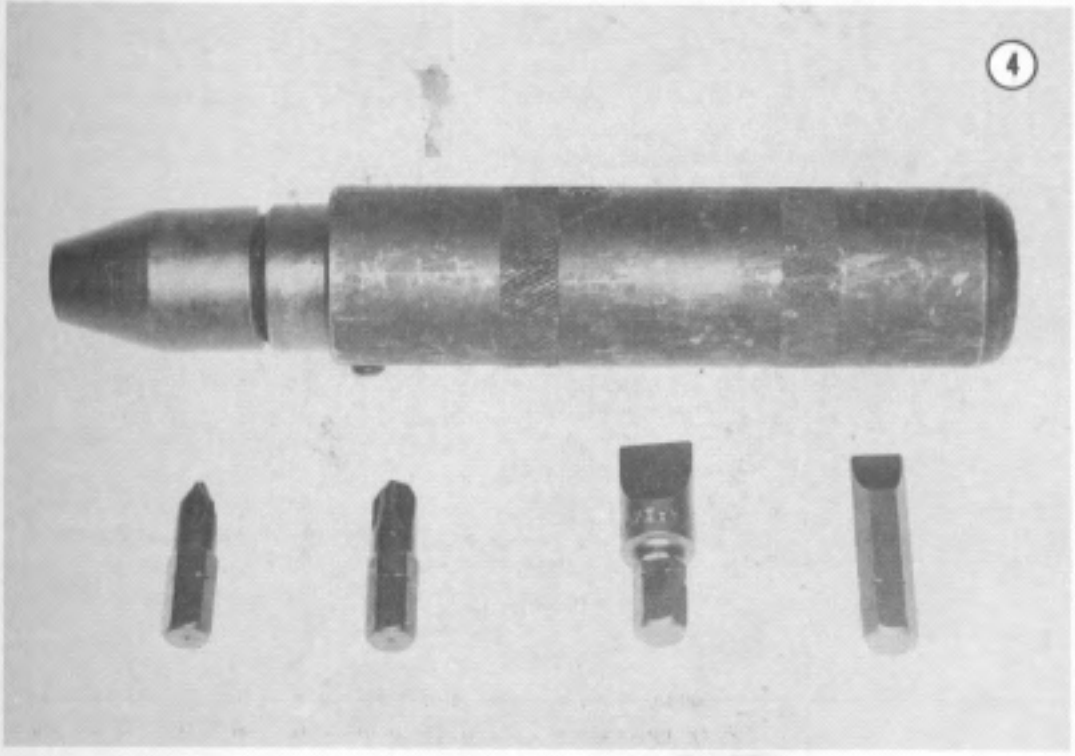
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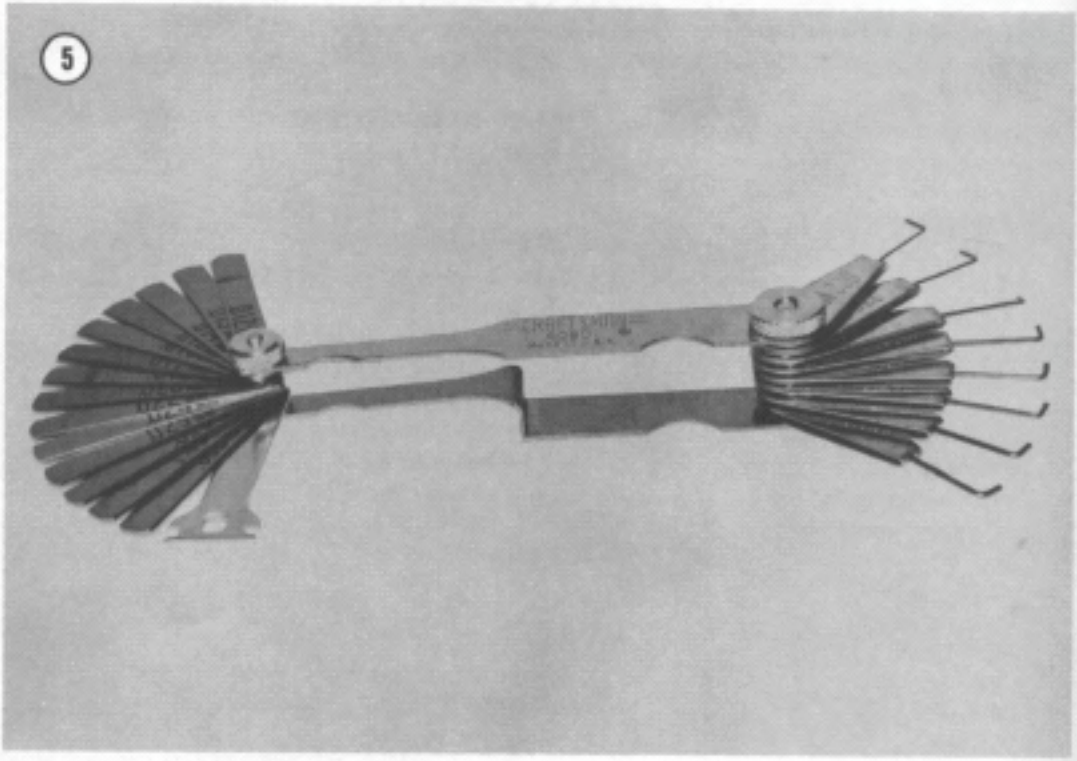
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Table 1 SPECIFICATIONS AND CLEARANCES — 1½ AND 2 HP

GENERAL	
*Horsepower	1½ hp @ 4,000 rpm 2 hp at 4,500 rpm for 1971 and later
Operating range	3,500 to 4,500 rpm
Test tank	3,900 to 4,200 rpm
Engine type	Single cylinder, 2-cycle
Bore and stroke	1-9/16 in. bore x 1-3/8 in. stroke
Piston displacement	2.64 cu. in.
Crankshaft size	
Top journal	0.7502 - 0.7497 in.
Bottom journal	0.7502 - 0.7497 in.
Connecting rod crank pin	0.6690 - 0.6685 in.
Carburetion	Single barrel, float feed, high and low-speed adjustments
Float level setting	Flush with casting
Inlet needle seat	0.065 - 0.062 in. for 1968 0.050 - 0.053 in. Use a No. 55 drill as gauge
Cooling system	Centri-matic cooling
Propeller gear ratio	12:25
Propeller	7¼ x 4½ in.
Speed control	Single lever, synchronized throttle and spark
Starter	Manual
Ignition	Flywheel magneto
Spark plug	AC-M42K, Champion J4J, Auto-Lite A21X - 14mm (1½ hp)
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point gap	0.020 in.
Condenser	0.18 to 0.22 μfd.
Spark plug	AC-M44C, Champion J6J, 14mm (2 hp)
POWER HEAD	
Piston ring gap	0.015 - 0.005 in.
Piston ring groove	0.0035 - 0.001 in., 0.0040 - 0.0020 in. for 1002 1970 and later
Cylinder and piston	0.0005 - 0.0043 in., 0.0025 - 0.0013 in. for 1802 1968 Roller
Crankshaft	
Upper	Needle bearing
Lower	Needle bearing
Connecting rod	
Piston end	0.0011 - 0.0004 in.
Crankshaft end	Needle bearing

