
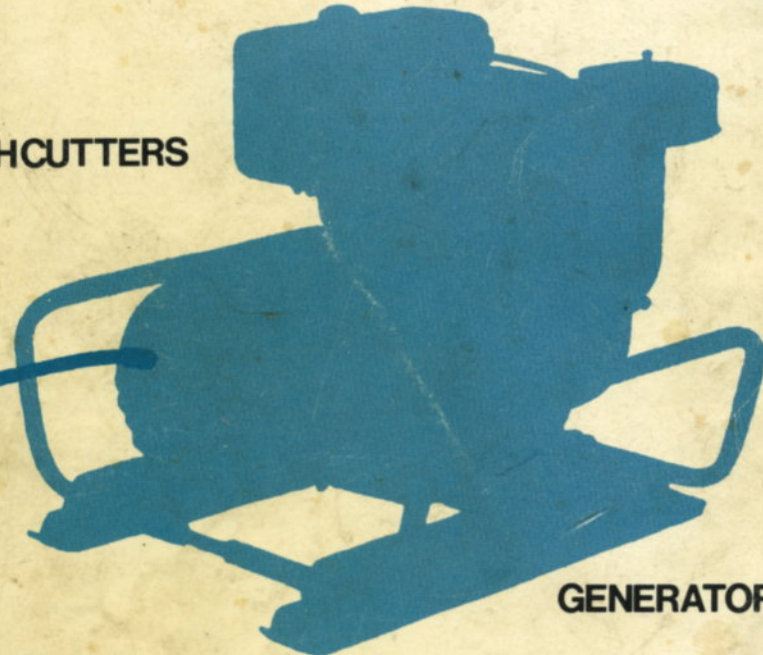


HOMELITE®


SHOP SERVICE MANUAL



BRUSHCUTTERS



GENERATORS



CHAIN SAWS

FOURTH EDITION

HOMELITE®

SHOP SERVICE MANUAL

(FOURTH EDITION)

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A **textron** DIVISION, PORT CHESTER, N.Y. 10573

FUNDAMENTAL SECTION

ENGINE DESIGN

OPERATING PRINCIPLES

The power source for the chain saw does not differ basically from that used to power automobiles, farm or garden tractors, lawn mowers, or many other items of power equipment in use today. All are technically known as "Internal Combustion, Reciprocating Engines."

The source of power is heat formed by the burning of a combustible mixture of petroleum products and air. In a reciprocating engine, this burning takes place in a closed cylinder containing a piston. Expansion resulting from the heat of combustion applies pressure on the piston to turn a shaft by means of a crank and connecting rod.

The fuel mixture may be ignited by means of an electric spark (Otto Cycle Engine) or by the heat of compression (Diesel Cycle). The complete series of events which must take place in order for the engine to run may occur in one revolution of the crankshaft (referred to as Two-Stroke Cycle), or in two revolutions of the crankshaft (Four-Stroke Cycle).

As the two-stroke cycle spark ignition engine is the predominate power source in this manual, this will be the only type engine discussed in this section.

OTTO CYCLE. In a spark ignited engine, a series of five events are required in order to provide power. This series of events is called the **Cycle** (or **Work Cycle**) and is repeated in each cylinder as long as work is done. The series of events which comprise the work cycle are as follows:

1. The mixture of fuel and air is pushed or drawn into the cylinder, by reducing cylinder pressure to less than the outside pressure, or by applying an initial, higher pressure to the fuel charge.

2. The mixture is compressed, or reduced in volume.

3. The mixture is ignited by a timed electric spark.

4. The burning fuel-air mixture expands, forcing the piston down, thus converting the generated chemical energy into mechanical power.

5. The burned gases are exhausted from the cylinder so that a new cycle can begin.

The series of events comprising the work cycle are commonly referred to as

INTAKE, COMPRESSION, IGNITION, EXPANSION (POWER), and EXHAUST.

TWO-STROKE CYCLE. In a two-stroke cycle engine, the five events of intake, compression, ignition, power and exhaust must take place in two strokes of the piston; or one revolution of the crankshaft. Thus, a compressed fuel charge is fired each time the piston reaches the top of the cylinder, and each downward stroke is a power stroke. In order to accomplish this, the initial pressure of the incoming fuel-air mixture must be raised to a point somewhat higher than the lowest pressure existing in the cylinder, or a fresh charge of fuel could not be admitted and the engine would not run. This elevation of pressure requires the use of an air pump, or compressor, of approximately the same volume as the cylinder itself. Coincidentally, such an air pump is available with a minimum of additional parts, cost, or friction losses by utilizing the opposite side of the piston and cylinder as the pump. Such engines are called "Crankcase Scavenged," and are universally used in the chain saw industry.

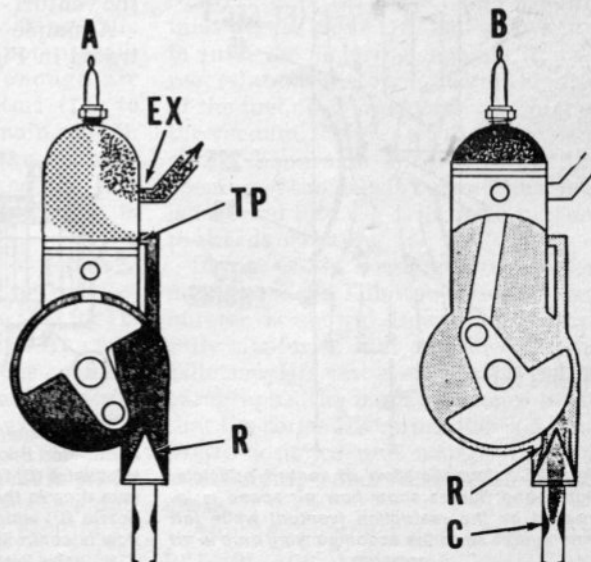
Fig. CS1 shows a schematic view of the crankcase scavenged, reed valve type, two-stroke cycle engine commonly used. The general sequence of events required for operation is as follows: As the piston moves outward from the crankshaft as shown in view "B", the volume of the closed crankcase is enlarged and the pressure lowered, causing air to be drawn through the carburetor (C), where it is mixed with fuel. This mixture is then drawn through the reed valve (R) and into the

crankcase. At the same time, a previous charge of fuel is being compressed between head of piston and closed end of cylinder as shown by the darkened area. As the piston approaches top center, a timed spark ignites the compressed fuel charge and the resultant expansion moves the piston downward on the power stroke. The reed valve (R) closes, and downward movement of piston compresses the next fuel charge in the crankcase as shown in view "A". When the piston nears the bottom of its stroke, the crown of piston uncovers the exhaust port (EX) in cylinder wall, allowing the combustion products and remaining pressure to escape as shown by the wavy arrow. Further downward movement of piston opens the transfer port (TP) leading from the crankcase to cylinder; and the then higher crankcase pressure forces the compressed fuel-air mixture through transfer port into the cylinder. The incoming fuel mixture from the transfer ports displaces exhaust gases in the cylinder, and most of the remaining exhaust gases are driven from the combustion chamber by this fresh charge. Two-stroke cycle, crankcase scavenged engines are sometimes produced with a fuel induction system other than the inlet reed valve. The two induction systems used in chain saw engines in addition to the reed valve are the three-port system illustrated in Fig. CS2 and the rotary valve system illustrated in Fig. CS3.

In the crankcase scavenged engine, most of the friction parts requiring lubrication are located in the fuel intake system. Lubrication is accomplished by mixing the required amount of oil with

Fig. CS1—Schematic view of two-stroke cycle, crankcase scavenged engine used in most chain saws. The series of events comprising the Otto cycle takes place in one revolution of the crankshaft by using the crankcase as a scavenging pump.

C. Carburetor
R. Reed valve
TP. Transfer port
EX. Exhaust port



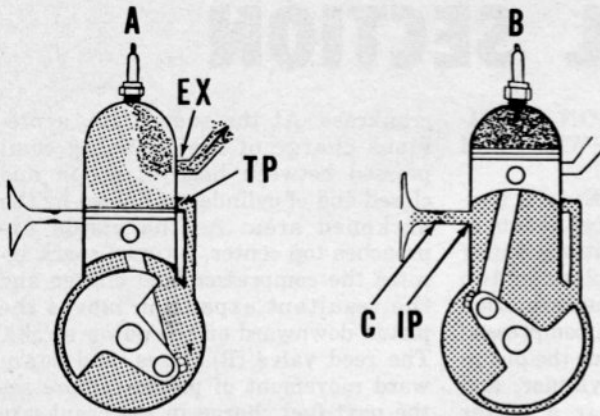


Fig. CS2—Two stroke, three port engine. Principles are similar to reed valve or rotary valve types except that a third, intake port is located in cylinder wall and opened and closed by the piston skirt.

C. Carburetor
EX. Exhaust port
TP. Transfer port

the fuel, so that a small amount of oil in the form of a fine mist is drawn into the crankcase with each fuel charge. It should be pointed out that the new oil brought into the crankcase can do little more than supplement the losses, therefore it is necessary that the friction parts be well lubricated at the time the engine is started. The use of too much oil in the fuel mixture results in plug fouling, excessive carbon, and poor performance, as well as being wasteful.

CARBURETION

The function of the carburetor is to atomize the fuel and mix it with the air flowing through the carburetor and into the engine. The carburetor must also meter the fuel so that the proper fuel-air ratio for different engine oper-

ating conditions is provided. Normal fuel-air ratios are approximately as follows:

	Fuel	Air
For starting in cold weather	1 lb.	7 lbs.
For idling	1 lb.	11 lbs.
For full load at open throttle	1 lb.	13 lbs.

Carburetor design is based on the venturi principle which is that a gas or liquid flowing through a necked-down section (venturi) in a passage undergoes an increase in speed and a decrease in pressure as compared to its speed and pressure in the full sized sections of the passage. This principle is illustrated in Fig. CS5. Due to the low pressure at the venturi, fuel is drawn out through the fuel jet and is atomized by the stream of air flowing through the venturi.

A simple carburetor design is illustrated in Fig. CS6 where flow of fuel

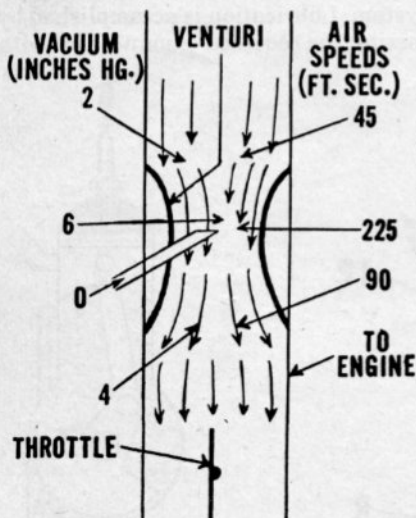


Fig. CS5—Schematic view of venturi principle. Right hand figures show how air speed is increased by the restriction (venturi) while left hand figures show the accompanying drop in air pressure.

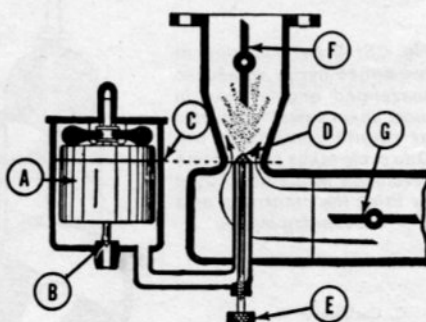


Fig. CS6—Schematic view of simple float-type carburetor. Buoyancy of float (A) closes the fuel inlet valve (B) to maintain fuel level at (C). Pressure drop in the venturi causes fuel to flow out nozzle (D) which is just above fuel level. Fuel flow is controlled by mixture valve (E). Throttle valve is at (F) and choke valve at (G).

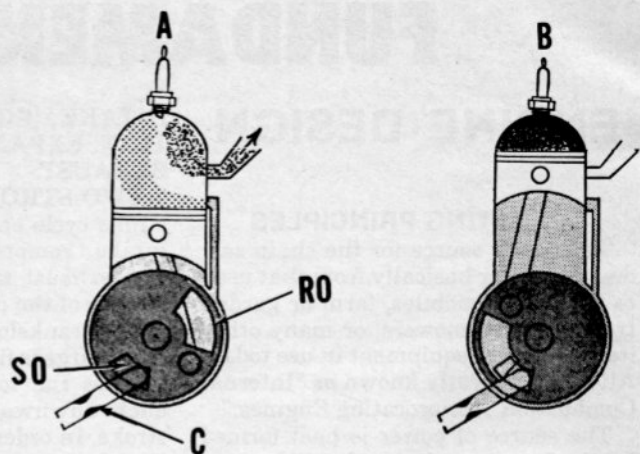


Fig. CS3—Two stroke, rotary valve engine. The incoming fuel charge is controlled by a rotary valve attached to the crankshaft. The opening in valve (RO) and crankcase (SO) align at the proper time to admit a fresh charge, then close to allow initial crankcase compression.

C. Carburetor
RO. Opening in rotating member

SO. Opening in crankcase wall

into the carburetor is controlled by a float valve. With the float type carburetor, the carburetor must be kept in a nearly upright position for the float valve to function. Early chain saws using this type of carburetor had a provision for tilting the bar and chain independently of the engine.

Later development of a floatless carburetor that would function in any position allowed a more simple and lighter design of chain saws. In this carburetor, the flow of fuel into the

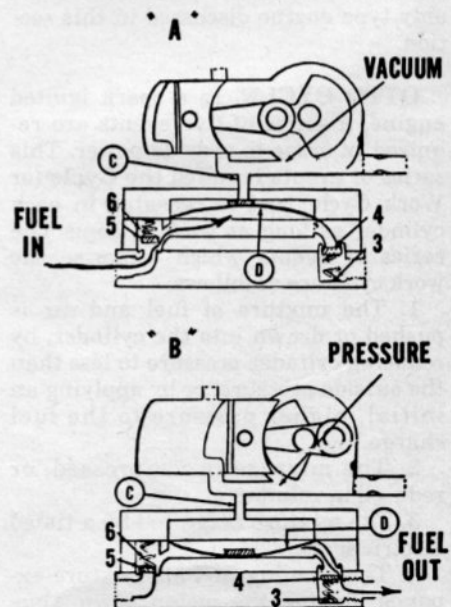


Fig. CS7—Schematic view of a typical, crankcase operated, diaphragm type fuel pump. Pressure and vacuum pulsations from crankcase pass through connection (C) to rear of diaphragm (D) which induces a pumping action on fuel line as shown.

3. Valve spring
4. Outlet check valve

5. Inlet check valve
6. Valve spring

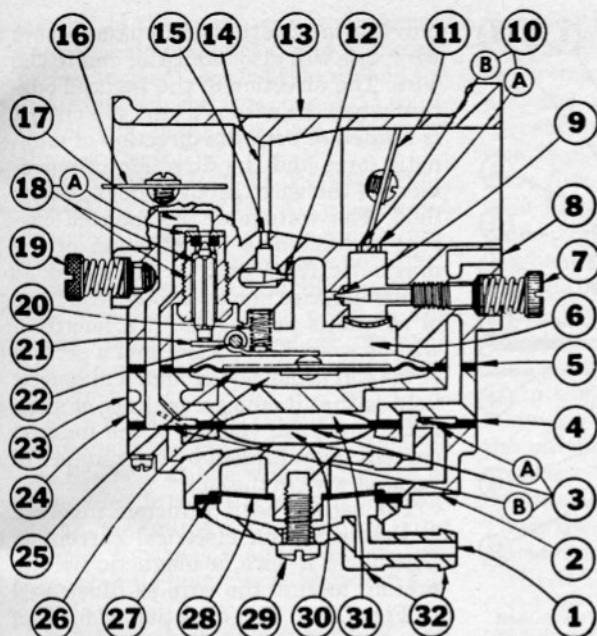


Fig. CS8—Cross-sectional schematic view of Tillotson series HL diaphragm carburetor. Some models of this type carburetor are equipped with an accelerator pump.

- | | | |
|----------------------|-----------------------|-------------------------|
| 1. Fuel inlet | 12. Main fuel orifice | 23. Vent hole |
| 2. Pump body | 13. Body | 24. Cover |
| 3. Pump diaphragm | 14. Venturi | 25. Diaphragm |
| 3 A & B. Pump valves | 15. Main fuel port | 26. Atmospheric chamber |
| 4. Gasket | 16. Choke shutter | 27. Gasket |
| 5. Gasket | 17. Inlet channel | 28. Screen |
| 6. Metering chamber | 18. Inlet valve | 29. Screw |
| 7. Idle needle | 19. Main needle | 30. Fuel chamber |
| 8. Impulse channel | 20. Spring | 31. Pulse chamber |
| 9. Idle fuel orifice | 21. Diaphragm lever | 32. Strainer cover |
| 10. Idle ports | 22. Fulcrum pin | |
| 11. Throttle shutter | | |

carburetor is controlled by linking the inlet valve to a spring-loaded diaphragm. The spring pressure is counteracted by suction through the fuel jets at the venturi of the carburetor.

To provide fuel at the carburetor with the engine in an inverted position, a fuel pump is usually incorporated within the diaphragm type carburetor. As the crankcase of 2-stroke engines is subjected to alternate surges of pressure and vacuum at each stroke of the piston, a diaphragm vented to the crankcase will pulsate at each turn of the engine crankshaft. Thus, the pulsating diaphragm can be used as a fuel pump. See Fig. CS7.

A cross-sectional schematic view of a typical Tillotson series HL diaphragm type carburetor with integral fuel pump is shown in Fig. CS8. The top of the pump diaphragm is vented to the engine crankcase through the channel (8). As the diaphragm pulsates, fuel is drawn into the carburetor through inlet (1), screen (28) and pump inlet valve (3A). The fuel is then pumped through the outlet valve (3B) into the supply channel (17). Engine suction through the main jet (15) and idle jets (10) is transmitted to the top of the car-

buretor diaphragm (25) and atmospheric pressure through the vent (23) pushes upward on the diaphragm (25) overcoming spring (20) pressure and unseating the inlet needle (18) allowing fuel to flow into the diaphragm chamber (6).

When starting an engine, closing the choke disc (16) increases the vacuum in the carburetor throat so that the carburetor will function at the low cranking RPM.

When the engine is idling, the throttle disc is almost completely closed and there is not enough air passing through the venturi (14) to create any vacuum on the main jet (15). A vacuum is created at the primary idle jet (10A), however, and the fuel necessary for running the engine is drawn through that jet.

As the throttle disc is opened, enough vacuum is created on the secondary idle jet port (10B) so that fuel is drawn through that port also. At a certain point, the throttle disc is open far enough so that the velocity of air passing through the venturi is sufficient to lower the pressure at the main fuel discharge port (15) so that fuel will flow through this port also. Opening the throttle disc farther results in higher air velocities and lower venturi

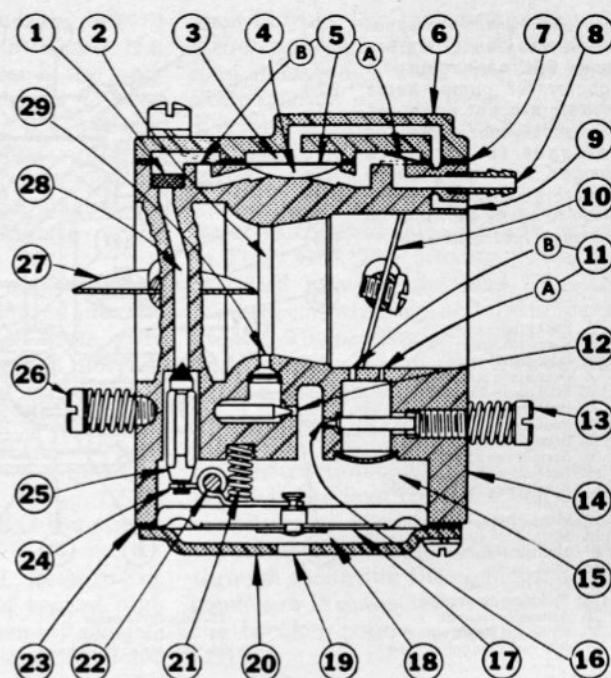


Fig. CS8A—Cross-sectional view of typical Series HS Tillotson diaphragm type carburetor.

- | | | |
|--------------------|--|----------------------|
| 1. Filter screen | 11. Primary (A) and secondary (B) idle ports | 19. Vent hole |
| 2. Venturi | 12. Main fuel orifice | 20. Diaphragm cover |
| 3. Pulse chamber | 13. Idle fuel needle | 21. Spring |
| 4. Fuel chamber | 14. Carburetor body | 22. Fulcrum pin |
| 5. Pump diaphragm | 15. Metering chamber | 23. Gasket |
| 5A. Inlet valve | 16. Idle fuel orifice | 24. Diaphragm lever |
| 5B. Outlet valve | 17. Metering diaphragm | 25. Inlet valve |
| 6. Pump body | 18. Atmospheric chamber | 26. Main fuel needle |
| 7. Gasket | | 27. Choke disc |
| 8. Inlet fitting | | 28. Inlet channel |
| 10. Throttle plate | | 29. Main fuel port |

pressures that increase the flow of fuel out of the discharge ports.

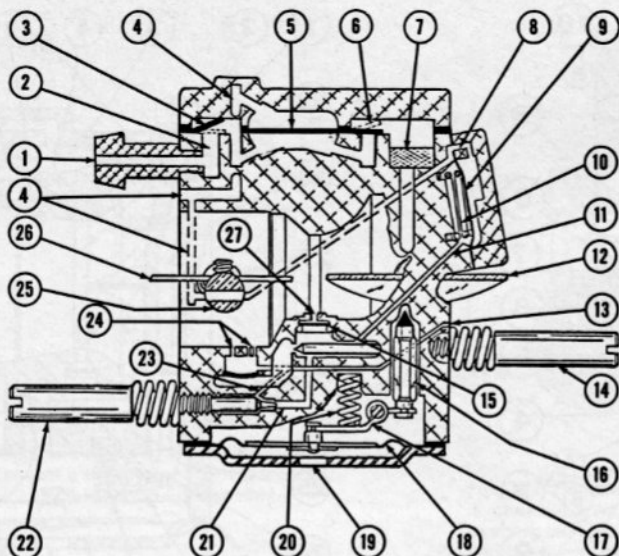
Any vacuum created at the idle discharge ports (10) or the main fuel discharge port (15) is transferred through the metering chamber (6) to the diaphragm (25). Air pressure entering through the atmospheric vent hole (23) pushes against the diaphragm because of the vacuum and overcomes pressure applied by the spring (20) through the control lever (21). This releases the inlet needle valve (18) and allows fuel to enter the metering chamber in a direct relationship to the vacuum created at the fuel discharge ports. The higher the vacuum, the greater the movement of the diaphragm and the larger the opening of the needle valve. Thus, fuel is metered into the carburetor to meet the needs of the engine.

In Fig. CS8A, a cross-sectional schematic view of a Tillotson series HS carburetor is shown. Operation is basically similar to that described for the Tillotson HL carburetor in preceding paragraphs, the main difference being that the series HS carburetor is a compactly designed unit usually used on lightweight, small displacement engines.

Another compact diaphragm carburetor, the Walbro series SDC, is

Fig. CS9—Cross-sectional schematic view of Walbro series SDC carburetor with accelerator pump. Some models are not equipped with accelerator pump and passages (8 & 11) are plugged. Fuel cavity above metering diaphragm extends to cavity shown at tip of main fuel needle (14).

1. Fuel inlet
2. Surge chamber
3. Inlet check valve
4. Crankcase pulse channel
5. Fuel pump diaphragm
6. Outlet check valve
7. Fuel filter
8. Accelerator pulse channel
9. Accelerator diaphragm
10. Accelerator spring
11. Accelerator fuel channel
12. Choke disc
13. Idle air bleed channel
14. Main (high speed) fuel needle
15. Main orifice check valve
16. Inlet needle
17. Metering lever
18. Metering diaphragm
19. Atmospheric vent
20. Metering diaphragm spring
21. Idle fuel channel
22. Idle fuel needle
23. Idle fuel passage
24. Idle air and fuel holes
25. Throttle shaft
26. Throttle disc
27. Main fuel orifice



shown in cross-sectional schematic view in Fig. CS9. Except for some models, the Walbro SDC carburetor is equipped with an accelerator pump. When throttle is open, indexing hole in throttle shaft (25) opens pulse passage (4) to accelerator pump passage (8). Pressure against pump diaphragm (9) compresses spring (10) and pressurizes fuel passage (11), ejecting excess fuel from main nozzle (27). When throttle is closed, or partially closed, indexing hole closes pulse passage and accelerator pump spring returns diaphragm to original position, drawing fuel back up passage (11) to recharge accelerator pump.

At idle speed, air is drawn into carburetor through air bleed hole (13) and mixed with fuel from idle fuel passage (24) nearest venturi and the fuel-air mixture is ejected from the third idle hole. Air cannot enter the main fuel nozzle (27) as the check valve (15) closes against its seat when engine is idling. Note that idle fuel supply must first pass main (high speed) metering needle (14) before it reaches idle fuel needle (22).

CONVENTIONAL FLYWHEEL MAGNETO IGNITION SYSTEM

The fundamental principles of the flywheel magneto ignition system in general use on chain saw engines are presented in this section. As the study of magnetism and electricity is an entire scientific field, it is beyond the scope of this manual to fully explore these subjects. However, the informa-

tion contained in this section should impart a working knowledge of the flywheel type magneto which will be useful when servicing chain saw ignition systems.

BASIC PRINCIPLES. Although the design of different flywheel magnetos varies, all flywheel magnetos operate on the same basic principles of electro-magnetic induction of electricity and formation of magnetic fields by electrical current.

The principle of electro-magnetic induction of electricity is as follows: When a wire (conductor) is moved through a magnetic field so as to cut across lines of magnetic force (flux), a potential voltage (electro-motive force or emf) is induced in the wire. If the wire is a part of a completed electrical circuit, current will flow through the circuit as illustrated in Fig. CS10. It should be noted that the movement is relative; that is, if the lines of force of a

Fig. CS10—When a wire (conductor) is moved through a magnetic field across lines of magnetic force, an electro-motive force is induced into the wire. If the wire is a part of an electrical circuit, current will flow in the circuit as shown.

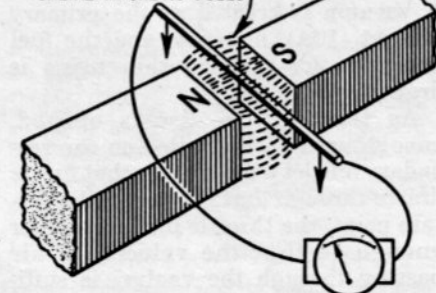


Fig. CS10—When a wire (conductor) is moved through a magnetic field across lines of magnetic force, an electro-motive force is induced into the wire. If the wire is a part of an electrical circuit, current will flow in the circuit as shown.

moving magnetic field cut across a wire, this will also induce an emf in the wire. The direction of the induced current when the wire is a part of a circuit is related to both the direction of magnetic force and the direction of movement of the wire through the magnetic field. The voltage of the induced current is related to the strength of the magnetic field and to the speed at which the wire moves through the lines of magnetic force. Also, if a length of wire is wound into a coil and a section of the coil is moved through a magnetic field so that it cuts across lines of magnetic force, the voltage of the induced current is multiplied by the number of turns of wire in the coil.

The second basic principle involved is that when an electrical current is flowing in a wire, a magnetic field is present around the wire as illustrated in Fig. CS11. The direction of force of the magnetic field is related to the direction of current in the wire and the strength of the magnetic field is related to the rate of flow of the electrical current. If the wire is wound in a coil, the magnetic forces around the wire converge to form a stronger single magnetic field as shown in Fig. CS12. If the wire is coiled closely, there is little tendency for the magnetic forces to surround individual loops of the coil.

When there is a change in the current flowing in a wire, there is a corresponding change in the magnetic field surrounding the wire. If the current ceases to flow, the magnetic field will "collapse." Thus, it can be seen from the illustration in Fig. CS12 that if

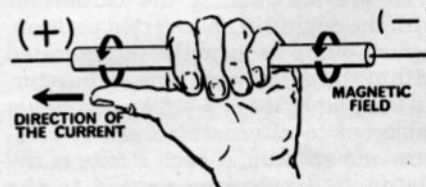


Fig. CS11—A field of magnetic force is always present around a wire through which current is flowing. The direction of magnetic force is related to the direction of electrical current as shown.



Fig. CS12—When a wire carrying an electrical current is wound in the shape of a coil or helix, the magnetic field surrounding loops of the wire tend to converge into a single electro-magnetic field as shown. If the loops of the coil are wound closely together, there is very little tendency for the electro-magnetic field to surround individual loops of the coil.

current in the coiled wire would cease, the collapsing magnetic field would cut across adjacent loops of the coil and the resulting induced current would counteract any change in flow of current through the coil.

CONVENTIONAL FLYWHEEL MAGNETO PARTS. To understand how the flywheel type magneto produces the ignition spark, it is necessary to identify each part of the magneto. The various component parts of the conventional type flywheel magneto are discussed in the following paragraphs.

FLYWHEEL MAGNETS. Permanent magnets are either attached to the flywheel as shown in Fig. CS13 or imbedded into the flywheel casting. Some magnetos use a single ring shaped flywheel magnet; others use two separate magnets as shown in Fig. CS13.

Alnico, a steel alloy containing aluminum, nickel and cobalt, is used for the flywheel magnet or magnets as Alnico retains strong magnetic properties for very long periods of time.

ARMATURE CORE (LAMINATIONS). As shown in Fig. CS14, a field

of magnetic force surrounds the poles of a permanent magnet at all times. If a soft iron bar is moved close to the magnet, the magnetic field will become concentrated in the bar because soft iron is a very good conductor of magnetic flux. Thus, the armature core is used in the flywheel type magneto to concentrate the field strength of the flywheel magnets.

In the operation of the magneto, electrical currents can be induced into the armature core. To prevent these stray currents (eddy currents) from building up in the armature core and creating magnetic forces which would decrease the efficiency of the magneto, the armature core is built up of thin plates (laminations) as shown in Fig. CS15. Thus, the armature core is sometimes called laminations.

HIGH TENSION COIL. Refer to Fig. CS16 for construction of typical high tension coil. The coil assembly consists of a primary coil (A) of about 100-200 turns of wire and a secondary coil (B) of about 10,000 turns of very fine wire. The wire is insulated, usually with a fine coating of enamel, and a paper insulating strip is placed between each

layer of wire. The entire coil assembly is then impregnated with an insulating compound and covered with varnished cloth tape or plastic. Refer to wiring diagram in Fig. CS19 for hook-up of coil leads.

BREAKER (CONTACT) POINTS. Refer to the magneto wiring diagram in Fig. CS19. The breaker points are installed between the lead from the primary coil windings and the magneto ground. The breaker points are opened and closed by a cam which is usually located on the engine crankshaft as shown in Fig. CS17.

CONDENSER. Refer to Fig. CS18 for construction of a typical condenser. Usually, the lead from one end of the condenser is connected to the metal covering and is thereby grounded through mounting the condenser. The condenser is connected in parallel with the breaker points as shown in Fig. CS19.

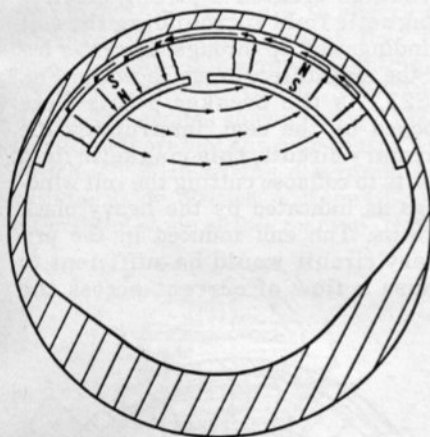


Fig. CS13-Cut-away of typical flywheel used for magneto rotor. The permanent magnets are usually cast into the flywheel. For flywheel magnetos having the ignition coil and core mounted to outside of flywheel, magnets would be flush with outer diameter of flywheel.

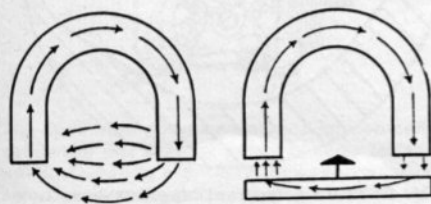


Fig. CS14-Drawing showing function of magneto armature core. At left, lines of force of permanent magnet are dispersed in the air. When a soft iron bar, which is an excellent conductor of magnetism, is moved close to the magnetic poles, the magnetic field becomes concentrated in the bar.

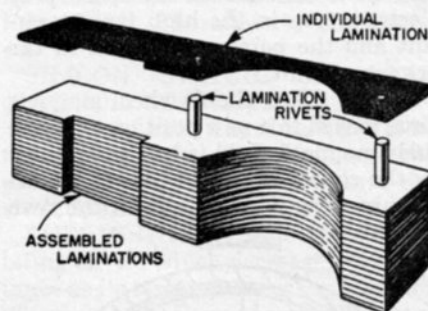


Fig. CS15-To prevent stray electrical currents (eddy currents) from building up within armature core and creating opposing magnetic fields that would decrease efficiency of magneto, armature core is constructed of thin plates (laminations) that are insulated from each other. (Oxide on surfaces of laminations usually provides sufficient insulation, although laminations in some magnetos are painted or varnished.)

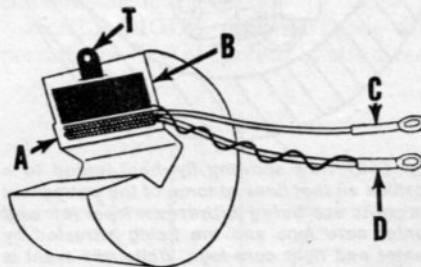


Fig. CS16-Cross-sectional view of a typical high tension coil. Primary windings (A) consist of 100-200 turns of copper wire. Secondary windings consist of about 10,000 turns of very fine wire. Lead (C) is to insulated terminal of breaker points. Lead (D) is to ground. Spark plug (high tension wire) attaches to terminal (T).

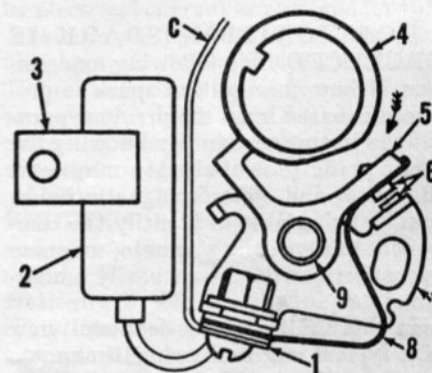


Fig. CS17-Typical flywheel magneto breaker point unit. Cam (4) is driven by engine crankshaft. Breaker arm spring (8) connects insulated contact point on breaker arm (5) to terminal (1).

- | | |
|--------------------------------------|-------------------|
| C. Lead to primary coil | 5. Breaker arm |
| 1. Insulated terminal | 6. Contact points |
| 2. Condenser | 7. Breaker base |
| 3. Condenser ground (mounting) strap | 8. Spring |
| 4. Breaker cam | 9. Pivot pin |

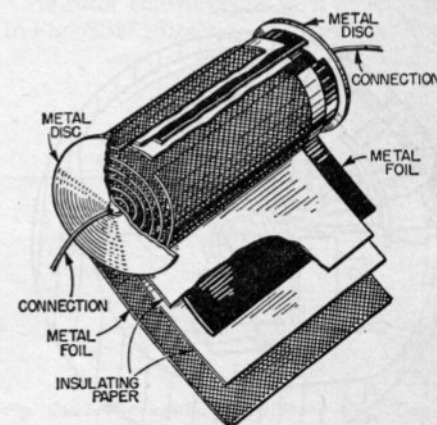


Fig. CS18-View showing construction of typical condenser. One connection is usually made to the metal housing of the condenser and is grounded to the magneto base plate through the condenser mounting strap (3-Fig. CS17).

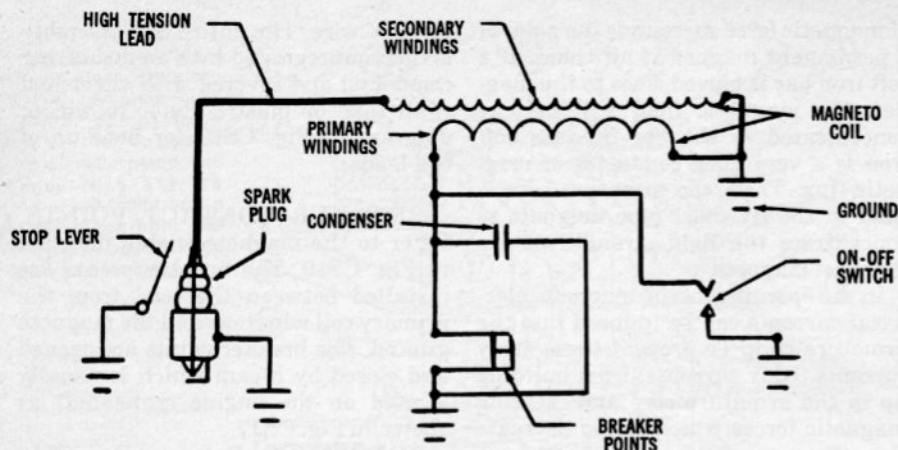


Fig. CS19—Typical wiring diagram for conventional flywheel type magneto. An on-off switch to stop the engine may be attached to the magneto primary circuit to ground out the system, or a stop lever may be used to ground out the center electrode of the spark plug.

The basic function of the condenser is to absorb the flow of current in the primary ignition circuit to prevent the current from arcing across the opening breaker points.

HOW IGNITION SPARK IS PRODUCED. The following explanation of how the ignition spark is produced is based upon the previous paragraphs in this section. By knowing the basic principles of electro-magnetic induction and electro-magnetic fields, and by being able to identify the component parts of the magneto, magneto operation can be more easily understood.

In Fig. CS13, a cross-sectional view of a typical engine flywheel (magneto rotor) is shown. The arrows indicate lines of force (flux) of the permanent magnets carried by the flywheel. As indicated by the arrows, direction of force of the magnetic field is from the north pole (N) of the left magnet to the south pole (S) of the right magnet.

Figs. CS20, CS21, CS22 and CS23

illustrate the operational cycle of the flywheel type magneto. In Fig. CS20, the flywheel magnets have moved to a position over the left and center legs of the armature (ignition coil) core. As the magnets moved into this position, their magnetic field was attracted by the armature core as illustrated in Fig. CS14 and a potential voltage (emf) was induced in the coil windings. However, this emf was not sufficient to cause current to flow across the spark plug electrode gap in the high tension circuit and the points were open in the primary circuit.

In Fig. CS21, the flywheel magnets have moved to a new position to where their magnetic field is being attracted by the center and right legs of the armature core, and is being withdrawn

from the left and center legs. As indicated by the heavy black arrows, the lines of force are cutting up through the section of coil windings between the left and center legs of the armature and are cutting down through the coil windings section between the center and right legs. If the right hand rule, as explained in a previous paragraph, is applied to the lines of force cutting through the coil sections, it is seen that the resulting emf induced in the primary circuit will cause a current to flow through the primary coil windings and the breaker points which have now been closed by action of the cam.

At the instant the movement of the lines of force cutting through the coil winding sections is at the maximum rate, the maximum flow of current is obtained in the primary circuit. At this time, the cam opens the breaker points interrupting the primary circuit and, for an instant, the flow of current is absorbed by the condenser as illustrated in Fig. CS22. An emf is also induced in the secondary coil windings, but the voltage is not sufficient to cause current to flow across the spark plug gap.

The flow of current in the primary windings created a strong electro-magnetic field surrounding the coil windings and up through the center leg of the armature core as shown in Fig. CS23. As the breaker points were opened by the cam, interrupting the primary circuit, this magnetic field starts to collapse cutting the coil windings as indicated by the heavy black arrows. The emf induced in the primary circuit would be sufficient to cause a flow of current across the

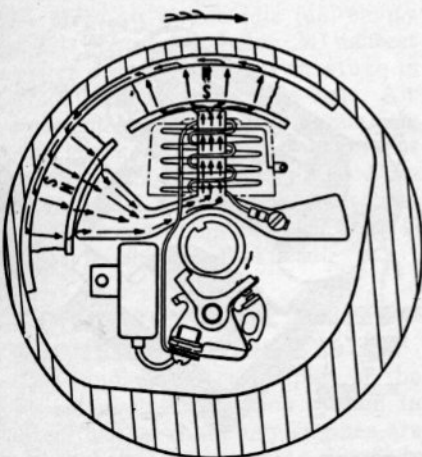


Fig. CS20—View showing flywheel turned to a position so that lines of force of the permanent magnets are concentrated in the left and center core legs and are interlocking the coil windings.

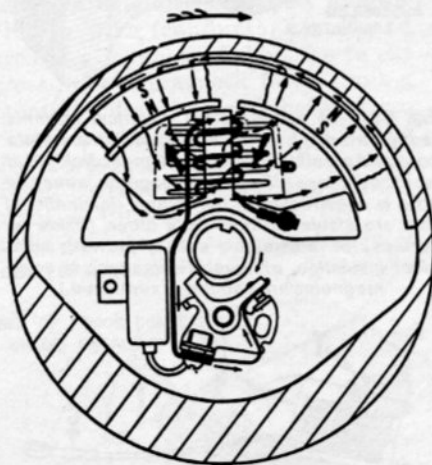


Fig. CS21—View showing flywheel turned to a position so that lines of force of the permanent magnets are being withdrawn from left and center core legs and are being attracted by center and right core legs. While this event is happening, the lines of force are cutting up through the coil windings section between left and center legs and are cutting down through section between the right and center legs as indicated by the heavy black arrows. The breaker points are now closed by the cam and a current is induced in the primary ignition circuit as lines of force cut through the coil windings.

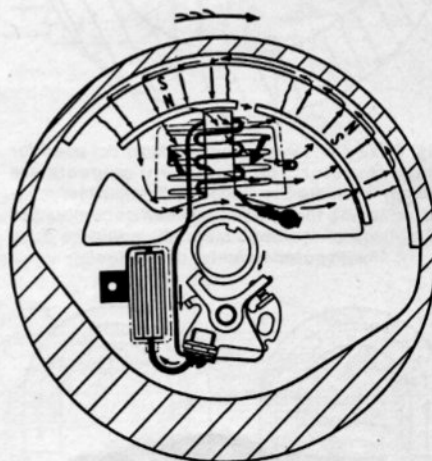


Fig. CS22—The flywheel magnets have now turned slightly past position shown in Fig. CS21 and rate of movement of lines of magnetic force cutting through coil windings is at maximum. At this instant, the breaker points are opened by the cam and flow of current in primary circuit is being absorbed by the condenser, bringing flow of current to a quick, controlled stop. Refer now to Fig. CS23.

opening breaker points were it not for the condenser absorbing the flow of current and bringing it to a controlled stop. This allows the electro-magnetic field to collapse at such a rapid rate to induce a very high voltage in the coil high tension or secondary windings. This voltage, in the order of 15,000 to 25,000 volts, is sufficient to break down the resistance of the air gap between the spark plug electrodes and a current will flow across the gap. This creates the ignition spark which ignites the compressed fuel-air mixture in the engine cylinder.

SOLID STATE IGNITION SYSTEMS

The introduction of the new ignition systems is bringing unfamiliar words into use which might be defined in the following non-technical terms:

CAPACITOR. The storage capacitor, or condenser.

DIODE. The diode is represented in wiring diagrams by the symbol as shown in Fig. CS24. Although the principle of diode operation is beyond the scope of this manual, it is sufficient to say that it is an electronic device that will permit passage of electrical current in one direction only. In electrical schematic diagrams, current flow is opposite to direction arrow is pointing.

GATE CONTROLLED SWITCH (GCS). The symbol shown in Fig. CS25 is used to represent the gate controlled switch (GCS) in wiring diagrams. As with the diode, discussion of the GCS is beyond the scope of this manual. How-

ever, its action in an electrical circuit is as follows:

The GCS acts as a switch to permit passage of electrical current in the direction indicated by the arrow portion of the symbol (Fig. CS25) when in "ON" state and will not permit electric current to flow when in "OFF" state. The GCS can be turned "ON" by a positive surge of electricity at the gate (G) terminal and will remain "ON" as long as current remains positive at the gate terminal or as long as current is flowing through the GCS from cathode (C) terminal to anode (A) terminal. The GCS can be turned "OFF" with a negative surge of electricity at the gate (G) terminal or will go to "OFF" state if current stops flowing through the switch from cathode (C) to anode (A).

RECTIFIER. Any device which allows the flow of current in one direction only, or converts Alternating Current to Direct Current. Diodes are sometimes used in combination to form a **BRIDGE RECTIFIER**.

SCR. (Silicon Controlled Rectifier). See **GATE CONTROLLED SWITCH**.

SEMI-CONDUCTOR. Any of several materials which permit partial or controlled flow of electrical current. Used in the manufacture of Diodes, Rectifiers, SCR's, Thermistors, Thyristors, etc.

SILICON SWITCH. See **GATE CONTROLLED SWITCH**.

SOLID STATE. That branch of electronic technology which deals with the use of semi-conductors as control devices. See **SEMI-CONDUCTOR**.

THERMISTOR. A solid state regulating device which decreases in resistance as its temperature rises. Used for "Temperature Compensating" a control circuit.

THYRISTOR. A "Safety Valve" placed in the circuit which will not pass current in either direction but is used to provide surge protection for the other elements.

TRIGGER. The timed, small current which controls, or opens, the "Gate", thus initiating the spark.

ZENER DIODE. A Zener Diode will permit free flow of current in one direc-

tion, and will also permit current to flow in the opposite direction when the voltage reaches a pre-determined level.

Solid State (Breakerless) Magneto Ignition System

The solid state (breakerless) magneto ignition system operates somewhat on the same basic principles as the conventional type flywheel magneto previously described. The main difference is that the breaker contact points are replaced by a solid state electronic Gate Controlled Switch (GCS) which has no moving parts. Since, in a conventional system, the breaker points are closed over a longer period of crankshaft rotation than is the "GCS", a diode has been added to the circuit to provide the same characteristics as closed breaker points.

BASIC OPERATING PRINCIPLES. The same basic principles for electro-magnetic induction of electricity and formation of magnetic fields by electrical current as outlined for the conventional flywheel type magneto also apply to the solid state magneto. Thus, the principles of the different components (diode and GCS) will complete the operating principles of the solid state magneto.

HOW IGNITION SPARK IS PRODUCED. The basic components and wiring diagram for the solid state (breakerless) magneto are shown schematically in Fig. CS27, the magneto rotor (flywheel) is turning and the ignition coil magnets have just moved into position so that their lines of force are cutting the ignition coil windings and producing a negative surge of current in the primary windings. The diode (see Fig. CS26) allows current to flow opposite to direction of diode symbol arrow and action is same as conventional magneto with breaker contact points closed.

As rotor continues to turn as shown in Fig. CS28, direction of magnetic flux

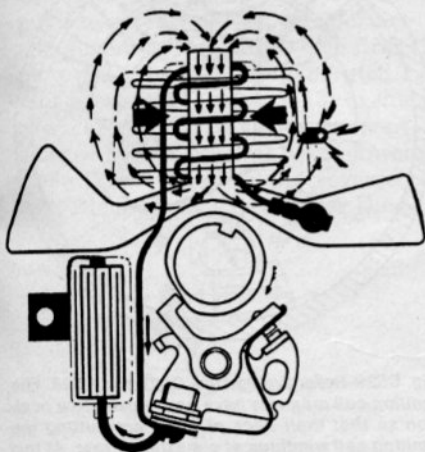


Fig. CS23—View showing magneto ignition coil, condenser and breaker points at same instant as illustrated in Fig. CS22; however, arrows shown above illustrate lines of force of the electro-magnetic field established by current in primary coil windings rather than the lines of force of the permanent magnets. As the current in the primary circuit ceases to flow, the electro-magnetic field collapses rapidly, cutting the coil windings as indicated by heavy arrows and inducing a very high voltage in the secondary coil winding resulting in the ignition spark.

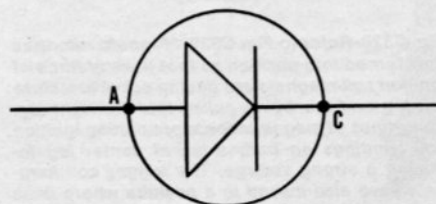


Fig. CS24—In a diagram of an electrical circuit, the diode is represented by the symbol shown above. The diode will allow current to flow in one direction only (from anode "A" to cathode "C" terminal of diode).

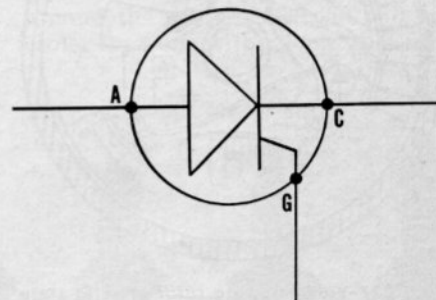


Fig. CS25—The symbol used for a Gate Controlled Switch (GCS) in an electrical diagram is shown above. The GCS will allow current to flow from anode (A) terminal to cathode (C) terminal when "turned on" by a positive electrical charge at gate (G) terminal. A negative electrical charge at gate (G) terminal will turn off the GCS.

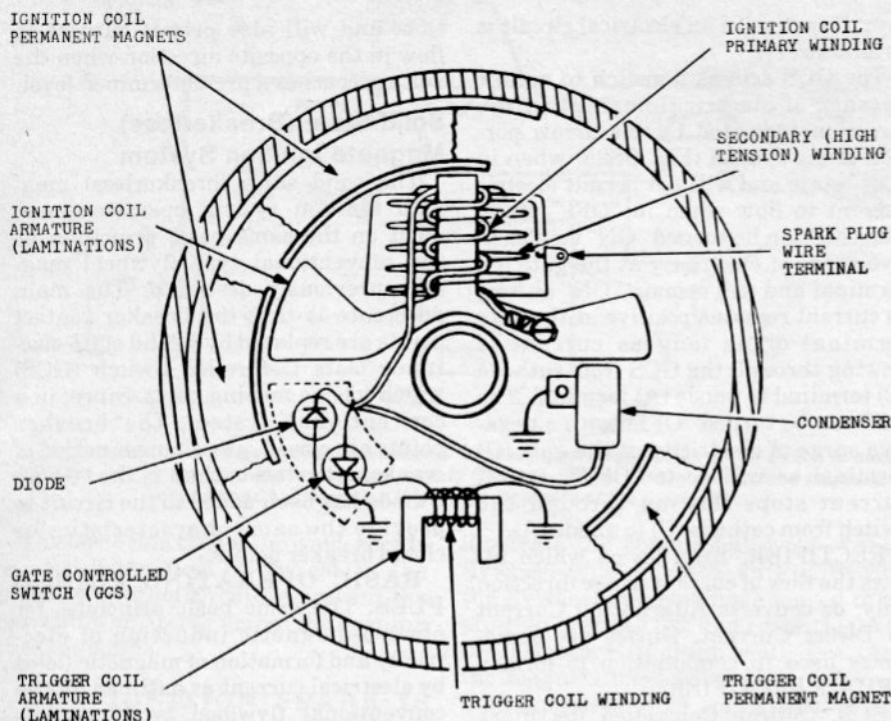


Fig. CS26-Schematic diagram of solid state (breakerless) flywheel magneto. The diagram is drawn to follow the schematic drawings of a conventional type magneto as shown in Figs. CS20, CS21, CS22 and CS23. Refer to Figs. CS24 and CS25 for diode and Gate Controlled Switch (GCS) symbols. Refer to Figs. CS27, CS28 and CS29 for schematic views of magneto operating cycle.

lines will reverse in the armature center leg. The direction of current will change in the primary coil circuit and the previously conducting diode will be shut off. At this point neither diode nor GCS is conducting. As voltage begins to build up as the rotor continues to turn, the condenser acts as a buffer to prevent excessive voltage build-up at the GCS before it is triggered.

When the rotor reaches the approximate position shown in Fig. CS29, maximum flux density has been achieved in the center leg of the armature. At this time the GCS is triggered. Triggering is accomplished by the trig-

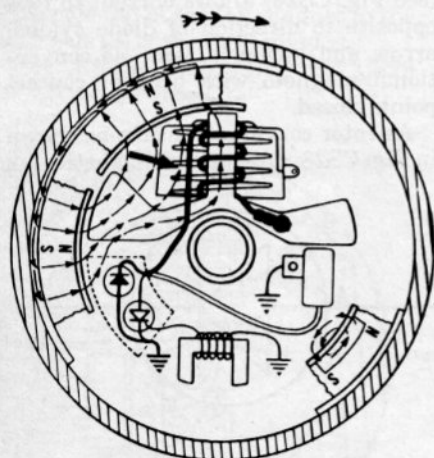


Fig. CS27-View showing rotor of solid state magneto at instant in rotation where lines of force of ignition coil magnets are being drawn into left and center legs of magneto armature. The diode (see Fig. CS24) acts as a closed set of breaker points in completing the primary ignition circuit at this time, thus preventing an unwanted (maverick) spark which could occur at this time. Refer next to Fig. CS28.

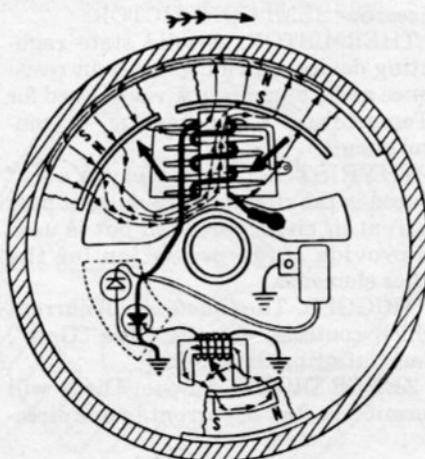


Fig. CS28-Refer to Fig. CS27. Magneto rotor has now turned into position so that lines of force of ignition coil magnets are pulling out of armature left leg and are being pulled into the right leg. Thus, lines of magnetic force are cutting ignition coil windings on both sides of center leg inducing a strong voltage. The trigger coil magnets have also moved to a position where lines of magnetic force are being pulled into the trigger coil armature creating a positive charge in the lead to the Gate Controlled Switch (GCS), thus "turning on" the switch for passage of current in the ignition primary circuit. Refer now to Fig. CS29.

gering coil armature moving into the field of a permanent magnet which induces a positive voltage on the gate of the GCS. Primary coil current flow results in the formation of an electromagnetic field around the primary coil which induces a voltage of sufficient potential in the secondary coil windings to "fire" the spark plug.

When the rotor has moved the magnets past the armature, the GCS will cease to conduct and revert to the "OFF" state until it is triggered. The condenser will discharge during the time that the GCS was conducting.

Solid State (Breakerless) Capacitor Discharge Ignition System

The capacitor discharge (CD) ignition system uses a permanent magnet rotor to induce a current in a coil, but unlike the conventional flywheel magneto and solid state (breakerless) magneto described previously, the current is stored in a capacitor (condenser), then the stored current is discharged through a transformer coil to create the ignition spark, whereas the other type magnetos utilize a collapsing magnetic field passing through the ignition coil to provide current for the ignition spark. The secondary current is in-

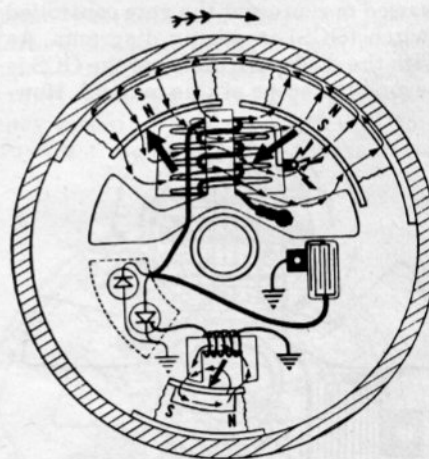


Fig. CS29-Refer first to Figs. CS27 and CS28. The ignition coil magnets have now moved to a position so that their lines of force are cutting the ignition coil windings at a maximum rate. At this same instant, movement of the trigger coil magnets is pulling lines of force away from the trigger coil armature thus creating a negative charge in the coil lead to the GCS gate terminal. This "turns off" the GCS and interrupts the primary ignition circuit just as would breaker points opening in a conventional magneto. As the primary current is interrupted at its peak, the current is brought to a quick stop by the condenser and a very high voltage is induced in the ignition coil. Refer to Fig. CS23 regarding the collapsing electro-magnetic field surrounding the ignition coil.

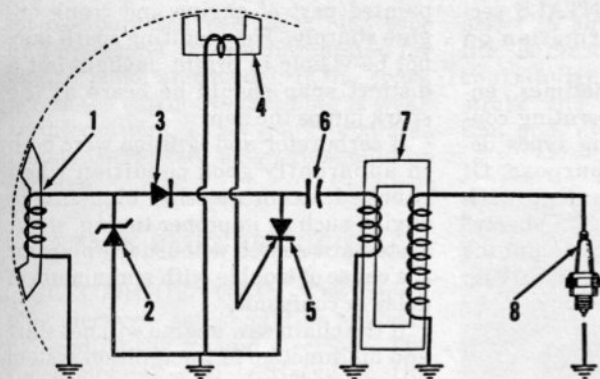


Fig. CS30-Schematic diagram of a simple Capacitor Discharge "Solid State" ignition system.

1. Generating coil
2. Zener diode
3. Diode
4. Trigger coil
5. Silicon Controlled Rectifier (SCR)
6. Capacitor
7. Pulse transformer (coil)
8. Spark plug

duced by the rapid build-up rather than by collapse of the primary current. The result is a high-energy ignition spark ideally suited to high-speed, two-stroke engine operation.

One development which made the new systems possible was the introduction of semi-conductors suitable for ignition system control. While solid state technology and the capacitor discharge system are not interdependent they are uniquely compatible and each has features which are desirable from the standpoint of reliability and performance.

Fig. CS30 shows a circuit diagram of a typical capacitor discharge, breakerless ignition system using permanent flywheel magnets as the energy source. The magnets pass by the input generating coil (1) to charge the capacitor (6), then by the trigger coil (4) to open the gate and permit the discharge pulse to enter the pulse transformer (7) and generate the spark which fires the plug. Only half of the generated current passes through diode (3) to charge the capacitor. Reverse current is blocked by diode (3) but passes through diode (2) to complete the reverse circuit. Diode (2) may be a Zener Diode to

limit the maximum voltage of the forward current. When the flywheel magnet passes by the trigger coil (4) a small electrical current is generated which opens the gate of the SCR (5) allowing the capacitor to discharge through the pulse transformer (7). The rapid voltage rise in the transformer primary coil induces a high-voltage secondary current which forms the ignition spark when it jumps the spark plug gap.

SPARK PLUG

In any spark ignition engine, the spark plug (See Fig. CS31) provides the means for igniting the compressed fuel-air mixture in the cylinder. Before an electric charge can move across an air gap, the intervening air must be charged with electricity, or ionized. If the spark plug is properly gapped and the system is not shorted, not more than 7,000 volts may be required to initiate a spark. Higher voltage is required as the engine warms up, or if compression pressures or the distance of the spark plug air gap is increased. Compression pressures are highest at full throttle and relatively slow engine speeds, therefore, high voltage requirements or a lack of available secondary voltage most often shows up as a miss during maximum acceleration from a slow engine speed. There are many different types and sizes of spark plugs

which are designed for a number of specific requirements.

THREAD SIZE. The threaded, shell portion of the spark plug and the attaching hole in the cylinder are manufactured to meet certain industry established standards. The diameter is referred to as "Thread Size." Those commonly used are: 10 mm, 14 mm, 18 mm, $\frac{7}{8}$ inch and $\frac{1}{2}$ inch pipe. The 14 mm plug is almost universal for chain saw engine use.

REACH. The length of thread, and the thread depth in cylinder head or wall are also standardized throughout the industry. This dimension is measured from gasket seat of head to cylinder end of thread. See Fig. CS32. Four different reach plugs commonly used are: $\frac{3}{8}$ -inch, $\frac{7}{16}$ -inch, $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch. The first two mentioned are the ones commonly used in chain saw engines.

HEAT RANGE. During engine operation, part of the heat generated during combustion is transferred to the spark plug, and from the plug to the cylinder through the shell threads and gasket. The operating temperature of the spark plug plays an important part in engine operation. If too much heat is retained by the plug, the fuel-air mixture may be ignited by contact with the heated surface before the ignition spark occurs. If not enough heat is retained, partially burned combustion products (soot, carbon and oil) may build up on the plug tip resulting in "fouling" or shorting out of the plug. If this happens, the secondary current is dissipated uselessly as it is generated instead of bridging the plug gap as a useful spark, and the engine will misfire.

The operating temperature of the plug tip can be controlled, within limits, by altering the length of the path the heat must follow to reach the threads and gasket of the plug. Thus, a plug with a short, stubby insulator around the center electrode will run cooler than one with a long, slim insu-

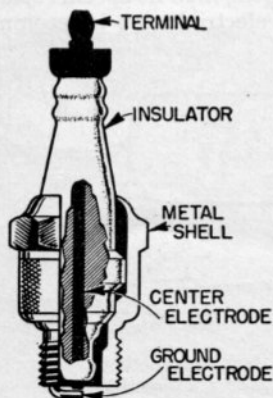
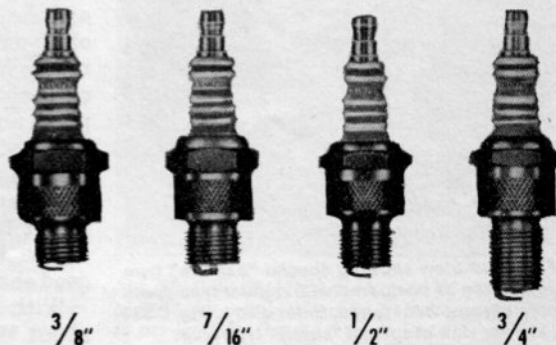


Fig. CS31-Cross sectional view of spark plug showing construction and nomenclature.

Fig. CS32-Various "reaches" of plugs available. Chain saw engines normally use a $\frac{3}{8}$ -inch reach spark plug. A $\frac{3}{8}$ -inch reach plug measures $\frac{3}{8}$ -inch from firing end of shell to gasket surface of shell.



lator. Refer to Fig. CS33. Most plugs in the more popular sizes are available in a number of heat ranges which are interchangeable within the group. The proper heat range is determined by engine design and the type of service. Refer to SPARK PLUG SERVICING,

in SERVICE FUNDAMENTALS section, for additional information on spark plug selection.

SPECIAL TYPES. Sometimes, engine design features or operating conditions call for special plug types designed for a particular purpose. Of special interest when dealing with chain saw engines are the "shorty" type plug shown in Fig. CS34, and the "bantam" type plug shown in Fig. CS35.

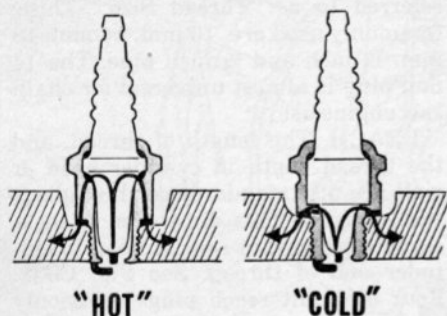


Fig. CS33—Spark plug tip temperature is controlled by the length of the path heat must travel to reach the cooling surface of the engine cylinder head.

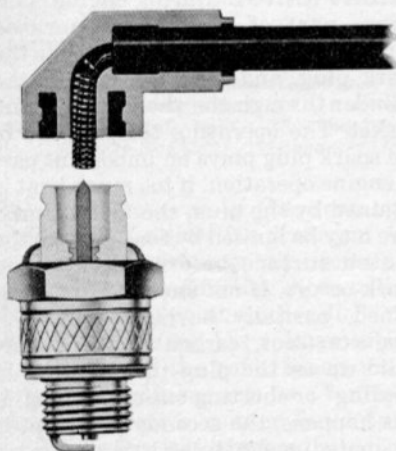


Fig. CS34—Cut-away view of special "shorty" type spark plug and terminal available for chain saw engines. Refer to Fig. CS35 for a second type special plug.

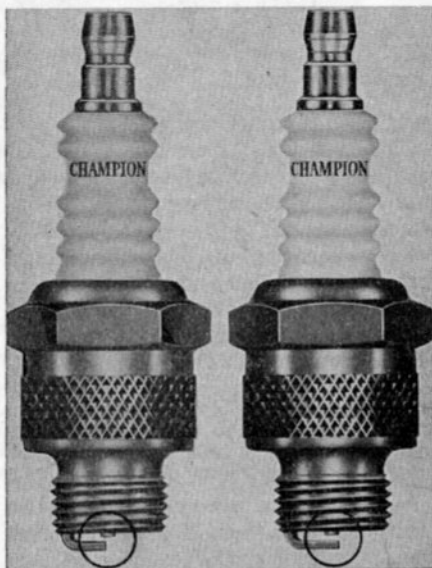


Fig. CS36—The two stroke (left) differs from conventional plug in that the grounded electrode is shortened to minimize carbon fouling.

ENGINE SERVICE

TROUBLE SHOOTING

Most performance problems such as failure to start, failure to run properly or missing out are caused by malfunction of the ignition system or fuel system. The experienced service technician generally develops and follows a logical sequence in trouble shooting which will most likely lead him quickly to the source of trouble. One such sequence might be as follows:

Remove and examine spark plug. If fuel is reaching the cylinder in proper amount, there should be an odor of gasoline on the plugs if they are cold. Too much fuel or oil can foul the plugs causing engine not to start. Fouled plugs are wet in appearance and easily detected. The presence of fouled plugs is not a sure indication that the trouble has been located, however, The engine might have started before fouling occurred if ignition system had been in good shape.

With spark plug removed, hold wire about 1/8 to 1/4 inch away from an un-

painted part of engine and crank engine sharply. The resulting spark may not be visible in bright daylight but a distinct snap should be heard as the spark jumps the gap.

If carburetor and ignition were both in apparently good condition when checked, examine other elements of engine such as improper timing, etc. A systematic search will usually pinpoint the cause of trouble with a minimum of delay or confusion.

If the chain saw engine will not start and malfunction of the ignition system is suspected, make the following checks to find cause of trouble.

Check to be sure that the ignition switch is in the "On" or "Run" position and that the insulation on the wire leading to the ignition switch is in good condition. The switch can be checked with the timing and test light as shown in Fig. S1. Disconnect the lead from the switch and attach one clip of the test light to the switch terminal and the other clip to the chain saw frame or engine. The light should go on when the switch is in the "Off" or "Stop" position, and should go off when the switch is in the "On" or "Run" position.

Inspect the high tension (spark plug) wire for worn spots in the insulation or breaks in the wire. Frayed or worn insulation can be repaired temporarily with plastic electrician's tape.

If no defects are noted in the ignition switch or ignition wires, remove and inspect the spark plug as outlined in the SPARK PLUG SERVICING section. If the spark plug is fouled or is in questionable condition, connect a spark plug of known quality to the high tension wire, ground the base of the spark plug to engine and turn engine rapidly with the starter. If the spark across the electrode gap of the spark plug is a bright blue, the magneto can be considered in satisfactory condition. **NOTE:** Some engine manufacturers specify a certain type spark plug and a specific test gap. Refer to appropriate engine service section; if no specific spark plug type or electrode gap is recommended

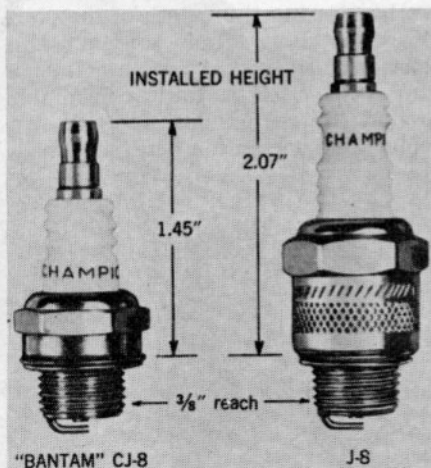


Fig. CS35—View showing special "bantam" type spark plug as compared with regular type spark plug of same heat range. Refer also to Fig. CS34 for view of special "shorty" type plug.

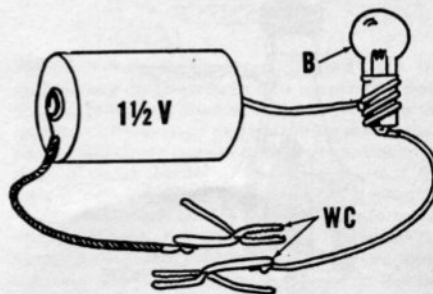


Fig. S1—A static timing light can be made from a flashlight battery, a bulb (B), two wire clips (WC) and short pieces of insulated wire. Bulb should light when clips are touched together. Refer to Fig. S2.

for test purposes, use spark plug type and electrode gap recommended for engine make and model. If the spark across the gap of the test plug is weak or intermittent, or no spark occurs as engine is cranked, magneto should be serviced.

SPARK PLUG SERVICING

ELECTRODE GAP. The spark plug electrode gap should be adjusted by bending the ground electrode. The recommended gap is listed in the SPARK PLUG paragraph in MAINTENANCE section for the individual motor.

PLUG APPEARANCE DIAGNOSIS. The appearance of a spark plug will be altered by use, and an examination of the plug tip can contribute useful information which may

assist in obtaining better spark plug life. It must be remembered that the contributing factors differ in two-stroke and four-stroke engine operation and, although the appearance of

two spark plugs may be similar, the corrective measures may depend on whether the engine is of two-stroke or four-stroke design. Fig. S3 to Fig. S8 are provided by Champion Spark Plug Company to illustrate typical observed conditions in two-stroke engines. Listed also are the probable causes and suggested corrective measures.

PLUG IDENTIFICATION. Each spark plug manufacturer uses a different special code to identify spark plug characteristics. It has been found impossible to provide a plug cross refer-

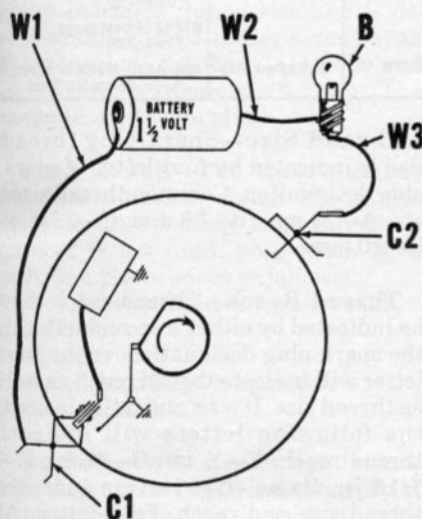


Fig. S2—When connecting timing light (see Fig. S1), first disconnect primary coil wire from breaker point terminal, then connect one wire clip (C1) to terminal and other clip (C2) to magneto back plate or engine. Bulb should be out when points are open and light when points close.



Fig. S2A—View of test plug which may be used for ignition troubleshooting.

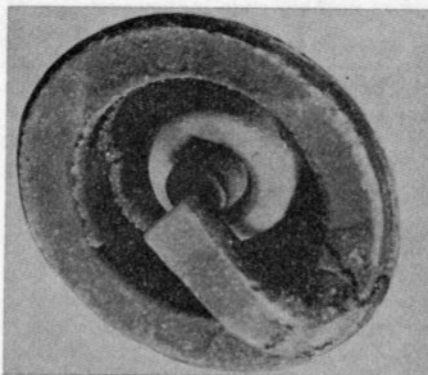


Fig. S3—Two stroke engine plug of correct heat range. Insulators light tan to gray with few deposits. Electrodes not burned.

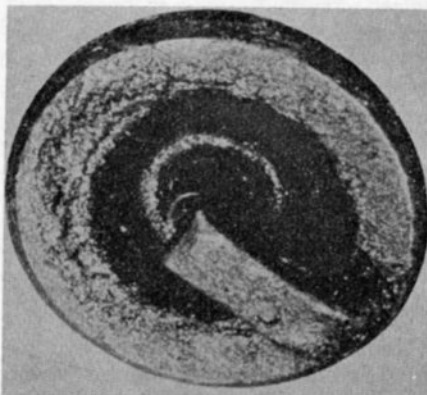


Fig. S4—Damp or wet black carbon coating over entire firing end of plug. Could be caused by rich carburetor mixture, too much oil in fuel, or low ignition voltage. Could also be caused by incorrect heat range (too cold) for operating conditions. Correct the defects or install a hotter plug.

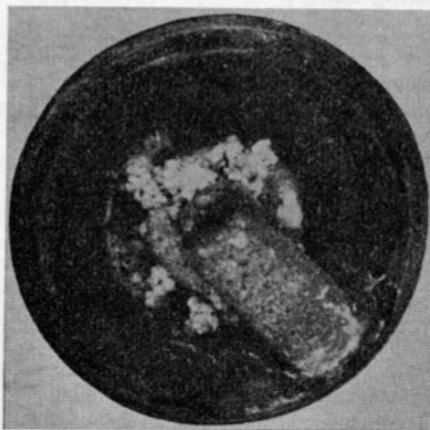


Fig. S5—Core bridging from center electrode to shell. Fused deposits sometimes have the appearance of tiny beads or glasslike bubbles. Caused by excessive combustion chamber deposits which in turn could be the result of: excessive carbon from prolonged usage; use of improper oil or incorrect fuel-oil ratio.

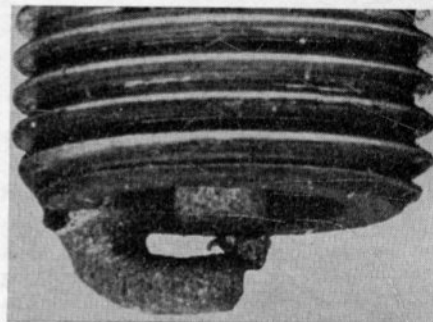


Fig. S6—Gap bridging. Usually results from the same causes outlined in Fig. S5.

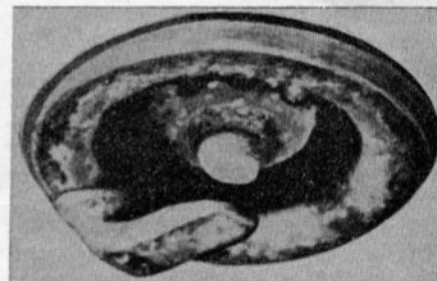


Fig. S7—Electrodes badly eroded, deposits white or light gray and gritty. Insulator has "blistered" appearance. Could be caused by lean carburetor mixture, fast timing, overloading, or air intake screen and engine cooling fins blocked with sawdust or other debris. Could also be caused by incorrect heat range (too hot) for operating conditions. Check timing, carburetor adjustment, cooling system. If timing, carburetor adjustment, cooling system and engine speed are correct, install a colder plug.

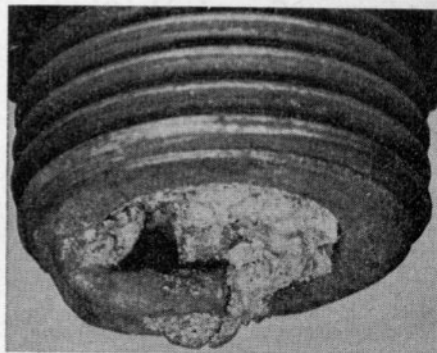
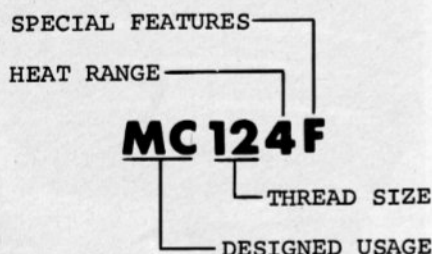


Fig. S8—Gray metallic aluminum deposits on plug. (Seldom encountered.) Piston damage due to pre-ignition. Overhaul engine and determine cause of pre-ignition.

ence chart which is accepted by all manufacturers, however the following code identification for some spark plugs may be helpful in selecting the correct plug. Although not universally true, it can be generally assumed that two plugs of different manufacture falling within similar portions of the heat range scale will interchange. In some cases it may be found necessary to move up or down the scale one or two steps for best performance.

AC SPARK PLUGS



Thread Size—the first digit or digits of the number code indicates thread size. The pictured sample indicates a 12 mm plug.

- 2—½ inch thread
- 4—14mm thread
- 7—¾ inch thread
- 8—18mm thread
- 10—10mm thread
- 12—12mm thread

Heat Range—The last digit of number code indicates heat range. Plugs may be numbered from "0" to "9", the lower number indicating the colder plug. The pictured example "4" falls approximately in mid-range.

Suffix Letters—A letter (or letters) after the number indicates special features. The "F" in pictured example indicates that plug is "Special Reach for Foreign Applications".

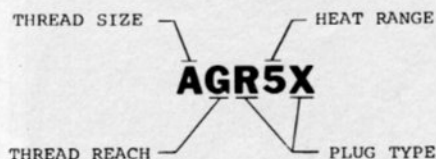
- B—Neon tube
- D—Dual side electrodes
- E—Engineer Corps shielded (Not Aircraft Type)
- F—Special reach for foreign applications
- FF—½-inch reach fully threaded (14mm)
- G—Marine racing gap
- H—Special hex size
- I—Iridium center electrode
- K—High performance marine
- L—Long reach
- XL—Extra long reach
- N—Extra long reach
- P—Platinum electrodes
- R—Resistor plug
- S—Extended tip (14mm)
- S—Moderate long reach

- T—Tapered seat
- TS—Tapered seat, extended tip
- W—Recessed termination
- X—Special gap
- Y—Three prong electrode

Prefix Letters—Letter (or letters) before number code indicates designed usage.

- B—Series gap
- C—Commercial
- CS—Low profile (chainsaw)
- G—Gas engine
- H—High altitude or weatherproof
- M—Marine
- MC—Motorcycle
- LM—Lawnmower
- R—Resistor
- S—Shielded
- SN—Snow vehicle
- TC—Tractor commercial
- V—Surface gap
- W—Waterproof

AUTOLITE SPARK PLUGS



Heat Range—Heat range is indicated by first one or two digits of spark plug number. If spark plug has one number, then heat range is indicated by number. The larger the number, the hotter the plug. Numbers (10, 11, 15) and any number followed by a zero also indicate heat range. Refer to the following chart.

HEAT RANGE	EXAMPLES
Cold: 0 thru 3	AK0, AT1, BT3
Medium: 4 thru 7	B4X, AT6, AGZ7
Hot: 8 thru 11	BT8, A9, BT9, AT10, A11
Extremely Hot: 15	BR15S, BT15, TT15

Numbers with a zero will be part of a three-digit number (i.e., 601 or 402) with the first digit indicating heat range in tenths. For example, number (601) indicates a heat range number of (.6) which is colder than heat range number (1). The decimal point is not used on the actual spark plug number.

THIRD DIGIT	INDICATES	EXAMPLES
1	Standard Tip	BF601 (.60 heat range, Standard Tip)
2	Power Tip	AG902 (.90 heat range, Power Tip)
3	Retracted Gap	A203 (.20 heat range, Retracted Gap) BF403 (.40 heat range, Retracted Gap)

Gap Type—Last number of a two-digit (except 10, 11 or 15) or three-digit spark plug number indicates the gap type. If last number is (1), a standard gap is used. Plugs with a last number of (2) have a Power Tip, and plugs with a last number of (3) have a retracted gap.

SECOND DIGIT	INDICATES	EXAMPLES
1	Standard Gap	A21 (2 heat range, Standard Gap)
2	Power Tip	A22 (2 heat range, Power Tip) AGR82, (8 heat range, Power Tip) BTF42 (4 heat range, Power Tip)
3	Retracted Gap	A23, AE23, AG23, (2 heat range, Retracted Gap)

Thread Size—Spark plug thread size is indicated by first letter of spark plug designation. Common thread sizes are: A—14 mm; B—18 mm; C—12 mm; D—10 mm.

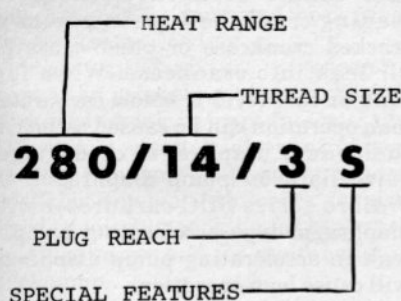
Thread Reach—Thread reach may be indicated by either a second letter in the spark plug designation, or the first letter will indicate thread reach as well as thread size. If a second letter is used, the following letters will indicate thread reach: E—½ in.; G—¾ in.; L—7/16 in. Some first letters indicate thread size and reach. First letter (A) indicates 14 mm thread size and ¾ in. thread reach. First letter (B) indicates an 18 mm thread size and ½ in. thread reach.

Special Plug Types—Special plug type may be indicated by one of the following letters directly preceding or following the spark plug heat range number:

- Prefix Letters**
- F—Tapered seat
 - K—Surface gap
 - R—Resistor
 - T—Transport
 - Z—Internal gap

- Suffix Letters**
- M—Inboard marine
 - N—Low profile insulator
 - S—Shielded
 - W—Small engine
 - X—Small engine; short side electrode

BERU SPARK PLUGS



Heat Range—The first number group indicates heat range. The hottest available plug is coded "20" and the coldest available plug "400". Readily available (stocked) plugs are within the range "95" to "280", placing the example at the cold end of the commercial scale.

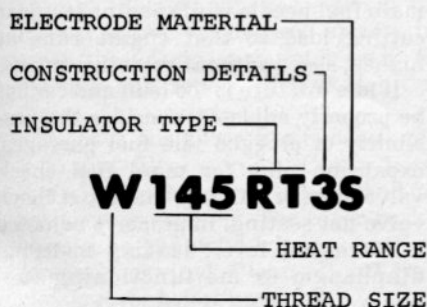
Thread Size—The second number group indicates thread size and is direct reading, millimeter sizes being given in whole number (14, 18 etc) and inch sizes in fractions ($\frac{1}{8}$, etc). The example is a 14 mm plug.

Plug Reach—The third number indicates thread or shank length, the example (3) denoting long thread. If number is not used, plug reach is $\frac{1}{2}$ inch. Complete code is as follows:
2—Long shank (between gasket seat and hex)
3— $\frac{3}{4}$ inch reach
4—Long thread and long shank
5— $\frac{1}{2}$ inch reach

Suffix Letters—Letter (or letters) following number code indicate special types or features. The example (S) indicates silver electrode.

A—Extended tip
AM—Short plug
HGF—Wide heat range
K—Tapered seat
P—Platinum electrode
S—Silver electrode
UK—Low profile (chainsaw type)

BOSCH SPARK PLUGS



Thread Size—The first letter (or letters) indicates thread size and general plug type. The example "W" is 14mm plug.

U—10mm plug
X—12mm plug
W—14mm plug
M—18mm plug
Z— $\frac{1}{8}$ inch plug

Additional letters in prefix indicate special types; A and AG indicate tapered seat; K and KA indicate short (chainsaw) plug; D indicates surface gap plug and V indicates booster gap.

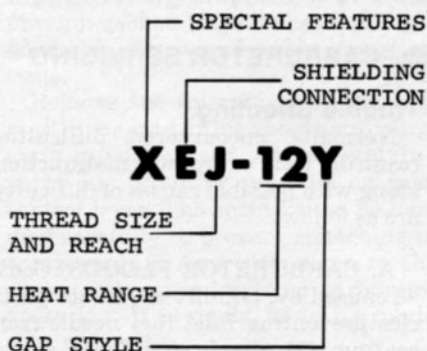
Heat Range—The number indicates plug heat range, 20 being the hottest readily available plug and 340 the coldest readily available. The example (145) is approximately midrange.

Insulator Type—The middle letter code denotes insulator type, the letter "M", "P", "T" indicating the particular ceramic material. The addition of "R" to code indicates resistor plug.

Construction Details—The final number code is a manufacturing design code and the number may have different meanings in different plug types. It has no particular value in service identification.

Electrode Material—The letter "S" indicates silver electrode material and the letter "P" indicates platinum material.

CHAMPION SPARK PLUGS



Heat Range—Heat range numbers are divided into four types. Numbers 1-25 are for automotive, marine and ordnance plugs; numbers 26-50 are for aircraft; numbers 51-75 are racing plugs; numbers 76-99 indicate special features or application. On all types, the higher number (within type range) indicates hotter plug.

NOTE: Gold Palladium plug types are not completely interchangeable with standard types with respect to heat range. The following chart compares Gold Palladium plug with standard type, the first column in each type being standard plug number and the second column Gold Palladium.

14mm / $\frac{1}{4}$ " Reach		14mm / .472" Reach
—	HOT	—
J-8J	—	L-86
—	UJ-11G	—
J-7J	—	—
—	UJ-7G	L-81 L-6G
J-6J	—	—
—	—	—
J-4J	—	L-78 L-3G
—	—	—
J-57R	COLD	L-77J L-2G

14mm / $\frac{1}{4}$ " Reach		18mm / .445" Reach
—	HOT	—
—	—	K-13
—	—	K-12G
N-5	—	K-9
—	—	K-8G
N-4	N-4G	K-8
—	—	K-5G
N-3	N-3G	K-7
—	—	—
N-2	N-2G	K-60R* K-3G
—	COLD	K-57R* K-2G

* .500" Reach

Thread Size and Reach—The code letter ("J" in example) indicates thread size and reach. The example is 14mm- $\frac{1}{4}$ inch reach.

Letter	Thread Size	Thread Reach (Inch)
Y	10mm	$\frac{1}{4}$
Z	10mm	.492
G	10mm	.700
P	12mm	.492
R	12mm	$\frac{3}{4}$
J	14mm	$\frac{3}{4}$
J (preceded by C)	14mm	$\frac{3}{4}$
J (preceded by D)	14mm	.325 Tapered Seat
H	14mm	7/16
L	14mm	$\frac{1}{2}$ or .472
L (preceded by B)	14mm	.460 Tapered Seat
N	14mm	$\frac{3}{4}$
N (preceded by B)	14mm	.708 Tapered Seat
E	14mm	.680
F	18mm	.460 Tapered Seat
K	18mm	All
B	18mm	13/16
U	18mm	1 $\frac{1}{8}$
W	$\frac{7}{8}$ "-18	All
C	$\frac{7}{8}$ "-18	All
S	1 $\frac{1}{2}$ "-12	.600
None	$\frac{1}{2}$ "-14 Pipe Thread	All
V	Model Airplane Engine Plug	

Type of Shielding Connection—In some cases, code indicates special short plugs. If this code is not used, plug is not shielded and is not a short plug. Example (E) indicates shielded plug with $\frac{5}{8}$ inch-24 threaded connection.

B—See Thread Size Code L & N

C—(See Thread Size Code J) Short plug (bantam)

D—(See Thread Size Code J) Short plug

E—Shielded— $\frac{5}{8}$ inch-24 thread

H—Shielded— $\frac{3}{4}$ inch-24 thread

M—Shielded— $\frac{5}{8}$ inch-24 thread Ord-nance

P—Shielded—9/16 inch—27 thread

S—Shielded—11/16 inch—24 Whi-tworth

T—Low Profile Plug (shorty)

W—Shielded 13/16 inch—20 thread

Special Internal Features—Indicates resistor or auxiliary gap. If this code is not present, plug has no resistor or auxiliary gap.

R—Resistor (Less than 6000 ohms)

X—Resistor (more than 6000 ohms)

U—Auxiliary gap

Gap or Electrode Type—Suffix letters indicate type of material of electrodes and type of gap. Letter (Y) in example indicates projected core.

B—Two heavy duty ground electrodes

C—Protruding nose, round ground electrode, sawed gap

D—Protruding nose, round ground electrode

F—Three heavy duty ground electrodes

G—"Gold Palladium" center electrode

J—Cut back ground electrode

LM—Special Lawn Mower Plug

N—Four-prong Aircraft Type

P—Fine wire Platinum electrodes

R—Push wire ground electrode

S—Single ground electrode, side gap

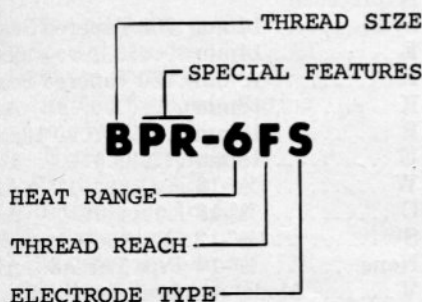
T—Special Gap

V—Surface Gap

Y—Projected core

NOTE: "Gold Palladium" plugs are factory gapped at 0.015" and a gap 0.003"-0.005" narrower than standard plug is recommended.

NGK SPARK PLUGS



Thread Size—The first letter indicates thread size. Second and third letters (if used) denote variations. The letter "M" as second or third letter indicates low profile plug; "P" indicates projected nose and "R" indicates resistor plug.

A—18mm plug

AB—18mm plug

B—14mm plug

C—10mm plug

D—12mm plug

Heat Range—The number indicates heat range. Numbers are from 2 (hot) to 14 (cold). Number "6" in example is approximately mid-range.

Thread Reach—Three suffix letters (E, H & L) are used to indicate thread reach. If none of the above letters appear on 14mm plug, reach is $\frac{3}{8}$ inch; if none appear on 18mm plug, reach is 12mm. Letter "F" suffix (example) indicates taper seat.

E— $\frac{3}{8}$ inch reach

H— $\frac{1}{2}$ inch reach

L—7/16 inch reach

Electrode Type—Suffix letters are also used to indicate special electrode types; may be used in combination with thread suffix as in example, or alone if thread suffix is not used. If electrodes are conventional type, no suffix is used.

C—Competition type electrode

N—Racing (Nickel) electrode

P—Racing (Platinum) electrode

S—Super wide heat range

X—Surface gap electrode

CARBURETOR SERVICING

Trouble Shooting

Normally encountered difficulties resulting from carburetor malfunction, along with possible causes of difficulty, are as follows:

A. CARBURETOR FLOODS. Could be caused by: (1), dirt or foreign particles preventing inlet fuel needle from seating; (2), diaphragm lever spring not seated correctly on diaphragm lever; or (3), improperly installed metering diaphragm. Also, when fuel tank is located above carburetor, flooding can be caused by leaking fuel pump diaphragm.

B. ENGINE RUNS LEAN. Could be caused by: (1), fuel tank vent plugged; (2) leak in fuel line or fittings between fuel tank and carburetor; (3), filter screen in carburetor or filter element in fuel pick-up head plugged; (4), fuel orifice plugged; (5), hole in fuel metering diaphragm; (6), metering lever not properly set; (7), dirt in carburetor fuel channels or pulse channel to engine crankcase plugged; or (8), leaky

gaskets between carburetor and crankcase intake port. Also, check for leaking crankshaft seals, porous or cracked crankcase or other cause for air leak into crankcase. When fuel tank or fuel level is below carburetor, lean operation can be caused by hole in fuel pump diaphragm or damaged valve flaps on pump diaphragm. On Walbro series SDC carburetor with diaphragm type accelerating pump, a leak in accelerating pump diaphragm will cause lean operation.

C. ENGINE WILL NOT ACCELERATE SMOOTHLY. Could be caused by: (1), inoperative accelerating pump, on carburetors so equipped, due to plugged channel, leaking diaphragm, stuck piston, etc.; (2), idle or main fuel mixture too lean on models without accelerating pump; (3), incorrect setting of metering diaphragm lever; (4), diaphragm gasket leaking; or (5), main fuel orifice plugged.

D. ENGINE WILL NOT IDLE. Could be caused by: (1), incorrect adjustment of idle fuel and/or idle speed stop screw; (2), idle discharge or air mixture ports clogged; (3), fuel channel clogged; (4), dirty or damaged main orifice check valve; (5), Welch (expansion) plug covering idle ports not sealing properly allowing engine to run with idle fuel needle closed; or (6), throttle shutter not properly aligned on throttle shaft causing fast idle.

E. ENGINE RUNS RICH. Could be caused by: (1), plug covering main nozzle orifice not sealing; (2), when fuel level is above carburetor, leak in fuel pump diaphragm; worn or damaged adjustment needle and seat.

Adjusting

Initial setting for the mixture adjustment needles is listed in the specific engine sections of this manual. Make final carburetor adjustment with engine warm and running. Adjust idle speed screw so that engine is idling at just below clutch engagement speed; do not try to make engine idle any slower than this. Adjust idle fuel needle for best engine idle performance, keeping the mixture rich as possible (turn needle out to richen mixture). If necessary, readjust idle speed screw. Adjust main fuel needle while engine is under cutting load so that engine runs at highest speed without excessive smoke.

If idle mixture is too lean and cannot be properly adjusted, consider the possibility of plugged idle fuel passages, expansion plug for main fuel check valve loose or missing, main fuel check valve not seating, improperly adjusted inlet control lever, leaking metering diaphragm or malfunctioning fuel pump.

If idle mixture is too rich, check idle mixture screw and its seat in carburetor body for damage. Check causes for carburetor flooding.

If high speed mixture is too lean and cannot be properly adjusted, check for dirt or plugging in main fuel passages, improperly adjusted inlet control lever, malfunctioning diaphragm or main fuel check valve. Also check for damaged or missing packing for high speed mixture screw and for malfunctioning fuel pump.

If high speed mixture is too rich, check high speed mixture screw and its seat for damage. Check causes for carburetor flooding.

Setting or adjusting the inlet control lever (metering diaphragm lever height) necessitates disassembly of the carburetor. Refer to the following carburetor sections for adjusting the lever height.

Tillotson Models HC, HJ and HL

Tillotson model HC, HJ and HL carburetors are diaphragm type carburetors with model HL having an integral diaphragm fuel pump. Operation and servicing of these carburetors is similar and covered in the following paragraphs.

OPERATION. Operation of model HL carburetor is outlined in CARBURETION section of ENGINE DESIGN. Operation of HC and HJ carburetors is similar to HL but they are not equipped with a diaphragm fuel pump.

Some HL carburetors are equipped with a governor valve (25—Fig. S10) which enriches the fuel mixture at the governed speed and prevents engine overspeeding. Original governor assembly is tuned for each engine and cannot be renewed. A disc may be installed in place of governor assembly.

OVERHAUL. Since the model HL carburetor is the most widely used carburetor, overhaul procedures for the model HL will be covered. Overhaul of models HJ and HL is similar to the HL carburetor with the exception of the fuel pump. Refer to Figs. S9 and S10.

DISASSEMBLY. Clean carburetor and inspect for signs of external damage. Remove idle speed screw and inspect screw, washer and spring. Inspect threads in carburetor body for damage and repair with a Heli-Coil insert, if necessary.

Remove the filter cover, cover gasket, and filter screen. Clean filter screen by flushing with solvent and dry with compressed air. The cover gasket should be renewed whenever filter screen is serviced. Clean all dirt from plastic cover before assembly.

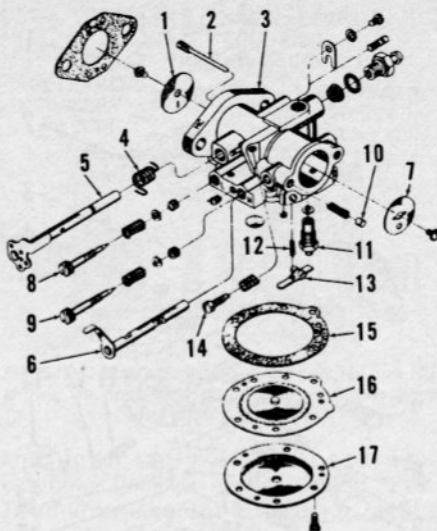


Fig. S9—Exploded view of Tillotson model HC carburetor. Model HJ is similar.