(continued)

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

Table 1 SPECIFICATIONS AND CLEARANCES — 1½ AND 2 HP (continued)

LOWER UNIT	
Drive shaft and bushing in gearcase	0.0025 - 0.0010 in., 0.0028 - 0.0010 in. for 1002 1970 and later
Gearcase head and propeller shaft	0.0020 - 0.0005 in., 0.0022 - 0.0007 in. for 1002 1970 and later
Propeller on shaft	0.0055 - 0.003 in., 0.0057 - 0.0032 in. for 1002 1970 and later
Bushing-to-propeller shaft	0.0022 - 0.007 in., 1970 and later

TORQUE CHART

POWER HEAD	
Flywheel unit	22 - 25 ft.-lb.
Connecting rod screws	60 - 66 in.-lb.
Cylinder head screws	60 - 80 in.-lb.
Manifold to crankcase screws	60 - 80 in.-lb.
Bearing housing-to-cylinder screws	60 - 80 in.-lb.
Spark plug	17½ - 20½ ft.-lb.
LOWER UNIT	
Pull required at propeller shaft to tilt up lower unit	11 - 14 lb.

Note: See Table 9 for tightening torques of standard screws.

Table 2 SPECIFICATIONS AND CLEARANCES — 3 HP

GENERAL	
*Horsepower	3 hp @ 4,000 rpm
Operating range	3,500 hp @ 4,500 rpm
Test tank	3,850 rpm
Engine type	2-cylinder, 2 cycle, 180° crank
Bore and stroke	1-9/16 in. bore x 1-3/8 in. stroke
Piston displacement	5.28 cu. in.
Crankshaft size	
All journals	0.6854 - 0.6849 in.
Connecting rod crank pin	0.6255 - 0.6250 in.
Carburetion	Single barrel, float feed, high and low-speed adjustments, manual choke
Float level	Flush with casting
Inlet needle seat	0.065 - 0.062 in. Use a No. 52 drill as gauge
Cooling system	Centri-matic (combination positive displacement and centrifugal pump)
Propeller gear ratio	17:28 Lightwin/Ducktwin
	12:25 Yachtwin
Propeller	Yachtwins—
	Standard - 8 in. diameter x 5½ in. pitch, 3 blade
	Optional - 8 x 4½ in., 3 blade
	Lightwins—
	6⅛ in. diameter x 6¼ in. pitch, 2 blades
Speed control	Single lever, synchronized throttle and spark
Starter	Manual, self-rewinding
Ignition	Flywheel magneto
Spark plug	AC-M42K, Champion J4J, 14mm
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft-lb.
Breaker point gap	0.020 in.
Condenser	0.18 to 0.22 μfd.
POWER HEAD	
Piston ring gap	0.015 - 0.005 in.
Piston ring groove	0.0035 - 0.001 in.
Cylinder and piston	0.0025 - 0.0013 in.
Crankshaft	
Upper	0.0023 - 0.0013 in.
Center	0.0023 - 0.0013 in.
Lower	0.0023 - 0.0013 in.
Connecting rod	
Piston end	0.0011 - 0.0004 in.
Crankshaft end	0.0017 - 0.0007 in.

(continued)

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

Table 2 SPECIFICATIONS AND CLEARANCES — 3 HP (continued)

LOWER UNIT	Weedless Gearcase	Standard Gearcase
Drive shaft and bushing in gearcase	0.003 - 0.001 in.	0.0025 - 0.0010 in. 0.0018 - 0.005 in. 1966
Gear housing cap	0.0015 - 0.0005 in.	0.0020 - 0.0005 in. 0.0018 - 0.0005 in. 1966
Propeller on shaft	0.0043 (Hub) - 0.0023 in. 0.003 in.	0.0055 - 0.003 in. 0.0053 - 0.003 in. 1966

TORQUE CHART

POWER HEAD	
Flywheel nut	30 - 40 ft.-lb.
Connecting rod screws	60 - 66 in.-lb.
Cylinder head screws	60 - 80 in.-lb.
Crankcase to cylinder screws— upper, center, lower	60 - 80 in.-lb.
Spark plug	17½ - 20½ ft.-lb.
Pull required at propeller shaft to tilt up lower unit	12 - 15 lb.
Starter housing	36 - 60 in.-lb. (3 - 5 ft.-lb.) 1966

Note: See Table 9 for tightening torques of standard screws.

Table 3 SPECIFICATIONS AND CLEARANCES — 4 HP

GENERAL	
*Horsepower	4 hp @ 4,500 rpm
Operating range	4,000 to 5,000 rpm
Test tank	4,100 rpm 4,100 rpm. Part No. 316021 for 4506 4,550 rpm. Part No. 317738 for 4536
Engine type	2-cylinder, 2 cycle 180° crank
Bore and stroke	1-9/16 in. bore x 1-3/8 in. stroke
Piston displacement	5.28 cu. in.
Crankshaft size	
Top journal	0.7520 - 0.7515 in.
Center journal	0.6854 - 0.6849 in.
Bottom journal	0.6854 - 0.6849 in.
Connecting rod crank pin	0.6255 - 0.6250 in.
Carburetion	Single barrel, float feed, high and low-speed adjustments, manual choke
Float level setting	Flush with casting
Inlet needle seat	0.053 - 0.050 in. Use a No. 55 drill as gauge
Cooling system	Centri-matic (combination positive displacement and centrifugal pump)
Propeller gear ratio	17:28 Weedless 12:25 Standard
Propeller drive pin	Part No. 316558 1/8 x 1.234 in. stainless steel
Propeller	Standard 7½ in. dia. x 6 in. pitch 3 blade LEXAN or 8 in. dia. x 5½ in. pitch, 3 blade, 8 x 4½ x 3 optional Weedless 6¼ in. dia. x 6 in. pitch, 2 blades LEXAN 6¼ x 5½ x 3 optional
Speed control	Single lever, synchronized throttle and spark
Starter	Eas-A-Matic, self-rewinding
Ignition	Flywheel magneto
Spark plug	AC-M44C, Champion J6J, 14mm 1969 to 1970 ACM42K, J4J
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point gap	0.020 in.
Condenser	0.18 to 0.22 μfd.

(continued)

* Standard length lower unit.