- | | |
|-----------------------------|----------------------------|
| 1. Throttle plate | 10. Choke friction pin |
| 2. Lever pin | 11. Fuel inlet valve assy. |
| 3. Body | 12. Spring |
| 4. Return spring | 13. Diaphragm lever |
| 5. Throttle shaft | 14. Idle speed screw |
| 6. Choke shaft | 15. Gasket |
| 7. Choke plate | 16. Metering diaphragm |
| 8. Idle mixture screw | 17. Cover |
| 9. High speed mixture screw | |

Remove the six body screws, fuel pump cover casting, fuel pump diaphragm and gasket. Diaphragm should be flat and free from holes. The gasket should be renewed if there are holes or creases in the sealing surface.

Remove the diaphragm cover casting, metering diaphragm and diaphragm gasket. Inspect the diaphragm for holes, tears and other imperfections.

Remove the fulcrum pin, inlet control lever and inlet tension spring. Care must be used while removing parts due to spring pressure on inlet control lever. The spring must be handled carefully to prevent stretching or compressing. Any alteration to the spring will cause improper carburetor operation. If in doubt as to its condition, renew it.

Remove inlet needle. Remove inlet seat assembly using a 5/16" thin wall socket. Remove the inlet seat gasket.

Inlet needles and seats are in matched sets and should not be interchanged. Needle and seat assembly must be clean for proper performance. Use a new gasket when installing the insert cage. Do not force cage as threads may be stripped or the cage distorted. Use a torque wrench and tighten cage to 25-30 inch-pounds torque.

Remove both high speed and idle mixture screws and inspect points. Notice the idle mixture screw point has the step design to minimize point and casting damage. The mixture screws

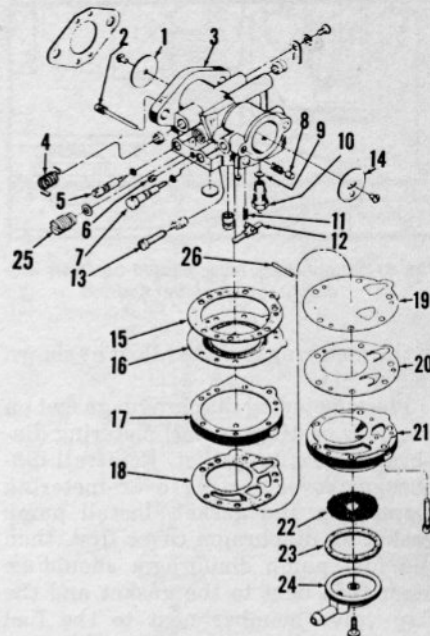


Fig. S10—Exploded view of Tillotson model HL carburetor. On some HL carburetors, pump diaphragm (19) and valves (20) are one-piece. Governor valve (25) is not used on all carburetors.

- | | |
|-----------------------------|-------------------------|
| 1. Throttle plate | 14. Choke plate |
| 2. Lever pin | 15. Gasket |
| 3. Body | 16. Metering diaphragm |
| 4. Throttle return spring | 17. Diaphragm cover |
| 5. Idle mixture screw | 18. Gasket |
| 6. Drain plug | 19. Fuel pump diaphragm |
| 7. High speed mixture screw | 20. Fuel pump valves |
| 8. Choke detent | 21. Pump body |
| 9. Gasket | 22. Screen |
| 10. Fuel inlet valve assy. | 23. Gasket |
| 11. Spring | 24. Fuel inlet |
| 12. Diaphragm lever | 25. Governor valve |
| 13. Idle speed screw | 26. Diaphragm lever pin |

may be damaged from being forced into the casting seat or possibly broken off in the casting. They may be bent. If damage is present be sure to inspect condition of casting. If adjustment seats are damaged, a new body casting is required.

ASSEMBLY. Install the main nozzle ball check valve if this part was found to be defective. Do not over-tighten as distortion will result. Install new welch plugs if they were removed. Place the new welch plug into the casting counter bore with convex side up and flatten it to a tight fit using a 5/16 inch flat end punch. If the installed welch plug is concave, it may be loose and cause an uncontrolled fuel leak. The correctly installed welch plug is flat.

Install inlet seat and tighten to 25-30 inch-pounds torque. Install inlet needle. Install inlet tension spring, inlet control lever, fulcrum pin and fulcrum pin retaining screw. The inlet control lever must rotate freely on the fulcrum pin. Adjust inlet control lever so that the center of the lever that contacts the metering diaphragm is flush

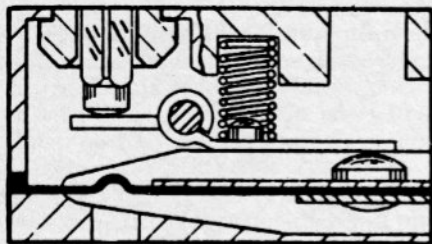


Fig. S11—Diaphragm lever should be flush with diaphragm chamber floor.

to the metering chamber floor as shown in Fig. S11.

Place metering diaphragm gasket on the body casting. Install metering diaphragm next to gasket. Reinstall diaphragm cover casting over metering diaphragm and gasket. Install pump gasket on diaphragm cover first, then the fuel pump diaphragm should be assembled next to the gasket and the flap valve member next to the fuel pump cover. Reinstall fuel pump cover and attach with six body screws. The above parts must be assembled in the proper order or the carburetor will not function properly.

Install filter screen on fuel pump cover. Install gasket on filter screen and replace filter cover over filter screen and gasket and attach with center screw.

Install high speed and idle mixture screws in their respective holes being careful not to damage points.

Welch plugs seal the idle bypass ports and main nozzle ball check valve from the metering chamber. Removal of these plugs is seldom necessary because of lack of wear in these sections and any dirt that may accumulate can usually be blown out with compressed air through the mixture screw holes. If removal of the welch plugs is necessary, drill through the welch plug using a 1/8 inch drill. Allow the drill to just break through the welch plug. If the drill travels too deep into the cavity, the casting may be ruined. Pry the welch plug out of its seat using a small punch.

Inspect the idle bypass holes to insure they are not plugged. Do not push drills or wires into the metering holes. This may damage the flow characteristics of the holes and damage carburetor performance. Blow out plugged holes with compressed air. Remove main nozzle ball check assembly with a screwdriver of correct blade width. If ball check is defective, engine idling will be hampered unless high speed mixture screw is shut off or there will be poor high speed performance with the high speed mixture screw adjusted

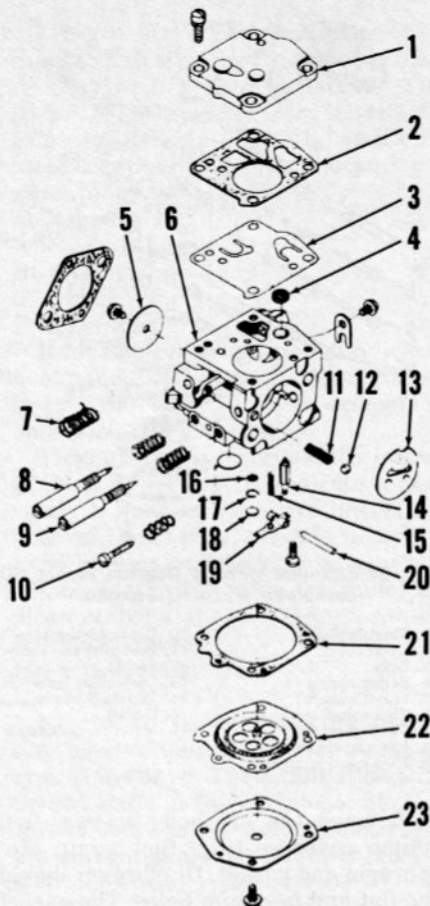


Fig. S12—Exploded view of Tillotson model HS carburetor.

- | | |
|---------------------------------|-------------------------|
| 1. Pump cover | 12. Choke friction ball |
| 2. Gasket | 13. Choke plate |
| 3. Fuel pump diaphragm & valves | 14. Fuel inlet valve |
| 4. Screen | 15. Spring |
| 5. Throttle plate | 16. Screen |
| 6. Body | 17. Screen retainer |
| 7. Throttle return spring | 18. Welch plug |
| 8. Idle mixture screw | 19. Diaphragm lever |
| 9. High speed mixture screw | 20. Lever pin |
| 10. Idle speed screw | 21. Gasket |
| 11. Spring | 22. Metering diaphragm |
| | 23. Cover |
| | 24. Welch plug |

at 1 1/4 turns open. Replace the ball check if defective.

Removing choke and throttle plates before cleaning the body is not necessary if there is no evidence of wear. Indication of wear will require the removal of plates to check the casting. To remove the plates, first mark the position of the plates on their respective shafts to assure correct reassembly. The plates are tapered for exact fit in the carburetor bore. Remove two screws and pull the plate out of the carburetor body. Remove the throttle shaft clip and pull the shaft out of the casting. Examine both the shaft and body bearing areas for wear. Should either part show wear then either the shaft or the body or both will have to be replaced. Remove the choke shaft from the body carefully so that the friction ball and spring will not fly

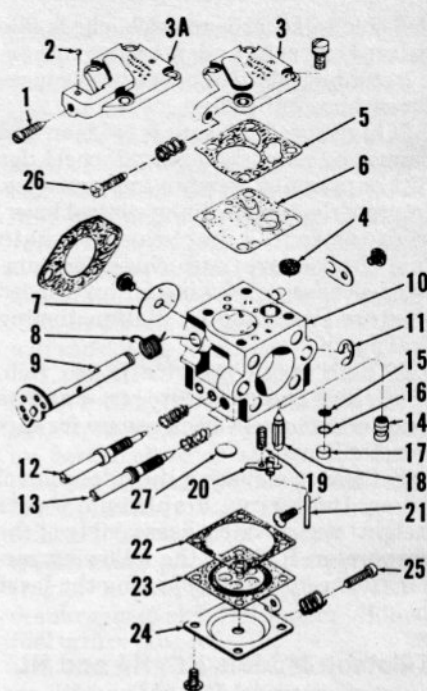


Fig. S13—Exploded view of Tillotson model HU carburetor. Note difference in idle speed screw location used on fuel pump covers (3 & 3A) of some carburetors. Idle speed screw (25) may be located in cover (24).

- | | |
|---------------------------------|------------------------|
| 1. Idle speed screw | 14. Nozzle check valve |
| 2. Friction ball | 15. Screen |
| 3 & 3A. Fuel pump cover | 16. Retainer |
| 4. Screen | 17. Cup plug |
| 5. Gasket | 18. Fuel inlet valve |
| 6. Fuel pump diaphragm & valves | 19. Spring |
| 7. Throttle plate | 20. Diaphragm lever |
| 8. Return spring | 21. Lever pin |
| 9. Throttle shaft | 22. Gasket |
| 10. Body | 23. Metering diaphragm |
| 11. "E" ring | 24. Cover |
| 12. Idle mixture screw | 25. Idle speed screw |
| 13. High speed mixture screw | 26. Idle speed screw |
| | 27. Welch plug |

out of the casting. Inspect the shaft and bushings for wear.

Tillotson Models HS And HU

Tillotson model HS and HU carburetors are diaphragm type with integral diaphragm type fuel pumps. Operation and servicing of HS and HU carburetors is similar and covered in the following paragraphs.

OPERATION. Operation of Tillotson model HS carburetor is covered in CARBURETION section of ENGINE DESIGN. Due to similarity, discussion of operation of HS carburetor will also apply to model HU.

OVERHAUL. Carburetor may be disassembled after inspecting unit and referring to exploded view in Figs. S12 or S13. Clean filter screen (4—Fig. S14). Welch plugs (Fig. 15) may be removed by drilling plug with a suitable size drill bit and prying out as shown in Fig. S16. Care must be taken not to drill into carburetor body.

Inspect inlet lever spring (15—Fig. S12 or 19—Fig. S13) and renew if

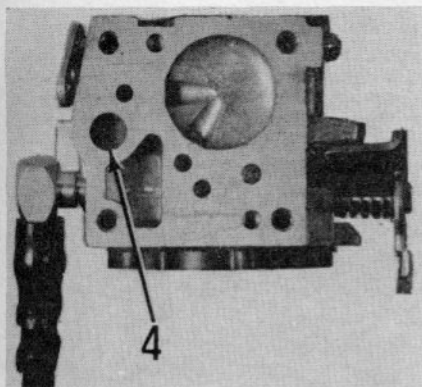


Fig. S14—Be sure to clean filter screen (4—Fig. S12 or S13) when servicing carburetor.

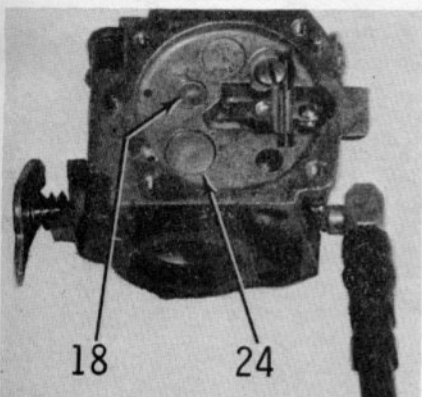


Fig. S15—View showing location of welch plugs (18 & 24—Fig. S12).

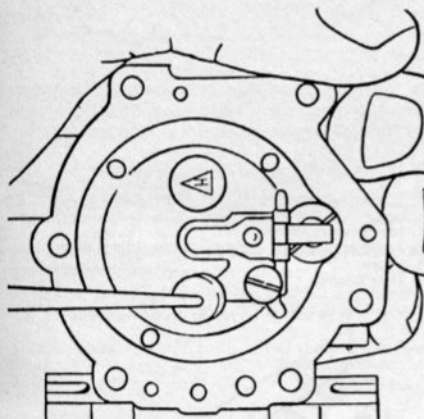


Fig. S16—A punch can be used to remove welch plugs as shown after carefully drilling a small hole in plug.

stretched or damaged. Inspect diaphragms for tears, cracks or other damage. Renew idle and high speed adjusting needles if needle points are grooved or broken. Carburetor body must be renewed if needle seats are damaged. Fuel inlet needle has a rubber tip and seats directly on a machined orifice in carburetor body. Inlet needle or carburetor body should be renewed if worn excessively.

Carburetor may be reassembled by reversing disassembly procedure. Adjust position of inlet control lever so

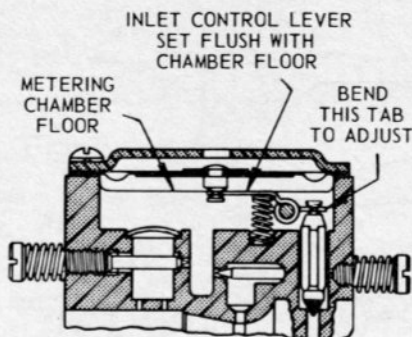


Fig. S17—Diaphragm lever on models HS and HU should be flush with diaphragm chamber floor as shown above.

that lever is flush with diaphragm chamber floor as shown in Fig. S17. Bend lever adjacent to spring to obtain correct lever position.

Walbro Models HDC And SDC

Walbro carburetor models HDC and SDC are diaphragm type carburetors with integral diaphragm type fuel pumps. Some carburetors are also equipped with an accelerator pump. Model number on model HDC carburetor is found on side of carburetor adjacent to fuel mixture adjusting screws. Model number on model SDC carburetors is stamped on bottom of carburetor.

OPERATION. Operation of model SDC carburetor with accelerator pump is discussed in CARBURETION section of ENGINE DESIGN. Operation of model HDC is similar to model SDC and discussion will also apply to model HDC except for explanation of model HDC accelerator pump.

Model HDC carburetors with accelerator pump have a pulse passage (P—Fig. S18) in carburetor body which allows crankcase pulsations to enter idle fuel circuit. The pulse passage is opened and closed by throttle shaft (S).

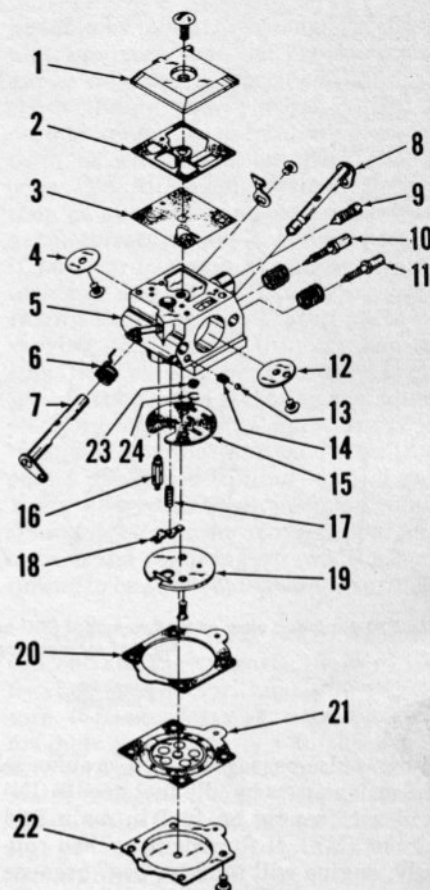


Fig. S19—Exploded view of Walbro model HDC carburetor.

- | | |
|---------------------------------|-------------------------|
| 1. Pump cover | 12. Choke plate |
| 2. Gasket | 13. Choke friction ball |
| 3. Fuel pump diaphragm & valves | 14. Spring |
| 4. Throttle plate | 15. Gasket |
| 5. Body | 16. Fuel inlet valve |
| 6. Return spring | 17. Spring |
| 7. Throttle shaft | 18. Diaphragm lever |
| 8. Choke shaft | 19. Circuit plate |
| 9. Idle speed screw | 20. Gasket |
| 10. Idle mixture screw | 21. Metering diaphragm |
| 11. High speed mixture screw | 22. Cover |
| | 23. Check valve screen |
| | 24. Retainer |

Passage is closed when throttle is closed and open when throttle is open.

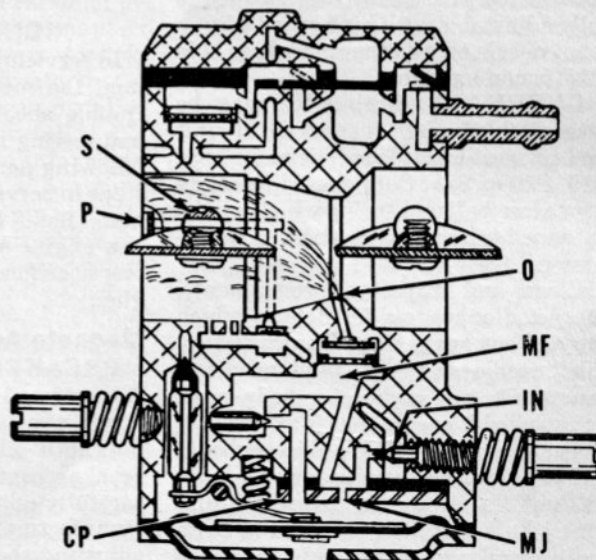


Fig. S18—Cross-sectional view of Walbro model HDC carburetor showing accelerator pump pulse passage (P). Refer to text for operation.

- S. Fuel screen
- 1. Throttle shaft
- 2. Return spring
- 3. Pump cover
- 4. Accelerator diaphragm
- 5. Spring
- 6. Limiting plug
- 7. Throttle plate
- 8. Fuel pump diaphragm
- 9. Gasket
- 10. Pump cover

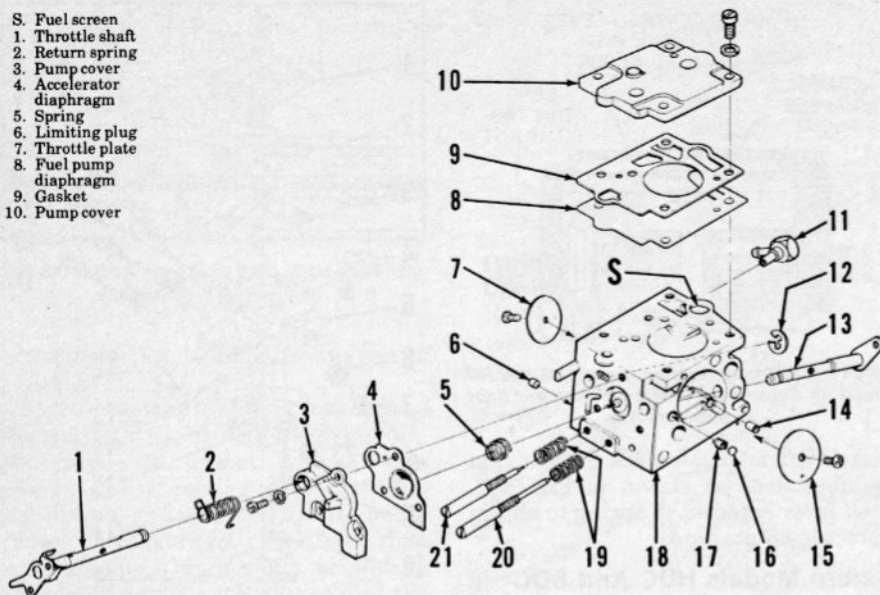


Fig. S20—Exploded view of Walbro model SDC carburetor with accelerator pump assembly. Refer to Fig. S21 for metering diaphragm assembly.

- 11. Elbow fitting
- 12. "E" ring
- 13. Choke shaft
- 14. Idle air jet
- 15. Choke plate
- 16. Detent ball
- 17. Spring
- 18. Body
- 19. Springs
- 20. High speed mixture screw
- 21. Idle mixture screw

When pulse passage is open, crankcase pulsations pass by idle fuel needle (IN) and act directly on fuel in main fuel circuit (MF). If throttle is opened rapidly, engine will tend to "bog" because vacuum in carburetor bore is insufficient to pull fuel from main fuel orifice. Pressure of crankcase pulsations is sufficient to force fuel out main fuel orifice (O) to feed engine and remove bogging tendency. The relative strength of the crankcase pulsations is such that they will affect engine operation only when there is a low vacuum condition such as previously described.

Model HDC circuit plate (CP) may have a hole (MJ) to serve as main jet. High speed adjustment needle on these models is used only to enrichen high speed mixture. Main fuel supply is fully adjustable with high speed adjustment needle on all other models as hole (MJ) is non-existent.

OVERHAUL. Carburetor may be disassembled after inspection of unit and referral to exploded views in Figs. S19, S20 or S21. Care should be taken not to lose ball and spring which will be released when choke shaft is withdrawn.

Clean and inspect all components. Inspect diaphragms for defects which may affect operation. Examine fuel inlet needle and seat. Inlet needle is renewable, but carburetor body must be renewed if needle seat is excessively worn or damaged. Sharp objects should not be used to clean orifices or passages as fuel flow may be altered. Compressed air should not be used to clean main nozzle as check valve may be

damaged. A check valve repair kit is available to renew a damaged valve. Fuel mixture needles must be renewed if grooved or broken. Inspect mixture needle seats in carburetor body and renew body if seats are damaged or excessively worn. Screens should be clean.

To reassemble carburetor, reverse disassembly procedure. Fuel metering lever should be flush with a straight edge laid across carburetor body of model HDC as shown in Fig. S22. On model SDC, lever should be flush with bosses (B—Fig. S23) on chamber floor. Be sure lever spring correctly contacts locating dimple on lever before measuring lever height. Bend lever to obtain correct lever height.

IGNITION SYSTEM

In servicing a chain saw ignition system, the mechanic is concerned with trouble shooting, service adjustments and testing magneto components. The following paragraphs outline the basic steps in servicing a flywheel type magneto. Refer to the appropriate chain saw engine section for adjustment and test specifications for a particular engine.

Magneto Adjustments

BREAKER CONTACT POINTS.

Adjustment of the breaker contact points affects both ignition timing and magneto edge gap. Therefore, the breaker contact point gap should be carefully adjusted according to engine manufacturer's specifications. Before adjusting the breaker contact gap, in-

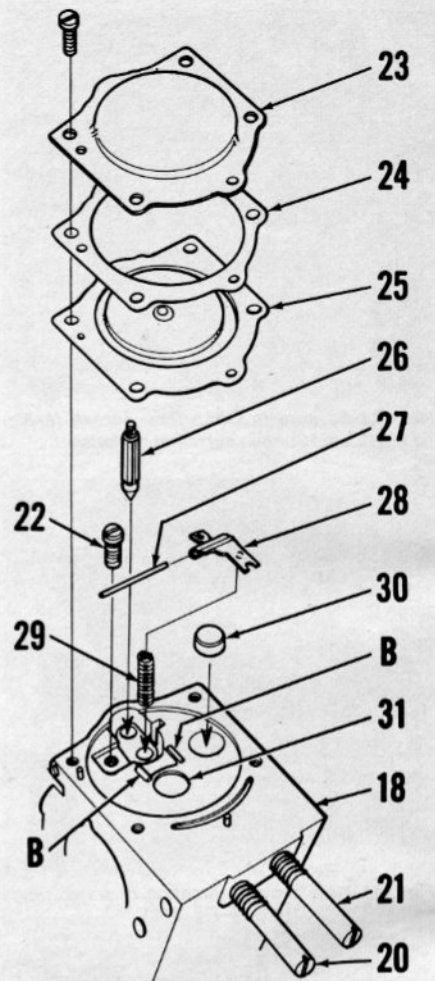


Fig. S21—Exploded view of metering diaphragm assembly used on Walbro model SDC. Refer to Fig. S20 for other carburetor components.

- B. Bosses
- 18. Body
- 20. High speed mixture screw
- 21. Idle mixture screw
- 22. Lever pin screw
- 23. Cover
- 24. Diaphragm
- 25. Gasket
- 26. Fuel inlet valve
- 27. Lever pin
- 28. Diaphragm lever
- 29. Spring
- 30. Idle passage plug
- 31. Main channel plug

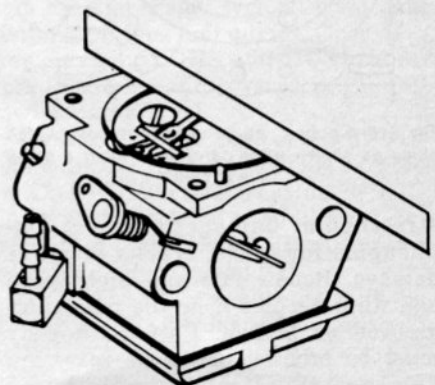


Fig. S22—Diaphragm lever on model HDC should just touch a straight edge laid on carburetor body as shown.

spect contact points and renew if condition of contact surfaces is questionable. It is sometimes desirable to check the

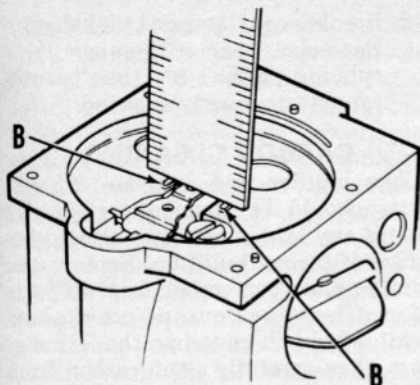


Fig. S23—Diaphragm lever on model SDC should just touch straight edge placed on bosses (B) adjacent to lever.

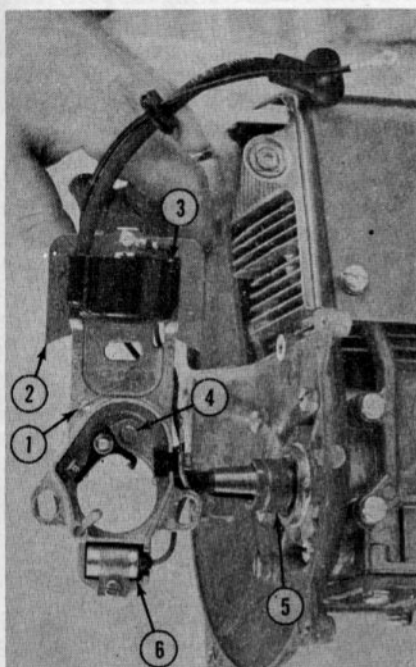


Fig. S24—On some chain saw engines, the magneto stator plate mounting holes are slotted as shown so that ignition timing can be adjusted by relocating position of stator plate.

- | | |
|------------------|-----------------------|
| 1. Stator plate | 4. Breaker point base |
| 2. Armature core | 5. Breaker cam |
| 3. Ignition coil | 6. Condenser |

condition of points as follows: Disconnect the condenser and primary coil leads from the breaker point terminal. Attach one clip of a test light or ohmmeter to the breaker point terminal and the other clip of the test light to magneto ground. The light should be out when contact points are open and should go on when the engine is turned to close the breaker contact points. If the light stays on when points are open, insulation of breaker contact arm or condenser is defective. If light does not go on when points are closed, contact surfaces are dirty, oily or are burned.

Adjust breaker point gap as follows unless manufacturer specifies adjusting breaker gap to obtain correct

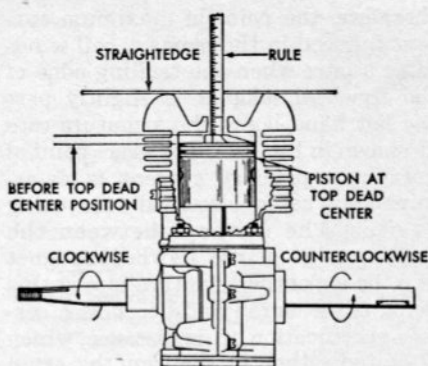


Fig. S25—Where timing is specified as measurement of piston travel, measurement can be made as illustrated. Use of a dial indicator instead of ruler will give more exact measurement. Some manufacturers provide a timing gage that can be screwed into spark plug hole or a gage that can be attached to crankshaft.

ignition timing. First, turn engine so that points are closed to be sure that the contact surfaces are in alignment and seat squarely. Then, turn engine so that breaker point opening is maximum and adjust breaker gap to manufacturer's specification. Be sure to recheck gap after tightening breaker point base retaining screws.

IGNITION TIMING. On some engines, ignition timing is non-adjustable and a certain breaker point gap is specified. On other engines, timing is adjustable by changing the position of the magneto stator plate (see Fig. S24) with a specified breaker point gap or by simply varying the breaker point gap to obtain correct timing. Ignition timing is usually specified either in degrees of engine (crankshaft) rotation or in piston travel before the piston reaches top dead center position. In some instances, a specification is given for ignition timing even though the timing may be non-adjustable; if a check reveals timing is incorrect on these engines, it is an indication of incorrect breaker point adjustment or excessive wear of breaker cam. Also, on some engines, it may indicate that a wrong breaker cam has been installed or that the cam has been installed in a reversed position on engine crankshaft.

Some engines may have a timing mark or flywheel locating pin to locate the flywheel at proper position for the ignition spark to occur (breaker points begin to open). If not, it will be necessary to measure piston travel as illustrated in Fig. S25 or install a degree indicating device on the engine crankshaft.

A timing light or an ohmmeter is a valuable aid in checking or adjusting engine timing. After disconnecting the ignition coil lead from the breaker point terminal, connect the leads of the timing light as shown. If timing is ad-

justable by moving the magneto stator plate, be sure that the breaker point gap is adjusted as specified. Then, to check timing, slowly turn engine in normal direction of rotation past the point at which ignition spark should occur. The timing light should be on, then go out (breaker points open) just as the correct timing location is passed. If not, turn engine to proper timing location and adjust timing by relocating the magneto stator plate or varying the breaker contact gap as specified by engine manufacturer. Loosen the screws retaining the stator plate or breaker points and adjust position of stator plate or points so that points are closed (timing light is on). Then, slowly move adjustment until timing light goes out (points open) and tighten the retaining screws. Recheck timing to be sure adjustment is correct.

ARMATURE AIR GAP. To fully concentrate the magnetic field of the flywheel magnets within the armature core, it is necessary that the flywheel magnets pass as closely to the armature core as possible without danger of metal to metal contact. The clearance between the flywheel magnets and the legs of the armature core is called the armature air gap.

On magnetos where the armature and high tension coil are located outside of the flywheel rim, adjustment of the armature air gap is made as follows: Turn the engine so that the flywheel magnets are located directly under the legs of the armature core and check the clearance between the armature core and flywheel magnets. If the measured clearance is not within manufacturers specifications, loosen the armature core mounting screws and place shims of thickness equal to minimum air gap specification between the magnets and armature core (Fig. S26). The magnets will pull the armature core against the shim stocks. Tighten the armature core mounting screws, remove the shim stock and turn the engine through several revolutions to be sure the flywheel does not contact the armature core.

Where the armature core is located under or behind the flywheel, the following methods may be used to check and adjust armature air gap. On some engines, slots or openings are provided in the flywheel through which the armature air gap can be checked. Some engine manufacturers provide a cut-away flywheel that can be installed temporarily for checking the armature air gap. A test flywheel can be made out of a discarded flywheel (See Fig. S27), or out of a new flywheel if service volume on a particular engine war-

rants such expenditure. Another method of checking the armature air gap is to remove the flywheel and place a layer of plastic tape equal to the minimum specified air gap over the legs of the armature core. Reinstall flywheel and turn engine through several revolutions and remove flywheel; no evidence of contact between the flywheel magnets and plastic tape should be noticed. Then cover the legs of the armature core with a layer of tape of thickness equal to the maximum specified air gap; then, reinstall flywheel and turn engine through several revolutions. Indication of the flywheel magnets contacting the plastic tape should be noticed after the flywheel is again removed. If the magnets contact the first thin layer of tape applied to the armature core legs, or if they do not contact the second thicker layer of tape, armature air gap is not within specifications and should be adjusted. NOTE: Before loosening armature core mounting screws, scribe a mark on mounting plate against edge of armature core so that adjustment of air gap can be gauged.

In some instances, it may be necessary to slightly enlarge the armature core mounting holes before proper air gap adjustment can be made.

MAGNETO EDGE GAP. The point of maximum acceleration of the movement of the flywheel magnetic field through the high tension coil (and

therefore, the point of maximum current induced in the primary coil windings) occurs when the trailing edge of the flywheel magnet is slightly past the left hand leg of the armature core as shown in Fig. S28. The exact point of maximum primary current is determined by using electrical measuring devices. The distance between the trailing edge of the flywheel magnet and the leg of the armature core at this point is measured and becomes a service specification. This distance, which is stated either in thousandths of an inch or in degrees of flywheel rotation, is called the Edge Gap or "E" Gap.

For maximum strength of the ignition spark, the breaker points should just start to open when the flywheel magnets are at the specified edge gap position. Usually, edge gap is non-adjustable and will be maintained at the proper dimension if the contact breaker points are adjusted to the recommended gap and the correct breaker cam is installed. However, magneto edge gap can change (and spark intensity thereby reduced) due to the following:

- a. Flywheel drive key sheared
- b. Flywheel drive key worn (loose)
- c. Keyway in flywheel or crankshaft worn (oversized)
- d. Loose flywheel retaining nut which can also cause any above listed difficulty
- e. Excessive wear on breaker cam

- f. Breaker cam loose on crankshaft
- g. Excessive wear on breaker point rubbing block so that points cannot be properly adjusted.

CARBON CLEANING

The muffler and cylinder exhaust ports should be cleaned periodically before any loss of power is noticed because of carbon build up. Remove the muffler and clean carbon from all parts of muffler. Turn engine crankshaft until piston is covering the exhaust port, then carefully clean carbon from the exhaust using a soft scraper. Be especially careful not to damage the piston. Do not attempt to clean exhaust with piston not covering the port. Hard carbon deposits can cause extensive damage if permitted to fall into the engine. The engine cooling fins should be cleaned at the same time that carbon is cleaned from exhaust.

LUBRICATION

Refer to the individual section for each motor for recommended type and amount of lubricant to be used for the engine and saw chain.

OIL-FUEL RATIO. Chain saw engines are lubricated by oil that is

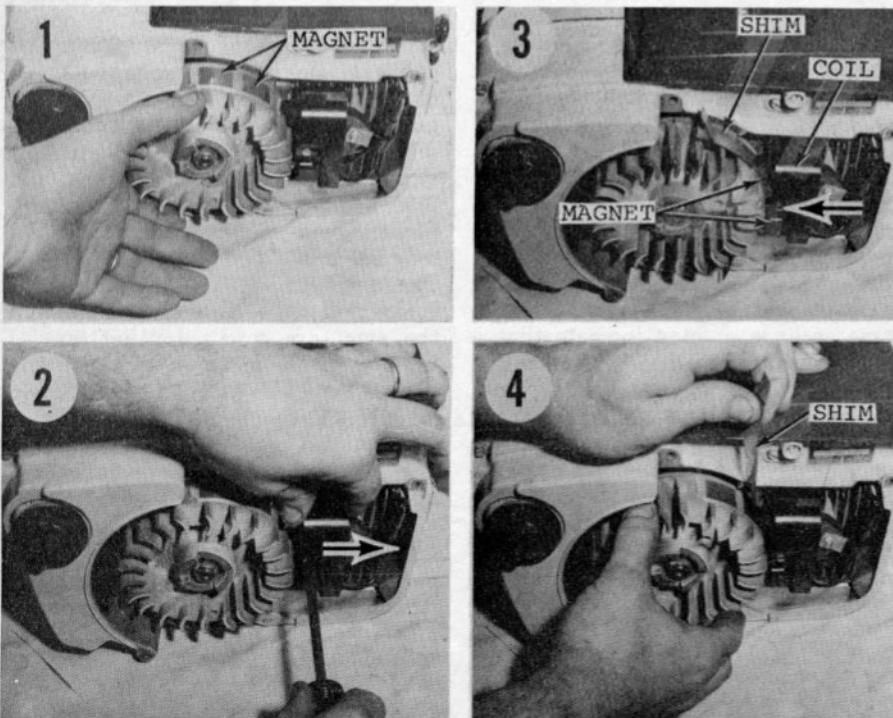


Fig. S26—Views showing adjustment of armature air gap when armature (coil) is located outside of flywheel. In view (1) the magnets are turned away from armature. In view (2) the coil is moved away from the flywheel. View (3) shows shims positioned between magnets and armature legs for setting correct clearance (gap). Tighten armature holding screws, then roll shim out as shown in view (4).

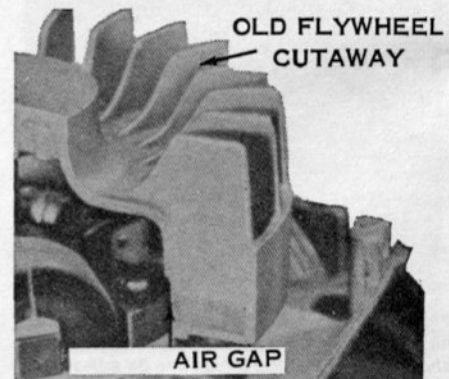


Fig. S27—Where armature core and ignition coil are located inside of flywheel, and old discarded flywheel can be cut away as shown to provide air gap adjustment fixture.

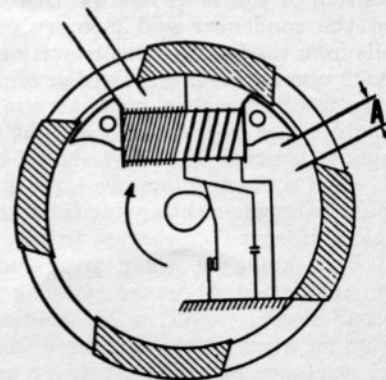


Fig. S28—The distance (A) between trailing edge of magnet and leading edge of pole shoe when primary voltage is highest is known as EDGE GAP.

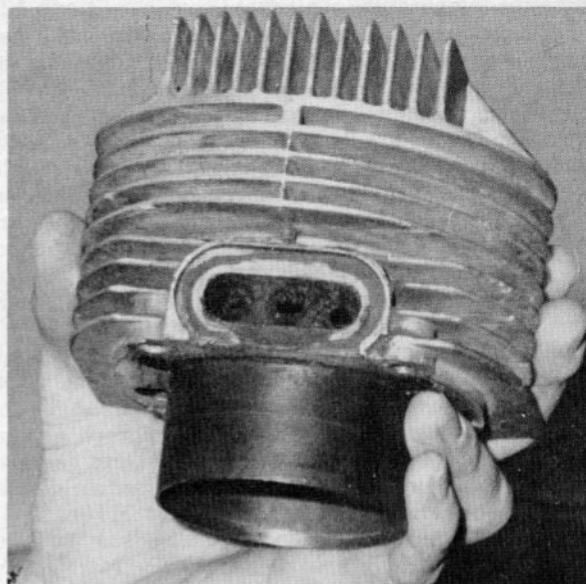
mixed with the fuel. It is important that the manufacturer's recommended type of oil and oil to fuel ratio be closely followed. Excessive oil or improper type oil will cause low power, plug fouling and excessive carbon build-up. Insufficient amount of oil will result in inadequate lubrication and rapid internal damage. The recommended ratios and type of oil are listed in LUBRICATION paragraph for each motor. Oil should be mixed with gasoline in a separate container before it is poured into the fuel tank. The following table may be useful in mixing the correct ratio.

RATIO	Gasoline	Oil
10:1	.63 Gallons	½ Pint
12:1	.75 Gallons	½ Pint
14:1	.88 Gallons	½ Pint
15:1	.94 Gallons	½ Pint
16:1	1.00 Gallons	½ Pint
20:1	1.25 Gallons	½ Pint
22:1	1.38 Gallons	½ Pint
24:1	1.50 Gallons	½ Pint
25:1	1.56 Gallons	½ Pint
32:1	2.00 Gallons	½ Pint
50:1	3.13 Gallons	½ Pint
100:1	6.25 Gallons	½ Pint
10:1	5 U.S. Gallons	4 Pints 64 Fl. Oz.
12:1	3 U.S. Gallons	2 Pints 32 Fl. Oz.
14:1	5 U.S. Gallons	3 Pints 45¼ Fl. Oz.
15:1	5 U.S. Gallons	2¾ Pints 42½ Fl. Oz.
16:1	5 U.S. Gallons	2½ Pints 40 Fl. Oz.
20:1	5 U.S. Gallons	2 Pints 32 Fl. Oz.
22:1	5 U.S. Gallons	1¾ Pints 29 Fl. Oz.
24:1	3 U.S. Gallons	1 Pint 16 Fl. Oz.
25:1	4 U.S. Gallons	1¼ Pints 20½ Fl. Oz.
32:1	4 U.S. Gallons	1 Pint 16 Fl. Oz.
50:1	3 U.S. Gallons	½ Pint 8 Fl. Oz.
100:1	3 U.S. Gallons	¼ Pint 4 Fl. Oz.

REPAIRS

Because of the close tolerance of the internal parts, cleanliness is of utmost importance. It is suggested that the exterior of the engine and all nearby areas be absolutely clean before any repair is started. The manufacturer's recommended torque values for tightening screw fasteners should be followed closely. The soft threads in aluminum castings are often damaged by carelessness in over-tightening fasteners or in

Fig. S29—Example of severe case of port carbon. Carbon must be removed to restore performance.



attempting to loosen or remove seized parts.

A given amount of heat applied to aluminum or magnesium will cause it to expand a greater amount than will steel under similar conditions. Because of the different expansion characteristics, heat is usually recommended for easy installation of bearings, pins, etc., in aluminum or magnesium castings. Sometimes, heat can be used to free parts that are seized or where an interference fit is used. Heat, therefore, becomes a service tool and the application of heat, one of the required service techniques. An open flame is not usually advised because it destroys the paint and other protective coatings and because a uniform and controlled temperature with open flame is difficult to obtain. Methods commonly used for heating are: 1. In oil or water. 2. With a heat oven or kiln. 3. With hot air gun. The hot air gun has the advantages of

being portable and having a directional control of heat to a small or large area depending upon the type of gun. Two types of hot air guns are shown in Figs. S30 and S31. Thermal crayons are available which can be used to deter-

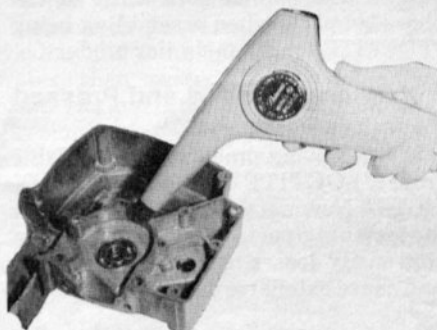


Fig. S30—Heat can be used efficiently as a service tool. Shown is an Electric Heat Gun available from UNGAR, 233 East Manville, Compton, California 90220.

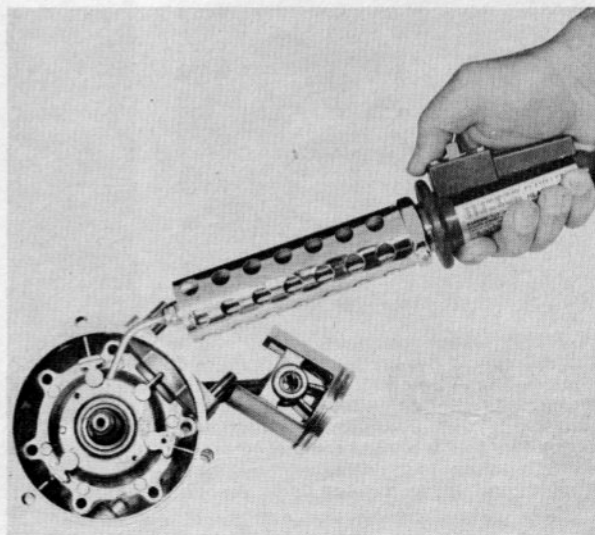


Fig. S31—Heat Torch delivers hot air to a smaller area than Heat Gun shown in Fig. S30. Dry compressed air is electrically heated and temperature (up to 1000° F.) is varied by controlling air pressure. The torch shown is available from Master Appliance Corp., 1745 Flett Ave., Racine, Wis. 53403.

mine the temperature of a heated part. These crayons melt when the part reaches specified temperature, and a number of crayons for different temperatures are available. Temperature indicating crayons are usually available at welding equipment supply houses.

On two stroke engines the crankcase and combustion chambers must be sealed against pressure, vacuum and oil leakage. To assure a perfect seal, nicks, scratches and warpage are to be avoided, especially where no gasket is used. Slight imperfections can be removed by using a fine-grit sandpaper. Flat surfaces can be lapped by using a surface plate or a smooth piece of plate glass and a sheet of fine sandpaper or lapping compound. Use a figure-eight motion with minimum pressure, and remove only enough metal to eliminate the imperfection. Bearing clearance must not be lessened by removing metal from the joint.

Use only the specified gaskets when re-assembling, and use an approved gasket cement or sealing compound unless otherwise stated. All friction surfaces, including bearings and seals, should be coated with oil before assembling.

It is desirable to lock most of the threaded parts when assembling using "LOCTITE" or other similar product.

Retaining Threaded and Pressed Together Parts

The following products are available from "LOCTITE SERVICE PRODUCTS", Newington, Connecticut 06111 for fastening parts together. Vibration can easily loosen untreated fasteners and cause extensive damage.

"Lock N' Seal" is colored **Blue** and is formulated to lock threaded parts from shaking loose from shock and vibration. Oil, fuel and air fittings can be sealed against leakage and worn parts may sometimes be repaired using this locking sealant. Lock N' Seal flows as a liquid to completely fill the inner space between threaded parts, then hardens. Only the locking sealant which is confined hardens, excess on outside will not harden and may be wiped off.

"Stud N' Bearing Mount" is colored **Red** and is intended for parts with slip and light press fits or for extra strength for locking threaded parts such as studs. Pullers, press, heat and/or extra effort will be required when disassembling. Stud N' Bearing Mount will fill the air space and harden to form a key between the microscopic irregular surface of two close fitting parts. Worn parts can sometimes be repaired by using this hardening sealer to assist in holding a bearing in a worn bore or onto a worn shaft.

"Sleeve Retainer" is colored **Green** and is designed to improve the fit of parts that are pressed together. Seats, guides, liners, etc. can be assembled using Sleeve Retainer to help prevent loosening, leakage, wear, corrosion, seizure or hot spots. The compound is thinner than other "Loctite" resins to make it better suited for use in press fits. The compound will withstand intermittent temperatures up to 400 degrees F. The Sleeve Retainer displaces the air insulating pockets and eliminates hot spots.

"Klean N' Prime" is used to clean parts and to provide the best curing of the locking resins. Loctite resins will not work properly on dirty, oily parts.

Some primers ("Locquic") are available to speed up or slow down the curing time of the resins. The "Locquic" primers are most often used for production assembly and are not often available for service.

REPAIRING DAMAGED THREADS

Damaged threads in castings can be renewed by use of thread repair kits which are recommended by a number of manufacturers. Use of thread repair kits is not difficult, but instructions must be carefully followed. Refer to Figs. S32 through S34 which illustrate the use of Heli-Coil thread repair kits that are manufactured by the Heli-Coil Corporation, Danbury, Connecticut.

Heli-Coil or similar thread repair kits are available through the parts departments of most engine and equipment manufacturers; the thread inserts are available in most common thread sizes and types.

PISTON, PIN, RINGS AND CYLINDER

Two stroke engines do not have a complex valve mechanism and the piston rings have no oil control function. On the other hand, carbon buildup is more likely to occur, and where oil consumption is the most common service problem on four stroke engines, carbonization is the two stroke counterpart.

The simple construction of two stroke engines and the benefits to be gained from periodic carbon removal make decarbonization a part of the recommended maintenance procedure of most two cycle experts. Because the

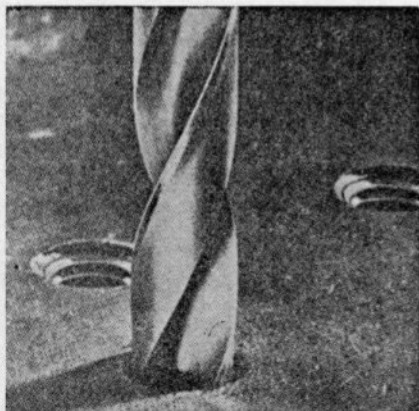


Fig. S32—First step in repairing damaged threads is to drill out old threads using exact size drill recommended in instructions provided with thread repair kit. Drill all the way through an open hole or all the way to bottom of blind hole, making sure hole is straight and that centerline of hole is not moved in drilling process. (Series of photos provided by Heli-Coil Corp., Danbury, Conn.)

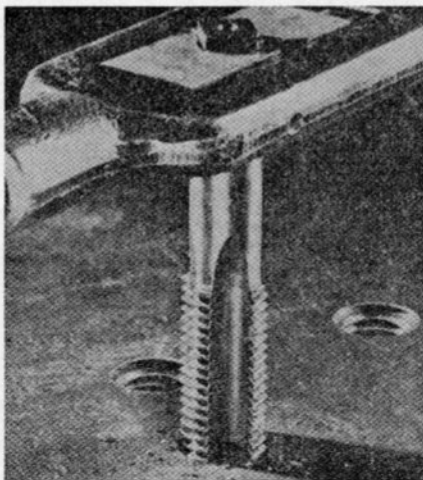


Fig. S33—Special drill taps are provided in thread repair kit for threading drilled hole to correct size for outside of thread insert. A standard tap cannot be used.

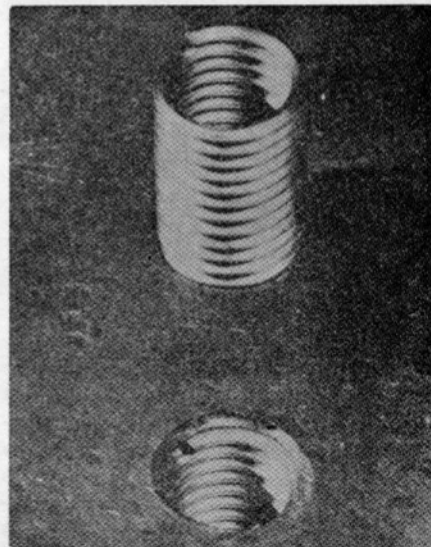


Fig. S34—A thread insert and a complete repair are shown above. Special tools are provided in thread repair kit for installation of thread insert.

piston rings have no oil control function, ring renewal is not required at carbon removal except to correct for wear or other damage.

Excessive carbon build-up can be harmful in two ways. First, it insulates to keep the heat from escaping normally. Second, it raises the compression ratio to create more heat. This places an additional heat load on that portion of the cylinder which is scraped clean of carbon by the piston rings.

The need for carbon removal is often first indicated by inability to properly adjust the carburetor. If performance is erratic and improper carburetion is indicated, but attempts to adjust the carburetor fail, check first for excessive carbon build up. No cleaning or adjustment of the carburetor can materially improve performance if exhaust passages are partially carbon blocked.

No problems will be encountered in removing cylinder head and/or cylinder for carbon removal provided normal standards of care and cleanliness are observed.

Examine the parts as engine is disassembled for clues to engine condition, to correct possible future trouble, or identify the cause of existing trouble. As an example, refer to Fig. S35. On this particular piston, the skirt is not scored and the first glance will show melted aluminum which has covered the ring on one side. The melted spot (D) on top and below piston crown is conclusive proof of detonation damage and the cause must be corrected during overhaul or the same failure can be expected to reoccur.

If pistons are scuffed or scored, look for metal transfer to cylinder walls. Metal transfer and score marks must be removed from cylinder walls with a

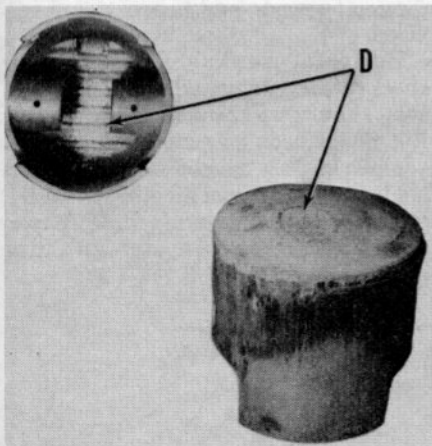


Fig. S35—Top and bottom view of piston severely damaged by detonation. Spot (D) on top and bottom of crown show where metal has started to melt. Absence of scoring on skirt rule out seizure, overheating or lack of lubrication as a contributing cause.

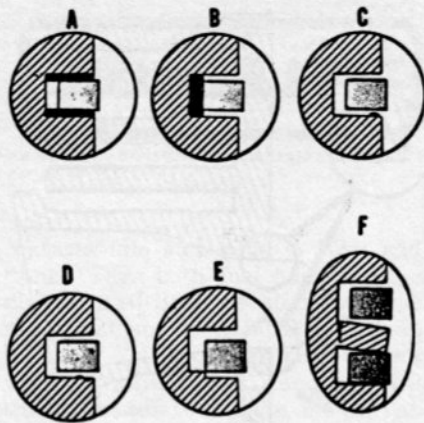


Fig. S36—Examine piston for damage before removing old rings. Shown are some common faults.

- | | |
|------------------------------------|--|
| A. Carbon buildup, sides of groove | C. Incomplete carbon removal, loose carbon |
| B. Carbon buildup behind ring | D. Nicks in groove |
| | E. Stepped wear |
| | F. Broken or bent land |

hone. Install new chrome plated cylinder if the plating is worn away exposing the softer base metal. Chrome plated cylinder bores should not be honed.

Full strength muriatic acid can be used to remove aluminum deposits from a cast iron cylinder bore. Muriatic acid can be purchased in a drug store. It is also used as a soldering acid, although the supply kept in most radiator shops has usually been cut (diluted) with zinc. Use acid carefully, it can cause painful burns if spilled on the skin and the fumes are toxic. It is most easily used by carefully transferring a small amount to a plastic squeeze bottle, or to another small container and applying with a cotton swab. DO NOT allow the acid to spill or run onto aluminum portions of the cylinder; it will rapidly attack and dissolve the metal. Do not use the acid on a chrome bore. When applied to aluminum deposits, the acid will immediately start to boil and foam. When the action stops the aluminum has been dissolved or the acid is diluted; wipe the area with an old rag or towel which can be discarded. If deposits remain, repeat the process. Flush the area with water when aluminum is removed. Water will dilute the acid and can be used to stop the action if desired, or if acid runs off onto aluminum portion of cylinder, is accidentally spilled, etc. Immediately coat treated portion of cylinder with oil, as the acid makes the cast iron especially susceptible to rust.

A rule of thumb says scuffing or scoring of piston above the piston pin is due to overheating. Damage below the pin is more likely due to insufficient lubrication or improper fit. Over-

heating may be caused by a lean mixture, overloading, a damaged cooling fan or fins, air leaks in carburetor mounting gasket or manifold, blow-by (stuck or broken rings) as well as carbon build-up.

The greatest cylinder wear of a two stroke engine generally occurs in port area of cylinder wall instead of at top of ring travel. Cast iron or aluminum bores should be measured using ring gap as an indicator or an inside micrometer. Check for spots on chromed bores which are different in appearance. Spots may be metal deposits from overheated pistons or may be where the thin chrome plating is worn through. Deposited metal can be scraped or carefully hand sanded from the chrome. If plating is worn through, cylinder must be renewed. Aluminum will be easily scratched by a sharp object but chrome will not.

On models with cast iron cylinder, the bore should be honed when engine is overhauled, to true the bore, remove the glaze and remove the ridge at top and bottom of ring travel area. If ridge is not removed, new unworn rings may strike the ridge and bend ring lands in piston as shown at (F—Fig. S36). The finished cylinder should have a light cross-hatch pattern. After honing, wash cylinder assembly with soap and water, then swab with new oil on a clean rag until all tendency of rag to discolor is gone. Washing in solvent will not remove the abrasive from finished cylinder walls.

Some manufacturers have oversize piston and ring sets available. If care and approved procedures are used, in-

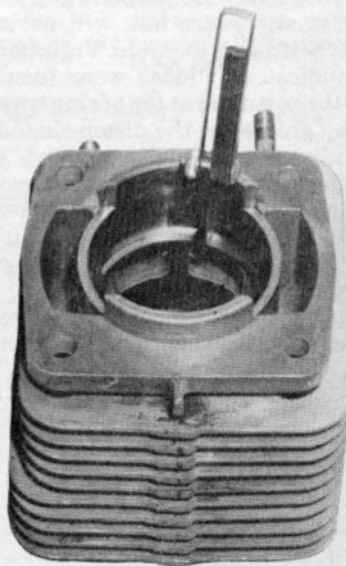


Fig. S37—Clearance between ends of ring (ring end gap) should be measured with feeler gage as shown. Make sure ring is straight in cylinder.

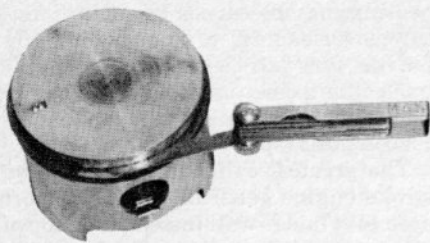


Fig. S38—Ring side clearance in groove should be measured with feeler gage as shown. Clearance should be within recommended limits and the same all the way around piston.

stallation of oversize units should result in a highly satisfactory overhaul.

The cylinder bore may be oversized by using either a boring bar or hone; however, if a boring bar is used, finish sizing should be done with a hone. Before attempting to rebore, first check to be sure that new standard units cannot be fitted within the recommended clearances and that the correct oversize is available.

Some manufacturers recommend that after boring a cylinder to an oversize, the top and bottom edges of cylinder wall ports be rounded to prevent rings from catching. Fig. S39 shows typical port cross section with area to be removed indicated in the inset.

Before installing new piston rings, check ring end gap as follows: Position the ring near the bottom of cylinder bore. The piston should be used to slide the ring in cylinder to locate ring squarely in bore. Measure the gap between end of ring using a feeler gage as shown in Fig. S37. Slide the ring down in the cylinder to the area of transfer and exhaust ports and again measure gap. Rings may break if end gap is too tight at any point; but, will not seal properly if gap is too wide. Variation in gap indicates cylinder wear (usually near the ports and at top of ring travel).

Ring grooves in the piston should be carefully cleaned and examined. Use caution when cleaning to prevent damage to piston. Grooves for Dykes (L rings), Keystone (Both sides angled) and Half Keystone rings are especially easily damaged. Carelessness can result in poor performance and possibly extensive internal engine damage.

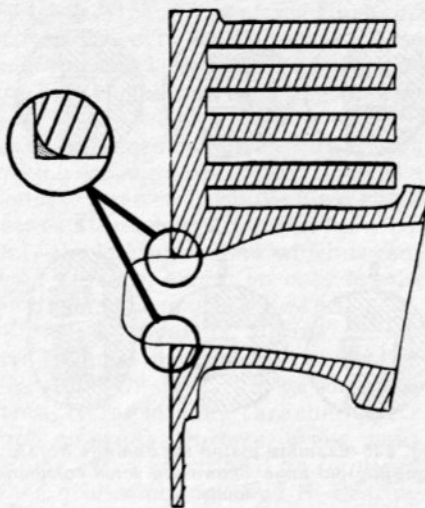


Fig. S39—Some manufacturers recommend that edges of ports be chamfered as shown in insert, after re-boring.

Refer to Fig. S36. When installing rings on piston, expand only far enough to slip over the piston and **do not twist rings**. After installing rings on piston, use feeler gage to measure ring side clearance in groove as shown in Fig. S38. Excessive side clearance will prevent an effective seal and may cause rings to break.

When assembling piston to connecting rod, observe special precautions outlined in the individual repair sections. The pistons in some engines may have the pin offset, rings pinned or other design features which make it necessary to install piston in only one way. Check for assembly marks or other indicators on the piston and in the individual repair sections.

Lubricate piston pin bearing (or bushing), piston, rings and cylinder as engine is assembled. Run engine with slightly rich carburetor setting during break-in period and do not overload, to prevent overheating until the parts wear in. It is sometimes advisable to install a hotter heat range spark plug in an attempt to prevent oil fouling in a newly started engine. Plug fouling during this period is not uncommon and it is advisable to have spare plugs along when running a newly overhauled engine.

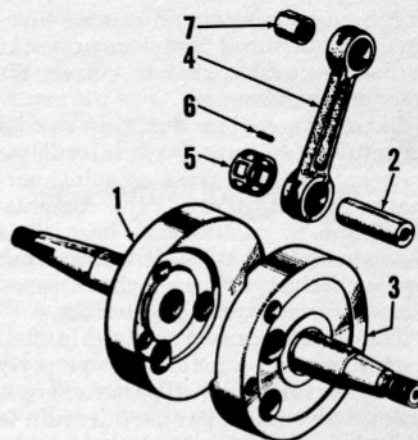


Fig. S40—Exploded view of typical built-up crankshaft.

- | | |
|-------------------|-------------------|
| 1. Counterweight | 5. Roller bearing |
| 2. Crankpin | 6. Needle roller |
| 3. Counterweight | 7. Bushing |
| 4. Connecting rod | |

CONNECTING ROD, CRANKSHAFT AND BEARINGS

Before detaching connecting rods from crankshaft, mark rods and caps for correct assembly to each other. Most damage to ball and roller bearings (anti friction bearings) is evident after visual inspection and turning the assembled bearing by hand. If bearing shows evidence of overheating, renew the complete assembly. On models with plain (bushing) bearings, check the crankpin and main bearing journals for wear with a micrometer. Crankshaft journals will usually wear out-of-round with most wear on side that takes the force of power stroke (strokes). If main bearing clearances are excessive, new crankcase seals may not be able to prevent pressure from blowing fuel and oil around crankshaft. All crankcase seals should be renewed when crankshaft, connecting rods and bearings are serviced.

Built-up crankshafts should be checked for runout when removed. A typical built-up crankshaft is shown in Fig. S40. Check for runout using either vee blocks or lathe centers. Should the shaft not meet specifications, then it should be taken to a machine shop or shop experienced in straightening built-up shafts.

HOMELITE®A **Textron** DIVISION, PORT CHESTER, N. Y. 10573**MODEL COVERAGE**

Chain Saw Model	Design Features
EZ	A,D,E,G,H
EZ Automatic	B,D,F,G,H
Super EZ Automatic	C,D,F,G,H
EZ 250 Automatic	C,D,F,G,H
XL-Mini	A,D,E,G,H
XL-Mini Automatic	B,D,F,G,H

DESIGN FEATURES CODE

- A—Displacement, 2.1 cu. in.; bore—1.4375 in.; stroke—1.3 in.
 B—Displacement, 2.3 cu. in.; bore—1.5 in.; stroke—1.3 in.
 C—Displacement, 2.5 cu. in.; bore—1.5625 in.; stroke—1.3125 in.
 D—Direct drive
 E—Manual chain oiler
 F—Automatic & manual chain oiler
 G—Pyramid reed intake valve
 H—Conventional flywheel type magnet

MAINTENANCE

SPARK PLUG. A Champion DJ-6J spark plug with tapered seat is used; no gasket is required. Adjust electrode gap to 0.025.

CARBURETOR. A Walbro model HDC diaphragm type carburetor is used on all models. Refer to Walbro section of SERVICE FUNDAMENTALS section for overhaul and exploded view of carburetor.

For initial carburetor adjustment, back idle speed adjusting screw out until throttle valve will completely close, then turn screw back in until it

contacts idle stop plus ½ turn additional. Turn both fuel adjusting needles in until lightly seated, then back main fuel needle (located to left and marked "HI" on grommet when viewing adjustment needle side of throttle handle) out about one turn and back idle ("LO") needle out about ¾-turn. Start engine, readjust idle speed and fuel needles so that engine idles at just below clutch engagement speed. With engine running at full throttle under load, readjust main fuel needle so that engine will run at highest obtainable speed without excessive smoke.

To adjust starting speed (speed at which engine will run with throttle latch engaged), stop engine and remove chain, guide bar, air filter cover and air filter. Open trigger adjusting screw ¼-turn clockwise. With trigger latched, start engine and run at half throttle (not at high speed) for 30-50 seconds to warm it up. Release throttle trigger, then latch it while engine is running. If engine stops, restart it. With throttle trigger latched, gently hold trigger down and slowly back trigger adjusting screw out counter-clockwise until engine falters, then turn screw back in 1/16-turn clockwise. Squeeze and release trigger to idle engine, then shut engine off with stop switch. Try to restart engine; if hard to start, open screw another 1/16-turn at a time until enough for consistent starting. When starting speed is satisfactorily adjusted, stop engine and reinstall guide

bar, chain, air filter and filter cover. If engine will start readily and saw chain does not turn or only turns slowly, adjustment is correct. If chain turns rap-

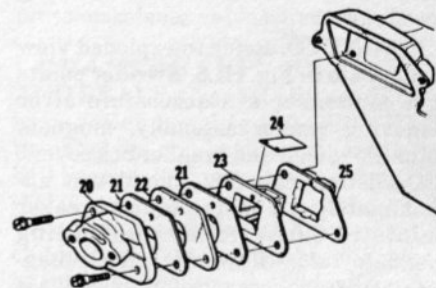


Fig. HL2—View showing earliest production reed valve and spacer installation.

- | | |
|-----------------|-------------------|
| 20. Reed spacer | 23. Reed seat |
| 21. Gaskets | 24. Valve reeds |
| 22. Spacer | 25. Reed retainer |

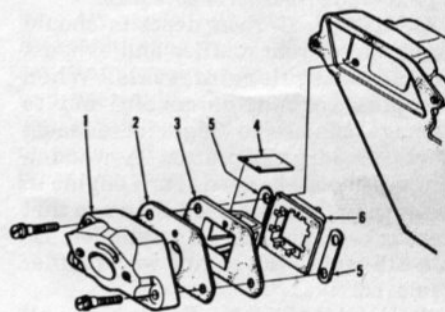


Fig. HL3—View showing reed valve and spacer installation used later in production than parts shown in Fig. HL2, but prior to installation shown in Fig. HL1.

- | | |
|----------------|------------------|
| 1. Reed spacer | 4. Valve reeds |
| 2. Gasket | 5. Spacers |
| 3. Reed seat | 6. Reed retainer |

Fig. HL1—Exploded view of handle assembly and related assemblies.

1. Air filter
2. Carburetor
3. Throttle rod
4. Oil line
5. Spacer
6. Gasket
7. Reed valve seat
8. Reed retainer
9. Reed petals
10. Spring post
11. Spring
12. Choke rod
13. Throttle stop
14. Spring
15. Trigger
16. Bushing
17. Spring
18. Throttle latch

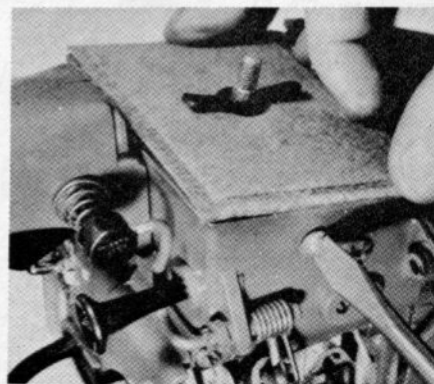
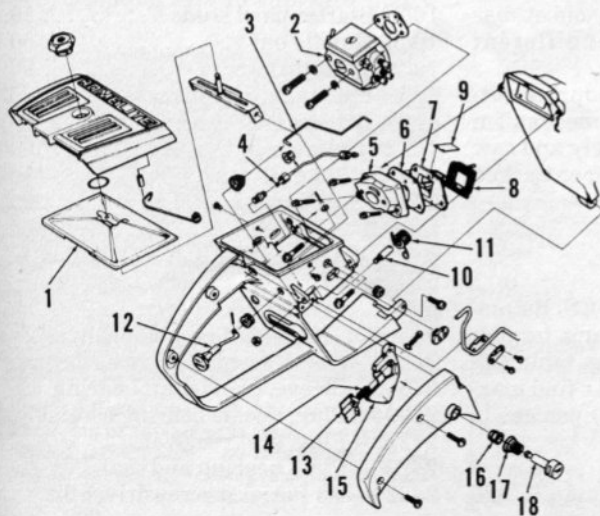


Fig. HL4—Before tightening screws retaining air filter bracket in throttle handle, place air filter element on bracket stud and align filter with edges of air box.

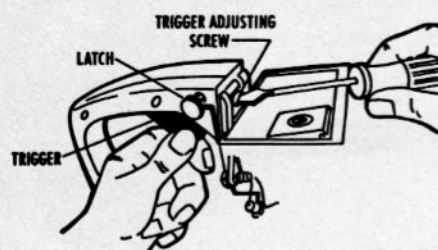


Fig. HL5—Adjusting starting speed for models EZ and XL-Mini. Refer to text for procedure.

idly with throttle latched, repeat adjustment procedure to set starting speed slower.

MAGNETO. Refer to exploded view of magneto in Fig. HL6. Breaker points and condenser are accessible after removing starter assembly, magneto rotor (flywheel) and breaker box cover.

Condenser capacity should test approximately 0.2 mfd. Adjust breaker points to 0.015. After reinstalling magneto rotor (flywheel), check magneto armature core to rotor air gap. Air gap should be 0.008-0.012 and can be adjusted using plastic shim stock available as Homelite part No. 24306. Load crankshaft bearings while setting air gap by applying light pressure against flywheel in direction of core legs.

CARBON. Carbon deposits should be removed from muffler and exhaust ports at regular intervals. When scraping carbon, be careful not to damage chamfered edges of exhaust ports or scratch piston. A wooden scraper should be used. Turn engine so that piston is at top dead center so that carbon will not fall into cylinder. Do not attempt to run engine with muffler removed.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

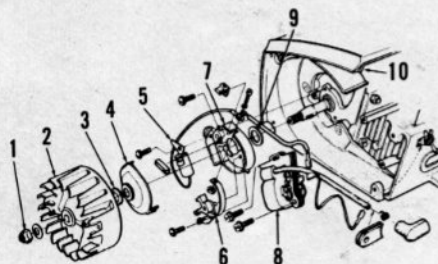


Fig. HL6—Exploded view of ignition assembly. Felt seal (3) is cemented to breaker box cover (4).

- | | |
|--------------|-------------------|
| 1. Nut | 6. Breaker points |
| 2. Flywheel | 7. Breaker box |
| 3. Felt seal | 8. Ignition coil |
| 4. Box cover | 9. Felt seal |
| 5. Condenser | 10. Fuel tank |

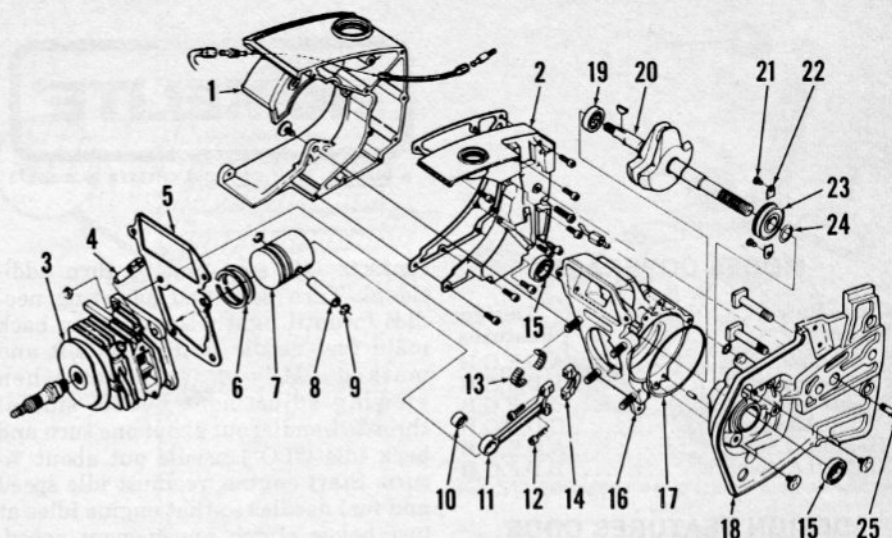


Fig. HL7—Exploded view of typical engine assembly. A head land piston ring is used on EZ Automatic model in place of rings (6) shown.

- | | | | |
|------------------------------|--------------------|--------------------------|----------------------|
| 1. Fuel tank | 7. Piston | 13. Bearing rollers (28) | 19. Roller bearing |
| 2. Oil tank | 8. Piston pin | 14. Connecting rod cap | 20. Crankshaft |
| 3. Cylinder | 9. Pin retainer | 15. Seal | 21. Screw |
| 4. Compression release valve | 10. Needle bearing | 16. Crankcase | 22. Bearing retainer |
| 5. Gasket | 11. Connecting rod | 17. "O" ring | 23. Ball bearing |
| 6. Piston rings | 12. Capscrew | 18. Drivecase | 24. Snap ring |

Fill chain oiler reservoir with Homelite Bar and Chain oil or with light weight motor oil (not over SAE 30). In cold weather, thin oil with kerosene until it will flow freely.

The clutch needle roller bearing should be cleaned and relubricated after each 100 hours of use. A high temperature grease such as Homelite® ALL-TEMP Multi-Purpose Grease or equivalent should be used.

CHAIN TENSION. Model EZ 250 Automatic is equipped with an automatic chain tensioner. Chain is automatically tensioned by cam (29—Fig. HL10) acting against pin (25). When chain is being installed, turn knob counterclockwise as far as possible so low portion of cam contacts pin. After assembly, turn knob clockwise until correct slack in chain is obtained. Additional adjustment is possible by turning bar over so that offset bar mounting holes engage different mounting studs.

Note: If chain is pinched during cutting operation, tensioning mechanism may tighten chain excessively and saw must be stopped and tensioner backed off.

REPAIRS

TIGHTENING TORQUES. Recommended minimum tightening torques are listed in the following table; all values are in inch-pounds. To find maximum torque value, add 20 percent to given value.

- | | |
|--------------------------------|----|
| 4/40 Flange bearing | 5 |
| 6/32 Compression release clamp | 20 |

- | | |
|------------------------------------|-----|
| 6/32 Compression release post nut | 20 |
| 6/32 Breaker box | 20 |
| 6/32 Breaker point adjustable arm | 20 |
| 6/32 Condenser | 20 |
| 8/32 Air filter bracket | 25 |
| 8/32 Connecting rod | 55 |
| 8/32 Throttle handle cover | 35 |
| 8/32 Rewind spring cover | 35 |
| 8/32 Intake manifold (reed spacer) | 20 |
| 8/32 Coil assembly | 20 |
| 8/32 Automatic oiler pump | 35 |
| 8/32 Fuel tank | 35 |
| 10/32 Main bearing retainer screws | 50 |
| 10/32 Stack muffler | 50 |
| 10/32 Muffler body | 50 |
| 10/32 Muffler cap | 35 |
| 10/32 Starter housing | 50 |
| 10/32 Carburetor | 20 |
| 10/32 Starter pawl studs | 50 |
| 10/32 Handle bar | 50 |
| 12/24 Throttle handle | 80 |
| 12/24 Fuel tank to crankcase | 75 |
| 12/24 Drivecase | 75 |
| 1/4-28 Cylinder nuts | 100 |
| 5/16-24 Rotor (flywheel) nut | 150 |
| 14mm Spark plug | 120 |
| Clutch | 180 |

SPECIAL SERVICE TOOLS. Special service tools which may be required are listed as follows:

- | Tool No. | Description & Model Usage |
|----------|---------------------------------|
| 24299 | Anvil, crankshaft installation. |
| 24300 | Sleeve, crankshaft bearing. |
| 24294 | Plug, needle bearing assembly. |
| 24292 | Plug, seal removal. |
| 24298 | Plug, bearing and seal. |
| 24320 | #3 Pozidriv screwdriver bit. |

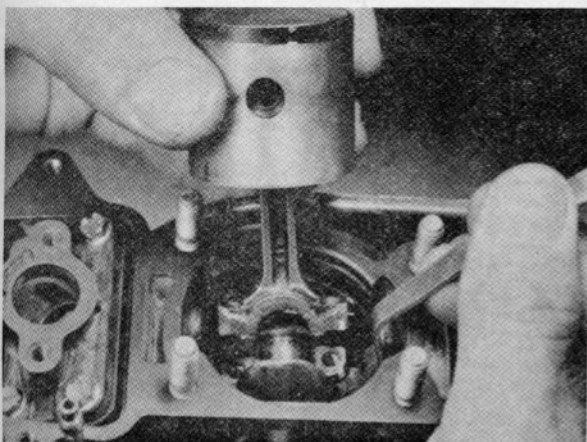


Fig. HL8—Installing piston and connecting rod assembly using locally made tool to hold rod cap in position. Tool can be made from flat strip of metal. Using grease, stick 14 rollers in cap and 14 rollers in rod; make sure that match marks on rod and cap are aligned.

- A-24290—Bracket, rotor remover.
 A-24060—Wrench, clutch spanner.
 A-24309—Jackscrew, crankshaft and bearing.
 23136-1—Body for A-24309.
 24295—Bearing collar for A-24309.
 24291—Sleeve, drivecase seal.
 24297—Sleeve, crankcase seal.

CONNECTING ROD. Connecting rod and piston assembly can be detached from crankshaft after removing cylinder; refer to Fig. HL8. Be careful to remove all of the 28 loose needle bearing rollers.

Renew connecting rod if bent, twisted or if crankpin bearing surface shows visible wear or is scored. The needle roller bearing for piston pin should be renewed if any roller shows flat spot or if worn so that any two rollers can be separated the width equal to thickness of one roller and if rod is otherwise serviceable. Press on lettered side of bearing cage only when removing and installing bearing.

The crankpin needle rollers should be renewed at each overhaul. To install connecting rod, refer to Fig. HL8. Stick 14 rollers in cap with grease. Support rod cap in crankcase, then place rod over crankpin and to cap with match

marks aligned and install new retaining cap screws.

PISTON PIN AND RINGS. The piston on all models except EZ Automatic has two pinned piston rings. The rings should be renewed whenever engine is disassembled for service.

Model EZ Automatic piston has one Head Land ("L" shaped) ring only. The ring should be renewed if ring end gap exceeds 0.016; desired ring end gap is 0.006-0.016. The base side of the ring has a cut-out at ring end gap to fit the ring locating pin in piston.

Piston pin in both models is retained in piston by "Rulon" plastic plugs. Insert a plug at each end of pin in piston bore and be sure piston pin and plugs are centered in piston.

Assemble piston to connecting rod so that piston ring locating pin is towards intake side (away from exhaust port).

CYLINDER. The cylinder can be unbolted and removed from crankcase after removing starter housing and throttle handle. Be careful not to let piston strike crankcase as cylinder is removed.

The cylinder bore is chrome plated and cylinder should be renewed if the chrome plating has worn through exposing the softer base metal. Also inspect for cracks and damage to compression release valve bore.

CRANKSHAFT, BEARINGS AND SEALS. Crankshaft is supported by a roller bearing (19—Fig. HL7) mounted in crankcase bore and by a ball bearing (23) mounted in drive-case (18).

To remove crankshaft, first remove clutch assembly, automatic oil pump on models so equipped, starter housing, magneto rotor, throttle handle, cylinder, piston and connecting rod assembly and the fuel/oil tank assembly. Remove retaining screws and separate drivecase and crankshaft from crankcase. Note: Use "Pozidriv" screwdriver bit only when removing drivecase to fuel tank cover screw (25). Remove the two main bearing retaining screws (21) and special washers (22), then push crankshaft and ball bearing (23) from drivecase. Remove snap ring (24) and press crankshaft from ball bearing.

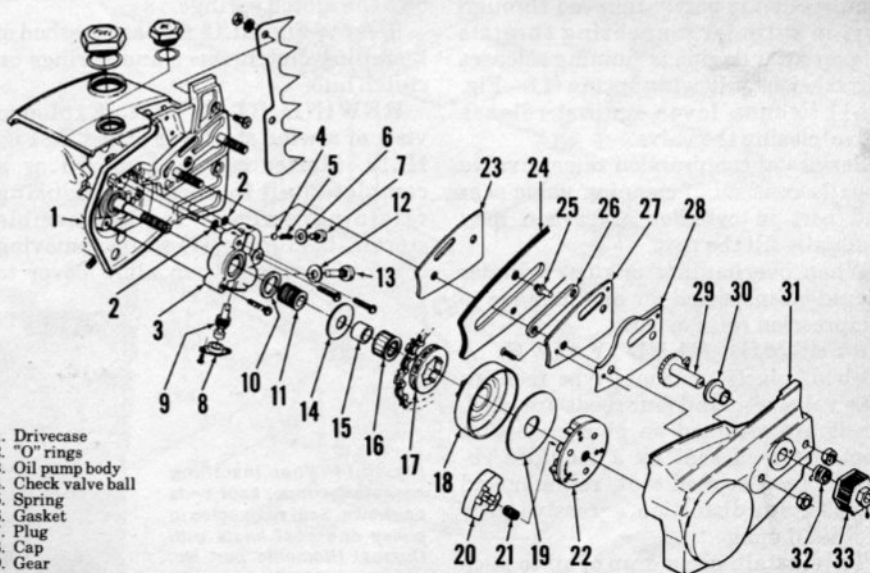


Fig. HL10—Exploded view of automatic oil pump and clutch assemblies. Chain adjusting components (23 thru 33) are used on EZ 250 Automatic models only. Sprocket (17) and clutch drum (18) are integral on some models.

- | | | | |
|-------------------|-------------------|-----------------------|-------------------|
| 10. Seal | 16. Bearing | 22. Clutch hub | 28. Cam cover |
| 11. Worm gear | 17. Sprocket | 23. Inner guide plate | 29. Adjusting cam |
| 12. Gasket | 18. Clutch drum | 24. Bar | 30. Bushing |
| 13. Cam screw | 19. Thrust washer | 25. Pin | 31. Cover |
| 14. Thrust washer | 20. Clutch shoe | 26. Block | 32. Spring |
| 15. Inner race | 21. Spring | 27. Outer guide plate | 33. Knob |

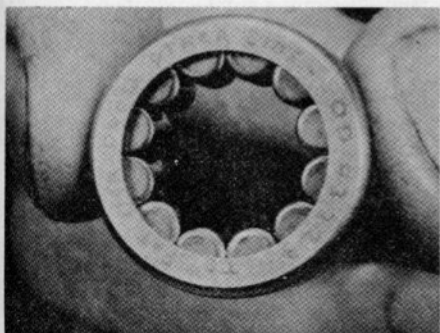


Fig. HL9—Roller type main bearing used at fly-wheel end of crankshaft is marked on one side, "PRESS OTHER SIDE". Be sure to observe this precaution when installing bearing in crankcase.

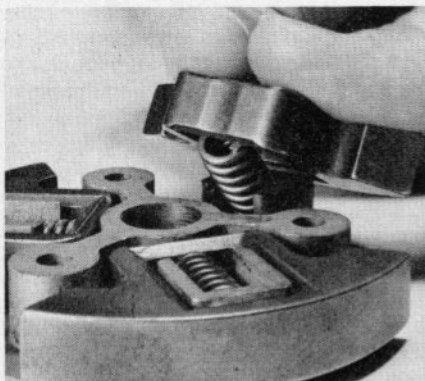


Fig. HL11—View showing easy method of installing clutch shoes and springs. Model EZ clutch is not shown; however, method is same.

When reassembling, be sure groove in outer race of ball bearing is towards crankpin and that retaining snap ring is seated in groove on crankshaft. Install new seals (15) with lip of seal inward. Using protector sleeve to prevent damage to seal, press the crankshaft and ball bearing into drivecase and install new retaining screws and washers. Assemble crankcase to crankshaft and drivecase using new "O" ring (17) and protector sleeve to prevent damage to crankcase seal. Be sure bar studs are in place before installing fuel tank.

COMPRESSION RELEASE.

When throttle lock is pushed in, a lever connected to throttle lock lifts away from compression release valve (4—Fig. HL7). When engine is cranked, compression forces valve open and compression is partly relieved through port in cylinder. Squeezing throttle trigger after engine is running releases throttle lock, allowing spring (11—Fig. HL1) to snap lever against release valve, closing the valve.

Service of compression release valve usually consists of cleaning valve seat and port in cylinder as carbon may gradually fill the port.

When overhauling engine, cylinder should be inspected for any damage to compression release port.

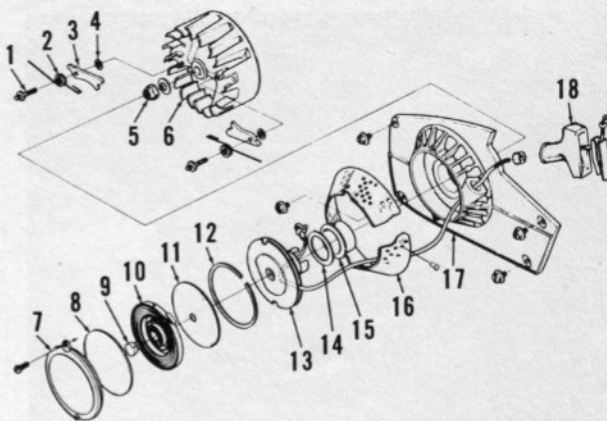
PYRAMID REED VALVE. A "Delrin" plastic pyramid type reed intake valve seat and four reeds are used. Reeds are retained on pins projecting from the reed seat by a moulded retainer. Inspect reed seat, retainer and reeds for any distortion, excessive wear or other damage.

To reinstall, use a drop of oil to stick each reed to the plastic seat, then push reed retainer down over the seat and reeds. Then install the assembly in crankcase; never install retainer, then attempt to install reed seat and reeds.

AUTOMATIC CHAIN OILER PUMP. Refer to Fig. HL10 for ex-

Fig. HL12—Exploded view of recoil starter.

1. Stud
2. Spring
3. Pawl
4. Washer
5. Nut
6. Flywheel
7. Cover
8. Spring shield
9. Spring lock
10. Rewind spring
11. Spring shield
12. Snap ring
13. Rope pulley
14. Washer
15. Bushing
16. Screen
17. Starter housing
18. Rope handle



ploded view showing automatic chain oiler pump installation. After removing clutch, the pump can be removed from crankshaft and drivecase. The pump body, flange and plunger are available as a complete pump assembly, less worm gear, only. Check valve parts, cam screw and worm gear are available separately. If pump body and/or plunger are scored or excessively worn, it will be necessary to install a new pump.

CLUTCH. Refer to Fig. HL10 for exploded view of the shoe type clutch. The clutch hub (22) is threaded to crankshaft; turn clutch hub in direction indicated by arrow on face of hub to remove from crankshaft.

If clutch slips with engine running at high speed under load, check clutch shoes for excessive wear. If clutch will not release (chain continues to turn at a normal idle speed), check for broken or weak clutch springs.

Refer to Fig. HL11 for easy method of installing clutch shoes and springs on clutch hub.

REWIND STARTER. Exploded view of rewind starter is shown in Fig. HL12. Starter can be removed as a complete unit by removing housing retaining screws. To disassemble starter, hold cover (7) while removing retaining screws, then allow cover to

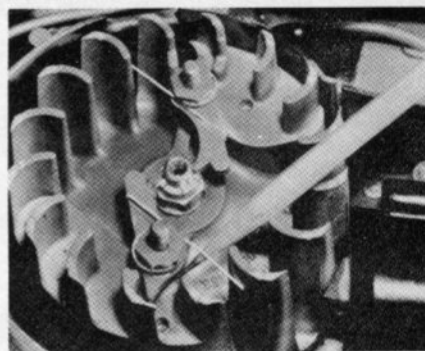


Fig. HL13—View showing proper installation of pawl springs.

turn slowly until spring tension is released. Remainder of disassembly is evident from inspection of unit and with reference to exploded view.

Refer to Fig. HL13 to correctly install starter dogs on flywheel. Rewind spring is wound in clockwise direction in cover (7—Fig. HL12). When installing a new starter rope, knot rope ends as shown in Fig. HL14, pull the knots tight and coat with Duxseal (Homelite part No. 24352). Before installing cover (7—Fig. HL12) retaining screws, turn cover to pull rope handle against starter housing, then continue turning cover three turns to properly tension the rewind spring.

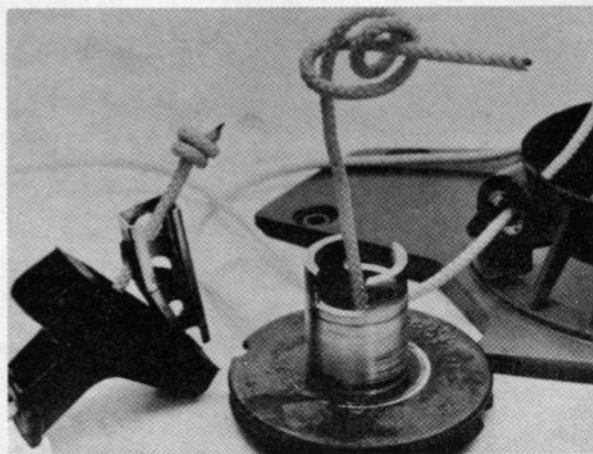


Fig. HL14—When installing new starter rope, knot ends as shown. Seal rope holes in pulley and coat knots with Duxseal (Homelite part No. 24352)

HOMELITE®A **textron** DIVISION, PORT CHESTER, N.Y. 10573**Chain Saw Model****Design Features**

XL-12	A,E,G,H,K
XL-15	A,E,G,J,K
Super XL-12	B,E,G,H,K
Super XL-15	B,F,G,J,K
XL Automatic	B,F,G,H,L
XL Auto. Gear Drive	B,F,G,J,L
Super XL	B,F,G,H,K
Super XL Automatic	B,F,G,H,L
XL-400 Automatic	C,F,G,H,L
XL-500 Automatic	D,F,G,H,L

DESIGN FEATURES CODE

- A—Displacement, 3.3 cu. in.; bore, 1 1/8 in.; stroke, 1 1/8 in.
 B—Displacement, 3.55 cu. in.; bore, 1 13/16 in.; stroke, 1 1/8 in.
 C—Displacement, 4.0 cu. in.; bore, 1 1/8 in.; stroke, 1 7/16 in.
 D—Displacement, 4.5 cu. in.; bore, 2 in.; stroke, 1 7/16 in.
 E—Flat reed type intake valve.
 F—Pyramid type reed intake valve, 4 reeds.
 G—Conventional flywheel type magneto.
 H—Direct drive.
 J—Planetary gear drive transmission.
 K—Manual chain oiler only.
 L—Automatic chain oiler only; manual chain oiler pump available as optional accessory.

MAINTENANCE

SPARK PLUG. Depending upon type of spark plug boot and connector, either a "Bantam" (CJ-prefix) or "Shor-ty" (TJ-prefix) spark plug is used.

Early production models XL 12 and Super XL-12 were equipped with a Champion TJ-8J spark plug and a TJ-6J was recommended for other early models.

Late production models XL-12, Super XL-12 and XL-15 are equipped with a Champion CJ-8 spark plug and other models use a CJ-6. To convert earlier models to use either the CJ-8 or CJ-6, install a new terminal (Homelite part No. A-33055) on plug wire.

For heavy duty service, a Champion UTJ-11P gold-palladium tip spark plug can be used on all models.

For all models, set spark plug electrode gap to 0.025.

CARBURETOR. A Tillotson model HS diaphragm carburetor or a Walbro model SDC diaphragm carburetor may

be used. Refer to Tillotson or Walbro section of SERVICE FUNDAMENTALS section for overhaul and exploded views.

Initial adjustment of idle mixture screw and high speed mixture screw is one turn open. Adjust idle mixture screw and idle speed screw so that engine idles just below clutch engagement speed. Make high speed mixture adjustment with engine warm and under cutting load. It may be necessary to readjust one mixture screw after adjusting the other mixture screw as the functions of the idle and high speed mixture screws are related.

MAGNETO. A Wico or Phelon flywheel type magneto with external armature and ignition coil is used.

Units equipped with Phelon magneto will have a letter "P" stamped after the serial number. The Wico and Phelon magnetos are similarly constructed, so care should be taken to properly identify magneto before ordering service parts. Breaker points and condenser are located behind flywheel.

Armature core and stator plate are riveted together and are serviced only as a unit. Stator plate fits firmly on shoulder of crankcase; hence, armature air gap is non-adjustable.

Late production Wico magneto stator plates are built to retain a felt seal (5—Fig. HL33); the seal cannot be used with early production Wico stator plates. All Phelon stator plates are built to retain the felt seal (5).

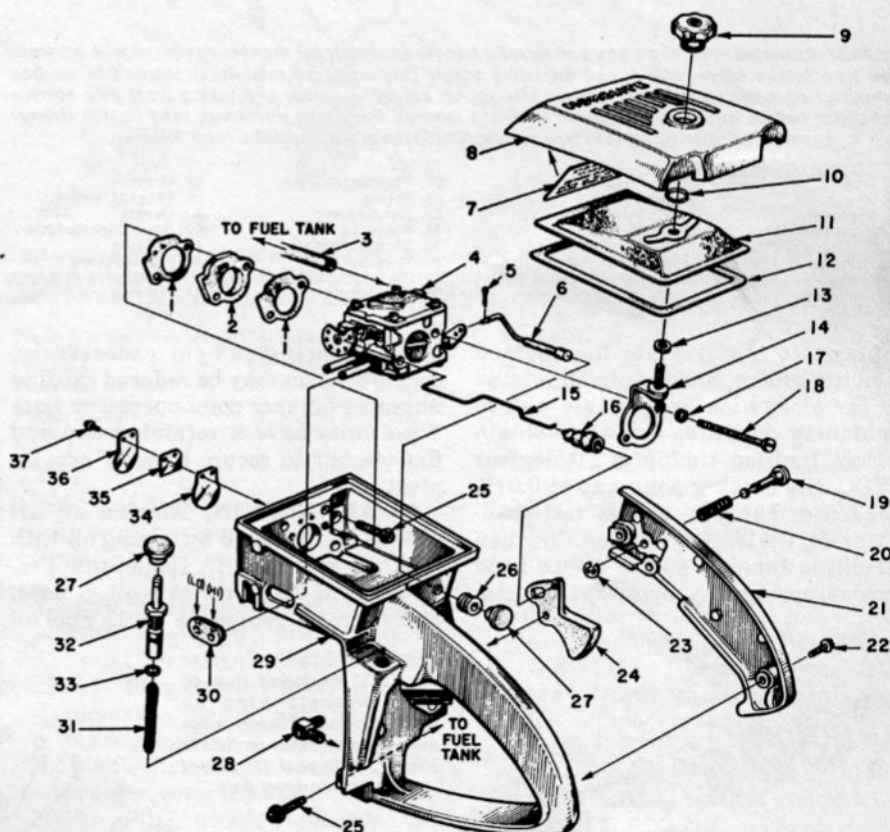


Fig. HL30—Exploded view of air box (throttle handle) and related parts on models with flat reed intake valve (34). Refer to Fig. HL31 for models equipped with pyramid reed valve.

- | | | | |
|-----------------|------------------------|----------------------|------------------|
| 1. Gasket | 10. Snap ring | 20. Spring | 30. Grommet |
| 2. Insulator | 11. Filter element | 23. Snap ring | 31. Spring |
| 3. Fuel line | 12. Gasket | 24. Throttle trigger | 32. Pump plunger |
| 4. Carburetor | 13. Gasket | 26. Grommet | 33. "O" ring |
| 5. Cotter pin | 14. Bracket | 27. Choke button | 34. Reed valve |
| 6. Choke rod | 15. Throttle rod | 28. Check valve | 35. Reed back-up |
| 8. Filter cover | 16. Boot | 29. Air box | 36. Reed stop |
| 9. Nut | 19. Throttle latch pin | | |

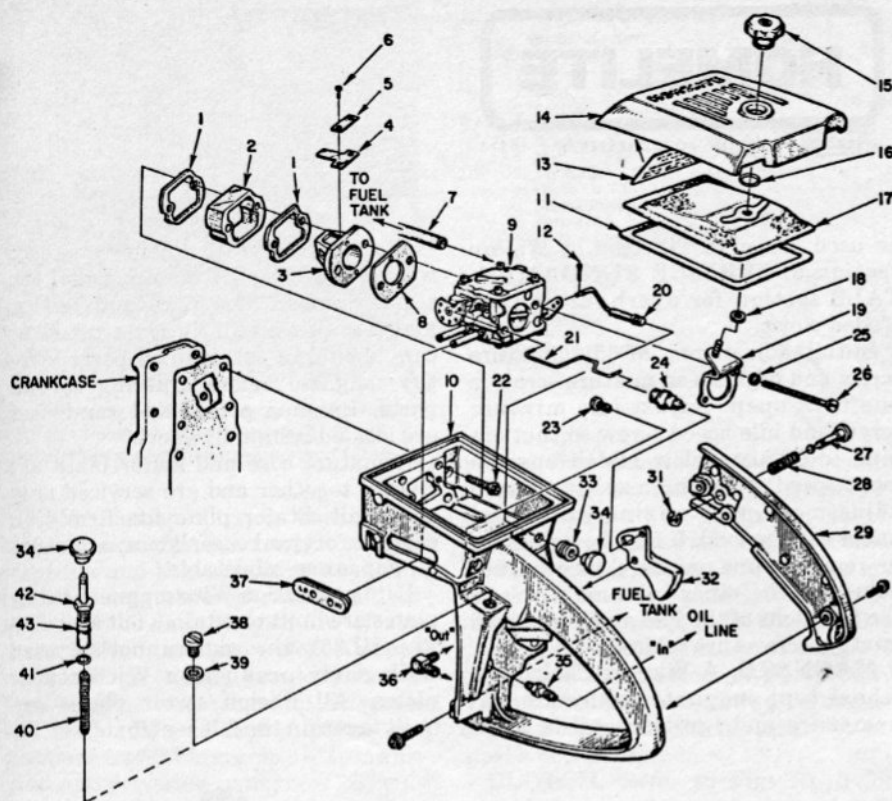


Fig. HL31—Exploded view of air box and throttle handle assembly for models equipped with pyramid reed type intake valve. Idle speed adjusting screw (23) on some models, is located in air box instead of on carburetor body; remove idle speed adjusting screw and spring from new service carburetor before installing carburetor on these models. Early type aluminum reed seat is shown; refer to Fig. HL32 for late type plastic (Delrin) seat and moulded reed retainer.

- | | | | |
|---------------------|----------------------|------------------------|---------------------------|
| 1. Gaskets | 11. Gasket | 27. Throttle latch pin | 37. Grommet |
| 2. Spacer | 14. Cover | 28. Spring | 38. Plug (AO models) |
| 3. Reed seat | 17. Filter | 29. Handle cover | 39. Gasket |
| 4. Valve reeds (4) | 18. Gasket | 31. Snap ring | 40. Spring (manual oiler) |
| 5. Retaining plates | 19. Bracket | 32. Throttle trigger | 41. "O" ring |
| 6. Fuel line | 20. Choke rod | 33. Grommet | 42. Manual pump |
| 7. Carburetor | 21. Throttle rod | 35. "In" check valve | 43. "O" ring |
| 10. Air box | 23. Idle speed screw | 36. "Out" check valve | |
| | 24. Boot | | |

Magneto stator plate has slotted mounting holes, and should be rotated as far clockwise as possible before tightening mounting screws to obtain correct ignition timing of 30 degrees BTDC. Set breaker point gap to 0.015. Condenser capacity should test 0.16-0.20 mfd. CAUTION: Be careful when installing breaker points not to bend tension spring any more than neces-

sary; if spring is bent excessively, spring tension may be reduced causing improper breaker point operation. Late Wico units have a retaining clip and flat washer to secure breaker arm on pivot post.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil

ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

Fill chain oiler reservoir with Homelite Bar and Chain oil or a light weight oil (no heavier than SAE 30). In cold weather, chain oil can be diluted with kerosene to allow easier flow of oil through pump and lines.

On early model XL-12, the clutch drum and sprocket assembly should be removed and a few drops of oil placed on the Oilite bushings occasionally. All other models (and converted early production XL-12) have needle bearing instead of Oilite bushing.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. Do not run engine with muffler removed.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values for XL-12/XL-500 Automatic units are as follows: NOTE: All values are in inch-pounds; minimum torque value is given. To find maximum torque value, add 20% to value given.

4/40 Reed & stop to chamber	5
4/20 Oil line plate or shield to tank	5
8/32 Throttle handle cover	40
8/36 Connecting rod	55
10/32 Muffler cap	50
10/32 Bearing retainer	55
10/32 Screen to rotor	50
10/32 Drivecase cover	55
10/32 Pulley to fan housing	50
10/32 Flanged inner race for pulley	55
10/32 Carburetor to chamber	50
12/24 Handle bar to fuel tank	80

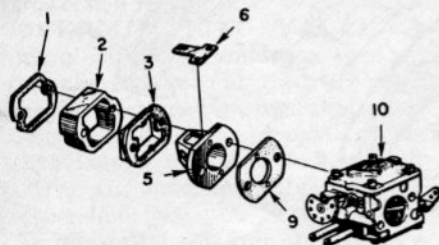
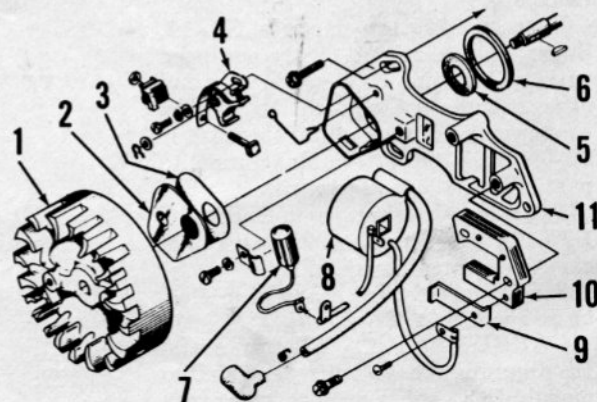


Fig. HL33—Exploded view of Wico magneto used on some models. Phelon magneto used on other models is similar. Felt seal (5) is not used on early models.

Fig. HL32—View showing late type Delrin plastic reed seat (5) and moulded reed retainer (3). Reed seat (6) are held on pins protruding from seat by the retainer. Refer to text for assembly instructions.

- | | |
|------------------|----------------|
| 1. Gasket | 6. Reeds (4) |
| 2. Spacer | 9. Gasket |
| 3. Reed retainer | 10. Carburetor |
| 5. Reed seat | |



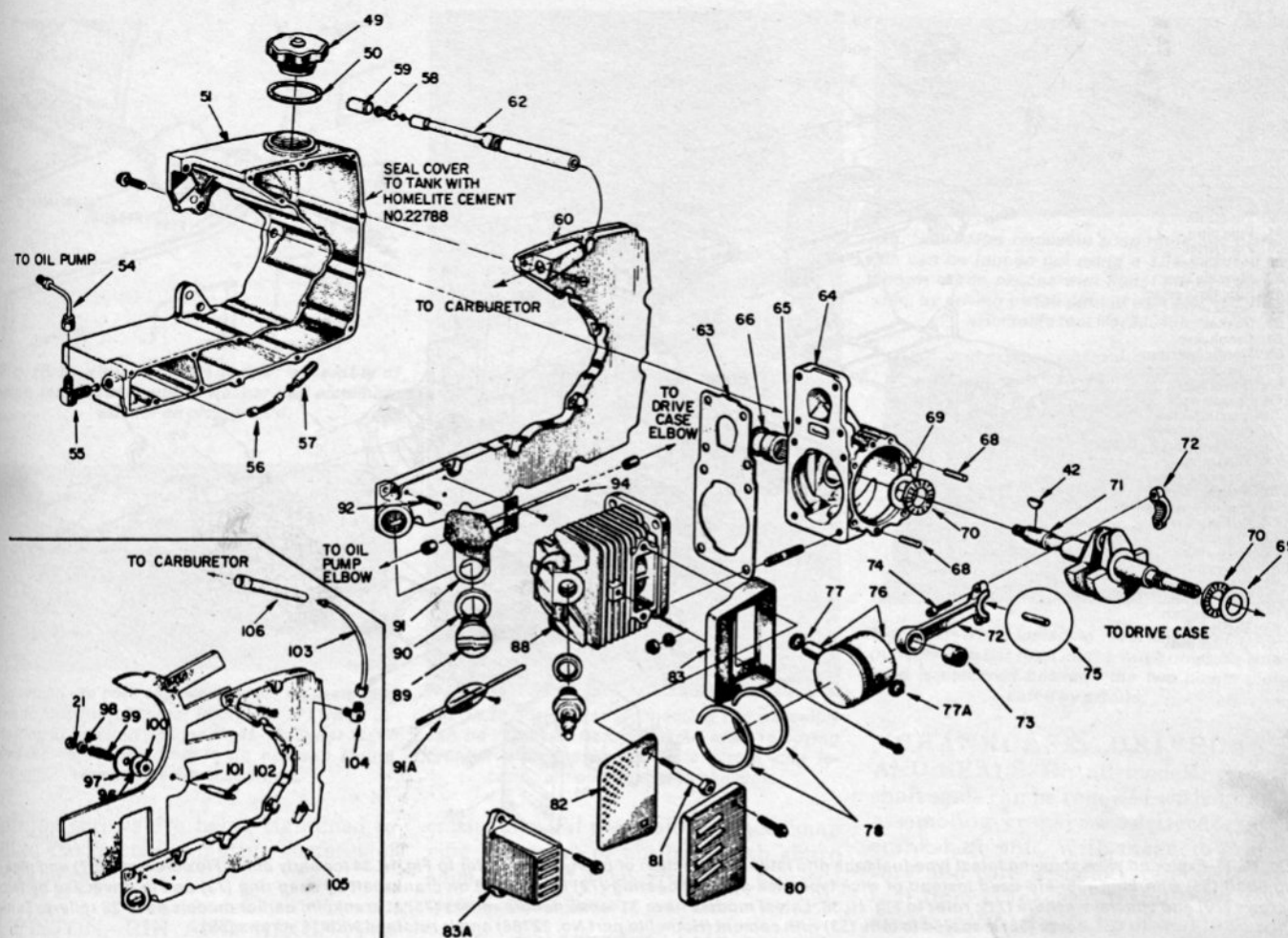


Fig. HL34—Exploded view showing powerhead and fuel tank construction of models XL-12, Super XL-12 and XL-15, refer to Fig. HL35 for other models. Early wick type fuel pickup and tank cover are shown in inset; beginning with serial No. 2188611, flexible hose (62) type pickup is used. Dowel pins (68) are used on later models; refer to text. Single piece muffer (83A) is used on XL-12 and Super XL-12; XL-15 is fitted with three piece muffer (80, 82 & 83).

21. Lock nut	58. Fuel pickup	69. Thrust washers	77A. Snap ring	89. Oil cap	98. Flat washer
42. Woodruff key	59. Fuel filter	70. Thrust bearings	78. Piston rings	90. Gasket	99. Spring
49. Fuel tank cap	60. Tank cover (late)	71. Crankshaft	80. Muffer cap (XL-15)	91. Shield (XL-15)	100. Washer (felt)
50. Gasket	62. Flexible fuel line	72. Connecting rod & cap	81. Special studs	91A. Plate (XL-12 & S/XL-12)	101. Wick
51. Fuel tank	63. Gasket	73. Needle bearing	82. Baffle (XL-15)	92. Cotter pin (breather)	102. Stud
54. Oil line	64. Crankcase	74. Rod cap screws	83. Muffer body (XL-15)	94. Oil line	103. Fuel line
55. Check valve	65. Needle bearing	75. Needle rollers	83A. Muffer (XL-12 & S/XL-12)	96. Washer (aluminum)	104. Elbow
56. Oil line	66. Crankshaft seal	76. Piston & pin	88. Cylinder	97. Washer (rubber)	105. Tank cover (early)
57. Oil filter	68. Dowel pins	77. Snap ring			106. Fuel line

12/24 Bracket to drivecase	80
12/24 Stator to crankcase and cylinder	80
12/24 Drivecase to crankcase	80
12/24 Carburetor chamber to fuel tank	80
12/24 Muffer to cylinder	80
1/4-20 Fuel tank to crankcase	80
12/24 Fan housing to fuel tank	80
1/4-28 Cylinder nuts	100
12/24 Pawl studs to rotor	80
1/4-20 Handle bar to bracket	100
1/4-20 Bumper screws	80
3/8-24 Clutch nut	150
5/8-32 Clutch nut	150
5/16-24 Rotor nut	150
1/2-20 Clutch to crankshaft	150
14mm Spark plug	250
Clutch spider	180

HOMELITE SERVICE TOOLS.
Listed below are Homelite tool num-

bers, tool description and model application of tools for servicing XL-12 through XL-500 series chain saws.

Tool No. Description & Model Usage

A-23949—Remover, piston pin with Spirol pin at exhaust side of piston.
23756—Plug, connecting rod bearing removal and installation, all models.
A-23960—Remover and locking bracket, rotor (flywheel), all models.
23757—Plug, needle roller type main bearing installation, all models.
23758—Plug, crankcase seal installation, all models; drivecase seal installation, models XL-12, XL-15 & S/XL-12.
23759—Sleeve, crankcase seal protector, all models; drivecase seal protector, models XL-12, XL-15 & S/XL-12.

23800—Sleeve, crankcase seal installation, all models; drivecase seal installation, models XL-12, XL-15 & S/XL-12.

23843—Sleeve, drivecase seal installation, all models except XL-12, XL-15 & S/XL-12.

23844—Sleeve, drivecase seal protector, all models except XL-12, XL-15 & S/XL-12.

23884—Sleeve, bearing and shaft installation, all models except XL-12, XL-15 & S/XL-12.

24448—Plug, crankcase bearing installation, Model XL-400.

23845—Plug, drivecase seal installation, all models except XL-12, XL-15 & S/XL-12.

23846—Anvil, crankshaft installation, all models except XL 12, XL-15 & S/XL-12.

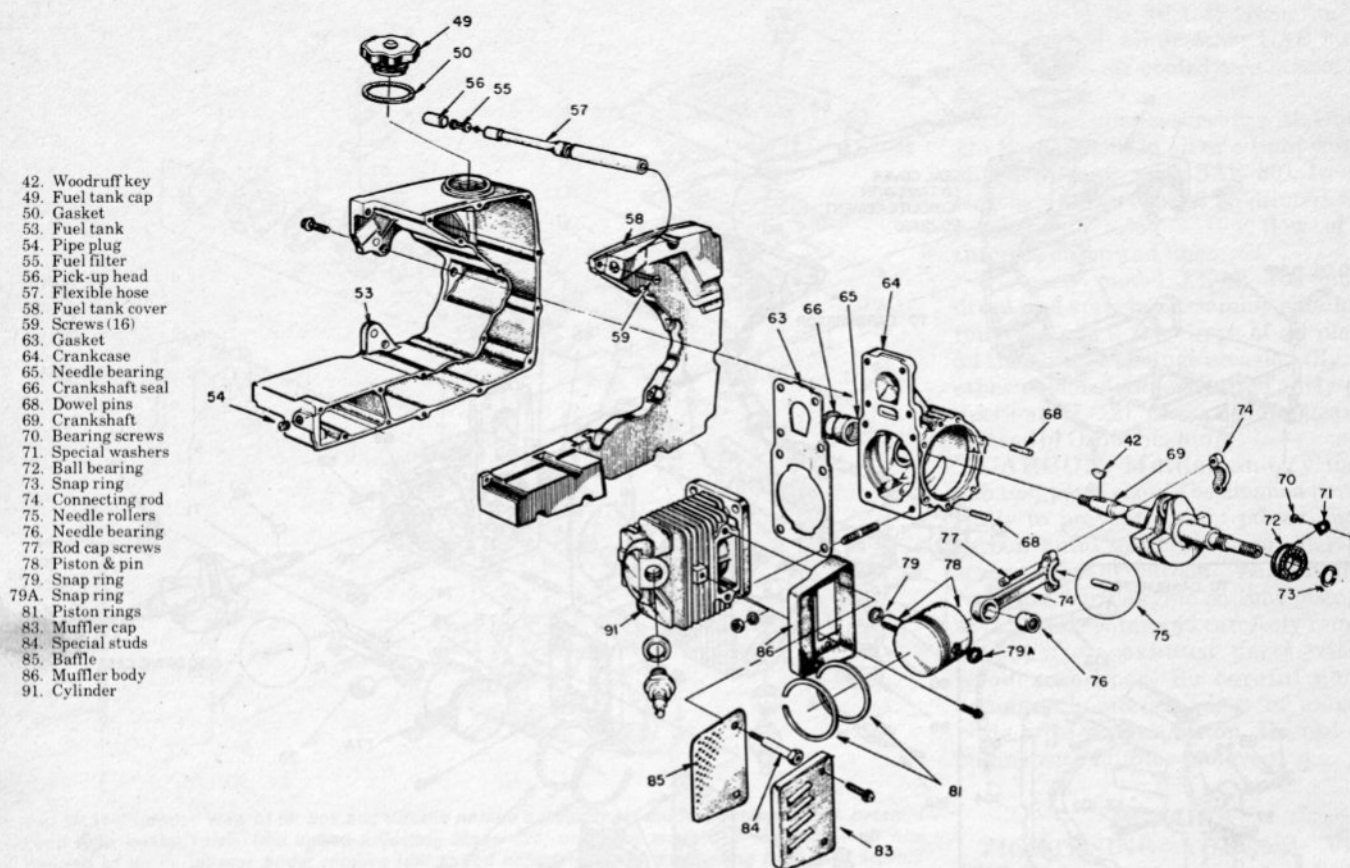


Fig. HL35—Exploded view showing latest type fuel tank and later construction of power head; refer to Fig. HL34 for early units. Flexible hose (57) and pick-up head (55) with filter (56) are used instead of wick type pick-up. Ball bearing (72) is retained on crankshaft by snap ring (73) and in drivecase by two screws (70) and special washers (71); refer to Fig. HL36. Latest models have 31 loose needle rollers (75) at crankpin; earlier models have 28 rollers. Tank cover (58) is sealed to tank (53) with cement (Homelite part No. 22788) and is retained with 16 screws (59).

A-23858—Tool, crankcase to drivecase installation, model XL-500.

A-23137—Jackscrew, crankshaft assembly & installation, all models except XL-12, XL-15 & S/XL-12.

22820-1—Bearing collar for A-23137.

23136—Body for A-23137.

A-23841-A—Wrench, guide bar stud insert, all models except XL-12, XL-15 & S/XL-12.

A-23934—Wrench, clutch plate removal and installation, all late production.

A-23696—Wrench, clutch spider removal and installation, all early production; sun gear removal on gear drive models.

A-78—SNAP-ON tool, remover for clutch drum needle roller bearing on all models.

23819—Plug, clutch drum needle bearing installation, all direct drive models.

27773—Plug, clutch drum needle bearing installation, all gear drive models.

23665—Pliers, planetary gear drive snap ring, all gear drive models.

23772—Plug, planetary gear drive needle bearing, all gear drive models.

A-23792—Sprocket holder, all gear drive models.

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Refer to Fig. HL39. Be careful to remove all of the loose needle rollers when detaching rod from crankpin. Early models have 28 loose needle rollers; starting with serial No. 207-1277, 31 needle rollers are used. Note: A different crankshaft and connecting rod are used on late models with 31 needle rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23756. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. On early models with 28 needle rollers, stick 14 needle rollers in the rod and remaining 14 needle rollers in rod cap with light grease or beeswax. On late models with 31 needle rollers,

stick 16 rollers in rod and 15 rollers in rod cap. Assemble rod to cap with match marks aligned, and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap re-

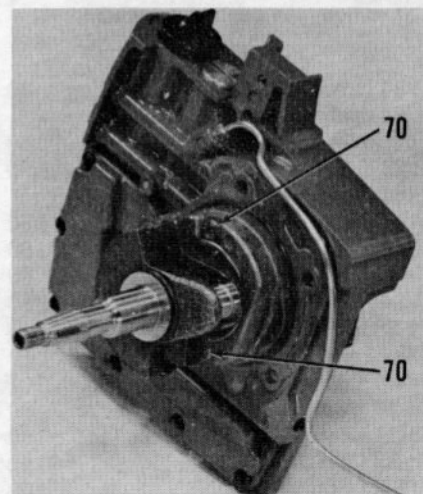


Fig. HL36—View showing crankcase removed from drive case and crankshaft on models equipped with ball bearing at drive end of crankshaft. To remove crankshaft from drive case, bearing retaining screws (70) must first be removed.

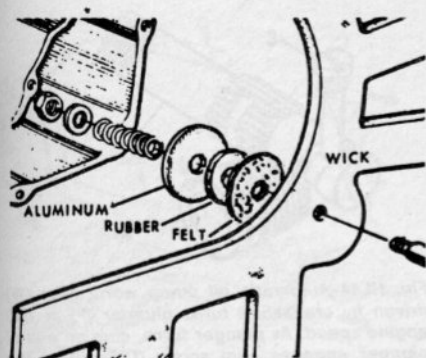


Fig. HL37—View showing proper assembly of wick, felt washer, rubber washer and aluminum washer on pickup stud.

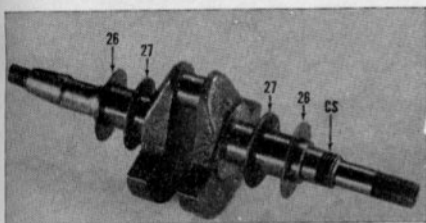


Fig. HL38—Be sure the steel thrust washers (26) are to outside of thrust bearings (27) when installing crankshaft on models XL-12, Super XL-12 and XL-15. Other models do not use thrust washers or thrust bearings.

taining screws are being tightened to align the fractured mating surfaces of rod and cap.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.0035.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are available in a matched set, and are not available separately.

Piston pin has one open and one closed end and may be retained in piston with snap rings or a Spirol pin. A wire retaining ring is used on exhaust side of piston on some models and should not be removed.

To remove piston pin on all models, remove the snap ring at intake side of piston. On piston with Spirol pin at exhaust side, drive pin from piston and rod with slotted driver (Homelite tool No. A-23949). On all other models, insert a 3/16-inch pin through snap ring at exhaust side and drive piston pin out as shown in Fig. HL40.

When reassembling piston to connecting rod, be sure to install closed end of piston pin towards exhaust side of piston (away from piston ring lo-

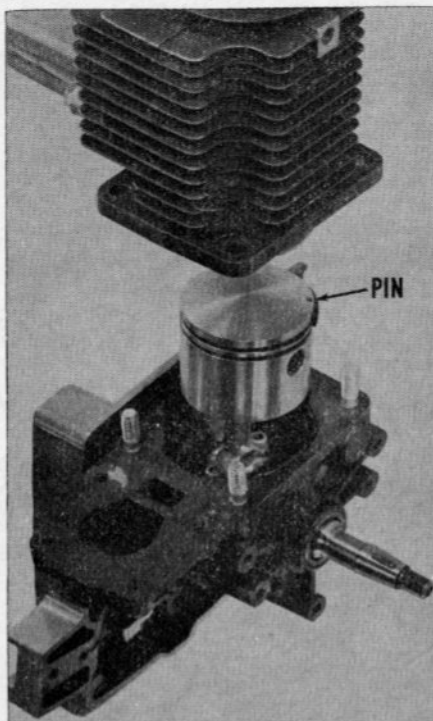


Fig. HL39—Piston and connecting rod assembly can be removed from crankpin after removing cylinder from crankcase. Note piston ring locating pin on intake side of piston.

cating pin). Fit the Waldes Truarc snap ring in groove of pin bore with sharp edge out and turn ring gap towards closed end of piston.

CRANKSHAFT AND BEARINGS. On models XL-12, Super XL-12 and XL-15, the crankshaft is supported in two caged needle roller bearings and crankshaft end play is controlled by a roller bearing and hardened steel thrust washer on each end of the shaft. Refer to Fig. HL38. On all other models, flywheel end of crankshaft is supported in a needle bearing in crankcase and drive end is supported in a ball bearing located in drive case; end play is controlled by the ball bearing.

Maximum allowable crankshaft end play on models with thrust bearings (Fig. HL38) is 0.002; renew thrust bearings if end play is excessive. Normal end play is approximately 0.010.

Renew the crankshaft if any of the main bearing, crankpin bearing or thrust bearing surfaces or sealing surfaces are scored, burned or excessively worn. Renew the drivecase ball bearing if excessively loose or rough. Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged.

CYLINDER. The cylinder bore is chrome plated. Renew the cylinder if chrome plating is worn away exposing the softer base metal.

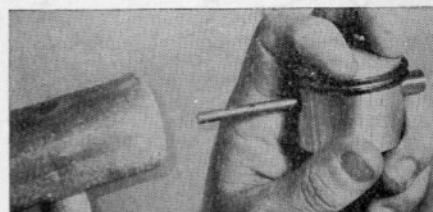


Fig. HL40—After removing snap rings, the piston pin can be tapped out using a 3/16-inch rod as shown or, on pistons with Spirol pin at exhaust side, by driving piston pin out with slotted driver (Homelite tool No. 23949).

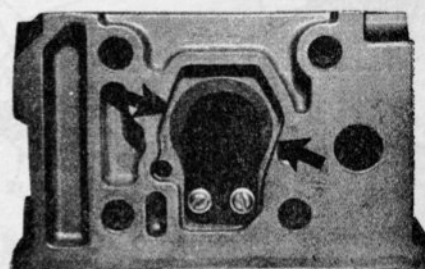


Fig. HL41—When installing reed valve on air box (models with flat reed intake valve only), be sure reed is centered between the two points indicated by arrows.

CRANKCASE, DRIVECASE AND SEALS. On all models, crankshaft seals can be renewed without disassembling crankcase, drivecase and crankshaft unit. With magneto armature and core assembly removed, pry seal from crankcase. Install new seal over crankshaft with lip of seal inward, then using driver sleeve, drive seal into crankcase. Seal in drivecase can be pried out after removing clutch assembly and, on models so equipped, the automatic chain oiler pump. Install seal with lip inward and drive into position with sleeve. Note: Use of seal protectors is recommended; if protectors are not available, wrap threads on crankshaft with thin plastic tape to prevent damage to seal lips.

Crankcase can be removed from crankshaft and drivecase after removing cylinder, piston and connecting rod and removing retaining screws. On models XL-12, XL-15 and Super XL-12, crankshaft can be withdrawn from drivecase. On all other models, remove the two bearing retaining screws (70—Fig. HL35) and special washers (71), then press crankshaft and ball bearing (72) from drivecase. Remove snap ring (73), then press crankshaft out of the ball bearing.

Inspect the needle roller bearing in crankcase, and on models XL-12, XL-15 and Super XL-12, the needle roller bearing in drivecase. Bearings should be renewed if any needle roller has flat spot or is otherwise damaged, or if rollers are worn so that two rollers may

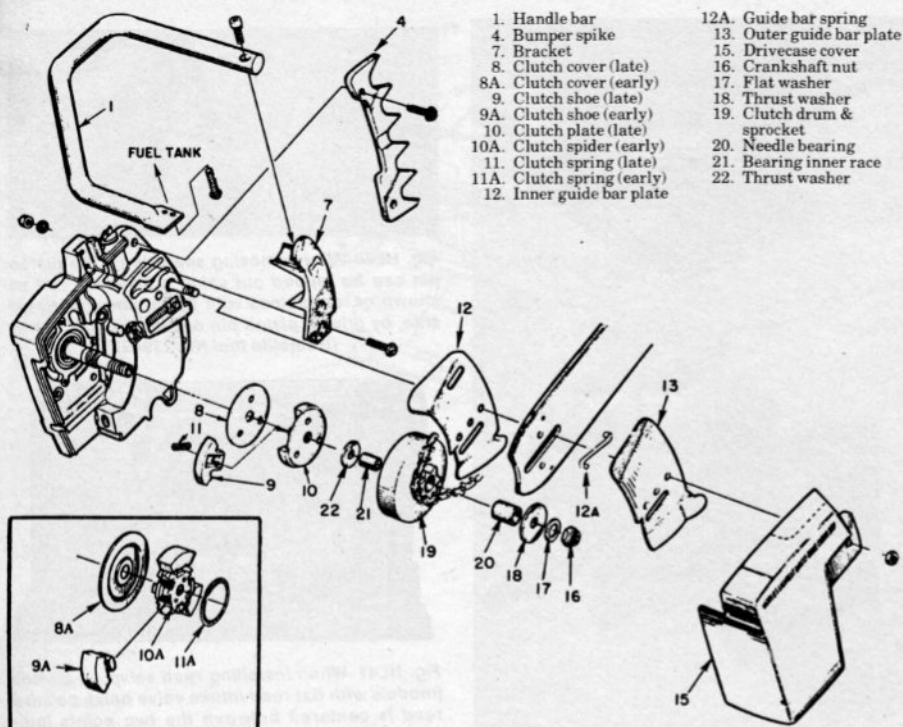


Fig. HL42—Exploded view of typical direct drive clutch assembly; refer to Fig. HL46 for gear drive models. Late type clutch assembly (items 8, 9, 10 & 11) is interchangeable as a unit with early production clutch shown in inset at lower left corner.

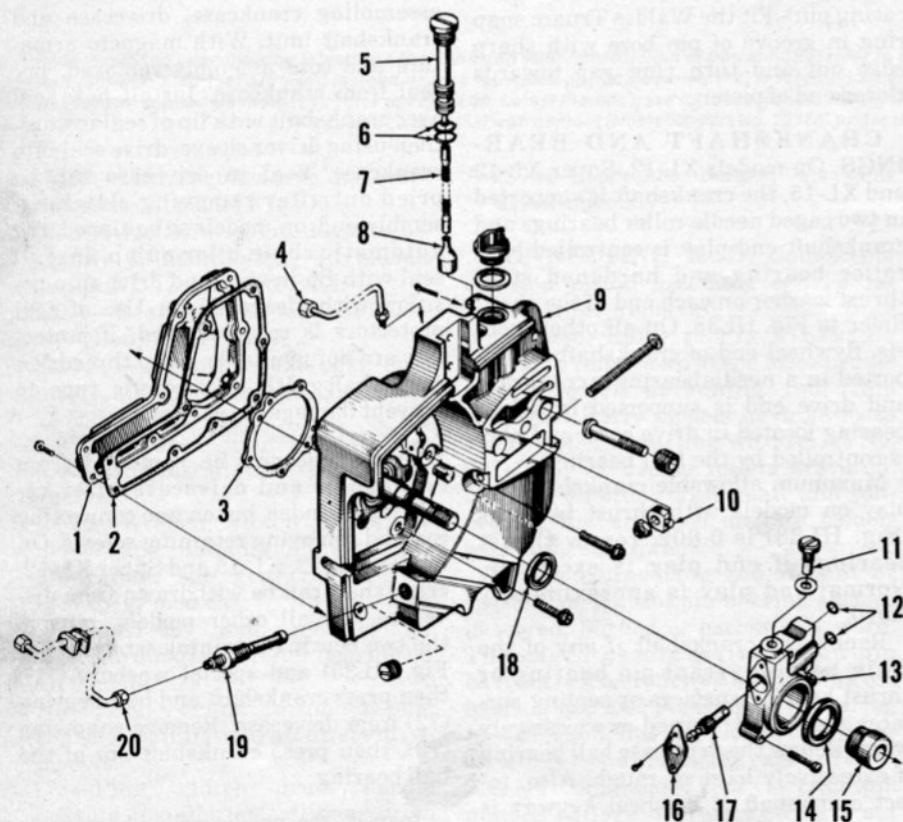


Fig. HL43—Exploded view of automatic chain oil pump on models so equipped.

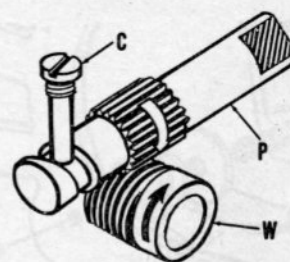


Fig. HL44—Automatic oil pump worm gear (W) driven by crankshaft turns plunger (P) at 1/20 engine speed. As plunger turns, cam on end of plunger engages cam screw (C) causing the plunger to go back and forth. Flat end of plunger acts as inlet and outlet valve.

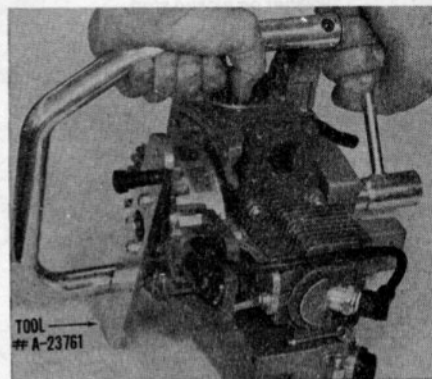


Fig. HL45—Using Homelite tool No. A-23761 to keep crankshaft from turning while removing clutch retaining nut and clutch rotor. Homelite tool No. A-23696 is used to remove or install clutch rotor.

be separated a width equal to thickness of one roller. Always press against lettered end of bearing cage when removing and installing needle roller bearings. Needle roller bearings should be installed using appropriate installation plug.

Install new ball bearing on crankshaft using jackscrew or by supporting crankshaft at crank throw and installing bearing in a press. Groove in outer race of bearing must be towards crankpin.

Renew crankshaft seals before assembling crankshaft, crankcase and drivecase. Using installation plug, press seal into position with lip to inside of crankcase. On models XL 12, XL-15 and Super XL-15, install thrust bearings on crankshaft next to crankpin throw, then install the hardened steel thrust washers at outer side of each thrust bearing. On all other models, first assemble crankshaft and drivecase by placing seal protector on crankshaft, then pulling crankshaft and ball bearing into drivecase with jackscrew and adapters. Install two NEW bearing retaining screws and lockwashers. On models XL-12, XL-15 and Super XL-12, place seal protector on crankshaft and insert crankshaft in crankcase. Then, on all models, as-

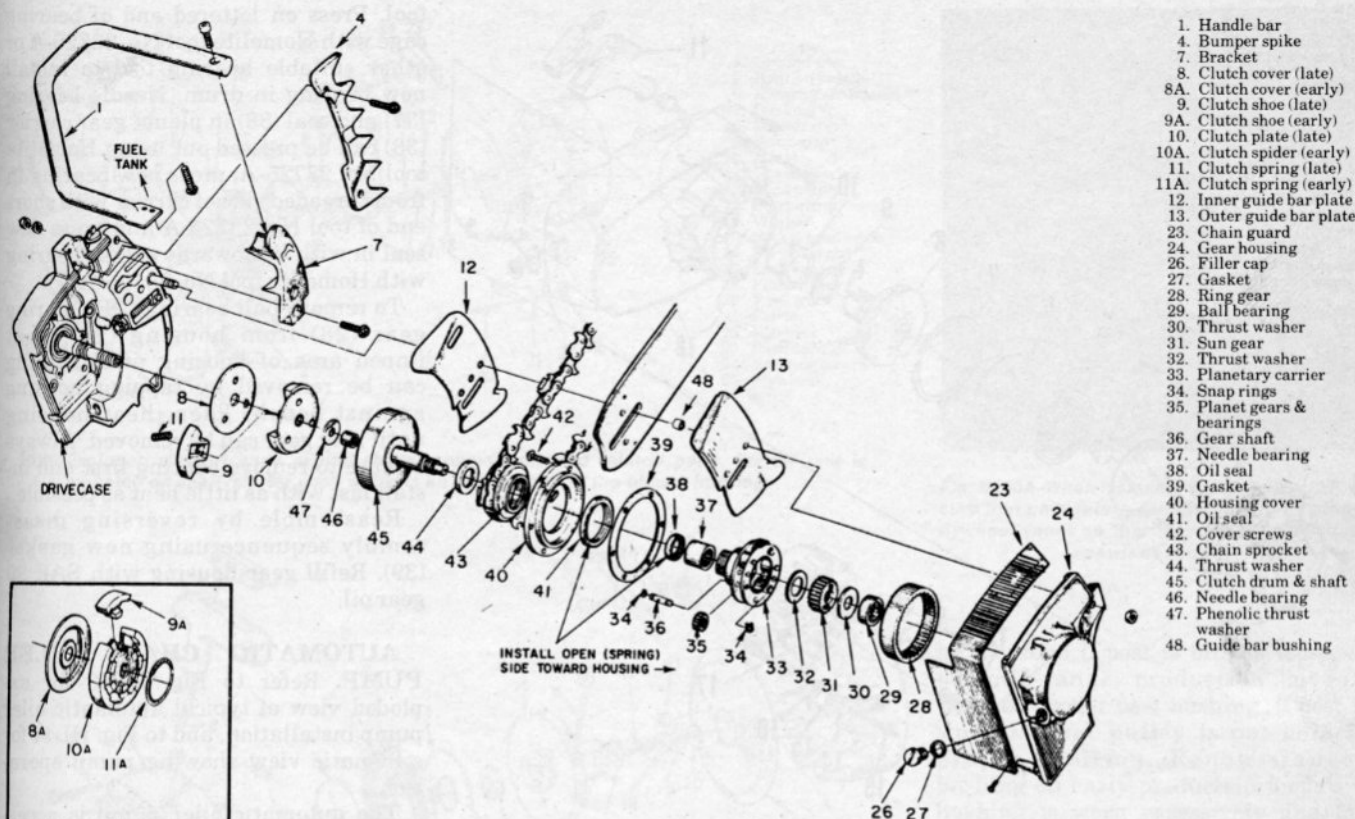


Fig. HL46—Exploded view showing planetary gear drive transmission, clutch and drivecase. Late type clutch assembly (items 8, 9, 10 & 11) is interchangeable with early type clutch assembly (inset, lower right). To remove transmission assembly (including clutch drum), remove bar stud retaining nuts and withdraw housing (24) and bar and chain from studs. Clutch plate (10), or spider (10A) is threaded to crankshaft.

semble crankcase to drivecase using new gasket. Note: On early production, crankcase was sealed to drivecase with an "O" ring; however, use of "O" ring has been discontinued and a gasket, rather than an "O" ring, should be used on all models.

On all late production models, crankcase is fitted with two dowel pins to provide a more positive alignment of crankcase and drivecase. Service crankcases are drilled for dowel pins, but dowel pins are not installed so that crankcase can be used with early type drivecase not drilled for dowels. If renewing late type crankcase fitted with dowel pins, two new dowel pins must be obtained and installed in new crankcase; install dowel pins so they protrude 0.165-0.180 from crankcase.

FLAT REED VALVE. The reed valve is attached to the carburetor air box as shown in Fig. HL30, and is accessible after removing air box from crankcase.

Check the reed seating surface on air box to be sure it is free of nicks, chips or burrs. Renew valve reed if rusted, pitted or cracked, or if it does not seat flatly against its seat.

The reed stop is curved so that measurement of reed lift distance is not practical. However, be sure that reed is

centered over opening in air box and reed stop is aligned with reed as shown in Fig. HL41. Clean the screw threads and apply Loctite to threads before installing screws.

NOTE: If air box has been removed to service reed valve, inspect gasket (63—Fig. HL34) between air box and crankcase. If gasket is damaged and cylinder is not being removed for other purposes, it is suggested that the exposed part of the old gasket be carefully removed and the new gasket be cut to fit between the air box and crankcase.

PYRAMID REED VALVE. All models except XL-12, XL-15 and Super XL-12 are equipped with a pyramid reed type intake valve with four reeds. Early production reed seat was made of aluminum and reeds were retained to seat by spring plates and screws.

Late production reed seat (see Fig. HL32) is made of Delrin plastic. The reeds fit onto pins protruding from the plastic seat and are held in place by a molded retainer, eliminating the retaining spring plates and screws.

Reeds, spring plates and retaining screws are available for servicing the early type aluminum reed seat. However, if the seat is worn or damaged beyond further use, the Delrin seat and molded retainer is used as replacement.

When assembling reeds to aluminum seat, apply Loctite to retaining screws to keep them from working loose. Renew the spacer gaskets and carburetor gasket and install the spacer, reed seat assembly and carburetor as in Fig. HL31.

To assemble and install Delrin reed seat and reeds, proceed as follows: Fit the reed retainer (3—Fig. HL32) into spacer (2) so that the pin on retainer clears cut-out in spacer. Using a drop of oil under each reed, stick the reeds to pyramid seat so that holes in reeds fit

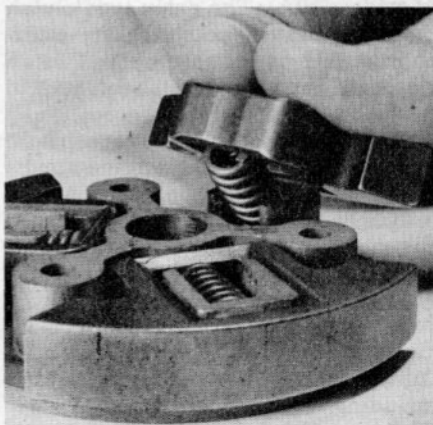


Fig. HL47—View showing easy method for installing late type clutch shoes and springs on clutch plate.

1. Cover
2. Dirt guard
3. Shield
4. Spring lock
5. Rewind spring
6. Shield
7. Snap ring
8. Rope pulley
9. Washer
10. Bushing
11. Rope handle
12. Nut
13. Stud
14. Starter pawl
15. Washer
16. Spring
17. Flywheel
18. Starter housing

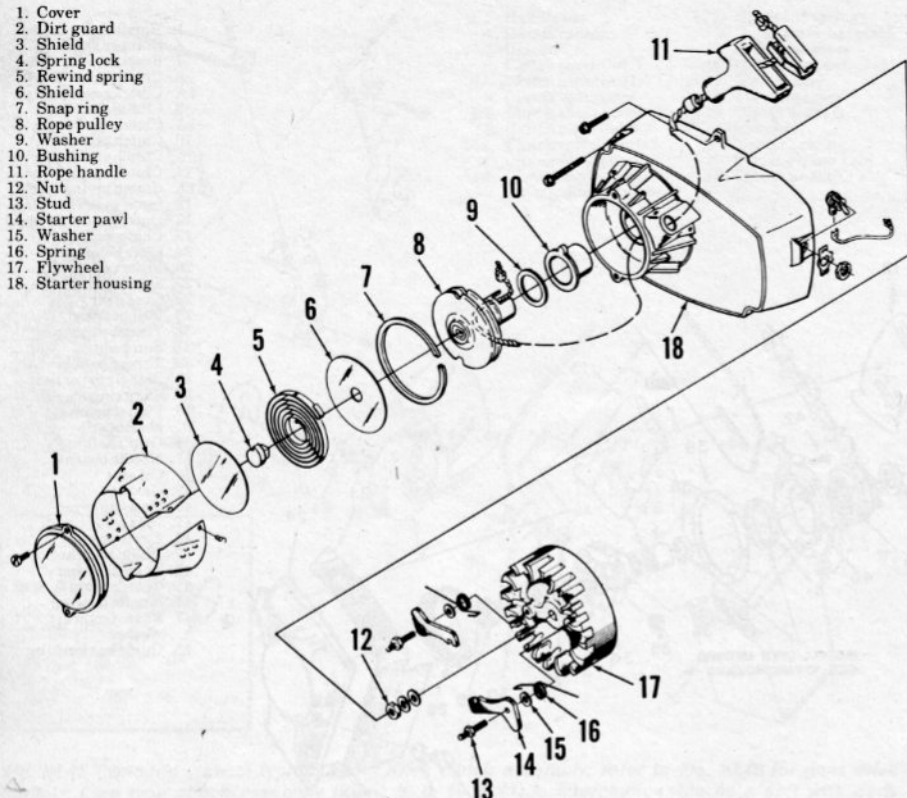


Fig. HL48—Exploded view of recoil starter used on model XL-400 Automatic.

over the pins molded into seat. Place the retainer and spacer over the reeds and seat so that all parts are locked together, then install the valve assembly and carburetor with new gaskets (1 & 9).

CLUTCH. Refer to Fig. HL42 for exploded view of typical direct drive clutch assembly and to Fig. HL46 for planetary gear drive models. Both illustrations show late type clutch assembly using three compression springs (11) to hold shoes retracted in plate (10) and in insets at lower left corner, the early type clutch using garter type springs (11A) to hold shoes to spider (10A). The early type clutch (inset) and late type clutch are interchangeable as an assembly. Clutch plate (10) or spider (10A) is threaded to crankshaft.

If clutch will not disengage (chain continues to turn) with engine at idle speed, check for broken, weak or improperly installed clutch springs. If clutch slips under load and engine continues to run at high speed, excessive wear of clutch shoes is indicated.

On early production model XL-12, clutch drum was equipped with an Oilite bushing. All later clutch drums, including service clutch drum for early XL-12, are fitted with caged needle roller bearings. When renewing early bushing type clutch drum, a new

needle bearing inner race must also be installed.

Renew needle roller bearing inner race if wear marks are visible. Renew bearing in clutch drum if any roller has flat spot or is damaged, or if worn to extent that two rollers can be separated the width equal to thickness of one roller. Using installer plug, press against lettered side of needle bearing cage when installing bearing.

Refer to Fig. HL47 for assembly of late type clutch.

TRANSMISSION. Gear drive models are equipped with a planetary gear drive as shown in exploded view in Fig. HL46.

To disassemble gear drive unit, drain oil from housing and remove screws (42); then, pull unit from housing (24). Hold drum (45) from turning by hand or in a three-jaw chuck and turn sun gear (31) in a clockwise direction with Homelite tool No. A-23696. Insert two ¼ x 2 inch dowel pins in carrier (33), hold chain sprocket in sprocket locking fixture (Homelite tool No. A-23792) and turn planet carrier in a counter-clockwise direction with pry-bar against the dowel pins.

Planet gears (35) and shafts (36) can be removed from carrier after removing snap rings (34).

Needle bearing (46) can be removed from blind hole in clutch drum with Snap-On puller A-78 or equivalent

tool. Press on lettered end of bearing cage with Homelite tool No. 23726-A or other suitable bearing tool to install new bearing in drum. Needle bearing (37) and seal (38) in planet gear carrier (33) can be pressed out using Homelite tool No. 23725-A; press new bearing in from threaded side of carrier with short end of tool No. 23725-A and press new seal in with lip towards needle bearing with Homelite tool No. 23726-A.

To remove ball bearing (29) and ring gear (28) from housing (24), heat finned area of housing until bearing can be removed by tapping housing against bench. Then, heat housing until ring gear can be removed. Always be sure to remove bearing first and install last with as little heat as possible.

Reassemble by reversing disassembly sequence using new gasket (39). Refill gear housing with SAE 90 gear oil.

AUTOMATIC CHAIN OILER PUMP. Refer to Fig. HL43 for exploded view of typical automatic oiler pump installation, and to Fig. HL44 for schematic view showing pump operation.

The automatic oiler pump is accessible after removing the clutch assembly from crankshaft and disconnecting oil lines. Pump plunger (67) and body (72) are available as a complete assembly only which includes flange (66), cam screw (68), gasket (69), "O" rings (70), sealing felt (71) and flange retaining screws; however, all parts except plunger and body are available separately.

Inspect tip of cam screw (68) and cam groove on plunger (67) for wear and plunger bore in body and piston portion of plunger for scoring or wear. Renew pump assembly if body and/or piston is worn or damaged beyond further use.

REWIND STARTER. Starter used on model XL-400 Automatic is shown in Fig. HL48. Early and late starters used on other models are shown in Figs. HL49 and HL50.

XL-400 AUTOMATIC. To disassemble the starter used on XL-400 Automatic, remove cover (1—Fig. HL48) screws, then allow cover to turn slowly until spring tension is released. Remainder of disassembly is evident with inspection of unit. Starter housing (18) must be removed for access to pawls (14). Care should be taken to prevent rewind spring from uncoiling uncontrolled.

Refer to Fig. HL50A to correctly install starter dogs on flywheel. Rewind spring on XL400 Automatic is wound in clockwise direction in cover (1—Fig. HL48). Wind rope on pulley so that pulley will engage inner hook of spring

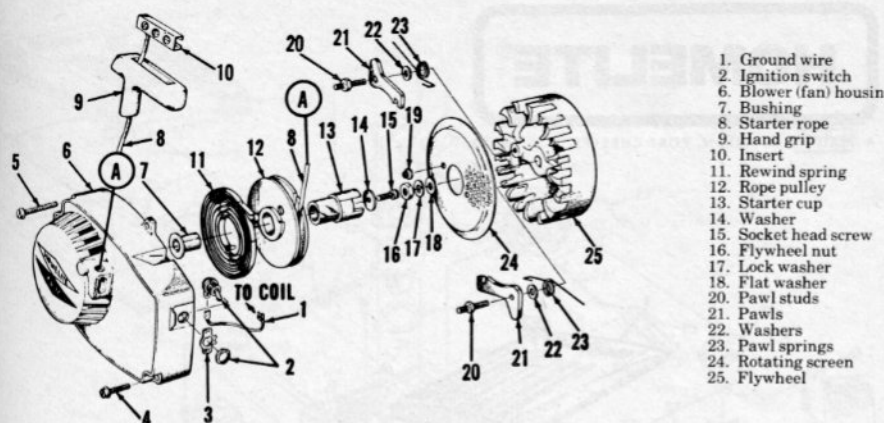


Fig. HL49—Exploded view of early rewind starter components and related parts. Starter unit is mounted on shaft (starter post) which is an integral part of the blower housing.

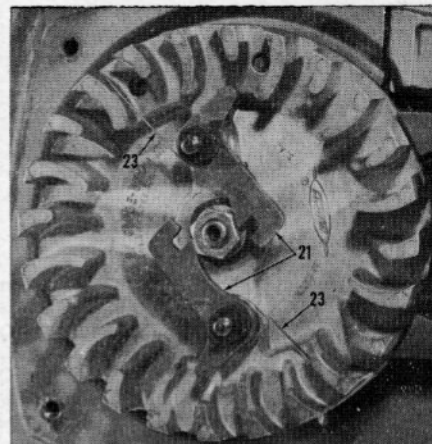


Fig. HL50A—When installing starter pawls (21), be sure that pawl return springs (23) are located in flywheel vanes so that they are parallel to the pawls as shown.

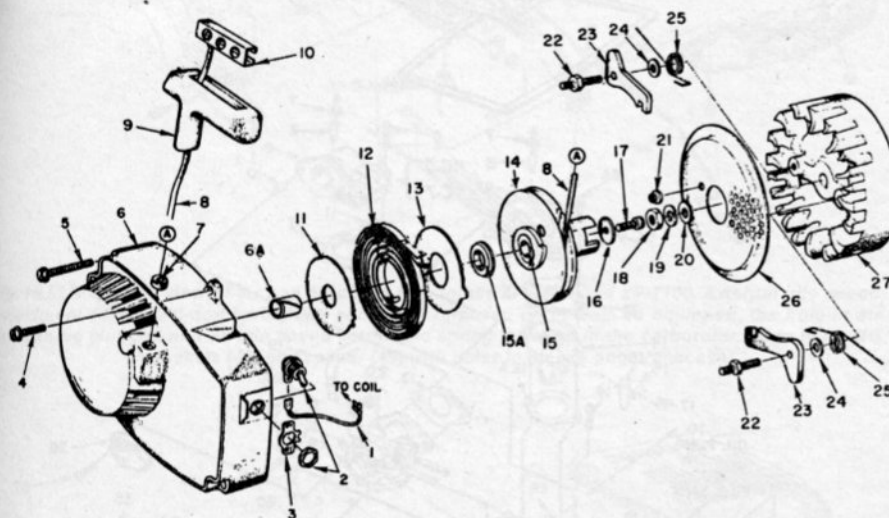


Fig. HL50—Exploded view of later production rewind starter except XL-400 Automatic.

be installed if post is broken loose, or on mid-range production models without starter post bushing, if post is worn so that pulley is not held in proper position. Renew flanged bushing on early production models if bushing is worn excessively and fan housing is serviceable. Renew rope bushing if worn.

To reassemble, proceed as follows: Do not lubricate starter spring, but apply light oil sparingly to starter post, bushing (if used) and bore of starter pulley. Place outer shield (if used) in fan housing, then install rewind spring with loop in outer end over spring post in fan housing and install inner spring shield (if used). Attach starter cord to pulley, insert rope through rope bore or bushing in fan housing and attach handle and insert to outer end of rope. Wind rope onto starter pulley. Place pulley and starter cup (with spring lock and spring lock bushing if integral pulley and lock are used) on starter post and be sure spring lock or pulley is properly engaged with rewind spring. Install retaining washer and hex head screw and tighten screw to a torque of 50 inch-pounds. Pull rope out about two feet and hold pulley from turning. Locate notch in pulley at cord insert in housing and pull up loop of cord between notch and housing. Holding onto pulley, wind cord three more turns onto pulley by turning pulley, then let spring rewind pulley until handle is pulled against fan housing.

when rope is pulled. Before installing cover (1) retaining screws, turn cover to pull rope handle against starter housing, then continue turning cover three turns to properly tension the rewind spring.

ALL OTHER MODELS. Early and late type starters are shown in Figs. HL49 and HL50. There were some models equipped with the early starter that used some of the components shown on the later starter. Service procedures for all of these starters are the same.

To disassemble starter, pull starter rope fully out, hold starter pulley from turning, pull all slack in rope out inner side of fan housing and allow pulley to unwind slowly until spring tension is relieved. Remove the slotted hex head screw retaining pulley to post and remove starter pulley and cup with flat retaining washer. Remove the rewind spring and, if so equipped, the spring shields, from fan housing. Remove rope from pulley and handle.

Starter pulley post in fan housing is not renewable; a new fan housing must

HOMELITE®

A **Textron** DIVISION, PORT CHESTER, N.Y. 10573

Chain Saw Model	Design Features
C-5	A,F,K,M,Q
C-51	A,F,K,M,Q
C-52	A,F,K,M,Q
C-7	B,F,K,M,Q
C-71	B,F,K,M,Q
C-72	B,F,K,M,Q
C-9	C,G,K,M,Q
C-91	C,J,K,M,Q
C-51G	A,F,K,N,P
C-71G	B,F,K,N,P
C-91G	C,J,K,N,P
XP-1000	D,G,K,L,Q
XP-1020	D,G,K,L,Q
XP-1020A	D,G,K,L,R
Super XP-1020	D,G,K,L,Q
Super XP-1020A	D,G,K,L,R
1050 Automatic	D,G,K,L,R
XP-1100	D,G,K,O,R
XP-1130A	D,G,K,O,R
Super XP-1130A	D,G,K,O,R
1130G	D,G,K,O,R
2000	E,H,K,L,R
2000E	E,H,K,L,R
2000P	E,H,K,L,R
Super 2000	E,H,K,L,R
2100	E,H,K,L,R
2100S	E,H,K,L,R
3100G	E,H,K,O,R

DESIGN FEATURES CODE

- A—Displacement, 4.7 cu. in.; bore, 2 in.; stroke, 1½ in.
- B—Displacement, 4.9 cu. in.; bore, 2 in.; stroke, 1 9/16 in.
- C—Displacement, 5.22 cu. in.; bore, 2 1/16 in.; stroke, 1½ in.
- D—Displacement, 6.1 cu. in.; bore, 2 3/16 in.; stroke, 1½ in.
- E—Displacement, 7.0 cu. in.; bore, 2¼ in.; stroke, 1¾ in.
- F—Flat reed type intake valve.
- G—Pyramid reed type intake valve, 4 reeds.
- H—Pyramid reed type intake valve, 6 reeds.
- J—Pyramid reed type intake valve, 4 reeds, prior to Serial No. 1854403, flat reed type intake valve on all later production.
- K—Conventional flywheel type magneto.
- L—Direct drive.
- M—Direct drive, convertible to planetary gear drive.
- N—Planetary gear drive transmission.
- O—Three gear transmission with optional ratios of 2:1 and 3:1.
- P—Manual chain oiler only.
- Q—Manual chain oiler, automatic oiler kit available for models with drilled oil channel in drive case.
- R—Automatic and manual chain oiler.

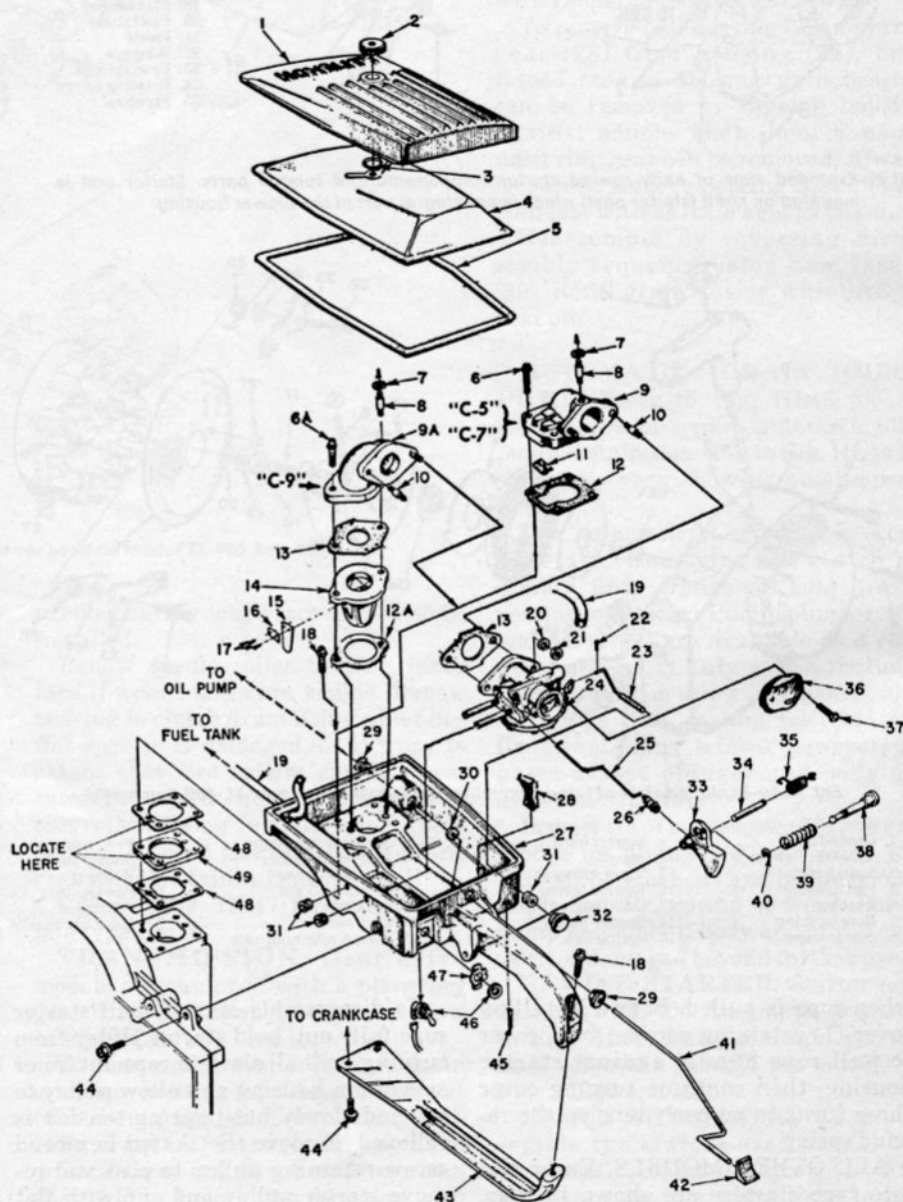


Fig. HL51—Exploded view of C-Series air box assembly (throttle handle) and related parts. Models C-5, C-51, C-51G, C-71 and C-71G have integral elbow (9) and reed valve unit. Models C-9, C-91 and C-91G are equipped with pyramid type reed valve assembly (14, 15, 16 & 17). Air deflector (36) is used on late production Models C-7 and C-9 and can be installed on earlier production C-7 and C-9 units if clearance in air box is adequate and by installing new oil pump rod (41). Nylon pump rod bushing (29) and stop (28) fit only late production air box (throttle handle). Filler block (11) is used with C-51, C-51G, C-71, C-71G and late production C-5 and C-7 elbow and reed valve assembly (9) only. Some models may have external idle speed adjusting screw (refer to 29—Fig. HL52).

- | | | | |
|------------------------|---------------------|-------------------------------|---------------------|
| 1. Air filter cover | 14. Reed seat (C-9) | 27. Air box (throttle handle) | 35. Throttle spring |
| 4. Filter element | 15. Valve reeds (4) | 28. Stop | 36. Air deflector |
| 5. Gasket | 16. Reed plates (4) | 29. Nylon bushing | 38. Throttle detent |
| 9. Elbow & Valve assy. | 17. Screws (8) | 30. Felt washer | 39. Spring |
| 9A. Elbow | 19. Fuel line | 31. Grommets | 41. Pump rod |
| 11. Filler block | 23. Choke rod | 32. Choke button | 46. Ignition switch |
| 12. Gasket (C-5 & C-7) | 24. Carburetor | 33. Throttle trigger | 48. Gaskets |
| 12A. Gasket (C-9) | 25. Throttle rod | | 49. Spacer |
| 13. Gasket | 26. Grommet | | |

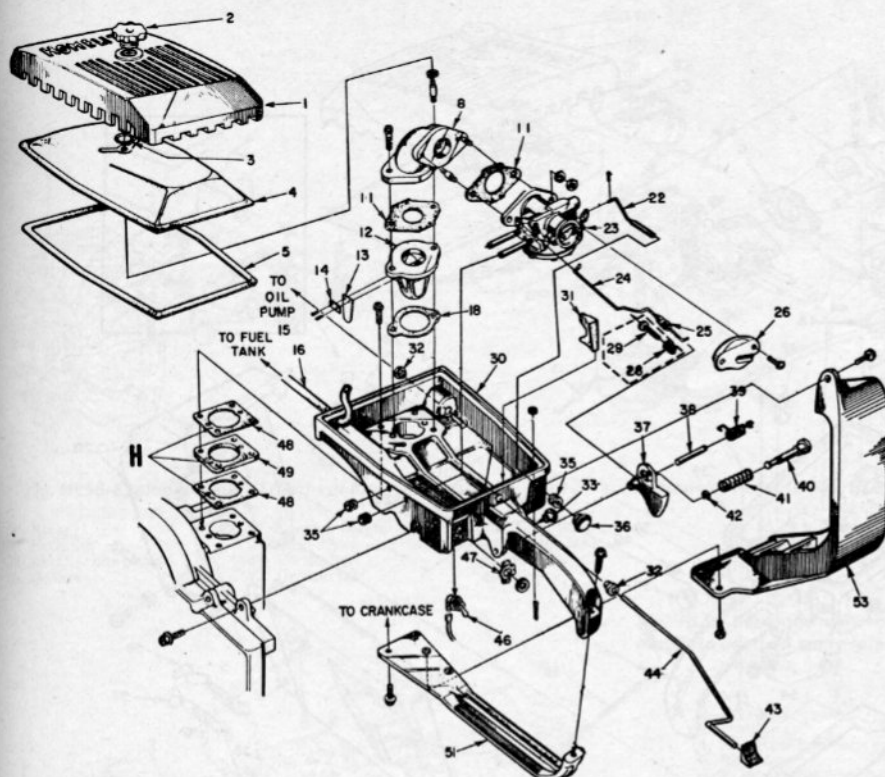


Fig. HL52—Exploded view of air box assembly for models XP-1000 and XP-1100. External idle speed adjustment screw (29) and spring (28) should be removed on models so equipped, the hole in air box can be plugged and an idle speed screw and spring installed in the carburetor. Align holes (H) in gaskets (48) and spacer (49) with holes in air box and crankcase.

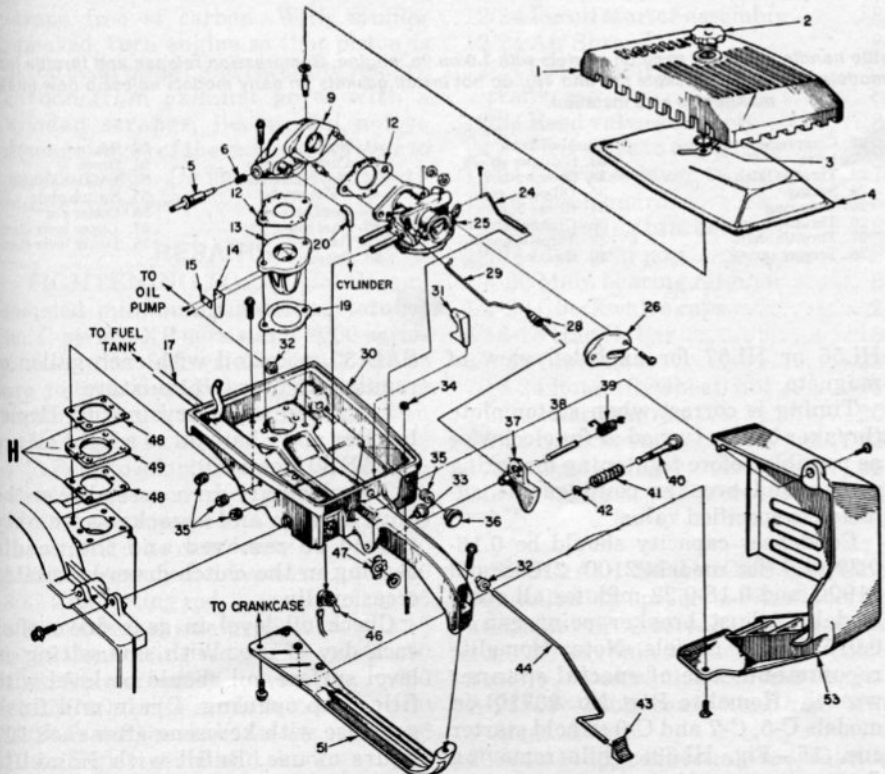


Fig. HL53—Exploded view of air box assembly for models with 6.1 cu. in. engine except XP-1000 and XP-1100. Note idle air (speed) adjusting screw (5) in elbow (intake manifold) (9). Tube (20) is connected between intake manifold and cylinder transfer port. Align holes (H) in gaskets (48) and spacer (49) with holes in air box and crankcase as shown. Air filter element (4) has integral air box sealing gasket.

- | | |
|----------------------|------------------------------|
| 1. Cover | 31. Stop |
| 2. Knob | 32. Grommet |
| 3. Retainer | 33. Bushing |
| 4. Filter | 35. Grommets |
| 5. Gasket | 36. Choke button |
| 8. Elbow | 37. Throttle trigger |
| 11. Gaskets | 38. Pivot pin |
| 12. Reed valve seat | 39. Return spring |
| 13. Reed valves | 40. Throttle latch pin |
| 14. Retainer | 41. Spring |
| 16. Fuel tube | 42. Snap ring |
| 18. Gasket | 43. Oiler button |
| 22. Choke rod | 44. Oiler rod |
| 23. Carburetor | 46. Ignition switch |
| 24. Throttle rod | 47. On-off plate |
| 25. Grommet | 48. Gaskets |
| 26. Air deflector | 49. Spacer |
| 28. Spring | 51. Brace |
| 29. Idle speed screw | 53. Muffler shield (XP-1100) |
| 30. Air box | |

MAINTENANCE

SPARK PLUG. Recommended

Champion spark plug is as follows:

Saw Model	Plug Type
All C-Series	J-6J
XP-1000, XP-1100	UJ-11G
XP-1020 Series, 1050 Auto	CJ-6
XP-1130 Series, 1130G	CJ-6
2000 Series	UCJ-7G
2100	UCJ-7G
2100S, 3100G	CJ6

Recommended spark plug electrode gap is 0.025.

CARBURETOR. All models are equipped with a Tillotson model HL diaphragm carburetor. Carburetor model number is stamped on carburetor mounting flange. Refer to Tillotson section of SERVICE FUNDAMENTALS section for carburetor overhaul and exploded view.

Initial carburetor adjustment for all C series saws is $\frac{1}{2}$ turns open for idle and high speed mixture screws. Initial adjustment for all other models is one turn open for idle and high speed adjustment screws. Note that idle speed on models XP-1020, XP-1020 Automatic, XP-1130, 1050 Automatic, and 1130G is adjusted by turning air screw (5—Fig. HL53) in intake manifold. Turning screw clockwise will increase idle speed while turning screw counter-clockwise will decrease idle speed. Initial setting is $\frac{3}{4}$ turn open. Make final adjustments with engine at running temperature. Adjust high speed screw to obtain optimum performance with engine under cutting load.

- | | |
|---------------------|------------------------|
| H. Holes | 31. Stop |
| 1. Cover | 32. Grommet |
| 2. Cover knob | 33. Bushing |
| 3. Retainer | 34. Felt |
| 4. Air filter | 35. Grommets |
| 5. Idle air screw | 36. Choke button |
| 6. Spring | 37. Throttle trigger |
| 9. Intake manifold | 38. Pivot pin |
| 12. Gaskets | 39. Return spring |
| 13. Reed valve seat | 40. Throttle latch pin |
| 14. Reed valves | 41. Spring |
| 15. Retainers | 42. Snap ring |
| 19. Gasket | 43. Oiler button |
| 20. Idle air tube | 44. Oiler rod |
| 24. Choke rod | 46. Ignition switch |
| 25. Carburetor | 47. On-off plate |
| 26. Air deflector | 48. Gaskets |
| 28. Grommet | 49. Spacer |
| 29. Throttle rod | 51. Brace |
| 30. Air box | 53. Muffler shield |

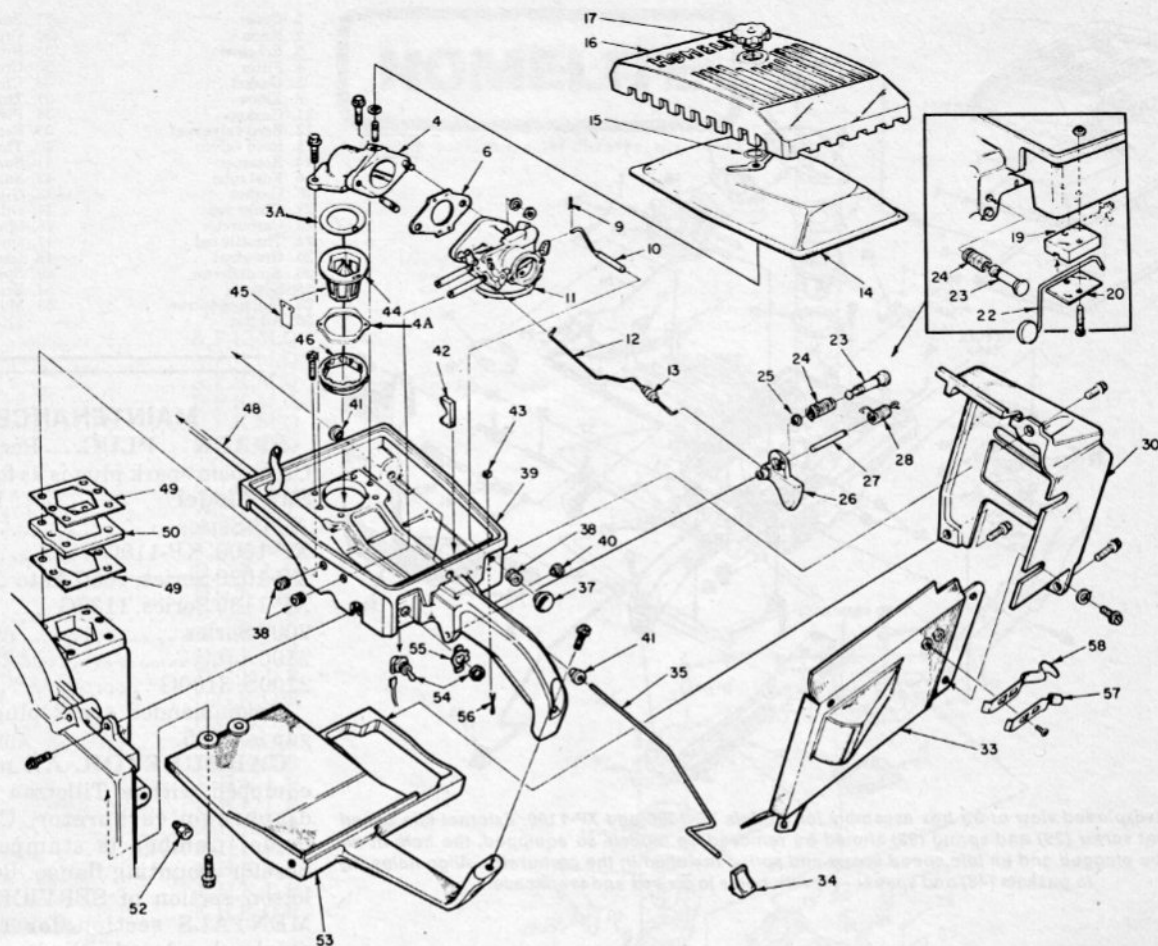


Fig. HL54—Exploded view of typical air box and throttle handle assembly used on models with 7.0 cu. in. engine. Compression release and throttle lock mechanism is shown in inset at upper right. Early models did not use gaskets (3A and 4A); do not install gaskets on early models unless a new intake manifold is also installed.

- | | | | | | |
|--------------------|------------------------|-------------------------------|---------------------|---------------------|-----------------------|
| 3A. Gasket | 12. Throttle rod | 22. Compression release lever | 30. Muffler shield | 41. Bushing | 52. Spacer |
| 4. Intake manifold | 13. Boot | 23. Throttle latch pin | 33. Cylinder shield | 42. Pump rod stop | 53. Brace |
| 4A. Gasket | 14. Air filter element | 24. Spring | 34. Oiler button | 44. Reed valve seat | 54. Ignition switch |
| 6. Gasket | 15. Snap ring | 25. Snap ring | 35. Oil pump rod | 45. Valve reeds | 55. Switch plate |
| 9. Cotter pin | 16. Air filter cover | 26. Throttle trigger | 37. Choke button | 46. Reed retainer | 56. Cotter pin |
| 10. Choke rod | 17. Cover nut | 27. Throttle shaft | 38. Grommet | 48. Fuel line | 57. Upper lever clamp |
| 11. Carburetor | 19. Lever guide | 28. Trigger spring | 39. Throttle handle | 49. Gasket | 58. Lower lever clamp |
| | 20. Guide plate | | 40. Bushing | 50. Spacer | |

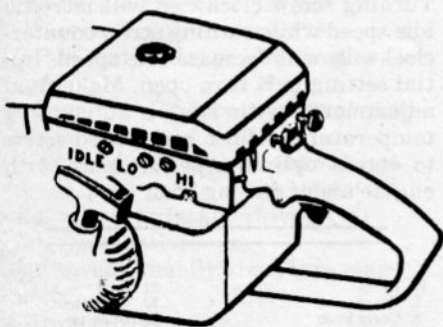


Fig. HL55—View showing carburetor adjustment points for models XP-1020, XP-1020 Automatic, 1050 Automatic, XP-1130 and 1130G. Refer to exploded view in Fig. HL53 for view showing idle adjusting screw (5), spring (6) and intake manifold (9).

MAGNETO AND TIMING. All saws are equipped with a conventional flywheel type magneto. Refer to Fig.

HL56 or HL57 for exploded view of magneto.

Timing is correct when stator plate (breaker box) is turned as far clockwise as possible before tightening mounting screws and breaker point gap is adjusted to specified value.

Condenser capacity should be 0.16-0.20 mfd. for models 2100, 2100S and 3100G and 0.18-0.22 mfd. for all other models. Adjust breaker point gap to 0.015 for all models. Note: Homelite recommends use of special spanner wrench (Homelite Part No. 23710) on models C-5, C-7 and C-9 to hold starter cup (15—Fig. HL69) while removing flywheel nut to gain access to magneto.

LUBRICATION. Engine is lubricated by mixing oil with fuel. Mix thoroughly in a separate container ½-pint of Homelite motor oil or good grade

SAE 30 motor oil with each gallon of regular gasoline (16:1 mixture).

Fill chain oil reservoir with Homelite Bar and Chain oil or a light oil (up to SAE 30 motor oil).

The planetary drive assembly or the clutch drum and sprocket assembly should be removed and the needle bearing in the clutch drum lubricated occasionally.

Check oil level in gear drive after each day of use. With saw setting on level surface, oil should be level with filler cap opening. Drain and flush gearcase with kerosene after each 100 hours of use. Refill with Homelite 55291-C gear oil.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and

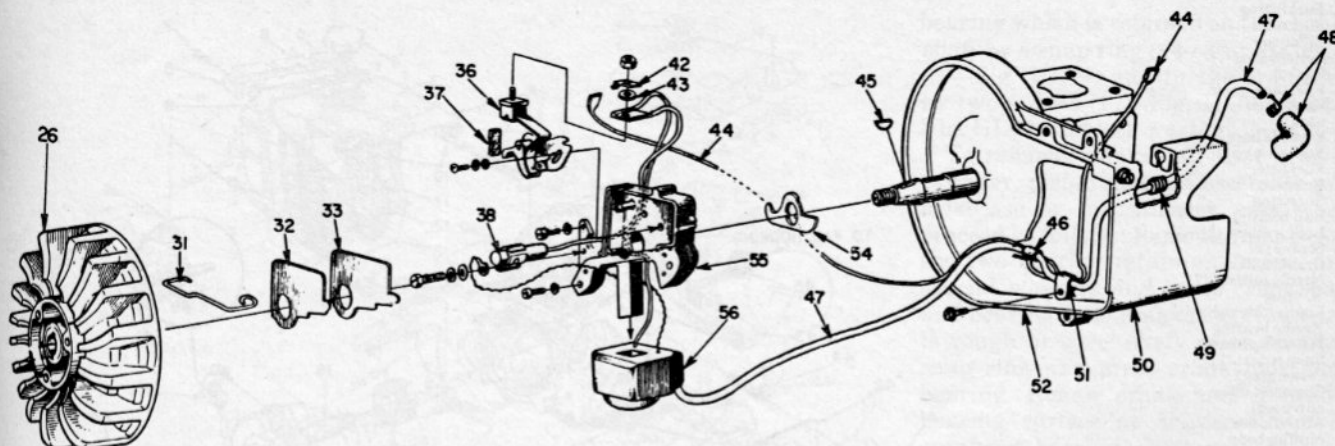


Fig. HL56—Exploded view of flywheel magneto assembly used on some models. Refer to Fig. HL57 for magneto which is also used on some models.

26. Rotor
31. Retainer
32. Breaker box cover
33. Gasket

36. Breaker points
37. Cam wiper
38. Condenser
42. Ground tab

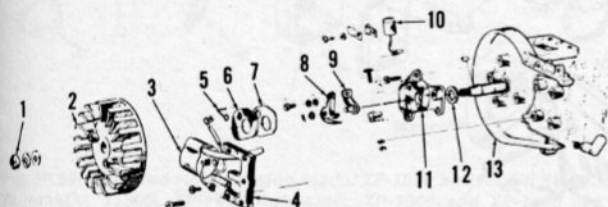
43. Terminal washer
44. Switch lead
45. Rotor key
46. Sleeve

47. Spark plug wire
48. Terminal
49. Grommet

50. Cylinder shield
51. Clamp
52. Crankcase

54. Seal
55. Breaker box & core
56. Ignition coil

Fig. HL57—Exploded view of magneto used on some later models.



1. Nut
2. Flywheel
3. Ignition coil
4. Armature laminations
5. Retainer
6. Breaker box cover
7. Gasket
8. Moveable breaker point
9. Fixed breaker point
10. Condenser
11. Stator plate
12. Seal
13. Crankcase

scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage edges of the exhaust ports or to scratch piston. Do not run engine with muffler removed.

REPAIRS

TIGHTENING TORQUES. Recommended minimum tightening torques for C-series, XP-series and 2000-series saws are as follows: Note: All values are in inch-pounds; to find maximum tightening torque, add 20% to given values.

4/40 Reed to adapter	5
4/40 Flange bearing, oil pump	5
#6 Oil reservoir cover	25
Automatic oiler cam screw	70
8/32 Oiler pump to drive-case	40
8/32 Connecting rod	55
8/32 Condenser screw	15
10/32 Connecting rod	70
10/32 Starter pulley	50
10/32 Carburetor air deflector	50
10/24 Stator to crankcase	40
10/24 High tension lead clamp	25
10/24 Cylinder shield	50
12/24 Fuel tank	80
12/24 Muffler cap	50
12/24 Muffler to cylinder	60
12/24 Pistol grip bracket	80

12/24 Recoil starter assembly	80
12/24 Air Shroud	80
12/24 Carburetor chamber to crankcase	80
12/24 Reed valve assembly	80
12/24 Drivecase to crankcase	80
12/24 Gearcase cover	70
12/24 Chain guard	80
12/24 Mounting bracket	80
12/24 Idler gear post	80
1/4-20 Main bearing retainer	80
1/4-28 Check valve caps	25
5/16-18 Handle bar	180
3/8-24 Clutch nut	250
7/16-24 Rotor (flywheel) nut	250
1/2-20 Idler gear nut	200
1/2-20 Sprocket nut	250
14mm Spark plug	250
Clutch spider	180

SPECIAL SERVICES TOOLS.

The following special service tools are available for C-series, XP-series and 2000-series chain saws.

Tool No.	Description & Model Usage
A-23809	Plug connecting rod bearing, C-series.
23874	Plug, connecting rod bearing, XP-series, 1050, 1130G.
24206-1	Plug, connecting rod bearing, 2000, 2100, 2100S.
22828	Pliers, piston pin snap ring, all models.

23234—Remover, piston pin, early C-series.

A-23950—Remover, piston pin W/Spirol pin, XP-series.

A-23951—Remover, piston pin W/Spirol pin, early C-series.

AA-22560—Remover, rotor, C-series, early XP.

A-24028—Remover, rotor, late XP-series, 1050, 1130G, 2000.

A-23762—Jackscrew, ball main bearing, all models.

23136—Body for A-23762.

22820-2—Bearing collar for A-23762.

23670—Aligning plate, crankshaft, C-series, XP-series, 1050, 1130G.

24207-1—Aligning plate, crankshaft, 2000, 2100, 2100S, 3100G.

A-23858—Fixture, drivecase, 2000, 2100, 2100S.

23373-4—Bearing collar, 2000, 2100, 2100S, 3100G.

23382—Crankshaft spacer, 2000, 2100, 2100S, 3100G.

24210-1—Collar, 2000, 2100, 2100S.

23233-1—Plug, crankcase seal, all models.

23671—Plug, drivecase seal, all models.

23693—Sleeve, drivecase seal, C & XP-series, 1050, 1130G, 3100G.

23876—Plug, drivecase bearing, C-series & XP-1020, 1050.

23391-2—Plug, drivecase bearing, C-series.

23391-3—Plug, drivecase bearing, XP-1130, 1130G.

23384—Plug, drivecase seal, 2000, 2100, 2100S, 3100G.

23390—Sleeve, crankshaft assembling, 2000, 2100, 2100S.

A-24138—Reamer, compression release valve seat 2000, 2100, 2100S, 3100G.

23420—Plug, clutch drum bearing, XP-1020 Automatic, XP-1130, 1050.

2. Fuel fitting
3. Fuel tank
4. Filler cap
5. Relief valve
6. Gasket
8. Fuel tank cover
9. Gasket (no longer used)
10. Flexible hose
11. Fuel pick-up
12. Fuel filter
13. Bumpers
14. Snap ring
15. Ball bearing
16. Lock washers (2)
17. Screws (2)
18. Crankshaft
19. Needle rollers (27)
20. "O" ring
21. Connecting rod
22. Needle bearing
24. Piston & pin assy.
25. Snap rings (2)
26. Piston rings
27. Grommet (Sleeve now used)
28. Air deflector
29. Muffler body
31. Baffle
32. Muffler cap
35. Spark plug
41. Cylinder
42. Gasket
43. Crankcase
45. Seal

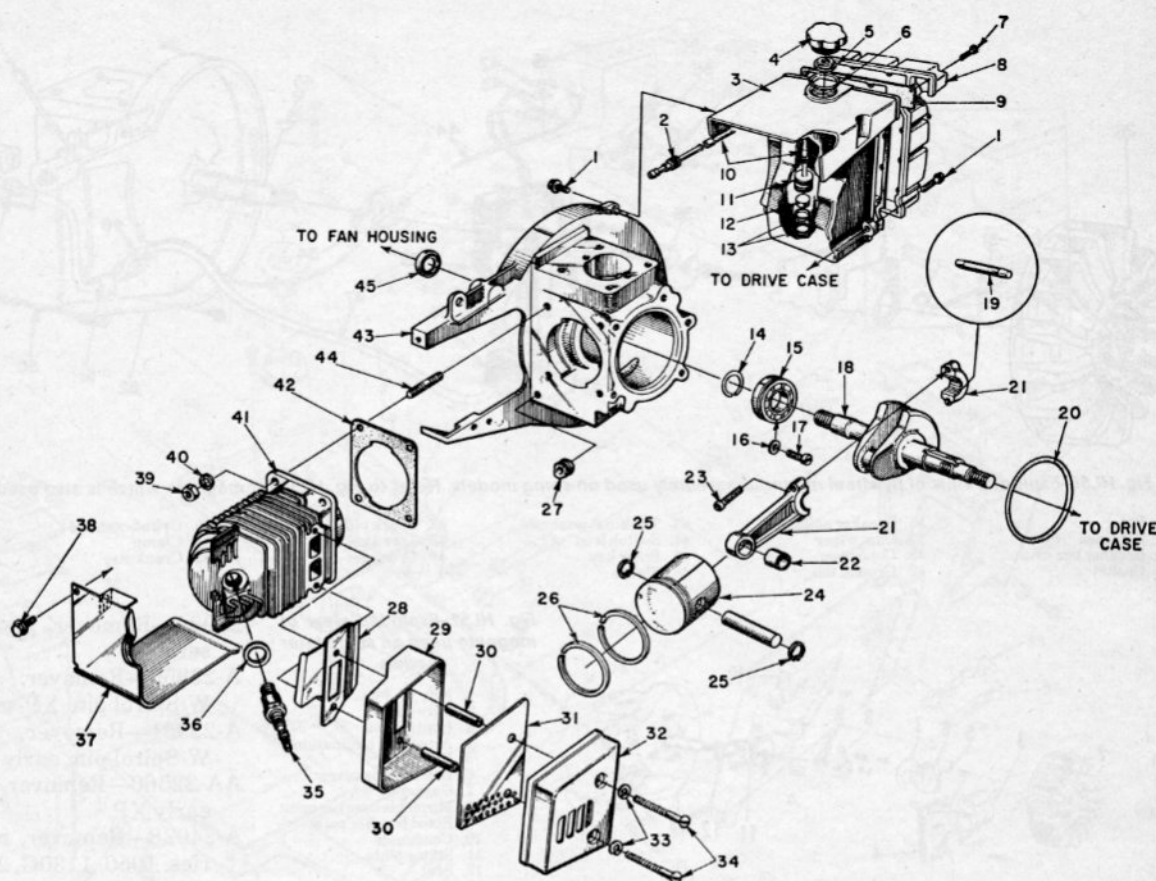


Fig. HL58—Exploded view of model C-7 powerhead and fuel tank. Other C series saws are similar. Gasket (9) is no longer used. Homelite cement No. 22788 is used in place of gasket to seal between tank and cover.

- 23139—Plug, clutch drum bearing, C-series, XP-1020, 2100, 2100S, 3100G.
- A-23137—Jackscrew, clutch, 2000, 2100, 2100S, 3100G.
- A-23696—Remover, spider, sun gear, all models.
- 23678—Tool, starter bearing, C-series, early XP.
- A-23679—Remover, starter bearing, C-series, early XP.
- A-23713—Sprocket holder, C-series.
- 23725A—Plug, planetary bearing, C-series.
- 23726A—Plug, planetary drum, C-series.
- 23913—Plug, ball bearing & seal, XP-1130 trans., 1130G, 3100G.
- 22750—Sprocket locking tool, XP-1130, 1130G, 3100G.
- 23228—Plug, sprocket shaft bearing, XP-1130, 1130G, 3100G.
- A-78—Clutch drum bearing puller, C-series (Snap-On Tool).
- 23528—Wrench, conn. rod screw, 1050, 1130G, 2100S, 2100, 3100G.
- A-23960—Puller, magneto, 2100, 2100S, 3100G.
- 24397-1—Plug, conn. rod bearing, 3100G.

CONNECTING ROD. Connecting rod and piston assembly can be re-

moved from crankpin after removing cylinder from crankcase. Be careful to remove all the loose needle rollers from crankcase.

The C model saws are equipped with 27 rollers whereas the XP models and models 1050 Auto and 1130G have 31 rollers. 2000 models and models 2100, 2100S and 3100G have 26 rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. Latest connecting rods are 1/16-inch wider than early rods (at piston pin end). The caged needle roller piston bearing can be renewed by pressing old bearing out of rod and pressing new bearing in. Press on lettered side of bearing cage during installation. Recommended Homelite tools are listed in SPECIAL TOOLS section.

Renew the crankpin needle rollers as a set if any roller has flat spots, or is scored or worn. New needle rollers are serviced in a strip; wrap the strip around crankpin. If reusing needle rollers, use beeswax or light grease to stick rollers to rod and cap. Install piston and rod assembly with ring retaining pin in piston away from exhaust port side of cylinder. Be sure that match marks on rod and cap are aligned and

secure rod to cap with new socket head screws.

PISTON, PIN AND RINGS. On model Super 2000 and model 2100, piston is fitted with a pinned head land type piston ring; on all other models, piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.004.

On 2-ring pistons, recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003. Ring end gap on head land ring should be 0.012-0.022; ring side clearance in groove should be 0.001-0.004.

Several different methods of retaining piston pin have been used; pin may be retained by two Waldes Truarc snap rings, by a non-removable Spirol pin at exhaust side and a Waldes Truarc snap ring at intake side, by two Rulon plastic plugs that snap into pin bore, or by a wire section snap ring at exhaust side and a Waldes Truarc snap ring at intake side of piston.

On all pistons with Truarc snap ring, remove snap ring from intake side using special pliers (Homelite tool No.

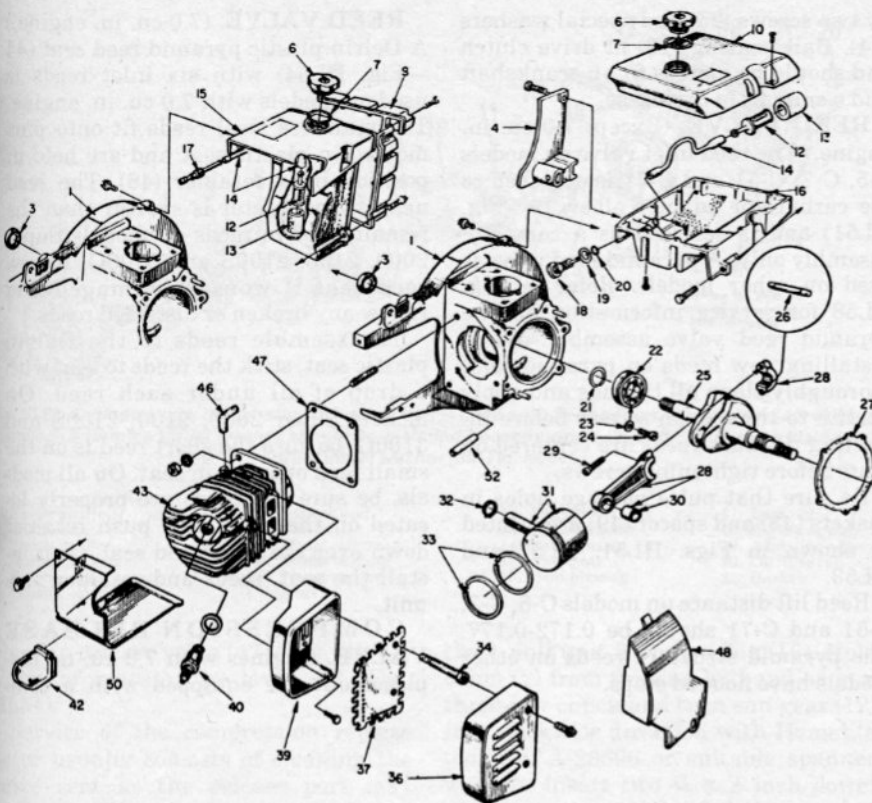


Fig. HL59—Exploded view showing model XP-1020 and model XP-1130 engine assembly. Models 1050 Automatic, 1130G, XP-1020 Automatic, XP-1000 and XP-1100 are similar. View shows fuel tank construction for both the direct and gear drive models.