Table 3 SPECIFICATIONS AND CLEARANCES — 4 HP (continued)

POWER HEAD		
Piston ring gap	0.015 - 0.005 in.	
Piston ring groove	0.0040 - 0.0020 in. 1969, 0.0035 - 0.0010	
Cylinder and piston	0.0020 - 0.0008 in. 1969, 0.0049 - 0.0014	
Crankshaft		
Upper	Needle bearings	
Center	0.0023 - 0.0013 in.	
Lower	0.0023 - 0.0013 in.	
Connecting rod		
Piston end	0.0011 - 0.0004 in.	
Crankshaft end	0.0017 - 0.0007 in.	
LOWER UNIT	Weedless	Standard
Standard		
Pinion and bushing in gearcase		0.0018 - 0.0005 in.
Weedless		
Drive shaft and bushing in gearcase	0.003 - 0.001 in.	
Gearcase head and bushing assembly	0.0015 - 0.0005 in.	0.0022 - 0.0007 in.
Propeller on shaft		
1970, 0.0065 - 0.0030	0.0053 - 0.0020 in.	0.0067 - 0.0022 in.
1971, 0.0065 - 0.0020	0.0043 - 0.0023 in. 1969	0.0055 - 0.003 in. 1969
Gearcase bushing to propeller shaft		0.0022 - 0.0007 in.
		0.0020 - 0.0008 in. 1971

TORQUE CHART

POWER HEAD	
Flywheel nut	30 - 40 ft.-lb.
Connecting rod screws	60 - 66 in.-lb.
Cylinder head screws	60 - 80 in.-lb.
Crankcase to cylinder screws—	
upper, center lower	60 - 80 in.-lb.
Spark plugs	17½ - 20½ ft.-lb.
Pull required at propeller shaft to tilt up lower unit	12 - 15 ft.-lb.

Note: See Table 9 for tightening torques of standard screws.

Table 4 SPECIFICATIONS AND CLEARANCES — 5 AND 6 HP

GENERAL		
		Model Nos.
*Horsepower	5 hp @ 4,000 rpm	5602-5803
	6 hp @ 4,500 rpm	6602-6805
Operating range	3,500 - 4,500 rpm	
Tank test	4,150 rpm	
Engine type	2-cylinder, 2-cycle 180° crank	
Bore and stroke	1-15/16 in. bore x 1-1/2 in. stroke	
Piston displacement	8.84 cu. in.	
Crankshaft size		
Top journal	0.8085 - 0.8080 in.	
Center journal	0.8080 - 0.8075 in.	
Bottom journal	0.8085 - 0.8080 in.	
Connecting rod crank pin	0.6690 - 0.6685 in.	
Carburetion	Single barrel, float feed, low-speed adjustment	
Float level setting	Flush with rim of casting	
Carburetor orifice plug	Hole size 0.041 in.	
Inlet needle seat	0.053 to 0.050 in. Use a No. 55 drill as gauge	
Cooling system	Centri-Matic (combination positive displacement and centrifugal pump)	
Propeller gear ratio	12:25	
Propeller	8 in. dia. x 7½ in. pitch, 3 blade	
Speed control	Single lever, synchronized throttle and spark	
Starter	Manual, self-rewinding	
Ignition	Flywheel magneto	
Spark plug	AC-M42K, Champion J4J	
Spark plug gap	0.030 in.	
Spark plug torque	17½ - 20½ ft.-lb.	
Breaker point gap	0.020 in.	
Condenser	0.18 - 0.22 μfd.	
POWER HEAD		
Piston ring gap	0.015 - 0.005 in.	
Piston ring groove clearance	0.0035 - 0.0010 in.	
Cylinder and piston	0.003 - 0.0018 in.	
Crankshaft bushings		
Upper	0.0020 - 0.0010 in.	
Center	0.0025 - 0.0015 in.	
Lower	0.0020 - 0.0010 in.	
Crankshaft end-play	0.010 - 0.002 in., 1966 0.007 in. max.	
Connecting rod bearings		
Piston end	0.0010 - 0.0003 in.	
Crankshaft end	Needle bearing	
	1966 0.0010 - 0.0003 in., roller bearing	

(continued)

* Standard length lower unit.

Table 4 SPECIFICATIONS AND CLEARANCES — 5 AND 6 HP (continued)

LOWER UNIT	
Gearcase head and propeller shaft	0.0018 - 0.0005 in.
Driveshaft	0.0025 - 0.0010 in.
Propeller shaft bushing—front	0.0020 - 0.0005 in., 1966 0.0020 - 0.0008 in.
Propeller hub on shaft	0.0055 - 0.0025 in. 0.0033 - 0.0010 in., 1966

TORQUE CHART

POWER HEAD	
Flywheel nut	40 - 45 ft.-lb.
Connecting rod screws	60 - 66 in.-lb.
Cylinder head screws	60 - 80 in.-lb.
Crankcase to cylinder screws	
Upper	60 - 80 in.-lb.
Center	60 - 80 in.-lb.
Lower	60 - 80 in.-lb.
Spark plugs	17½ - 20½ ft.-lb.
LOWER UNIT	
Pull required at propeller shaft for tilt up lower units*	12 - 15 lb.
Slip clutch propeller	45 - 55 ft.-lb.

Note: See Table 9 for tightening torques or standard screws.

Table 5 SPECIFICATIONS AND CLEARANCES — 9.5 Hr

GENERAL	
*Horsepower	9½ hp @ 4,500 rpm
Operating range	4,000 to 5,000 rpm
Tank test	4,400 rpm
	Part No. 379673
Engine type	2-cylinder, 2-cycle, 180° crank
Bore and stroke	2-5/16 in. bore x 1-13/16 in. stroke
Displacement	15.2 cu. in.
Crankshaft size	
Top journal	0.8125 - 0.8120 in.
Center journal	0.8132 - 0.8127 in., 0.8118 - 0.8113 in. 1966
Bottom journal	0.8125 - 0.8120 in.
Connecting rod crank pin	0.8132 - 0.8127 in.
	0.8118 - 0.8113 in., 1966
Cooling system	Centri-matic (combination positive displacement and centrifugal pump) thermostatically controlled
Carburetion	Float feed, low-speed adjustment, and manual choke
Float level setting	Parallel with face of casting
Carburetor orifice plug	Hole size 0.048 in. Use a No. 56 drill as gauge
Inlet needle seat	0.053 - 0.050 in. Use a No. 55 drill as a gauge
Propeller gear ratio	13:23
Propeller	3 blade, 8⅛ in. dia. x 8 in. pitch
Speed control	On steering handle, synchronized throttle and spark
Gear shift control	Forward, neutral and reverse
Starter	Manual-self rewind
Ignition	Flywheel magneto
Spark plug	AC-M42K, Champion J4J - 14mm
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point gap	0.020 in.
Condenser	0.18 - 0.22 μfd
POWER HEAD	
Piston and wrist pin—loose end	0.0005 - 0.0000 in.
Piston ring gap	0.017 - 0.007 in.
Piston ring groove clearance	0.0035 - 0.001 in.
Cylinder and piston	0.0050 - 0.0035 in.
	0.0045 - 0.003 in., 1966
Crankshaft bearings	
Upper	Needle bearing, roller bearing
Center	Needle bearing, roller bearing
Lower	Needle bearing, roller bearing

(continued)

* Standard length lower unit.