- | | | | |
|--------------------|-------------------------|--------------------|-----------------------------------|
| 1. Crankcase | 16. Fuel tank | 27. Gasket | 39. Muffler body |
| 3. Crankshaft seal | 17. Fitting | 28. Connecting rod | 40. Spark plug |
| 4. Handle brace | 18. Fitting | 29. Screws | 42. Spark plug cap |
| 6. Filler cap | 19. Gasket | 30. Needle bearing | 43. Cylinder |
| 7. "O" ring | 20. "O" ring | 31. Piston & pin | 46. Idle tube (see 20—Fig. HL51D) |
| 9. Tank cover | 21. Snap ring | 32. Snap ring | 47. Gasket |
| 10. Tank cover | 22. Ball bearing | 33. Piston rings | 48. Heat exchanger (optional) |
| 12. Fuel pickup | 23. Lock washers (2) | 34. Muffler studs | 50. Cylinder shield |
| 13. Filter | 24. Screws (2) | 36. Muffler cap | |
| 14. Flex hose | 25. Crankshaft | 37. Baffle | |
| 15. Fuel tank | 26. Needle rollers (31) | | |

22828), then push pin out towards intake side. On models with snap ring at exhaust side, push pin out with a plain rod inserted through the snap ring. On models with Spirol pin, use slotted remover (Homelite tool No. A-23950). On models with Rulon plugs, pry plugs out, then remove piston pin.

When reassembling piston to connecting rod on models with Rulon plugs, install piston pin, then snap plugs into pin bore at each end of pin. Be sure pin and plugs are centered in piston.

When reassembling piston to connecting rod using snap rings or snap ring and Spirol pin, be sure closed end of pin is towards exhaust side of piston (away from piston ring locating pin or towards the Spirol or wire section retaining ring). Be sure the Waldes Truarc snap ring, or rings are installed with sharp edge out and turn end gap of ring towards closed end of piston.

CRANKSHAFT, MAIN BEARINGS AND SEALS. Except on 7.0 cu. in. engines, the crankshaft is supported

in a caged needle roller bearing at drivecase end of shaft and a ball bearing at flywheel end. End play of the crankshaft is controlled by the ball

- | |
|-------------------------------|
| 1. Crankcase |
| 2. Dowel pins |
| 3. Cylinder studs |
| 4. Crankshaft seal |
| 17. Gasket |
| 18. Ball bearing |
| 19. Needle rollers |
| 20. Crankshaft |
| 21. Woodruff key |
| 22. Ball bearing |
| 23. Snap ring |
| 24. Special washers |
| 25. Bearing screws |
| 26. Connecting rod |
| 27. Needle bearing |
| 28. Rod cap screws |
| 29. Snap ring |
| 30. Head land ring |
| 31. Muffler cover |
| 32. Spark arrester |
| 33. Muffler baffle |
| 34. Self-locking nut |
| 35. Cylinder |
| 36. Compression release valve |
| 37. Spring post |
| 38. Spring |
| 39. Cylinder gasket |

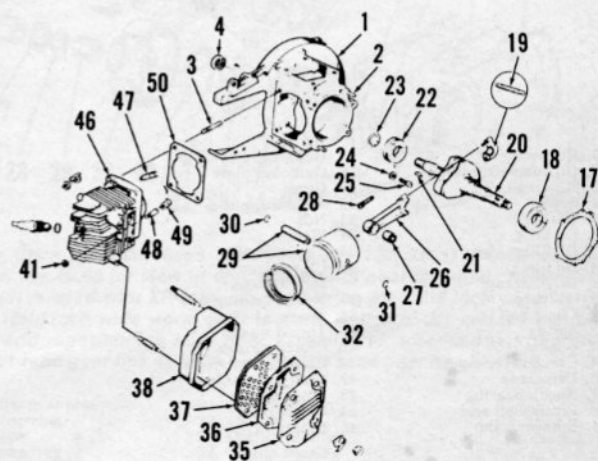


Fig. HL60—Exploded view of powerhead used on Super 2000 saw. Other 2000, 2100 and 3100 series models are similar. Some models use two conventional piston rings instead of head land type ring shown. Be sure piston and rings are of same type.

bearing which is retained on the crankshaft by a snap ring (14—Fig. HL58, or 21—Fig. HL59) and in the crankcase by two screws (17—Fig. HL58 or 24—Fig. HL59) and lock washers.

To remove crankshaft, first remove cylinder, piston and rod assembly and drivecase or transmission case, then proceed as follows: Remove and discard the two bearing retaining screws and special washers and press crankshaft and bearing from crankcase. If bearing is rough or excessively worn, remove snap ring and press crankshaft from bearing. Renew crankshaft if needle bearing surface at drivecase end or crankpin bearing surface is burned, scored or excessively worn. Also, inspect keyways and threads for damage.

Install new seal with lip to inside of crankcase. Press bearing onto crankshaft and secure with snap ring. Apply heat to bearing seat in crankcase, taking care not to damage seal, until the crankshaft with main bearing can be pushed into the crankcase. Do not press bearing into crankcase. Install new bearing retaining screws and special washers.

Renew needle bearing (all models except 2000 series) in drivecase, if necessary, by removing seal (18—Fig. HL62 or 1—Fig. HL64) and pressing bearings from casting. Press new bearing into case and install new seal with lip on inside. Place large "O" ring, or gasket on the drivecase, place seal protector (or tape) over keyways, threads and shoulder; and install drive case on crankshaft and crankcase. Tighten the retaining screws alternately.

On 7.0 cu. in. engines, both ends of crankshaft are supported in ball bearings. Ball bearing (22—Fig. HL60) at magneto side is retained in crankcase

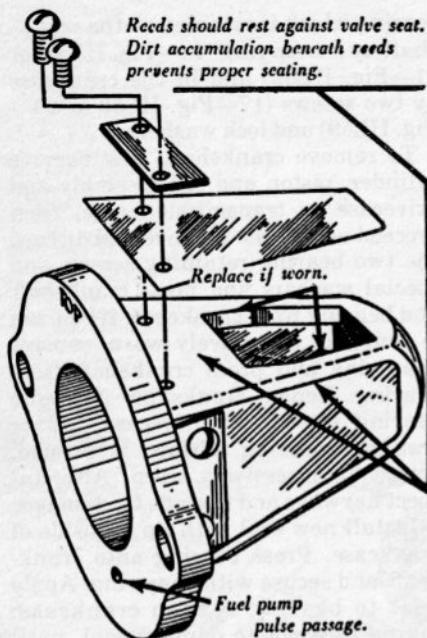


Fig. HL61—Pyramid type reed valve, showing proper installation for models with metal reed seat.

by two screws (25) and special washers (24). Ball bearing (18) at drive clutch end should be a press fit on crankshaft and a snug fit in drivecase.

REED VALVE. (Except 7.0 cu. in. engine.) The reed inlet valve on models C-5, C-7, C-51 and C-71 is attached to the carburetor adapter elbow (9—Fig. HL51) and is serviced as a complete assembly only. A pyramid reed valve is used on other models. Refer to Fig. HL58 for service information on the pyramid reed valve assembly. When installing new reeds on pyramid seat, thoroughly clean all threads and apply Loctite to threads on screws before installing. Be sure reeds are centered on seats before tightening screws.

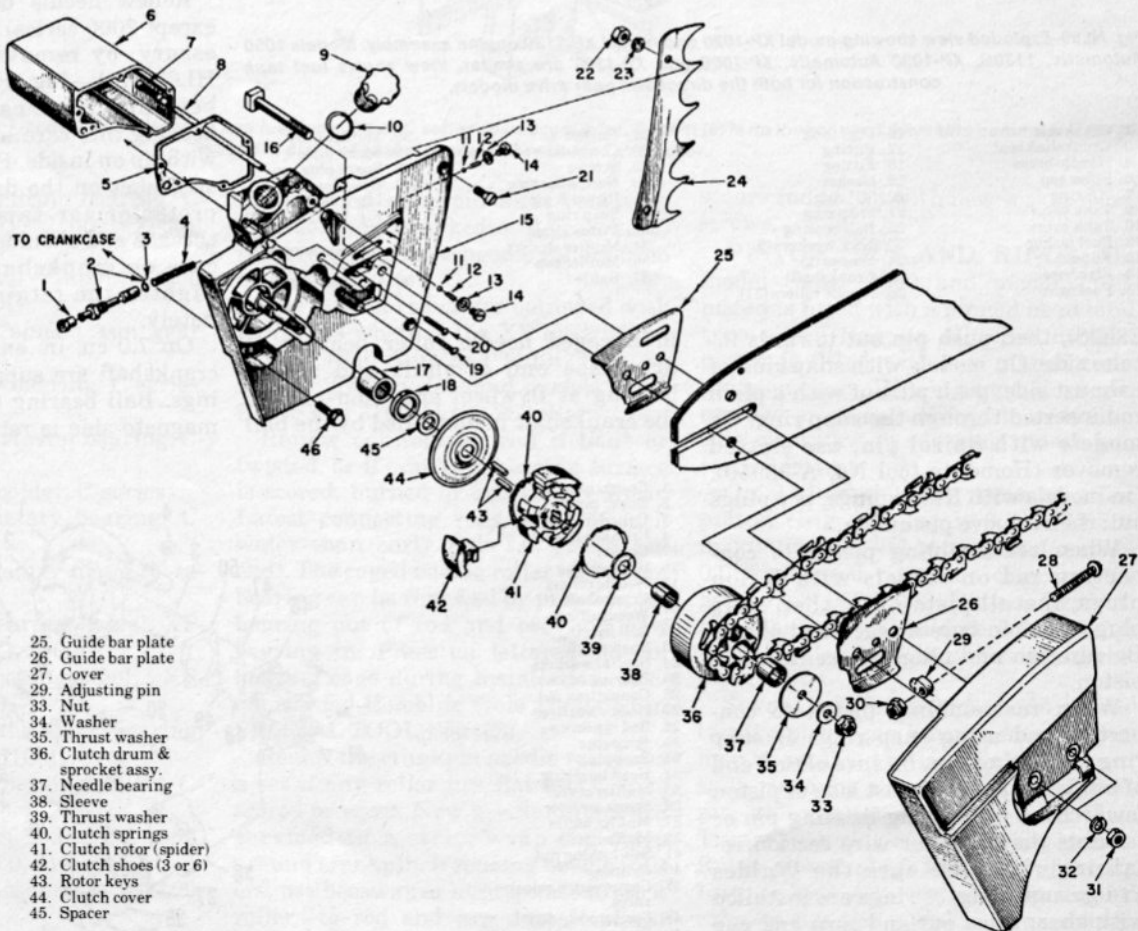
Be sure that pulse passage holes in gaskets (48) and spacer (49) are located as shown in Figs. HL51, HL52 and HL53.

Reed lift distance on models C-5, C-7, C-51 and C-71 should be 0.172-0.177. The pyramid structure reeds on other models have no reed stops.

REED VALVE. (7.0 cu. in. engine.) A Delrin plastic pyramid reed seat (44—Fig. HL54) with six inlet reeds is used on models with 7.0 cu. in. engine. The stainless steel reeds fit onto pins molded in plastic seat and are held in position by a retainer (46). The reed nearest carburetor is shorter than the remaining five reeds on models Super 2000, 2100, 2100S and 3100G. Renew reed seat if worn or damaged and renew any broken or distorted reeds.

To assemble reeds to the Delrin plastic seat, stick the reeds to seat with a drop of oil under each reed. On models Super 2000, 2100, 2100S and 3100G, be sure the short reed is on the small reed opening in seat. On all models, be sure the reeds are properly located on the pins, then push retainer down over the reeds and seat, then install the seat, reeds and retainer as a unit.

COMPRESSION RELEASE VALVE. Engines with 7.0 cu. in. displacement are equipped with a com-



- | | |
|---------------------|----------------------------------|
| 1. Connector | 25. Guide bar plate |
| 2. Oil pump plunger | 26. Guide bar plate |
| 3. "O" ring | 27. Cover |
| 4. Spring | 29. Adjusting pin |
| 5. Gasket | 33. Nut |
| 6. Oil tank | 34. Washer |
| 7. Oil filter | 35. Thrust washer |
| 8. Oil line | 36. Clutch drum & sprocket assy. |
| 9. Oil filler cap | 37. Needle bearing |
| 10. "O" ring | 38. Sleeve |
| 11. Check ball | 39. Thrust washer |
| 12. Spring | 40. Clutch springs |
| 13. Gasket | 41. Clutch rotor (spider) |
| 14. Check valve cap | 42. Clutch shoes (3 or 6) |
| 15. Drive case | 43. Rotor keys |
| 17. Needle bearing | 44. Clutch cover |
| 18. Crankshaft seal | 45. Spacer |
| 24. Bumper spike | |

Fig. HL62—Exploded view of direct drive clutch of model C-5 and related parts. Same clutch rotor (spider) and shoe assembly (40, 41 & 42) are used with planetary gear drive shown in Fig. HL63. Rotor is threaded to crankshaft on C-7, C-9 and late production C-5 saws; keys (43) are not used on models with threaded spider. Spacer (45) is used on early production C-5 saws only. Six clutch shoes (42) are used on C-9, C-91 and late production model C-7; three shoes are used on C-5, C-51 and early production C-7. Six clutch shoes are required on all models with planetary gear drive.

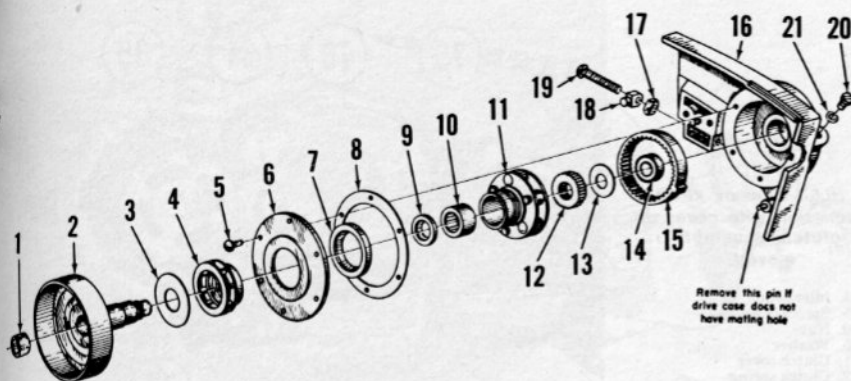


Fig. HL63—Exploded view of planetary drive unit that is used on C Series saws. When planetary drive is installed, a formica thrust washer should be installed between drum (2) and clutch rotor instead of steel thrust washer (39—Fig. HL62).

- | | | | |
|-------------------------|----------------------------|-------------------|---------------------|
| 1. Needle bearing | 7. Gearlock seal | 12. Sun gear | 17. Lock nut |
| 2. Clutch drum | 8. Gasket | 13. Thrust washer | 18. Adjusting pin |
| 3. Thrust washer | 9. Planet carrier seal | 14. Ball bearing | 19. Adjusting screw |
| 4. Chain sprocket | 10. Needle bearing | 15. Ring gear | 20. Oil filler cap |
| 5. Housing cover screws | 11. Planet carrier & gears | 16. Gear housing | 21. Gasket |
| 6. Housing cover | | | |

pression release valve (47—Fig. HL60). Valve is operated by lever (22—Fig. HL54).

Service of the compression release valve usually consists of cleaning the valve seat as the release port may gradually fill with carbon while engine is running with compression release valve open. A special service tool (Homelite tool No. A-24138) can be used to ream carbon from the valve seat and bore.

CLUTCH. All models are equipped with a dry shoe type clutch. Models C-5 and C-51 and early production model C-7 use three clutch shoes; all other models use six clutch shoes.

The clutch rotor (spider) on early production C-5 saws is keyed to the crankshaft, and has a spacer between the rotor and shoulder on crankshaft. Service rotor will be threaded; discard the keys but retain spacer when installing new type threaded rotor. Late production model C-5 saws and all other saws will have threaded rotor, but are not fitted with a spacer between rotor and shoulder on crankshaft.

To remove clutch on early model C-5 saw, pull the rotor from the crankshaft. On all other models hold crankshaft from turning and turn clutch rotor in a clockwise direction. If Homelite tools are not available, suitable spanner wrenches may be used.

TRANSMISSION (C SERIES). A planetary gear transmission is used on models C-52G, C-71G and C-91G and a planetary drive kit is available to convert C Series direct drive saws to gear drive. Refer to exploded view in Fig. HL63.

To disassemble gear drive unit, drain oil from housing and remove screws (5);

then, pull unit from housing (16). Hold drum (2) from turning by hand or in a three-jaw chuck and turn sun gear (12) in a clockwise direction with Homelite tool No. A-23696 or suitable spanner wrench. Insert two 1/4 x 2 inch dowel pins in carrier (11), hold chain sprocket from turning (use of Homelite sprocket locking fixture No. A-23713 is suggested) and turn planet carrier in a

counter-clockwise direction with pry-bar against the dowel pins.

Needle bearing (1) can be removed from blind hole in clutch drum (2) with Snap-On puller A-78 or equivalent tool. Press on lettered end of bearing cage with Homelite tool No. 23726-A or other suitable bearing tool to install new bearing in drum. Needle bearing (10) and seal (9) in planet gear (11) can be pressed from gear with Homelite tool No. 23725-A; press new bearing in from threaded side of gear with short end of tool No. 23725-A and press new seal in with lip towards needle bearing with Homelite tool No. 23726-A.

To remove ball bearing (14) and ring gear (15) from housing (16), heat finned area of housing until bearing can be removed by tapping housing against bench. Then, heat housing until ring gear can be removed. Always be sure to remove bearing first and install last with as little heat as possible.

Reassemble by reversing disassembly sequence. Refill gear housing with SAE 90 gear oil.

TRANSMISSION (XP SERIES, 1130G, 3100G). Model XP-1100, XP-1130, 1130G and 3100G saws are equipped with a gear transmission as shown in Fig. HL64. Except for renewal of the crankshaft needle bear-

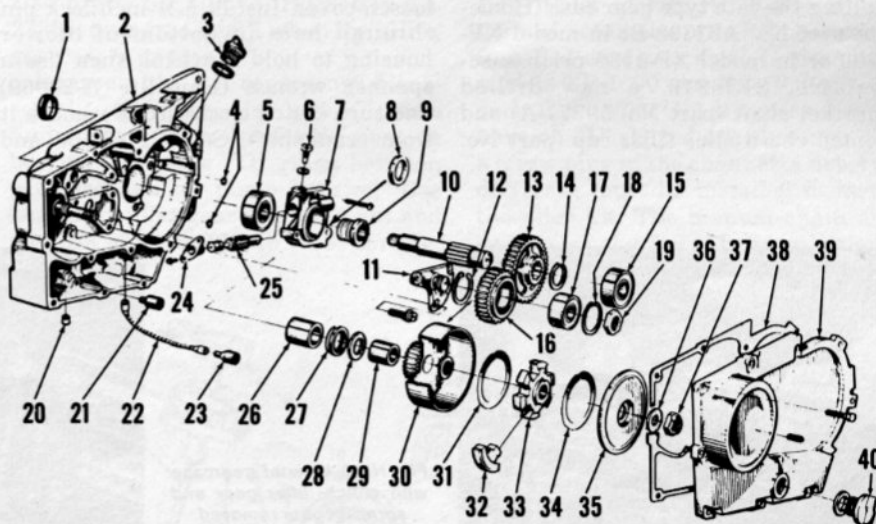


Fig. HL64—Exploded view of gear drive assembly used on models XP-1100, XP-1130A, Super XP-1130A, 1130G and 3100G. Refer to Fig. HL65 for view of opposite side of gearcase and chain drive sprocket. A 1/8-inch thick spacer (8) is used with XP-1100 models having an 11/16-inch wide worm gear (9); do not use spacer if a 13/16-inch wide worm gear is used. Ratios of 2:1 and 3:1 can be obtained by changing gear (13) and repositioning idler gear assembly to accommodate the different gear diameter. The 2:1 ratio gear has 42 teeth and the 3:1 ratio gear has 64 teeth.

- | | | | |
|---------------------|---------------------|-------------------------|-------------------|
| 1. Oil seal | 11. Idler gear post | 21. Oil filter (manual) | 31. Spring |
| 2. Gearcase | 12. Snap ring | 22. Oil line | 32. Clutch shoe |
| 3. Filler cap | 13. Gear | 23. Oil filter (auto) | 33. Clutch spider |
| 4. "O" rings | 14. Snap ring | 24. Flange bearing | 34. Spring |
| 5. Ball bearing | 15. Ball bearing | 25. Plunger & gear | 35. Clutch cover |
| 6. Cam screw | 16. Idler gear | 26. Needle bearing | 36. Washer |
| 7. Oil pump housing | 17. Ball bearing | 27. Oil seal | 37. Nut |
| 8. Spacer | 18. Snap ring | 28. Thrust washer | 38. Gasket |
| 9. Worm gear | 19. Nut | 29. Sleeve bearing | 39. Cover |
| 10. Sprocket shaft | 20. Bushing | 30. Clutch drum | 40. Filler cap |

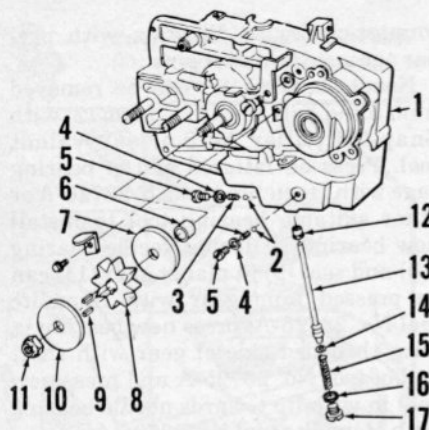


Fig. HL65-View showing chain drive sprocket and manual oiler pump components removed on models shown in Fig. HL64.

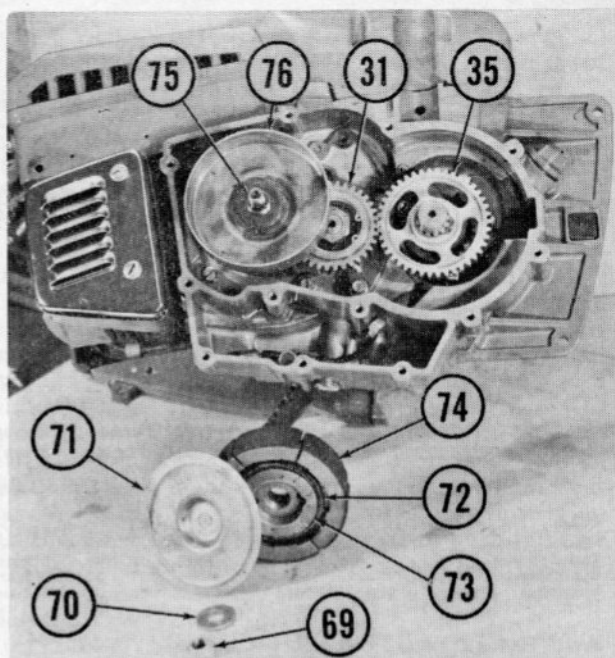
- | | |
|------------------|-------------------|
| 1. Gearcase | 10. Washer, outer |
| 2. Check ball | 11. Nut |
| 3. Spring | 12. Bushing |
| 4. Gasket | 13. Plunger |
| 5. Cap | 14. "O" ring |
| 6. Spacer | 15. Spring |
| 7. Washer, inner | 16. Washer |
| 8. Sprocket | 17. Cap |
| 9. Keys | |

ing, transmission can be serviced after cover (39) is removed.

NOTE: Effective with model XP-1130 serial No. 2188219, gear case is vented through drilled sprocket shaft instead of through hole in gear case. Also, the chain oiler reservoir is vented through the filler cap instead of through hole in reservoir. When installing the late type gear case (Homelite part No. A63398-B) in model XP-1100 or in model XP-1130 prior to serial No. 2188219, a new drilled sprocket shaft (part No. 59277-A) and vented chain oiler filler cap (part No.

Fig. HL67-View of XP-1100 transmission with cover off and clutch assembly removed.

- | |
|-------------------|
| 31. Idler gear |
| 35. Sprocket gear |
| 69. Nut |
| 70. Washer |
| 71. Clutch cover |
| 72. Clutch spring |
| 73. Clutch |
| 74. Clutch shoe |
| 75. Thrust washer |
| 76. Clutch drum |



A63717) must also be installed. When installing drilled sprocket shaft in early type vented gear case, it is recommended that the transmission vent hole in gear case be plugged.

To service transmission, drain oil from chain oil tank and transmission case, then remove handlebar and cover (39). Tap cover lightly, if necessary, to loosen cover. Install a 1/4-inch lock pin through hole in bottom of blower housing to hold flywheel, then use a spanner wrench (Homelite A-23969) and turn clutch clockwise to remove it from crankshaft. See Fig. HL66 and

HL67. Thrust bearing (75) and clutch drum (76) can now be removed. Drum sleeve bearing (29—Fig. HL64) can be removed if necessary. Turn nut (19) clockwise to remove and lift idler gear assembly (16) off idler post (11). Bearing (17) can be removed from idler gear after removing snap ring (30). Remove retaining ring (14) and pull sprocket gear (13) from sprocket shaft (10). See Fig. HL68.

NOTE: Sprocket shaft gear can be removed without removing idler gear should it be necessary for service only on the sprocket gear, sprocket shaft

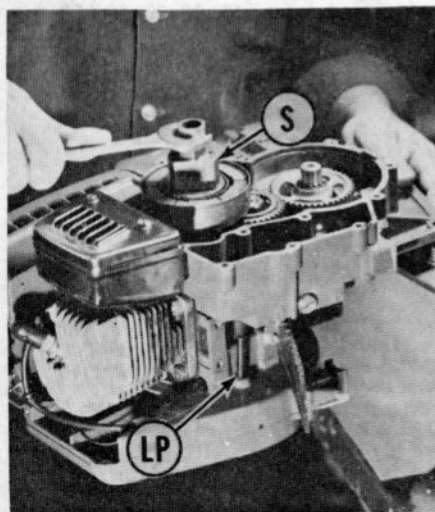
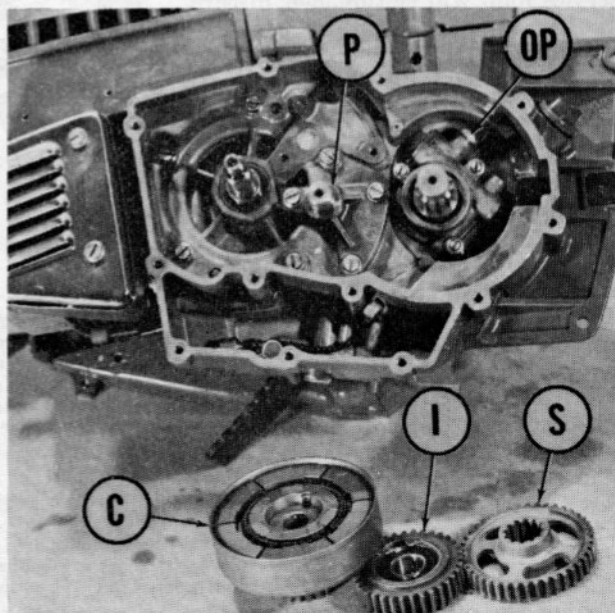


Fig. HL66-When removing clutch spider, use lock pin (LP) inserted as shown and turn clutch spider clockwise using a spanner wrench (S). Homelite number for spanner is A-23969.

Fig. HL68-View of gearcase with clutch, idler gear and sprocket gear removed.

- | |
|----------------------|
| C. Clutch assembly |
| I. Idler gear Assy. |
| P. Idler gear post |
| S. Sprocket gear |
| OP. Oil pump (chain) |



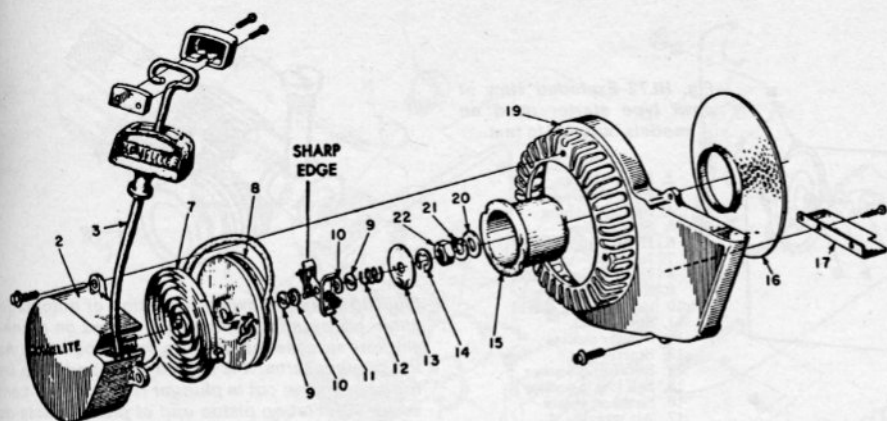


Fig. HL69—Exploded view of C Series Fairbanks-Morse starter. Friction shoe (11) components are not available separately; however, if unit has been disassembled, refer to Fig. HL70 for reassembly. Baffle (17) is integral with housing on late production units.

- 2. Starter housing
- 3. Starter rope
- 7. Rewind spring
- 8. Starter pulley
- 9. Brake washer

- 10. Fiber washer
- 11. Friction shoe
- 12. Spring
- 13. Washer

- 14. Snap ring
- 15. Starter cup
- 16. Rotating screen
- 17. Baffle

- 19. Fan housing
- 20. Flat washer
- 21. Lock washer
- 22. Flywheel nut

and bearings or the automatic chain oiler pump (OP) which is located behind the sprocket gear.

To remove the sprocket shaft, unbolt and remove the oil pump housing and discard the two "O" rings (4—Fig. HL64). Hold sprocket (8—Fig. HL65) from turning and remove nut (11), outer washer (10), sprocket and keys, inner washer (7), spacer (6), then push sprocket shaft from gearcase. Spacer (8—Fig. HL64) and worm gear (9) can now be removed from shaft.

NOTE: Spacer (8) is used with a short (11/16-inch long) worm gear (9) which was used in some saws. Do not use spacer in the saws which have a 13/16-inch long worm gear. For information on chain oiler pump, refer to AUTOMATIC CHAIN OILER section.

If sprocket shaft outer (pilot) bearing requires renewal, heat cover (39) until

bearing will drop out. To remove sprocket shaft inner bearing, remove oil seal and press bearing out toward clutch side of gearcase using Homelite tool No. 23228, or equivalent.

If crankshaft needle (main) bearing (26—Fig. HL64) is to be renewed, remove gearcase and using Homelite tool No. 23931-3, press bearing out toward clutch side. When reinstalling bearing, install from engine side of gearcase and press only on lettered end of bearing. Use protector sleeve, Homelite No. 23963, over crankshaft when installing gearcase to engine.

Reassemble by reversing disassembly procedure. Use new oil seals and install with open side next to bearing. Use new "O" rings between gearcase and oil pump housing. Use Loctite on idler gear retaining nut and tighten nut to 200 in.-lbs. torque.

Tighten clutch spider and nut (37) to a minimum of 300 in.-lbs. torque and sprocket nut to 250 in.-lbs. torque.

REWIND STARTER. A Fairbanks-Morse rewind starter is used on models C-5, C-7, C-9 and C-52. Install friction shoes on brake lever as shown in Fig. HL70 if unit was disassembled. The friction shoe and lever unit is available for service as a complete assembly only. Refer to Fig. HL69 for complete starter exploded view.

Models C-51, C-51G, C-71, C-71G, C-91, C-91G, XP-1000, XP-1100 and early models XP-1020, XP-1020A and XP-1130A are equipped with an overrunning bearing type starter as shown in Fig. HL71. Bearing (14) must be installed with end lettered "LOCK" towards rope pulley (10).

Late model XP-1020, XP-1020A, XP-1130A and all other models are equipped with the pawl type clutch assembly shown in Fig. HL72. Rewind spring (9) is wound in cover (2) in clockwise direction. Tension is placed on rewind spring by turning cover (2) in clockwise direction approximately three turns before installing cover retaining screws.

AUTOMATIC CHAIN OILER KIT. Refer to Fig. HL73 for exploded view of automatic oiler kit that can be installed on direct drive Series C and models XP-1000 and XP-1020 saws. If early C-5, C-7 or C-9 drivecase does not have an "L" shaped oiler passage with a screw plug in the channel, a new type drivecase must be installed to install the oiler kit. The manual chain oiler system is not affected by installation of

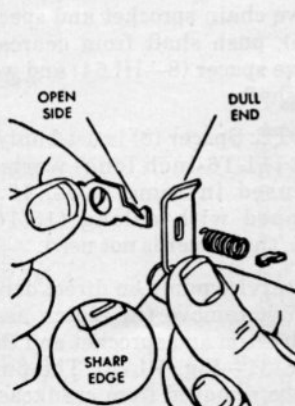


Fig. HL70—Fairbanks-Morse friction shoe unit is serviced as complete assembly only. However, if unit has been disassembled, it must be reassembled as shown. Refer to Fig. HL69 for complete view of Fairbanks-Morse starter.

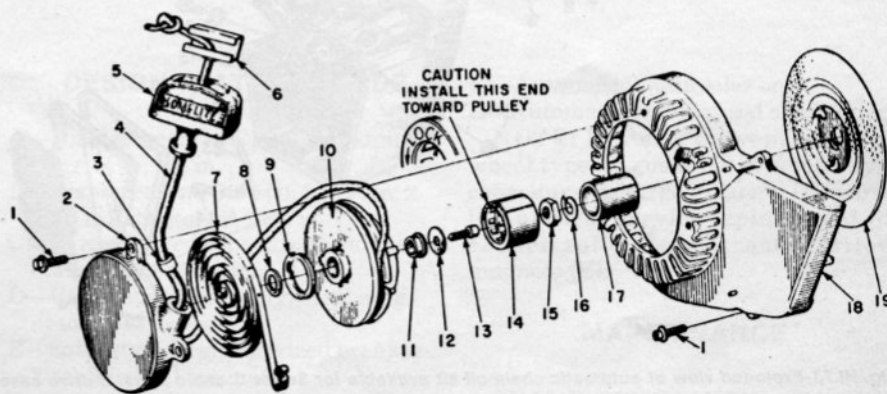


Fig. HL71—Exploded view of overrunning bearing starter used on models listed in text.

- 2. Starter cover
- 3. Rope bushing
- 4. Starter rope
- 7. Rewind spring

- 8. Thrust washer
- 9. Rewind spring lock
- 10. Starter pulley
- 11. Pulley bushing

- 12. Thrust washer
- 13. Socket head screw
- 14. Overrunning bearing
- 15. Flywheel nut

- 16. Lock washer
- 17. Inner race for (14)
- 18. Blower housing
- 19. Rotary screen

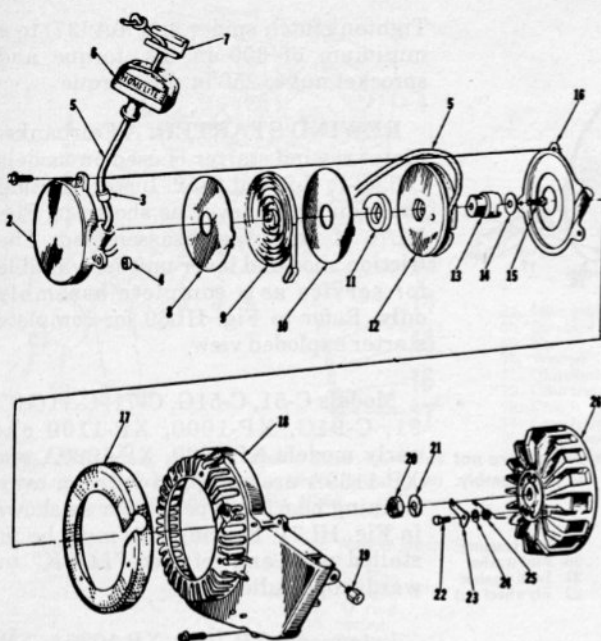


Fig. HL72—Exploded view of pawl type starter used on models outlined in text.

2. Starter cover
3. Rope bushing
4. Spring bushing
5. Starter rope
6. Hand grip
7. Insert
8. Inner spring shield
9. Rewind spring
10. Outer spring shield
11. Spring lock
12. Starter pulley
13. Starter cup
14. Retaining washer
15. Self locking screw
16. Sawdust shield
17. Air screen
18. Fan housing
19. Spacer
20. Crankshaft nut
21. Flat washer
22. Pawl stud
23. Starter pawl
24. Washer
25. Pawl spring
26. Rotor (flywheel)

the automatic oiler kit and can be used to supply extra chain lubricating oil in special cutting situations.

The drive pin (7) must extend 25/64 to 13/32-inch, and must engage the

drive slot in clutch drum (1). Under normal conditions, use Homelite Bar and Chain oil or SAE 30 motor oil in reservoir. In cold weather, dilute oil with kerosene as necessary to keep it

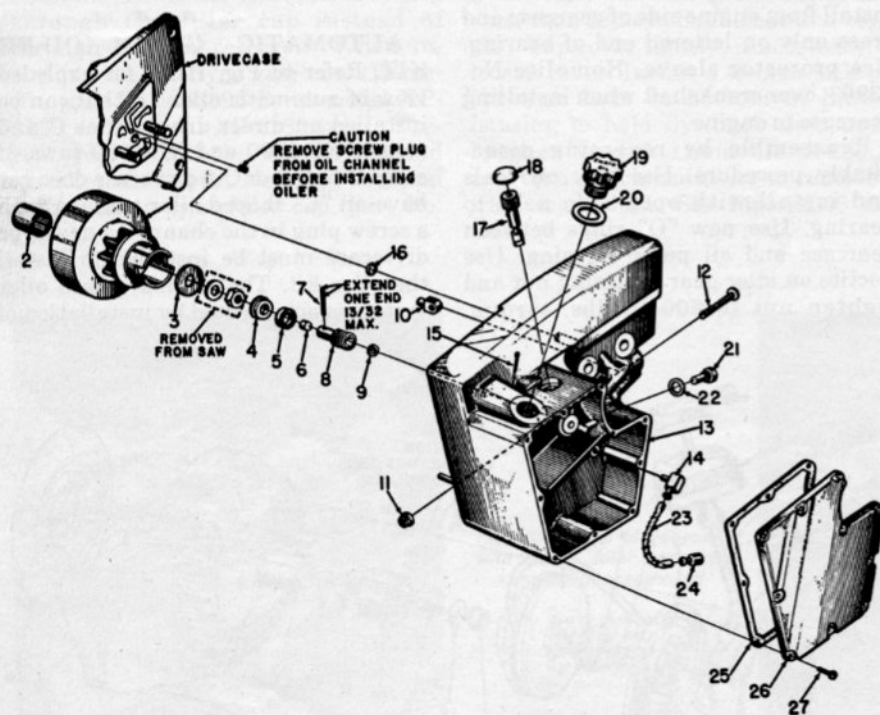


Fig. HL73—Exploded view of automatic chain oil kit available for Series C chain saws. If drive case does not have "L" shaped oiler passage as shown with a screw plug in the channel, a new drive case must be installed.

- | | | | |
|--------------------|----------------------------|--------------------|----------------|
| 1. Clutch drum | 7. Worm gear pin | 14. Elbow | 20. Gasket |
| 2. Needle bearing | 8. Worm gear | 15. Cotter pin | 21. Cam screw |
| 3. Thrust washer | 9. Thrust washer | 16. "O" ring | 22. Oil line |
| 4. Oil seal shield | 10. Guidebar adjusting pin | 17. Pump plunger | 23. Oil filter |
| 5. Oil seal | 11. Oiler housing | 18. Expansion plug | 24. Oil filter |
| 6. Worm gear plug | | 19. Oil filler cap | 25. Gasket |
| | | | 26. Cover |

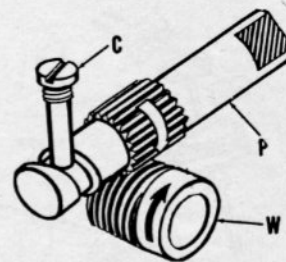


Fig. HL74—View showing operation of automatic chain oiler pump. Worm (W) mounted on crankshaft or sprocket shaft turns the plunger (P). As the plunger turns, it is moved back and forth by the cam groove cut in plunger riding on the cam screw (C). Flat on piston end of plunger acts as inlet and outlet valve as the plunger turns past inlet and outlet ports.

flowing through pump. Oil filter (24) can be cleaned after removing cover (26).

AUTOMATIC CHAIN OILER.

Gear drive models XP-1100, XP-1130A, Super XP-1130A, 1130G and 3100G are equipped with an automatic chain oil system and pump located in gearcase shown in Fig. HL68. Refer also to exploded view in Fig. HL64.

Models XP-1020A, Super XP-1020A, 1050 Automatic, 2000, 2000E, 2000P, Super 2000, 2100 and 2100S are equipped with automatic oil pump shown in Fig. HL75.

To service pump on gear drive models, drain chain oil tank and transmission case, then remove cover (39—Fig. HL64). Remove retaining ring (14) and pull gear (13) from sprocket shaft (10). Unbolt and remove pump body (7) from gearcase. Discard "O" rings (4) and use new "O" rings during installation. Pump plunger (25) can be removed from body after removing the flanged bearing (24).

If necessary to remove worm (24), remove chain sprocket and spacer (6—HL65), push shaft from gearcase and remove spacer (8—HL64) and worm (9) from shaft.

NOTE: Spacer (8) is used only with a short (11/16-inch long) worm which was used in some saws. If saw is equipped with a long (13/16-inch) worm, the spacer is not used.

To service pump on direct drive models, first remove the clutch assembly, clutch drum and sprocket and the drive worm (31—Fig. HL75). The pump can then be removed from crankcase cover (11).

Clean and inspect all parts and renew parts as necessary. Reassemble by reversing the disassembly procedure.

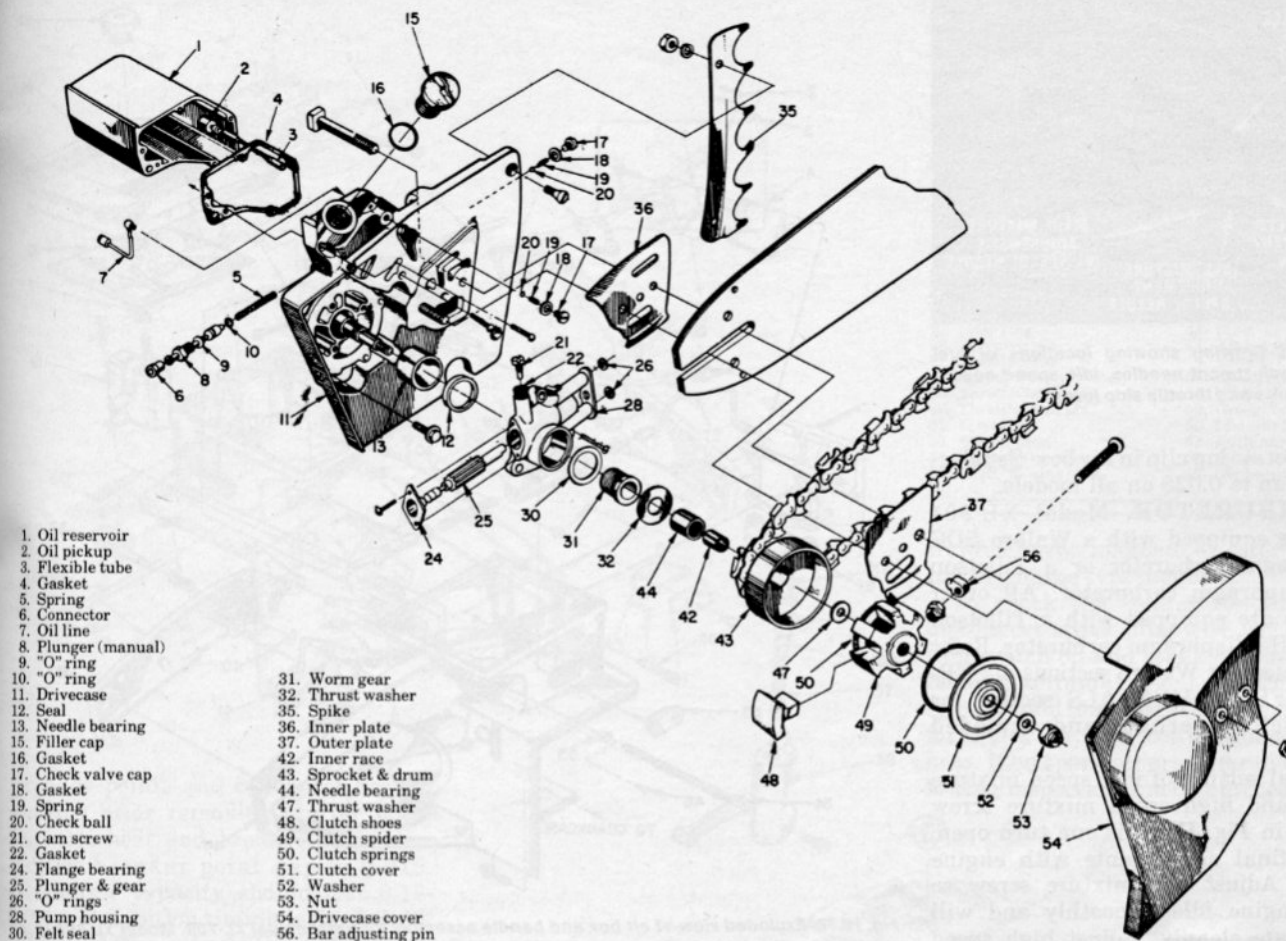


Fig. HL75—Exploded view of model XP-1020 Automatic chain oiler pump and related parts; other models are similar except for ball bearing main instead of needle bearing. Refer to Fig. HL74 for view showing pump operation.

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N. Y. 10573

Chain Saw Model

Design Features

XL-700	A,C,D,H,J
XL-800	B,C,D,H,K
XL-800AM	B,C,D,H,L
XL-850	B,C,E,H,L
XL-870	B,C,D,H,L
XL-875	B,C,E,H,L
XL-900E	B,C,D,H,K
XL-900EAM	B,C,D,H,L
XL-901	A,C,D,H,J
XL-903	B,C,D,G,H,L
XL-903E	B,C,D,G,H,K
XL-903EAM	B,C,D,G,H,L
XL-904	B,C,F,G,H,L
XL-921	A,C,D,H,J
XL-923	B,C,D,G,H,L
XL-924	B,C,F,G,H,L
XL-924W	B,C,F,G,H,L
SXL-925	B,C,F,H,J
VI-944	B,C,D,G,H,L
VI-955	B,C,F,H,L

DESIGN FEATURES CODE

- A—Displacement, 4.71 cu. in.; bore, 2 in.; stroke, 1½ in.
B—Displacement, 5.01 cu. in.; bore, 2 1/16 in.; stroke, 1½ in.
C—Pyramid reed type intake valves, 4 stainless steel reeds.
D—Conventional type flywheel magneto.
E—Solid state (transistorized breakerless) flywheel magneto.
F—Capacitor discharge (CD) solid state magneto.
G—Decompression valve (Simplex starting).
H—Direct drive.
J—Manual chain oiler only.

K—Automatic chain oiler only.

L—Automatic and manual chain oiler.

NOTE: Either a conventional flywheel type magneto (D) or a later type capacitor discharge magneto (F) can be installed as service replacement for earlier solid state (transistorized) magneto (E).

MAINTENANCE

SPARK PLUG. A Champion model CJ-6 spark plug is used for all models. For heavy duty operation, a Champion UJ11G gold-palladium tipped spark plug can be used, though it will be necessary to pull the plug wire further out

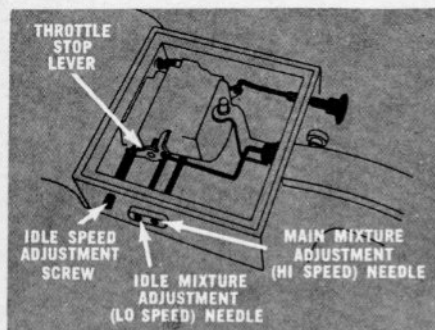


Fig. HL76—Drawing showing locations of fuel mixture adjustment needles, idle speed needle and throttle stop lever.

of the retaining clip in air box. Set electrode gap to 0.025 on all models.

CARBURETOR. Model XL-901 may be equipped with a Walbro SDC diaphragm carburetor or a Tillotson HS diaphragm carburetor. All other models are equipped with a Tillotson model HS diaphragm carburetor. Refer to Tillotson or Walbro sections of SERVICE FUNDAMENTALS section for carburetor overhaul and exploded views.

Initial setting of idle speed mixture screw and high speed mixture screw shown in Fig. HL76 is one turn open. Make final adjustments with engine warm. Adjust idle mixture screw so that engine idles smoothly and will accelerate cleanly. Adjust high speed mixture screw to obtain optimum performance with saw under cutting load. Do not adjust high speed screw too lean as engine may be damaged.

On models with Simplex starting system (decompression valve and adjustable starting speed), speed at which engine runs with throttle latch engaged can be adjusted by turning eccentric throttle trigger pivot pin (24—Fig. HL79 or 26—Fig. HL79A).

MAGNETO. Three different types of magnetos are used. All models except XL-850, XL-875, XL-924, XL-924W, SXL-925, VI-955 and late model XL-904 are equipped with a conventional flywheel type magneto. Models XL-850, XL-875 and early XL-904 are equipped with a transistorized breakerless magneto. Late model XL-904 and models XL-924, XL-924W, SXL-925 and VI-955 are equipped with a capacitor discharge (CD) magneto. Either the conventional type magneto or the capacitor discharge magneto are available as complete assemblies for service replacement of the solid state magneto. Refer to appropriate following paragraph for service information on each type magneto.

CONVENTIONAL (BREAKER POINT) MAGNETO. Refer to Fig. HL81 for exploded view of magneto.

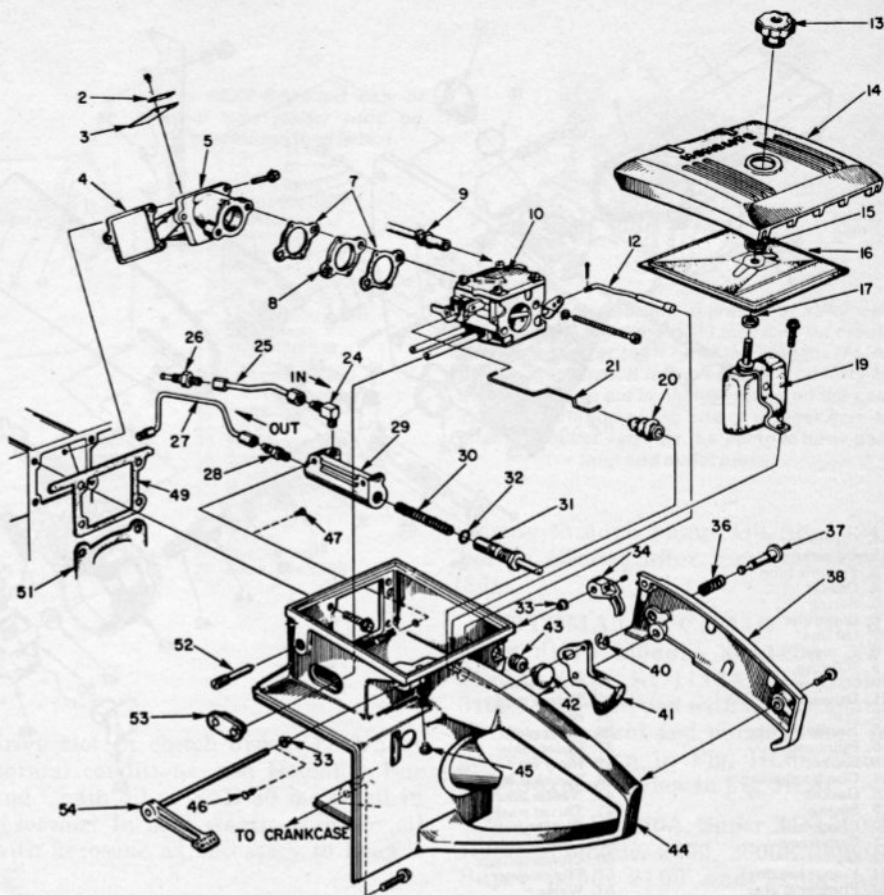
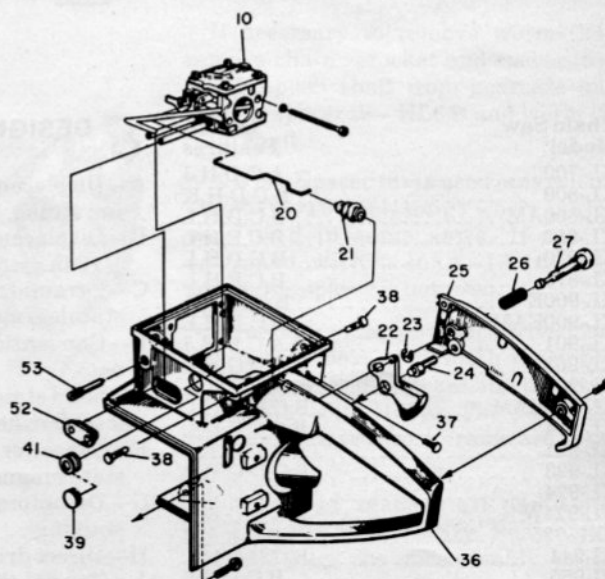


Fig. HL78—Exploded view of air box and handle assembly for early model XL-700. Model XL-800 is not equipped with manual oiler pump (items 24 through 31) and operating lever (34 and 54) although late model XL-800 has provisions for installing same. Model XL-850 and late models XL-700 and XL-800 have "Delrin" pyramid reed seat which does not use reed retaining plates (2) and screws; refer to Fig. HL79A.

- | | | | |
|----------------------|--------------------|------------------------|-----------------------|
| 2. Retaining plates | 15. Retaining ring | 29. Pump body | 42. Choke button |
| 3. Inlet valve reeds | 16. Filter element | 30. Plunger spring | 43. Grommet |
| 4. Gasket | 17. Gasket | 31. Pump plunger | 44. Throttle handle |
| 5. Elbow & reed seat | 19. Air deflector | 32. "O" ring | 45. Rubber bumper |
| 7. Gaskets | 20. Boot | 33. Bushing | 46. Plug (XL-800) |
| 8. Spacer | 21. Throttle rod | 34. Oiler lever | 47. Plug (XL-800) |
| 9. Fuel tube | 24. Check valve | 36. Lock spring | 49. Gasket |
| 10. Carburetor assy. | 25. Oil line | 37. Throttle latch pin | 51. Cylinder gasket |
| 12. Choke rod | 26. Connector | 38. Handle cover | 52. Idle speed screw |
| 13. Cover nut | 27. Oil line | 40. Snap ring | 53. Grommet |
| 14. Air filter cover | 28. Check valve | 41. Throttle trigger | 54. Oil lever & shaft |

Fig. HL79—View showing late type air box (throttle handle) and carburetor with single lever choke system. Plugs (37, 38 & 39) allow late type throttle handle to be used on both late type and earlier units.

- | |
|-------------------------------|
| 10. Carburetor |
| 20. Throttle rod |
| 21. Grommet |
| 22. Throttle trigger |
| 23. Snap ring |
| 24. Eccentric pin |
| 25. Handle cover |
| 26. Spring |
| 27. Throttle latch |
| 36. Air box (throttle handle) |
| 37. Plug, choke rod hole |
| 38. Plug, cross shaft hole |
| 39. Plug, choke lever hole |
| 41. Grommet, choke lever |
| 52. Grommet, fuel needle |
| 53. Idle stop screw |



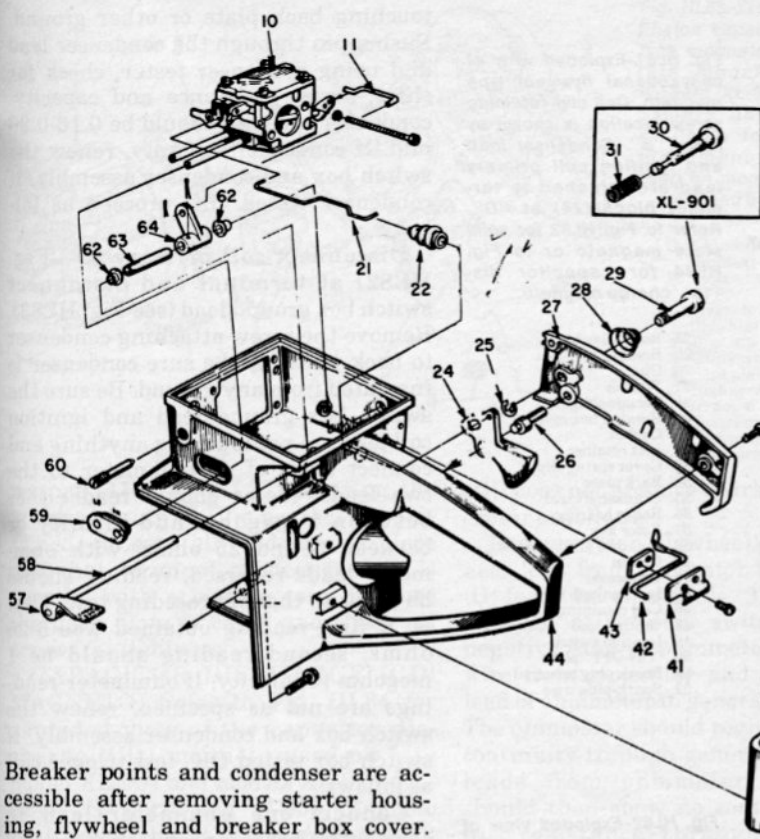


Fig. HL79A—On models XL-901, XL-903 and XL-904, choke is actuated by bellcrank (64) mounted on shaft (58) and manual chain oiler pump body (38) is mounted on air box near handle. Manual oil pump is also used on models XL-921, XL-923, XL-924, XL-924W and SXL-925. Compression release lever (42), on models so equipped, is operated by throttle latch (29). Also refer to Fig. HL79 or HL80.

- | | |
|------------------------|-------------------------------|
| 10. Carburetor | 36. Plunger "O" ring |
| 11. Choke link | 37. Compression spring |
| 21. Throttle rod | 38. Oil pump body |
| 22. Grommet | 41. Lever clamp |
| 24. Throttle trigger | 42. Valve lever |
| 25. Snap ring | 43. Plate |
| 26. Eccentric pin | 44. Air box (throttle handle) |
| 27. Handle cover | 57. Choke lever |
| 28. Spring | 58. Choke shaft |
| 29. Throttle latch pin | 59. Grommet |
| 30. Throttle latch pin | 60. Idle speed screw |
| 31. Spring | 62. Bushings |
| 33. Oiler button | 63. Spacer sleeve |
| 35. Shaft "O" ring | 64. Choke bellcrank |

Breaker points and condenser are accessible after removing starter housing, flywheel and breaker box cover. Adjust breaker point gap to 0.015. Condenser capacity should test 0.18-0.22 mfd. Ignition timing is fixed at 30° BTDC. After reinstalling flywheel, check armature air gap which should be 0.005-0.007. To adjust air gap loosen core retaining screws, turn flywheel so that magnets are below legs of armature core and place plastic shim (Homelite part No. 23987) between armature and magnets. Push flywheel toward core legs and tighten armature retaining screws, then remove shim.

SOLID STATE (WICO) MAGNETO. Refer to Fig. HL82 for exploded view of the solid state (transistorized breakerless) magneto used on Models XL-850, XL-875 and early XL-904. NOTE: Some of these models may be equipped with service installed conventional

flywheel type magneto or later capacitor discharge type magneto.

To check the solid state magneto, disconnect spark plug wire, turn ignition switch on and crank engine while holding terminal about 1/4-inch away from ground (engine casting) and check for spark as with conventional magneto. If no spark occurs, refer to the following inspection and test procedure:

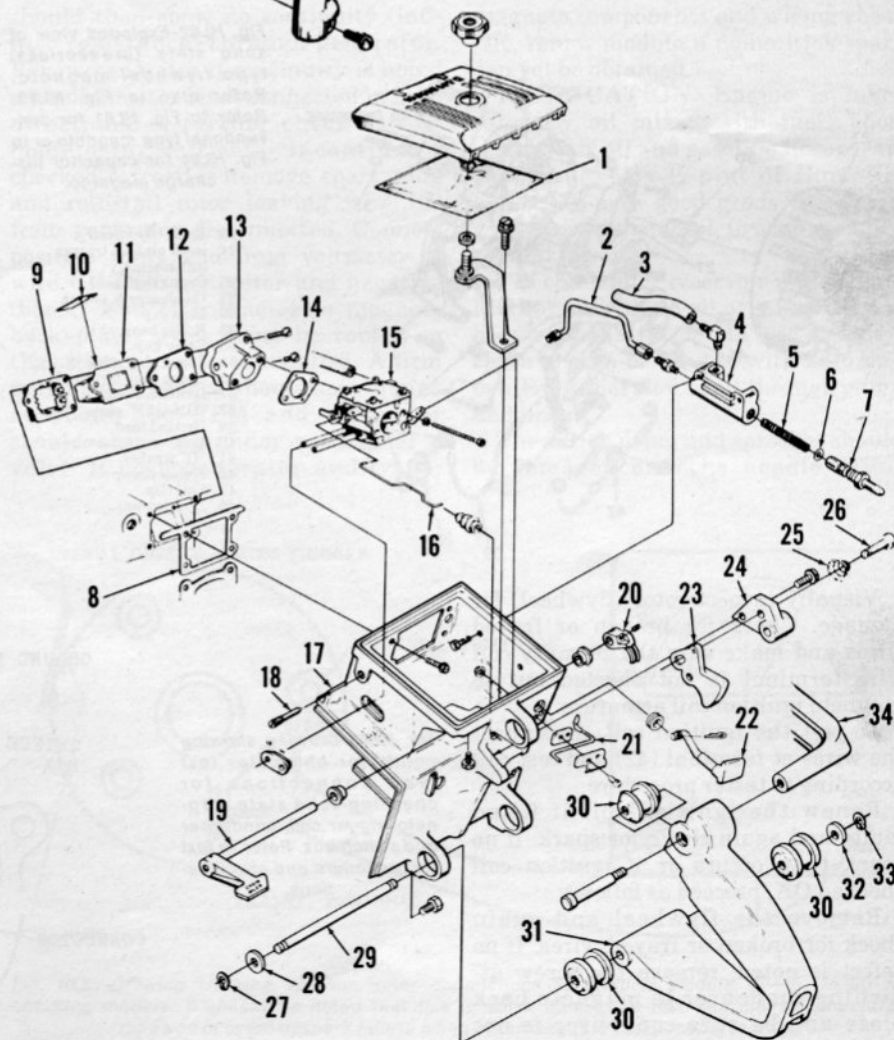


Fig. HL80—Exploded view of models VI-944 and VI-955. Note vibration isolating bushings (30). Choke rod (22) is also used on models XL-1, XL-923, XL-924, XL-924W and SXL-925.

- | | |
|---------------------------|-------------------------------|
| 1. Air filter | 19. Manual oil pump lever |
| 2. Oil discharge line | 20. Oiler arm |
| 3. Oil intake line | 21. Compression release lever |
| 4. Manual oil pump | 22. Choke rod |
| 5. Spring | 23. Trigger |
| 6. "O" ring | 24. Trigger cover |
| 7. Oil pump plunger | 25. Spring |
| 8. Gasket | 26. Throttle latch |
| 9. Reed retainer | 27. Snap ring |
| 10. Reed petal | 28. Washer |
| 11. Reed valve seat | 29. Shaft |
| 12. Gasket | 30. Vibration bushing |
| 13. Intake manifold | 31. Handle |
| 14. Gasket | 32. Washer |
| 15. Carburetor | 33. Snap ring |
| 16. Throttle rod | 34. Mounting arm |
| 17. Frame | |
| 18. Idle speed stop screw | |

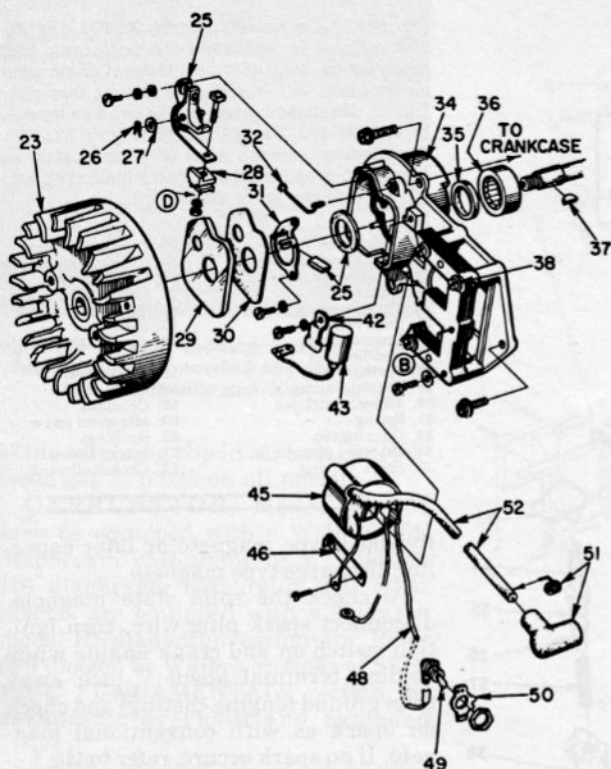
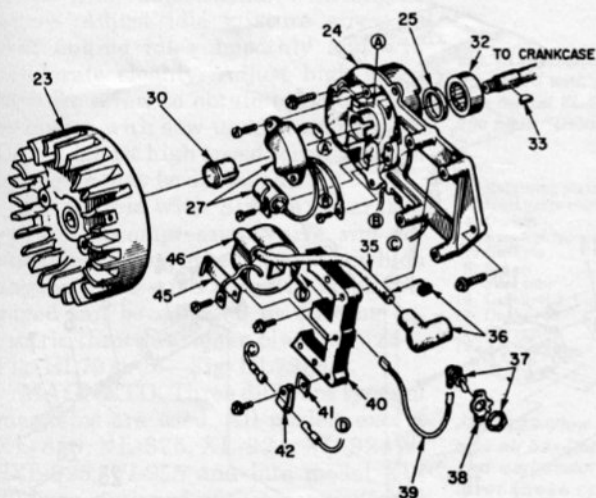


Fig. HL81—Exploded view of conventional flywheel type magneto. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D". Refer to Fig. HL82 for solid state magneto or to Fig. HL84 for capacitor discharge magneto.

- 23. Rotor (flywheel)
- 25. Breaker point set
- 26. Clip
- 27. Washer
- 28. Terminal block
- 29. Breaker box cover
- 30. Gasket
- 31. Felt retainer
- 32. Cover spring clip
- 34. Back plate
- 35. Crankshaft seal
- 36. Roller bearing
- 37. Rotor key
- 38. Coil core (armature)
- 42. Clamp
- 43. Condenser
- 45. Ignition coil
- 46. Coil retaining clip
- 48. Ground lead
- 49. Ignition switch
- 50. "ON-OFF" plate
- 51. Spark plug terminal
- 52. Spark-plug wire

Fig. HL82—Exploded view of solid state (breakerless) type flywheel magneto. Refer also to Fig. HL83. Refer to Fig. HL81 for conventional type magneto or to Fig. HL84 for capacitor discharge magneto.



- 23. Rotor (flywheel)
- 24. Back plate & trigger coil assembly
- 25. Crankshaft seal
- 27. Condenser & switch
- 30. Dust cap
- 32. Roller bearing
- 33. Rotor key
- 35. Spark plug wire
- 36. Spark plug terminal
- 37. Ignition switch
- 38. "ON-OFF" plate
- 39. Ground lead
- 40. Coil core (armature)
- 41. "D" washer
- 42. Nylon clamp
- 45. Coil clip
- 46. Ignition coil

Visually inspect rotor (flywheel) for damage. Check for broken or frayed wires and make sure the primary coil wire terminal is not shorted out to magneto ignition coil armature.

To test the ignition coil, disconnect the wires at terminal (42) and test coil according to tester procedure.

Renew the ignition coil if found faulty and again check for spark. If no spark then occurs or if ignition coil checked OK, proceed as follows:

Remove the flywheel and again check for broken or frayed wires. If no defect is noted, remove the screw attaching condenser to magneto back plate and be sure condenser is not

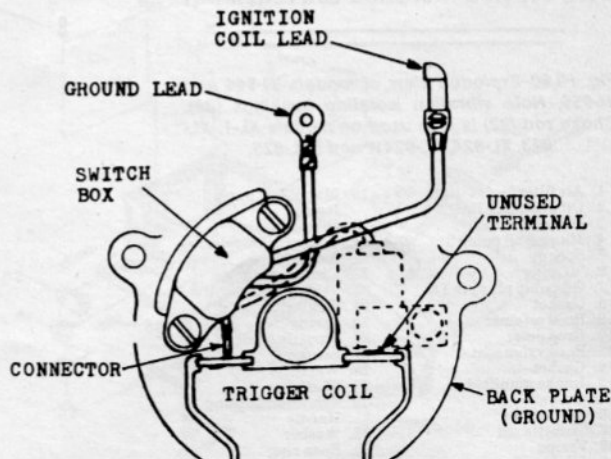
touching back plate or other ground. Push a pin through the condenser lead and using condenser tester, check for short, series resistance and capacity; condenser capacity should be 0.16-0.20 mfd. If condenser is faulty, renew the switch box and condenser assembly. If condenser tested OK, proceed as follows:

Disconnect coil primary (D—Fig. HL82) at terminal and disconnect switch box ground lead (see Fig. HL83). Remove the screw attaching condenser to back plate and be sure condenser is insulated from any ground. Be sure the switch box ground lead and ignition coil lead are not touching anything and connect leads of an ohmmeter to the two leads. Meter should read either between 1 megohm and infinity or between 5 and 25 ohms; with ohmmeter leads reversed, reading should be opposite that of preceding test. That is, if first reading obtained was 5-25 ohms, second reading should be 1 megohm to infinity. If ohmmeter readings are not as specified, renew the switch box and condenser assembly. If switch box tested OK, test trigger coil as follows:

Connect one ohmmeter lead to connector between switch box and trigger coil and other ohmmeter lead to back plate (ground). Reading should be either between 0 to 85 ohms or between 85 and 150 ohms. Reverse the leads; second reading on ohmmeter should be opposite first reading. That is, if first reading was in specified range of 0-85 ohms, second reading should be within range of 85-150 ohms. Then, connect the ohmmeter leads to unused terminal of trigger coil and to magneto back plate. Ohmmeter reading should then be 20 to 26 ohms. If trigger coil does not test within specifications, renew the magneto assembly.

When reassembling magneto, check back plate and remove any sharp edges, especially where wires may contact the back plate. Be sure the "D"

Fig. HL83—Drawing showing points for ohmmeter test lead connections for checking solid state magneto trigger coil, condenser and switch box. Refer to text for procedure and specifications.



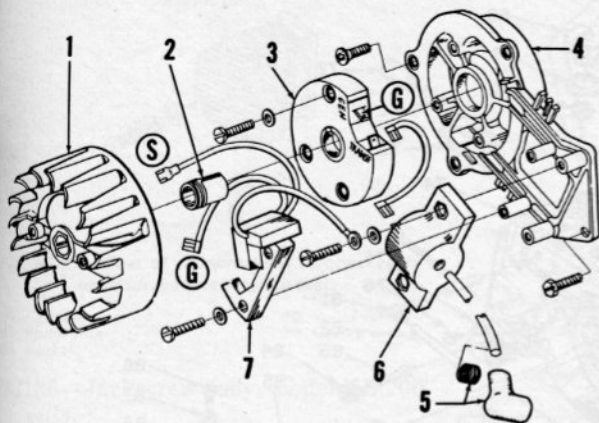


Fig. HL84—Exploded view of Phelon capacitor discharge type magneto first used on late model XL904 and models XL-924, XL-924W, SXL-925 and VI-955 and available for service replacement of magnetos used on models XL-850, XL-875 and early XL-904.

- G. Connector to "Gen." terminal
 S. Connector to "ON-OFF" terminal
 1. Magneto rotor (flywheel)
 2. Dust cap
 3. Ignition module
 4. Back plate
 5. High tension wire & terminal
 6. Transformer coil
 7. Generator coil & armature

washer (41—Fig. HL82) securing the plastic clamp (42) is correctly positioned. Be sure all leads are in place and that terminal connection (42) is parallel with armature core. Be sure the back plate is clean and check all screws for tightness.

CAPACITOR DISCHARGE (CD) MAGNETO. Refer to Fig. HL84 for exploded view of the capacitor discharge (CD) magneto used on late model XL-904 and models XL-924, XL-924W, SXL-925 and VI-955. Magneto is also available as service replacement of solid state magneto used on models XL-850, XL-875 and early XL-904.

NOTE: Refer to CAPACITOR DISCHARGE (CD) IGNITION SYSTEM section for explanation of magneto operation.

The capacitor discharge magneto can be considered OK if spark will jump a $\frac{1}{8}$ -inch gap when turning engine at cranking speed. If magneto fails to produce spark, service consists of locating and renewing inoperative unit; no maintenance is necessary.

To check magneto with volt-ohmmeter, proceed as follows: Remove starter housing and disconnect wire from ignition switch. Check to be sure there is no continuity through switch when in "ON" position to be sure a grounded switch is not cause of trouble and inspect wiring to be sure it is not shorted. **CAUTION:** Be sure that storage capacitor is discharged before touching connections; flip ignition switch to "OFF" position or ground switch lead (S).

Resistance through secondary (high tension) winding of transformer coil should be 2400 to 2900 ohms and resistance through primary winding should be 0.2—0.4 ohms. Connect ohmmeter leads between high tension (spark plug) wire and ground, then between input terminal and ground. If transformer coil does not test within specifications, renew coil and recheck for spark at cranking speed. If magneto

still does not produce spark, check generator as follows:

Remove rotor (flywheel) and disconnect lead from generator to generator (G) terminal on module (3) and switch lead (S) at ignition switch. Connect negative lead of ohmmeter to ground wire from generator and the positive lead of ohmmeter to generator (G) wire. The ohmmeter should register showing continuity through generator. Reverse leads from ohmmeter; ohmmeter should then show no continuity (infinite resistance) through generator. Renew generator if continuity is noted with ohmmeter leads connected in both directions. A further check can be made using voltmeter if continuity checked correctly. Remove spark plug and reinstall rotor leaving wire (G) from generator disconnected. Connect positive (red) lead from voltmeter to wire (G) from generator and negative (black) lead of voltmeter to magneto back plate; wires must be routed so that starter can be reinstalled. A firm pull on starter rope should spin engine at about 500 RPM and voltmeter should show minimum reading of 4 volts. If both generator and trans-

former coil tested OK, a faulty ignition module (3) should be suspected.

A partial check of ignition module can be made using ohmmeter. With ohmmeter set to R X 1000 scale, connect positive (red) lead of ohmmeter to module terminal marked "Gen." and negative ohmmeter lead to module ground connection (see Fig. HL85). An instant deflection of ohmmeter needle should be noted; if not, reverse ohmmeter leads and observe needle. If no deflection of needle is noted with ohmmeter leads connected in either direction, module is faulty and should be renewed. If needle deflection is observed, select R X 1 (direct reading) scale of ohmmeter and connect positive (red) lead to module terminal marked "Gen." and place negative (black) lead against terminal marked "Trans." Place a screwdriver across the two trigger poles (see Fig. HL85); the ohmmeter needle should deflect and remain deflected until the ohmmeter lead is released from the module terminal. If the desired results are obtained with ohmmeter checks, the module is probably OK; however, as this is not a complete check and other magneto components and wiring check OK, renew module if no ignition spark can yet be obtained.

LUBRICATION. Engine is lubricated by oil mixed with fuel. Thoroughly mix oil and gasoline in separate container. Mix $\frac{1}{2}$ -pint of Homelite motor oil, or a good grade non-detergent SAE 30 motor oil, in each gallon of regular gasoline.

Fill chain oiler reservoir with Homelite Bar and Chain oil or a light oil (no heavier than SAE 30). In cold weather, chain oil can be diluted with kerosene to allow easier flow of oil through pump and lines.

The clutch drum and sprocket should be removed and the needle roller

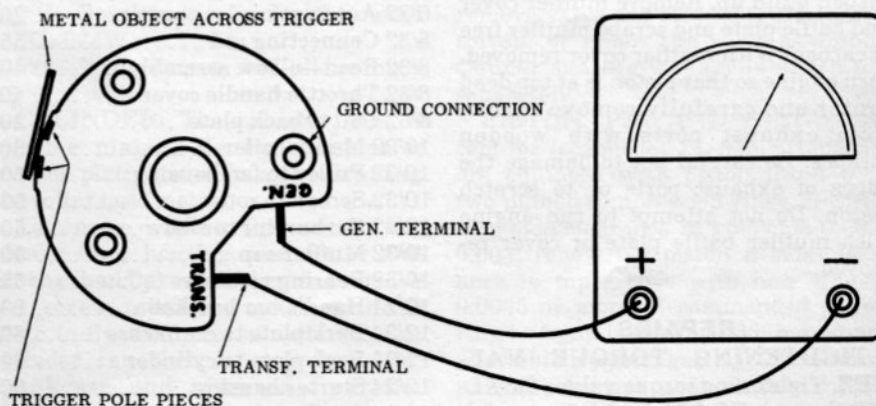


Fig. HL85—Drawing showing volt-ohmmeter connections to ignition module (3—Fig. HL84) for checking module. It should be noted that this is not a conclusive test and module should be renewed in event of spark failure when other magneto components test OK.

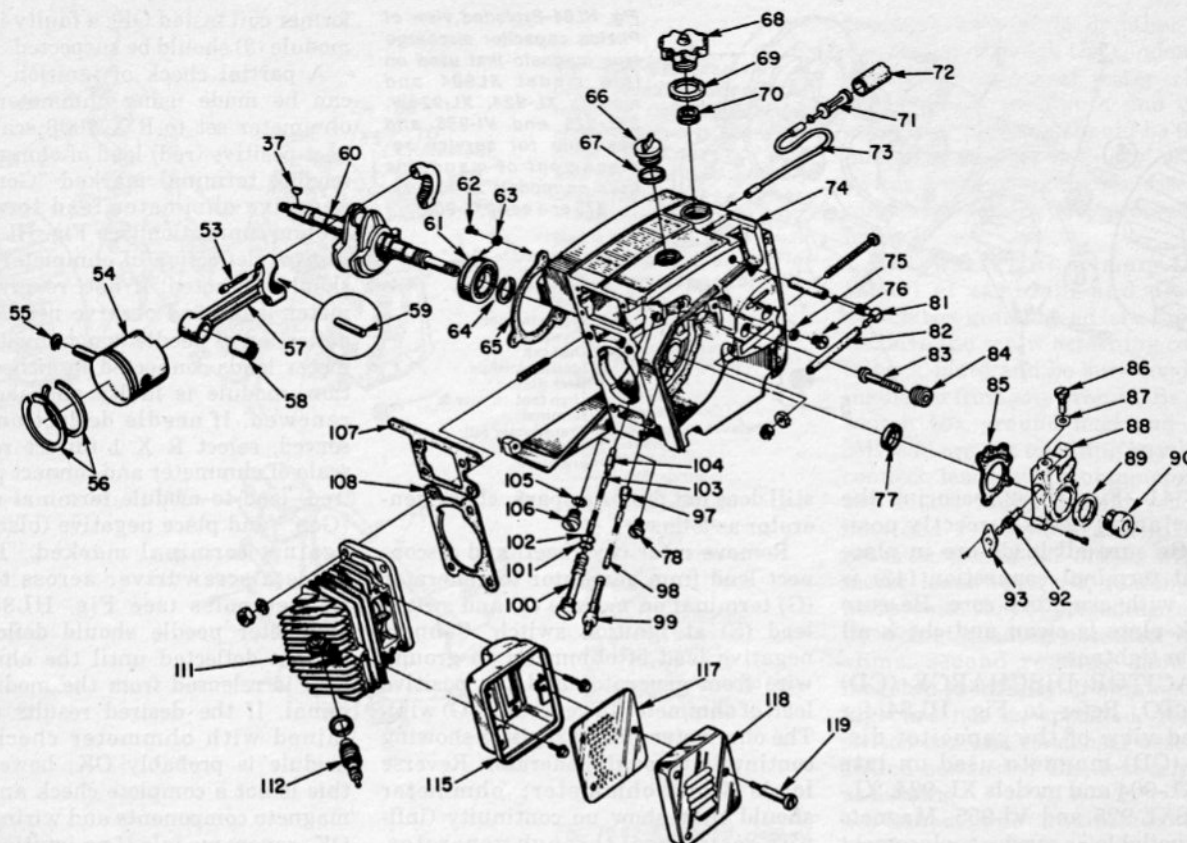


Fig. HL86—Exploded view of typical engine assembly. Some models are not equipped with automatic chain oiler pump assembly (Items 85 through 93). Note that to remove the guide bar studs (83), the stud retainers (84) must be unscrewed from crankcase and tank assembly (74); do not attempt to unscrew the studs. Refer to Fig. HL86A for XL-903 and XL-904 models with compression relief valve. Fig. HL89 shows later type crankcase with removable fuel tank and with sawdust shield used in place of gasket (85).

37. Rotor (flywheel) key	63. Lock washers	73. Flexible line	84. Stud retainers (threaded inserts)	97. Chain oil filter	107. Gasket (same as 49—Fig. HL78)
54. Piston & pin	64. Snap ring	74. Crankcase & tank assy.	85. Gasket	98. Oil line	108. Gasket (same as 51—Fig. HL78)
55. Snap ring	65. Back plate gasket	75. Gasket	86. Cam screw	99. Connector	109. Gasket (same as 51—Fig. HL78)
56. Piston rings	66. Oil filler cap	76. Cap plug	87. Gasket	100. Oil tube	110. "O" ring
57. Connecting rod	67. Gasket	77. Crankshaft seal	88. Automatic oiler pump housing	101. "O" ring	111. Cylinder
58. Needle bearing	68. Fuel filler cap	78. Pipe plug	89. Felt seal	102. Gasket	112. Spark plug
59. Needle rollers	69. Gasket	81. Elbow fitting	90. Worm gear	103. Oil pick-up line	115. Muffler body
60. Crankshaft	70. Relief valve	82. Fuel line	92. Pump plunger gear	104. Oil filter	117. Baffle
61. Ball bearing	71. Fuel pickup	83. Guide bar studs		105. Washer	118. Muffler cap
62. Bearing retaining screws	72. Filter element			106. Cap	119. Shoulder screws

bearing and inner race be cleaned and greased occasionally.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler cover and baffle plate and scrape muffler free of carbon. With muffler cover removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with wooden scraper. Be careful not to damage the edges of exhaust ports or to scratch piston. Do not attempt to run engine with muffler baffle plate or cover removed.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values for XL-700 through XL-904 models are as follows: Most of the torque values will also apply to other models. Note: All values are in inch-pounds; minimum

torque value is given. To find maximum torque value, add 20% to value given.

4/40 Outer spring shield	5
4/40 Reeds to seat	5
4/40 Flange bearing, oil pump	5
6/32 Automatic oiler pump	20
8/32 Connecting rod	55
8/32 Reed—elbow assembly	40
8/32 Throttle handle cover	40
8/32 Coil to back plate	20
10/32 Manual oiler	30
10/32 Pulley to fan housing	50
10/32 Screen to rotor	50
10/32 Carburetor to elbow	50
10/32 Muffler cap	30
10/32 Bearing retainer	55
12/24 Handle bar bracket	80
12/24 Back plate to crankcase	80
12/24 Back plate to cylinder	80
12/24 Starter housing	80
12/24 Air filter bracket	80
12/24 Muffler body	80
12/24 Carburetor chamber	80
12/24 Pawl studs to rotor	80

1/4-20 Handle bar to bracket	100
1/4-20 Handle bar to crankcase	100
3/8-24 Clutch nut	150
3/8-24 Rotor nut	150
1/4-28 Cylinder nuts	100
14MM Spark plug	150
Clutch spider or plate	180

RECOMMENDED SERVICE TOOLS. Special tools for servicing models XL-700 through VI-955 are as follows:

Tool No.	Description & Model Usage
23987	Shim, magneto air gap, all models except with capacitor discharge magneto.
24306	Shim, capacitor discharge magneto air gap.
23955 or 23955-I	Plug, connecting rod bearing installation, all models.
A-23137	Jackscrew, crankshaft and bearing, XL-700, XL-901 and XL-921.
A-23965	Jackscrew, crankshaft and bearing, all models, except XL-700, XL-901 and XL-921.

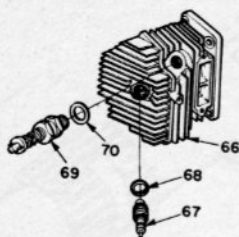


Fig. HL86A—View of compression release valve used on models listed in text.

66. Cylinder
67. Spark plug
68. Gasket
69. Relief valve
70. Copper washer

23136—Jackscrew body, model XL-700 only.

23136-1—Jackscrew body, all models except XL-700, XL-901 and XL-921.

23136-2—Jackscrew body, models XL-901 and XL-921.

22820-3—Collar, main bearing installation, models XL-700, XL-901 and XL-921.

22820-4—Collar, main bearing installation, all models except XL-700, XL-921.

23759—Sleeve, crankcase seal protector, models XL-700, XL-901 and XL-921.

23971—Sleeve, crankcase seal protector, all models except XL-700, XL-901 and XL-921.

23972—Sleeve, crankcase seal installation, all models.

23957—Plug, crankcase seal installation, all models.

A-23696—Wrench, clutch spider, all models with garter spring type clutch.

A-23934—Wrench, clutch plate, all models with compression spring type clutch.

A-23841—Wrench, bar stud retainer remover, models XL-700-800-850-900.

A-23841-A—Wrench, bar stud retainer remover, models XL-870-875-901-903-904.

A-23960—Puller, flywheel (magneto rotor), all models.

23819—Plug, sprocket bearing, models XL-700 and others with small diameter bearing.

23420—Plug, sprocket bearing, models with large diameter bearing.

23956—Plug, back plate bearing and seal, all models except XL-924, XL-924W, SXL-925, VI-944 and VI-955.

A-23962—Jackscrew, back plate bearing, all models.

23846-2—Anvil, back plate bearing, all models.

A-23951—Remover, piston pin, piston with Spirol pin.

22828—Pliers, piston pin snap ring, all models except with Rulon plastic pin retaining plugs.

23846-1—Anvil, crankshaft installation, all models.

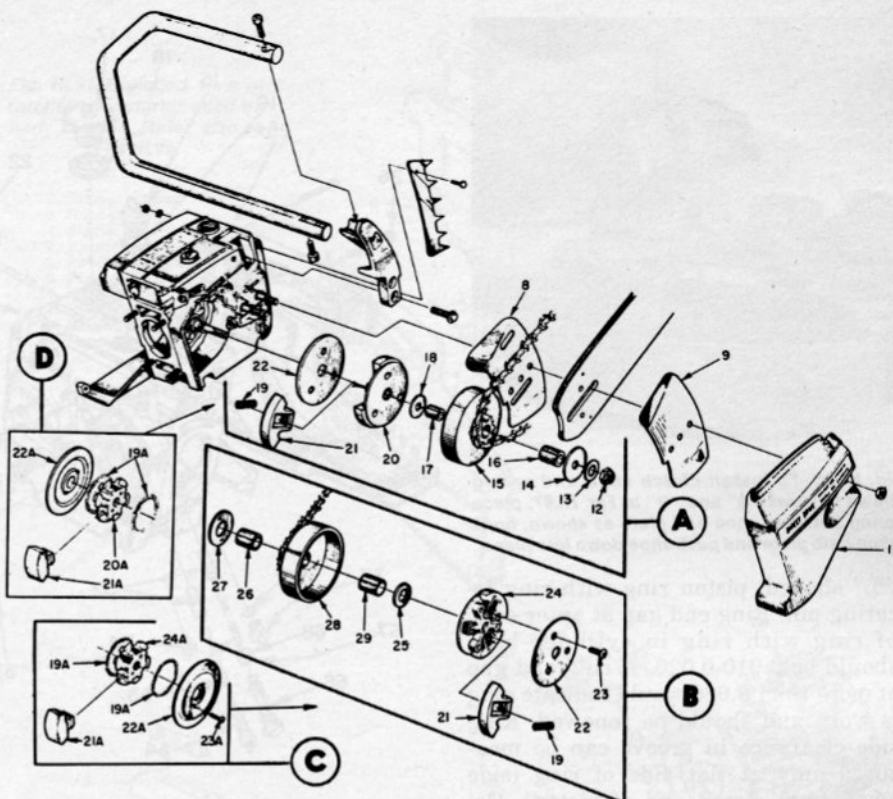


Fig. HL87—View showing different clutches which have been used. Refer to Fig. HL88 for assembly of clutch shoes (21) and springs (19) to clutch plate (20 or 24). Clutch shoes should be renewed in complete sets only to maintain balance of clutch assembly. On models XL-901, XL-921 and late XL-700, clutch construction is as shown in View "A". Early model XL-700 clutch is shown in View "D". Models XL-870, XL-875, XL-923, XL-924, XL-924W, SXL-925, VI-944, VI-955 and early XL-800 use clutch shown in View "C". All other models have clutch as shown in View "B".

8. Inner guide plate	16. Needle roller bearing	20A. Clutch spider (early)	23A. Button head screws
9. Outer guide plate	17. Inner race	21. Clutch shoe (late)	24. Clutch plate (late)
11. Clutch cover	18. Inner thrust washer	21A. Clutch shoe (early)	25. Outer thrust washer
12. Crankshaft nut	19. Clutch spring (late)	22. Clutch cover (late)	26. Inner race
13. Flat washer	19A. Clutch spring (early)	22A. Clutch cover (early)	27. Inner thrust washer
14. Outer thrust washer	20. Clutch plate (late)	23. Socket head screws	28. Clutch drum & sprocket
15. Clutch drum & sprocket			29. Needle roller bearing

23846-2—Anvil, back plate bearing, all models.

24006-1—Aligning plate, crankshaft installation, all models.

24304—"Pozidriv" screwdriver bit.

24230—"Pozidriv" hand screwdriver.

24302—Plug, backplate seal, models XL-924, XL-924W, SXL-925, VI-944 and VI-955.

24094—Spark plug removal, model XL-924W.

23528—Wrench, conn. rod, all models.

CYLINDER. The cylinder bore is chrome plated. Renew cylinder if chrome plating is worn away exposing the softer base metal.

To remove cylinder, first remove the blower (fan) housing, carburetor and air box (handle) assemblies and remove the screw retaining magneto back plate to flywheel side of cylinder. The cylinder can then be unbolted from crankcase and removed from the piston.

COMPRESSION RELIEF VALVE. Models XL-903, XL-903E, XL-903EAM, XL-904, XL-923, XL-924,

early XL-924W and VI-944 are equipped with a compression relief (decompression) valve. The poppet type relief valve is mounted in a port adjacent to exhaust port as shown in Fig. HL86A. The valve is opened as throttle lock plunger is depressed to lock position. If valve fails to close when throttle lock plunger is released, either remove valve and clean using a carbon solvent or renew the valve assembly. Copper sealing washer is available separately.

PISTON, PIN AND RINGS. Except for late model XL-875, all models are equipped with piston fitted with two pinned compression rings. Desired ring side clearance in groove is 0.002-0.003; renew the piston if side clearance in top groove with new ring is 0.0035 or more. Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Piston, pin and rings are available in standard size only. Pin and piston are available, fitted set only.

Late model XL-875 is equipped with piston having a single head-land type

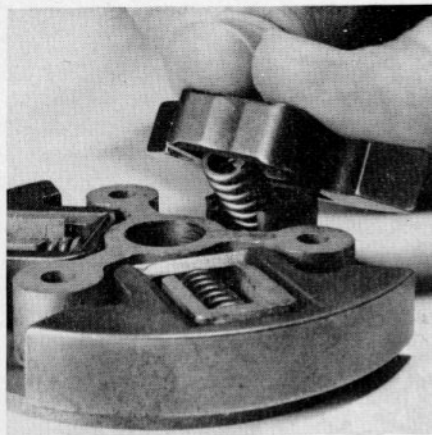


Fig. HL88—To install clutch shoe and spring shown in views "A" and "B" in Fig. HL87, place spring between shoe and plate as shown, hook shoe onto plate and push shoe down into place.

("L" shaped) piston ring with ring locating pin. Ring end gap at outer edge of ring with ring in cylinder bore should be 0.010-0.020. A ring end gap of more than 0.020 would indicate ring is worn and should be renewed. Ring side clearance in groove can be measured only at flat side of ring (side away from closed end of piston). Desired side clearance in ring groove is 0.001-0.004. NOTE: Piston with head land ring should not be used to renew early model XL-875 piston with two pinned rings unless a new unworn cylinder is also installed.

Different methods of retaining piston pin have been used. Early models were equipped with piston fitted with non-removable Spirol pin through pin boss at exhaust side of piston and a Walde Truarc snap ring at intake side. Later models and service replacement piston for early models utilize a non-removable snap ring at exhaust side of piston instead of the Spirol pin. A third method of retaining piston pin is using "Rulon" (thermal plastic) plugs that snap into pin bore of piston at end of piston pin.

To remove piston pin retained with snap ring at intake side of piston, remove the snap ring using special pliers (Homelite tool No. 22828). On early type piston with Spirol pin at exhaust side, push piston pin out towards intake side using slotted remover (Homelite tool No. A-23951). On models with snap ring at exhaust side of piston, insert a 3/16-inch diameter rod through snap ring and push pin from piston. On models with "Rulon" retaining plugs, pry the plugs from piston, then push piston pin out.

When installing piston pin, be sure closed end is towards exhaust side of piston (away from piston ring locating pin). On models with snap ring at intake side of piston (all models except

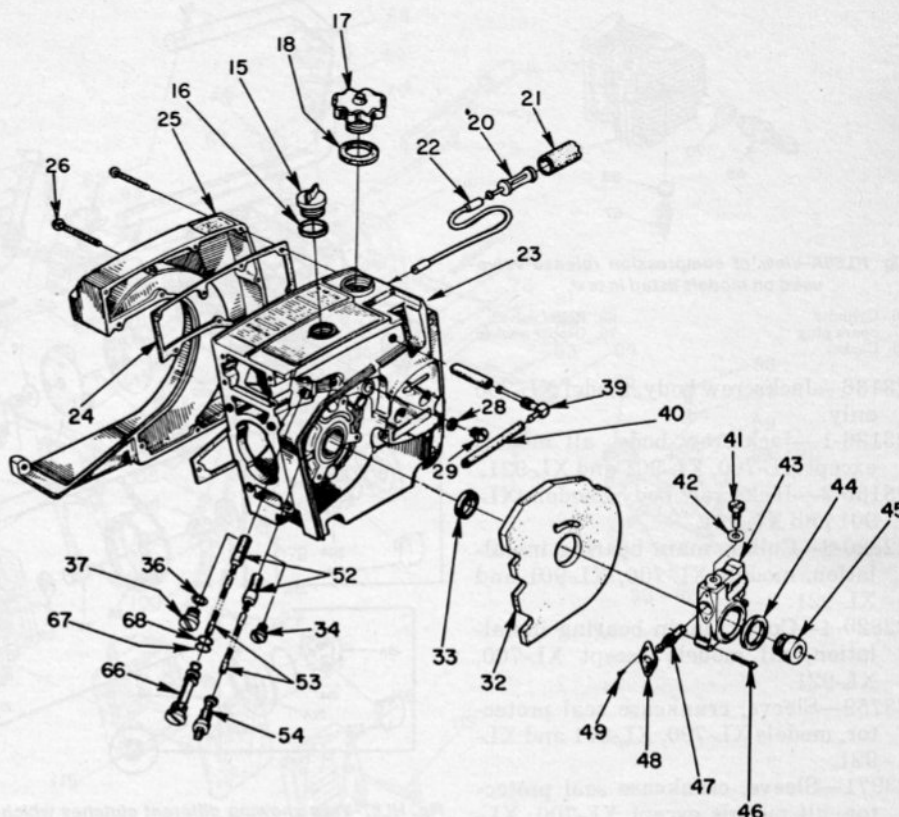


Fig. HL89—Exploded view showing automatic chain oiler pump, manual and automatic oiler pick-ups, crankcase and oil reservoir and fuel tank. Automatic oil pump plunger (47) and pump body (43) are available as a matched set only. Plug (34) is used to seal opening when saw is not equipped with manual chain oiler; plug (37) and washer (36) are used on models not equipped with automatic chain oiler. On late models, fuel tank cover (25) is sealed to crankcase and chain oil reservoir with gasket (24); early units were equipped with integral epoxied unit.