Table 5 SPECIFICATIONS AND CLEARANCES — 9.5 HP (continued)

POWER HEAD (continued)	
Connecting rod bearings	
Piston end	Needle bearing, roller bearing
Crankshaft end	Needle bearing, roller bearing
LOWER UNIT	
Gearcase head and propeller shaft	0.0020 - 0.0010 in.
Driveshaft—upper	0.0020 - 0.0003 in.
Driveshaft—lower	0.0030 - 0.0013 in.
Propeller on shaft	0.009 - 0.007 in.
Front gear to gearcase bearing	0.0022 - 0.0010 in.
Front gear to front bushing	Press fit
Front gear bushing to propeller shaft	0.0015 - 0.0005 in.
Rear reverse gear to rear bushing	0.0020 - 0.0005 in.
Rear gear bushing to propeller shaft	0.0015 - 0.0005 in.

TORQUE CHART

POWER HEAD	
Flywheel nut	40 - 45 ft.-lb.
Connecting rod screws	90 - 100 in.-lb.
Cylinder head screws	96 - 120 in.-lb.
Crankcase to cylinder screws	
Upper	120 - 145 in.-lb.
Center	120 - 145 in.-lb.
Lower	120 - 145 in.-lb.
Spark plugs	17½ - 20½ ft.-lb.
LOWER UNIT	
Side mounts nuts— upper and lower	150 - 170 in.-lb. (12 - 14 ft.-lb.)
Slip clutch propeller	70 ft.-lb.

Note: See Table 9 for tightening torques of standard screws.

Table 6 SPECIFICATIONS AND CLEARANCES — 9.9 AND 15 HP

GENERAL	
Horsepower	9.9 hp @ 5,000 rpm
Operating range	4,500 to 5,500 rpm
Tank test	5,400 rpm
Engine type	2-cylinder, 2-cycle 180° crank
Bore and stroke	2.188 in. bore x 1.760 in. stroke
Piston displacement	13.20 cu. in.
Crankshaft size	
Top journal	0.8757 - 0.8752 in.
Center journal	0.8125 - 0.8120 in.
Bottom journal	0.8125 - 0.8120 in.
Connecting rod crank pin	1.06350 - 1.06300 in.
Carburetion	Single barrel, float feed, fixed high speed adjustable low-speed, manual choke
High speed orifice plug	Identification Number 51 Check with No. 0.051 dia. drill
Cooling system	Centri-matic (combination positive displacement and centrifugal pump) Thermostatically controlled
Propeller gear ratio	12:29
Propeller supplied with motor	3 blade, 9½ in. dia. x 10 in. pitch
Propeller options	3 blade, 10 in. dia. x 5 in. pitch 2 blade weedless 9 in. dia. x 10 in. pitch
Speed control	On steering handle Remote control available
Gear shift control	Forward, neutral and reverse
Electrical system (Electric start models only)	5 amp flywheel alternator
Starter	Manual self-winding Electric - 12 volt, and rope
Starter amperage draw while cranking	55 amps max.
Ignition	Low tension magneto
Spark plug	Champion LJ7, 14mm
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point	Gap 0.020 in.
Condenser	0.25 - 0.29 μfd
POWER HEAD	
Piston ring gap	0.015 - 0.005 in.
Piston ring groove clearance, lower	0.0035 - 0.0025 in.
Piston pin to piston — loose end	0.0005 - 0.0000 in.
Cylinder and piston	0.0053 - 0.0040 in.
Crankshaft end-play	Controlled by lower journal bearing

(continued)

Table 6 SPECIFICATIONS AND CLEARANCES — 9.9 AND 15 HP (continued)

LOWER UNIT	
Propeller shaft in front gear bushing	0.0087 - 0.0002 in.

TORQUE CHART

POWER HEAD	
Flywheel nut	45 - 50 ft.-lb.
Connecting rod screw	48 - 60 in.-lb. (4 - 5 ft.-lb.)
Cylinder head screws	145 - 170 in.-lb. (12 - 14 ft.-lb.)
Crankcase to cylinder screws — upper, center and lower	145 - 170 in.-lb. (12 - 14 ft.-lb.)
Electric starter through bolts	30 - 40 in.-lb.
Electric starter pinion nut	150 - 170 in. lb.
Spark plug	17½ - 20½ ft.-lb.
Manual starter assembly screw	24 - 26 ft.-lb.
LOWER UNIT	
Upper mounts	60 - 80 in.lb. (5 - 7 ft.lb.)
Pilot shaft to steering bracket screws	60 - 80 in.-lb. (5 - 7 ft.lb.)
Slip clutch propeller	85 ft.-lb. min.
*Pull at propeller shaft for tilt up	30 - 40 lbs.
*Pull at propeller to overcome reverse lock	100 - 200 lbs.

Note: See Table 9 for tightening torques of standard screws.

* Standard length lower unit.

Table 7 SPECIFICATIONS AND CLEARANCES — 18 AND 25 HP

GENERAL	
Horsepower	25 hp@ 5,500 rpm (18 hp @ 4,500 rpm)
Operating range	5,000 to 6,000 rpm (4,000 to 5,000 rpm)
Tank test	4,900 rpm
Engine type	2-cylinder, 2-cycle, 180° crank
Bore and stroke	2½ in. bore x 2¼ in. stroke
Piston displacement	22.0 cu. in.
Crankshaft size	
Top journal	1.0000 - 0.9995 in.
Center journal	1.0000 - 0.9995 in.
Bottom journal	1.0000 - 0.9995 in.
Connecting rod crank pin	1.0005 - 1.0000 in.
Carburetion	Single barrel, float feed, low-speed adjustment
Float level setting	Parallel to and 1/16 in. above gasket surface
Carburetor orifice plug	0.072 in. (0.068 for 18 hp)
Inlet needle seat	0.065 - 0.062 in. Use a No. 52 drill as a gauge
Cooling system	Centri-matic (combination positive displacement and centrifugal pump) thermostatically controlled by-pass system
Propeller gear ratio	12:21
Propeller drive pin	3/16 x 1 25/64 in., stainless steel
Propeller, supplied with motor	3 blade, 9 in. dia. x 10 in. pitch
Propeller, optional	3 blade, 9 in. dia. x 9 in. pitch
Propeller, optional	3 blade, 9 in. dia. x 10 in. pitch weedless
Speed control	Twist grip, sychronized throttle and spark
Gear shift control	Forward, neutral and reverse
Starter	12 volt electric key and automatic rewind rope, manual for 18 hp
Starter amperage draw when cranking	120 amperes maximum
Ignition	Low tension magneto
Spark plug	Champion UJ4J, - 14mm
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point gap	0.020 in.
Condenser	0.25 - 0.29 μfd
Driver coil resistance	0.80 ± 0.05 ohm
POWER HEAD	
Piston and wrist pin — loose end	0.0005 - 0.0000 in.
Piston ring gap	0.017 - 0.07 in.
Piston ring groove clearance	0.0040 - 0.0020 in.
Cylinder and piston	0.0048 - 0.0033 in.
Crankshaft bearings	
Upper	Roller type
Center	Needle type
Lower	Roller type

(continued)

Table 7 SPECIFICATIONS AND CLEARANCES — 18 AND 25 HP (continued)

POWER HEAD (continued)	
Crankshaft end-play	0.023 - 0.009 in.
Connecting rod bearings	
Piston end	Needle type
Crankshaft end	Needle type
POWER HEAD	
Driveshaft — upper	Needle bearing
Propeller shaft in front gear bushing	0.0015 - 0.0005 in.
Gearcase head and propeller shaft	0.002 - 0.001 in.
Driveshaft pinion in gearcase	0.0025 - 0.0015 in.
Propeller shaft to reverse gear bushing	0.0015 - 0.0005 in.
Front gear to gearcase bearing	0.0060 - 0.0045 in.
Rear reverse gear to bushing	0.002 - 0.0005 in.