15. Chain oil cap
16. Gasket
17. Fuel tank cap
18. Gasket
20. Pick-up head
21. Fuel filter
22. Flexible line
23. Crankcase
24. Gasket

25. Fuel tank
26. Tank cover screws
28. Gasket
29. Cap
32. Saw dust shield
33. Crankshaft seal
34. Plug
36. Sealing washer
37. Plug

39. Elbow
40. Fuel line
41. Oil pump cam
42. Gasket
43. Oil pump body
44. Felt seal
45. Worm gear
46. Pump retaining screws

47. Pump gear/plunger
48. Flanged bearing
49. Screws
52. Oil pick-ups
53. Flexible oil lines
54. Connector
56. Oil line tube
57. Gasket
58. "O" ring

those with "Rulon" plugs), insert snap ring using special pliers; sharp edge of snap ring must be out and locate end gap towards closed end of piston. On models with "Rulon" plugs, use new plugs when reassembling piston to connecting rod.

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Be careful to remove all of the 28 loose needle rollers when detaching rod from crankpin.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23955 or 23955-1. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. Stick 14 needle rollers in rod

and the remaining 14 needle rollers in rod cap with light grease or beeswax. Assemble rod to cap with match marks aligned and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured surfaces of rod and cap.

CRANKSHAFT. Flywheel end of crankshaft is supported in a roller bearing in magneto back plate and drive end is supported in a ball bearing located in crankcase. End play is controlled by the ball bearing.

Renew the crankshaft if the flywheel end main bearing or crankpin bearing surface or sealing surfaces are scored, burned or excessively worn. Renew the ball bearing if excessively loose or rough. Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged.

CRANKCASE, MAGNETO BACK PLATE AND SEALS. To remove the magneto back plate, first remove the blower (fan) housing, flywheel and (ex-

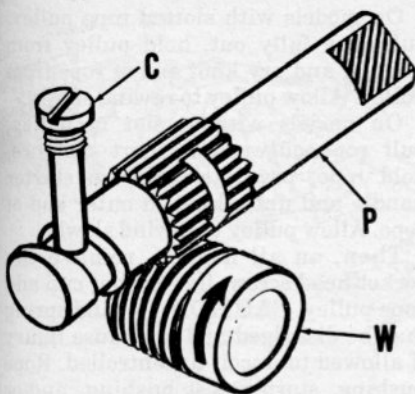


Fig. HL90—Schematic diagram of automatic chain oiler pump operation. Worm gear (W) on crankshaft drives (rotates) pump plunger (P). Cam cut in plunger rides against cam screw (C) causing plunger to move back and forth as it rotates. Flat on plunger acts as a valve as it opens intake port on downward stroke and outlet port on upward stroke.

cept on model XL-850) breaker point assemblies. Loosen the cylinder retaining stud nuts on flywheel side of engine to reduce clamping effect on back plate boss, then unbolt and remove the back plate assembly from crankcase.

To remove crankshaft from crankcase, first remove the cylinder, connecting rod and piston assembly and the magneto backplate as previously outlined. Remove the drive clutch assembly and, on models so equipped, the automatic chain oiler drive worm and pump from drive end of crankcase and shaft. Then, remove the two ball bearing retaining screws (62—Fig. HL86) from inside of crankcase and remove the crankshaft and ball bearing assembly from crankcase. Remove snap ring (64) and press crankshaft from bearing if necessary.

REED VALVES. All models are equipped with pyramid reed valves. On early models XL-700 and XL-800, the four 0.005 thick reeds are retained to the metal pyramid seat by retaining plates and screws.

On later models the pyramid seat is of "Delrin" plastic and the 0.004 thick reeds are located by pins molded in the seat. The reeds are held in place by a molded retainer that also serves as a gasket between reed seat and crankcase. Reeds for the previous diecast metal seat are 0.005 thick whereas reeds for the late type "Delrin" seat are 0.004 thick. Do not attempt to interchange reeds between metal and "Delrin" type seats.

When installing latest type intake elbow and "Delrin" seat assembly, insert reed retainer into crankcase first. Stick reeds to seat with oil, then insert seat with reeds. Also, it is important

Fig. HL91—Exploded view of ratchet type starter used on early models. Refer also to Fig. HL92.

2. Starter housing
3. Rope guide
4. Starter rope
7. Plastic disc
8. Rewind spring
9. Plastic disc
10. Rope pulley
11. Starter cup
12. Flat washer
13. Screw

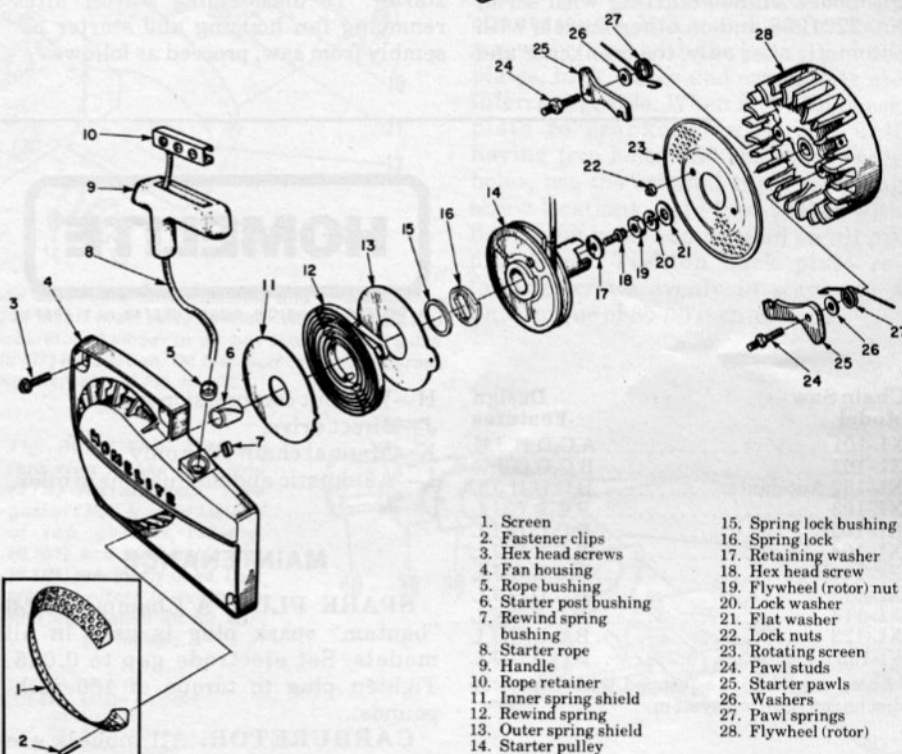
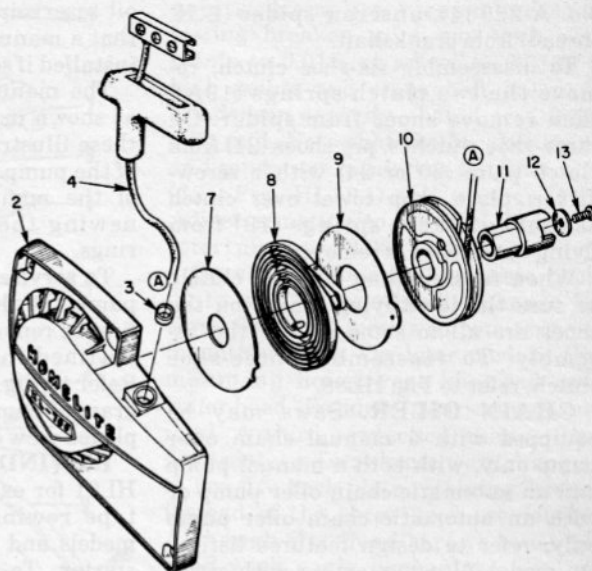


Fig. HL92—Exploded view of late type starter. Note that fan housing (4) has renewable starter post bushing (6) and rewind spring bushing (7). Also, pulley and starter cup are an integral unit (14). Separate spring lock (16) and spring lock bushing (15) are used. Screen (1) and attaching clips (2) are optional equipment. An air flow ring is used in place of screen (23) on some later models.

that the special shoulder type retaining screws be installed.

CLUTCH. Early models XL-700 and XL-800 were equipped with a six-shoe clutch as shown in the exploded views (C & D—Fig. HL87). All later models may be equipped with a three-shoe clutch as shown in views A & B or six-shoe clutch.

To remove either type clutch, proceed as follows: On models with clutch outside of chain first remove screws

retaining clutch cover (22 or 22A) to clutch spider (24 or 24A) and remove cover. Unscrew the clutch spider (L.H. thread) from crankshaft using a spanner wrench (Homelite tool No. A-23696 or No. A-23934). The clutch drum, bearing and inner race can then be removed from crankshaft.

On models with clutch inside chain, remove nut from drive end of crankshaft and slide clutch drum and inner race from shaft. Then, using spanner wrench (Homelite tool No. A-23696 or

No. A-23934), unscrew spider (L.H. thread) from crankshaft.

To disassemble six-shoe clutch, remove the two clutch springs (19A), then remove shoes from spider. On three-shoe clutches, pry shoes (21) from clutch plate (20 or 24) with a screwdriver; place shop towel over clutch assembly to keep springs (19) from flying out as shoe is removed.

When reassembling six-shoe clutch, be sure the identifying marks on the shoes are all to same side of the assembly. To reassemble three-shoe clutch, refer to Fig. HL88.

CHAIN OILER. Saws may be equipped with a manual chain oiler pump only, with both a manual pump and an automatic chain oiler pump or with an automatic chain oiler pump only; refer to design features listing. On model XL-800 starting with serial No. 2201258 and on other models with automatic oiler only, the crankcase and

oil reservoir are drilled and tapped so that a manual chain oiler pump can be installed if so desired.

The manual oiler pump is installed as shown in Fig. HL78 or Fig. HL79A; these illustrations show exploded view of the pump assembly. Usually, service of the manual pump consists of renewing the plunger and shaft "O" rings.

To service the automatic chain oiler pump, the clutch drum and spider must first be removed from the crankshaft as outlined in a preceding paragraph. Refer to Fig. HL90 for operational diagram of pump and to Fig. HL89 for exploded view of pump assembly.

REWIND STARTER. Refer to Fig. HL91 for exploded view of the ratchet type rewind starter used on early models and to Fig. HL92 for late type starter. To disassemble starter after removing fan housing and starter assembly from saw, proceed as follows:

On models with slotted rope pulley, pull rope fully out, hold pulley from turning and pry knot end of rope from pulley. Allow pulley to rewind slowly.

On models without slot in pulley, pull rope outward a short distance, hold rope, pry retainer from starter handle and untie knot in outer end of rope. Allow pulley to rewind slowly.

Then, on all models, remove the socket head screw, flat washer cup and rope pulley. **CAUTION:** Rewind spring may be dislodged and can cause injury if allowed to uncoil uncontrolled. Rope bushing, starter post bushing, and/or rewind spring bushing in housing should be renewed if worn.

When reassembling starter, lubricate starter port lightly and install spring dry except for a small amount of lithium base grease on edges of spring.

Reassemble starter using exploded view in Fig. HL91 or Fig. HL92 as a guide. Prewind spring about 2-4 turns.

HOMELITE®

A **Textron** DIVISION, PORT CHESTER, N.Y. 10573

Chain Saw Model

Design Features

XL-101	A,C,D,H,J,K
XL-102	B,C,D,G,J,K
XL-102 Automatic	B,C,D,H,J,L
XL-103	B,C,D,G,J,L
XL-103E	B,C,D,G,J,L
XL-104	B,C,E,G,J,L*
XL-104E	B,C,E,G,J,L
XL-113	B,C,D,G,J,L
XL-114	B,C,F,G,J,L
XL-123	B,C,D,G,J,L
VI-123	B,C,D,G,J,L

*Later models are equipped with capacitor discharge ignition system.

DESIGN FEATURES CODE

- A—Displacement, 3.3 cu. in.; bore, 1 3/4 in.; stroke, 1 3/8 in.
- B—Displacement, 3.5 cu. in.; bore, 1 13/16 in.; stroke, 1 3/8 in.
- C—Pyramid reed type intake valve, 4 reeds.
- D—Equipped with conventional fly-wheel type magneto.
- E—Equipped with solid state (transistorized breakerless) flywheel magneto.
- F—Equipped with capacitor discharge ignition system.
- G—Equipped with compression release.

- H—Without compression release.
- J—Direct drive.
- K—Manual chain oiler only.
- L—Automatic and manual chain oiler.

MAINTENANCE

SPARK PLUG. A Champion CJ-6 "bantam" spark plug is used in all models. Set electrode gap to 0.025. Tighten plug to torque of 150 inch-pounds.

CARBURETOR. All models are equipped with a Walbro model SDC diaphragm carburetor. Refer to Walbro section of SERVICE FUNDAMENTALS section for overhaul and exploded views.

Initial adjustment of idle mixture screw is 3/4-1 turn open. Initial adjustment of high speed mixture screw is 1-1 1/4 turns open. Adjust idle speed screw and idle mixture screw so that engine idles smoothly just below clutch engagement speed. Make final adjustments with engine warm. Adjust high speed mixture screw to obtain optimum performance with engine under cutting load. Do not adjust carburetor too lean as engine may be damaged.

When reinstalling carburetor on early models, stick gaskets to spacer

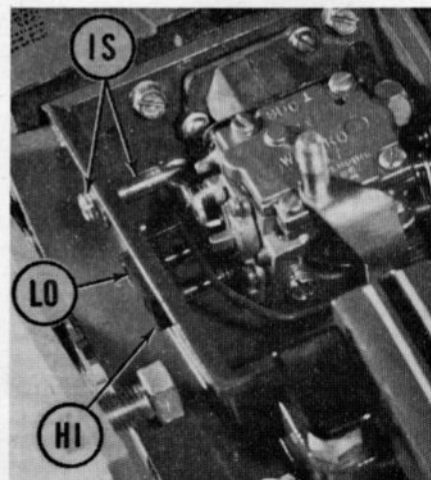


Fig. HL100—View with air filter removed showing carburetor adjusting points. Early model air box and idle speed screw have 5/16-18 thread; late models have 5/16-24 thread for more accurate idle speed adjustment.

HI. High speed needle
IS. Idle speed screw
LO. Idle fuel needle

and stick spacer and gasket assembly to carburetor with tacky grease to aid in reinstalling unit to adapter. Tighten retaining screws evenly to a torque of 50 inch-pounds. On late models without spacer, install carburetor with new gasket and tighten screws evenly

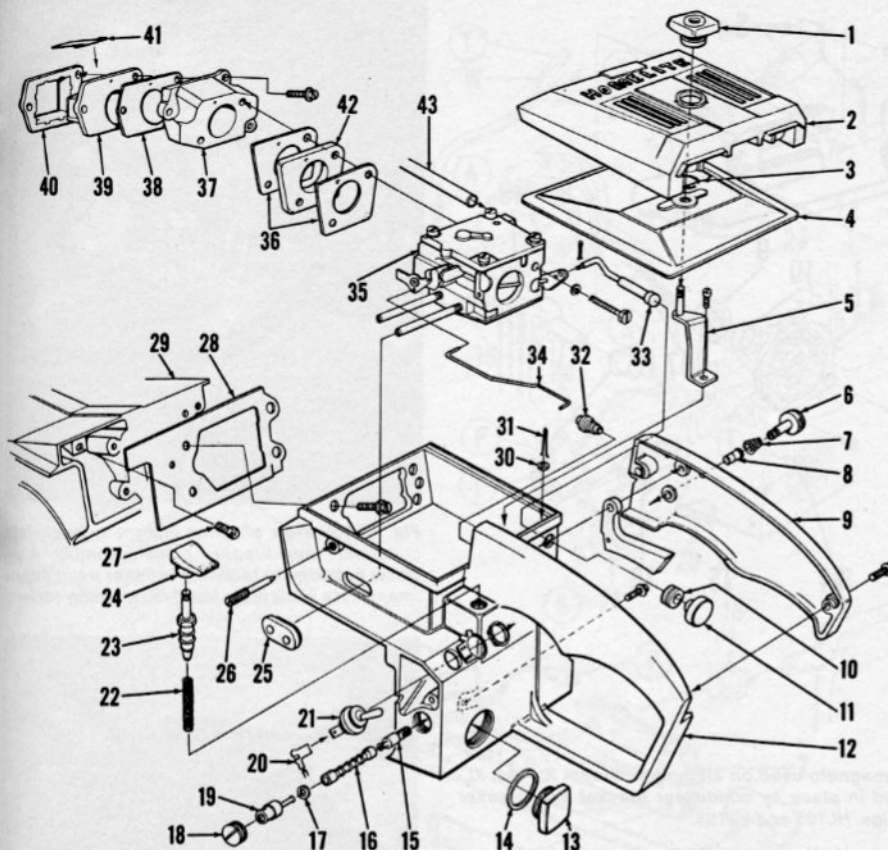


Fig. HL101—Exploded view of throttle handle, air box chain oiler tank assembly and related parts. When cementing new gasket (28) to crankcase (29), insert reed valve retainer (40) in crankcase opening to align gasket. Fuel tank is vented to carburetor chamber in air box through vent valve (27). Refer to Fig. HL102 for late type intake manifold (37) installation. Oil reservoir cover is separate from throttle handle on late models; refer to Fig. HL103.

- | | |
|---------------------|---------------------------|
| 1. Knob | 23. Pump plunger |
| 2. Air filter cover | 24. Oil pump button |
| 3. Snap ring | 25. Grommet |
| 4. Filter element | 26. Idle speed stop screw |
| 5. Bracket | 27. Fuel tank vent |
| 6. Throttle latch | 28. Gasket |
| 7. Spring | 29. Crankcase |
| 8. Bushing | 30. Felt washer |
| 9. Handle cover | 31. Cotter pin |
| 10. Grommet | 32. Boot |
| 11. Choke knob | 33. Choke rod |
| 12. Throttle handle | 34. Throttle rod |
| 13. Oil tank cap | 35. Carburetor |
| 14. Gasket | 36. Gaskets |
| 15. Oil filter | 37. Intake manifold |
| 16. Flexible tube | 38. Gasket |
| 17. Gasket | 39. Reed valve seat |
| 18. Plug | 40. Reed retainer |
| 19. Check valve | 41. Valve reeds |
| 20. Ground lead | 42. Heat insulator |
| 21. Ignition switch | 43. Fuel tube |
| 22. Spring | |

Fig. HL102—View showing late type intake manifold (37A) installation. One gasket (36A) is used instead of two gaskets (36—Fig. HL101) previously used. Late type manifold is available with installation kit for earlier models.

- | |
|----------------------|
| 36A. Gasket |
| 37A. Intake manifold |
| 38. Gasket |
| 39. Reed valve seat |
| 40. Reed retainer |
| 44. Manifold screws |
| 45. Manifold screw |
| 46. Carburetor screw |

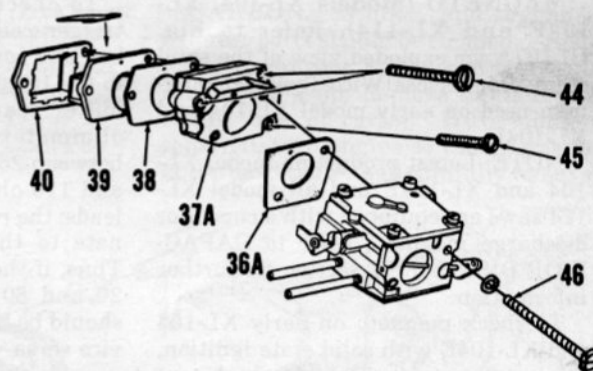
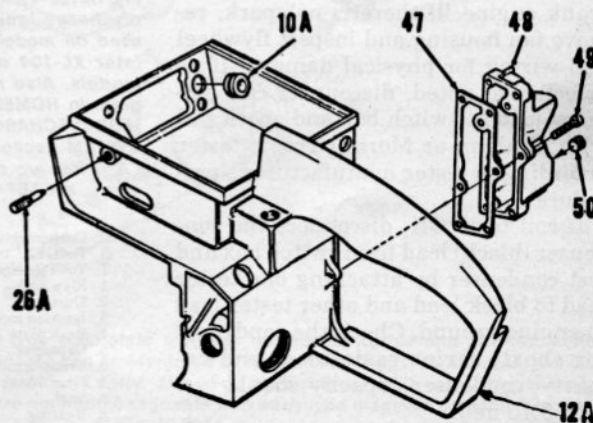


Fig. HL103—Oil tank cover (48) is sealed to throttle handle (12A) with gasket (47) on later models. An oil tank repair (gasket) kit is available for resealing epoxied cover on earlier models. Idle speed adjusting screw (26A) on late throttle handle has 5/16"-24 thread for more accurate idle speed adjustment. Grommet (10A) is used to seal fuel line air box entry. "Pozidriv" screws (49) retain cover to throttle handle. Plug (50) is used on models XL-101 and XL-102 to seal automatic oiler opening.



to a torque of 25 inch-pounds. Note: A kit is available to install late type manifold on early model saws.

MAGNETO (Except XL-104, XL-104E and XL-114). Refer to Fig. HL104 for exploded view of the conventional flywheel type Wico magneto used on all models except XL-104, XL-104E and XL-114.

Breaker points and condenser are accessible after removing the fan housing and starter assembly, flywheel and breaker cover. A pry slot is provided to facilitate breaker point gap adjustment using screwdriver as shown in Fig. HL105. Adjust breaker point gap to 0.015 if not renewing

points. Homelite recommends adjusting breaker point gap with new points to 0.016, or adjust to 0.0165 if both points and crankshaft are new. Condenser capacity should test 0.16-0.20 mfd. Note that the breaker point and condenser retain the felt dust seal (12—Fig. HL104) and washer (13). Adjust armature to flywheel (magneto rotor) air gap to 0.004-0.008.

On early production, magneto back plate was retained to crankcase by three flat head screws in countersunk mounting holes. On later models, the mounting holes were changed and wafer head "Pozidriv" type screws were used. A third production change, the back plate and crankcase were changed to use five back plate retaining screws instead of the three used previously. Although flat head screws must be used with early back plate having countersunk holes and wafer head screws be used with the later type back plates, back plates and crankcases are interchangeable. When installing back plate to crankcase with one unit having five holes and the other three holes, use the original three retaining screw locations. Late type gasket with five screw holes can be used on all applications. Tighten back plate retaining screws evenly in stages to a final torque of 80-90 inch-pounds.

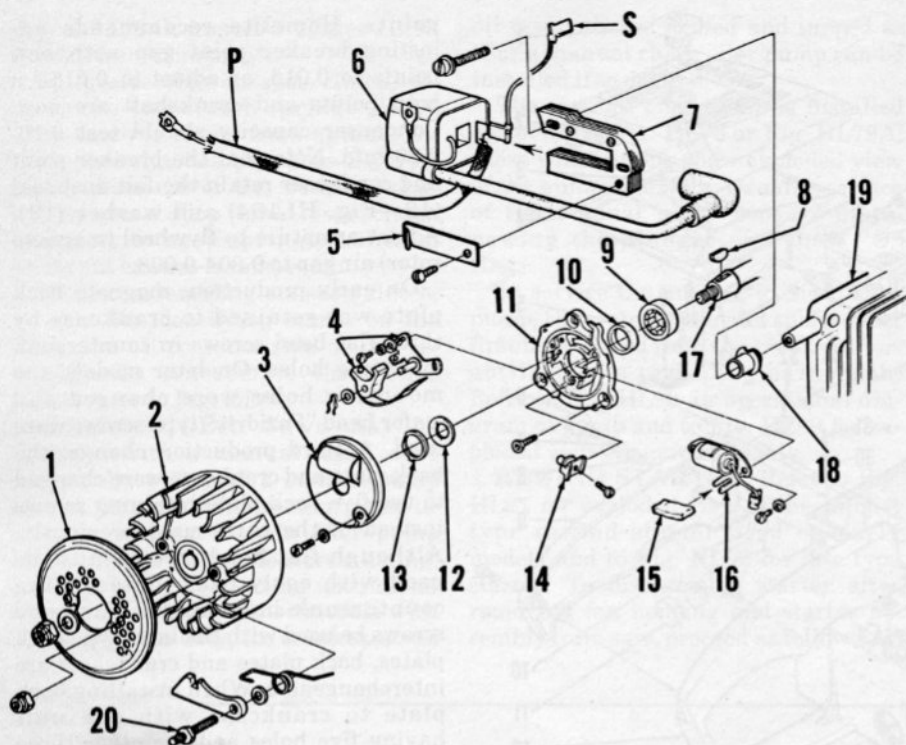


Fig. HL104—Exploded view of conventional flywheel magneto used on all models except XL-104, XL-104E and XL-114. Felt dust seal retainer (13) is held in place by condenser bracket and breaker point base. Refer also to Figs. HL105 and HL106.

- | | | | |
|-------------------------|---------------------|------------------------|-------------------|
| P. Primary lead | 5. Coil retainer | 11. Magneto backplate | 16. Condenser |
| S. Switch (ground) lead | 6. Ignition coil | 12. Felt dust seal | 17. Crankshaft |
| 1. Rotating screen | 7. Armature core | 13. Retainer | 18. Lead retainer |
| 2. Rotor (flywheel) | 8. Flywheel key | 14. Insulated terminal | 19. Cylinder |
| 3. Breaker cover | 9. Roller bearing | 15. Felt cam wiper | 20. Pawl studs |
| 4. Breaker points | 10. Crankshaft seal | | |

MAGNETO (Models XL-104, XL-104E and XL-114). Refer to Fig. HL107A for exploded view of the solid state breakerless Wico flywheel magneto used on early model XL-104 and XL-104E.

NOTE: Latest production model XL-104 and XL-104E and all model XL-114 saws are equipped with a capacitor discharge magneto; refer to CAPACITOR DISCHARGE section for further information.

To check magneto on early XL-104 and XL-104E with solid state ignition, connect a test spark plug to high tension lead, turn ignition switch on and crank engine. If there is no spark, remove fan housing and inspect flywheel and wiring for physical damage. If no defects are noted, disconnect coil primary lead at switch box and check coil with Graham or Merc-O-Tronic tester according to tester manufacturer's procedure.

If coil tests OK, disconnect the condenser (black) lead from switch box and test condenser by attaching one tester lead to black lead and other tester lead to engine ground. Check the condenser for short, series resistance and capacity; condenser capacity should test 0.13-0.15 mfd.

To check trigger coil, disconnect trigger coil (white) lead from switch box and connect one lead of ohmmeter to the trigger coil lead and other ohmmeter lead to engine ground. The ohmmeter reading should be either between 25 and 80 ohms or between 80 and 110 ohms. Reverse the ohmmeter leads; the reading should then be alternate to the first ohmmeter reading. Thus, if the first reading was between 20 and 80 ohms, the second reading should be between 80 and 110 ohms, or vice versa.

Fig. HL107—View of capacitor discharge ignition system used on model XL-114 and later XL-104 and XL-104E models. Also refer to diagram in HOMELITE CAPACITOR DISCHARGE IGNITION SYSTEM section. Note that "A" wires are connected as are "B" wires.

- | |
|------------------------------|
| C. Condenser wires |
| G. To "GEN" terminal |
| T. To "TRANSF" terminal |
| 1. Flywheel |
| 2. Dust cap |
| 3. Ignition module |
| 4. Back plate |
| 5. Capacitor |
| 6. Transformer |
| 7. Generator coil & armature |
| 8. Seal |
| 9. Bearing |

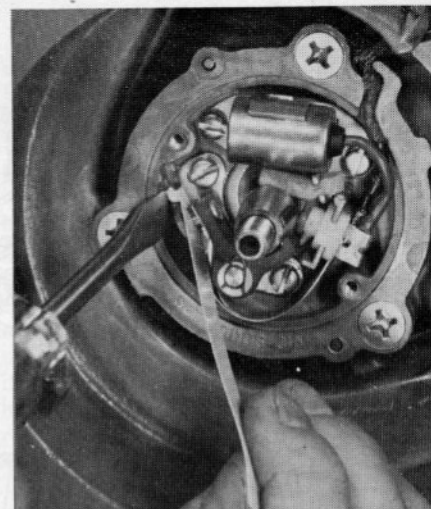
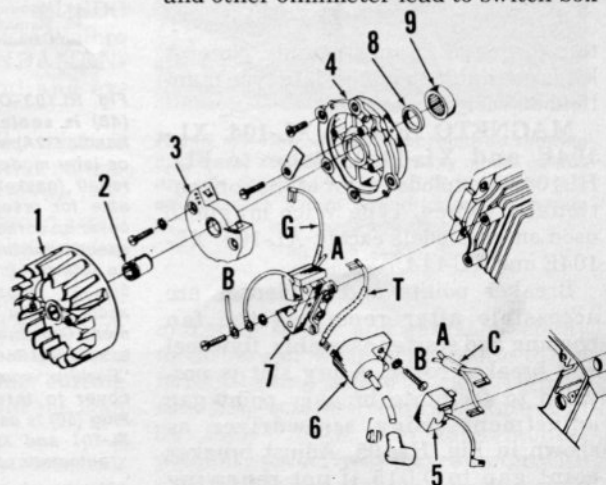


Fig. HL105—View showing magneto backplate, condenser and breaker point assembly. A pry slot is provided to facilitate breaker point adjustment. Late back plate has five retaining screws.

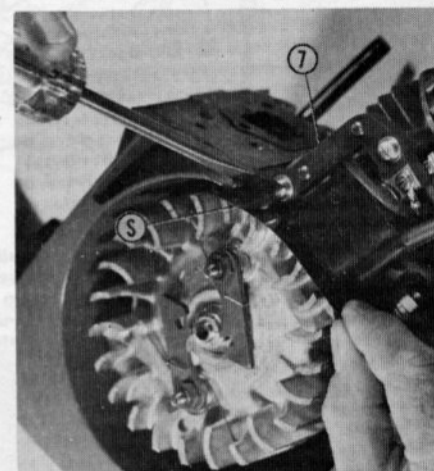


Fig. HL106—Adjusting air gap between flywheel and armature (7) using plastic shim (S). Air gap should be 0.004-0.008.

To check trigger switch, disconnect all wires from the switch. Then, connect one lead of ohmmeter to switch box "P" terminal (see Fig. HL107A) and other ohmmeter lead to switch box

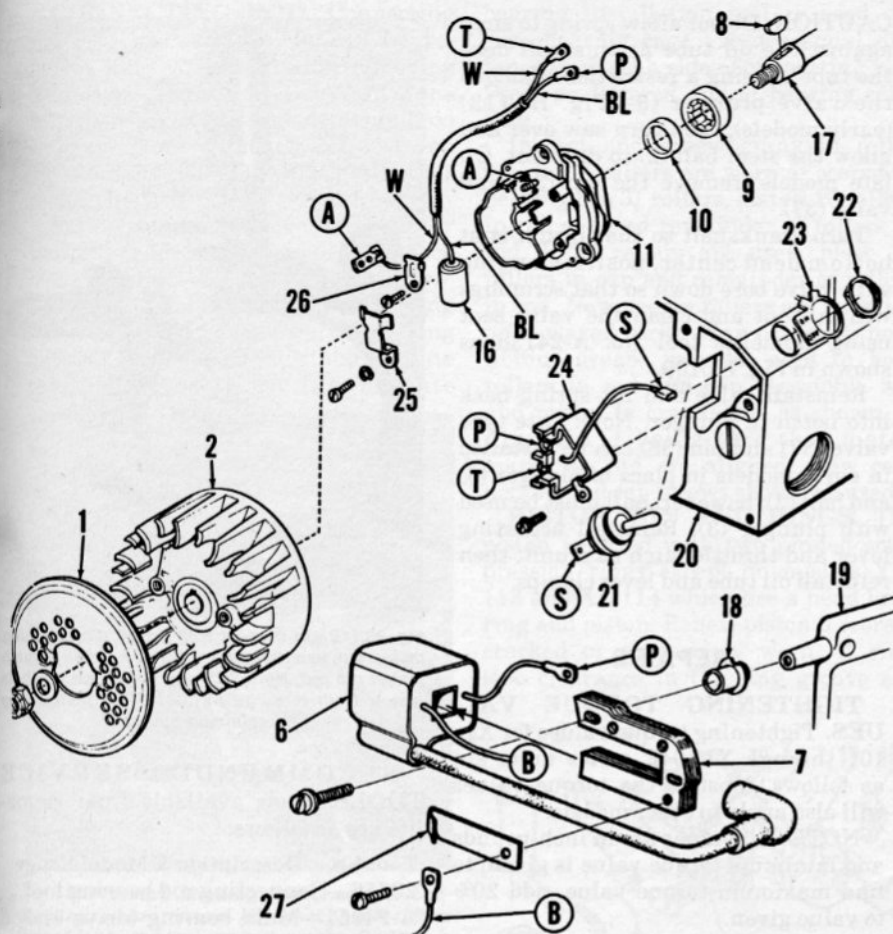


Fig. HL107A—Exploded view of the breakerless solid state Wico magneto used on early models XL-104 and XL-104E. Wiring connections are identified by circled letter; thus, connect wire clip (A) to connection (A) on trigger coil, etc. White wire (W) connects trigger coil to terminal (T) on trigger switch (24). Refer to Fig. HL107B for wiring diagram on model XL-104 above serial No. 2805889.

A. Trigger coil connection
B. Coil ground lead
BL. Black (condenser) lead
P. Trigger switch connection
S. Switch connection
T. Trigger switch connection

W. White lead
1. Rotating screen
2. Magneto rotor (flywheel)
6. Ignition coil
7. Armature
8. Flywheel key
9. Roller main bearing
10. Crankshaft seal

11. Magneto backplate (trigger coil)
16. Condenser
17. Crankshaft
18. Condenser lead retainer
19. Cylinder
20. Throttle handle

21. Ignition switch
22. Nut
23. "ON-OFF" plate
24. Trigger switch
25. Condenser clamp
26. Lead retainer
27. Coil retainer

ground terminal (retaining strap screw eye). Ohmmeter reading should be either between 5 to 25 ohms or between 1 megohm to infinity. Reverse the ohmmeter leads and alternate reading should be obtained. Thus, if first reading was between 5 to 25 ohms, second reading should be between 1 megohm to infinity, or vice versa.

Renew any component not checking within specified test values and reconnect wiring according to connection code shown in Fig. HL107A. Note: Although not necessary to remove flywheel to check or test magneto components, the flywheel must be removed to renew trigger coil and/or condenser. Adjust armature air gap of model XL104 breakerless Wico and Phelon CD ignition systems to 0.008-0.012 using 0.0125 plastic shim stock, Homelite #24306. Adjust armature air gap as outlined in preceding paragraph for

conventional magneto used on other models.

On early models, trigger coil (magneto back plate) was retained to crankcase with three screws. Later production models have five back plate retaining screws. When installing late type back plate or crankcase with five screw holes to crankcase or back plate with three screw holes, use only the original three mounting screw positions. Tighten the wafer head screws evenly in stages to a final torque of 80-90 inch-pounds. Use only a #2 "Pozi-driv" screwdriver bit (Homelite tool No. 24304) to remove or tighten back plate screws.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

Fill chain oiler reservoir with Homelite Bar and Chain oil or with light motor oil (not over SAE 30). In cold weather, thin oil with kerosene until it flows freely.

The clutch needle roller bearing should be cleaned and relubricated after each 100 hours of operation. Homelite® ALL-TEMP Multi-Purpose Grease or an equivalent grease is recommended.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove

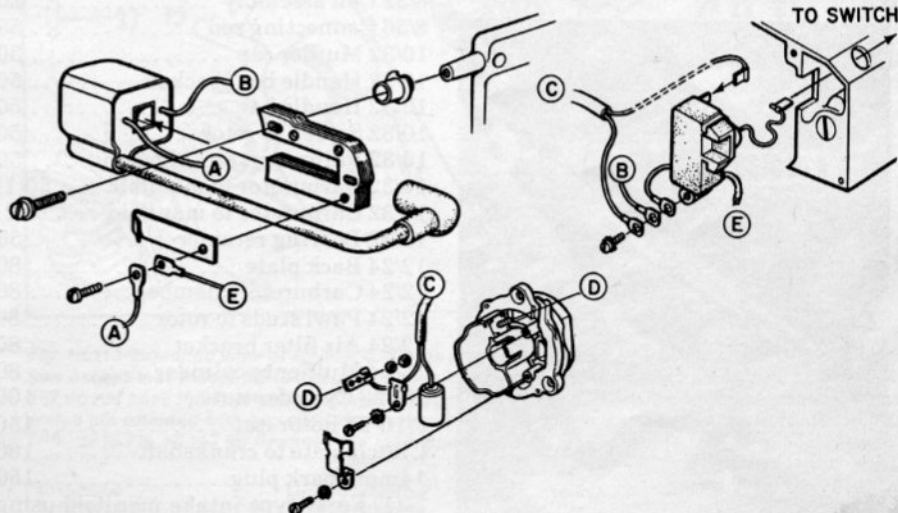


Fig. HL107B—View showing late type solid state magneto on models XL-104 and XL-104E. Letters indicate wiring connections. Magneto can be identified by red colored trigger switch whereas early trigger switch (24—Fig. HL107A) is natural color. The back plate (trigger coil), rotor, trigger switch, condenser and throttle handle are not interchangeable with early type magneto components shown in Fig. HL107A.

carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. **Do not** run engine with muffler removed.

CLEAN COMPRESSION RELIEF VALVE. While muffler is removed to clean carbon from the muffler and exhaust ports, proceed as follows to clean the compression relief valve:

Remove the two bolts retaining compression relief lever bracket (51—Fig. HL108) and oil tube clamp (55) to air box and remove the compression relief lever (50) and throttle latch (6). Using pliers, carefully lift end of spring (52) from notch in end of valve plunger (2) and ease spring down against oil tube.

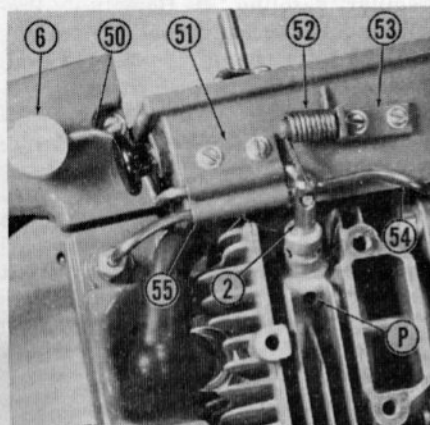


Fig. HL108—View with muffler assembly removed to show compression relief mechanism. Depressing throttle latch button (6) actuates lever (50) lifting compression relief plunger (2). Engine compression is then relieved through port (P).

- | | |
|----------------------------|----------------------|
| P. Compression relief port | 51. Lever bracket |
| 2. Relief valve plunger | 52. Valve spring |
| 6. Throttle latch button | 53. Spring bracket |
| 50. Release lever | 54. Chain oiler tube |
| | 55. Tube clamp |

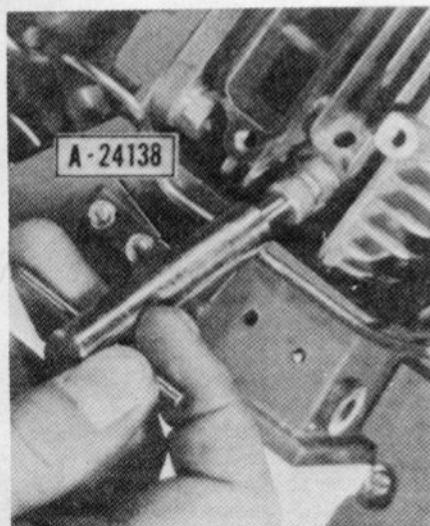


Fig. HL109—Cleaning compression relief valve seat using Homelite tool No. A-24138. Hold the engine in inverted position so that carbon scraped from seat will fall out.

CAUTION: Do not allow spring to snap against the oil tube as this will dent the tube causing a restriction. Remove the valve plunger (3—Fig. HL113) (early models), then turn saw over and allow the steel ball (2) to drop out. On late models, remove the pin (38) and valve (37).

Turn crankshaft so that piston is at bottom dead center, position engine with valve bore down so that scrapings will fall out and clean the valve seat using Homelite tool No. A-24138 as shown in Fig. HL109.

Reinstall valve and lift spring back into notch in plunger. Note: Late type valve (37) and pin (38) can be installed in early models in place of plunger (3) and ball (2); however, ball must be used with plunger (3). Reinstall actuating lever and throttle latch as a unit, then reinstall oil tube and lever clamps.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values for XL101 through XL104E series units are as follows. Most of the torque values will also apply to other models.

NOTE: All values are in inch-pounds and minimum torque value is given; to find maximum torque value, add 20% to value given.

6/32 Compression release lever	20
6/32 Compression release spring	20
6/32 Point dust cover	15
8/32 Automatic chain oiler	40
8/32 Intake manifold	40(1)
8/32 Intake manifold	20(2)
8/32 Throttle handle cover	40
8/32 Starter (fan) housing	40
8/32 Coil assembly	20
8/36 Connecting rod	55
10/32 Muffler cap	30
10/32 Handle bar bracket	50
10/32 Handle bar	50
10/32 Screen to rotor	50
10/32 Pulley to starter housing	50
10/32 Carburetor to manifold	50(1)
10/32 Carburetor to manifold	25(2)
10/32 Bearing retainer	55
12/24 Back plate	80
12/24 Carburetor chamber	80
12/24 Pawl studs to rotor	80
12/24 Air filter bracket	80
12/24 Muffler to cylinder	80
1/4-28 Cylinder nuts	100
5/16-24 Rotor nut	150
Clutch plate to crankshaft	180
14mm Spark plug	150

- (1) Early type intake manifold using spacer and two gaskets between manifold and carburetor.
- (2) Late type intake manifold using single gasket (no spacer) between manifold and carburetor.

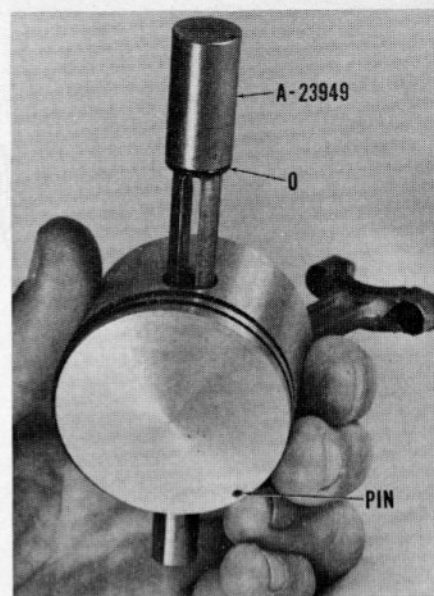


Fig. HL110—On models with Spirol pin retaining piston pin, use Homelite tool No. A-23949 to push piston pin out. Note "O" ring (O) which protects piston from damage by tool. Note piston ring retaining pin.

RECOMMENDED SERVICE TOOLS. Tools available from Homelite are as follows:

Tool No.	Description & Model Usage
23756	Connecting rod bearing tool
A-24051	Main bearing (drive end) & crankshaft jackscrew; also requires:
23136-1	Sleeve
22820-5	Collar
24076	Seal protector
24006-1	Alignment plate
23972	Crankshaft seal installer (drive end w/crankshaft installed)
24054	Crankshaft seal installer (drive end w/crankshaft removed)
A-24057	Main bearing remover (backplate end)
23846-2	Anvil (for use w/A-24057)
24055	Main bearing installer (backplate end); seal remover & installer (backplate)
24053	Seal protector sleeve (XL-101)
24076	Seal protector sleeve (Except XL-101)
23759	Seal protector (backplate)
22828	Piston pin snap ring pliers
A-23949	Piston pin remover
A-23960	Rotor (flywheel) holder & remover
A-24060	Clutch spanner wrench (Early)
A-23934	Clutch spanner wrench (Late)
A-24138	Compression relief valve seat reamer
24304	#2 "Pozidriv" bit
24230	#3 "Pozidriv" bit
A-23841-A	Bar stud insert wrench
24173	Carburetor check valve installer

CONNECTING ROD. Connecting rod and piston assembly can be removed from crankshaft after removing cylinder. Be careful to remove all of the loose needle rollers when detaching rod from crankshaft. Models XL-123 and VI-123 have 25 rollers while all other models have 31 rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The needle roller piston pin bearing can be renewed by pressing old bearing out and new bearing in using Homelite tool No. 23756. Note: If substitute

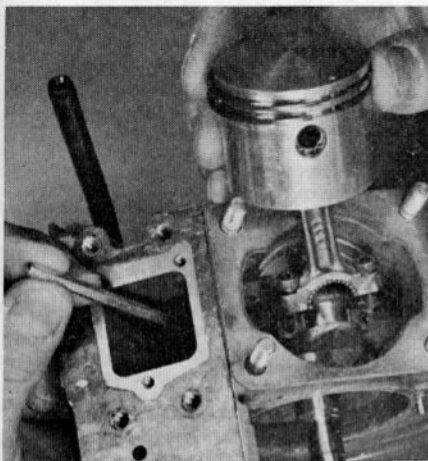


Fig. HL111-View showing reassembly of connecting rod to crankpin. Note that needle rollers are stuck to rod and cap with grease. Rod cap is held in position with Allen wrench. Be sure that match marks on rod and cap are aligned, and that intake side of piston is towards flywheel end of crankshaft as shown.

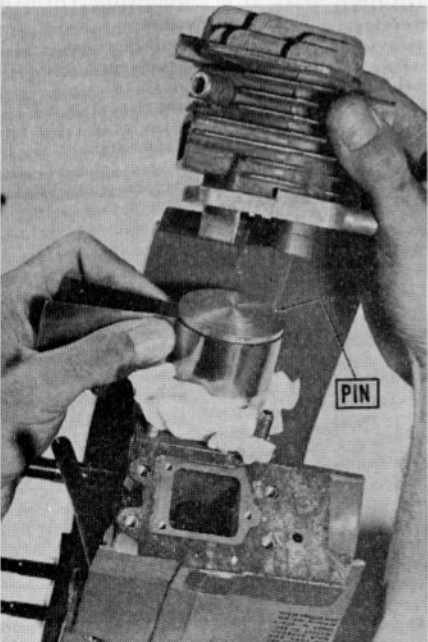


Fig. HL112-View showing cylinder being installed over piston. Piston is held upright by rags stuffed around rod. Make final check to be sure piston ring pin is towards intake side of cylinder as shown.

bearing installation tool is used, be sure bearing cage extends equal distance from each side of connecting rod. Press on lettered end of bearing cage only.

Inspect and renew crankpin roller bearing if rollers are worn or scored. If bearing has 31 rollers, install 16 rollers in rod cap and remainder of rollers in rod. If 25 rollers are used, place 13 rollers in cap and remainder of rollers in rod. New needle rollers are supplied on a waxed strip. Wax or heavy non-fibrous grease may be used to hold rollers in rod and cap. Assemble rod and piston to crankshaft as shown in Fig. HL111 being sure that match marks on rod are aligned. New connecting rod cap screws should be used.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings except on models XL-113 and XL-114 which use a head land ring and piston. Renew piston if scored, cracked or excessively worn. If ring side clearance in top ring groove ex-

ceeds 0.004 when measured with new ring, piston should be renewed.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003. No piston ring specifications for head land ring used on models XL-113 and XL-114 were available before publication.

Piston, pin and rings are available in standard size only. Piston and pin are not available separately.

Early type pin is retained in piston by a Waldes Truarc snap ring at intake side of piston and by a Spirol pin at exhaust side. Closed end of piston pin must be towards Spirol pin. To remove piston from connecting rod, remove snap ring using Truarc snap ring pliers (Homelite tool No. 22828 or equivalent) and push pin out using Homelite tool No. A-23949 as shown in Fig. HL110.

On late production pistons, pin is retained by a plain square end snap ring at exhaust side and by a Waldes

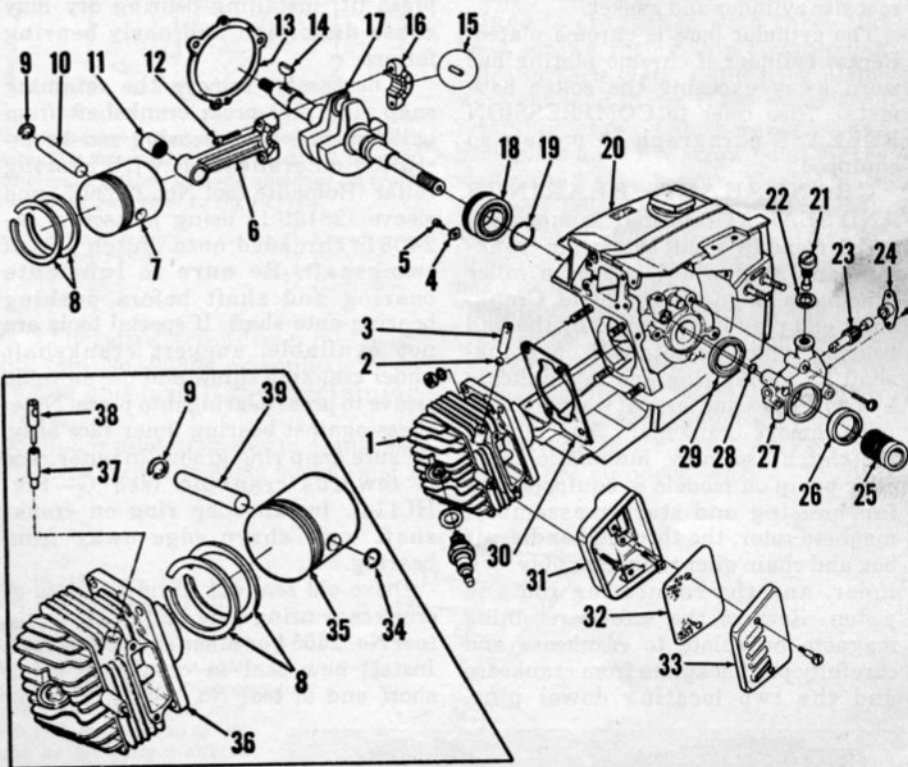


Fig. HL113-Exploded view of typical XL-Series engine assembly; all models are of similar construction except that Model XL-101 does not have compression relief valve and Models XL-101 and XL-102 do not have the automatic chain oiler pump. Inset shows late type compression relief valve and piston pin retained with two snap rings instead of Spirol pin and one snap ring. Refer to Fig. HL104 or to Fig. HL107 for flywheel end main bearing which is supported in magneto backplate.

- | | | | |
|-------------------------|----------------------|-------------------------|-------------------|
| 1. Cylinder | 11. Needle bearing | tank assy. | 30. Gasket |
| 2. Relief valve | 12. Rod cap screws | 21. Cam screw | 31. Muffler body |
| 3. Valve plunger | 13. Backplate gasket | 22. Gasket | 32. Baffle |
| 4. Special washers (2) | 14. Flywheel key | 23. Pump plunger & gear | 33. Muffler cover |
| 5. Retaining screws (2) | 15. Needle rollers | 24. Flange bearing | 34. Snap ring |
| 6. Connecting rod | 16. Rod cap | 25. Worm gear | 35. Piston |
| 7. Piston | 17. Crankshaft | 26. Felt seal | 36. Cylinder |
| 8. Rings | 18. Ball bearing | 27. Pump body | 37. Relief valve |
| 9. Snap ring | 19. Snap ring | 28. "O" ring | 38. Valve plunger |
| 10. Piston pin | 20. Crankcase & fuel | 29. Crankshaft seal | 39. Piston pin |

Truarc snap ring at intake side. Do not remove the plain square end snap ring. To remove piston pin, remove the Waldes Truarc snap ring, then insert a 3/16-inch dia. rod through the plain snap ring and drive pin from piston.

When reassembling piston to connecting rod, push piston pin in with a 3/16-inch diameter rod inserted in open end of pin. Install snap ring at open end of pin with sharp edge of ring out. Rotate snap ring to be sure it is seated in groove, then turn snap ring gap towards closed end of piston.

CYLINDER. The cylinder can be unbolted and removed from crankcase and piston after removing fan housing and starter assembly and the throttle handle, air box and chain oil tank assembly. Be careful not to let piston hit against crankcase as cylinder is removed.

NOTE: If renewing cylinder, measure pilot diameter in crankcase. Pilot diameter of early models is 1-15/16 inch, whereas late models have 2 inch pilot diameter. Be sure to obtain correct size cylinder and gasket.

The cylinder bore is chrome plated. Renew cylinder if chrome plating has worn away exposing the softer base metal. Also refer to COMPRESSION RELEASE paragraph on models so equipped.

CRANKSHAFT, BEARINGS AND SEALS. Crankshaft is supported at drive end by a ball bearing in crankcase and at flywheel end by a roller bearing in magneto back plate. Crankshaft end play is controlled by the ball bearing which is retained on crankshaft by a snap ring and in crankcase by two screws and special washers.

To remove crankshaft, first remove the clutch assembly, automatic chain oiler pump on models so equipped, the fan housing and starter assembly, magneto rotor, the throttle handle, air box and chain oiler tank assembly, cylinder, and the connecting rod and piston. Remove the screws retaining magneto backplate to crankcase and carefully pry backplate from crankcase and the two locating dowel pins.

Working through magneto backplate opening, remove the two screws and special washers retaining ball bearing in crankcase, then press crankshaft and bearing assembly from crankcase.

An expandable type bearing remover (Homelite tool No. A-24507) is available for removing roller bearing from backplate. Insert tool through bearing from inner side of backplate taking care to push tool through bearing only far enough that collets will engage outer side of rollers. Tighten the expander screw of tool, then place backplate on suitable support such as Homelite tool No. 23846-2 and drive bearing from backplate. Remove old crankshaft seal, lubricate new seal and install with lip to inner side of backplate; large stepped end of Homelite tool No. 24055 may be used to install seal. **Lubricate** outer race of new bearing and bore in backplate, then place bearing on small stepped end of Homelite tool No. 24055 or use other suitable tool and press bearing into backplate. **CAUTION:** Due to tight press fit, installing bearing dry may cause distortion and early bearing failure.

If necessary, remove the retaining snap ring and press crankshaft from ball bearing. New bearing can be installed on crankshaft with bearing collar (Homelite tool No. 22820-5) and sleeve (23136-1) using jackscrew (A-24051) threaded onto clutch end of crankshaft. **Be sure to lubricate** bearing and shaft before pushing bearing onto shaft. If special tools are not available, support crankshaft under crankpin throw and use suitable sleeve to press bearing into place. **Note:** Press against bearing inner race only. Be sure snap ring groove in outer race is towards crankpin (see G—Fig. HL114). Install snap ring on crankshaft with sharp edge away from bearing.

Drive old seal out towards inside of crankcase using long end of Homelite tool No. 24054 or other suitable driver. Install new seal in crankcase using short end of tool No. 24054; if using

substitute seal installation tool, outer face of seal should be 1/16-inch below flush with crankcase. **Note:** Be sure lip of seal is towards inside of crankcase. If desired, new seal can be installed after installing crankshaft and bearing assembly; Homelite tool No. 23972 can be used to install seal with crankshaft installed.

Refer to Fig. HL114 for recommended crankshaft installation procedure. **Be sure to lubricate** both bearing and bore in crankcase before installing crankshaft and bearing assembly. Due to tight press fit, installing bearing dry may cause distortion and early bearing failure. Alignment plate (P) (Homelite tool No. 24006-1) fits onto magneto backplate dowels to guide shaft and bearing as the bearing is being pressed into crankcase. Insert shows removing seal protector (SP) (Homelite tool No. 24076) after crankshaft is installed. **Note** position of retaining groove (G) in bearing outer race. Use two new screws and special washers to secure bearing in crankcase. Refer to appropriate MAGNETO paragraph for installation of back plate to crankcase.

COMPRESSION RELIEF VALVE. Except for models XL-101 and XL-102 Automatic, all models are equipped with compression relief valve for easier cranking. When throttle lock (6—Fig. HL115) is pushed in, lever (50) lifts plunger (2) against spring (52) pressure. Then, when engine is cranked, compression is partly relieved through port (P). Squeezing throttle trigger after engine starts releases throttle lock allowing spring to close valve.

Service of the compression relief valve usually consists of cleaning the

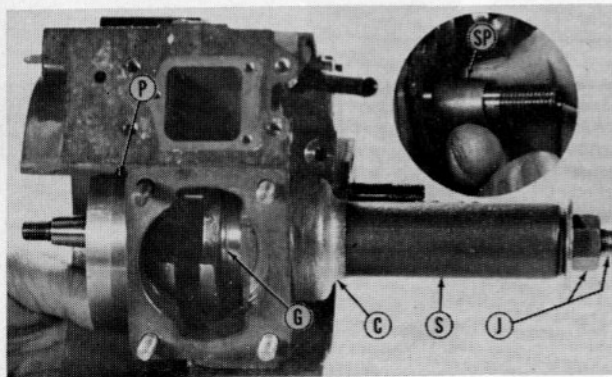


Fig. HL114—Alignment plate (P) fits onto magneto backplate dowel pins to guide crankshaft as it is being pulled into position with collar (C), sleeve (S) and jackscrew (J). **Note** that groove (G) in main bearing outer race is next to crankpin throw. Inset shows seal protector (SP) being removed after crankshaft is in position.

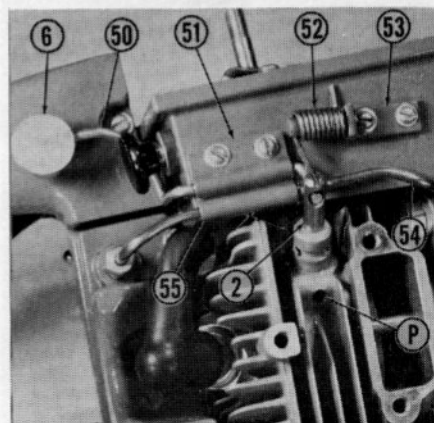


Fig. HL115—View showing compression relief mechanism; all models except XL-101 and XL-102 Automatic are so equipped.

- | | |
|---------------------------|--------------------|
| P. Relief port | 52. Valve spring |
| 2. Valve plunger | 53. Spring bracket |
| 6. Throttle trigger latch | 54. Oiler tube |
| 50. Valve lever | 55. Tube clamp |
| 51. Lever bracket | |

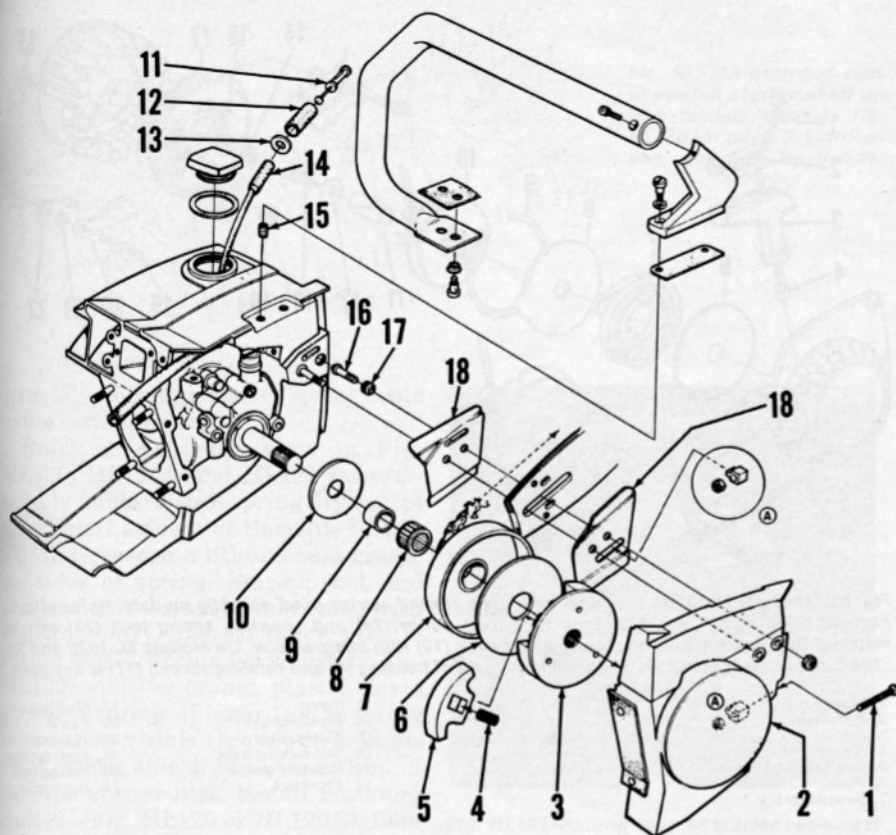


Fig. HL116—Exploded view showing clutch cover and chain tension adjustment, clutch and fuel tank (engine crankcase and fuel tank assembly). Clutch plate (3) is threaded to crankshaft (L.H. threads). On model XL-102 only, a spacer (not shown) is used between washer (10) and shoulder on crankshaft. On late models, fuel tank cover is a separate part; refer to Fig. HL116A.

- | | | | |
|--------------------|---------------------------|-------------------|--------------------|
| 1. Adjusting screw | 6. Large washer | 10. Small washer | 15. Thread insert |
| 2. Clutch cover | 7. Clutch drum & sprocket | 11. Fuel pickup | 16. Bar studs |
| 3. Clutch plate | 8. Needle bearing | 12. Filter | 17. Stud retainers |
| 4. Springs | 9. Bearing race | 13. Washer | 18. Guide plates |
| 5. Shoes | | 14. Flexible tube | |

valve seat as the port may gradually fill with carbon while the engine is running with compression relief valve open. Refer to MAINTENANCE paragraph for seat cleaning procedure. Early models used steel ball (2—Fig. HL113) and plunger (3) to hold ball on seat. Late valve (37) and pin (38) are available as assembly only and may be used to renew early type plunger and steel ball.

When overhauling engine, the cylinder should be inspected for any damage to the compression relief valve port and valve seat. Renew cylinder if there is damage to port or seat that cannot be remedied by cleaning with Homelite tool No. A24138 as shown in Fig. HL109.

CRANKCASE, FUEL TANK AND BACK PLATE. On early models, crankcase and fuel tank were an integral epoxied unit. On later models, fuel tank cover is sealed to crankcase with a gasket and is retained with screws. Several different types of screws have been used, the latest type being "Pozi-driv" screws which are used as service replacement for all earlier types. Use a

No. 2 "Pozi-driv" screwdriver bit (Homelite tool No. 24304 or equivalent) to remove and install cover retaining screws.

Cylinder pilot diameter in crankcase is 1-15/16 inches on early models and 2

Fig. HL116A—Late type fuel tank (19) and cover (21) are separate parts sealed with a gasket (20) whereas early tank and cover was a single epoxied unit. Note flexible hose (14), pickup (11) and filter (12) used instead of felt wick as on early models. Guide bar studs (16) are retained by threaded retainers (17).

- | |
|---------------------------|
| 11. Pickup |
| 12. Filter |
| 13. Washer |
| 14. Flexible hose |
| 15. Threaded insert |
| 16. Guide bar studs |
| 17. Stud retainers |
| 19. Fuel tank & crankcase |
| 20. Gasket |
| 21. Fuel tank cover |
| 22. Bumper spike |
| 23. Fuel line |

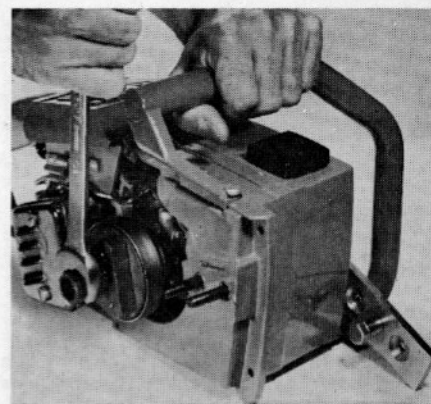
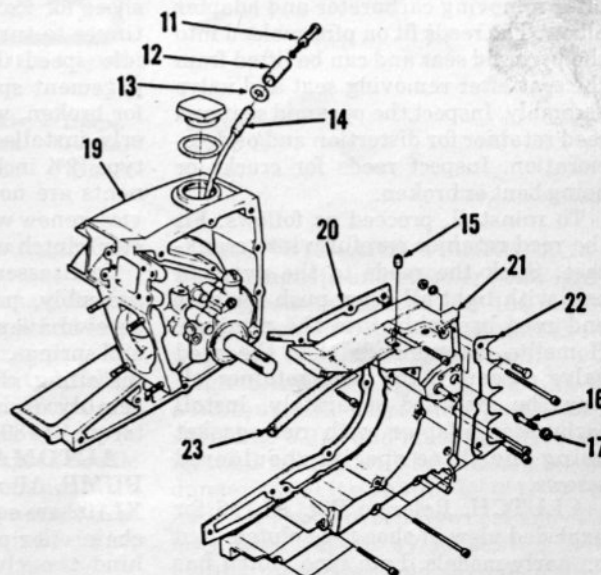


Fig. HL117—Turn clutch rotor clockwise to unscrew from crankshaft (L.H. threads). Spanner wrench is Homelite tool No. A-24060 for early 2-3/4 inch clutch or A-23934 for late 3-1/16 inch clutch. Flywheel (rotor) holder is Homelite tool No. A-23960.

inches on late models. A new crankcase with 2 inch pilot diameter can be installed with early type cylinder having a 1-15/16 inch pilot diameter; use correct gasket with cylinder.

Early magneto back plate was retained to crankcase with three flat head screws fitting into countersunk holes in back plate. Later back plates were changed to use three wafer head retaining screws. Latest crankcase and back plate have five screw holes for the wafer head type screws. Gasket with five bolt holes is used for all models. Use a No. 3 "Phillips" screwdriver bit to remove and install early type flat head (countersunk) screws, or a No. 2 "Pozi-driv" screwdriver bit for the later type wafer head screws. Tighten retaining screws evenly and in stages to a final torque of 80-90 inch-pounds when installing magneto back plate.

PYRAMID REED VALVE. All models are equipped with a "Delrin"

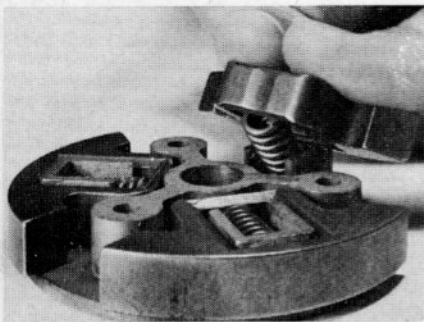


Fig. HL118—To install clutch shoes on early type clutch, hook shoe and spring on clutch plate as shown, then push shoe down into place.

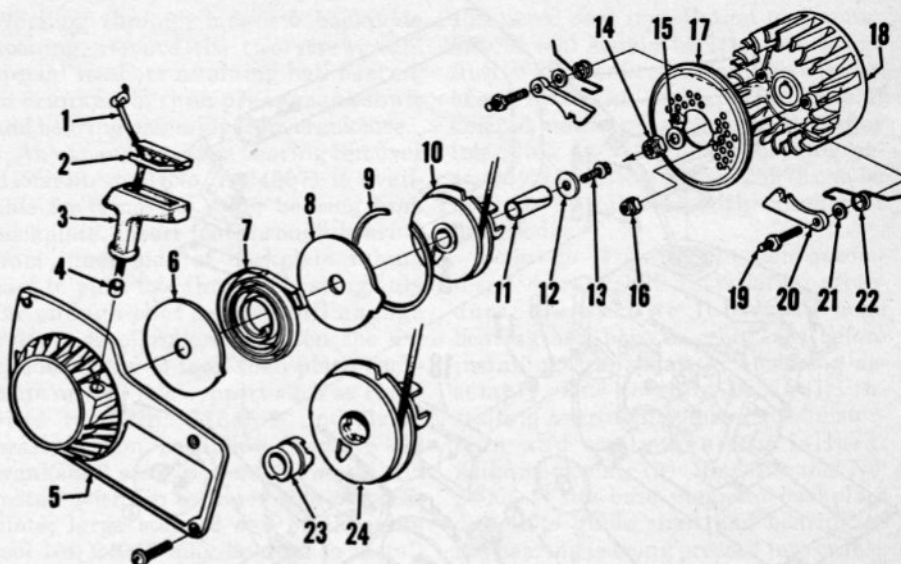


Fig. HL120—Exploded view of typical pawl type rewind starter used on early models. Refer also to Figs. HL120A, HL121 and 122. Late type rope pulley (24) and separate spring lock (23) can be installed if necessary to renew early type pulley (10) with integral lock. On models XL-103E and XL-104E, a stationary screen is attached to outside of housing (5) and rotating screen (17) is not used.

- | | | | |
|---------------------------|----------------------------|-----------------------|------------------|
| 1. Starter rope | 8. Plastic shield (orange) | 13. Screw | 19. Stud bolts |
| 2. Rope lock | 9. Retaining ring | 14. Flywheel nut | 20. Pawls |
| 3. Handle | 10. Rope pulley | 15. Flat washer | 21. Washers |
| 4. Rope insert | 11. Plastic bushing | 16. Self-locking nuts | 22. Pawl springs |
| 5. Fan housing | 12. Flat washer | 17. Rotating screen | 23. Spring lock |
| 6. Plastic shield (black) | | 18. Flywheel | 24. Rope pulley |
| 7. Rewind spring | | | |

"full radius" shoes and is 3-1/16 inch diameter whereas early clutch is 2 3/4 inch diameter. The clutch rotor (plate) (3) is threaded to the crankshaft and can be removed as shown in Fig. HL117; note that L.H. threads are used.

The needle roller bearing (8—Fig. HL116) should be removed, cleaned and lubricated after each 100 hours of operation. A high temperature grease such as Aero Shell #L-14, Aero Shell #5, Texaco Unitemp #500 or Humble (Esso) Nebula EP1 should be used.

If clutch slips with engine running at high speed under load, check the clutch shoes for excessive wear. If chain continues to turn with engine running at idle speed (below normal clutch engagement speed of 3000 RPM), check for broken, weak, distorted or improperly installed clutch springs. If early type (2 3/4 inch diameter) clutch components are not suitable for further service, renew with late type (3-1/16 inch diameter) clutch unit.

To disassemble clutch plate and shoe assembly, pry shoes from plate with screwdriver. To install clutch shoes and springs, refer to Fig. HL118. When installing clutch plate and shoe assembly on crankshaft, tighten to a torque of 180 inch-pounds.

AUTOMATIC CHAIN OILER PUMP. All models except XL-101 and XL102 are equipped with an automatic chain oiler pump which is located behind the clutch and chain sprocket.

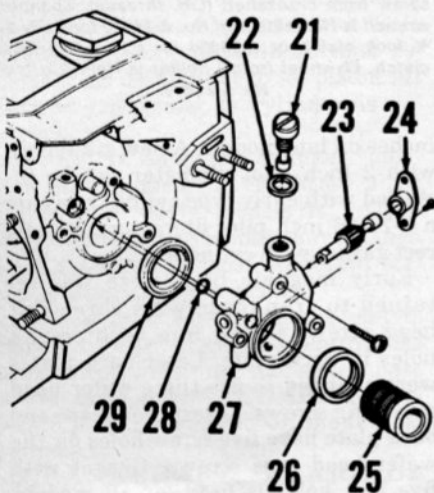


Fig. HL119—Exploded view of automatic chain oiler pump assembly used on models so equipped. Worm gear (25) is driven by engine crankshaft.

- | | |
|--------------------|---------------------|
| 21. Cam screw | 26. Felt seal |
| 22. Gasket | 27. Pump body |
| 23. Plunger & gear | 28. "O" ring |
| 24. Flange bearing | 29. Crankshaft seal |
| 25. Worm | |

plastic pyramid valve seat and stainless steel valve reeds. Pyramid seat, reeds and retainer can be removed after removing carburetor and adapter elbow. The reeds fit on pins molded into the pyramid seat and can be lifted from the seat after removing seat and valve assembly. Inspect the pyramid seat and reed retainer for distortion and/or deterioration. Inspect reeds for cracks or being bent or broken.

To reinstall, proceed as follows: Fit the reed retainer carefully into crankcase. Stick the reeds to the pyramid seat with light oil, then push the seat and reed assembly into the retainer. Homelite recommends that the reed valve assembly and reed retainer always be installed separately. Install carburetor adapter with new gasket using the three special shouldered screws.

CLUTCH. Refer to Fig. HL116 for exploded view of shoe type clutch used on early models. Late type clutch has

Refer to exploded view in Fig. HL119. Pump body (27) is attached to crankcase and worm gear (25) is driven by crankshaft.

To service pump, unscrew the clutch plate assembly as shown in Fig. HL117 and remove clutch drum and bearing. The automatic chain oiler pump can then be removed from engine crankcase after disconnecting the oil lines.

Worm gear (25—Fig. HL119) can be removed from pump body. To remove pump plunger (23) for inspection, first remove flange bearing (24) and cam screw (21). Pump body and plunger are serviced as a matched assembly only. Flange bearing retaining screws are available separately. Pry felt dust seal (26) from pump body and install new seal using suitable driver. Install new gasket (22) on cam screw and use new "O" ring (28) when reassembling and reinstalling pump. Tighten pump retaining screws evenly to a minimum torque of 40 inch-pounds.

REWIND STARTER. For exploded view of starter, refer to Fig. HL120 or HL120A. To disassemble starter, refer to Fig. HL121 and proceed as follows: If starter spring remains under tension, pull the starter rope out about two turns of pulley, hold pulley from turning and pull loop of rope out past notch in pulley. Allow the starter spring to completely unwind, then remove screw (13) and disassemble unit. Be careful when removing spring;

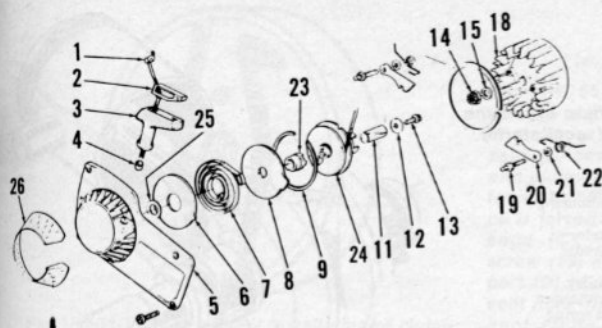


Fig. HL120A—Exploded view of rewind starter used on later models. Refer to Fig. HL120 for parts identification, except: 25. Washer; 26. Screen.

a rapidly uncoiling starter spring could cause serious injury.

Refer to exploded view in Fig. HL120, HL120A and HL122 for reassembly guide. Install spring dry except for a small amount of Homelite® ALL-TEMP Grease or a lithium base grease on sides of spring. Starter post and plastic sleeve should be lubricated with light oil only. Install black plastic spring shield, spring (as shown in Fig. HL122) and the orange plastic shield on top of spring. If inner loop of spring is not then visible through hole in orange plastic shield, bend inner loop in towards starter post. Install retaining ring (9—Fig. HL120 or HL120A). Late type pulley (24—Fig. HL120) and separate spring lock (23) are used to renew early type pulley (10) with integral spring lock.

If necessary to install new rope, insert end through pulley and tie knot as shown at (K—Fig. HL121). Heat end of rope to secure knot, then insert other end through rope guide in fan housing



Fig. HL121—Pulling loop of starter rope past notch in rope pulley. Rope is retained by knot (K). Rope pulley retaining screw is (13).

and secure in handle. Wind cord all the way onto pulley, then fit pulley and plastic sleeve onto starter post. Pull rope out far enough to be sure pulley

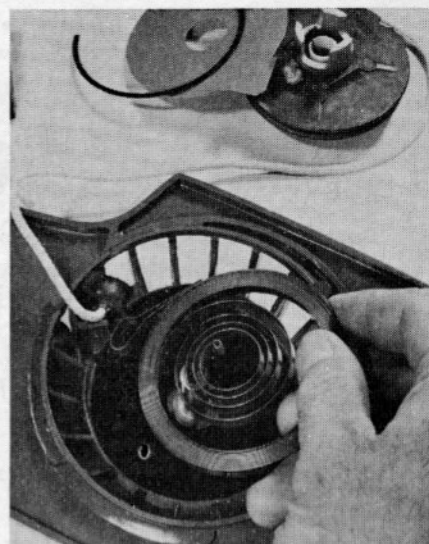


Fig. HL122—Installing rewind spring. Outer (black plastic) spring shield is already installed.

engages spring, then allow spring to rewind. Install pulley retaining washer and screw and tighten screw to minimum torque of 50 inch-pounds. Pull cord out about two feet so that notch in pulley is at rope insert in housing and hold pulley from turning (Fig. HL121). Pull up a loop of rope between notch and fan housing, then holding loop, turn pulley and rope three turns clockwise (winding spring). Pull out the rope so that it runs straight from pulley through insert in fan housing, then allow pulley to rewind slowly.

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N. Y. 10573

Model	Bore Inches	Stroke Inches	Displ. Cu. In.	Drive Type
150 Automatic	1 9/16	1 3/8	2.64	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ-7J or AC CS45T. Spark plug electrode gap should be 0.025. Note that spark plug has a tapered seat and does not require a gasket.

CARBURETOR. Model 150 Automatic is equipped with a Walbro model HDC-3 diaphragm carburetor. Refer to Walbro section of SERVICE FUNDA-

MENTALS section for carburetor overhaul and an exploded view.

Initial carburetor adjustment is idle mixture needle $\frac{3}{4}$ turn open and high speed mixture needle 1 turn open. Adjust idle speed screw so that clutch is not engaged at idle speed. Turn idle mixture needle until engine will accelerate cleanly. Adjust high speed needle to obtain optimum performance with saw under cutting load. Do not set mixture needle position too lean as engine may be damaged.

MAGNETO AND TIMING. A flywheel magneto and breaker point ignition system is used on the 150 Automatic. Breaker points are contained in a breaker box under the flywheel.

Ignition timing is 28° BTDC and is nonadjustable. Breaker point gap should be 0.015 and must be correct or ignition timing will be affected. Condenser capacity should be 0.15-0.19 mfd. Air gap between flywheel and coil may be adjusted by loosening coil mounting screws and repositioning

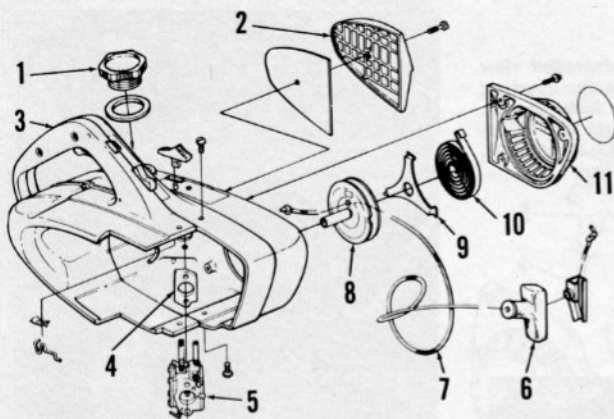


Fig. HL150-View of engine housing and recoil starter.

1. Gas cap
2. Air filter
3. Engine housing
4. Gasket
5. Carburetor
6. Rope handle
7. Rope
8. Rope pulley
9. Spring retainer
10. Rewind spring
11. Starter housing

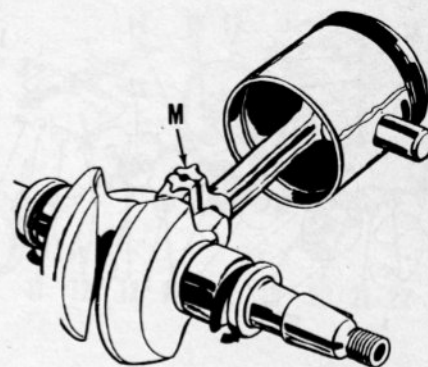


Fig. HL152-View of connecting rod match marks (M).

coil. Place 0.0125 in. (black) shim stock between flywheel and coil legs and apply pressure against flywheel in direction of coil to take up bearing play. Tighten coil screws and remove shim stock.

LUBRICATION. The engine is lubricated by mixing oil with the fuel. Fuel:oil ratio should be 16:1 when using Homelite SAE 30 oil or another good quality SAE 30 oil designed for use in chain saw or air-cooled two-stroke engines. Premium Homelite SAE 40 oil may be used and mixed with the fuel at a ratio of 32:1. Recommended fuel is regular or low lead.

Chain oil tank should be filled with Homelite Bar and Chain Oil or a good quality SAE 30 oil. It may be necessary to use SAE 10 oil or oil mixed with kerosene if temperature is below 40° F.

Clutch needle bearing should be removed, cleaned and lubricated periodically with Homelite All-Temp Multi-Purpose Grease.

CARBON. Carbon deposits should be removed from muffler and exhaust ports at regular intervals. Be careful not to damage ports or piston or to allow loose carbon to enter cylinder.

REPAIRS

TIGHTENING TORQUES. Recommended tightening torques are listed in the following table; all values are in inch-pounds.

Flywheel nut	200
Spark plug	150
Clutch hub	100
Connecting rod screws	60
10-24 Engine housing	45
10-24 Front handle	45
8-32 Socket Head, Cylinder-to-crankcase	40
8-32 Muffler	36
8-32 Intake manifold	36
8-32 Oil pump mounting screws	36
8-32 Cylinder-to-crankcase	36
8-32 Oil pump spring screw	36
8-32 Starter housing	36

CYLINDER, PISTON, PIN AND RINGS. Refer to Fig. HL151 for exploded view of engine. To remove cylinder, remove chain, bar, starter, carburetor, engine housing, clutch, flywheel and ignition assembly. Remove chain and dirt guards. Remove oil tank and unscrew cylinder-to-crankcase screws. Note that there are four socket head screws in bottom of crankcase. Be careful when removing cylinder as crankshaft assembly will be loose in crankcase. Care should be taken not to scratch or nick mating surfaces of cylinder and crankcase.

Cylinder bore is chromed and should be inspected for excessive wear which may expose soft base metal underneath. Also inspect bore for scoring, flaking, or chipping of chrome surface.

Piston pin retaining ring on exhaust side of piston does not have a removal notch and opposite retaining ring must be removed to push pin out of piston.

Piston pin is a snug fit in piston and has a closed end which must be installed on exhaust side of piston. Piston rings are retained in position by locating pins. Install piston on connecting rod so that piston ring locating pins will be towards flywheel side of engine when cylinder is installed.

Be sure piston rings are correctly positioned around ring locating pins while installing cylinder. Refer to CRANKSHAFT AND CRANKCASE section to install cylinder on crankcase.

CONNECTING ROD. Connecting rod may be removed after removing cylinder as previously outlined. Connecting rod has a needle roller bearing in small end and 18 loose bearing rollers in big end. Big end is fractured and rod and cap must have serrations correctly mated. Rod and cap have aligning marks as shown in Fig. HL152 which must be aligned to correctly assemble connecting rod.

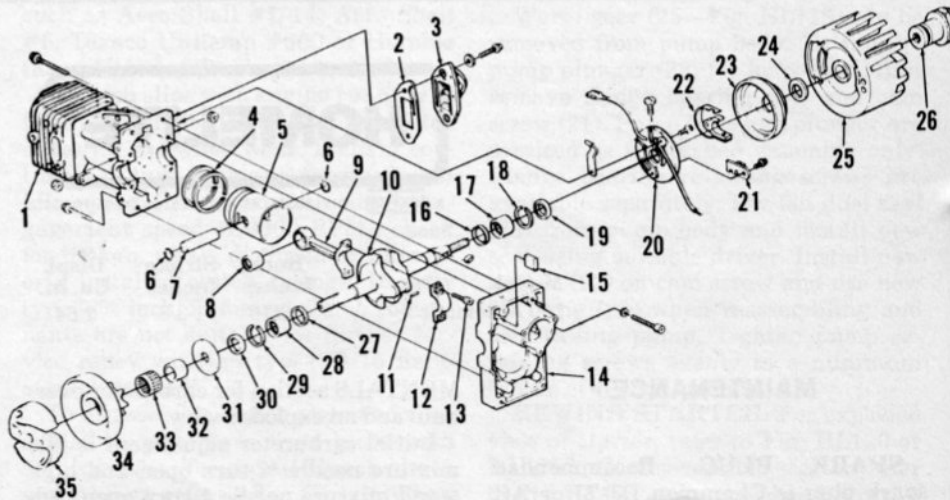


Fig. HL151-Exploded view of 150 Automatic engine, clutch and flywheel assemblies.

- | | | | |
|--------------------|-------------------------|---------------------------|--------------------|
| 1. Cylinder | 10. Crankshaft | 19. Seal | 27. Thrust bearing |
| 2. Gasket | 11. Roller bearing (18) | 20. Breaker plate | 28. Roller bearing |
| 3. Intake manifold | 12. Rod cap | 21. Fixed breaker point | 29. Retaining ring |
| 4. Piston rings | 13. Screw | 22. Movable breaker point | 30. Seal |
| 5. Piston | 14. Crankcase | 23. Breaker box | 31. Thrust washer |
| 6. Pin retainers | 15. Oil tank vent seal | 24. Seal | 32. Bearing race |
| 7. Piston pin | 16. Thrust washer | 25. Flywheel | 33. Roller bearing |
| 8. Needle bearing | 17. Roller bearing | 26. Flywheel nut | 34. Clutch drum |
| 9. Connecting rod | 18. Retaining ring | | 35. Clutch hub |



Fig. HL153—View of correct installation of clutch hub in drum.

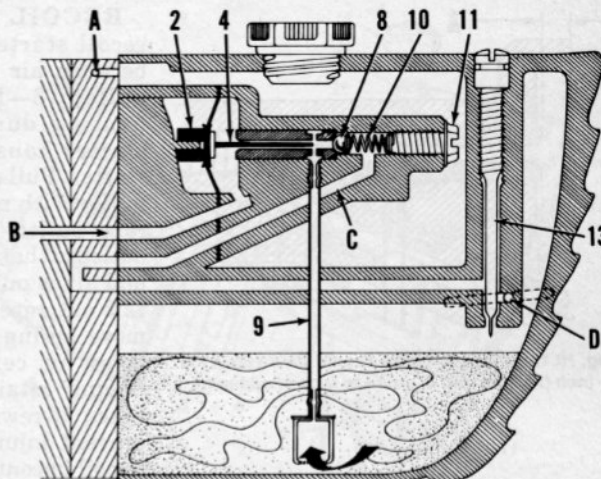
Bearing rollers may be held in place during assembly with grease or beeswax on new bearing roller strip. Homelite Tool No. 24294 and Spacer No. 24548 may be used to remove and install small end needle bearing.

CRANKSHAFT AND CRANKCASE. Disassemble engine as outlined previously. Care should be taken not to scratch or damage mating surface between cylinder and crankcase.

Crankshaft is supported at both ends by roller bearings which are retained in crankcase by a retaining ring in a groove at either end. Crankshaft seals are installed with seal lip to inside. Mating surfaces of cylinder and crankcase should be cleaned then coated with room temperature-vulcanizing silicone sealer before assembly. Be sure crankshaft bearings, retaining rings and seals sit squarely in crankcase before sliding cylinder on piston. If crankshaft is cocked or cylinder is not installed squarely with crankcase, piston ring ends may catch in ports and be broken.

CLUTCH. Clutch hub has left hand threads and must be installed as shown in Fig. HL153. Clean and inspect clutch hub, drum and bearing for

Fig. HL155—Oil is drawn through pick-up (9) by action of crankcase pulses in passage (B) against diaphragm and plunger (4). Plunger (4) forces ball (8) off its seat and oil is forced into outlet passage (C), past adjusting screw (13) and out exhaust port (D) to the chain. Note vent hole (A) which must be kept clear. Refer to Fig. HL154 for parts identification.



damage or excessive wear. Inspect crankshaft for wear or damage caused by clutch bearing. Lubricate clutch bearing with Homelite ALL-TEMP Multi-Purpose Grease.

AUTOMATIC CHAIN OILER.

Model 150 Automatic is equipped with a crankcase pulse actuated automatic chain oiler pump. Crankcase pulses move diaphragm and plunger (4—Fig. HL155) to force oil out oil outlet. Refer to Fig. HL155 for operation of pump.

Output of early models is adjusted by turning adjusting screw. (13—Fig. HL154). Later models are not equipped with adjusting screw.

To remove oil pump, remove recoil starter, engine housing and drain oil tank. Disconnect high tension lead from spark plug and clamp. Unscrew four screws and separate oil tank from crankcase. Remove oil pump from crankcase and disassemble pump. Clean and inspect pump components and passages. Note that there is a bleed hole (A—Fig. HL155) on clutch side of

crankcase which must be clear to vent pump. Air vent seal (15—Fig. HL151) has been changed from packing felt to foam rubber.

Bumper (2—Fig. HL154) must have a minimum clearance of 0.100 between flange face of crankcase (1) and bumper as shown in Fig. HL156. Grind bumper and stud until minimum clearance is obtained. Plunger (4—Fig. HL154) length should be 0.620-0.630 measured from collar to end of plunger as shown in Fig. HL157. Plunger guide in pump body (7—Fig. HL154) should be 0.125-0.155 from face of pump body as shown in Fig. HL158. Plunger guide is not available separately from housing.

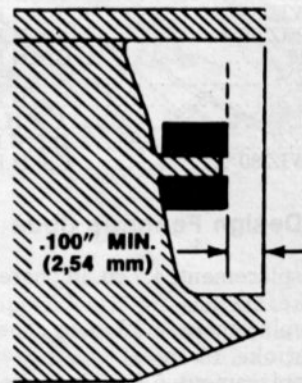


Fig. HL156—Bumper (2—Fig. HL154) and stud must be at least 0.100 inch from edge of crankcase.

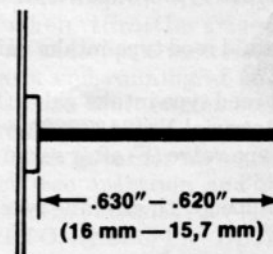


Fig. HL157—Plunger length must be 0.620-0.630 inch from collar to end.

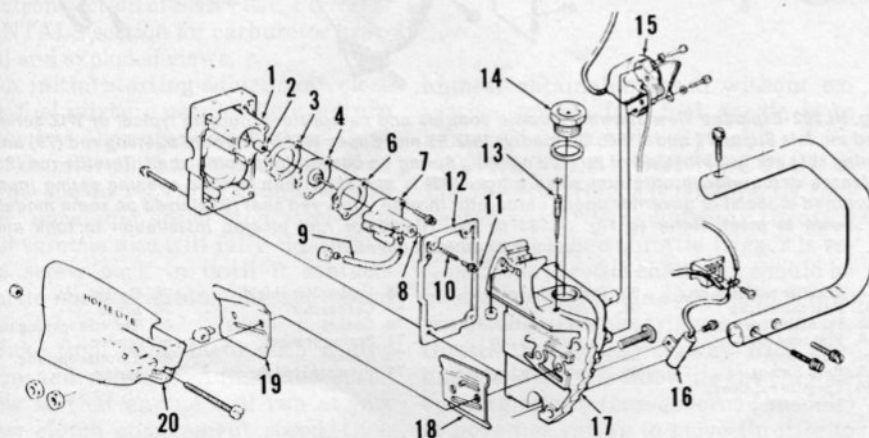


Fig. HL154—Exploded view of oil tank and related assemblies.

- | | | | |
|------------------------|------------------|------------------------------|---------------------|
| 1. Crankcase | 7. Oil pump body | 12. Gasket | 16. Condenser |
| 2. Bumper | 8. Ball | 13. Oil pump adjusting screw | 17. Oil tank |
| 3. Gasket | 9. Oil intake | 14. Oil tank cap | 18. Inner bar plate |
| 4. Diaphragm & plunger | 10. Spring | 15. Ignition coil | 19. Outer bar plate |
| 6. Gasket | 11. Screw | | 20. Chain guard |

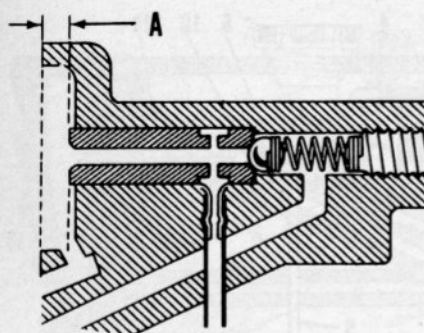


Fig. HL158—Plunger guide should be 0.125-0.155 inch (A) from end of guide to face of oil tank.

RECOIL STARTER. To remove recoil starter, insert a screwdriver between air intake slots to hold rope pulley (8—Fig. HL150) in starter housing during removal. Unscrew starter housing screws and remove starter. Pull starter rope and hold rope pulley with notch in pulley adjacent to rope outlet. Pull rope back through outlet so that it engages notch in pulley and allow pulley to completely rewind. Lift out rope pulley and carefully remove spring retainer (9) by pressing down in center of retainer while freeing retainer legs. Care must be taken if rewind spring is removed to prevent injury if spring is allowed to uncoil uncontrolled.

Rewind spring is wound in clockwise direction in starter housing. Rope is wound on rope pulley in clockwise direction as viewed with pulley in housing. To place tension on rewind spring, pass rope through rope outlet in housing and install rope handle. Pull rope out and hold rope pulley so notch on pulley is adjacent to rope outlet. Pull rope back through outlet between notch in pulley and housing. Turn rope pulley clockwise to place tension on spring. Release pulley and check starter action. Do not place more tension on rewind spring than is necessary to draw rope handle up against housing.

HOMELITE®

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Chain Saw Model

Design Features

ZIP	A,E,J,K,L,O
WIZ	B,E,J,K,M,O
Super WIZ	A,F,H,K,M,O
WIZ 55	B,G,J,K,M,O
Super WIZ 55	B,F,J,K,M,O
Super WIZ 66	A,F,H,K,M,O
Super 77	C,F,H,K,M,O
775-D	C,F,H,K,L,O
775-G	C,F,H,K,M,O
995-D	C,F,H,K,L,O
995-G	D,F,H,K,N,O
Super WIZ 80	C,F,H,K,M,O

Design Features Code

- A—Displacement, 4.7 cu. in.; bore 2 in.; stroke, 1½ in.
 B—Displacement, 4.32 cu. in.; bore, 2 in.; stroke, 1¾ in.
 C—Displacement, 5.8 cu. in.; bore, 2 3/16 in.; stroke, 1 35/64 in.
 D—Displacement, 6.83 cu. in.; bore, 2 5/16 in.; stroke, 1 35/64 in.
 E—Flat reed type intake valve, single reed.
 F—Pyramid reed type intake valve, 4 reeds.
 G—Flat reed type intake valve (E) prior to serial No. 2537289; pyramid reed type valve (F) after serial No. 2537288.
 H—Equipped with air-vane type governor.
 J—Non-governed.
 K—Conventional type flywheel magneto.

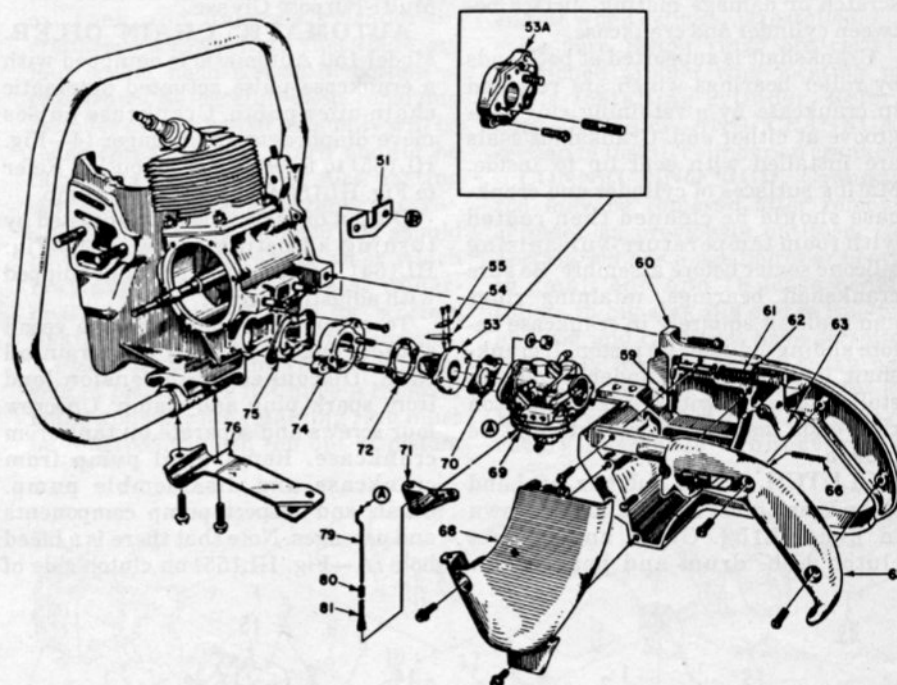


Fig. HL202—Exploded view showing throttle controls and carburetor mounting typical of WIZ series and models Super 77 and 775G. On models WIZ 55 and Super WIZ 55, throttle opening rod (79) and spring (81) are used instead of throttle opening spring on carburetor throttle shaft. Throttle rod (61) releases carburetor throttle arm when trigger (63) is actuated, then throttle opening spring (non-governed models) or governor opens carburetor throttle. Flat reed seat (53A) used on some models is shown in inset. Refer to Fig. HL203 or Fig. HL204 for fuel pick-up installation in tank and carburetor air inlet connections.

A. Throttle rod hook-up	60. Throttle handle	68. Carburetor shield	75. Gasket
51. Fuel tank strap	61. Throttle rod	69. Carburetor	76. Brace
53. Pyramid reed seat	62. Throttle spring	70. Gasket	79. Throttle opening rod
53A. Flat reed seat	63. Throttle trigger	71. Spring bracket	80. Spacer
54. Inlet reeds	65. Handle cover	72. Gasket	81. Throttle opening spring
55. Reed clamps	66. Throttle latch spring	74. Pyramid reed spacer	
59. Throttle rod sleeve			

- L—Direct drive.
 M—Reduction drive, 2-gear transmission.
 N—Reduction drive, 3-gear transmission.
 O—Manual chain oiler only.

MAINTENANCE

SPARK PLUG. Recommended Champion spark plug is type UJ-7G for models 995D and 995G, type UJ-11G for models Super 77, 775D, 775G and

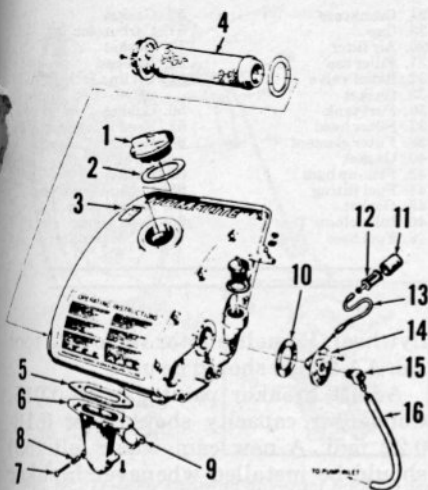


Fig. HL203-Exploded view showing fuel pick-up installation in tank and carburetor air inlet for models WIZ, Super WIZ, WIZ 55 and Super WIZ 55. Note springs (8) on air inlet elbow to carburetor screws.(7).

- | | |
|-----------------|------------------|
| 1. Fuel cap | 9. Gasket |
| 2. Gasket | 10. Gasket |
| 3. Fuel tank | 11. Filter |
| 4. Air filter | 12. Filter head |
| 5. Gasket | 13. Fuel hose |
| 6. Intake elbow | 14. Fuel fitting |
| 7. Screw | 15. Elbow |
| 8. Spring | 16. Fuel hose |

Super WIZ 80 and type J-6J for all other models listed.

Set electrode gap to 0.025. Champion J-6J plug may be substituted for type UJ-11G, but will be more susceptible to electrode erosion. In high temperatures or for heavy duty operation, use UJ-7G plug in place of J-6J or UJ-11G. In extremely cold weather, a UJ-12 plug may be used to avoid cold fouling and improve starting.

CARBURETOR. All models are equipped with a Tillotson model HL diaphragm type carburetor. Carburetor model number is stamped on carburetor mounting flange. Refer to Tillotson section of SERVICE FUNDAMENTALS section for carburetor overhaul and exploded views.

For initial starting adjustment, close both fuel mixture needles lightly (turn clockwise), then open idle fuel needle $\frac{3}{4}$ turn counter-clockwise and main fuel needle one to $1\frac{1}{4}$ turns counter-clockwise. Back idle speed stop screw out until throttle disc will fully close, then turn screw back in until it contacts throttle shaft arm plus one additional turn.

Make final adjustment with engine warm and running. Adjust idle speed screw so that engine will run at just below clutch engagement speed, then adjust idle fuel mixture needle so that engine runs smoothly. Readjust idle speed stop screw if necessary. With engine running at full throttle under load (stall chain in cut), adjust main fuel needle so that engine runs at

Fig. HL204-Exploded view showing fuel pick-up, air cleaner and carburetor inlet elbow and fuel tank typical of models Super WIZ 66, Super 77, 775G and Super WIZ 80. Model 775D is similar except chain oil tank is separate from fuel tank. Springs (9) are used on inlet to carburetor screws.

1. Air filter element
2. Cover
3. Gasket
4. Gasket
5. Stud
6. Pick-up hose
7. Fuel fitting
8. Fuel line
9. Springs
10. Air inlet elbow
11. Gasket
12. Gasket
13. Filter head
14. Filter element
15. Fuel tank
16. Gasket
17. Valve (integral W/cap on late models)
18. Filler cap

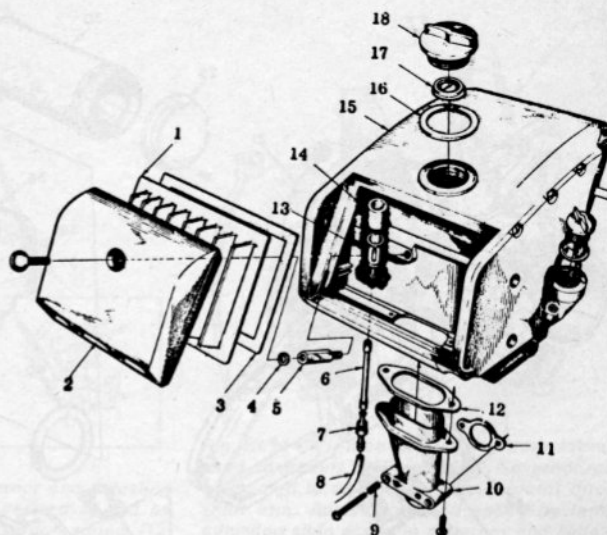
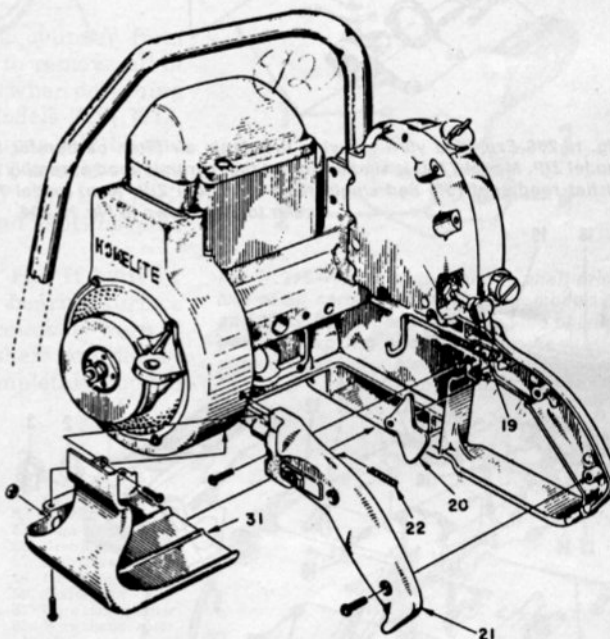


Fig. HL205-View showing throttle trigger and throttle rod installation on models ZIP and 775D; refer to Fig. HL206 for carburetor and reed valves.

19. Throttle rod & return spring
20. Throttle trigger
21. Handle cover
22. Throttle lock spring
31. Carburetor cover



highest obtainable speed without excessive smoke. Idle fuel needle is to left, main fuel needle is to right.

THROTTLE CONNECTIONS. The throttle trigger is not directly connected with the carburetor throttle shaft arm. When throttle trigger is released, the throttle shaft arm should be held against the idle speed stop screw. Squeezing throttle trigger moves the throttle rod or lever away from carburetor shaft arm allowing the throttle opening spring (non-governed models) or governor spring to move throttle to wide open position. Check action of throttle linkage, carburetor throttle shaft and throttle opening or governor spring with engine stopped.

GOVERNOR. All models except ZIP, WIZ, WIZ 55 and Super WIZ 55

are equipped with an air vane type governor to prevent over-speeding of engine when saw is out of cut. Maximum no-load engine speed should be 7500 RPM; engine peak horsepower is obtained at about 6000 RPM.

With engine not running, check to see that governor spring will fully open throttle when throttle trigger is squeezed to wide open position. With engine warm and running at no load, governor should limit engine speed to about 7500 RPM by closing carburetor throttle. Check governor air vane and linkage for free operation and renew governor if worn or damaged.

MAGNETO. Refer to Fig. HL217 for exploded view of typical REPCO magneto. Breaker points, coil and condenser are accessible after removing

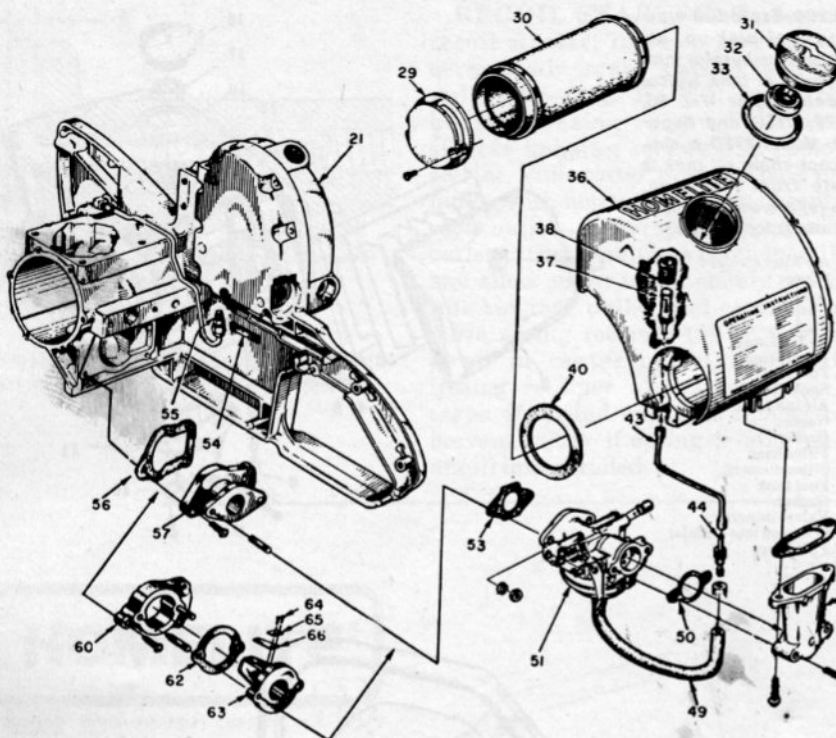


Fig. HL206—Exploded view showing fuel tank, air filter, carburetor and reed valve installation on model ZIP. Model 775D is similar except that pyramid reed assembly (items 60 to 66) is used instead of flat reed seat (57) and single reed on model ZIP. Also, model 775D fuel tank and air filter is similar to that shown in Fig. HL204.

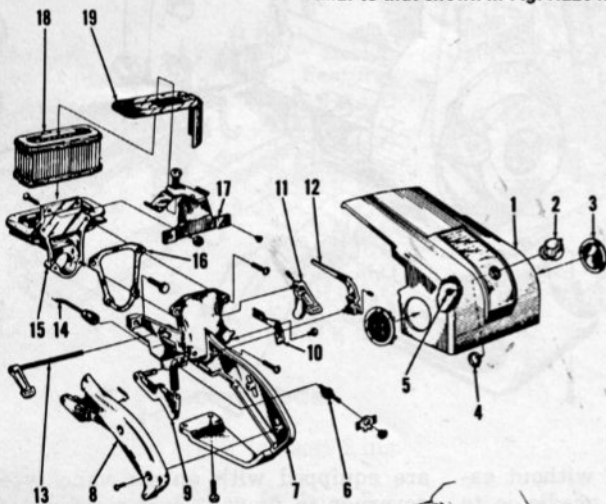


Fig. HL207—Exploded view of throttle handle, air inlet filter, throttle linkage and cover for models 995D and 995G. Refer to Fig. HL208 for fuel pick-up, carburetor and reed valve installation.

1. Cover
2. Retaining nut
3. Plugs
4. Snap ring
5. Rubber bumper
6. "ON-OFF" switch
7. Throttle handle
8. Handle cover
9. Throttle trigger
10. Choke lever
11. Oiler lever
12. Throttle lever
13. Oiler shaft & lever
14. Switch ground lead
15. Air filter holder
16. Gasket
17. Bracket
18. Air filter element
19. Filter cap

42. Gasket
43. Reed seat adapter
44. Gasket
45. Valve reeds
47. Reed plates
48. Pyramid reed seat
49. Gasket
52. Carburetor
53. "O" ring
55. Fuel line
56. Spring insert
58. Fuel fitting
59. Gasket
60. Pick-up hose
76. Filler cap
77. Relief valve
78. Gasket
79. Fuel & oil tank
80. Filter head
81. Filter element

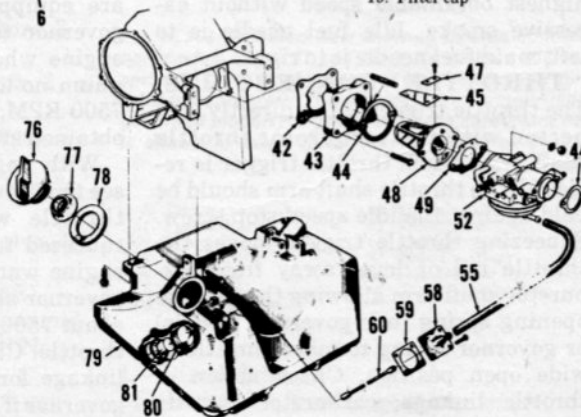


Fig. HL208—Exploded view showing fuel pick-up, carburetor and reed valve installation for models 995D and 995G. Throttle handle and linkage are shown in Fig. HL207. Note that a coil spring (56) is inserted in fuel line (55).

- | | |
|--------------------|------------------------------|
| 21. Crankcase | 50. Gasket |
| 29. Cap | 51. Carburetor |
| 30. Air filter | 53. Gasket |
| 31. Filler cap | 54. Felt pad |
| 32. Relief valve | 55. Oil line & check valve |
| 33. Gasket | 56. Gasket |
| 36. Fuel tank | 57. Reed valve seat (ZIP) |
| 37. Filter head | 60. Reed seat adapter (775D) |
| 38. Filter element | 62. Gasket |
| 40. Gasket | 63. Pyramid reed seat |
| 43. Pick-up hose | 64. Reed screws |
| 44. Fuel fitting | 65. Reed plates |
| 45. Gasket | 66. Valve reeds (4) |
| 46. Inlet elbow | |
| 49. Fuel hose | |

flywheel. Homelite rotor removing tool No. AA-22560 should be used.

Adjust breaker point gap to 0.015. Condenser capacity should test 0.18-0.22 mfd. A new cam wiper felt (53) should be installed whenever breaker points are being renewed. Adjust position of felt so that it lightly contacts cam surface of engine crankshaft.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

The clutch drum and sprocket assembly on direct drive models should be removed occasionally and the needle roller bearing be cleaned and lubricated.

On gear drive models, maintain oil level in gear case to arrow on inspection window using Homelite Gear Oil or SAE 90 gear lubricant. Check oil level with saw setting on level surface. Do not overfill.

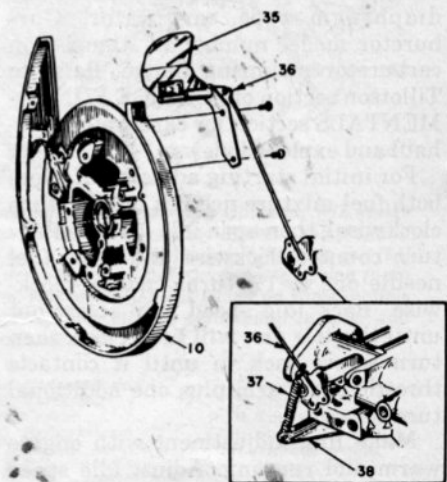


Fig. HL210—View showing Super WIZ governor installation. Refer to Fig. HL215; governor spring attaches to carburetor throttle arm hole numbered (1) and governor link attaches at hole numbered (3).

- | | |
|--------------------|---------------------|
| 10. Back plate | 37. Governor spring |
| 35. Governor assy. | 38. Spring bracket |
| 36. Governor rod | |

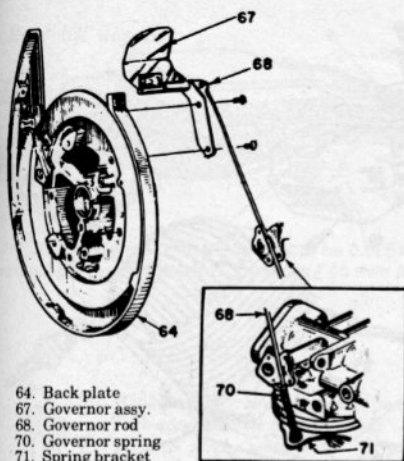


Fig. HL211-View showing governor hookup used on models Super WIZ 66, Super 77 and Super WIZ 80. Refer to Fig. HL215; throttle rod is connected at hole numbered (3). Governor spring (70) is compressed between bracket (71) and shoulder on governor rod.

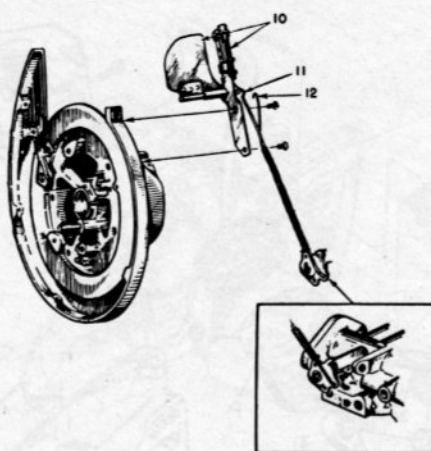


Fig. HL213-Model 775G governor and adjusting slide assembly; adjust governed speed by turning screw on slide. Governor spring (12) connects to adjusting slide and lower end of spring is threaded onto burr washer on rod (11). Hook rod to throttle arm hole numbered (4) (Fig. HL215).

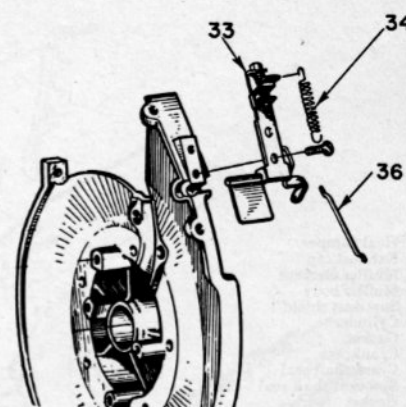


Fig. HL214-View showing governor assembly used on models 995D and 995G. Governor rod is connected to single hole in carburetor throttle shaft arm. Adjust governed speed by turning adjusting slide screw in governor and slide assembly (33). Governor spring (34) is connected between adjustable slide and arm on governor shaft.

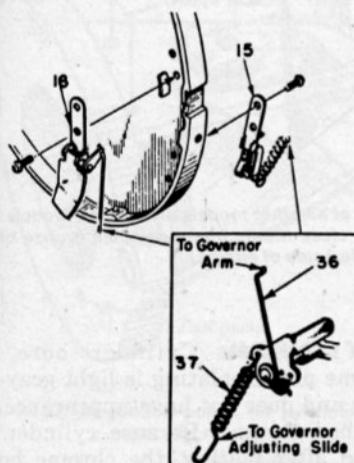


Fig. HL212-Model 775D governor spring (37) is connected to adjustable slide (15) making it possible to adjust engine governed speed by turning adjusting screw on slide. Refer to Fig. HL215; spring is hooked in throttle arm hole numbered (1) and governor rod is hooked in hole numbered (2).

moved after removing cylinder from crankcase. Be careful to remove all of the loose needle rollers when detaching rod from crankpin. Models ZIP, WIZ, Super WIZ, WIZ 55, Super WIZ 55 and Super WIZ 66 have 27 needle rollers and models Super 77, 775D, 775G, Super WIZ 80, 995D and 995G have 31 loose needle rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn or if Formica thrust washers are deeply grooved or are not completely bonded

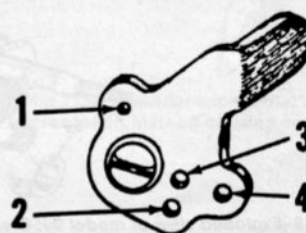


Fig. HL215-View showing throttle shaft arm typical of all carburetors except for models 995D and 995G. It is important that throttle opening or governor spring and/or link be hooked into proper hole. Refer also to Fig. HL202 and Figs. HL210 through HL213.

- 35. Plug terminal
- 36. High tension wire
- 37. Grommet
- 38. "ON-OFF" switch
- 39. Switch plate
- 40. Ground wire
- 41. Sleeve
- 42. Rotor
- 43. Ignition coil
- 47. Condenser

- 49. Breaker cover
- 50. Gasket
- 52. Breaker points
- 53. Cam wiper felt
- 56. Ground wire tab
- 57. Armature core
- 58. Cover clip
- 59. Sealing felt
- 61. Wire clamp, inner
- 63. Wire clamp, outer

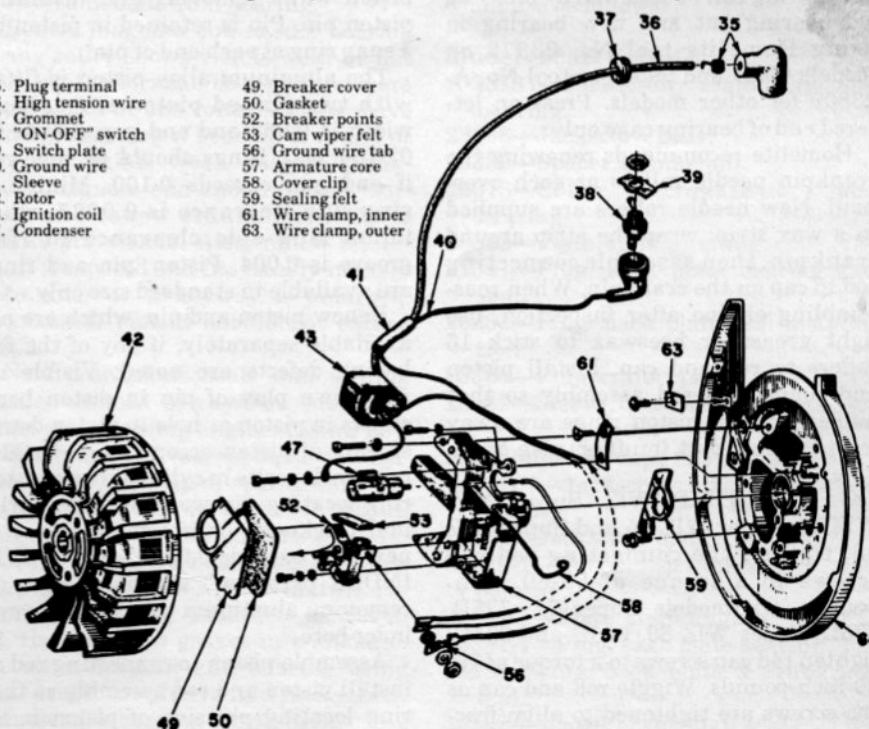


Fig. HL217-Exploded view of typical REPCO magneto used on all models. Rotor (flywheel) has three tapped holes for installation of remover (Homelite tool No. AA-22560). Magneto back plate (64) supports crankshaft seal and needle bearing.

Chain oiler tank should be filled with Homelite Bar and Chain Oil or SAE 30 motor oil. In low temperatures, dilute chain oil with one part of kerosene to four parts of oil.

CARBON REMOVAL. Carbon deposits should be removed from exhaust ports and muffler at regular intervals. Use a wood scraper and be careful not to damage edges of exhaust ports. Piston should be at top dead center when removing carbon. Do not attempt to start engine with muffler removed.

REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be re-

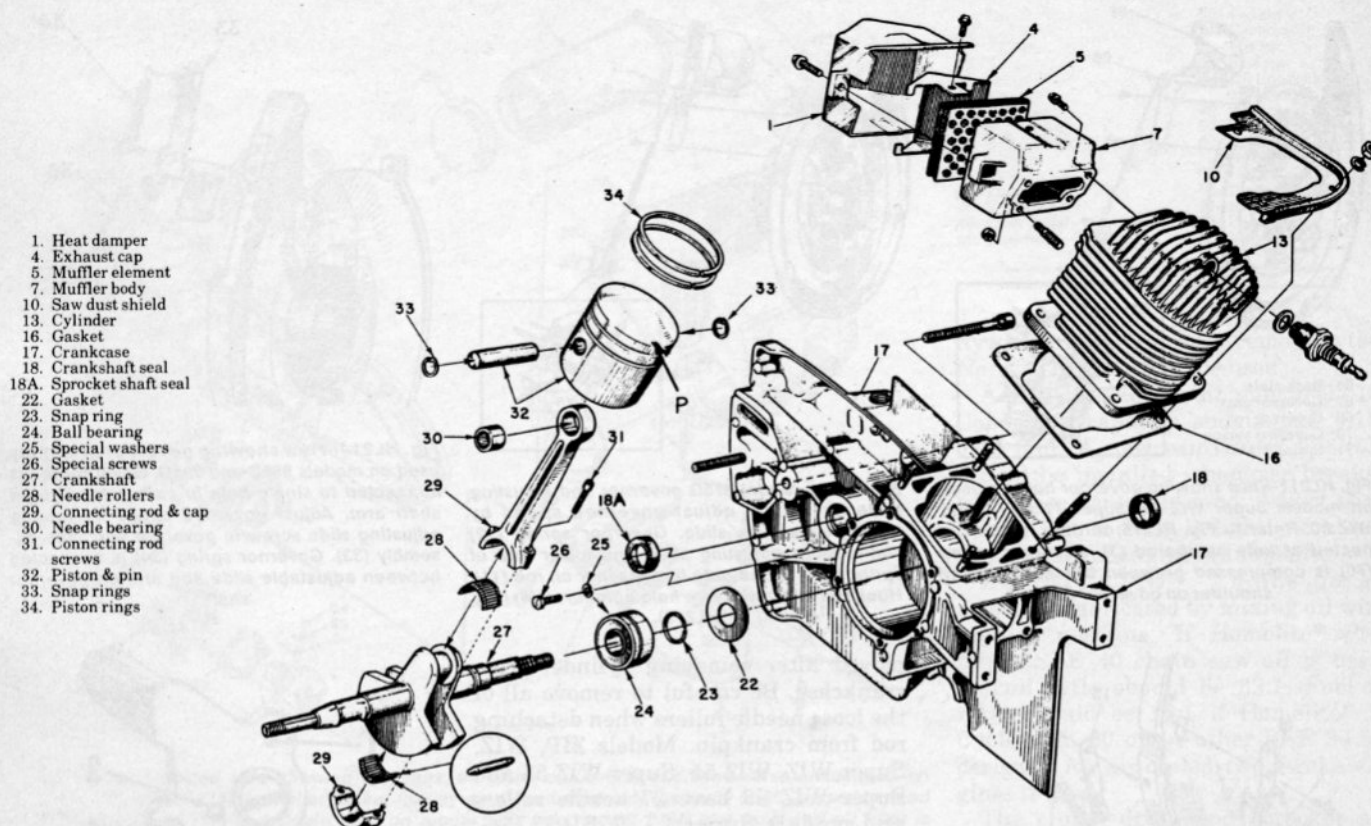


Fig. HL219—Exploded view of model 995G engine. Cylinder, crankshaft, connecting rod and piston installation of all other models are similar. Models ZIP and 775D are not fitted with crankcase crankshaft seal (18); crankcases on these models are fitted with a close fitting, non-renewable bronze oilite bushing. Note side of piston with ring retaining pin (P) is away from exhaust port (muffler) side of engine.

to rod. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and new bearing in using Homelite tool No. 23372 on models 995D and 995G, or tool No. A-23809 for other models. Press on lettered end of bearing cage only.

Homelite recommends renewing the crankpin needle rollers at each overhaul. New needle rollers are supplied in a wax strip; wrap the strip around crankpin, then assemble connecting rod to cap on the crankpin. When reassembling engine after inspection, use light grease or beeswax to stick 16 rollers to rod and cap. Install piston and connecting rod assembly so that pinned ends of piston rings are away from exhaust port (muffler) side of engine.

On models ZIP, WIZ, Super WIZ, WIZ 55, Super WIZ 55 and Super WIZ 66, tighten the connecting rod cap screws to a torque of 55-60 inch-pounds. On models Super 77, 775D, 775G, Super WIZ 80, 995D and 995G, tighten rod cap screws to a torque of 70-80 inch-pounds. Wiggle rod and cap as the screws are tightened to align fracture mating surfaces.

PISTON, PIN AND RINGS. Piston can be removed from connecting rod

after removing cylinder. Support the piston while removing and installing piston pin. Pin is retained in piston by a snap ring at each end of pin.

The aluminum alloy piston is fitted with two pinned piston rings. Ring width is 0.037 and end gap should be 0.070-0.080. Rings should be renewed if end gap exceeds 0.100. Minimum ring side clearance is 0.0025; maximum ring side clearance in ring groove is 0.004. Piston, pin and rings are available in standard size only.

Renew piston and pin, which are not available separately, if any of the following defects are noted: Visible up and down play of pin in piston bore, cracks in piston or hole in piston dome, scoring of piston accompanied by aluminum deposits in cylinder bore, piston ring locating pin worn to half of original thickness, or if side clearance of new ring exceeds 0.004. Refer to CYLINDER paragraph for information on removing aluminum deposits from cylinder bore.

Assemble piston to connecting rod or install piston and rod assembly so that ring locating pin side of piston is towards intake side of cylinder (away from exhaust ports). Always use new piston pin retaining snap rings.

CYLINDER. Cylinder bore is chrome plated; plating is light gray in color and does not have appearance of polished chrome. Because cylinder is honed after plating, the chrome bore looks much like the base metal of the aluminum cylinder. If plating has been penetrated by scoring or other causes, the aluminum exposed will appear as a bright area. These bright areas are usually, but not always, located at edges of cylinder ports. If further checking, as outlined in following paragraph, shows that chrome has been penetrated, the cylinder should be renewed.

In some instances, particles of metal from scored piston are deposited on the cylinder bore. This condition is indicated by a rough appearance and deposits can be removed using a rubber impregnated grinding wheel mounted in a 1/4-inch electric drill. If a screwdriver will scratch the cleaned surface, chrome plating has been worn away and the cylinder should be renewed. Also, renew the cylinder if cracked or if more than three critical cooling fins are broken off.

When installing both a new piston and a new cylinder, clean and oil both parts and place piston in cylinder bore

Reed lift distance

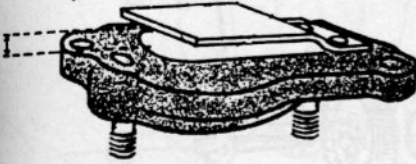


Fig. HL220—Reed lift distance should be 0.085 for model ZIP and 0.190 for WIZ and WIZ 55 with flat reed.

Reeds should rest against valve seat. Dirt accumulation beneath reeds prevents proper seating.

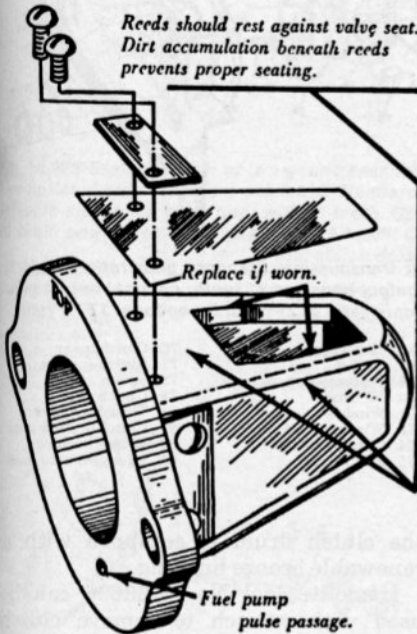
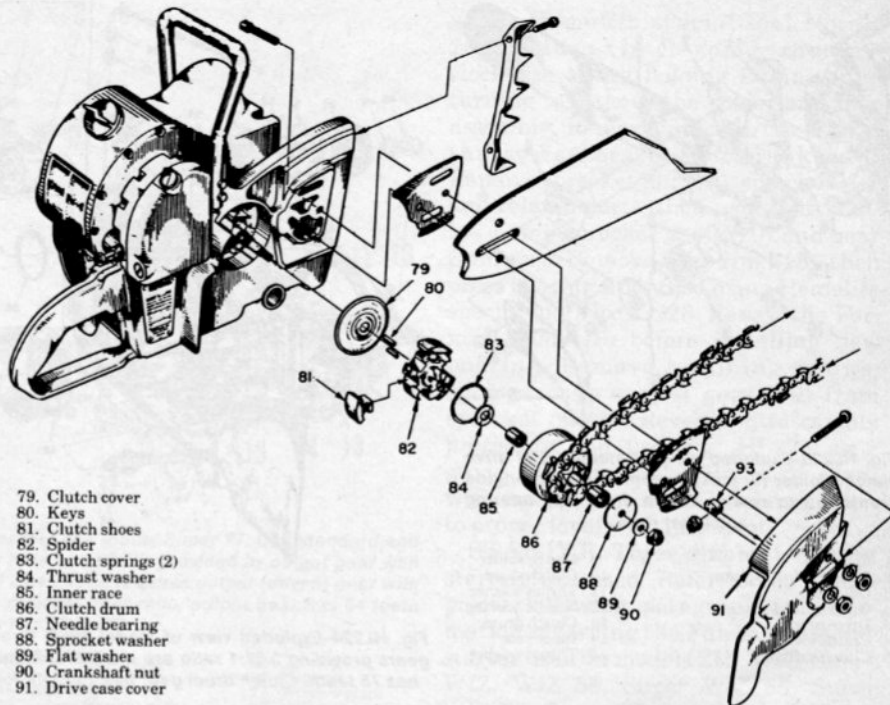


Fig. HL221—Inspection points for pyramid reed seat and reeds.

without rings or connecting rod. The piston should fall freely when cylinder is turned up. If not, select a new piston or a new cylinder that will give this desired fit.

CRANKSHAFT, BEARINGS AND SEALS. The drive end of the crankshaft is supported in a ball bearing (24—Fig. HL219) which is retained in crankcase by two screws (26) and special washers (25) which engage groove in ball bearing outer race. Crankshaft is held in position by a snap ring (23) at outer side of bearing. The flywheel end crankshaft journal rotates in a caged needle roller bearing supported in magneto back plate (64—Fig. HL217).

To remove crankshaft, first remove cylinder, piston and connecting rod assembly, clutch spider and drum, flywheel (magneto rotor) and magneto back plate. Note: On models with governor, be sure to disconnect governor linkage before attempting to remove



- 79. Clutch cover
- 80. Keys
- 81. Clutch shoes
- 82. Spider
- 83. Clutch springs (2)
- 84. Thrust washer
- 85. Inner race
- 86. Clutch drum
- 87. Needle bearing
- 88. Sprocket washer
- 89. Flat washer
- 90. Crankshaft nut
- 91. Drive case cover

Fig. HL222—Exploded view of model ZIP clutch assembly. Model 775D is similar except that six clutch shoes are used instead of three and spider is threaded to crankshaft instead of using keys (80).

back plate. Remove the two bearing retaining screws (26) and washers (25), then bump or push crankshaft and bearing from crankcase. To remove ball bearing, remove snap ring (23) and press crankshaft from bearing.

Renew magneto end needle bearing if any roller shows visible wear or flat spot, or if rollers can be separated more than width of one roller. Renew drive end ball bearing if bearing is rough or has perceptible wear. Inspect crankshaft magneto end and crankpin journals and renew crankshaft if wear marks are visible. Also, renew crankshaft if tapered end fits loosely in magneto rotor or if keyway is enlarged. Crankshaft runout should not exceed 0.003.

New crankshaft seals and sealing gasket should always be installed when reassembling engine. Install new seal in crankcase (except on models ZIP and 775D) with lip of seal inward (towards main bearing position). Install ball bearing on crankshaft with retaining groove in outer race towards crankshaft throw, then install retaining snap ring. Soak new gasket in oil, then position gasket in crankcase. Install crankshaft and bearing using seal protector sleeve and jackscrew, then secure bearing in position using new special washers and screws. Install new seal in back plate with lip inward and install new needle roller

bearing by pressing on lettered end. Then, using seal protector, install back plate with new gasket.

Homelite special tools for installing bearings, crankshaft seals and crankshaft are as follows:

Models 995D & 995G:

- A-23137—Jackscrew, crankshaft and bearing.
- 23136—Jackscrew body.
- 23382—Spacer, crankshaft.
- 23373—Collar, crankshaft and bearing.
- 23383—Plate, shaft aligning.
- 22391—Plug, back plate bearing and seal.
- 23233—Plug, back plate seal installation.
- 23384—Plug, crankcase seal.
- 23422—Sleeve, crankshaft seal.

All models Except 995D & 995G:

- A-23137—Jackscrew, crankshaft and bearing.
- 23136—Jackscrew body.
- 22820-1—Collar, crankshaft and bearing.
- 22812-1—Plate, shaft aligning.
- 23391-1—Plug, back plate bearing.
- 23233—Plug, back plate & crankcase seal.
- 23232—Sleeve, crankshaft seal.

CRANKCASE. With crankshaft and bearing removed, check bearing

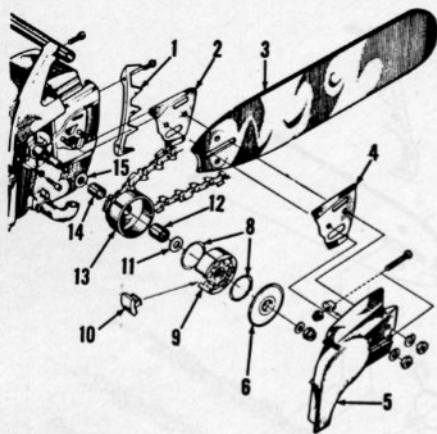


Fig. HL223—Exploded view of model 995D drive clutch. Spider (9) must be removed from engine crankshaft to service clutch drum (13), bearing and inner race.

- | | |
|--------------------------|--------------------|
| 1. Spike | 9. Clutch spider |
| 2. Inner guide bar plate | 10. Clutch shoes |
| 3. Guide bar | 11. Thrust washer |
| 4. Outer guide bar plate | 12. Needle bearing |
| 5. Drive cover | 13. Clutch drum |
| 6. Clutch cover | 14. Inner race |
| 8. Clutch springs | 15. Thrust washer |

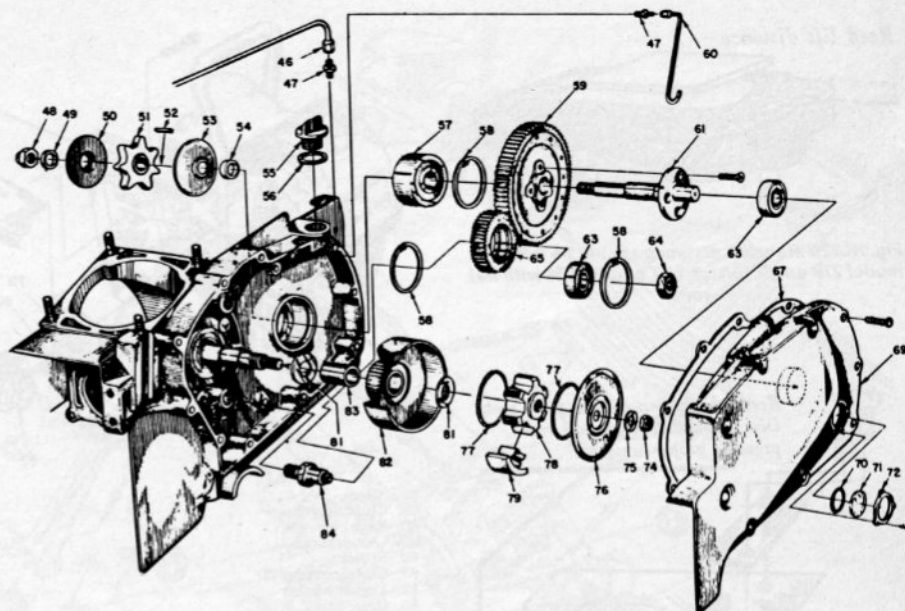


Fig. HL224—Exploded view of model 995G three-gear transmission. Standard gear ratio is 2.84:1; gears providing 3.57:1 ratio are available. Standard output gear has 71 teeth; optional output gear has 75 teeth. Clutch drum gear has 25 teeth for standard ratio or 21 teeth for optional 3.57:1 ratio.

- | | | | |
|------------------------|--------------------------|------------------------|---------------------------|
| 47. Fitting | 55. Filler cap | 65. Idler gear | 76. Clutch cover |
| 48. Sprocket shaft nut | 56. Gasket | 67. Gasket | 77. Clutch springs |
| 49. Sprocket spacer | 57. Ball bearings | 69. Transmission cover | 78. Spider |
| 50. Sprocket washer | 58. Snap rings | 70. "O" ring | 79. Clutch shoes |
| 51. Sprocket | 59. Driven (output) gear | 71. Window | 81. Thrust washers |
| 52. Sprocket key | 61. Sprocket shaft | 72. Window plate | 82. Clutch drum & gear |
| 53. Sprocket washer | 63. Ball bearing | 74. Crankshaft nut | 83. Bronze bushing |
| 54. Sprocket spacer | 64. Idler shaft nut | 75. Flat washer | 84. Idler gear stud shaft |

bore. A lapped appearance indicates that the bearing outer race has been turning in the bore. If bearing fits loose in bore, renew the crankcase and/or bearing as necessary to obtain a tight fit. New ball bearing special retaining washers and screws should always be used when reassembling.

REED VALVE. The reed valve should be inspected whenever carburetor is removed. Model WIZ 55 prior to serial No. 2537288 and models ZIP and WIZ are equipped with a single reed valve; all other models are equipped with a pyramid reed type valve.

Single reed type valve should be renewed if reed has loosened or if reed and/or reed seating surface are worn or damaged. Reed lift should be checked as shown in Fig. HL220.

On pyramid reed type valve, individual reeds may be renewed. Refer to Fig. HL221 for inspection of the pyramid reed valve assembly.

CLUTCH. A shoe type clutch is used on all models and except on model ZIP, clutch rotor is threaded to engine crankshaft. Clutch spider on model ZIP is keyed and press fitted to crankshaft; use puller (Homelite tool No. A-23131) to pull spider from crankshaft. On models 775D, 995D and 995G, the rotor and crankshaft have left hand threads; lock engine from turning and turn rotor clockwise to remove. All other models have right hand threads.

On models ZIP and 775D, refer to Fig. HL222 for exploded view of clutch assembly. Exploded view of model 995D clutch is shown in Fig. HL223.

On gear drive models, the clutch is located inside the transmission cover; refer to Fig. HL224 for exploded view showing model 995G 3-gear transmission and to Fig. HL225 for exploded view of 2-gear transmission used on all other gear drive models.

Clutch shoes on direct drive models are of Oilite bronze. On gear drive models, the clutch shoes have 1/16-inch thick bonded Raybestos linings. Model ZIP is equipped with three clutch shoes; all other models have six clutch shoes. On models WIZ, Super WIZ, WIZ 55, Super WIZ 55 and Super WIZ 66, standard clutch shoes are 3/8-inch wide; optional heavy duty clutch shoes are 1/2-inch wide. Standard and heavy duty clutch components are not individually interchangeable; also, a different gear case cover is required with heavy duty clutch.

On direct drive models, the clutch drum should be removed occasionally and the needle bearing cleaned and relubricated. A high temperature grease such as Homelite® ALL-TEMP Multi-Purpose Grease or equivalent should be used. Needle roller bearing should be renewed if rollers can be separated the width of one roller and clutch drum is otherwise serviceable. Press on lettered end of bearing cage only when removing and installing needle bearings. On gear drive models,

the clutch drum is equipped with a renewable bronze bushing.

Homelite tool No. A-23696 can be used with wrench to remove clutch spider. When assembling clutch, be sure that end loops of springs are closed and are located at the center of a clutch shoe. If installing new clutch drum, wash off protective coating with petroleum solvent.

TRANSMISSION. Model 995G is equipped with a 3-gear transmission as shown in Fig. HL224. Other gear drive models have a 2-gear transmission as shown in Fig. HL225.

To service transmission, first drain oil from transmission case, then remove the screws retaining cover to case. Tap cover lightly, if necessary, to loosen gasket seal and remove the cover.

On model 995G, remove nut (74—Fig. HL224), lock washer and clutch cover (76), block engine from turning and unscrew clutch rotor (78) in a clockwise direction using Homelite tool No. A-23696. Remove clutch drum (82) and the two thrust washers (81). Unscrew nut (64) and remove idler gear (65) and bearing assembly. If necessary to renew bearing (63), remove snap rings (58) and press bearing from gear. Remove gear case vent tube, sprocket nut (48), sprocket (51) and related parts. Then, using soft mallet, bump

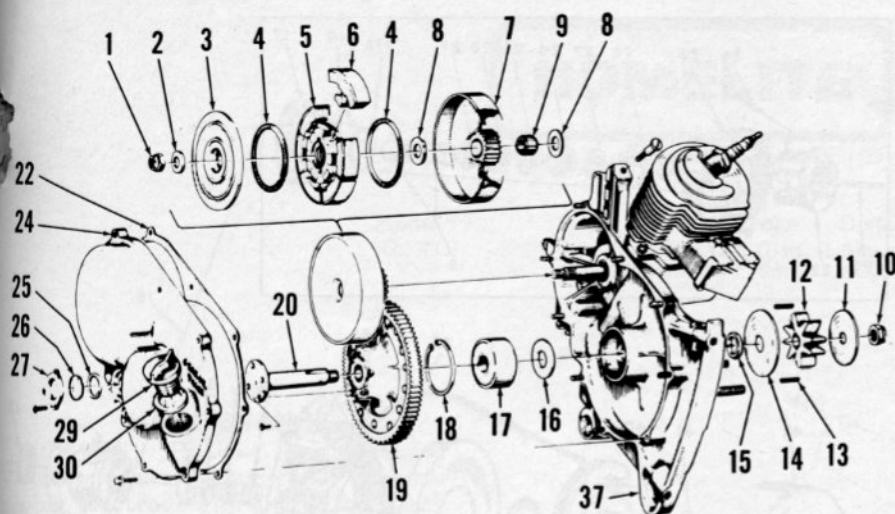


Fig. HL225—Exploded view of two-gear transmission for WIZ and model Super 77. One standard and two optional gear ratios are available. Standard gear ratio of 3.57:1 is provided by output gear with 75 teeth and clutch drum gear with 21 teeth. Optional 2.84:1 ratio requires output (driven) gear with 71 teeth and clutch drum gear with 25 teeth. On 2:1 optional gear ratio, output gear has 64 teeth and clutch drum gear has 32 teeth.

- | | | | |
|-----------------------|------------------------|--------------------------|---------------------------|
| 1. Crankshaft nut | 9. Bronze bushing | 16. Formica seal | 25. "O" ring |
| 2. Flat washer | 10. Sprocket shaft nut | 17. Ball bearing | 26. Window |
| 3. Clutch cover | 11. Sprocket washer | 18. Snap ring | 27. Window plate |
| 4. Clutch springs | 12. Chain sprocket | 19. Driven (output) gear | 29. Filler cap |
| 5. Clutch spider | 13. Sprocket keys | 20. Sprocket shaft | 30. Gasket |
| 6. Clutch shoes | 14. Sprocket washer | 22. Gasket | 37. Crankcase & gear case |
| 7. Clutch drum & gear | 15. Sprocket spacer | 24. Transmission cover | |

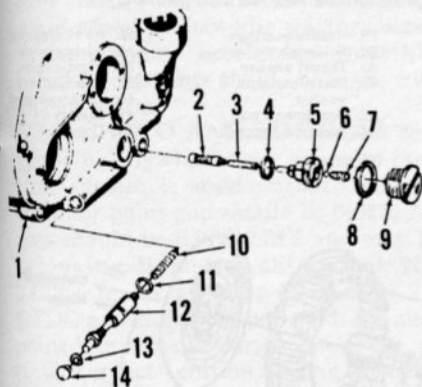


Fig. HL226—Exploded view of typical manual oil pump assembly.

- | | |
|-----------------------|------------------|
| 1. Fuel tank | 8. Gasket |
| 2. Oil filter | 9. Plug |
| 3. Oil line | 10. Spring |
| 4. Gasket | 11. "O" ring |
| 5. Valve seat | 12. Pump plunger |
| 6. Check ball | 13. "O" ring |
| 7. Check valve spring | 14. Button |

sprocket shaft from case. To remove ball bearing (57), remove retaining snap ring (58) and press bearing from case using Homelite special tool No. 23389. If bearing (63) remained in cover, heat cover slightly to free the bearing; otherwise, press sprocket shaft from bearing. Remove output gear from sprocket shaft after removing retaining screws. Reassemble by reversing disassembly procedure, reinstall cover with new gasket and fill to proper level with lubricant.

On all two-gear models, remove nut (1—Fig. HL225) from crankshaft, remove washer and clutch cover (3) and

using Homelite special tool No. A-23696, turn clutch spider counter-clockwise while holding engine from turning to remove the spider and shoe assembly. Remove clutch drum (7) and thrust washers (8) from crankshaft. Remove sprocket nut (10), sprocket (12) and related parts, then using soft mallet, bump sprocket shaft (20) and gear from case. Remove snap ring (18), then press bearing from case using Homelite special tool No. 23228. Renew the Formica seal (16) before installing new bearing. Remove retaining screws, then remove output gear (19) from sprocket shaft. Reverse disassembly procedure and use Fig. HL225 as a guide to reassemble. Reinstall cover with new gasket and fill transmission to proper level with lubricant.

STARTER. Three different types of starters are used. Refer to the appropriate following paragraph for information regarding the Fairbanks-Morse starter used on models ZIP, WIZ, Super WIZ, WIZ 55, Super WIZ 55, Super WIZ 66, Super 77 and Super WIZ 80, the ball drive starter used on models 775D and 775G or the over-running clutch type starter used on models 995D and 995G.

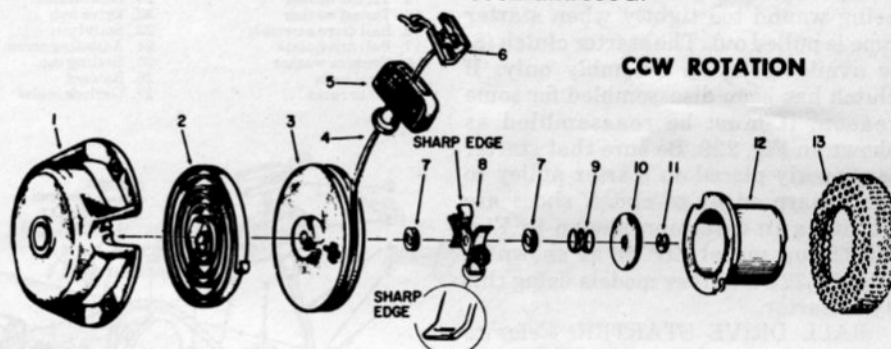


Fig. HL227—Fairbanks-Morse counter-clockwise rotation starter similar to that used on model ZIP. Refer to Fig. HL229, for assembly of friction shoe assembly (8) if unit has been disassembled. Note direction of sharp edge on shoes when reassembling starter. Refer to Fig. HL228 for legend.

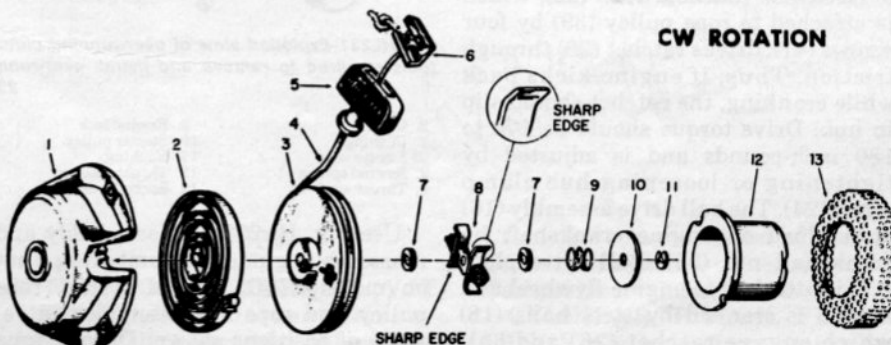


Fig. HL228—Exploded view of Fairbanks-Morse starter used on WIZ series and model Super 77. Fig. HL229 shows proper method of assembling friction shoe assembly if it has been disassembled for some reason; individual parts of friction shoe assembly are not available. Note direction for sharp edges of shoes when reassembling starter.

- | | | | |
|------------------|------------------|------------------------|--------------------|
| 1. Cover | 5. Handle grip | 8. Friction shoe assy. | 11. Retaining ring |
| 2. Rewind spring | 6. Grip insert | 9. Brake spring | 12. Starter cup |
| 3. Rope pulley | 7. Brake washers | 10. Retaining washer | 13. Starter screen |

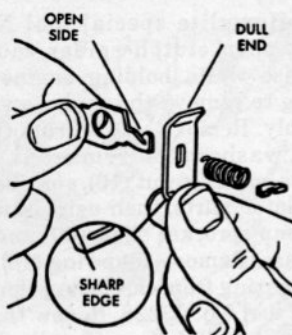


Fig. HL229-H Fairbanks-Morse starter friction shoe assembly is disassembled, be sure to reassemble as shown.

FAIRBANKS-MORSE STARTER. Refer to Fig. HL227 for exploded view showing counter-clockwise rotation starter used on model ZIP and to Fig. HL228 for clockwise rotation starter used on WIZ series of models and Super 77. When installing rewind spring, pulley and rope, spring should be pre-tensioned so that pulley will rewind all rope and pull rope handle lightly against starter housing. If spring is tensioned too tightly, or if starter rope is too long, spring can be damaged by being wound too tightly when starter rope is pulled out. The starter clutch (8) is available as an assembly only. If clutch has been disassembled for some reason, it must be reassembled as shown in Fig. 229. Be sure that starter is properly placed on starter pulley so that sharp edges of clutch shoes are pointing in direction shown in Fig. HL227 on model ZIP or as shown in Fig. HL228 for other models using this type starter.

BALL DRIVE STARTER. Refer to Fig. HL230 for exploded view of ball drive starter used on model 775G. Starter for model 775D is similar except for being counterclockwise instead of clockwise rotation. Hub (22), which is attached to rope pulley (39) by four screws (41), drives ratchet (26) through friction. Thus, if engine kicks back while cranking, the ratchet should slip in hub. Drive torque should be 170 to 180 inch-pounds and is adjusted by tightening or loosening hub clamp screw (24). The ball drive assembly (16) is retained on engine crankshaft by crankshaft nut (32). Ball drive plate (17) is attached to engine flywheel and engine is cranked by steel balls (18) which engage ratchet (26) and ball drive plate. When engine is running, centrifugal force disengages drive balls from ratchet and crankshaft turns in the needle bearings (28) in ratchet. Rewind spring (35) inner hook engages roll pin (23) carried in bores in ratchet and rope pulley.

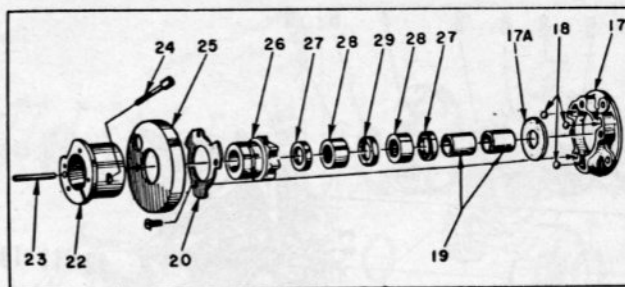


Fig. HL230—Exploded view of Homelite ball drive starter for model 775G. Starter for model 775D is similar except it is designed for counterclockwise rotation. Tension screw (24) should be adjusted so that hub (22) will drive ratchet (26) to crank engine, but ratchet will slip in hub if engine kicks back. Torque transmitted through hub and ratchet can be measured by locking engine, removing two opposite screws (41) from pulley and turning pulley with special key (Homelite tool No. A-22224) and inch-pound torque wrench. Torque should be 170-180 inch-pounds.

- | | | | |
|-------------------------|---------------------|--------------------------|-------------------|
| 13. Thrust washer | 20. Ball retainer | 28. Needle bearings | 35. Rewind spring |
| 15. Thrust washer | 22. Drive hub | 29. Felt wick | 37. Spring cover |
| 16. Ball drive assembly | 23. Spirol pin | 30. Thrust washer | 38. Plastic shim |
| 17. Ball drive plate | 24. Adjusting screw | 31. Flat aluminum washer | 39. Rope pulley |
| 17A. Formica washer | 25. Sealing cup | 32. Crankshaft nut | 40. Lock washers |
| 18. Steel balls | 26. Ratchet | 34. Screen & bracket | 41. Screws |
| 19. Inner races | 27. Garlock seals | | 42. Cover |

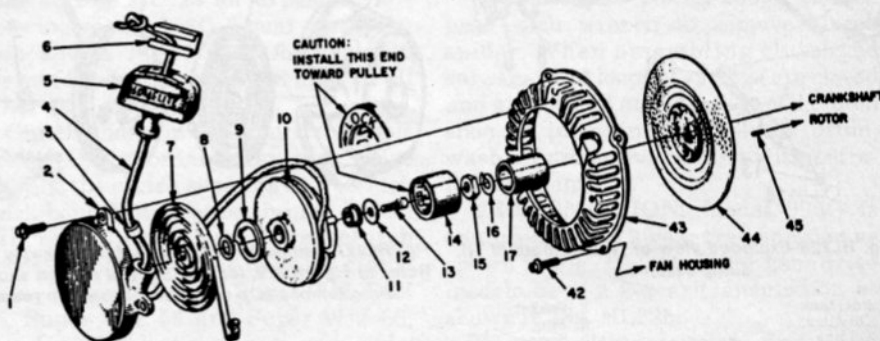


Fig. HL231—Exploded view of over-running clutch starter used on models 995D and 995G. Special tools required to remove and install over-running bearing (14) are puller (Homelite tool No. A-23679).

- | | | | |
|------------------|-----------------------|--------------------------|-------------------------------|
| 2. Cover | 9. Rewind lock | 17. Inner race | 43. Mounting ring |
| 3. Bushing | 10. Starter pulley | 14. Over-running bearing | 44. Rotating screen |
| 4. Starter rope | 11. Bushing | 15. Crankshaft nut | 45. Dowel pin (race to rotor) |
| 7. Rewind spring | 12. Thrust washer | 16. Lock washer | |
| 8. Thrust washer | 13. Socket head screw | | |

Use Fig. HL230 as disassembly and reassembly guide, remembering that on model 775D, rewind spring, rope pulley and rope are assembled in reverse of positions shown. Drive torque can be checked using torque wrench and special key (Homelite tool No. A-22224).

OVER-RUNNING CLUTCH STARTER. Refer to Fig. HL231 for exploded view of over-running clutch type starter used on models 995D and

995G. When starter pulley (10) is turned, over-running bearing (14) engages inner race (17) which is pinned to flywheel with pin (45).

Over-running bearing (14) is a press fit and can be removed using Homelite special tool No. A-23679. When installing new bearing, be sure end marked "LOCK" as shown in Fig. HL231 is towards rope pulley (10). Install bearing using plug, Homelite tool No. 23678.

HOMELITE®A **textron** DIVISION, PORT CHESTER, N. Y. 10573Model
XL, XL2

Bore	Stroke	Displ.
1-5/16 in.	1-3/16 in.	1.6 cu. in.
33.34mm	30.16mm	26.2cc

Drive
Type
Direct**MAINTENANCE**

SPARK PLUG. Recommended spark plug is a Champion DJ-7J. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. A Walbro model HDC-15 diaphragm carburetor is used. Refer to Walbro section of SERVICE FUNDAMENTALS section for carburetor overhaul and exploded views.

High speed mixture is not adjustable. Initial adjustment of idle mixture screw is one turn open. Adjust idle mixture and idle speed screws so that engine idles just below clutch engagement speed. Adjust idle mixture screw so that engine accelerates smoothly. Final adjustments should be made with engine warm.

MAGNETO AND TIMING. A conventional flywheel type magneto ignition system is used on both models. Breaker point gap should be 0.015. Air gap should be 0.008-0.012 and may be set using Homelite shim stock No. 24306. Ignition timing is fixed at 23° BTDC and cannot be adjusted. Breaker point gap must be correct, however, as it will affect ignition timing if incorrect.

LUBRICATION. Model XL or XL2 chain saw engine is lubricated by mixing oil with the fuel. If Homelite Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used. Regular grade (about 90 octane) gasoline should be used.

Saw chain is lubricated by oil from an automatic oil pump. Recommended chain oil is Homelite® Bar and Chain Oil or clean SAE 30 oil. Dilute SAE 30 oil with kerosene if ambient temperature is below 40° F.

MUFFLER. Outer screen of muffler should be cleaned of debris every week or as required. Carbon should be removed from muffler and engine ports to prevent excessive carbon build-up and power loss. Do not allow loose carbon to enter cylinder and be careful not to damage exhaust port or piston.

Fig. HL240—View showing dual trigger mechanism used on model XL2.

1. Rear trigger
2. Trigger rod
3. Spring
4. Front trigger
5. Throttle rod
6. Handle cover

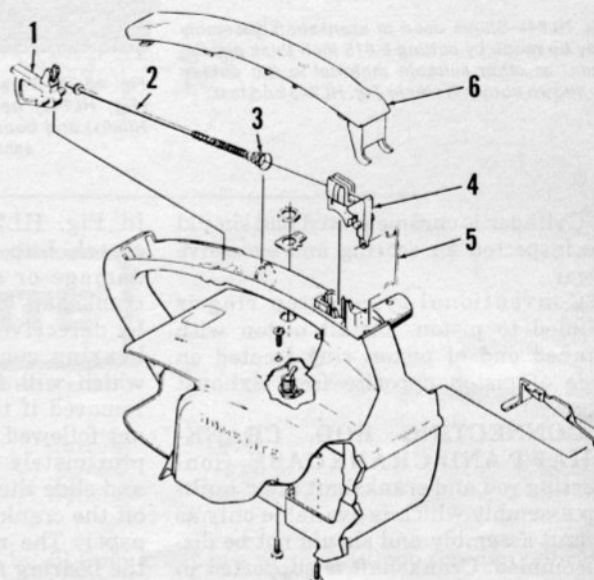
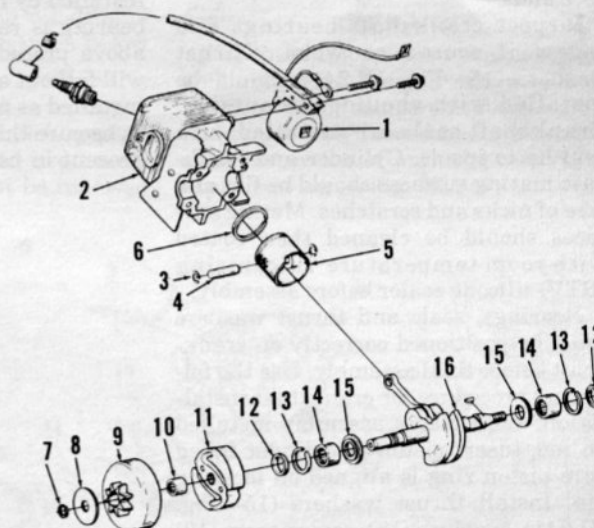


Fig. HL241—Exploded view of cylinder, crankshaft and clutch assemblies.

1. Ignition coil
2. Cylinder
3. Retainer
4. Piston pin
5. Piston
6. Piston ring
7. Snap ring
8. Washer
9. Clutch drum
10. Bearing
11. Clutch hub
12. Seal
13. Seal spacer
14. Bearing
15. Thrust washer
16. Crankshaft assy.

**REPAIRS**

TIGHTENING TORQUE VALUES. Tightening torque values are listed in following table. Note: Values given are average figures in inch-pounds. To obtain minimum or maximum values, reduce or increase given values by 10 per cent.

Flywheel nut	100
Clutch hub	100
Spark plug	150

Crankcase screws—socket hd.	35
Starter pulley screw	35
Carburetor retaining screws	35

CYLINDER, PISTON, PIN AND RINGS. Cylinder may be removed after unscrewing socket head cap-screws in bottom of crankcase (6—Fig. HL244). Be careful when removing cylinder as crankshaft assembly will be loose in crankcase. Care should be taken not to scratch or nick mating surfaces of cylinder and crankcase.

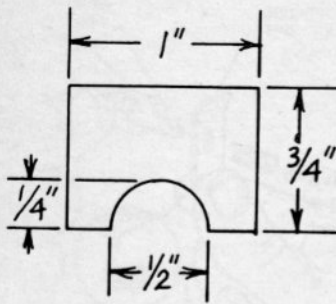


Fig. HL242—Shims used in crankshaft assembly may be made by cutting 0.015 inch thick plastic, metal or other suitable material in the outline shown above. Refer to Fig. HL243 and text.

Cylinder is chrome plated and should be inspected for scoring and excessive wear.

Conventional type piston ring is pinned to piston. Install piston with pinned end of piston ring located on side of piston opposite from exhaust port.

CONNECTING ROD, CRANKSHAFT AND CRANKCASE. Connecting rod and crankshaft are a built-up assembly which is available only as a unit assembly and should not be disassembled. Crankshaft is supported in crankcase by a needle roller bearing at both ends.

Inspect crankshaft bearings and renew if scored or worn. Thrust washers (15—Fig. HL241) should be installed with shoulder to outside. Crankshaft seals are installed with seal lip to inside. Cylinder and crankcase mating surfaces should be flat and free of nicks and scratches. Mating surfaces should be cleaned then coated with room temperature vulcanizing (RTV) silicone sealer before assembly.

Bearings, seals and thrust washers must be positioned correctly on crankshaft before final assembly. Use the following procedure for crankshaft installation: With piston assembly installed on rod, insert piston in cylinder being sure piston ring is aligned on locating pin. Install thrust washers (15—Fig. HL241), bearings (14), seal spacers (13) and seals (12) on crankshaft. Place 0.015 inch thick shims shown in Fig. HL242 between thrust washers and bearings as shown in Fig. HL243.

Gently push seals toward crankshaft counterweights until assemblies are snug. Remove shims and complete assembly being careful not to disturb position of thrust washers, bearings and seals.

CLUTCH. Clutch hub has left hand threads and must be installed as shown

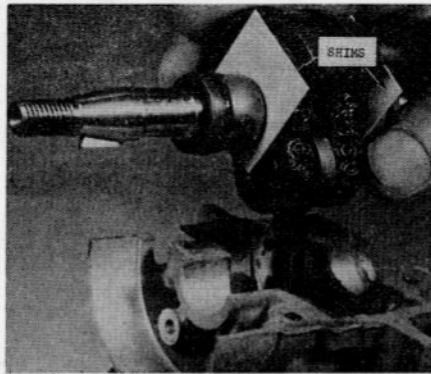


Fig. HL243—View showing placement of shims (Fig. HL242) between thrust washers (15—Fig. HL241) and bearings (14) for correct crankshaft assembly. Refer to text.

in Fig. HL245. Clean and inspect clutch hub, drum and bearing for damage or excessive wear. Inspect crankshaft for wear or damage caused by defective clutch bearing. Clutch bearing contains 21 needle rollers which will fall out when bearing is removed if the following procedure is not followed. Roll a tube of paper approximately the size of the crankshaft and slide the clutch drum and bearing off the crankshaft and on to the rolled paper. The roll of paper will prevent the bearing needle rollers from falling out and the drum and bearing can be installed by reversing the procedure. If bearing is removed without using the above procedure, the needle bearings will fall out and a new bearing must be installed as needle rollers are too small to be sure that all 21 needle rollers are present in bearing race. New bearings

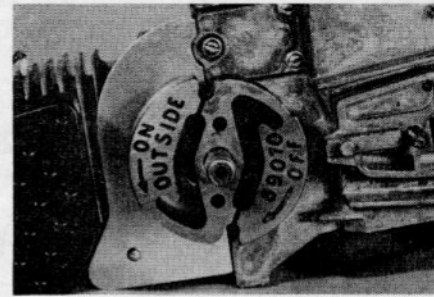


Fig. HL245—View of correct installation of clutch hub in drum.

can be installed without using above procedure since wear has not yet loosened rollers.

AUTOMATIC CHAIN OIL PUMP. Models XL and XL2 are equipped with a crankcase pulse actuated automatic chain oiler pump. Crankcase pulses move diaphragm and plunger (5—Fig. HL244) to force oil out oil outlet. Inspect diaphragm (5) and gaskets (4) for leaks.

RECOIL STARTER. To service recoil starter, remove starter housing from saw. Pull starter rope and hold rope pulley with notch in pulley adjacent to rope outlet. Pull rope back through outlet so that it engages notch in pulley and allow pulley to completely unwind. Unscrew pulley retaining screw (7—Fig. HL246) and remove rope pulley being careful not to dislodge rewind spring in housing. Care must be taken if rewind spring is removed to prevent injury if spring is allowed to uncoil uncontrolled.

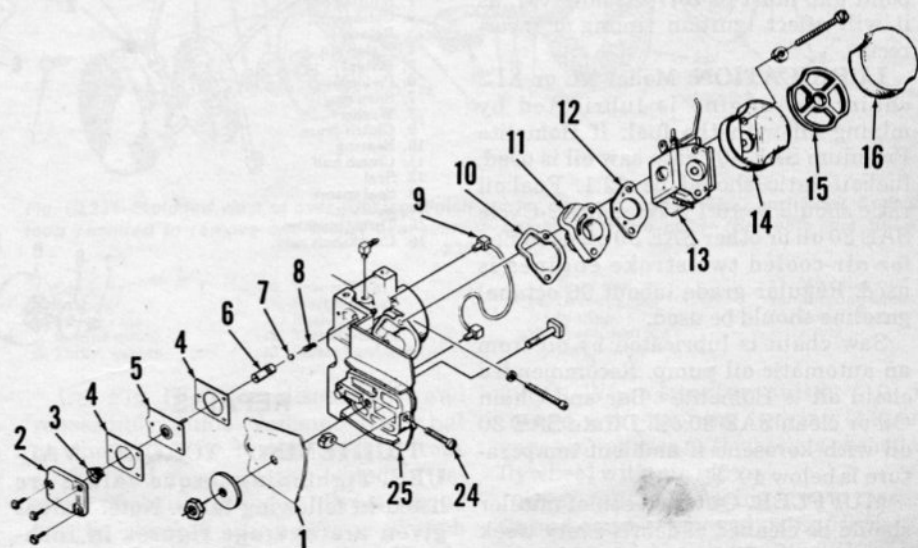


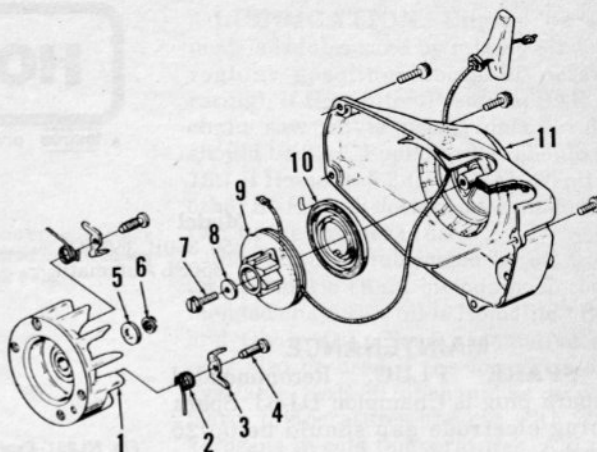
Fig. HL244—Exploded view of model XL-2 crankcase and oil pump assemblies. Model XL is similar.

- | | | | |
|------------------------|----------------------|---------------------|-----------------------------------|
| 1. Bar plate | 6. Oil pump cylinder | 10. Gasket | 14. Filter housing |
| 2. Pump cover | 7. Check ball | 11. Intake manifold | 15. Retainer |
| 3. Spring | 8. Spring | 12. Gasket | 16. Air filter |
| 4. Gasket | 9. Oil line | 13. Carburetor | 24. Chain Tension Adjusting Screw |
| 5. Diaphragm & plunger | | | 25. Crankcase |

Rewind spring is wound in clockwise direction in starter housing. Rope is wound on rope pulley in clockwise direction as viewed with pulley in housing. To place tension on rewind spring, pass rope through rope outlet in housing and install rope handle. Pull rope out and hold rope pulley so notch on pulley is adjacent to rope outlet. Pull rope back through outlet between notch in pulley and housing. Turn rope pulley clockwise to place tension on spring. Release pulley and check starter action. Do not place more tension on rewind spring than is necessary to draw rope handle up against housing.

Fig. HL246—Exploded view of recoil starter.

1. Flywheel
2. Spring
3. Starter pawl
4. Pawl pin
5. Washer
6. Nut
7. Capscrew
8. Washer
9. Rope pulley
10. Rewind spring
11. Housing



A **Textron** DIVISION, PORT CHESTER, N.Y. 10573

Model
110

Volts
115-120

Current/
Cycles
AC/25-60

Drive
Type
Gear

ELECTRICAL REQUIREMENTS

Model 110 electric saw is designed to be used on electrical circuits with 115-120 volt alternating current. If a portable power plant is used, power rating of plant should be no less than 3000 watts of alternating current up to 60 Hz. (cycles per second).

Model 110 electric saw is double-insulated and does not require a ground wire. A two-wire extension cord is recommended but a three-wire cord may be used if ground wire is not connected to saw. A UL or similarly approved extension cord should be used. It is necessary that the correct wire gauge be matched to cord length and line current. Using an undersized cord may result in power loss and overheating.

MAINTENANCE

LUBRICATION. Rear bearing of motor should be lubricated after every ten hours of operation by adding oil in oil hole in center of air screen. Oil should be a good quality SAE 20 or SAE 30 oil.

The clutch drum bearing is lubricated by removing clutch and packing bearing with Homelite All-Temp Multi-Purpose Grease at periodic intervals. Bearing should be oiled after every 10 hours of operation with SAE 20 or SAE 30 oil.

Saw chain is lubricated by oil from a manual oil pump. Recommended chain oil is SAE 30 oil for temperatures above 40° F. and SAE 30 oil diluted with kerosene for temperatures below 40° F.

BRUSHES. Model 110 is equipped with brushes which will not contact commutator when brushes are excessively worn. Brushes must be renewed

if saw motor will not run due to brush wear.

REPAIR

Overhaul information was not available from manufacturer at time of publication. Major component disassembly and reassembly procedures are evident after inspection of unit and referral to exploded view in Fig. HL247.

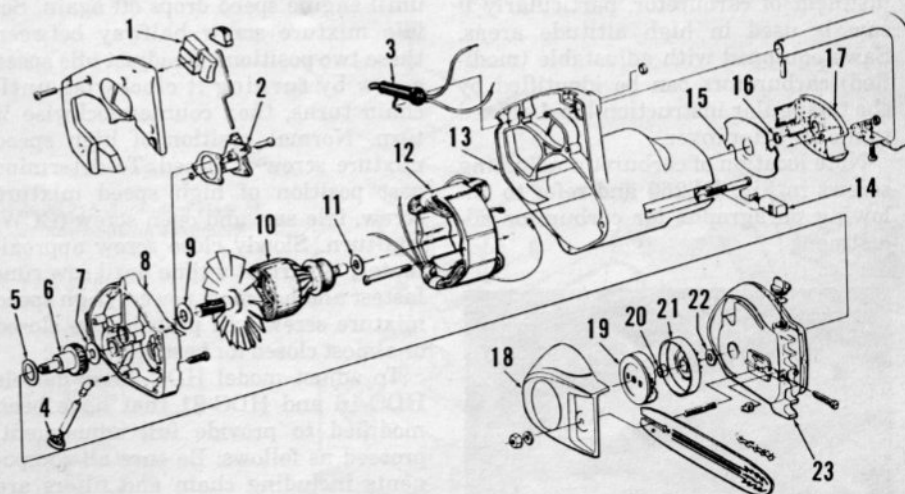


Fig. HL247—Exploded view of model 110 electric chain saw.

1. Switch
2. Manual oil pump
3. Power cord
4. Oil filter
5. Washer
6. Gear & spindle

7. Washer
8. Bearing plate
9. Bakelite washer
10. Armature & fan
11. Bakelite washer
12. Field assy.

13. Housing
14. Brushes
15. Radiator
16. Felt wick
17. Air screen
18. Clutch cover

19. Clutch hub assy.
20. Bearing
21. Clutch drum
22. Washer
23. Gear housing

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N. Y. 10573

Model	Bore Inches	Stroke Inches	Displ. Cu. In.	Drive Type
350, 350B, 350HG, 350SL Automatic	1.75	1.44	3.5	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ-6J. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. A Walbro model HDC-16, HDC-21 or HDC-23 diaphragm carburetor may be used. Refer to Walbro section of SERVICE FUNDAMENTALS section for Walbro carburetor overhaul and an exploded view of carburetor. A Tillotson HK-1A is offered as a replacement for the above carburetors. Components are not interchangeable but adjustment procedure for Walbro HDC-23 should be used when adjusting Tillotson HK-1A.

Correct carburetor adjustment procedure is determined by type of high speed fuel delivery system in carburetor. Model HDC-16 carburetors were originally designed with an 0.037 inch main jet in the circuit plate and the high speed adjustment needle was used to enrich the high speed fuel mixture. Recent production of model 350 saws are equipped with model HDC-21 carburetors which have an 0.033 inch main jet in the circuit plate.

Model HDC-16 and HDC-21 carburetors may be modified to allow full adjustment of carburetor, particularly if saw is used in high altitude areas. Saws equipped with adjustable (modified) carburetors can be identified by the triangular instruction label affixed to the air filter cover.

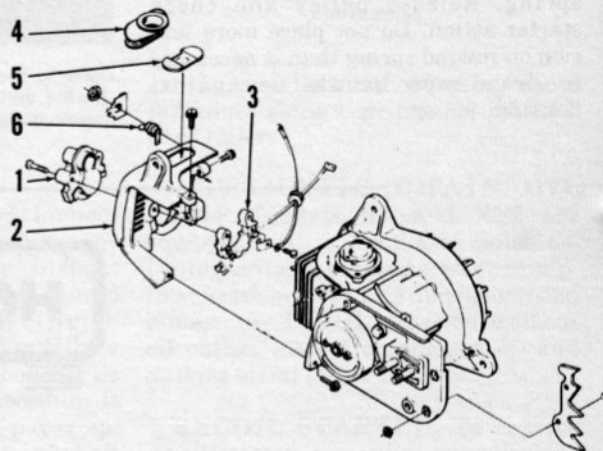
Note location of carburetor adjusting screws in Fig. HL250 and refer to following paragraphs for carburetor adjustment.



Fig. HL250-View of carburetor idle speed screw (I), high speed mixture screw (H) and idle mixture screw (L).

Fig. HL251-Exploded view of cylinder shield assembly. Heat exchanger (4) is used in place of plug (5) in cold weather to warm carburetor airbox.

1. Transformer
2. Cylinder shield
3. Transformer receptacle
4. Heat exchanger
5. Plug
6. Ignition switch



Model HDC-16 and HDC-21 carburetors with fixed main jets are adjusted as follows: Turn high speed adjusting screw fully clockwise until closed and turn idle mixture screw one turn open (counterclockwise). Start saw and allow to idle. If necessary, increase idle speed with idle speed screw until saw will idle without stalling. Turn idle mixture screw slowly clockwise and note where idle speed drops off. Turn idle mixture screw in opposite direction until engine speed drops off again. Set idle mixture screw halfway between these two positions. Readjust idle speed screw by turning it clockwise until chain turns, then counterclockwise 1/2 turn. Normal position of high speed mixture screw is closed. To determine best position of high speed mixture screw, idle saw and open screw (CCW) one turn. Slowly close screw approximately 1/8 turn at a time until saw runs fastest and has most power. High speed mixture screw will probably be closed or almost closed for best power.

To adjust model HDC-23 or models HDC-16 and HDC-21 that have been modified to provide full adjustment, proceed as follows: Be sure all components including chain and filters are installed and chain is properly tensioned and lubricated. Note: Engine must not be placed under load during adjustments and nothing should come in contact with chain. Initial settings are 1 1/4 turns open for high speed mix-

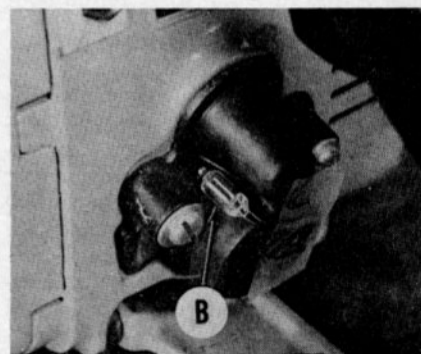


Fig. HL252-A neon bulb may be used to determine if ignition system is operating correctly. See text.

ture screw and 1-3/16 turns open for idle mixture screw. Turn screw counterclockwise to open screw. Start engine and increase idle speed by turning idle speed screw if necessary to prevent stalling. Run engine under no load until it reaches operating temperature and then momentarily at full throttle to clear engine out. If necessary, turn idle speed screw counterclockwise until chain rotation stops. Turn idle mixture screw clockwise to find fastest engine speed. Squeeze trigger rapidly to check for smooth acceleration. If engine stumbles or hesitates, open idle mixture screw slightly but not beyond initial setting of 1-3/16 turns open. Engine should idle smoothly at lowest possible speed (approximately 2500-

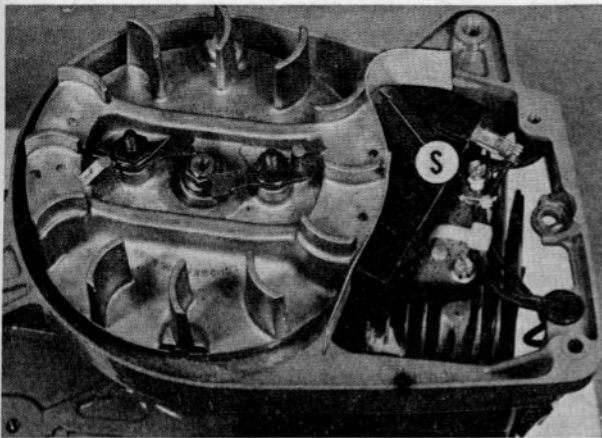


Fig. HL253—Insert shim stock (S) as indicated in text to set air gap.

2800 rpm) and not fluctuate when attitude of saw is changed.

Maximum no load speed of saws equipped with fully adjustable carburetors is 12,500 rpm and should be adjusted to operate in a no load range of 11,000-12,500 rpm. A tachometer is necessary to accurately adjust high speed mixture screw. If no load speed at full throttle is below 11,000 rpm, turn high speed mixture screw clockwise. Note: Final high speed mixture screw position should not be less than $\frac{3}{8}$ turn open at altitudes below 5000 feet.

Components required to convert fixed main jet carburetors to fully adjustable are available from Homelite in kit A-12958.

A thin coat of suitable RTV silicone rubber sealant should be applied to both sides of intake gasket (6—Fig. HL257).

MAGNETO AND TIMING. A solid state ignition is used on all models. The ignition module is mounted adjacent to the flywheel while the high tension coil is mounted on the cylinder shield as shown in Fig. HL251 and covers the spark plug. The coil must be removed for access to the spark plug.

The ignition system is serviced by replacing the spark plug, ignition

module, high tension coil or wires with new components. The ignition system can be checked by taping or glueing a neon lamp (#NE-2) to the high tension coil as shown in Fig. HL252. The leads of the lamp are not attached to the system. Pull the recoil starter handle and the lamp should flash with each revolution of the flywheel. It is helpful to compare the lamp flash on a saw with a good ignition system when analyzing the ignition system on a faulty saw. If the lamp flash is dim, irregular, or non-existent, check wires and connections, then renew ignition components by starting with the spark plug until the problem is corrected.

Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place 0.0125 in. (black) shim stock between flywheel and module as shown in Fig. HL253. Apply pressure against flywheel in direction of module to take up bearing play and tighten module screws. Remove shim stock.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline (about 90 octane rating). If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

Saw chain is lubricated by oil from an automatic chain oil pump. Recommended chain saw oil is Homelite® Bar and Chain Oil. Clean automotive oil may also be used if the former is not available. SAE 30 oil should be used in warm temperatures and cut with 20% kerosene in cold temperatures. A light weight oil such as SAE 10 may also be used in cold temperatures.

A sprocket nose bar is used on all models and should be lubricated periodically each working day by removing chain and forcing a good quality grease such as Homelite® ALL-TEMP Multi-Purpose Grease through lube hole in nose of bar. Bar should be warm before applying grease. Force grease into nose of bar until dirty grease is forced out and fresh grease is evident.

Lubricate clutch needle bearing after every 100 hours of operation with Homelite® ALL-TEMP Multi-Purpose Grease.

MUFFLER. Muffler should be disassembled and periodically cleaned. Carbon should be removed from muffler and exhaust port to prevent excessive carbon build-up and power loss. Do not allow loose carbon to enter cylinder.

VIBRATION ISOLATORS. All models are equipped with cushion type vibration isolators (10—Fig. HL255) between powerhead and housing as-

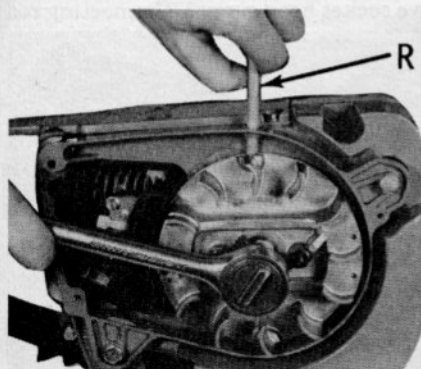
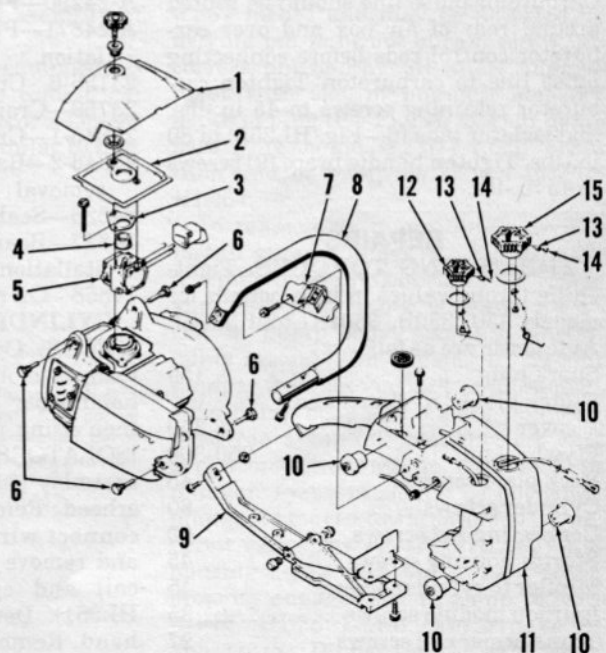


Fig. HL254—Removal of flywheel or clutch is facilitated by preventing flywheel rotation with a $\frac{1}{4}$ inch rod stuck through hole in back plate into notch in flywheel.

Fig. HL255—Exploded view of engine housing assembly.

1. Filter cover
2. Air filter
3. Spring plate
4. Flange bushing
5. Carburetor
6. Isolator pins
7. Handlebar bracket
8. Handlebar
9. Handle brace
10. Vibration isolators
11. Engine housing
12. Oil cap
13. Duckbill valve
14. Bronze filter
15. Fuel cap



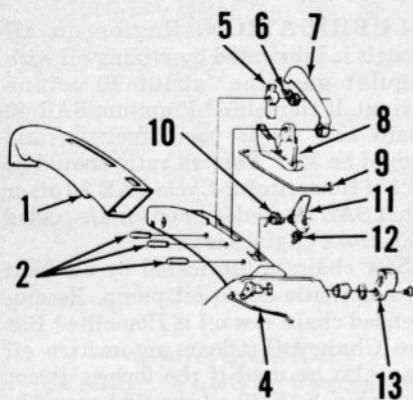


Fig. HL256—Exploded view of trigger assembly.

- | | |
|-----------------------|-------------------|
| 1. Handle grip | 8. Trigger |
| 2. Dowel pin | 9. Throttle rod |
| 4. Choke rod | 10. Spring |
| 5. Trigger lock lever | 11. Trigger latch |
| 6. Spring | 12. Screw |
| 7. Trigger lock | 13. Choke knob |

sembly (11). Isolators may be renewed as follows:

Remove air filter cover, filter, drive case cover and guide bar. Remove handle brace (9—Fig. HL255). Unscrew two screws securing carburetor and disconnect pulse line at rear of carburetor. Lift and angle carburetor and grommet on carburetor adjustment screws to gain access to two screws in floor of air box. Unscrew screws. Remove isolator pins (6) and lift upward on throttle grip and gently slide engine housing (11) free of powerhead until it is possible to remove rear isolators. Disconnect oil line (Fig. HL262) and slide housing further off powerhead for access to front isolators.

Reverse isolator removal procedure to reassemble saw. Apply a thin coat of RTV silicone rubber sealant to both sides of intake gasket (6—Fig. HL257). Carburetor pulse line should be routed around rear of air box and over carburetor control rods before connecting pulse line to carburetor. Tighten carburetor retaining screws to 45 in.-lbs. and isolator pins (6—Fig. HL255) to 80 in.-lbs. Tighten handle brace (9) screws to 45 in.-lbs.

REPAIRS

TIGHTENING TORQUES. Tightening torque values in inch-pounds for models 350, 350B, 350HG and 350SL Automatic are as follows:

Spark plug	150
Clutch plate, "S" clutch and cover	350
Flywheel nut	250-300
Back plate screws	45
Cylinder screws	80
Connecting rod screws	60
Starter housing screws	45
Muffler to cylinder screws	45
Ignition module screws	35
Transformer coil screws	27

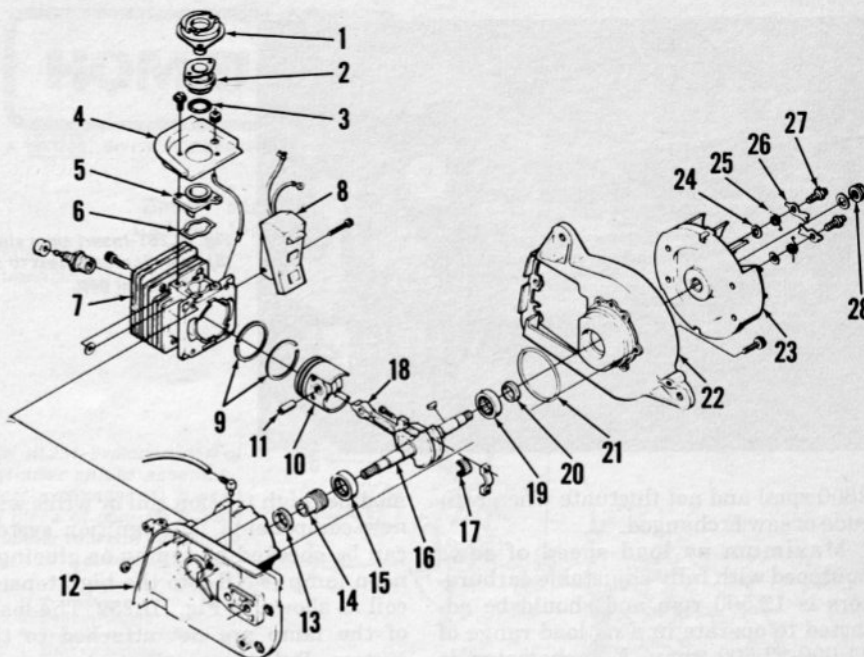


Fig. HL257—Exploded view of engine.