TORQUE CHART

POWER HEAD	
Flywheel nut	40 - 45 ft.-lb.
Connecting rod screws	180 - 186 in.-lb.
Cylinder head screws	96 - 120 in.-lb.
Crankcase to cylinder screws	
Upper	110 - 130 in.-lb.
Center	120 - 130 in.-lb.
Lower	110 - 130 in.-lb.
Starter housing	96 - 120 in.-lb. (8 - 10 ft.-lb.)
Spark plug	17½ - 20½ ft.-lb.
LOWER UNIT	
Lever to shift rod clamp screw	50 - 60 in.-lb. (5 - 7 ft.-lb.)
Side mounts, upper and lower nuts	150 - 170 in.-lb. (12 - 14 ft.-lb)
Pilot shaft to steering bracket screws	84 - 108 in.-lb. (7 - 9 ft.-lb.)
Lower mount housing to pilot shaft screws	170 - 190 in.-lb. (14 - 16 ft.-lb)
Slip clutch propeller	90 ft.-lb.
Lower motor cover mount nuts	72 - 96 in.-lb. (6 - 8 ft.-lb.)
*Pull at propeller shaft for tilt up lower units	30 - 35 lbs.
*Pull at propeller shaft to overcome reverse lock	200 - 240 lbs.

Note: See Table 9 for tightening torques of standard screws.

* Standard length lower unit.

Table 8 SPECIFICATIONS AND CLEARANCES — 33 HP

GENERAL	
Horsepower	33 hp @ 4,500 rpm
Operating range	4,000 to 5,000 rpm
Tank test	4,400 rpm
Engine type	2-cylinder, 2-cycle, 180° crank
Bore and stroke	3 1/16 in. bore x 2½ in. stroke
Piston displacement	40.5 cu. in.
Crankshaft size	
Top journal	1.2500 - 1.2495 in.
Center journal	1.000 - 0.9995 in.
Bottom journal	1.000 - 0.9995 in.
Connecting rod crank pin	1.1828 - 1.1823 in.
Carburetion	Single barrel, float feed, high and low-speed adjustments, manual or electric choke
Float level setting	Flush with rim of casting
Inlet needle seat	0.065 - 0.062 in. Use No. 52 drill as a gauge
Cooling system	Centri-matic (combination positive displacement and centrifugal pump)
Propeller gear ratio	12:21
Propeller	3 blade, 10½ in. dia. x 12 in. pitch
Propeller options	3 blade, 10⅜ in. dia. x 11½ in. pitch
	3 blade, 10⅜ in. dia. x 14 in. pitch
	3 blade, 10⅜ in. dia. x 13¼ in. pitch
Speed control	Knob on steering bracket or remote control. Synchronized throttle and spark
Gear shift control	Forward, neutral, and reverse
Starter	Ski-Twin — Simplex self-winding spring
	Ski-Twin Electric — Electric
Ignition	Flywheel magneto
Spark plug	AC - M42K, Champion J4J, 14mm
Spark plug gap	0.030 in.
Spark plug torque	17½ - 20½ ft.-lb.
Breaker point gap	0.020 in.
Condenser	0.25 - 0.29 μfd
POWER HEAD	
Piston ring gap	0.017 - 0.007 in.
Piston ring groove clearance	0.007 - 0.0045 in.
Piston pin to piston — loose end	0.0006 - 0.0001 in.
Cylinder and piston	0.0045 - 0.0030 in.
Crankshaft end play	0.011 - 0.003 in.
LOWER UNIT	
Driveshaft — upper	Roller
Propeller shaft in front gear bushing	0.0020 - 0.0010 in.

(continued)

Table 8 SPECIFICATIONS AND CLEARANCES — 33 HP (continued)

LOWER UNIT (continued)	
Rear reverse gear to rear bushing	0.0020 - 0.0005 in.
Rear gear bearing to propeller shaft	0.0025 - 0.0005 in.
Propeller on shaft at drive pin hole	0.007 - 0.003 in.
Propeller on shaft — above the shoulder	0.0069 - 0.0034 in.

TORQUE CHART

POWER HEAD	
Flywheel nut	100 - 105 ft.-lb.
Connecting rod screw	348 - 372 in.-lb. (29 - 31 ft.-lb.)
Cylinder head screws	168 - 192 in.-lb.
Crankcase to cylinder screws	
Upper and lower	150 - 170 in.-lb.
Center	162 - 168 in.-lb.
Spark plug	17½ - 20½ ft.-lb.
Starter housing screws	96 - 120 in.-lb. (8 - 10 ft.-lb.)
Side mounts — upper and lower nuts	150 - 170 in.-lb. (12 - 14 ft.-lb.)
Front mount — upper nut	240 - 320 in.-lb. (20 - 26 ft.-lb.)
Pilot shaft to steering bracket	120 - 140 in.-lb. (10 - 12 ft.-lb.)
Slip clutch propeller	185 - 255 ft.-lb.
*Pull at propeller shaft for tilt up lower units	30 - 40 lbs.
*Pull at propeller shaft to overcome reverse lock	260 - 310 lbs.

Note: See Table 9 for tightening torques of standard screws.

* Standard length lower unit.

Table 9 STANDARD SCREWS (TYPICAL TORQUE VALUE)

	Inch-Pounds	Foot-Pounds
No. 6	7 - 10	
No. 8	11 - 14	
No. 10	25 - 35	2 - 3
No. 12	35 - 40	3 - 4
¼ in.	60 - 80	5 - 7
5/16 in.	120 - 140	10 - 12
⅜ in.	220 - 240	18 - 20

Never tighten a screw completely if it is on a part with 2 or more screws. The pressure on one side can cause distortion and leakage possibly resulting in damage. This is especially critical on the cylinder head and gear case.

To avoid such warping, tighten each screw down in thirds until all are tight. In other words, if the torque is 9 ft.-lb., then tighten each screw to 3 ft.-lb., then to 6 ft.-lb., and finally to 9 ft.-lb.

Re-torque spark plugs, cylinder head and gear case screws after the first 15 minutes of running time.

CHAPTER TWO

LUBRICATION, PERIODIC MAINTENANCE, AND TUNE-UP

The 3 parts of this chapter present procedures necessary for maintaining maximum economy, performance, and dependability. Periodic performance of lubrication items will coincide with some maintenance periods; similarly, engine tune-up periods coincide with lubrication and maintenance periods. Ideally, all lubrication and maintenance items should be performed when it is time for engine tune-up.

Lubrication and maintenance intervals are identical for all models. See **Table 1** for lubrication points. Checks should include cleaning and tightening as well as inspection for unscheduled maintenance or repair. Manufacturer's recommended maintenance intervals for some items might possibly be performed less frequently if experience so indicates. It is suggested, however, that recommended intervals be followed until the effects of local environment and use indicate increased or reduced frequency.

The capacities shown for each model are typical. Minor improvements and changes in parts configurations have occasionally raised or lowered various capacities for a group of engines independent of model designation; therefore, fluid levels should always be confirmed by a visual check.

Tune-up specifications and torque values are presented at the end of Chapter One. Operating principles of piston port 2-stroke engines are discussed in this chapter.

Engine Operation

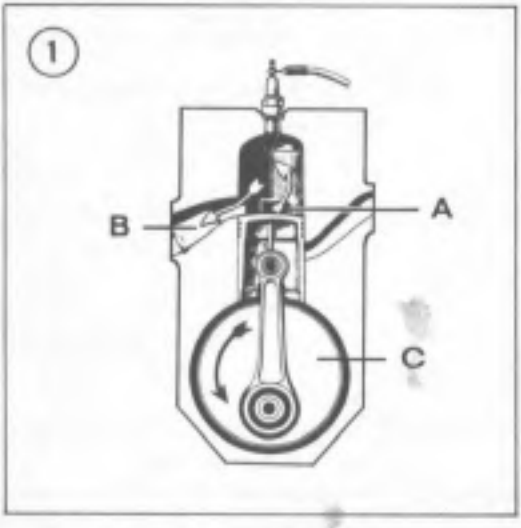
Figures 1 through **4** illustrate the operation of a piston-port engine. This engine is similar to a rotary-valve type, except that intake valving is accomplished by the piston rather than by a valve rotating with the crankshaft. During this discussion, assume that the crankshaft is rotating counterclockwise.

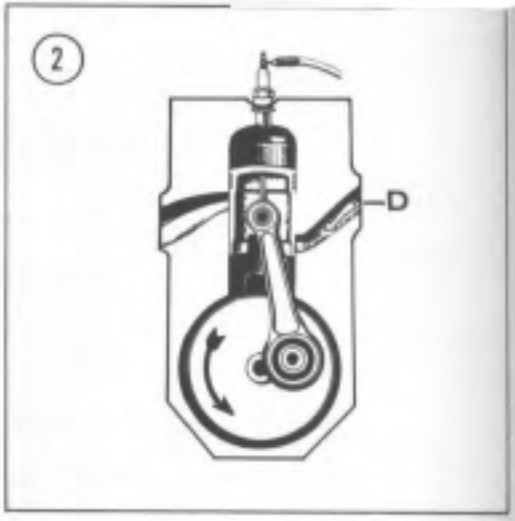
In **Figure 1**, as the piston travels downward, a scavenging port (A) between the crankcase and the cylinder is uncovered. The exhaust gases leave the cylinder through the exhaust port (B), which is also opened by the downward movement of the piston. A fresh fuel/air charge, which has previously been compressed slightly, travels from the crankcase (C) to the cylinder through the scavenging port (A) as the port opens. Since the incoming charge is under pressure, it rushes into the cylinder quickly and helps to expel the exhaust gases from the previous cycle.

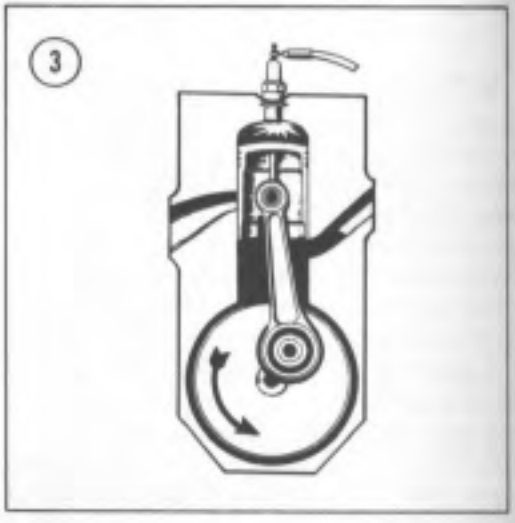
Figure 2 illustrates the next phase of the cycle. As the crankshaft continues to rotate, the piston moves upward, closing the exhaust and scavenging ports. As the piston continues upward, the air/fuel mixture in the cylinder is

Table 1 LUBRICATION POINTS

Part	Lubricant
Tilt reverse lock lever	OMC Sea-Lube anti-corrosion lube
Clamp screw threads	OMC Sea-Lube anti-corrosion lube
Throttle shaft gears	OMC Sea-Lube anti-corrosion lube
Idle speed adjuster	OMC Sea-Lube anti-corrosion lube
Magneto linkage	OMC Sea-Lube anti-corrosion lube
Manual starter spring	OMC Sea-Lube anti-corrosion lube
Choke	OMC Sea-Lube anti-corrosion lube
Carburetor linkage	OMC Sea-Lube anti-corrosion lube
Shift lever detent	OMC Sea-Lube anti-corrosion lube
Gearcase	OMC Sea-Lube gearcase lube (13.9 oz.)
Electric starter pinion shaft	Lubriplate 777
Motor cover latch lever	OMC Sea-Lube anti-corrosion lube
Swivel bracket	OMC Sea-Lube anti-corrosion lube







compressed. Notice also that a low pressure area is created in the crankcase at the same time. Further upward movement of the piston uncovers the intake port (D). A fresh fuel/air charge is then drawn into the crankcase through the intake port because of the low pressure created by the upward piston movement.

The third phase is shown in **Figure 3**. As the piston approaches top-dead-center, the spark plug fires, igniting the compressed mixture. The piston is then driven downward by the expanding gases.

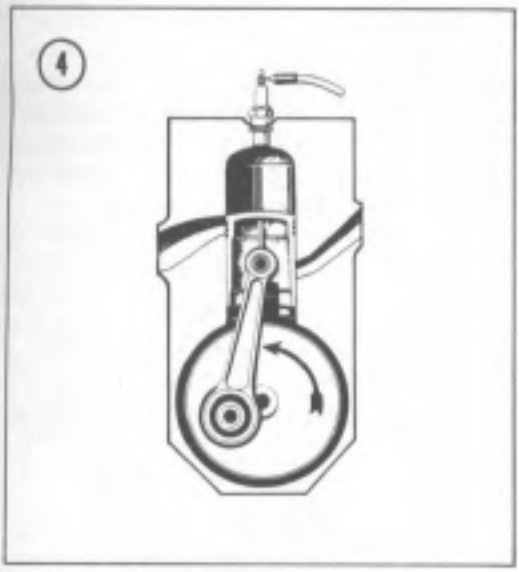
When the top of the piston uncovers the exhaust port, the fourth phase begins, as shown in **Figure 4**. The exhaust gases leave the cylinder through the exhaust port. As the piston continues downward, the intake port is closed and the mixture in the crankcase is compressed in preparation for the next cycle.