- | | | | |
|----------------------|------------------------|--------------------|------------------|
| 1. Carburetor flange | 8. Ignition module | 15. Roller bearing | 22. Back plate |
| 2. Connector | 9. Piston rings | 16. Crankshaft | 23. Flywheel |
| 3. Garter spring | 10. Piston & bearings | 17. Needle bearing | 24. Lockwasher |
| 4. Air deflector | 11. Piston pin | 18. Connecting rod | 25. Spring |
| 5. Intake manifold | 12. Crankcase | 19. Roller bearing | 26. Starter pawl |
| 6. Gasket | 13. Seal | 20. Seal | 27. Pawl stud |
| 7. Cylinder | 14. Oil pump worm gear | 21. "O" ring | 28. Nut |

Air deflector screws	45
Air box to carb connector screws	45
Carburetor mounting screws	45
Vibrator isolator pins	80
Starter pawl studs	60-70

HOMELITE SERVICE TOOLS.

Listed below are Homelite tool numbers and descriptions for models 350, 350B, 350HG and 350SL Automatic.

Tool No.	Description & Model Usage
A-23696-A	Clutch wrench ("S" clutch)
A-23934	Clutch wrench (3-shoe)
A-24290	Flywheel puller
A-24871	Piston pin removal & installation
23136-6	Crankcase seal removal
23759	Crankcase seal installation
23846-1	Crankcase bearing removal
23846-2	Backplate bearing & seal removal
24826	Seal installation plug
24827	Bearing & seal removal & installation
24868	Oil pump alignment plug

CYLINDER, PISTON, PIN AND RINGS. Cylinder can be removed using the following procedure: Remove handle bar and chain guide bar and then using procedure in VIBRATION ISOLATORS section, remove housing assembly (11—Fig. HL255) from powerhead. Remove starter housing, disconnect wires from ignition module and remove high voltage transformer coil and cylinder shield (2—Fig. HL251). Detach muffler from powerhead. Remove intake manifold. Un-

screw socket head screws retaining cylinder and remove cylinder.

Cylinder has chrome bore which should be inspected for excessive wear or damage. Piston is equipped with two piston rings and is available in standard size only. Piston pin is pressed in rod and rides in two needle roller bearings in piston. Piston and bearings are available only as a unit. Piston must be installed with side of piston indicated by arrow on piston pin boss marked "EXH" towards exhaust port. Refer to Fig. HL258.

CONNECTING ROD. Connecting rod may be removed after removing cylinder as previously outlined. Connecting rod is fractured type secured by two socket head screws. Connecting rod

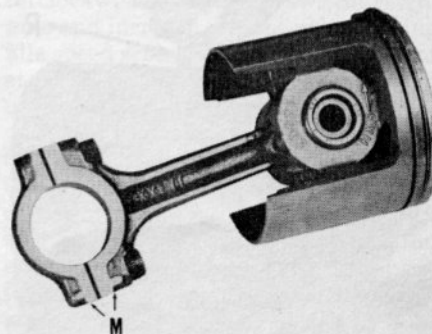


Fig. HL258—Alignment marks (M) on rod must match and arrow adjacent to "EXH" on piston pin boss must point towards exhaust port for proper installation of piston and connecting rod.

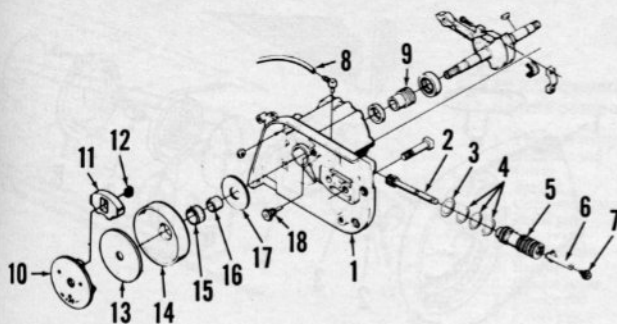


Fig. HL259—Exploded view of clutch and oil pump assemblies.

1. Crankcase
2. Oil pump plunger
3. "O" ring
4. "O" rings
5. Pump body
6. Adjusting lever
7. Sems screw
8. Oil line
9. Oil pump worm gear
10. Clutch shoe
11. Clutch hub
12. Spring
13. Washer
14. Clutch drum
15. Bearing
16. Bearing race
17. Washer
18. Cam screw

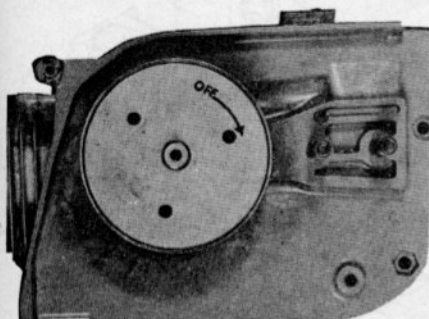


Fig. HL260—Clutch hub is removed by unscrewing clockwise as indicated on hub. Refer to Fig. HL254.

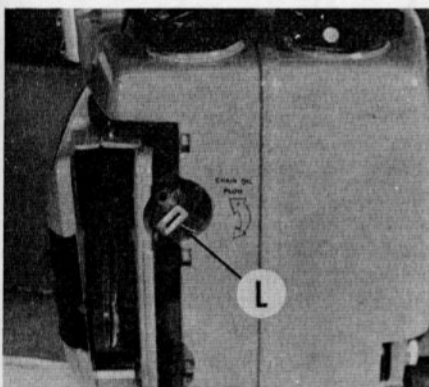


Fig. HL261—Oil pump output is adjusted by turning lever (L) counterclockwise to increase oil flow or clockwise to decrease oil flow.

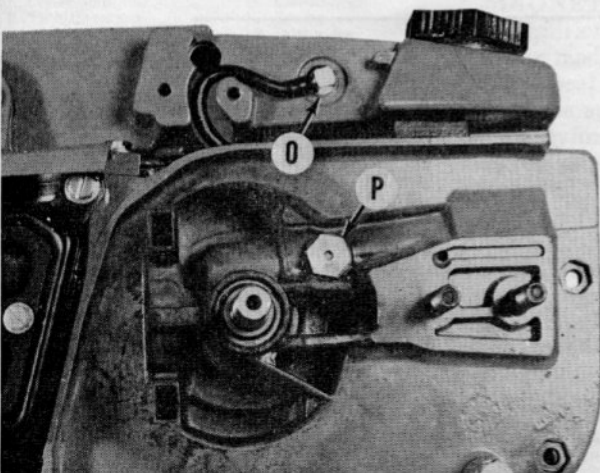


Fig. HL262—Oil line fitting (O) must be pointing towards 8 o'clock position and oil line routed as shown. Cam screw (P) must be installed carefully to insure proper meshing with cam in plunger (2—Fig. HL259).

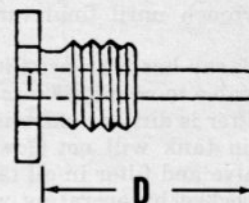


Fig. HL263—Depth (D) of cam screw pin in cam screw must be 0.553-0.557 when measured as shown above. Adjust pin depth by driving pin in or out of cam screw.

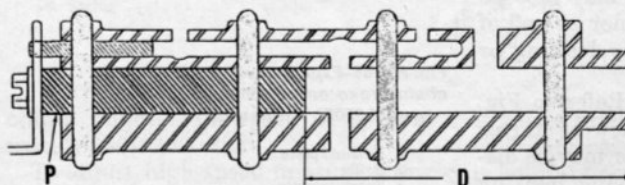


Fig. HL264—Plug (P) in pump bore must be 2.011-2.016 (D) from end of pump bore as shown above.

rides on 25 loose needle bearings around crankpin. Marks (M—Fig. HL258) at big end of rod must be aligned and cap and rod properly mated during reassembly. Needle bearings may be held in place around crankpin with a suitable grease.

CRANKSHAFT, CRANKCASE AND SEALS. To disassemble crankcase, remove clutch as outlined in CLUTCH section and then remove starter housing and flywheel assemblies. Remove connecting rod as previously outlined. Unscrew screw securing back plate (22—Fig. HL257) to crankcase (12). Bearings and seals may be pressed out of back plate and crankcase using Homelite tools previously listed. Inspect crankshaft bearings, seals and "O" rings (21) for damage or excessive wear. Be sure "O" ring is properly seated during assembly of crankcase.

CLUTCH. Models are equipped either with the three shoe centrifugal clutch shown in Fig. HL259 or a 1-piece "S" configuration clutch similar to that

shown in figure HL-153. Clutch may be removed by holding flywheel with a 1/4 inch rod (Fig. HL254) and turning clutch hub clockwise as shown in Fig. HL260.

AUTOMATIC CHAIN OIL PUMP. All models are equipped with the plunger type pump shown in Fig. HL259. The pump is driven by a worm (9) on the engine crankshaft. Oil output is adjusted by turning adjusting lever shown in Fig. HL259. Turning adjusting lever counterclockwise will increase oil output.

To disassemble oil pump, remove side cover, clutch, chain and bar. Unscrew cam screw (P—Fig. HL262) and pull oil pump assembly out of housing. Clean and inspect components. Measure depth of cam screw pin as shown in Fig. HL263. Depth should be 0.553-0.557 inches and may be adjusted by driving pin in or out of cam screw. Incorrect pin depth will affect engagement with slot in plunger. Measure depth of plug (P—Fig. HL264) in pump bore. Plug should be 2.011-2.016 inches from end of pump as shown in Fig. HL264.

To reassemble pump, lubricate and install pump plunger (2—Fig. HL259) in pump body (5). Lubricate "O" rings and align cam groove in plunger with slot in pump body. Carefully install pump assembly in housing to prevent plunger from moving out of alignment with pump body slot. Check pump by inserting a suitable tool through cam screw hole to engage cam slot in plunger. Pressure should be felt when plunger is moved towards end of pump. Screw cam screw (P—Fig. HL262) into housing being sure pin in cam screw properly engages slot in pump body (5—Fig. HL259) and cam groove in plunger (2). Do not tighten cam screw

with a wrench until final turns are reached.

Oil tank cap has a bronze filter and one-way valve to admit air into the oil tank. If filter is dirty or valve is defective, oil in tank will not flow to oil pump. Valve and filter in oil tank cap can be checked by operating with oil tank cap tight and then loose. If oil output is increased when cap is loose, filter and valve should be inspected.

Oil output fitting on oil tank should point in an 8 o'clock direction as shown in Fig. HL262 to properly route oil tube. Reduced oil output may also be due to a clogged oil strainer at end of oil tube in oil tank or by leaking or blocked oil lines.

RECOIL STARTER. Refer to Fig. HL265 for an exploded view of starter used on all models. Starter may be disassembled without removing housing (1) except to remove and install bushing (2).

To disassemble starter, unscrew cover (8) screws and allow cover to rotate until tension in rewind spring is relieved. Remove cover with spring (6), shield (5), and post (7). Untie knot in end of rope, remove rope handle and remove rope pulley (4) and rope. Inspect bushing (2) and remove housing (1) if it is necessary to remove bushing. Bushing is a press fit in housing.

If old bushing is to be retained, lubricate bushing with oil. Note direction spring (6) is wound in Fig. HL265. A new spring should be lightly lubricated on its edges with Homelite ALL-TEMP Multi-Purpose Grease or a suitable lithium base grease before installing spring in cover. Do not over-lubricate. Place spring post (7) in center of spring and snap shield (5) into cover (8). Install rope end through pulley and housing and install rope handle. Turn pulley clockwise until rope is wound on pulley. Install spring and cover assembly on housing but do not install

Fig. HL265—Exploded view of recoil starter.

1. Starter housing
2. Bushing
3. Washer
4. Rope pulley
5. Washer
6. Rewind spring
7. Spring post
8. Cover

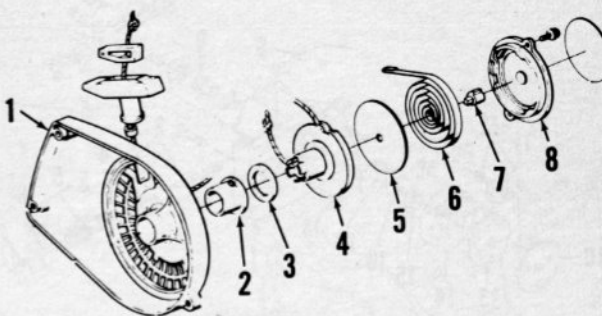
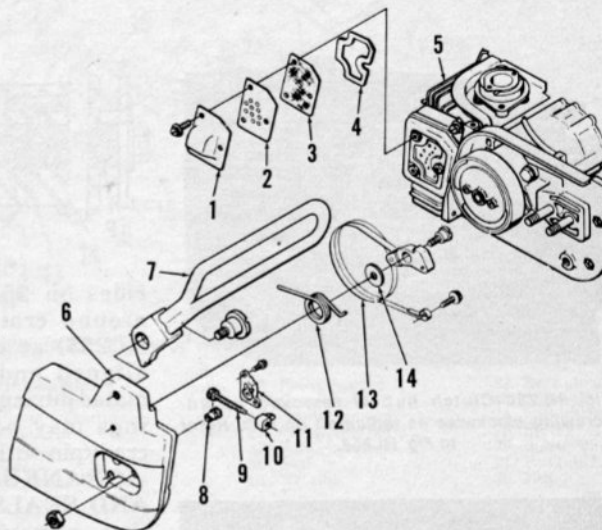


Fig. HL266—Exploded view of chain brake and muffler on model 350SL Automatic.

1. Exhaust plate
2. Baffle
3. Spark arrestor
4. Gasket
5. Powerhead
6. Drive cover
7. Brake lever
8. Guide bar adjuster
9. Chain tension adjusting screw
10. Pin
11. Gear cover
12. Spring
13. Chain brake band
14. Washer



cover screws. Be sure spring post (7) engages hole in pulley (4). To place tension on rewind spring, turn cover (8) clockwise until rope handle is held against housing (1). Do not turn cover excessively or spring may break when rope is pulled to its full length. Install cover screws and check starter operation.

CHAIN BRAKE. Model 350SL Automatic is equipped with a chain brake mechanism to stop saw chain motion in the event of kickback. In the event of kickback, the operator's left

hand will force brake lever (7—Fig. HL266) forward and brake band (13) will wrap around the clutch drum to stop clutch drum rotation. Chain brake effectiveness may be checked by running chain saw with chain turning but not cutting. Push chain brake lever forward. Chain brake should stop chain instantly. If chain brake does not operate correctly, outer surface of clutch drum may be glazed. Remove glaze with emery cloth being sure to clean drum afterwards. Clutch drum and brake band must not be bent or nicked.



Model	Bore	Stroke	Displ.	Drive Type
650	2.125 in. 54 mm	1.720 in. 43.7 mm	6.1 cu.in. 100 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion UCJ-4G gold palladium. A Champion CJ-4 spark plug is recommended if UCJ-4G plug is not available. Spark plug electrode gap should be 0.025 inch.

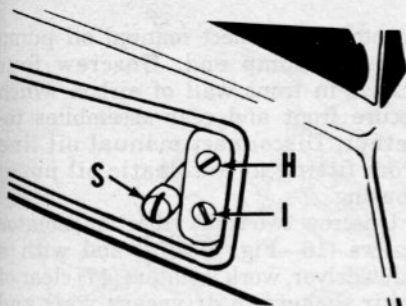


Fig. HL270—View showing location of carburetor high speed mixture screw (H), idle mixture screw (I) and idle speed screw (S).

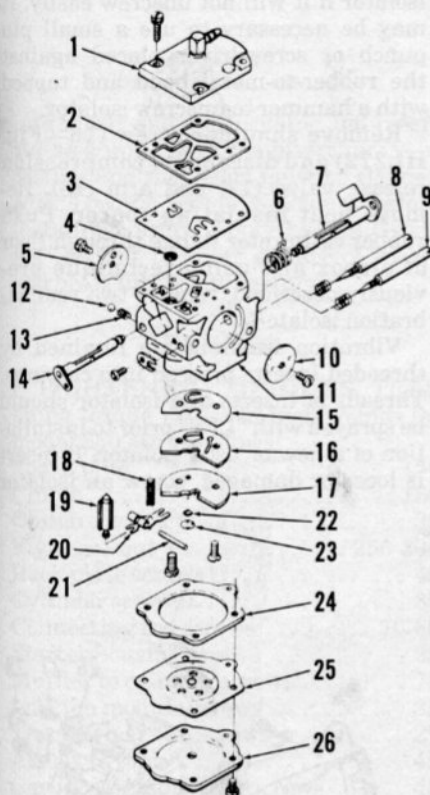


Fig. HL271—Exploded view of Walbro WB-2 carburetor used on model 650.

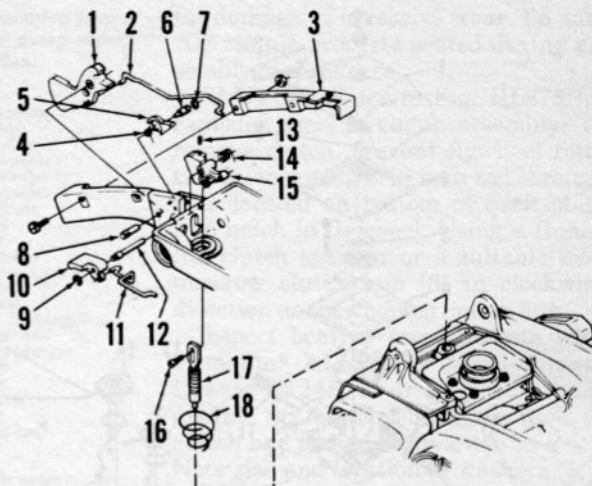
- | | |
|-----------------------------|-------------------------|
| 1. Fuel pump cover | 14. Choke shaft |
| 2. Gasket | 15. Circuit check valve |
| 3. Pump diaphragm | 16. Circuit gasket |
| 4. Inlet screen | 17. Circuit plate |
| 5. Choke plate | 18. Spring |
| 6. Throttle return | 19. Inlet valve |
| 7. Throttle shaft | 20. Diaphragm lever |
| 8. High speed mixture screw | 21. Pin |
| 9. Idle mixture screw | 22. Check valve screen |
| 10. Throttle plate | 23. Retaining ring |
| 11. Body | 24. Gasket |
| 12. Choke detent ball | 25. Metering diaphragm |
| 13. Spring | 26. Cover |

CARBURETOR. Model 650 is equipped with a Walbro WB-2 diaphragm carburetor.

Initial adjustment of idle and high speed mixture screws is one turn open. Adjust idle speed screw so that engine idles at approximately 2400-2600 rpm. Adjust idle mixture screw to obtain maximum engine speed at idle. If necessary, readjust idle speed screw to

Fig. HL272—Exploded view of handle components.

1. Throttle trigger
2. Throttle rod
3. Cover
4. Spring
5. Compression release cam
6. Pivot pin
7. Snap ring
8. Trigger pin
9. Spring
10. Choke lever
11. Choke rod
12. Pivot pin
13. Set screw
14. Spring
15. Compression release arm
16. Shoulder screw
17. Compression release valve
18. Spring



obtain engine idle speed of approximately 2400-2600 rpm.

To adjust high speed mixture screw, proceed as follows: Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle clockwise until engine will not accelerate cleanly when throttle is opened. Turn high speed mixture needle counterclockwise approximately $\frac{1}{8}$ - $\frac{1}{4}$ turn. Check performance of saw. Engine should accelerate without hesitation and should not exceed 12,000 rpm at full throttle under no load. When high speed no load rpm has been adjusted within the correct range, maximum power should occur at desired cutting speed.

Model 650 is equipped with a trigger latch mechanism coupled to a compression release valve to aid engine starting. Starting speed is adjusted by turning slotted head adjustment screw (13—Fig. HL272) at top and front of saw handle. Turning screw clockwise raises starting speed while turning screw counterclockwise lowers starting speed. Adjust starting speed by latching trigger in start position, start engine and turn screw until desired engine speed is obtained. Stop engine and restart to check starting speed.

MAGNETO AND TIMING. A solid state ignition is used on model 650. The ignition module is mounted adjacent to the flywheel while the high tension coil covers the spark plug and is mounted on the cylinder shield. The high tension coil must be removed for access to spark plug.

The ignition system is serviced by replacing the spark plug, ignition module, high tension coil or wires with new components. The ignition system can be checked by taping or gluing a neon lamp (#NE-2) to the high tension coil similar to method shown in Fig. HL 252 in model 350 section. The leads of the lamp are not attached to the system. When the recoil starter handle

is pulled briskly, the lamp should flash with each revolution of the flywheel. It is helpful to compare the lamp flash on a saw with a good ignition system when analyzing the ignition system on a faulty saw. If the lamp flash is dim, irregular or non-existent, check wires and connections, then renew ignition components by starting with the spark plug until the problem is corrected.

High tension coil and leads may be checked by disconnecting wires at ignition module which lead from ignition module to coil receptacle and connecting an ohmmeter to end of wires. There should be continuity between wire ends. If continuity does not exist, disassemble rear of saw until access is possible to two coil receptacle leads and disconnect leads. Check continuity of each wire and terminal.

To check ignition switch and lead, connect one probe of ohmmeter to switch terminal and ground other probe to ignition module core. Check continuity of ignition switch and lead with switch in "RUN" and "STOP" positions. If continuity exists when switch is in "RUN" position, switch or lead is shorted and must be replaced. Continuity should exist with switch in "STOP" position. If continuity is not present in "STOP" position, check connection of switch lead and replace lead and switch if necessary.

Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place 0.015 inch (pink) shim stock between flywheel and module. Load crankshaft bearings during adjustment by applying pressure to flywheel in direction of ignition module.

LUBRICATION. Model 650 engine is lubricated by mixing oil with regular gasoline (about 90 octane rating). If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE

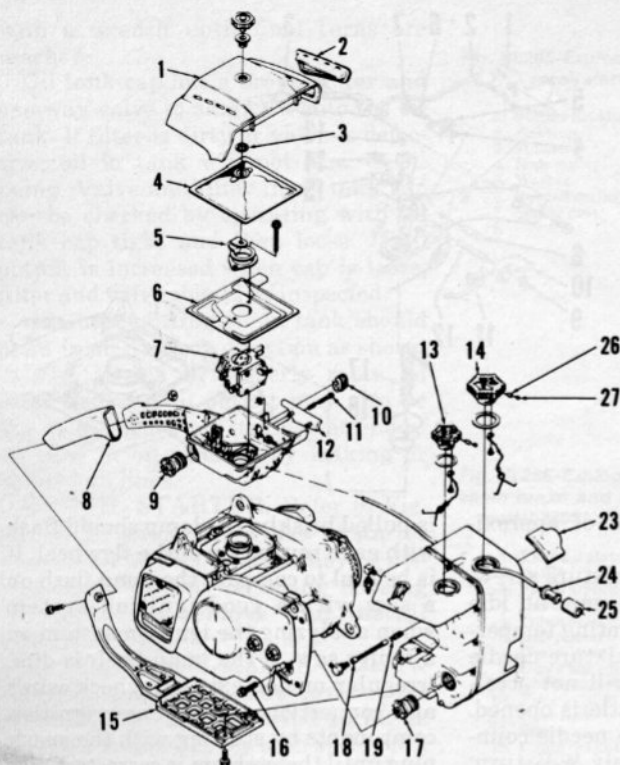


Fig. HL273—View of induction, fuel and oil assemblies.

1. Air filter cover
2. Air intake
3. Spring nut
4. Air filter
5. Air intake tube
6. Airbox shield
7. Carburetor
8. Handle grip
9. Rear vibration isolator
10. Grommet
11. Idle speed screw
12. Air deflector
13. Oil tank cap
14. Fuel tank cap
15. Handle brace
16. Vibration isolator screw
17. Front Vibration isolator
18. Oil Line
19. Oil pickup
23. Fuel tank bumper
24. Fuel pickup
25. Fuel filter
26. Check valve
27. Filter

30 oil designed for air-cooled two stroke engines is used.

Saw chain is lubricated by oil from an automatic or manual chain oil pump. Recommended saw chain oil is Homelite® Bar and Chain Oil. Clean automotive oil may also be used if the former is not available. SAE 30 oil should be used in warm temperatures above 40° F. and cut with 20% kerosene in cold temperatures. A light weight oil such as SAE 10 or SAE 5 may also be used in cold temperatures.

Automatic chain oil pump is designed to leave approximately 3 ounces of oil in oil tank when one tankful of fuel is consumed after oil and fuel tanks had been full.

A sprocket nose bar is used on model 650 and should be lubricated periodically by removing chain and forcing a good quality grease such as Homelite® ALL-TEMP Multi-Purpose Grease through lube hole in nose of bar. Bar should be warm before applying grease. Force grease into nose of bar until dirty grease is forced out and fresh grease is evident.

VIBRATION ISOLATORS. Model 650 is equipped with vibration isolators between engine and engine housing. Use the following procedure to remove vibration isolators:

Remove drive case cover, chain and bar, and bumper spikes. Remove throttle handle brace (15—Fig. HL273) and handlebar. Remove air filter cover and filter and disconnect choke rod from choke lever. Unscrew carburetor

mounting screws and remove air intake tube (5). Lift metal shield (6) off airbox and pull carburetor free of adjustment needle grommet. Disconnect pulse line and fuel line from car-

buretor. Disconnect manual oil pump lines at pump end. Unscrew four screws in front wall of airbox which secure front and rear assemblies together. Disconnect manual oil line from fitting at automatic oil pump housing.

Unscrew two front vibration isolator screws (16—Fig. HL273) and with a screwdriver, work isolators (17) clear of their sockets in drivecase wall and back plate. Remove fuel and oil tanks and disconnect oil line from oil tank. Unscrew vibration isolators (17) from tank. Note: Do not continue twisting isolator if it will not unscrew easily. It may be necessary to use a small pin punch or screwdriver placed against the rubber-to-metal bond and tapped with a hammer to unscrew isolator.

Remove shoulder screw (16—Fig. HL272) and disconnect compression release valve (17) and arm (15). Remove heat insulating spacer. Push rubber carburetor flange through floor of airbox and using technique previously described, remove two rear vibration isolators.

Vibration isolators are retained by threaded inserts pressed into castings. Threads of inserts and isolator should be sprayed with "LPS" prior to installation of a new or used isolator. If insert is loose or damaged, screw an isolator

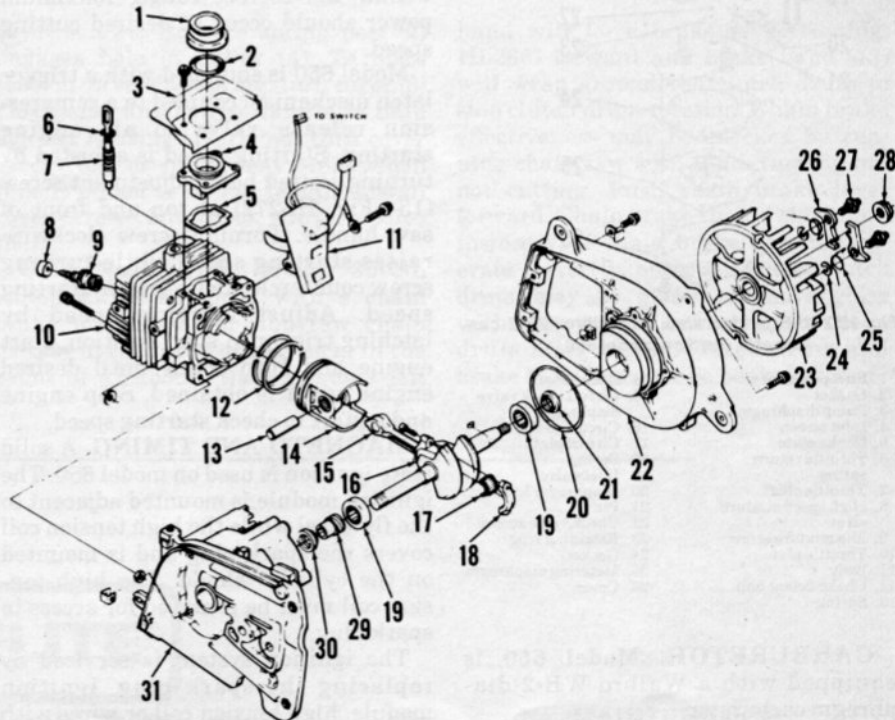


Fig. HL274—Exploded view of model 650 engine.

- | | | | |
|-----------------------------|---------------------|------------------------|-------------------|
| 1. Rubber carb. flange | 8. Grommet | 16. Crankshaft | 24. Lockwasher |
| 2. Garter spring | 9. Spark plug | 17. Split cage bearing | 25. Spring |
| 3. Air deflector | 10. Cylinder | 18. Rod cap | 26. Starter pawl |
| 4. Intake manifold | 11. Ignition module | 19. Roller bearing | 27. Pawl stud |
| 5. Gasket | 12. Piston rings | 20. "O" ring | 28. Nut |
| 6. Snap ring | 13. Piston pin | 21. Seal | 29. Oil pump worm |
| 7. Compression relief valve | 14. Piston | 22. Back plate | 30. Seal |
| | 15. Connecting rod | 23. Flywheel | 31. Crankcase |

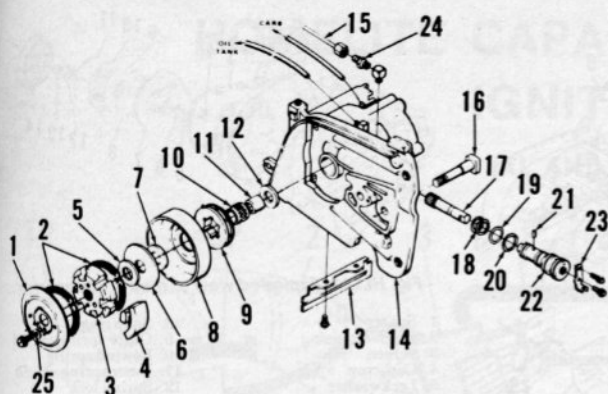


Fig. HL275—Exploded view of clutch and oil pump assemblies.

1. Cover
2. Clutch spring
3. Clutch hub
4. Clutch shoe
5. Thrust washer (1")
6. Thrust washer (2")
7. Thrust washer (1-1/4")
8. Clutch drum
9. Sprocket
10. Bearing
11. Bearing race
12. Thrust washer (1-1/4")
13. Heat shield
14. Crankcase
15. Manual discharge line
16. Guide bar stud
17. Oil pump plunger
18. "O" rings
19. "O" ring
20. "O" ring
21. Cam pin
22. Oil pump body
23. Bracket
24. Fitting
25. Belleville washer

into insert and pull isolator and insert out as a unit. Both the insert recess in casting and the insert must be cleaned with Locquic Grade N Primer before installing insert. Apply Loctite Grade AA Sealant to outer surface of insert and press insert into casting.

REPAIRS

TIGHTENING TORQUES. Tightening torque values in inch-pounds for model 650 are as follows:

Spark plug	150
Clutch	180
Clutch cover screws	35
Flywheel nut	250-300
Back plate screws	45
Cylinder screws	80
Connecting rod screws	70-80
Starter housing screws	35
Muffler to cylinder screws	70
Ignition module screws	35
Transformer coil screws	27
Airbox to tank	45
Carburetor mounting screws	45
Vibration isolator screws	45
Starter pawl studs	80-90

HOMELITE SERVICE TOOLS.

Listed below are Homelite tool numbers and descriptions for model 650.

Tool No.	Description & Model Usage
A-23696-A	Clutch wrench
A-24851	Flywheel puller
A-24871	Piston pin tool
A-24876	Collar & plunger
A-24884	Compression valve seat reamer
22126	Hex socket key
22486	Feeler gauge (0.015 in. pink plastic)
22828	Retaining ring pliers
23136-6	Crankcase seal removal sleeve
23759	Crankcase & backplate seal assembly sleeve
23846-1	Crankcase bearing removal anvil

23846-2—Crankcase & backplate bearing removal anvil

24826-A—Seal installation plug

24827-A—Bearing & seal installation & removal plug

CYLINDER, PISTON, PIN AND RINGS. Cylinder has chrome bore which should be inspected for wear or damage. Piston and rings are available in standard sizes only. Piston pin is pressed in rod and rides in two needle roller bearings in piston. Piston and bearings are available as a unit assembly only.

Note that one piston pin boss is marked with an arrow and "EXH". Install piston with side indicated by arrow towards exhaust port.

CONNECTING ROD. Connecting rod is fractured type secured by two socket head screws. Connecting rod rides on a split caged needle bearing at big end. Marks at big end of rod must be aligned and cap and rod properly mated during assembly. Needle bearings may be held around crankpin with a suitable grease to aid in assembly.

CRANKSHAFT, CRANKCASE AND SEALS. Crankshaft is supported by roller bearings (19—Fig. HL274) in crankcase (31) and back plate (22). Bearings and seals may be pressed out of crankcase and backplate using Homelite tools previously listed. Inspect bearings, seals and "O" ring (20)

for damage or excessive wear. Be sure "O" ring is properly seated during assembly of crankcase.

CLUTCH. Refer to Fig. HL275 for exploded view of clutch assembly. To remove clutch, prevent flywheel rotation by inserting 3/16 inch rod through hole located on bottom of back plate into notch in flywheel. Using a Homelite clutch spanner or a suitable tool, unscrew clutch hub (3) in clockwise direction as shown by arrow on hub.

Inspect bearing and lubricate with Homelite® ALL-TEMP Multi-Purpose Grease (#24551) or a lithium base grease. Six clutch shoes are used in clutch and should be renewed as a set. Note size and location of washers (5, 6 and 7).

AUTOMATIC CHAIN OIL PUMP. Model 650 is equipped with an automatic oil pump driven by worm (29—Fig. HL274) on crankshaft. Oil is pumped by plunger (17—Fig. HL276) as it reciprocates due to cam pin (21) located in cam groove (G). Oil enters pump through port (A) and passes around pump body (22) to enter plunger bore through port (B). Oil exits through ports (C, D and E) to saw chain. Oil may be pumped through port (F) and fitting (24) to manual oil pump. Oil is also routed through ports (H and J) to cam groove to reduce back pressure on oil plunger.

To disassemble automatic oil pump, unscrew oil pump bracket screw and gently withdraw oil pump body (22—Fig. HL275). Do not lose cam pin (21) which is loose in pump body. Remove pin (21) and slide pump plunger out of pump body. Inspect pump plunger, body and "O" rings for excessive wear or damage. An excessively loose fit between pump plunger and pump body will cause low pump output. Oil "O" rings before installation in grooves of pump body. "O" rings must be straight in grooves and not twisted. Oil "O" rings before inserting pump body and plunger assembly into pump housing.

If oil pump operates correctly but oil output is insufficient, disconnect and clean oil lines and fittings (Fig. HL275). Install outlet elbow in oil tank

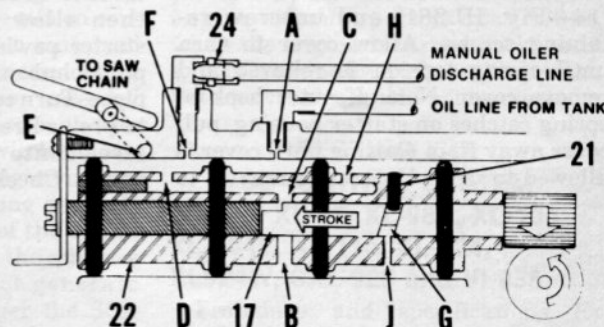


Fig. HL276—Cross-section of oil pump. Refer to text for operation.

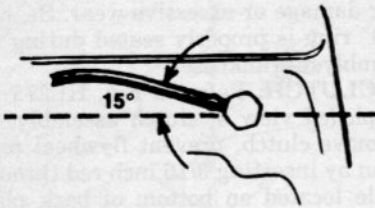


Fig. HL278—Oil line and fitting in oil tank must be angled 15° as shown above.

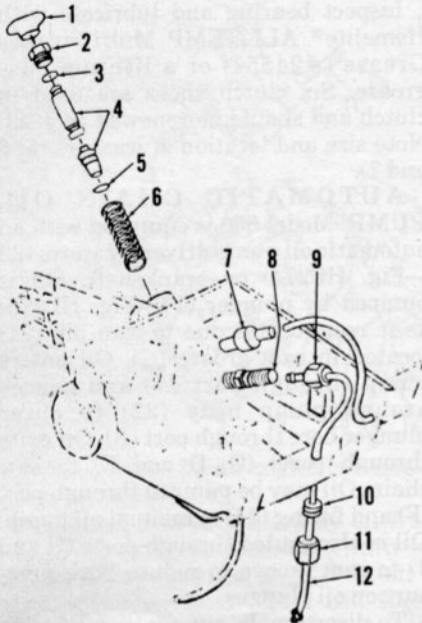


Fig. HL279—Exploded view of manual oil pump used on model 650. End of oil line (12) is connected to fitting (24—Fig. HL276). Oil line (12) must be disconnected from fitting and pulled into air box for removal.

- | | |
|------------------|---------------------|
| 1. Button | 7. Check valve |
| 2. Plunger nut | 8. Check valve |
| 3. "O" ring | 9. Compression nut |
| 4. Plunger assy. | 10. Grommet |
| 5. "O" ring | 11. Compression nut |
| 6. Spring | |

wall to provide an angle of 15° as shown in Fig. HL278. Elbow threads should be coated with thread sealant.

RECOIL STARTER. Refer to Fig. HL281 for an exploded view of starter assembly. Starter pawl components attached to flywheel are shown in Fig. HL274.

To disassemble starter, hold cover (14—Fig. HL281) and unscrew retaining screws. Allow cover to turn until spring tension is relieved and remove cover. Note: If outer hook of spring catches on starter housing, pull cover away from housing until cover is allowed to turn. Unscrew screw (4) to

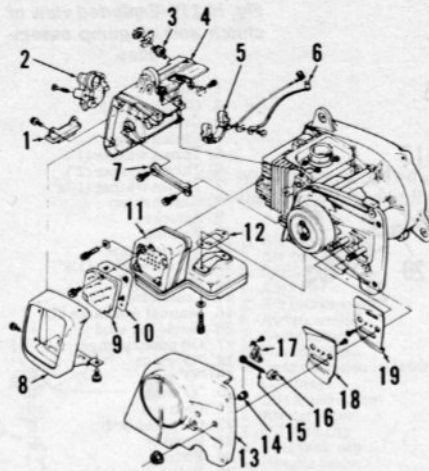


Fig. HL280—Exploded view of exhaust and chain tensioning assemblies.

- | | |
|----------------------|----------------------------------|
| 1. Rear snubber | 12. Gasket |
| 2. High tension coil | 13. Cover |
| 3. Ignition switch | 14. Guide bar adjuster gear |
| 4. Cylinder shield | 15. Chain tension adjuster screw |
| 5. Coil receptacle | 16. Pin |
| 6. Ground lead | 17. Gear cover |
| 7. Brace | 18. Outer guide bar plate |
| 8. Muffler shield | 19. Inner guide bar plate |
| 9. Muffler cap | |
| 10. Spark arrestor | |
| 11. Muffler | |

separate rope pulley (7) from cover. Remove snap ring (8) for access to rewind spring. If starter pawl assemblies must be removed, unscrew housing screws and remove starter housing (2). Threaded inserts are available if stud holes are damaged in flywheel.

Clean and inspect components. Lubricate sides of rewind spring with a small amount of Homelite® ALL-TEMP Multi-Purpose grease or a lithium base grease. Do not oil spring. Install inner spring shield (11), rewind spring (10) and spring lock (12) in cover with spring wound as shown in Fig. HL282. Install outer spring shield (9—Fig. HL281) and snap ring (8). Insert bushings (6 and 13) in rope pulley (7) being sure knobs on bushings align with notches in pulley. Slide pulley onto post in cover and check to be sure splines on pulley engage splines in spring lock. Install and tighten cap-screw (4) to 45 in.-lbs. Wind rope around pulley in clockwise direction as viewed from screw end of pulley. Set cover in housing. Pull rope handle and then allow rope to rewind so that starter pawls will be forced open and pulley hub can slide between them into place. Turn cover clockwise 2 or 3 turns to preload rewind spring, snap plastic screen into place and install cover screws. Check starter operation.

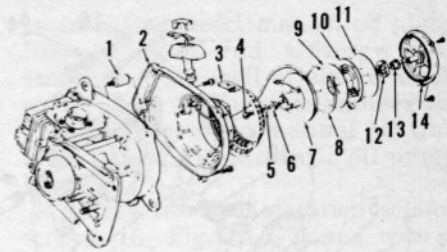


Fig. HL281—Exploded view of model 650 starter.

- | | |
|--------------------|-------------------------|
| 1. Spacer | 8. Snap ring |
| 2. Starter housing | 9. Outer spring shield |
| 3. Screen | 10. Rewind spring |
| 4. Capscrew | 11. Inner spring shield |
| 5. Lockwasher | 12. Spring lock |
| 6. Bushing | 13. Bushing |
| 7. Rope pulley | 14. Cover |

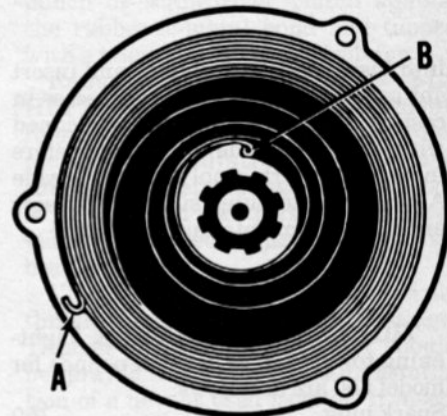


Fig. HL282—View of rewind spring installation in starter cover. Hook outer loop (A) of spring in notch as shown. Inner loop (B) of spring must be curved inward to engage notch of spring lock.

COMPRESSION RELEASE.

Model 650 is equipped with a compression release to aid starting. A leaking compression release valve may be repaired by cleaning valve seat with Homelite Tool No. A-24884. This tool is designed to remove carbon without removing metal from valve seat. Piston must be at TDC and engine positioned with valve side down to prevent debris from entering cylinder.

Inspect valve stem for wear which may not allow valve to seat properly and renew valve if valve stem is excessively worn. Examine pin connecting valve link to stem and renew assembly if pin is worn or loose.

Install compression release valve with sharp side of snap ring (6—Fig. HL274) out. Push compression release valve and snap ring down into valve bore making sure snap ring fully engages snap ring groove.

HOMELITE CAPACITOR DISCHARGE (CD) IGNITION SYSTEM

(XL AND VI SERIES MODELS)

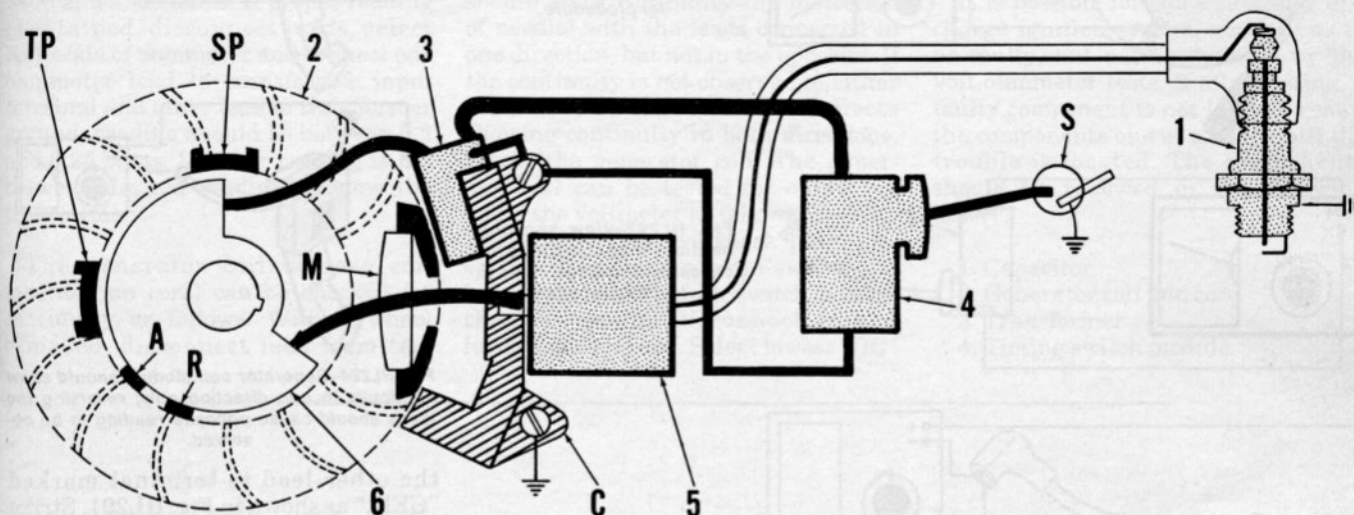


Fig. HL290—Schematic diagram of XL-104 CD ignition system. Electrical energy created by magnet (M) in flywheel (2) passing generator coil (3) and core (C) is stored in the capacitor (4) until SCR switch in timing module (6) is turned on by timing pole piece (TP) passing magnetic triggering device (A or R) in module. The capacitor will then discharge the stored electrical energy into the transformer (5) which builds up the voltage to fire the spark plug (1). SCR switch is actuated by retard magnetic triggering device (R) at cranking speeds and by advance triggering device (A) when engine is running. Safety pole piece (SP) will cause spark plug to be fired on exhaust stroke if engine is turned backwards. "ON-OFF" switch (S) is used to stop engine by grounding the capacitor.

OPERATING PRINCIPLES

The Homelite capacitor discharge ignition system used in several XL series and VI995 chain saw models and in the Multi-Purpose Saw models XL98 and XL98A generates alternating current which is rectified into direct current, the current is stored as electrical energy in a capacitor (condenser) and is discharged on timing signal into the transformer (coil) that steps up the voltage to fire the spark plug. Instead of using breaker points as in a conventional magneto, ignition timing is done by magnetically triggered solid state switch components. Refer to Fig. HL290 for schematic diagram of capacitor discharge ignition system. Ignition system components are as follows:

1. SPARK PLUG—A conventional Champion spark plug with a 0.025 inch firing gap.

2. FLYWHEEL (ROTOR)—The CD flywheel is slightly different from breaker ignition flywheels in that it has two pole pieces to trigger the solid state components. One pole piece triggers the switch for normal starting and operating ignition timing and the second pole piece is a safety device to prevent the engine from running backwards. The flywheel magnet passes the generator coil and core to generate electrical current.

3. GENERATOR—The generator is an alternator type similar to that used in a battery charging circuit. The generator coil module is a permanently sealed unit mounted on a core. The module generates electrical current to charge the capacitor.

4. CAPACITOR—The capacitor stores electrical energy which is discharged into the transformer on signal from the switch module.

5. TRANSFORMER—The transformer increases the voltage discharged from the capacitor to a voltage high enough to fire the spark plug. The transformer is mounted on the generator core and can be renewed separately.

6. TIMING SWITCH MODULE—The timing switch module, which is mounted on the backplate under the flywheel, consists of two magnetic devices which will trigger the silicon controlled rectifier (SCR) switch contained in the module. One magnetic device will trigger the switch for retarded timing at cranking speed and the second will trigger the switch for advanced timing when the engine is running. The advance triggering device is located 16 degrees ahead of the retard device. At cranking speed, the advance triggering device will not generate enough electricity to trigger the SCR switch, but the retard device is

stronger and will trigger the SCR switch at cranking speed, thus allowing the electrical energy stored in the capacitor to be discharged into the transformer and fire the spark plug. When the engine is running, the increased speed at which the pole piece in the flywheel passes the advanced triggering device generates enough electrical energy to trigger the SCR switch, thus the capacitor is discharged into the transformer 16 degrees sooner than at cranking speed. When the pole piece passes the retard device, a triggering current is also created, but the capacitor has already been discharged and no ignition spark will occur. Should the engine be turned backwards far enough to charge the capacitor, a second "safety" pole piece in the flywheel will trigger the SCR switch and the spark plug will be fired when the engine exhaust port is open. Thus, when the engine is turned backwards, a "poof" may be heard from the exhaust but a power stroke will not be created.

TESTING THE CD IGNITION SYSTEM

Models XL-98, XL-98A, XL-104, XL-104E, XL-114, XL-924, XL924W, SXL-925 and VI-955

Procedure and specifications for checking the capacitor discharge igni-

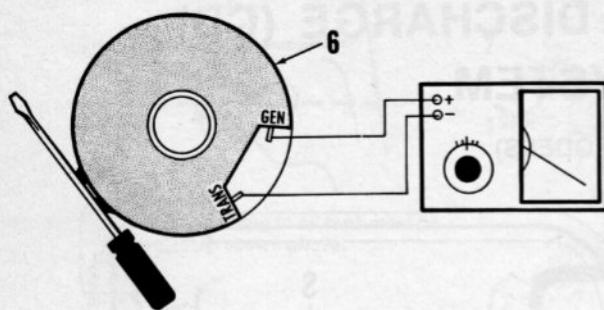


Fig. HL291—Checking the timing switch module using an ohmmeter; refer to text for procedure.

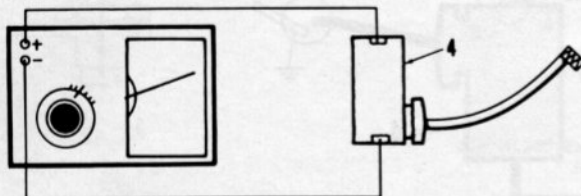


Fig. HL292—View showing ohmmeter connections for checking capacitor; refer to text for procedure.

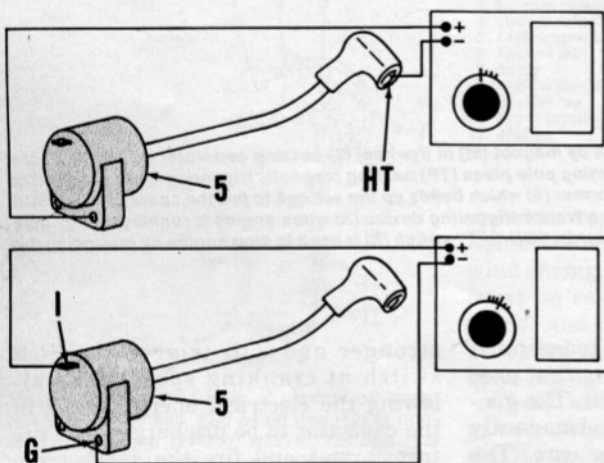


Fig. HL293—High tension coil of transformer should have between 2400 and 2900 ohms resistance; make ohmmeter connections as shown in top view. Resistance of input coil should be between 0.2 and 0.25 ohms with leads connected as shown in bottom view.

tion system with a Graham or Merc-O-Tronic tester were not available at time of publication, but a number of tests to indicate condition of the ignition system components can be made using a volt-ohmmeter, preferably a Triplett or Monarch. To make the volt-ohmmeter tests, refer to Figs. HL291 through HL295 and proceed as follows:

Turn the ignition switch to "ON" position, disconnect lead terminal from spark plug and insert a screw into the terminal. Hold terminal insulating boot to position the screw head 1/4-inch from engine ground and observe for spark while pulling the starter rope. If a spark is observed, the magneto can be considered OK; if no spark is observed, proceed as follows:

CAUTION: Discharge capacitor by switching ignition to "OFF" position or by touching the switch lead to ground if disconnected from switch.

Remove fan housing and flywheel and thoroughly inspect to see that all wires are properly connected and that there are no broken or loose connections. If all wires are secure and in

place, make the following tests: Note: Except where rotor is required to be in place during the generator coil test, components may be tested on or off the unit.

Select Rx1 scale of ohmmeter and connect one lead of ohmmeter to timing switch module marked "TRANS." and

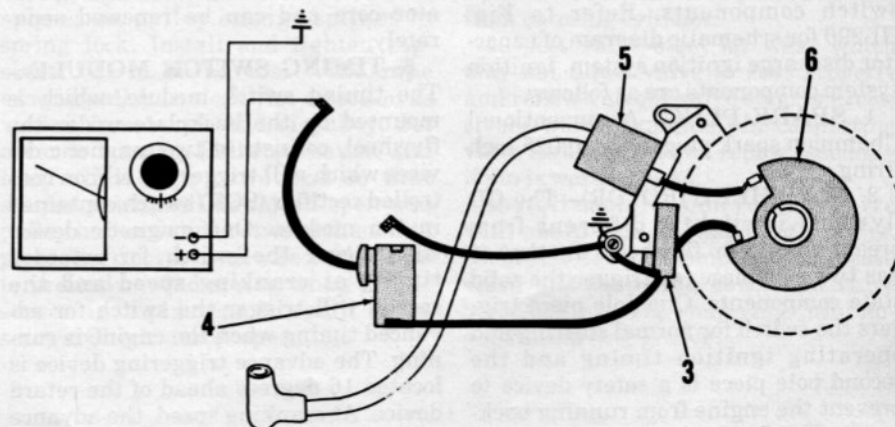


Fig. HL295—Testing output of generator with voltmeter; refer to text for procedure; minimum output should be 4 volts.

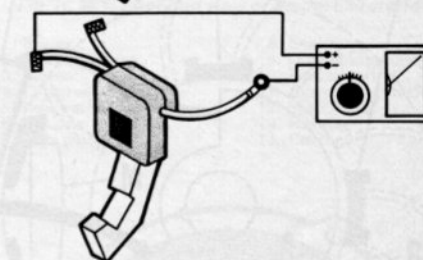
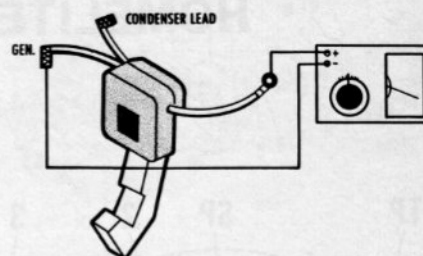


Fig. HL294—Generator coil module should show continuity in one direction only; reversing the leads should cause opposite reading to be observed.

the other lead to terminal marked "GEN." as shown in Fig. HL291. Strike the pole pieces with a screwdriver as shown; the ohmmeter needle should show a deflection and remain deflected until the leads are disconnected. If no deflection is noted, reverse the leads and again strike pole pieces with screwdriver. If no needle deflection is noted with ohmmeter leads connected in either manner, renew the switch module.

To check capacitor, select Rx1000 scale of ohmmeter and disconnect ignition switch lead or turn switch to "ON" position. Connect negative (black) lead of ohmmeter to capacitor terminal used for generator coil lead connection and the positive (red) lead to capacitor ground lead terminal. An instant deflection of needle should occur; if not, reverse ohmmeter leads. If no deflection of ohmmeter needle occurs with leads connected in either direction, renew the capacitor.

Again using Rx1000 scale of ohmmeter, test transformer by connecting either lead of ohmmeter to transformer high voltage lead and other ohmmeter lead to transformer ground; the resulting reading should be between 2400 and 2900 ohms. If proper reading is obtained, disconnect leads, select Rx1 scale of ohmmeter and connect one ohmmeter lead to transformer input terminal and other lead to transformer ground; reading should be between 0.2 and 0.25 ohms. If either reading is not between desired readings, renew the transformer.

The generator coil (square coil mounted on core) can be checked for continuity as follows: With flywheel removed, disconnect lead from ter-

minal marked "GEN." on switch module. Select Rx1 scale of ohmmeter and connect one lead of ohmmeter to ground and other lead to the lead disconnected from switch module; then, reverse the leads. The ohmmeter should show continuity (by deflection of needle) with the leads connected in one direction, but not in the opposite. If the continuity is not observed in either direction, or if the needle deflects showing continuity in both directions, renew the generator coil. The generator coil can be tested for output by using the voltmeter as follows: Refer to Fig. HL295. Remove spark plug, disconnect lead from ignition switch and bring lead out through switch hole in throttle handle. Disconnect ground lead from capacitor. Select lowest "DC"

scale on voltmeter. Connect positive (red) lead of voltmeter to switch wire and the negative (black) lead to engine ground. Spin engine by pulling firmly on starter rope. A minimum of 4 volts should be observed on voltmeter.

It is possible for some capacitor discharge ignition system components to be faulty, but not be detected by the volt-ohmmeter tests. If after testing, a faulty component is not located, renew the components one at a time until the trouble is located. The components should be renewed in the following order:

1. Capacitor
2. Generator coil and core
3. Transformer
4. Timing switch module.

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N.Y. 10573

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion J6J for use on engine powering generator or centrifugal pump; a Champion UJ12 is recommended for use on diaphragm type pump engine. A Champion HO-8A (platinum tip) or UJ-11-G (gold palladium tip) spark plug may be substituted. Electrode gap is 0.025.

CARBURETOR. A Tillotson HS-45A carburetor is used on earlier engines while later models use a Tillotson model HS45C carburetor; refer to exploded view of carburetor in Fig. HL1. Note: As engine speed is controlled by governor plate on rotary inlet valve, there are no governor linkage connections to throttle shaft. Throttle shaft has spring loaded detent to hold shaft in wide open position. Generator engine is not fitted with throttle control knob. Carburetor is accessible after removing air cleaner cover (1—Fig. HL2).

Later model carburetor is fitted with a main nozzle check ball which allows use of larger mesh inlet screen (6—Fig. HL1) and provides easier adjustment of fuel mixture. The check ball assembly will be in the same bore as the small body channel welch plug (22), retaining ring (23) and screen (24), and will replace these parts.

When disassembling, slide diaphragm assembly towards adjustment needle side of carburetor body to disengage diaphragm from fuel inlet control lever. To remove welch plugs, carefully drill through plugs with a small diameter drill and pry plugs out with a pin. Caution should be taken that drill bit just goes through welch plug as deeper drilling may seriously damage carburetor. Note channel screen (24) (early model carburetor) and screen retaining ring (23) which are accessible after removing welch plug (22).

Inlet control metering lever (15) should be flush with metering chamber floor of carburetor body. If not, bend diaphragm end of lever up or down as required so that lever is flush.

Normal adjustment of low speed fuel mixture needle (marked "L" on carburetor body) is $\frac{3}{4}$ -turn open and main mixture adjusting needle (marked "H" on carburetor body) should be opened

one full turn. On pump or blower engine, back idle speed adjusting screw out until carburetor throttle plate will close fully, then slowly turn screw in until it just contacts pin on throttle shaft, then turn screw in an additional $1\frac{1}{2}$ turns.

Start engine and allow to warm up before making final carburetor adjustments. With carburetor throttle shaft in high speed detent position and engine running under load, adjust main (H) fuel needle for smoothest running. Note: On generators, there is no external control for throttle, thus no need to make idle adjustments. Move throttle shaft to idle speed position and

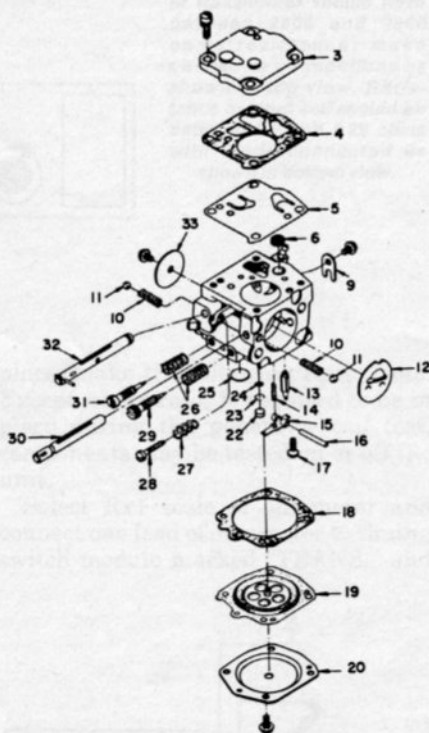


Fig. HL1—Exploded view of Tillotson carburetor used on model 250 and 270.

- | | |
|--------------------------------------|------------------------------|
| 3. Fuel pump cover | 20. Diaphragm cover |
| 4. Fuel pump gasket | 22. Welch plug |
| 5. Fuel pump diaphragm | 23. Retaining ring for (24) |
| 6. Inlet screen | 24. Body channel screen |
| 9. Throttle shaft clip | 25. Welch plug |
| 10. Shaft detent springs (2) | 26. Adjusting needle springs |
| 11. Shaft detent balls | 27. Idle speed screw |
| 12. Choke shutter | 28. Idle speed spring |
| 13. Inlet needle | 29. Main adjusting needle |
| 14. Inlet tension spring | 30. Choke shaft |
| 15. Inlet control lever | 31. Idle adjusting needle |
| 16. Inlet pinion pin | 32. Throttle shaft |
| 17. Inlet pinion pin retaining screw | 33. Throttle shutter |
| 18. Diaphragm gasket | |
| 19. Metering diaphragm | |

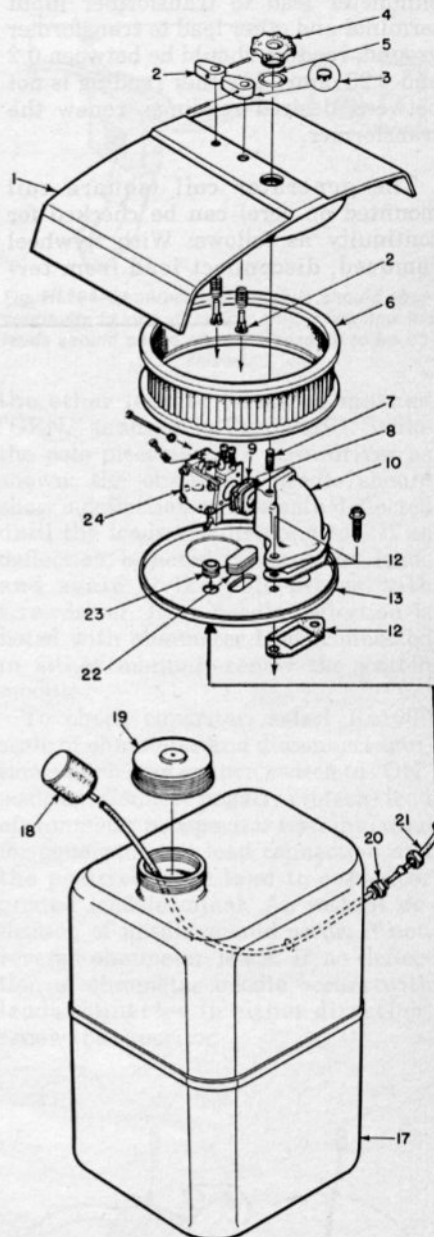


Fig. HL2—Exploded view of air intake and fuel system. Refer to Fig. HL1 for exploded view of carburetor (24). Control lever and shaft (2) is not used for throttle on generator engine and hole is covered by plug (3).

- | | |
|-----------------------------|----------------------------------|
| 1. Air filter cover | 13. Air filter mounting plate |
| 2. Control shaft assemblies | 17. Fuel tank |
| 3. Plug (generator only) | 18. Fuel filter |
| 4. Cover retaining nut | 19. Fuel filler cap |
| 5. Nylon washer | 20. Fitting |
| 6. Air filter element | 21. Fuel line |
| 7. Stud | 22. Governor adjusting hole plug |
| 8. Gasket | 23. Grommet |
| 9. Spacer | 24. Carburetor assembly |
| 10. Intake manifold | |
| 12. Crankcase gasket | |

adjust idle fuel needle (L) for smoothest idle. Adjust idle speed stop screw to desired idle speed. If engine will not accelerate from idle speed to full throttle without hesitation, open idle fuel needle an additional $\frac{1}{8}$ -turn.

GOVERNOR. The governor is a part of the rotary inlet valve; refer to Fig. HL3. As engine speed increases, centrifugal force pivots governor plate on pivot pin (P) against tension of spring (S). The governor plate then closes the opening in rotary valve and thus throttles the engine. Maximum governed engine speed is controlled by tension of governor spring, which is adjusted by turning screw (A).

To check and adjust engine speed, proceed as follows: First, bring engine

to normal operating temperature and adjust carburetor for highest speed and best performance obtainable, then check engine speed with tachometer. Refer to the following chart for correct governed speed:

	No Load rpm	Full Load rpm
Generator	3750	3600
Centrifugal Pump	3900-4000	3400-3600
Diaphragm Pump	2800-3000	2800-3000
Blower	3750-3800	3400-3600

If adjustment is necessary, stop engine and remove air filter cover and rubber plug (22—Fig. HL2) from air filter base (13). Remove brass plug from engine crankcase through opening in filter base and turn engine so that adjusting screw (A—Fig. HL3) is accessible. Then, as shown in Fig. HL4, turn adjusting screw clockwise to increase speed or counterclockwise to decrease speed. One turn of the screw will change governed speed approximately 100 RPM. Reinstall brass plug, rubber plug and air filter cover, then recheck engine speed; readjust if necessary.

IGNITION AND TIMING. Breaker points, condenser and ignition coil are accessible after removing engine flywheel (magneto rotor). A hole is provided in magneto back plate and inner face of flywheel so that a pin may be inserted to hold flywheel from turning.

Unscrew flywheel nut and remove flywheel using Homelite puller No. AA-22560, or equivalent.

To adjust breaker point gap, turn engine so that leading edge of breaker cam is about $\frac{1}{8}$ -inch past breaker point cam follower, then adjust point gap to 0.020.

NOTE: On earlier models, removal of flywheel (magneto rotor) will also require removal of the fan housing (17—Fig. HL8). Fan housing and magneto back plate are integral on later models; removing starter and starter adapter plate will permit access to remove magneto rotor. Also, service crankshafts may have **two keyways** for breaker cam and magneto rotor. The second keyway (painted red) is at 2 o'clock position (when considering cylinder at 12 o'clock position) for use with one-piece fan housing and back plate **only** when breaker points are located **above** crankshaft. On early engines with two-piece fan housing and back plate, breaker points are mounted **below** crankshaft (opposite cylinder). The breaker cam and rotor must be positioned in same keyway. The later one-piece fan housing and back plate may be installed on earlier models by tapping the two drilled stator mounting holes and mounting magneto stator (armature and coil) in original position. When both new crankshaft and fan housing/back plate are used, remount magneto stator in new position, use **red** keyway for installing cam and rotor and mount starter using new

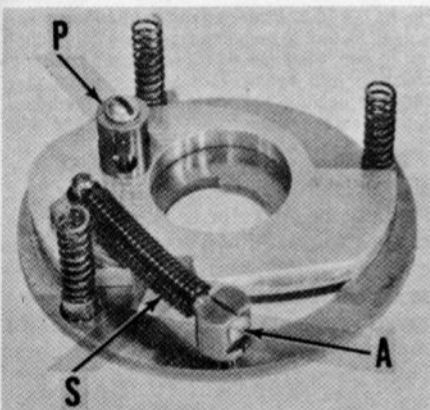


Fig. HL3—View of rotary intake valve and governor assembly. Governor plate pivots on post (P) to close off valve opening in rotary valve plate to govern engine speed. Speed at which plate closes the opening is regulated by tension of governor spring (S) which is adjusted by turning screw (A).

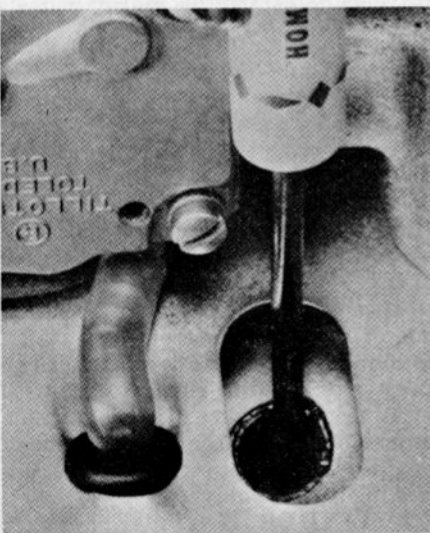


Fig. HL4—Access to governor spring adjusting screw (A—Fig. HL3) is gained by removing air filter cover, rubber plug (22—Fig. HL2) and the brass plug from engine crankcase. Then, turn engine so that screw can be turned with screwdriver as shown.

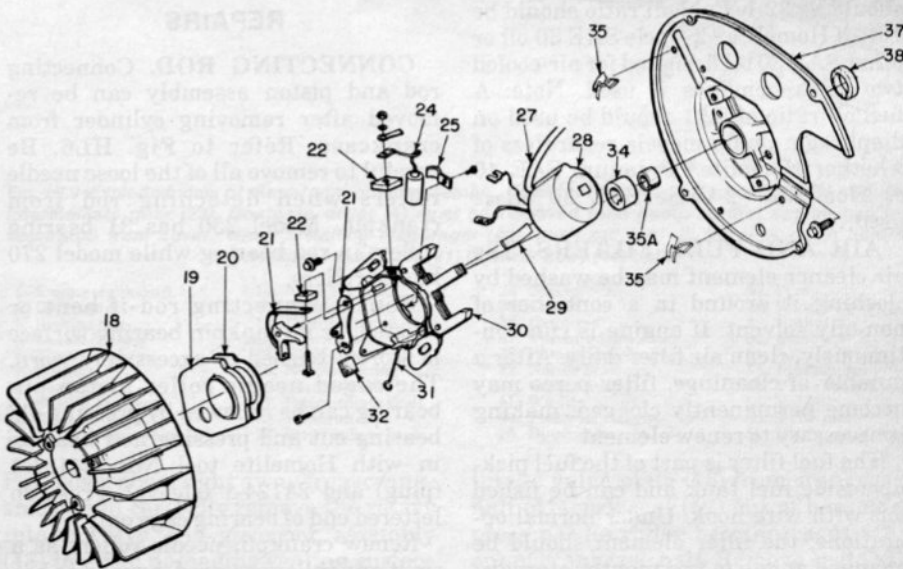


Fig. HL5—Exploded view of model 250 magneto assembly. Model 270 is similar. Magneto components are accessible after removing flywheel; refer to text. A zinc flywheel (magneto rotor) should be used on diaphragm pump engine; other model 250 engines use aluminum flywheel.

- | | | | |
|-------------------------|-----------------------|------------------------------|--------------------------|
| 18. Flywheel | 24. Condenser | 30. Stator & armature assy. | 34. Breaker cam |
| 19. Breaker box cover | 25. Condenser clamp | 31. Breaker box cover spring | 35. Wire retaining clips |
| 20. Gasket | 27. High tension lead | 32. Cam wiper felt | 35A. Felt seal |
| 21. Breaker points | 28. Ignition coil | | 37. Back plate |
| 22. Terminal connection | 29. Coil wedge | | 38. Felt seal |

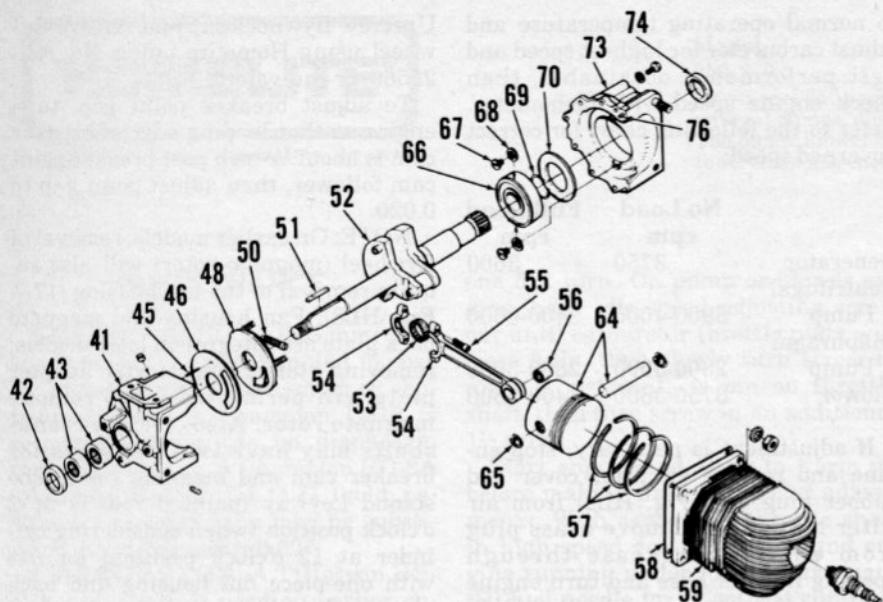


Fig. HL6—Exploded view of engine. Crankshaft end play is controlled by ball bearing (66). Three different crankshafts are used; shaft shown is for diaphragm pump. Crankshaft for generator has tapered end with threaded counterbore for armature retaining bolt. Crankshaft for other applications has externally threaded end.

41. Crankcase half
42. Crankshaft seal
43. Needle roller bearings
45. Dowel pins
46. Intake valve wear plate
48. Intake valve & governor assy.
50. Governor spring
51. Cam & flywheel key
52. Crankshaft (diaphragm pump)

53. Needle bearing rollers (31)
54. Connecting rod & cap
55. Socket head screws
56. Needle roller bearing
57. Piston rings
58. Gasket
59. Cylinder
64. Piston & piston pin
65. Snap rings

66. Roller bearing
67. Bearing retaining screws
68. Bearing retaining washers
69. Snap ring
70. Bearing gasket
73. Crankcase half
74. Crankshaft oil seal
76. Dowel pin

adapter plate. New magneto leads, retaining clips and rivets will be required also.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used. Note: A fuel:oil ratio of 32:1 should be used on diaphragm pump models regardless of whether Homelite® Premium SAE 40 or Homelite® 2-Cycle SAE 30 oil is used.

AIR AND FUEL FILTERS. The air cleaner element may be washed by sloshing it around in a container of non-oily solvent. If engine is run continuously, clean air filter daily. After a number of cleanings, filter pores may become permanently clogged, making it necessary to renew element.

The fuel filter is part of the fuel pick-up inside fuel tank and can be fished out with wire hook. Under normal operations, the filter element should be changed at one to two month intervals. If engine is run continuously, or fuel is dirty, the filter may need to be changed weekly, or more often if necessary.

CARBON. Carbon should be cleaned from exhaust ports at 100 to 200 hour intervals. Remove muffler,

crank piston to top dead center and use a wooden or plastic scraper to remove carbon deposits. Avoid scratching piston or damaging edge of port. Note: For easy access to exhaust port, stand engine on recoil starter end.

REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Refer to Fig. HL6. Be careful to remove all of the loose needle rollers when detaching rod from crankpin. Model 250 has 31 bearing rollers in rod bearing while model 270 has 23 rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool Nos. 24131-1 (plug) and 24124-1 (sleeve). Press on lettered end of bearing cage only.

Renew crankpin needle rollers as a set if any roller is scored, burned or has flat spots. Stick needle roller set to crankpin with heavy grease or beeswax. Using a 10-32 threaded rod or headless screw, position connecting rod cap so that mating boss on cap and connecting rod will align when pinned

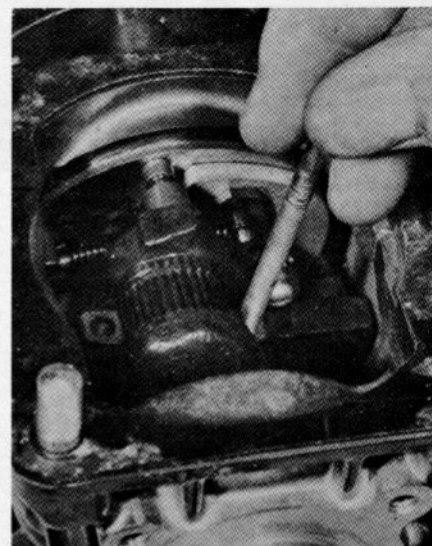


Fig. HL7—A 10-32 threaded rod or headless screw is used as tool to help in assembling connecting rod to cap. Stick the 31 loose needle rollers to crankpin with beeswax or heavy grease, then carefully position cap so that when assembled, pinned side of piston is towards intake side (upper side) of engine.

side of piston is on the intake (upper) side of engine; refer to Fig. HL7. Slide connecting rod down over threaded rod or screw, then install socket head screw in opposite side of rod and cap and remove the installation tool. Install remaining socket head screw and tighten both screws to a torque of 32 inch-pounds.

PISTON, PIN AND RINGS. Piston assembly is accessible after removing cylinder assembly from crankcase. Always support piston when removing or installing piston pin. Piston is of aluminum alloy and is fitted with three pinned piston rings.

If piston ring locating pin is worn to half the original thickness, or if there is any visible up and down play of piston pin in piston bosses, renew piston and pin assembly. Inspect piston for cracks or holes in dome and renew if any such defect is noted. Slight scoring of piston is permissible, but if rough surfaces are accompanied by deposit of aluminum on cylinder wall, renew piston.

Always use new piston pin retaining snap rings when reassembling piston to connecting rod. Fit new piston rings in grooves, aligning ring end gaps with locating pin. Be sure locating pin side of piston is away from exhaust side of engine when installing piston and connecting rod assembly.

CYLINDER. Cylinder bore is chrome plated; the plating is light gray in color and does not have the appearance of polished chrome. Renew cylinder if any part of chrome plated bore is worn through; usually, the worn

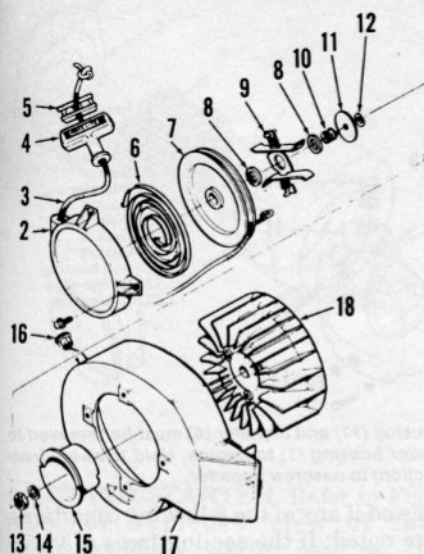


Fig. HL8—Exploded view of Fairbanks-Morse re-wind starter. Starter cup (15) has rope notches so that engine can be started with starter assembly removed. Early type fan housing (17) is shown; later fan housing and magneto back plate (37—Fig. HL5) are integral.

- | | |
|---------------------------|------------------------------|
| 2. Cover & bushing assy. | 11. Brake retaining washer |
| 3. Starting cord | 12. Snap ("E") ring |
| 4. Starting cord grip | 13. Flywheel nut |
| 5. Insert | 14. Lock washer |
| 6. Rewind spring | 15. Starter cup |
| 7. Starter pulley | 16. Engine stop switch |
| 8. Fiber washer | 17. Blower housing |
| 9. Friction shoe assembly | 18. Flywheel (magneto rotor) |
| 10. Brake spring | |

area is bright as the aluminum is exposed. In some instances, particles from the aluminum piston may be deposited on top of chrome plating. This condition is usually indicated by rough, flaky appearance and deposits can be removed by using a rubber compound buffing wheel on a ¼-inch electric drill. If a screwdriver can be run over the cleaned surface without leaving marks, the cylinder is suitable for further service. If screwdriver scratches surface, renew cylinder.

Lubricate piston, rings and cylinder bore. Compress rings, then slide cylinder down over piston. Tighten cylinder retaining nuts evenly and securely.

CRANKSHAFT, BEARINGS AND SEALS. To remove crankshaft, engine must first be removed from blower, pump or generator. Refer to exploded view of appropriate unit in Fig. HL9, HL10, HL11, HL12 or HL13 for required disassembly. Then refer to Figs. HL5 and HL6 and proceed as follows:

Remove flywheel, magneto assembly and magneto back plate. Remove and discard felt seals (35A & 38—Fig. HL5) from backplate (37). Remove "O" ring oil slinger (not shown) from crankshaft. Remove cylinder, piston and connecting rod assembly, then separate crankcase halves (41 & 73—Fig. HL6).

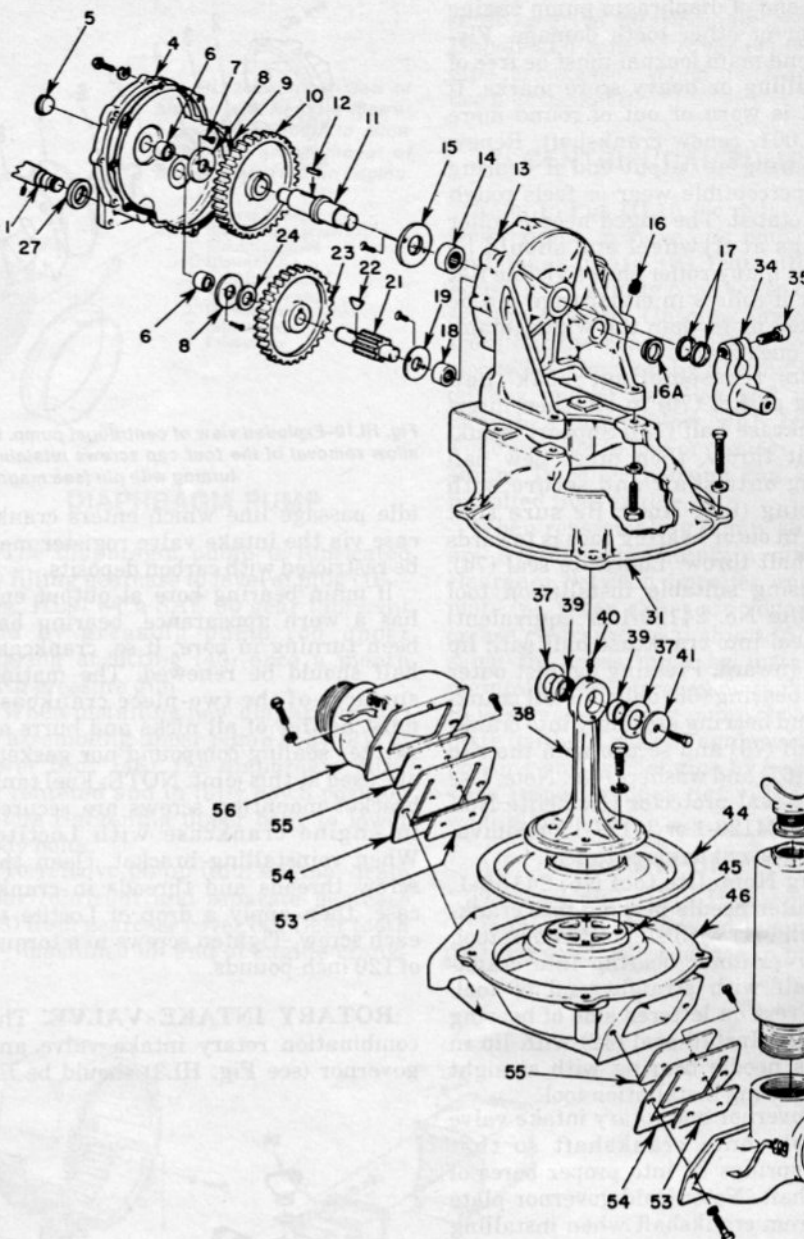


Fig. HL9—Exploded view of diaphragm pump assembly. Gear teeth on engine crankshaft (1) engage intermediate gear (23). Gearcase cover (4) must be removed from pump so that engine can be separated from cover. When installing diaphragm (44), push rod (38) all the way down before installing upper body (31) to lower body (46) bolts.

- | | | | |
|-----------------------|------------------------|-----------------------|-----------------------|
| 1. Engine crankshaft | 14. Needle bearing | 24. Spacer | 46. Pump body |
| 4. Gearcase cover | 15. Thrust washer | 34. Crank | 48. Wing plug |
| 5. Bearing cap | 16. Oil filter plug | 35. Cap screw | 49. Gasket |
| 6. Needle bearing | 17. Garlock seals | 37. Thrust washers | 50. Standpipe |
| 8. Thrust washer | 18. Needle bearing | 38. Pump rod assembly | 51. Suction fitting |
| 9. Gasket | 19. Thrust washer | 39. Needle bearings | 52. Pipe nipple |
| 10. Pump gear | 21. Intermediate shaft | 40. Grease fitting | 53. Valve weight |
| 11. Shaft & key assy. | 22. Woodruff key | 41. Washer | 54. Valve |
| 12. Key | 23. Intermediate gear | 44. Pump diaphragm | 55. Valve plate |
| 13. Gearcase assembly | | 45. Diaphragm cap | 56. Discharge fitting |

Pull governor weight away from crankshaft, then carefully remove the rotary intake valve and governor assembly (48) to avoid damaging sealing surface of crankshaft. Remove two screws (67) and washers (68) retaining ball bearing (66) in crankcase half (73) and remove shaft and bearing. Tape shaft to prevent scratching sealing surface, then remove snap ring (69) and pull bearing (66) from crankshaft. Remove

intake valve plate (46) from crankcase half (41), pry seal (42) out of bore and press needle roller bearing cages (43) out of crankcase half. Remove seal (74) from opposite half. Note: Remove bearings from crankshaft and flywheel side crankcase half only if renewal is indicated.

Renew crankshaft if it has damaged threads, enlarged keyways, or if run out exceeds 0.003. Inspect drive gear on

output end of diaphragm pump engine for wear or other tooth damage. Flywheel end main journal must be free of pits, galling or heavy score marks. If journal is worn or out of round more than 0.001, renew crankshaft. Renew ball bearing at output end if bearing shows perceptible wear or feels rough when rotated. The caged needle roller bearings at flywheel end should be renewed if any roller shows visible flat spot, or if rollers in either cage can be separated more than the width (diameter) of one roller.

When reassembling, soak new bearing gasket (70) in oil, then insert in crankcase half (73). Support crankshaft at throw, then press new ball bearing onto shaft and secure with snap ring (69). Note: Be sure that groove in outer bearing race is towards crankshaft throw. Lubricate seal (74), then using suitable installation tool (Homelite No. 24120-1 or equivalent) press seal into crankcase half with lip of seal inward. Pressing against outer race of bearing (66) only, install crankshaft and bearing assembly into crankcase half (73) and secure with the two screws (67) and washers (68). Note: Use suitable seal protector (Homelite Nos. 24125-1, 24126-1 or 24127-1, or equivalent) to prevent damage to seal.

Using Homelite tool No. 24155-1, press outer needle bearing into crankcase half (41) with stepped end of tool, then press inner bearing into crankcase half with straight end of tool. Note: Press on lettered side of bearing cage only. Install seal (42) with lip towards needle bearing with straight end of bearing installation tool.

Fit governor and rotary intake valve assembly onto crankshaft so that thrust springs fit into proper bores of crankshaft. Note: Hold governor plate away from crankshaft when installing to prevent scratching seal surface. Lubricate all parts thoroughly and insert intake valve plate (46) in crankcase half (41) so that it is properly positioned on dowel pins and intake opening. Using seal protector (Homelite No. 24121-1 or equivalent), assemble the crankcase half over crankshaft and governor assembly, hold assembly together against thrust spring pressure and install crankcase cap screws. Tighten cap screws to a torque of 80 inch-pounds. Insert new felt seal (38—Fig. HL5) in bore of magneto back plate, place new "O" ring oil slinger on crankshaft and install back plate. Tighten backplate retaining cap screws to a torque of 80 inch-pounds. Complete reassembly by reversing disassembly procedure.

CRANKCASE. Be sure that all passages through crankcase are clean. The

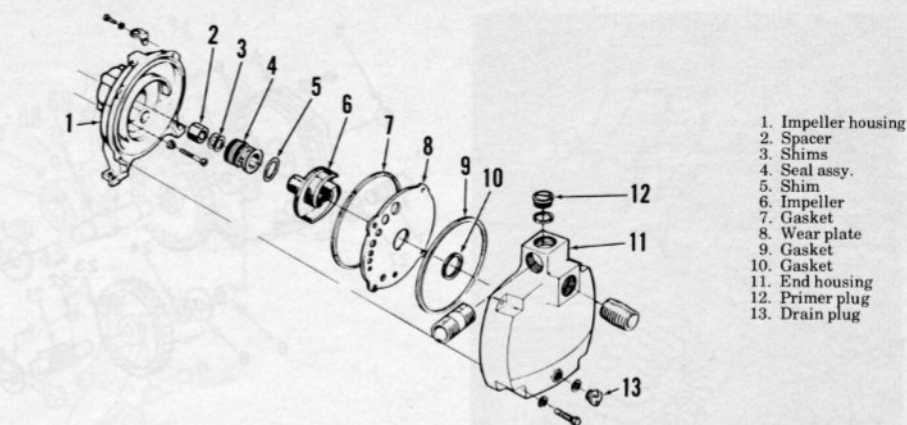


Fig. HL10—Exploded view of centrifugal pump. End housing (11) and impeller (6) must be removed to allow removal of the four cap screws retaining impeller housing (1) to engine. Hold flywheel from turning with pin (see magneto section) to unscrew impeller.

idle passage line which enters crankcase via the intake valve register may be restricted with carbon deposits.

If main bearing bore at output end has a worn appearance, bearing has been turning in bore. If so, crankcase half should be renewed. The mating surfaces of the two-piece crankcase must be free of all nicks and burrs as neither sealing compound nor gaskets are used at this joint. NOTE: Fuel tank bracket mounting screws are secured in engine crankcase with Loctite. When reinstalling bracket, clean the screw threads and threads in crankcase, then apply a drop of Loctite to each screw. Tighten screws to a torque of 120 inch-pounds.

ROTARY INTAKE VALVE. The combination rotary intake valve and governor (see Fig. HL3) should be re-

newed if any of the following conditions are noted: If the sealing faces of valve or governor plate are worn or scored enough to produce a ridge; if spring post is loose or extended to valve seating surface; or, if governor pivot point has started to wear through the surface of valve. Maximum allowable clearance between governor plate and intake valve plate is 0.006. The governor spring and/or governor spring adjusting screw may be renewed separately from the assembly.

Slight scoring of valve face may be corrected by lapping on a lapping plate using a very fine abrasive. Lapping motion should be in the pattern of a figure eight to obtain best results. Slight scoring of the Formica wear plate is permissible. Homelite recommends soaking a new Formica plate in oil for 24 hours prior to installation.

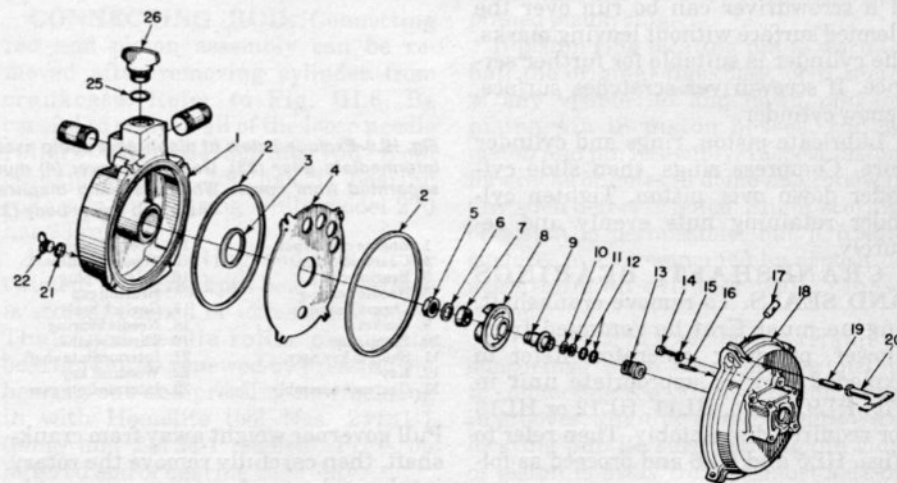


Fig. HL11—Exploded view of trash pump. End housing and impeller must be removed from impeller housing to allow housing to be unbolted from engine. Model 270 uses a spacer in place of washers (12).

1. End housing
2. Gasket
3. Gasket
4. Wear plate
5. Impeller nut
6. Washer
7. Tapered bushing

8. Impeller
9. Impeller hub
10. Shim (0.010, as required)
11. Shim (0.015, as required)
12. Spacer washers
13. Seal assembly
14. Screws

15. Sealing washers
16. Spiral pin
17. Pivot pin
18. Impeller housing
19. Studs
20. Wing nuts

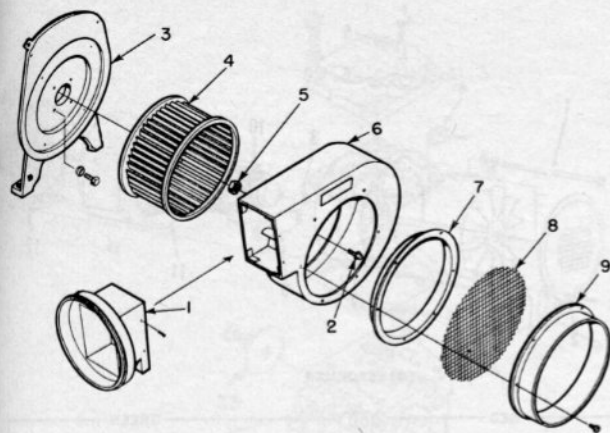


Fig. HL12—Exploded view of blower unit. Remove blower housing and rotor to allow unbolting and removal of blower plate (1) from engine.

1. Blower outlet
2. Slotted head screws
3. Mounting plate
4. Blower rotor
5. Elastic stop nut
6. Blower housing
7. Blower inlet venturi
8. Inlet screen
9. Inlet collar

REWIND STARTER. Refer to Fig. HL8 for exploded view of the Fairbanks-Morse starter used on all applications. In an emergency in case of rewind starter failure, remove starter assembly and wind rope around starter cup (15) to start engine.

Refer to exploded view for proper reassembly of starter unit. Hook end of starter rope in notch of pulley and turn pulley five turns counterclockwise, then let spring wind rope into pulley for proper spring pre-tension.

To remove starter cup, insert lock pin through hole in magneto back plate and hole in flywheel to hold flywheel from turning, then unscrew retaining nut.

DIAPHRAGM PUMP

The diaphragm pump is lubricated by filling gearcase to level of plug (16—Fig. HL9) with SAE 90 gear lubricant and by greasing pump rod upper bearing at fitting (40) once a month with pressure gun.

When installing new diaphragm (44) or assembling upper pump body (31) to lower body (46), the diaphragm must be centered and in fully down position before tightening upper body to lower body bolts.

To remove pump from engine, drain gear lubricant and separate gearcase (13) from gearcase cover (4). Gear teeth are machined on end of engine crank-

shaft to drive intermediate gear (23). Unbolt and remove cover (4) from engine crankcase. When reassembling, use new gasket (9).

CENTRIFUGAL PUMP

Refer to Fig. HL10. To remove pump from engine, remove end housing (11) and wear plate (8) from impeller housing (1), taking care not to damage sealing gaskets. Unscrew impeller (6) from engine crankshaft in counterclockwise direction by placing wrench on hex end of impeller and striking wrench a sharp blow with hammer. Take care not to lose or damage seals or shims. Impeller housing can now be unbolted from engine.

When reassembling pump, shims (3) are available to maintain minimum clearance between impeller and wear plate (8). When shims are added to decrease clearance, seal shims (5) of the same thickness must be installed to maintain proper tension on seal spring. Before reassembling pump, hold wear plate (without gasket) against impeller housing and turn engine by hand to be sure impeller does not rub against wear plate.