It can be seen from the foregoing discussion that every downward stroke of the piston is a power stroke.

LUBRICATION

Interval

The level of oil in the lower unit should be checked at the end of the first day of operation



or after 10 hours, whichever comes first, and after every 5 days or 50 hours thereafter. Drain the unit every 10 days, 100 hours, or every season, as use dictates. Add OMC Sea-Lube Premium blend lubricant (or equivalent) to the crankcase to bring the level up to vent or OIL LEVEL plug.

One-Cylinder Engines

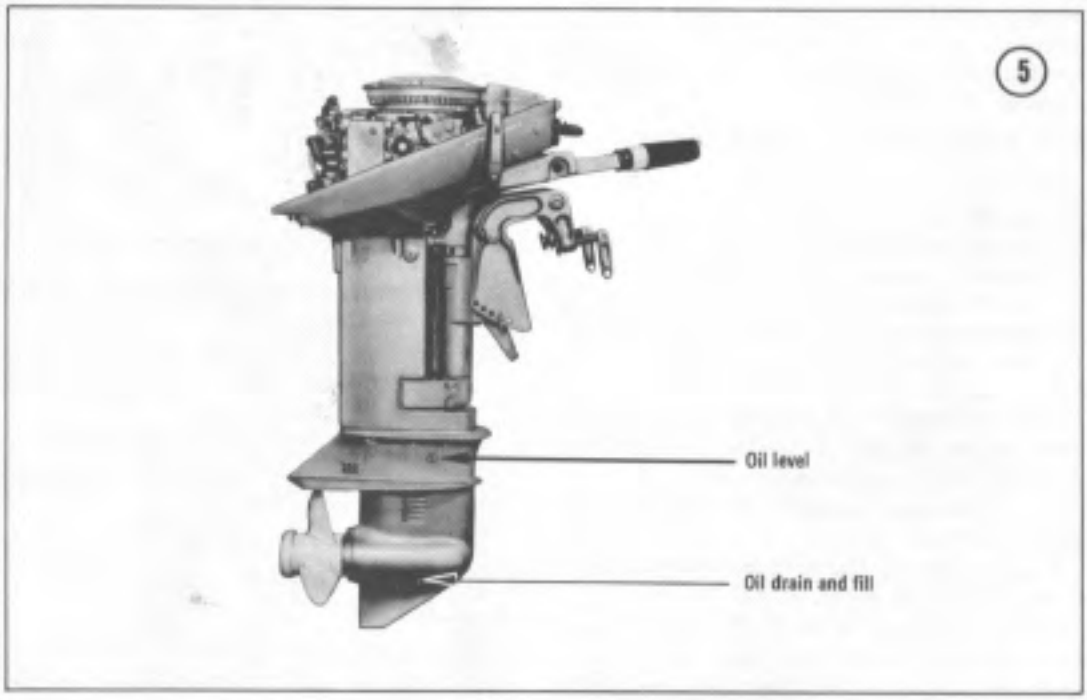
Remove the OIL DRAIN/FILL plug and gasket from the side of the gear case. Turn the engine onto its side and allow the oil to drain out. It's best to perform this operation while the engine is warm to eliminate all oil.

To refill, turn the engine rightside up and pump in oil through the OIL DRAIN/FILL hole. Bring the oil up to the level of the hole. Jiggle the engine slightly to release any trapped air and recheck oil level.

Two-Cylinder Engines

Remove the plugs and gaskets marked OIL DRAIN and OIL LEVEL from the side of the crankcase. See **Figure 5**. Position the engine with the propeller shaft in a horizontal position. Allow the oil to drain completely. It's best to warm the engine first so that all of the oil is thin enough to drain completely.

To refill, pump oil into the OIL DRAIN hole until it shows in the OIL LEVEL hole. Fill the case slowly to avoid creating any air pockets. Jiggle the engine after filling to eliminate any air pockets and top off.



ENGINE LUBRICATION

A conventional 2-stroke engine cannot re-eive its entire lubrication from an oil supply ı the crankcase. Oil splash in the crankcase ould be carried into the cylinder with the uel/air charge, resulting in high oil consump-on and spark plug fouling. These outboards se the following method for engine lubrication.

uel/Oil Mixture

In this system, lubricating oil is mixed with ıe fuel. The oil is then carried to the piston and ylinder with the fuel mixture as it is drawn into ıe engine. This system has an inherent dis-dvantage. Since sufficient oil must be mixed ith the fuel to meet the maximum lubrication equirements of the engine, the engine will re-eive excess oil when lubrication requirements re minimal, such as at idling.

The only fuels recommended for outboard, 2-troke motor use are marine, automotive white, nd aircraft gasolines of 90 octane or greater. he engine is extremely sensitive to changes in il or gasoline types. Optimum performance can nly be realized through consistency.

Never use any more (or less) oil in the fuel ıix than a 50:1 ratio of gas to oil. Too little oil esults in insufficient lubrication, scoring of ylinder walls, overheating, and eventual de-ruction. Too much oil results in plug fouling, noking, carbon buildup and poor performance.

CAUTION

Never use an oil which has detergent. The detergents are basically bits of metallic particles which can build-up on the piston and cause over-heating and pre-detonation. Never use additives or "boosters."

Never use gasoline which has been stored for reat periods of time; it contains substances hich will turn to gum if stored too long. These leposits can cause carburetion problems and park plug deterioration.

Always drain the fuel tank and carburetor if he engine is to be stored.

Don't be alarmed if the engine smokes ex-essively after having been stored for a few veeks, or even days, or after filling the tank with fresh pre-mix. The oil tends to settle out of the gas or will remain on the bottom of the tank if not mixed properly. This could cause problems since, as the fuel is used, the mixture will "lean out" and not lubricate as well as it should. Drain the tank into a suitable container and discard if old or re-mix if still fresh.

WATER PUMP/COOLING SYSTEM

These engines rely on a variable volume pump and, in some instances, a thermostat to control and reduce engine heat. The system works in some degree to that of an automobile and should be treated with the same respect if long engine life is expected.

Proper functioning can be determined if a steady flow of water discharges from the idle relief holes near the water line while the engine is idling. See **Figure 6**. If there isn't any flow, stop the engine immediately and check for the problem. Don't restart the engine until the situation is rectified or permanent damage will result. Check and clean the discharge holes with a fine strand of wire.

MOVING PARTS LUBRICATION (EXTERNAL)

It would be ideal to be able to check oil and fluid levels and electrical equipment on a daily basis as operated. Such frequency is impractical, but every fuel stop should include at least the following checks for maximum reliability and performance: engine oil level, battery electrolyte level and evidence of leaking. In addition, the following points should be lubricated as indicated in Table 1: tilt reverse lock lever, idle speed adjustment, magneto linkage, starter drag spring, shift lever detent, carburetor linkage, choke, gearcase, starter pinion, swivel bracket, and motor cover latch.

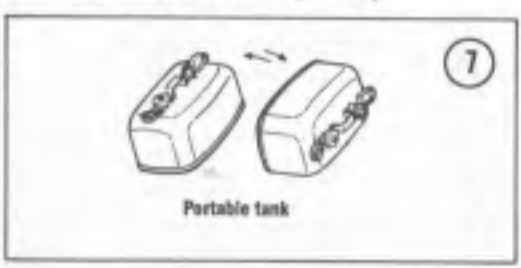
The lubrication functions can be performed as infrequently as 60-day intervals in fresh water but salt water running increases this need to a maximum of 30 days. Experience and observation will indicate the frequency required by your operating conditions.

FUEL MIXING

The fuel of a 2-stroke engine is critical to performance and reliability since the fuel also carries lubrication to the power head. You should know the correct amounts of oil and gas to mix and the proper method.

Always start with fresh gasoline of 90 octane or higher. Pour this into a separate gas can (not the tank) through a fine mesh copper screen or cheese cloth to remove any impurities.

Pour ½ of the gas to be used into the gas can and add oil to a 50:1 ratio of gas to oil. Replace the gas cap and tilt the can from side to side to thoroughly mix the two. See **Figure 7**. Add more gas and oil and repeat the mixing. A few simple tilting motions of the can will sufficiently mix the gas in warm weather above 32°F. Below 32°F, shake the can vigorously.



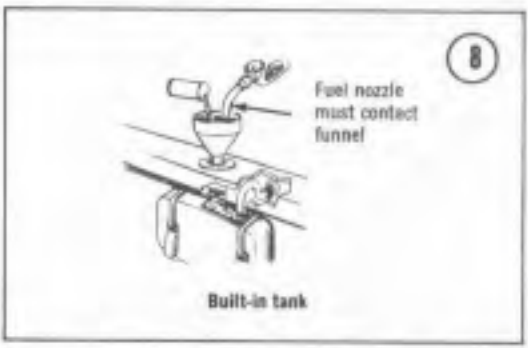
If the engine is not run for a few days, shake the fuel tank to mix any oil which may have settled to the bottom. Never use mix which has been stored for long periods or a mix of unknown ratio. Fuel and oil can be mixed at the pump on boats with built-in tanks. See **Figure 8**.

CAUTION

Never use additives to boost the gas or to otherwise enhance the fuel. Two-stroke engines could be damaged.

WARNING

Never store the gas in a living area. Never smoke near the container and avoid any sparks. Shut off the engine while refueling. Gasoline fumes in a confined area can be as damaging and dangerous as a bomb.



TUNE-UP PROCEDURE

When a motor seems to be in need of a tune-up, the following guide will be helpful. Check the motor carefully and begin a systematic tune-up. Consult Chapter Three for trouble-shooting any suspected malfunction.

Any thorough tune-up should also include a check of the power head and complete lubrication of moving parts. The first 4 steps of the following procedure may be skipped during a minor tune-up if the components listed are known to be in good shape from a previous overhaul. Complete, detailed procedures are included elsewhere in this manual.

1. Remove the exhaust cover and cylinder head.
2. Slowly rotate the flywheel and check for scored cylinder walls, cracked rings, carbon deposits, and excessive wear. Correct as necessary.

3. Clean carbon from the piston crown and cylinder head being careful not to deform the piston or alter its shape.

4. Surface the cylinder head.

5. Inspect, clean, and regap the spark plugs as needed.

6. Inspect the battery, condenser, points, coil, and all wiring.

7. Inspect the carburetor, especially the choke. For complete overhaul, see the *Fuel System* chapter (Chapter Four).

8. Inspect the fuel filter and shut-off valve.

9. Synchronize the carburetor linkage with the magneto.

10. Adjust the carburetor high- and low-speed needles and set idle.

11. Check the propeller for damage.

12. Drain and refill the gearcase and lubricate all moving parts.

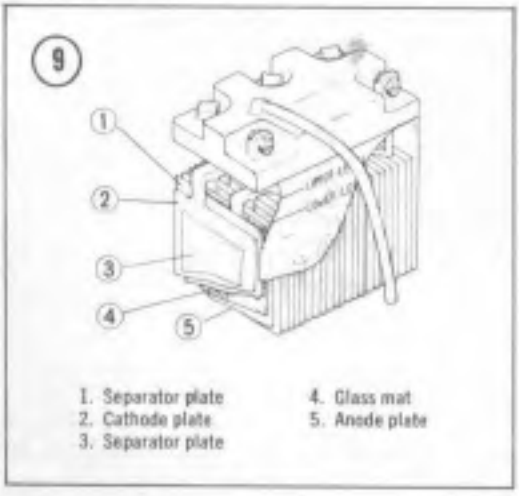
13. Tighten all screws, nuts, and bolts to the torque value as specified.

14. Check operation of cooling system and operating temperature.

BATTERY

All models use the same 12-volt battery. Refer to **Figure 9** for battery construction. **Table 2** gives specifications.

Battery electrolyte level should be checked regularly, especially in hot weather.



1. Separator plate
2. Cathode plate
3. Separator plate
4. Glass mat
5. Anode plate

Table 2 BATTERY

Type	6N6-3B
Voltage	12V
Capacity	70Ah (at 10 hour rate)
Charging current	1.0A
Specific gravity of electrolyte when fully charged)	1.260-1.280 at 20°C(68°F)

Removal

1. Remove the retaining strap. Disconnect the ground, or negative (—) cable first, then the positive (+) cable.

2. Lift the battery from the mounting, noting the location of the terminal covers, mounting pads, and vent tube for reinstallation later.

Safety Precautions

When working with batteries, use extreme care to avoid spilling or splashing the electrolyte. This electrolyte is sulfuric acid, which can destroy clothing and cause serious chemical burns. If any electrolyte is spilled or splashed on clothing or body, it should immediately be neutralized with a solution of baking soda and water, then flushed with plenty of clean water.

WARNING

Electrolyte splashed into the eyes is extremely dangerous. Safety glasses should always be worn when working with batteries. If electrolyte is splashed into the eye, call a physician immediately, force the eye open, and flood with cool, clean water for about 5 minutes.

If electrolyte is spilled or splashed onto painted or unpainted surfaces, it should be neutralized immediately with baking soda and water solution and then rinsed with clean water.

When batteries are being charged, highly explosive hydrogen gas forms in each cell. Some of this gas escapes through the filler openings and may form an explosive atmosphere around the battery. This explosive atmosphere may exist for several hours. Sparks, open flame, or a lighted