TRASH PUMP

The trash pump (Fig. HL11) impeller (8) is mounted on tapered bushings so that if a solid object lodges in pump to

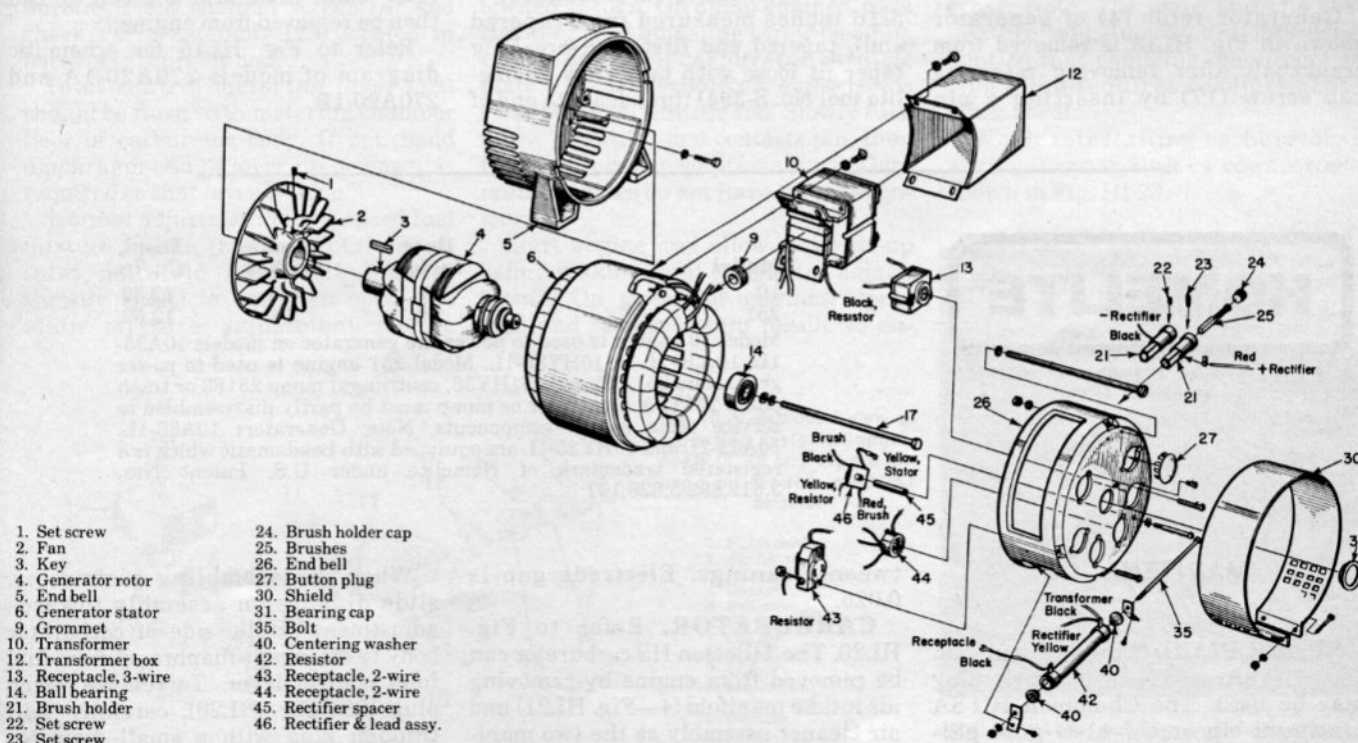


Fig. HL13—Exploded view of generator unit. Through bolt (17) retains generator rotor (4) on tapered end of engine crankshaft. After removing rotor and fan (2) assembly from engine crankshaft, fan housing end bell (5) can be unbolted from engine crankcase.

block the impeller, shaft rotation will not halt immediately.

To remove pump from engine, remove end housing (1) and wear plate (4), then unscrew impeller retaining nut (5) and remove impeller (8), taking care not to damage or lose seal and shims (10, 11 & 12). Unbolt and remove impeller housing (18) from engine.

When reassembling pump, use shims (10 & 11) of total thickness as required to maintain minimum clearance between impeller and wear plate. Shims are placed between shoulder on crankshaft and impeller hub (9). Install seal shims of same total thickness along with spacer washers (12) to maintain seal spring tension. Model 270 is equipped with a spacer in place of washers (12).

GENERATOR

Two generators have been used as shown in exploded views in Figs. HL13 and HL14. Care should be taken in disassembly of the generator that any leads disconnected are identified so they may be reconnected properly. Also, if brushes are to be reinstalled, they should be identified so they can be installed in same location and position from which they were removed. Careful disassembly is necessary to avoid damage to wiring or insulation.

Generator rotor (4) of generator shown in Fig. HL13 is removed from crankshaft after removing retaining cap screw (17) by inserting a pin

Fig. HL14—Exploded view of generator used on models 270A20-1A, 270A20-1B and 270A20-1C.

1. Screw
2. Cover
3. Fan
4. Rectifier
5. Brush
6. Brush holder
7. Brush head
8. Roller bearing
9. Resistor
10. Rotor
11. Stator & housing
12. End bell

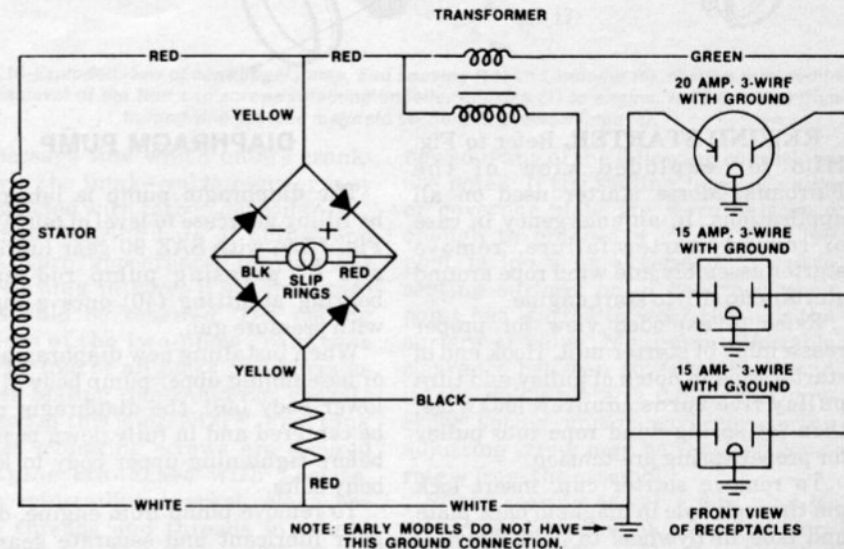
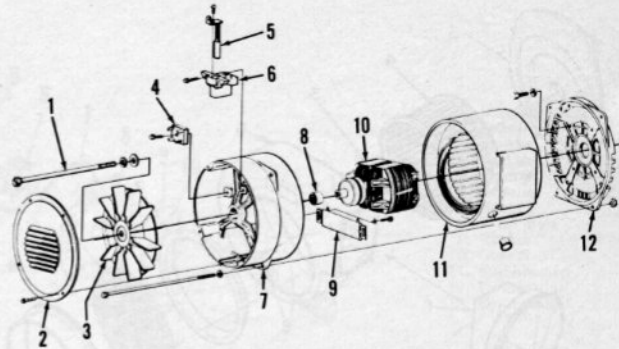


Fig. HL15—Schematic of generator models 270A20-1A, 270A20-1B and 270A20-1C.

(Homelite No. 22271 cut to length of 4-5/16 inches measured from tapered end), tapered end first, and breaking taper fit loose with jackscrew (Homelite tool No. S-394) threaded into end of

rotor shaft. Generator end bell (5) can then be removed from engine.

Refer to Fig. HL15 for schematic diagram of models 270A20-1A and 270A20-1B.



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Model	Bore Inches	Stroke Inches	Displ. Cu. In.
10	2 3/4	3 3/8	12.62
251	2 3/4	3 3/8	12.62

Model 10 engine is used to power the generator on models 10A35-1L, 10A35-2L or 10HY35-1L. Model 251 engine is used to power generators 251A35 and 251HY35, centrifugal pump 251S3 or trash pump 251TP3. Generator or pump must be partly disassembled to service some engine components. Note: Generators 10A35-1L, 10A35-2L and 10HY35-1L are equipped with Loadamatic which is a registered trademark of Homelite under U.S. Patent Nos. 3,612,892/3,626,197.

MAINTENANCE

SPARK PLUG. Either a Champion J6J, HO-8A or UJ-11-G spark plug may be used. The Champion HO-8A platinum tip or UJ-11-G gold palladium tip plug will provide longer service as well as longer intervals be-

tween cleanings. Electrode gap is 0.025.

CARBURETOR. Refer to Fig. HL20. The Tillotson HS carburetor can be removed from engine by removing air intake manifold (4—Fig. HL21) and air cleaner assembly as the two manifold bolts also retain carburetor and reed valve assemblies.

When disassembling carburetor, slide diaphragm assembly towards adjustment needle side of carburetor body to disengage diaphragm from fuel inlet control lever. To remove Welch plug (29—Fig. HL20), carefully drill through plug with a small diameter drill and pry plug out with a pin. Caution should be taken that drill bit just

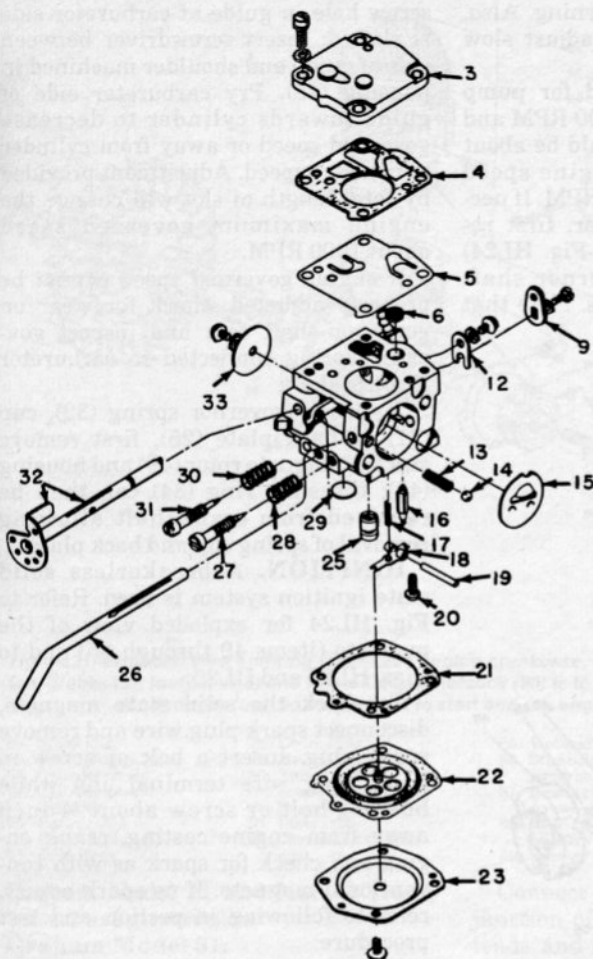


Fig. HL20—Exploded view of Tillotson Series HS carburetor used on model 251 engine. Note that carburetor is shown inverted from actual position on engine.

3. Fuel pump cover
4. Fuel pump gasket
5. Fuel pump diaphragm
6. Inlet channel screen
9. Governor spring arm
12. Throttle shaft clip
13. Choke detent spring
14. Choke dentent ball
15. Choke shutter
16. Inlet needle valve
17. Inlet lever spring
18. Inlet control lever
19. Lever pinion pin
20. Pinion pin retaining screw
21. Diaphragm gasket
22. Metering diaphragm
23. Diaphragm cover
25. Nozzle check valve
26. Choke shaft
27. Main adjusting needle
28. Main needle spring
29. Welch plug
30. Idle fuel needle spring
31. Idle adjusting needle
32. Throttle shaft
33. Throttle shutter

goes through welch plug as deeper drilling may seriously damage carburetor. Note channel screen (6) and check valve assembly (25) located in bores of carburetor body.

Inlet control metering lever (18) should be flush with metering chamber floor of carburetor body. If not, bend diaphragm end of lever up or down as required so that lever is flush.

Normal adjustment of low speed fuel mixture needle (marked "LO" on air inlet manifold or needle nearest throttle shaft) is one turn open and main mixture adjustment needle

(marked "HI" on air inlet manifold or needle nearest choke shaft) should be opened $\frac{1}{4}$ -turn. On pump engines, back the idle speed adjusting screw (see Fig. HL22) out until carburetor throttle plate will close completely and screw is clear of pin on throttle rod. Slowly turn screw in until it just contacts pin, then turn screw in one additional turn. Generator engines do not have throttle control rod.

Start engine and allow to warm up before making final carburetor adjustments. On generator engines, apply load and readjust main needle so en-

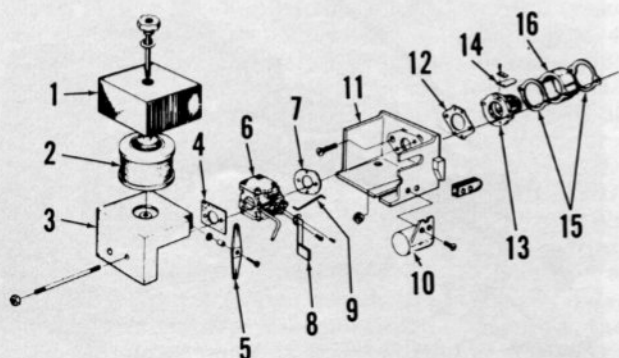


Fig. HL21—Exploded view of induction system. Components (8, 10 and 11) are not used on models with 251 engine.

1. Filter cover
2. Air filter
3. Intake manifold
4. Gasket
5. Bellcrank
6. Carburetor
7. Gasket
8. Throttle arm
9. Link
10. Loadamatic® electromagnet
11. Housing
12. Gasket
13. Reed valve seat
14. Reed valve
15. Gasket
16. Spacer

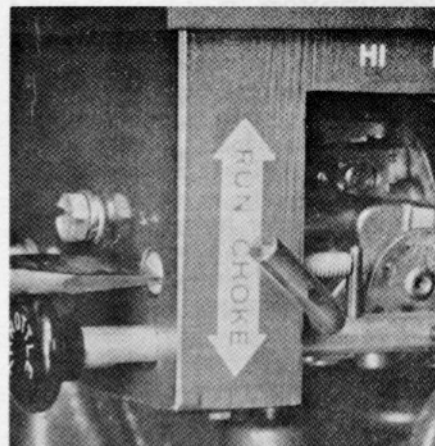


Fig. HL22—Adjusting idle speed screw. Throttle rod friction screw is just visible at under side of air intake manifold. Idle speed must not be adjusted to above 2500 RPM.

gine runs best, then remove load and adjust idle needle for smoothest operation. Refer to GENERATOR section for idle adjustment on models with Loadamatic.® On pump engines, pump water with throttle control rod pushed all the way in and readjust main mixture needle so engine runs best. Then, lift suction hose out of water, pull throttle rod out and adjust low idle speed for smoothest running. If necessary, readjust idle speed screw to obtain a slow idle speed of 1800-2500 RPM. CAUTION: Do not adjust low idle speed higher than 2500 RPM; higher idle speed will result in damage to governor. Note: The main and idle speed mixture adjustments are interdependent so that changing one needle setting often requires readjustment of other needle.

When reinstalling carburetor, be sure governor link is connected as shown in Fig. HL23.

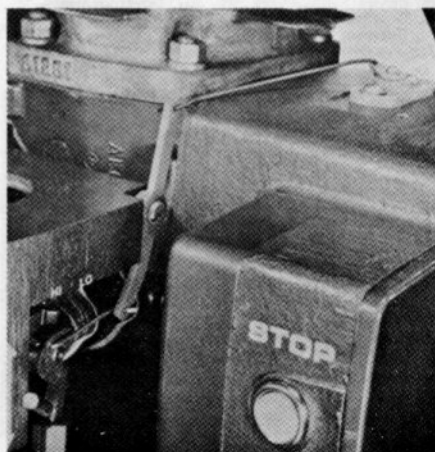


Fig. HL23—View showing proper installation of governor bellcrank and links. Generator engine not equipped with throttle (idle control) rod is shown.

GOVERNOR. Engine is equipped with a flyweight type governor mounted on engine crankshaft; refer to Fig. HL24 for exploded view showing governor unit. External governor linkage is shown in Fig. HL23.

CAUTION: Never move governor linkage manually, or exert any pressure on lever or linkage to increase engine speed. Working governor linkage manually, even momentarily, may cause damage to governor cup and

cam due to friction and burning. Also, on pump engines, do not adjust slow idle speed above 2500 RPM.

Maximum no-load speed for pump engines should be 3800-3900 RPM and for generator engines, should be about 3750 RPM; generator engine speed under load should be 3600 RPM. If necessary to readjust governor, first remove the cover plate (43—Fig. HL24) and slightly loosen governor shaft guide (36) retaining screws. Note that

screw hole in guide at carburetor side is slotted; insert screwdriver between side of guide and shoulder machined in housing (45). Pry carburetor side of guide towards cylinder to decrease governed speed or away from cylinder to increase speed. Adjustment provided by total length of slot will change the engine maximum governed speed about 1000 RPM.

If engine governed speed cannot be properly adjusted, check for wear on governor shaft cam and inspect governor spring connected to carburetor throttle shaft.

To renew governor spring (32), cup (31) or back plate (25), first remove starter, magneto rotor (49) and housing (45); the snap ring (34) can then be removed from crankshaft allowing removal of spring cup and back plate.

IGNITION. A breakerless solid state ignition system is used. Refer to Fig. HL24 for exploded view of the magneto (items 49 through 65) and to Figs. HL25 and HL26.

To check the solid state magneto, disconnect spark plug wire and remove spark plug. Insert a bolt or screw in spark plug wire terminal and while holding bolt or screw about 1/4-inch away from engine casting, crank engine and check for spark as with conventional magneto. If no spark occurs, refer to following inspection and test procedure:

Visually check for broken or frayed wires which would result in open circuit or short. Be sure stop switch is not permanently grounded. Inspect magneto rotor (49—Fig. HL24), trigger coil (52) and the switch box, condenser and magneto cover assembly (62) for visible damage.

To test magneto components, remove starter assembly, magneto cover and disconnect leads as shown in Fig. HL26, then proceed as follows:

To test ignition coil, refer to test instrument instructions; readings for

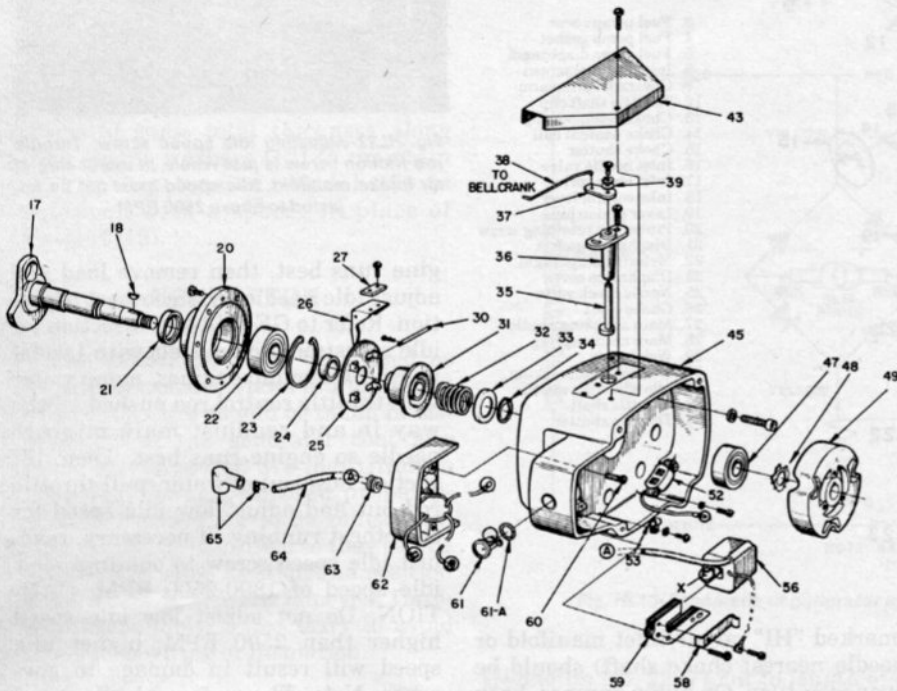


Fig. HL24—Exploded view showing magneto end of crankshaft (17), governor and magneto assemblies. The housing (45) retaining socket head screws can be removed by working through notches in outside of magneto rotor (49) allowing all parts to be removed as a unit after removing governor linkage and disconnecting spark plug wire.

- | | | | |
|-----------------------------|-----------------------|----------------------------|---|
| 17. Crankshaft, magneto end | 30. Weight pivot pin | 43. Governor linkage cover | 60. Cover retaining screw |
| 18. Woodruff key | 31. Governor cup | 45. Magneto housing | 61. Stop switch |
| 20. Bearing housing | 32. Governor spring | 47. Bearing | 61A. "O" ring |
| 21. Crankshaft seal | 33. Spring retainer | 48. Loading spring | 62. Magneto cover assembly (includes condenser and solid state switchbox) |
| 22. Bearing | 34. Snap ring | 49. Magneto rotor | 63. Grommet |
| 23. Snap ring | 35. Governor camshaft | 52. Magneto trigger coil | 64. Spark plug wire |
| 24. Spacer | 36. Camshaft guide | 53. Lead clamp | 65. Spark plug terminal |
| 25. Governor back plate | 37. Governor arm | 56. Ignition coil | |
| 26. Governor weight arm | 38. Bellcrank link | 58. Coil spring clip | |
| 27. Governor weight | 39. Flat washer | 59. Armature core | |

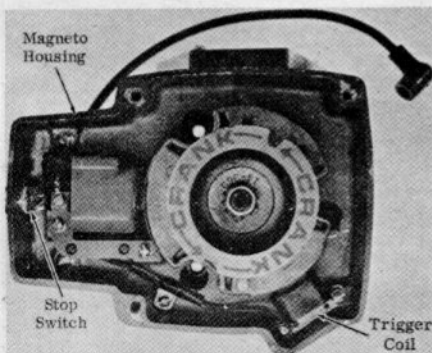
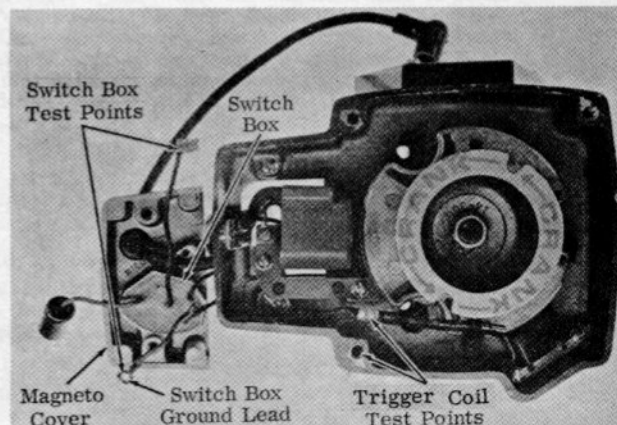


Fig. HL25—View of magneto assembly with rewind starter assembly removed. Armature to magneto rotor air gap and trigger coil to rotor air gap should be adjusted using a 0.0075 thick plastic shim.

Fig. HL26—View showing magneto leads disconnected for testing purposes. Condenser must not touch any other part of the unit. Refer to text for procedure and specifications.



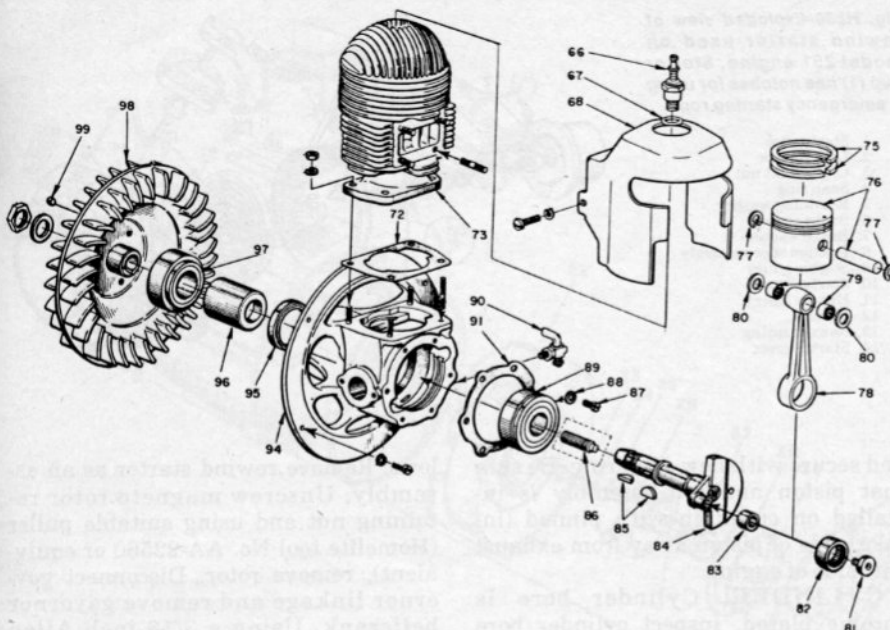


Fig. HL27—Exploded view showing model 251 engine crankcase, cylinder, rod and piston assembly, fan, crankshaft (output end) and related parts. Petcock (90) is to drain crankcase should it become flooded with fuel; do not attempt to start and run engine with petcock open.

66. Spark plug
67. Spark plug gasket
68. Cylinder shield
72. Cylinder gasket
73. Cylinder
75. Piston rings
76. Piston & pin assy
77. Snap rings

78. Connecting rod
79. Needle bearings
80. Thrust washers
81. Crankpin screw
82. Roller bearing
83. Inner race
84. Crankshaft (output end)

85. Woodruff keys
86. Stud bolts (251S3 pump only)
87. Bearing retaining screws
88. Bearing retaining washers
89. Bearing

90. Petcock
91. Crankcase gasket
94. Crankcase
95. Oil seal
96. Spacer
97. Bearing
98. Fan
99. Cork plug

Graham Model 51 and Merc-O-Tronic testers are given below:

Graham Model 51:

Maximum secondary 10,000
Maximum primary 1.7
Coil index 65
Maximum coil test 20
Maximum gap index 65

Merc-O-Tronic

Operating amperage 1.3
Minimum primary resistance 0.6
Maximum primary resistance 0.7
Minimum secondary continuity ... 50
Maximum secondary continuity ... 60

If ignition coil does not meet test specifications, renew using correct part number coil. Do not substitute a coil of other specifications with the solid state ignition system. If coil tested ok, check switch box as follows:

With leads and condenser disconnected as shown in Fig. HL26, connect one ohmmeter lead to one switch box test point (flag terminal or ground lead) and other ohmmeter lead to remaining switch box test point. The ohmmeter reading should be either between 5 to 25 ohms or from one megohm to infinity. When ohmmeter test leads are reversed, the opposite reading should be observed. If these ohmmeter readings are not observed, renew magneto cover and switch box assembly. If ignition coil and switch box both test ok, check trigger coil as follows:

Connect ohmmeter positive lead to junction of switch box and trigger coil leads and ohmmeter negative lead to magneto housing (see "Trigger Coil Test Points" in Fig. HL26). It is not necessary to disconnect trigger coil lead from switch box lead. The ohmmeter reading should be 22 to 24 ohms.

To check condenser, stick a pin through the condenser lead to provide a contact point, then test condenser using standard procedure to check series resistance, short and capacitance. Condenser capacitance should be 0.16-0.20 mfd.

If either the switch box or condenser tested faulty, renew the complete condenser, switch box and magneto cover assembly.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

AIR AND FUEL FILTERS. The air cleaner element may be washed in a detergent and water solution or by sloshing it around in a container of non-oily solvent. After a number of cleanings, the filter pores may become permanently clogged, making it necessary to renew element.

The fuel filter is a part of the fuel pick-up inside fuel tank and can be fished from tank filler opening using a wire hook. Under normal operations, the filter element should be changed at intervals of from one to two months. If engine is run continuously or fuel is dirty, filter may need to be changed weekly or at shorter intervals.

CARBON. The carbon should be cleaned from exhaust ports at 100 to 200 hour intervals. Remove muffler, crank piston to top dead center and use a wooden or plastic scraper to remove carbon deposits. Avoid scratching piston or damaging edges of port.

REPAIRS

CONNECTING ROD. Connecting rod lower end is fitted with a roller bearing (82—Fig. HL27) which rides on a renewable inner race (83). To remove piston and connecting rod assembly from crankshaft (84) crankpin, first remove cylinder and the magneto housing and crankshaft rotor end assembly. Place a block of wood between crankshaft throw and crankcase to keep crankshaft from turning, then unscrew crankpin screw (81) (counterclockwise) with $\frac{3}{8}$ -inch Allen wrench. If renewal of inner race is indicated, remove race from crankpin. Usually, race will slide off of pin; however, it may be necessary to pry race from crankpin with screwdrivers.

To renew crankpin needle roller bearing in the connecting rod, press old bearing out using plug (Homelite tool No. 24120-1), supporting rod on sleeve (Homelite tool No. 24118-1). Install new bearing by supporting rod on sleeve (Homelite tool No. 24124-1) and pressing bearing in with same plug as used to remove old bearing. Shouldered face of sleeve (24124-1) will properly position bearing so that it protrudes equally from each side of rod.

To renew piston pin bearings, support rod on sleeve (Homelite tool No. 24124-1) and press bearings out with plug (24131-1). New bearings are installed separately from opposite ends of bore. Support rod on sleeve (24124-1) and using straight end of plug (24131-1) (end with recessed face), press new bearing in (press on lettered side of cage only) until shoulder of plug seats against rod. Turn rod over and press other new bearing into rod in same manner. When properly installed, recessed faces of piston pin thrust washers will clear protruding bearing races and will contact connecting rod.

When reinstalling connecting rod and bearing inner race, thoroughly lubricate all parts and tighten connecting rod cap screw to a torque of 50

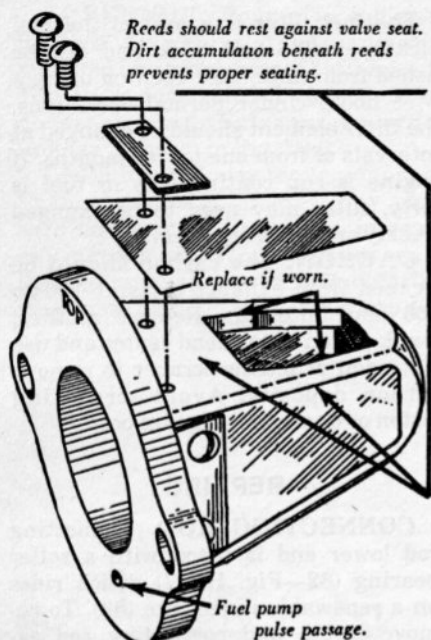


Fig. HL29-View showing reed valve assembly with one valve reed removed. Inspect seat and reeds as noted and be sure fuel pump pulse passage is open.

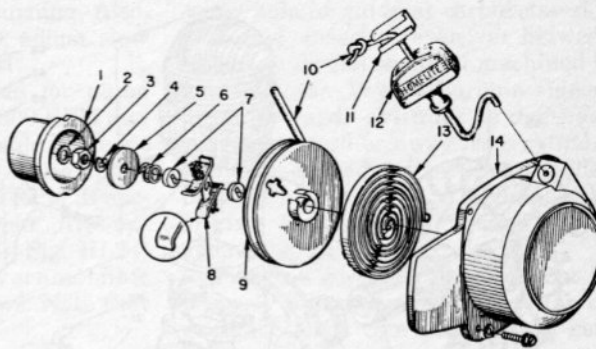
ft.-lbs. Note: Locate connecting rod on crankpin so that oil hole in upper end of rod will be towards intake side of engine. Piston should be assembled to connecting rod so that piston ring locating pin will be to same (intake) side of assembly as oil hole in rod.

PISTON, PIN AND RINGS. Piston is accessible after removing cylinder from crankcase. Always support piston while removing or installing piston pin. Piston should be renewed if ring side clearance, measured with new ring installed in top groove, exceeds 0.004. Also, renew piston if piston skirt to cylinder bore clearance exceeds 0.007 when measured with new or unworn cylinder. Inspect piston ring locating pin and renew piston if pin has worn to half of its original thickness. Piston pin should be a snug push-fit to light press-fit in piston. Piston, pin and rings are available in standard size only. Homelite recommends that piston rings be renewed whenever engine is disassembled for service.

When reassembling piston to connecting rod, insert new snap ring in exhaust side (opposite ring locating pin) side of piston. Lubricate all parts and place piston, exhaust side down, in holding fixture. (Note: A used cylinder sawed in half makes a good holding fixture.) Press pin into upper (intake) side of piston, then insert connecting rod and thrust washers into piston with oil hole in rod up and recessed sides of washers next to piston pin bearings in rod. Press pin on through the assembly

Fig. HL30-Exploded view of rewind starter used on model 251 engine. Starter cup (1) has notches for using emergency starting rope.

1. Starter cup
2. Lock washer
3. Crankshaft nut
4. Snap ring
5. Retaining washer
6. Brake spring
7. Brake washer
8. Friction shoe assembly
9. Starter pulley
10. Starter rope
11. Handle insert
12. Handle
13. Rewind spring
14. Starter cover



and secure with new snap ring. Be sure that piston and rod assembly is installed on crankpin with pinned (intake) side of piston away from exhaust port side of engine.

CYLINDER. Cylinder bore is chrome plated. Inspect cylinder bore for excessive wear and damage to chrome surface of bore. A new cylinder must be installed if chrome is scored, cracked or the base metal underneath exposed.

CRANKSHAFT, BEARINGS AND SEALS. The two-piece crankshaft can be serviced as two separate parts. Refer to following paragraphs for crankshaft service.

CRANKSHAFT, MAGNETO END. To service the shaft, bearings, seal or governor components, proceed as fol-

lows: Remove rewind starter as an assembly. Unscrew magneto rotor retaining nut and using suitable puller (Homelite tool No. AA-22560 or equivalent), remove rotor. Disconnect governor linkage and remove governor bellcrank. Using a 3/16-inch Allen wrench, remove the six socket head screws retaining magneto housing to crankcase and remove housing and shaft assembly. Remove the two screws retaining bearing housing (20—Fig. HL24) to magneto housing (45) and separate shaft and bearing assembly from housing (45). Bearing (47) can be renewed at this time. Remove snap ring (34), retainer (33) and governor spring (32) and pry governor back plate (25), with weights, from shaft (17). Remove spacer (24), support bearing

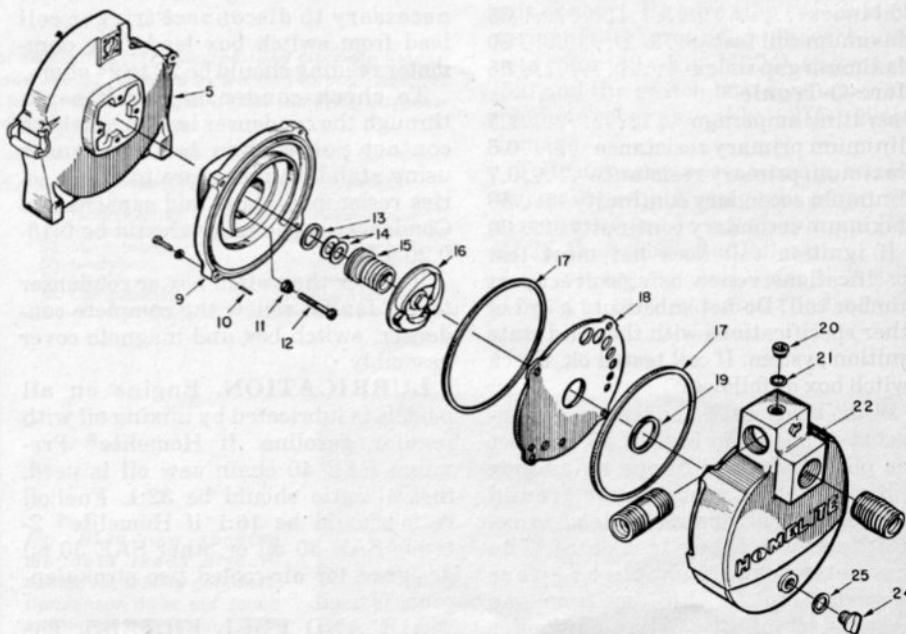


Fig. HL31-Exploded view of model 251S3 pump assembly. Impeller (16) threads onto stud (86—Fig. HL27) threaded into output end of crankshaft. Use shims (14) as required to maintain 0.020-0.030 clearance between impeller and wear plate (18).

- | | | | |
|---------------------------------|--------------------------|-----------------|-----------------|
| 5. Engine fan housing | 13. Washer | 17. Gaskets | 21. Gasket |
| 9. Impeller housing | 14. Shims (1/32 & 0.010) | 18. Wear plate | 22. End housing |
| 10. Spiral pin | 15. Seal assembly | 19. Gasket | 24. Drain plug |
| 11. Sealing washer | 16. Impeller | 20. Primer plug | 25. Gasket |
| 12. Cap screws (to fan housing) | | | |

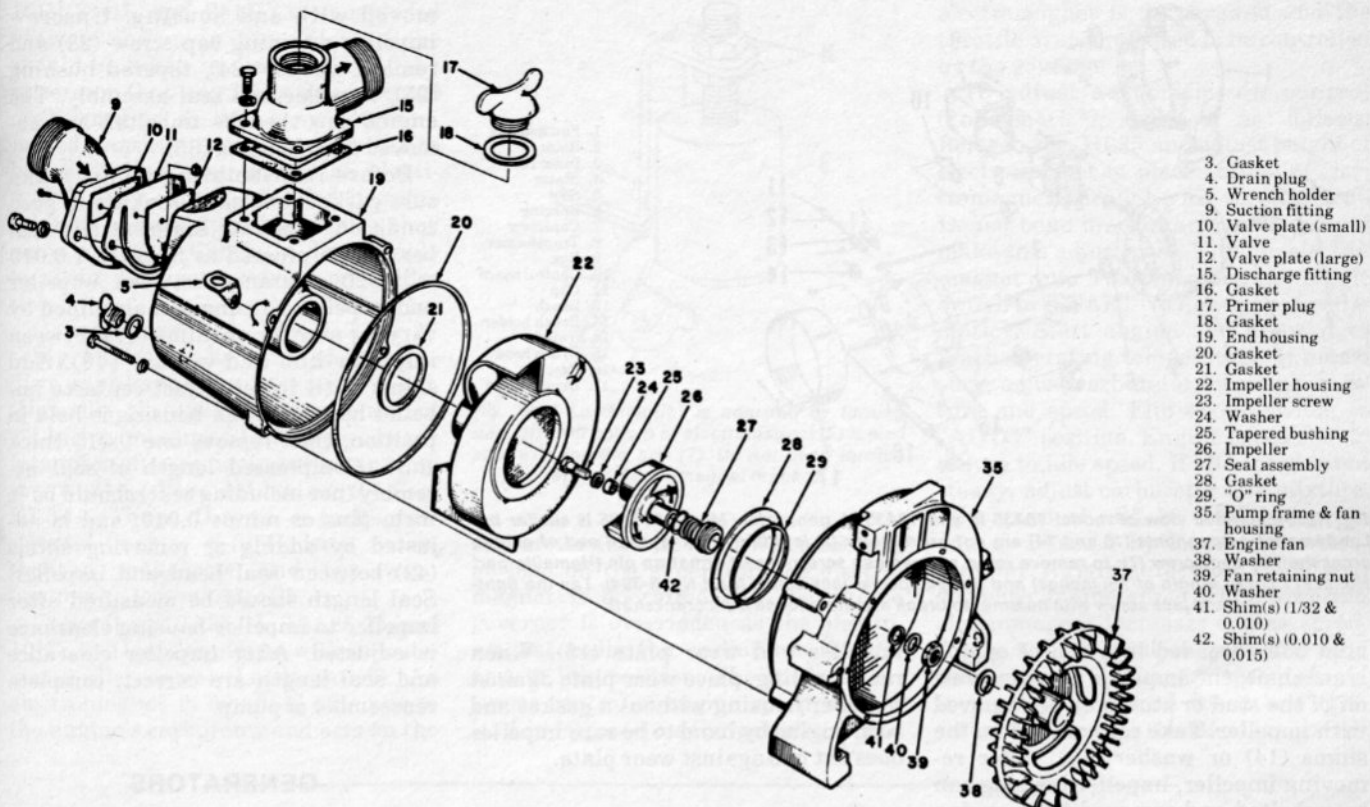


Fig. HL32—Exploded view of model 251TP3 pump assembly. Impeller screw (23) threads into end of engine crankshaft. Impeller is not solidly connected to engine crankshaft and can slip on tapered bushing (25) and end of crankshaft should a solid object become lodged between impeller and housing.

housing (20) and press shaft from housing. Remove crankshaft seal (21) and snap ring (23), then press bearing (22) from housing.

To assemble magneto end shaft and bearing assembly, proceed as follows: Install new seal (21) in housing with lip of seal towards crankcase side. Lubricate seal and insert shaft through seal and housing. Support flat inner end of shaft and press bearing (22) down over shaft and into housing until bearing inner race is seated against shoulder on shaft. Then, support housing and press bearing outer race into housing so that retaining snap ring (23) can be installed. Place spacer (24) on shaft, then drive or press governor back plate onto shaft against spacer. Install governor cup, spring, spring retainer and snap ring. Attach bearing housing to magneto housing with the two screws, then reinstall shaft, bearing housing and magneto housing to crankcase using new gasket.

CRANKSHAFT, OUTPUT END. First, remove magneto end crankshaft, bearing and magneto housing assembly as described in preceding paragraph. Remove cylinder and piston and connecting rod unit, then proceed as follows:

Remove the crankcase, output crankshaft end and blower rotor (fan) as an

assembly from pump or generator; refer to exploded views of pump and generator units shown in this section. Remove fan retaining nut and washer and the two crankshaft bearing retaining screws (87—Fig. HL27) and washers (88). Support magneto (open) end of crankcase, then press crankshaft (84) from fan and crankcase. Remove the three corks (99), if so equipped, from fan, insert jackscrews into the tapped holes and push bearing (97) from fan inner hub. Remove screws and reinstall corks. Corks keep threads clean but are not necessary for operation. Support outer race of bearing (89) and press shaft out of bearing. Remove spacer (96) and crankshaft seal (95) from crankcase.

To reassemble, proceed as follows: Press new seal into crankcase with lip towards inside (away from fan). Support outer hub of fan, then press new bearing (97) onto fan inner hub. Press new inner bearing (89) into crankcase with retaining groove in outer race properly positioned. Support bearing inner race with sleeve, then press crankshaft into bearing. Install bearing retaining screws and washers. Place spacer (96) in position on crankshaft, then carefully press fan onto shaft making sure that keys and keyways are aligned. Install fan retaining washer and nut securely. Complete

reassembly by installing connecting rod and piston, cylinder and magneto end assembly.

CRANKCASE. To renew crankcase, follow procedures as outlined in previous paragraph "CRANKSHAFT, OUTPUT END".

REED INTAKE VALVE. Engine is equipped with a pyramid reed valve assembly shown in Fig. HL21. The reed valve should be inspected whenever carburetor is removed. Refer to Fig. HL29 for inspection points. When installing new reeds on pyramid seat, thoroughly clean all threads and apply Loctite to threads on screws before installing. Be sure reeds are centered before tightening screws.

REWIND STARTER. Refer to Fig. HL30 for exploded view. In an emergency in case of rewind starter failure, engine can be started by removing starter and winding a rope around starter cup (1).

CENTRIFUGAL PUMP

Model 251S3

To remove pump from engine, remove end housing (22—Fig. HL31) taking care not to damage gaskets. Unscrew impeller clockwise by placing wrench on hex portion and striking wrench a sharp blow with hammer. Note: The impeller is mounted on a

- 3. Gasket
- 4. Drain plug
- 5. Wrench holder
- 9. Suction fitting
- 10. Valve plate (small)
- 11. Valve
- 12. Valve plate (large)
- 15. Discharge fitting
- 16. Gasket
- 17. Primer plug
- 18. Gasket
- 19. End housing
- 20. Gasket
- 21. Gasket
- 22. Impeller housing
- 23. Impeller screw
- 24. Washer
- 25. Tapered bushing
- 26. Impeller
- 27. Seal assembly
- 28. Gasket
- 29. "O" ring
- 35. Pump frame & fan housing
- 37. Engine fan
- 38. Washer
- 39. Fan retaining nut
- 40. Washer
- 41. Shim(s) (1/32 & 0.010)
- 42. Shim(s) (0.010 & 0.015)

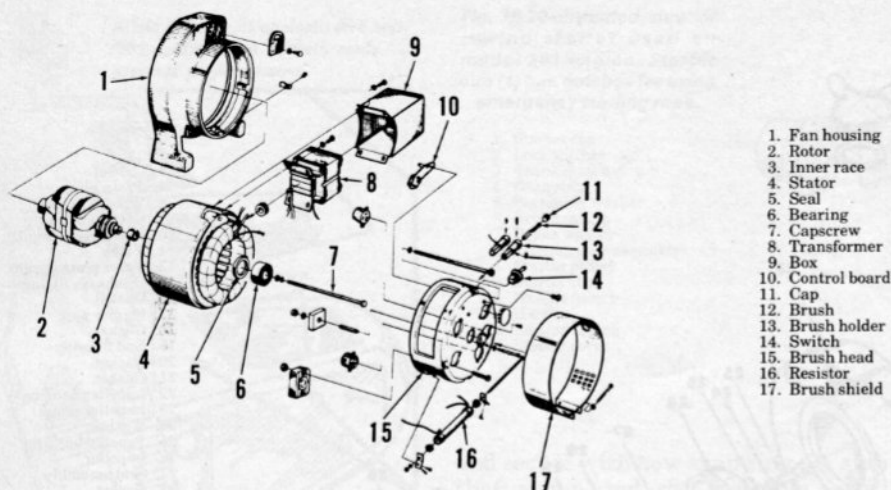


Fig. HL33—Exploded view of model 10A35-1L and 10A35-2L generator. Model 251A35 is similar but Loadomatic® components (10 and 14) are not used. Rotor (2) is retained on tapered end of engine crankshaft by cap screw (7); to remove rotor, remove cap screw, insert armature pin (Homelite part No. 22271 cut to length of 7 3/4 inches) and thread special jack screw (part No. S-394). Tap the tightened jack screw with hammer to break armature loose from crankshaft.

stud bolt threaded into end of engine crankshaft; the impeller may unscrew off of the stud or stud may be removed with impeller. Take care not to lose the shims (14) or washer (13). After removing impeller, impeller housing can be unbolted and removed from engine fan housing (5).

Before assembling pump, lubricate seal seat and seal head with oil and make sure gaskets are in good condition. Shims (14) are used as required to maintain minimum clearance between

impeller and wear plate (18). When reassembling, place wear plate against impeller housing without a gasket and turn engine by hand to be sure impeller does not rub against wear plate.

TRASH PUMP

Model 251TP3

Refer to Fig. HL32. To remove pump, first remove end housing (19) from pump body and fan housing (35). Remove impeller housing (22) if not re-

moved with end housing. Unscrew impeller retaining cap screw (23) and remove washer (24), tapered bushing (25), impeller and seal assembly. The engine can then be unbolted and removed from housing (35).

Before reassembling pump, make sure gaskets and shaft seal are in good condition, lubricate seal seat and seal head, then proceed as follows: A 0.010 to 0.020 clearance between impeller and impeller housing is maintained by varying number of shims (41) between impeller hub and washer (40). Add shims until impeller just contacts impeller housing when housing is held in position, then remove one 0.015 thick shim. Compressed length of seal assembly (not including seat) should be 7/8 inch, plus or minus 0.010, and is adjusted by adding or removing shims (42) between seal head and impeller. Seal length should be measured after impeller to impeller housing clearance is adjusted. After impeller clearance and seal length are correct, complete reassembly of pump.

GENERATORS

Models 10A35-1L, 10A35-2L, 10HY35-1L, 251A35 and 251HY35-1

Exploded view of model 10A35-1L, 10A35-2L and 251A35 generators is shown in Fig. HL33 and model

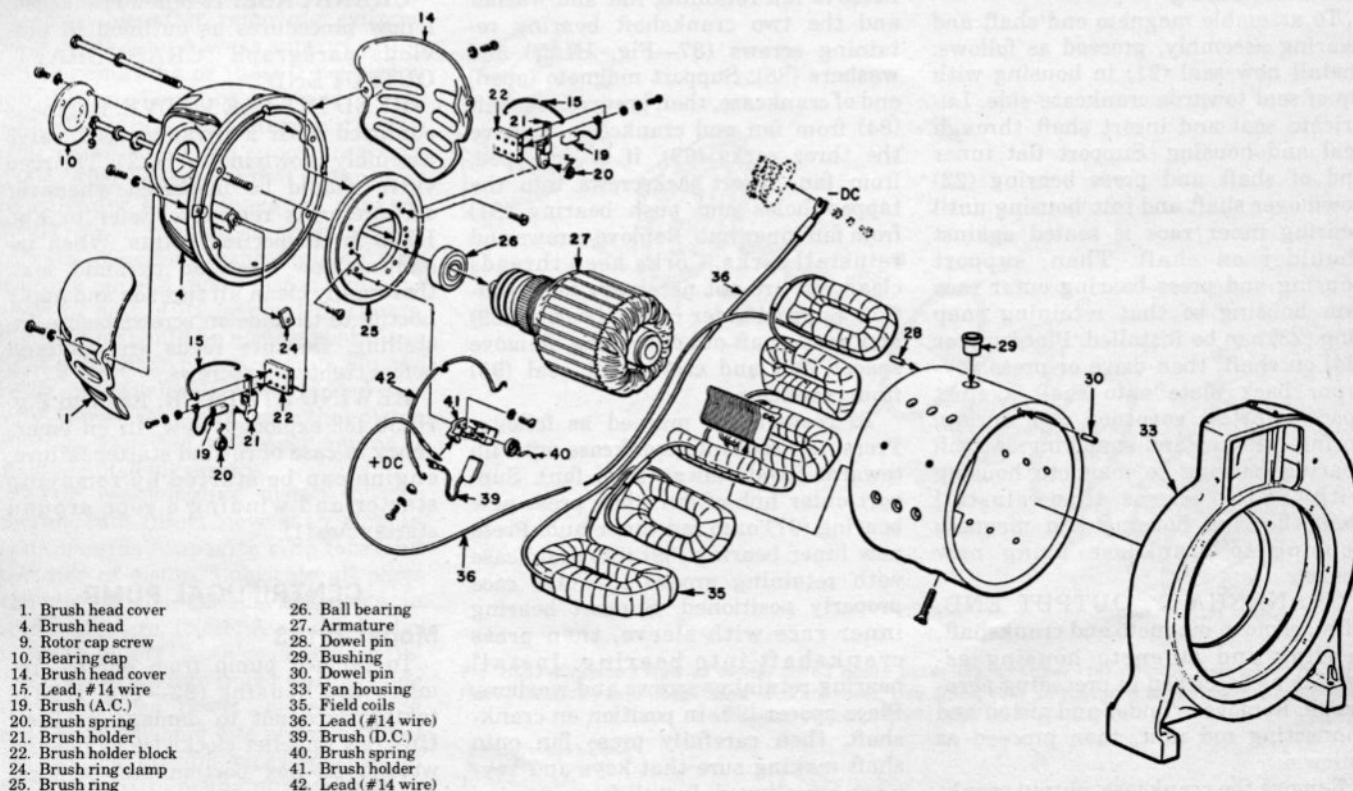


Fig. HL34—Exploded view of model 251HY35-1 generator assembly. Cap screw (9) retains generator rotor (27) to engine crankshaft.

10HY35-1L and 251HY35-1 exploded view is shown in Fig. HL34. Care should be taken in disassembly of the generator that any leads disconnected are identified so that they be reconnected properly. Also, if brushes are to be reinstalled, they should be identified so they can be installed in same location and position from which they were removed. Carefully disassemble to avoid damage to wiring or insulation.

Generator rotor (5—Fig. HL33 or 27—Fig. HL34) can be removed from engine crankshaft by inserting a pin (Homelite No. 22271 cut to a length of 7 $\frac{3}{4}$ inches measured from tapered end) into rotor after removing retaining cap screw (14—Fig. HL33 or 9—Fig. HL34). Then, thread a jackscrew (Homelite No. S-394) into rotor, tighten jackscrew and tap with hammer to loosen taper fit.

Generators 10A35-1L, 10A35-2L and 10HY35-1L are equipped with an automatic idle control (Loadamatic®). An electromagnet is mounted adjacent to the engine's carburetor and acts on the

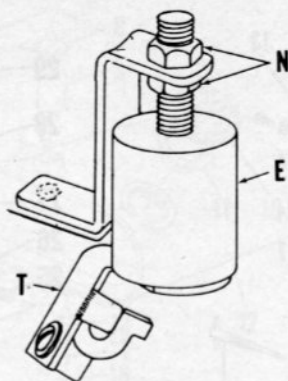


Fig. HL35—Loadamatic® is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

carburetor throttle arm. When there is no load on the generator, the electromagnet is energized and the engine governor is overridden as the electromagnet pulls the carburetor throttle arm to idle position. The governor resumes control of engine speed when a load is imposed on the generator. The

electromagnet is deenergized and the throttle arm is released to be controlled by the governor.

To adjust automatic idle control (Loadamatic®), proceed as follows: Refer to Fig. HL35 and adjust height of electromagnet to place bottom of electromagnet parallel with throttle arm. Do not bend bracket or throttle arm to make this adjustment. Tighten electromagnet nuts. Position generator toggle switch to "START" to disengage Loadamatic®. Start engine and allow it to reach operating temperature. If necessary, adjust carburetor for proper mixture and speed. Flip toggle switch to "AUTO" position. Engine speed should reduce to idle speed. If idle speed is not steady, adjust carburetor idle mixture. Idle speed should be 2400-2600 rpm and is adjusted by loosening electromagnet. Raising electromagnet will decrease engine speed while lowering electromagnet increases engine speed. Apply a light load to generator and then remove it. Engine speed should increase to governed speed and then return to idle after the load is removed.



A **Textron** DIVISION, PORT CHESTER, N. Y. 10573

Model	Bore Inches	Stroke Inches	Displ. Cu. In.
8	2 $\frac{3}{4}$	2 $\frac{1}{2}$	12.62
9	2 $\frac{3}{4}$	2 $\frac{1}{2}$	12.62
20	2 $\frac{3}{4}$	1 $\frac{1}{2}$	6.63
23	2 $\frac{1}{4}$	2 $\frac{1}{2}$	8.45
24	2 $\frac{3}{4}$	2 $\frac{1}{2}$	11.50
35	2-7/16	1 $\frac{1}{2}$	7.0
36	2 $\frac{1}{4}$	2 $\frac{1}{2}$	8.45

MAINTENANCE

This section covers Homelite 2-cycle engines used on various pumps and generators. The unit model number (such as pump model number 8S3-1 or generator model 9A115-1) also indicates engine model number (which would be model 8 and model 9 respectively). The pump or generator must be at least partially disassembled to perform certain engine service operations.

CAUTION: Centrifugal type pumps should not be operated without water in pump. Water is necessary for lubrication of the pump seal while engine is running. Cap suction side of pump and fill pump with water before starting engine when pump is assembled.

SPARK PLUG. Recommended spark plug for all except 36S2 and 8S3-1 pumps is Champion HO-8A or UJ-11-G. Models 36S2 and 8S3-1 require a Champion UJ-22 spark plug. Model J6 or J6J Champion plugs can be substituted for HO-8A or UJ-11-G; but will be more susceptible to fouling and electrode erosion. Electrode gap for all models should be 0.025.

CARBURETORS. Tillotson Series MD and MT float type carburetors and Homelite carburetors have been used;

refer to appropriate exploded view in Fig. HL40 or Fig. HL41, or to the cross-sectional view in Fig. HL43.

On some models, flow from fuel tank to carburetor is by gravity with tank mounted above carburetor. With Tillotson carburetors and fuel tank mounted below carburetor, a diaphragm type fuel pump is used as shown in Fig. HL42. On models equipped with Homelite carburetor, fuel tank is pressurized.

On all carburetors, clockwise rotation of fuel mixture adjustment needles leans the mixture. NOTE: Later models with MT carburetor are not equipped with a throttle disc or shaft.

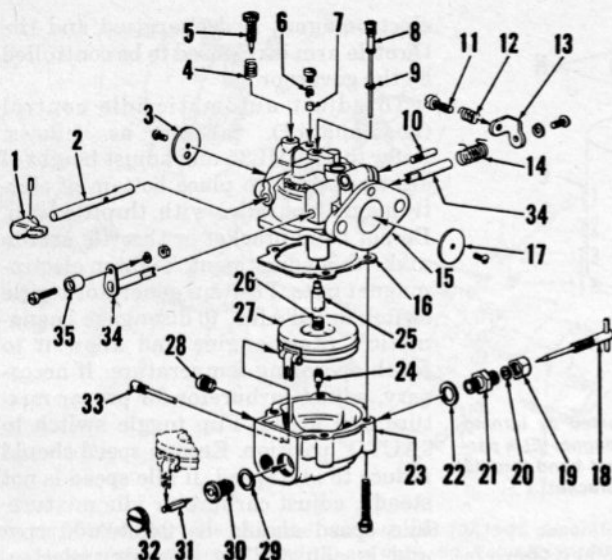


Fig. HL40—Exploded view of typical Tillotson Series MD carburetor as used on some Homelite pump models.

- | | | |
|-----------------------|----------------------------|------------------------|
| 1. Choke lever | 13. Throttle stop lever | 25. Main nozzle |
| 2. Choke shaft | 14. Throttle return spring | 26. Main nozzle plug |
| 3. Choke disc | 15. Carburetor body | 27. Float |
| 4. Spring | 16. Gasket | 28. Bowl drain plug |
| 5. Idle fuel screw | 17. Throttle disc | 29. Gasket |
| 6. Spring | 18. Main fuel needle | 30. Inlet valve seat |
| 7. Choke friction pin | 19. Packing nut | 31. Inlet valve needle |
| 8. By-pass tube | 20. Packing | 32. Plug |
| 9. Gasket | 21. Packing gland | 33. Float pin |
| 10. Throttle stop pin | 22. Gasket | 34. Throttle shaft |
| 11. Idle speed screw | 23. Fuel bowl | 35. Roller |
| 12. Spring | 24. Fuel bowl plug | |

Normal idle needle (5—Fig. HL40) setting for Tillotson MD carburetors is $\frac{1}{4}$ -turn open; main (high speed) needle (18) setting is $1\frac{1}{4}$ - $1\frac{1}{2}$ turns open. Float setting with fuel bowl assembly held in upside down position should be $\frac{1}{32}$ -inch from the lowest point of float at free end, to rim of fuel bowl.

Normal idle needle (23—Fig. HL41) setting for Tillotson MT carburetors is $\frac{3}{4}$ -turn open; main (high speed) needle (14) setting is 1-turn open. Float setting, with the float bowl cover assembly (2) inverted, should be $1\frac{13}{32}$ -inch as measured from the top of the float (20) to the gasket surface of the float bowl cover.

Normal mixture adjustment needle (32—Figs. HL43 and HL44) setting for the Homelite carburetor is $1\frac{1}{2}$ turns open. Carburetor operates by pressurizing the fuel tank and loss of tank pressure will prevent carburetor from operating properly.

GOVERNOR. All are equipped with rotary type inlet valves. The governor is a centrifugal type and is an integral part of the rotary inlet valve as indicated in Fig. HL45. On models so equipped, Formica wear plate (15—Fig. HL50) is pinned to the engine crankcase with opening in wear plate in register with intake opening in crankcase. On all models, the inlet opening in the valve plate (IV—Fig. HL45) is controlled by the combination

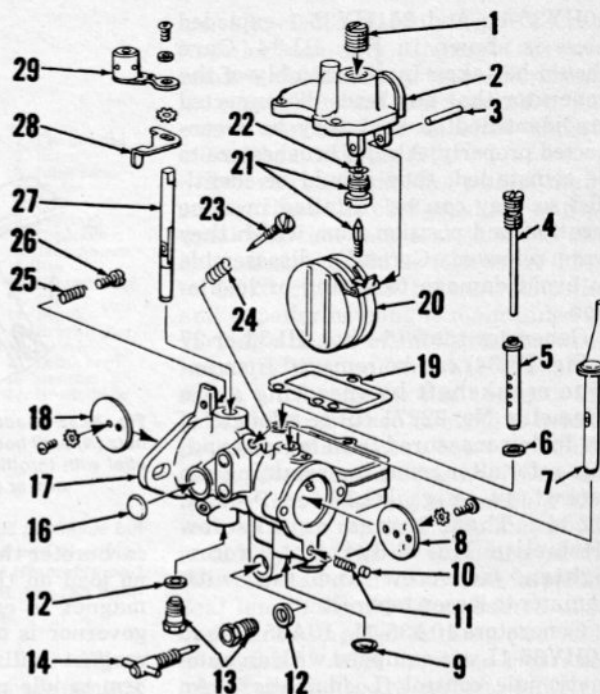


Fig. HL41—Exploded view of typical Series MT Tillotson float type carburetor as used on some Homelite pump and generator models.

- | | | |
|------------------------|----------------------|-----------------------|
| 1. Pipe plug | 11. Spring | 21. Inlet valve assy. |
| 2. Float bowl cover | 12. Gasket | 22. Gasket |
| 3. Float pin | 13. Packing nut | 23. Idle fuel needle |
| 4. By-pass tube | 14. Main fuel needle | 24. Spring |
| 5. Main nozzle | 15. Expansion plug | 25. Idle stop screw |
| 6. Gasket | 16. Carburetor body | 26. Throttle disc |
| 7. Choke shaft | 17. Throttle shaft | 27. Throttle lever |
| 8. Choke disc | 18. Gasket | |
| 9. Expansion plug | 19. Float | |
| 10. Choke friction pin | | |

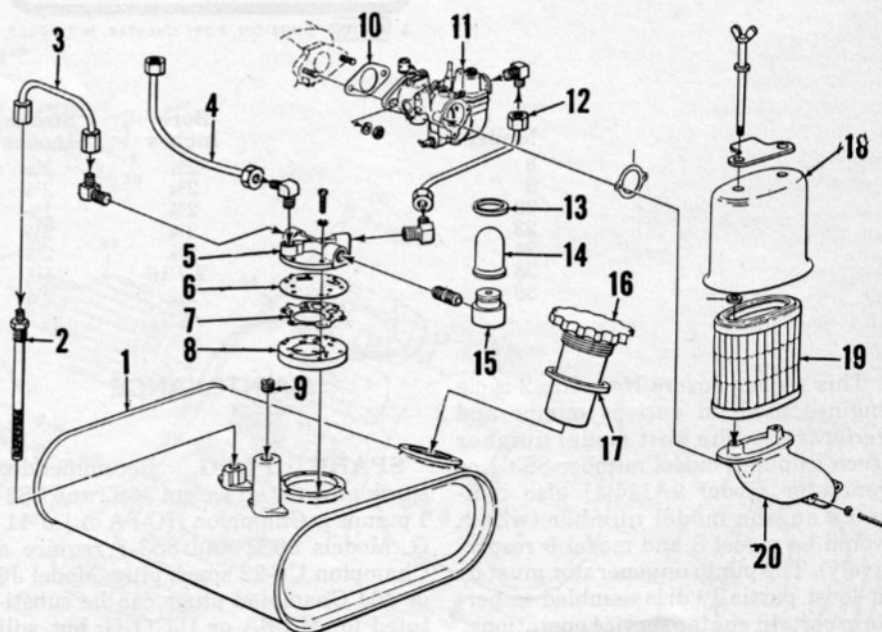


Fig. HL42—Exploded view of fuel system on models using Tillotson float type carburetor. Exploded view of carburetor is shown in Fig. HL41. Actuating primer bulb (14) will pump fuel into carburetor float bowl.

- | | | | |
|----------------------|--------------------|----------------------|-----------------------|
| 1. Fuel tank | 6. Pump diaphragm | 11. Carburetor assy. | 16. Filler cap |
| 2. Fuel filter | 7. Gasket | 12. Fuel line | 17. Gasket |
| 3. Pump suction line | 8. Diaphragm cover | 13. Ring | 18. Air cleaner cover |
| 4. Pump pulse line | 9. Pipe plug | 14. Priming bulb | 19. Element |
| 5. Pump body | 10. Gasket | 15. Adapter | 20. Adapter |

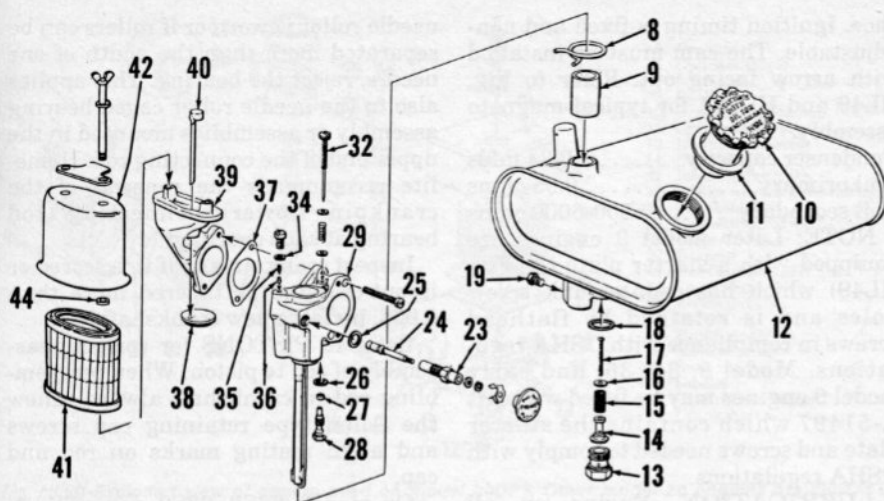


Fig. HL43—Exploded view of fuel system on models equipped with Homelite carburetor. Refer to Fig. HL44 for cross-sectional views of carburetor assembly. Fuel tank is pressurized to force fuel upward into carburetor.

- | | | | |
|--------------------|--------------------|---------------------|----------------------|
| 8. Hose clamps | 16. Washer | 27. Sleeve | 37. Gasket |
| 9. Adapter hose | 17. Screw | 28. Jet | 38. Carburetor cover |
| 10. Fuel cap | 18. Gasket | 29. Carburetor body | 39. Adapter |
| 11. Gasket | 19. Drain plug | 32. Fuel needle | 40. Vent tube |
| 12. Fuel tank | 23. Plunger tube | 34. Gasket | 41. Filter element |
| 13. Filter plug | 24. Primer plunger | 35. Spring | 42. Air filter cover |
| 14. Filter adapter | 25. Gasket | 36. Priming valve | 44. Washer |
| 15. Screen | | | |

shutter and governor weight (GW) which when the engine is stationary, is held in the open position by spring (GS). When engine speed exceeds the designed limit, centrifugal force acting on the weight overcomes the opposing spring pressure and partially covers the manifold opening and thus throt-

tles the engine. As the throttled engine slows down, centrifugal force diminishes and the spring again uncovers the opening to restore engine speed.

GOVERNOR ADJUSTMENT. On later production engines equipped with adjustable governor (Fig. HL45) or on earlier engines in which adjustable

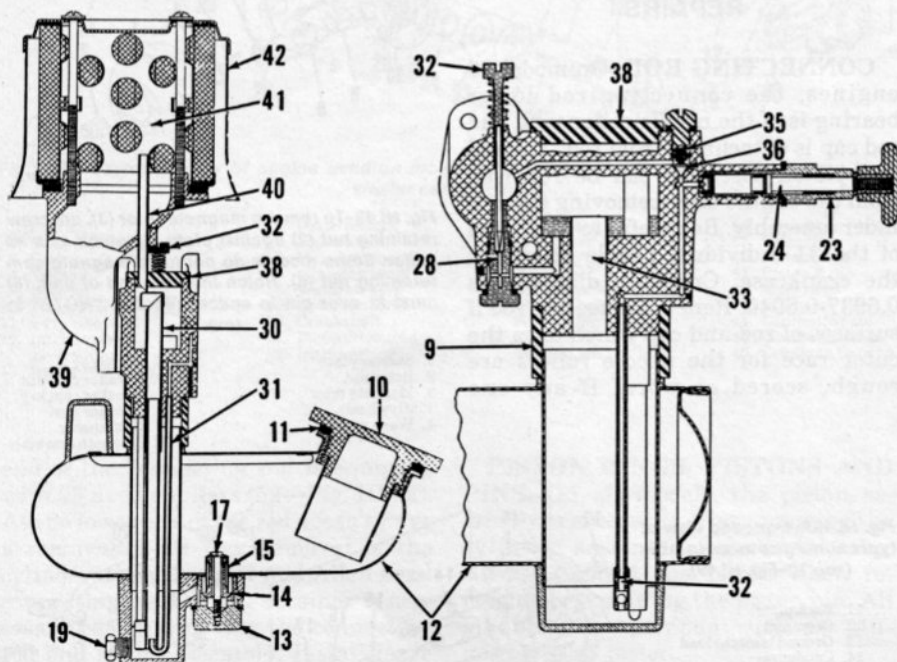


Fig. HL44—Cross-sectional view of Homelite carburetor. Refer to Fig. HL43 for additional legend and exploded view of complete fuel system.

- | | |
|--------------------------------|-------------------|
| 3. Priming tube and foot valve | 31. Pressure tube |
| 30. Feed tube | 33. Overflow tube |

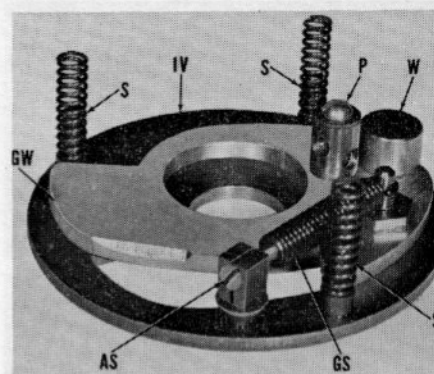


Fig. HL45—View of late production rotary inlet valve and governor assembly. Early production units did not have adjusting screw (AS) and engine governed speed was non-adjustable.

- | | |
|-----------------------------------|------------------------|
| AS. Adjusting screw | IV. Intake valve plate |
| GS. Governor spring | P. Pivot post |
| GW. Governor weight & plate assy. | S. Springs |
| | W. Weight |

governor has been installed, engine governed speed may be adjusted as follows:

First, bring engine to normal operating temperature and adjust carburetor for highest speed and best performance obtainable. Then, on model 35 engine, remove drain petcock (DP—Fig. HL46) on muffler side of front-half crankcase; on models 8, 9 and 9-A, disconnect pulse line (L—Fig. HL47) (above drain petcock) and unscrew the 90° elbow (E); or, on model 20 engine, remove slotted head brass plug (P—Fig. HL48) in front half of crankcase.

Turn adjusting screw (AS—Fig. HL45) clockwise to increase no-load speed, or counterclockwise to decrease no-load speed as required. One turn of the adjusting screw will change engine no-load governed speed approximately 100 RPM. Accurately adjust generator engine no-load speed to 3750 RPM.

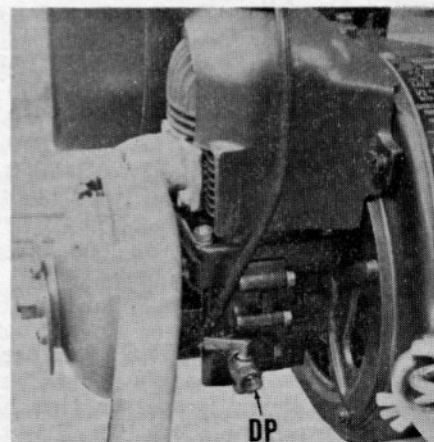


Fig. HL46—Governor adjusting screw (see Fig. HL45) is accessible on model 35 engines after removing drain petcock (DP).

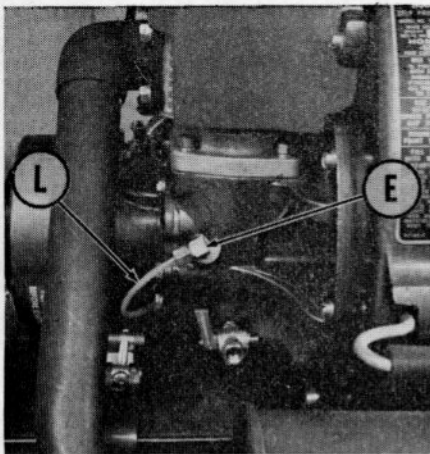


Fig. HL47—On engine models 8 and 9, governor adjusting screw (see Fig. HL45) is accessible after removing pulse line (L) and elbow (E).

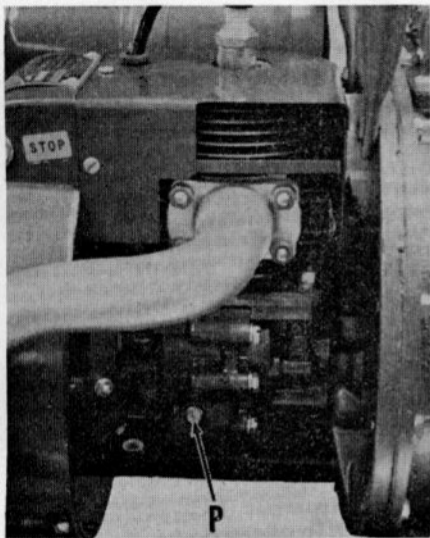


Fig. HL48—On engine model 20, governor adjusting screw (see Fig. HL45) is accessible after removing slotted head plug (P).

Recommended no-load engine governed RPM for the various pump applications is as follows:

Pump Model	No-Load RPM
20S1½-1A	3900-4000
20DP-3	2850-2950
35S2-1	2850-2950
8S3-1, 9S3-1	2850-2950
8S3-1P, 9S3-1P	4200-4300*
36S2	2650-2750
All other pumps	3800-3900

*3850 RPM at 60 psi pump pressure

IGNITION & TIMING. Breaker point gap on all models should be 0.020. Gap should be measured when breaker arm rub block is ¼-inch past breaking edge of cam.

Breaker spring tension should be 14-21 oz. as measured at center of breaker

shoe. Ignition timing is fixed and non-adjustable. The cam must be installed with arrow facing out. Refer to Fig. HL49 and HL49A for typical magneto assembly.

Condenser capacity 0.34 mfd
Coil primary 0.95 ohms
Coil secondary 5500-6000 ohms

NOTE: Later model 9 engines are equipped with a starter plate (1—Fig. HL49) which has countersunk screw holes and is retained by flathead screws in compliance with OSHA regulations. Model 8, 35, 36, and early model 9 engines may be fitted with Kit A-51497 which contains the starter plate and screws needed to comply with OSHA regulations.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used. Note: A fuel:oil ratio of 32:1 should be used on diaphragm pump models regardless of whether Homelite® Premium SAE 40 or Homelite® 2-Cycle SAE 30 oil is used.

CLEANING CARBON. Carbon deposits should be cleaned from the exhaust ports and muffler at regular intervals. When scraping carbon be careful not to damage the finely chamfered edges of the exhaust ports.

REPAIRS

CONNECTING ROD. On model 20 engines, the connecting rod lower bearing is of the needle roller type and rod cap is detachable from rod. The rod and piston assembly can be removed from the engine after removing the cylinder assembly. Be careful to avoid loss of the 31 individual needle rollers in the crankcase. Crankpin diameter is 0.6937-0.6940. Renew connecting rod if surfaces of rod and cap which form the outer race for the needle rollers are rough, scored or worn. If any one

needle roller is worn or if rollers can be separated more than the width of one needle, reject the bearing. This applies also to the needle roller caged bearing assembly or assemblies mounted in the upper end of the connecting rod. Homelite recommends the renewal of the crankpin (lower) connecting rod bearing at each overhaul.

Inspect crankpin and if it is scored or is out-of-round or tapered more than 0.001, install a new crankshaft.

Refer to PISTONS for correct reassembly of rod to piston. When reassembling rod to crankshaft always renew the Allen type retaining cap screws and align mating marks on rod and cap.

On models 36S2, 23S2, some 8S3-1, 8S3-1P and 8S3-1R and all 9S3-1, 9S3-1P and 9S3-1R (Refer to 42—Fig. HL52), the connecting rod lower bearing is of the double track ball bearing type. To remove the connecting rod, it is necessary to remove the cylinder, timer bracket and the connecting rod retaining Allen head screw (43); then, with the use of special pullers, remove the connecting rod and bearings. Renew bearing if it feels lumpy when rotated or has perceptible wear.

On models 24S3, 24S3-1P and some 8S3-1, 8S3-1P and 8S3-1R, the lower

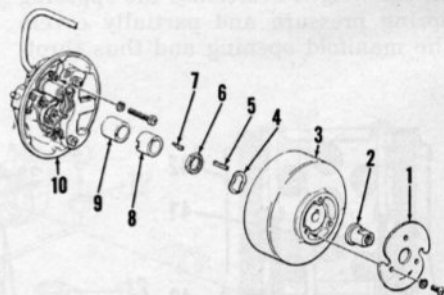
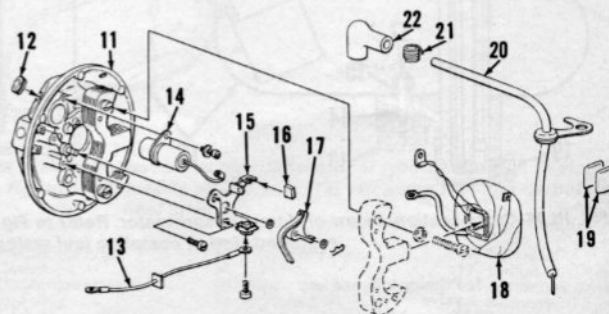


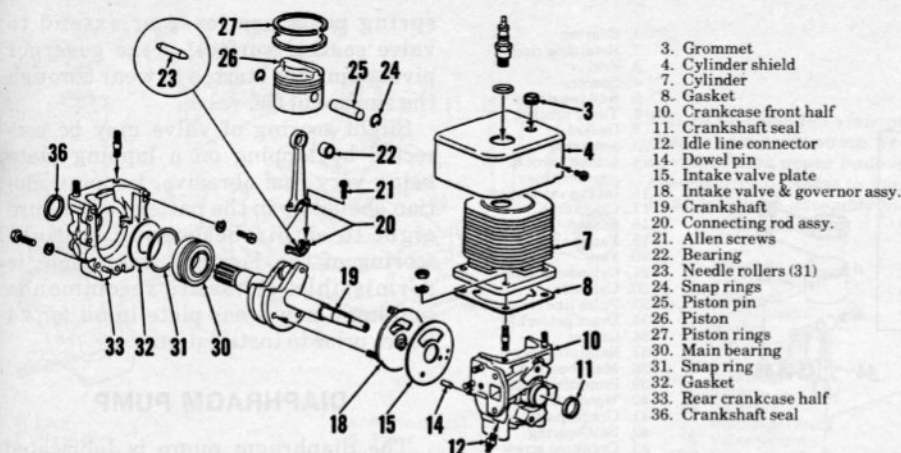
Fig. HL49—To remove magneto rotor (3), unscrew retaining nut (2) against plate (1) which acts as puller. Some models do not have magneto cam retaining nut (6). Notch in inner end of cam (8) must fit over pin in spacer (9). See "NOTE" in text.

- | | |
|-----------------------------|----------------------|
| 1. Starter plate | 5. Rotor key |
| 2. Rotor nut | 6. Breaker cam nut |
| 3. Magneto rotor (flywheel) | 7. Breaker cam key |
| 4. Wave washer | 8. Breaker cam |
| | 9. Cam spacer |
| | 10. Magneto assembly |

Fig. HL49A—Exploded view of typical magneto assembly (see 10—Fig. HL49).

- | |
|--------------------------|
| 11. Back plate |
| 12. Grommet |
| 13. Ground (switch) lead |
| 14. Condenser |
| 15. Breaker point base |
| 16. Cam wiper felt |
| 17. Breaker point arm |
| 18. Ignition coil |
| 19. Coil wedges |
| 20. Spark plug wire |
| 21. Terminal |
| 22. Spark plug boot |





3. Grommet
4. Cylinder shield
7. Cylinder
8. Gasket
10. Crankcase front half
11. Crankshaft seal
12. Idle line connector
14. Dowel pin
15. Intake valve plate
18. Intake valve & governor assy.
19. Crankshaft
20. Connecting rod assy.
21. Allen screws
22. Bearing
23. Needle rollers (31)
24. Snap rings
25. Piston pin
26. Piston
27. Piston rings
30. Main bearing
31. Snap ring
32. Gasket
33. Rear crankcase half
36. Crankshaft seal

Fig. HL50—Exploded view of engine used on model 20DP3. Other model 20 engines are similar in construction.

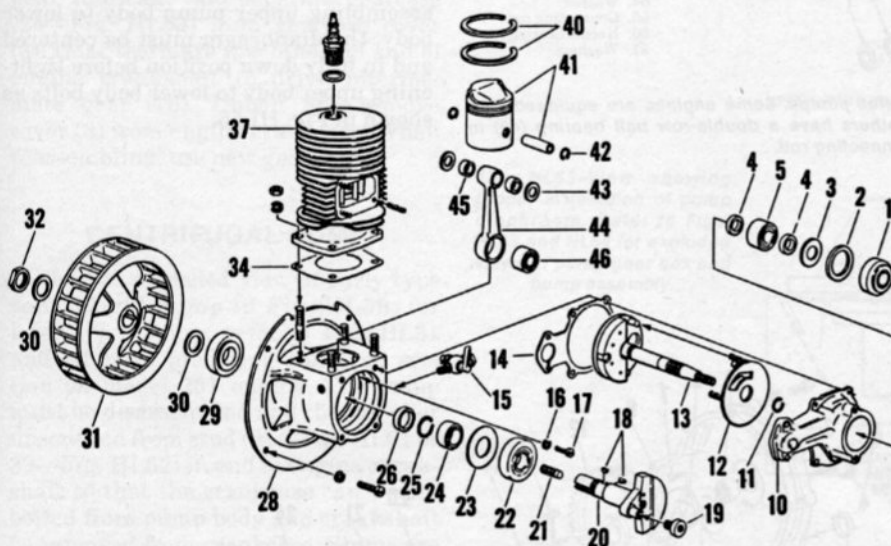


Fig. HL51—Exploded view of engine used on model 36S2 pump; engine used on 23S2 pump is of similar construction.

- | | | | |
|-----------------------------------|----------------------------------|-----------------|----------------------|
| 1. Bearing | 15. Drain petcock | 23. Gasket | 34. Gasket |
| 2. Seal retaining ring | 16. Lockwasher | 24. Spacer | 37. Cylinder |
| 3. Seal | 17. Main bearing retaining screw | 25. Snap ring | 40. Piston rings |
| 4. Spacers | 18. Woodruff keys | 26. Spacer | 41. Piston & pin |
| 5. Bearing | 19. Crankpin screw | 28. Crankcase | 42. Snap rings |
| 10. Timer bracket | 20. Crankshaft | 29. Fan bearing | 43. Washers |
| 11. Snap ring | 21. Pump drive stud | 30. Washer | 44. Connecting rod |
| 12. Intake valve & governor assy. | 22. Main bearing | 31. Fan | 45. Needle bearings |
| 13. Intake valve shaft | | 32. Fan nut | 46. Crankpin bearing |

end of the connecting rod is equipped with 25 needle rollers (52—Fig. HL52). As the lower end of the rod doesn't have a removable rod cap, removal of the cylinder, timer bracket and Allen head connecting rod bearing retainer is necessary before removing the connecting rod and piston assembly. Install large washer (54) with tapered side of hole toward pump and small washer (51) with tapered side toward inlet valve. Race (53) should be heated to 180° F. to aid in assembling to crankpin.

PISTON RINGS, PISTONS AND PINS. On all models, the piston assembly is accessible after removing the cylinder assembly from crankcase. Always support the piston when removing or installing the piston pin. All models are equipped with an aluminum alloy piston.

Piston ring end gap should be 0.105 to 0.115 on piston with ring locating pin and 0.008 to 0.020 on models with unpinned rings. Side clearance of piston ring in groove should be 0.0025-

0.004. Clearance between piston skirt and cylinder bore, measured at right angle to piston pin, should be 0.002-0.005 on models with 2 1/4 inch bore and 0.004-0.007 on other models.

On all models, reject the pin and the piston if there is any visible up and down play of pin in the piston bosses. Neither the piston nor the pin are available separately.

Install new needle roller bearing assemblies to upper end of connecting rod if any of the rollers have slight flat spots or are pitted. Do likewise if rollers can be separated more than the thickness of one roller.

Inspect piston for cracks and for holes in dome of same and reject if any are found. Slight scoring of piston walls is permissible, but if rough surfaces are accompanied by a deposit of aluminum on cylinder walls, reject the piston. Refer to CYLINDER for methods of removing such deposits.

If piston ring locating pins in piston grooves are worn to half their normal thickness, reject the piston.

When piston and rings unit is assembled to connecting rod, the side of the piston which has the piston ring locating pins should be on the intake (away from exhaust side) side of the cylinder. Always use new piston pin retaining snap rings when reassembling piston to connecting rod. All wearing parts of the engine are supplied as replacements in standard size only.

CYLINDER. Cylinder bore is chrome plated. Inspect chrome bore for excessive wear and damage to chrome surface of bore. A new cylinder must be installed if chrome is scored, cracked or the base metal underneath exposed.

CRANKSHAFT, BEARINGS AND SEALS. If shaft has damaged threads or enlarged keyways or if run out exceeds 0.003, reject the shaft. Journals for roller type bearings must be free of pits, galling or heavy score marks. If they are out of round or worn more than 0.001 reject the shaft.

If any needle roller shows wear or any visible flat spot, or if rollers can be separated more than the width (or diameter) of one roller, reject all of the rollers. If annular ball bearing feels "lumpy" when rotated, or has perceptible wear, reject the bearing.

Suitable pullers, pushers and mandrels (available from Homelite) should be used in removing and installing main and connecting rod bearings.

Crankshaft seals must be maintained in first class condition because crankcase compression leakage through seals causes a loss of power.

Centrifugal pumps must be disassembled to remove crankshaft from

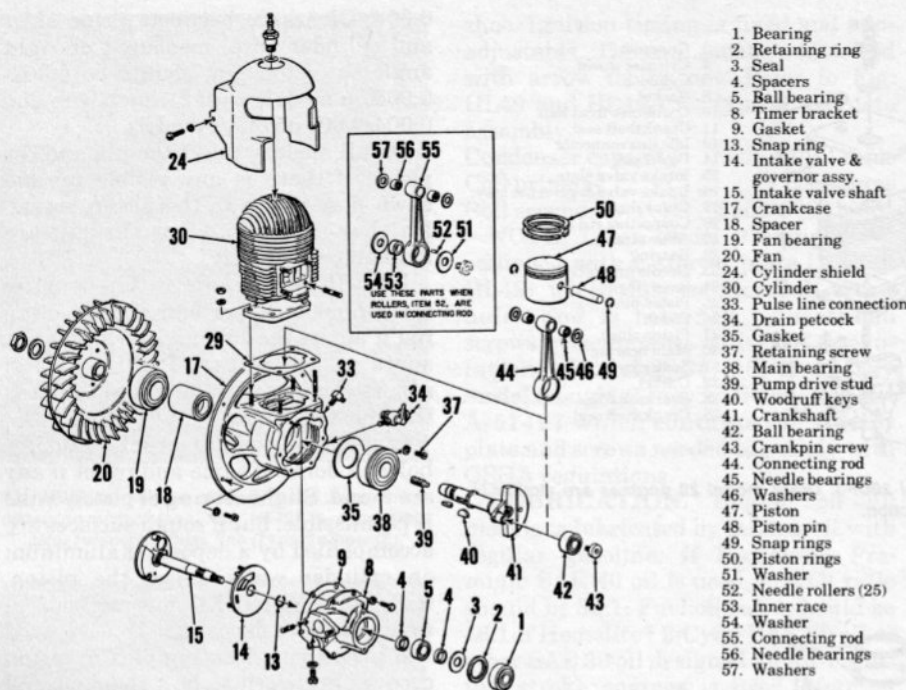


Fig. HL52—Exploded view of engine used on 8S3 series pumps. Some engines are equipped with needle roller crankpin bearings (see inset) while others have a double-row ball bearing (42) in crankpin end of connecting rod.

crankcase; refer to CENTRIFUGAL PUMPS paragraph.

CRANKCASE. Be sure that all passages through the crankcase are clean. This is especially true of the idle passage line (in the front half crankcase) which enters the crankcase via the intake valve register. This passage is sometimes restricted by carbon deposits which can be cleaned with a piece of wire. The same holds true of the passage for the fuel tank pressure line (on models with pressurized fuel tank) or the actuator line on pump equipped engines.

If main bearing bores are worn, indicating that the bearing has been turning in the crankcase, the bearing and/or the crankcase should be rejected. On models so constructed, the mating surfaces of two-piece crankcase (Fig. HL50) must be free of all nicks and burrs as neither sealing compound nor gaskets are used at this joint.

Always use new bearing seals when reassembling engine.

ROTARY VALVE. The combination rotary type inlet valve and governor (Fig. HL45) should be rejected if any of the following conditions are encountered during inspection:

The sealing faces of valve are scored or worn enough to produce a ridge; if

spring posts are loose or extend to valve seating surface; if the governor pivot point has started to wear through the surface of the valve.

Slight scoring of valve may be corrected by lapping on a lapping plate using very fine abrasive. Lapping motion should be in the pattern of a figure eight to obtain best results. Slight scoring of the Formica wear plate is permissible. Homelite recommends soaking a new wear plate in oil for 24 hours prior to installation.

DIAPHRAGM PUMP

The diaphragm pump is lubricated by filling gearcase to level of plug (25—Fig. HL53) with SAE 90 gear lubricant and by greasing pump rod upper bearing once a month with pressure gun through fitting in upper end of rod.

When installing new diaphragm or assembling upper pump body to lower body, the diaphragm must be centered and in fully down position before tightening upper body to lower body bolts as shown in Fig. HL55.

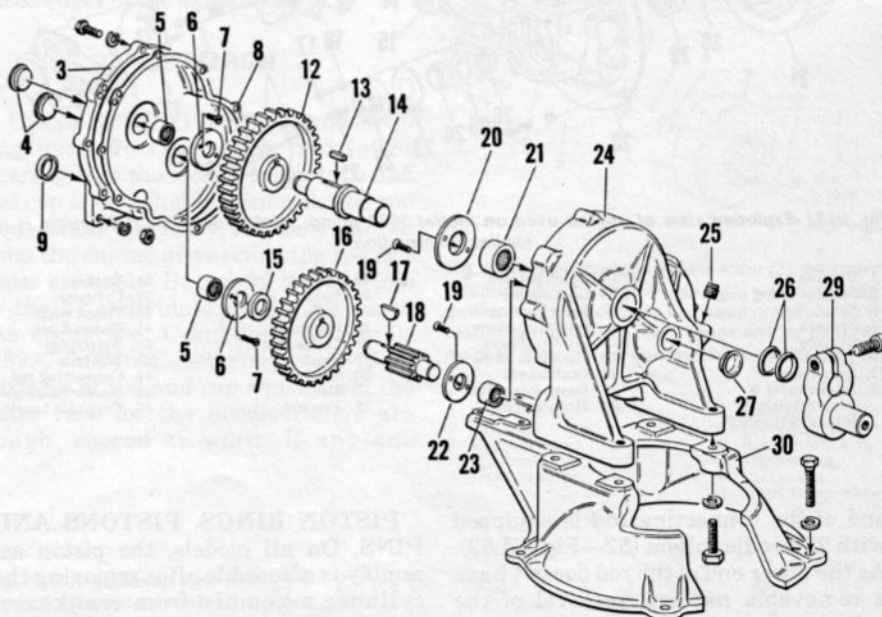


Fig. HL53—Exploded view of drive gear case for diaphragm type pump; refer to Fig. HL54 for exploded view of the pump assembly. Pinion machined on rear end of engine crankshaft engages the intermediate gear (16); pinion on shaft (18) drives crank gear (12). Guard A-51135 is available to cover pump rod and crank.

- | | | | |
|--------------------|-----------------------|------------------------|---------------------|
| 3. Gear case cover | 12. Pump crank gear | 18. Intermediate shaft | 24. Gear case |
| 4. Bearing caps | 13. Key | 19. Retainer screws | 25. Filler plug |
| 5. Needle bearings | 14. Pump crank shaft | 20. Thrust washer | 26. Seals |
| 6. Thrust washers | 15. Spacer | 21. Needle bearing | 27. Bearing cap |
| 7. Retainer screws | 16. Intermediate gear | 22. Thrust washer | 29. Pump crank |
| 8. Gasket | 17. Woodruff key | 23. Needle bearing | 30. Pump upper body |
| 9. Crankshaft seal | | | |

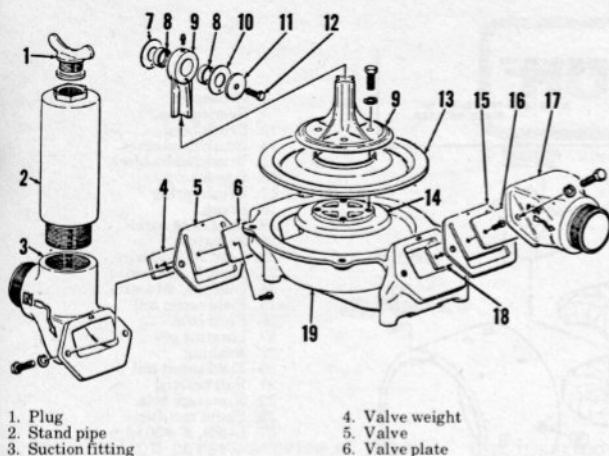


Fig. HL54—Exploded view of diaphragm type pump assembly. Pump upper body is (30—Fig. HL53). Refer to Fig. HL55 for pump assembly information.

7. Thrust washer
8. Needle bearings
9. Pump rod
10. Thrust washer
11. Washer
12. Cap screw
13. Pump diaphragm
14. Diaphragm cap
15. Valve
16. Valve plate
17. Discharge fitting
18. Valve weight
19. Pump lower body

To remove pump from engine, drain gear lubricant and separate gearcase (24—Fig. HL53) from gearcase cover (3). Gear teeth are machined on end of engine crankshaft to drive intermediate gear (16). Unbolt and remove cover (3) from engine crankcase. When reassembling, use new gasket (8).

CENTRIFUGAL PUMP

Refer to exploded view of early type centrifugal pump in Fig. HL56; for later type pumps, refer to Fig. HL31 and HL32 in preceding Homelite section on model 251 engine. The pump must be disassembled and the impeller unscrewed from stud (21—Fig. HL51 or 39—Fig. HL52) in end of engine crankshaft so that the crankcase can be unbolted from pump body and crankshaft be removed from crankcase. Shims are used between impeller and end of crankshaft to maintain minimum clearance between impeller and wear plate (10—Fig. HL56); two shims are normally used. Remove shims if impeller rubs against wear plate when reassembling engine.

If necessary to renew pump seals, proceed as follows: Apply a thin coat of shellac to plain side of ceramic ring (15) and press new washer (16) against ring. Then, apply a thin coat of shellac on washer and press the washer and ceramic ring, washer side in, against and into recess of pump body. Slide seal (14) over hub of impeller with hy-car side of seal towards impeller. Thread impeller onto stud that is screwed into end of crankshaft.

Place the assembled impeller housing (9, 10 and 12) over impeller and in proper engagement with pin (18), press against housing and turn engine. If impeller rubs, remove im-

Fig. HL55—View showing proper installation of pump diaphragm. Refer to Figs. HL53 and HL54 for exploded views of pump gear box and pump assembly.

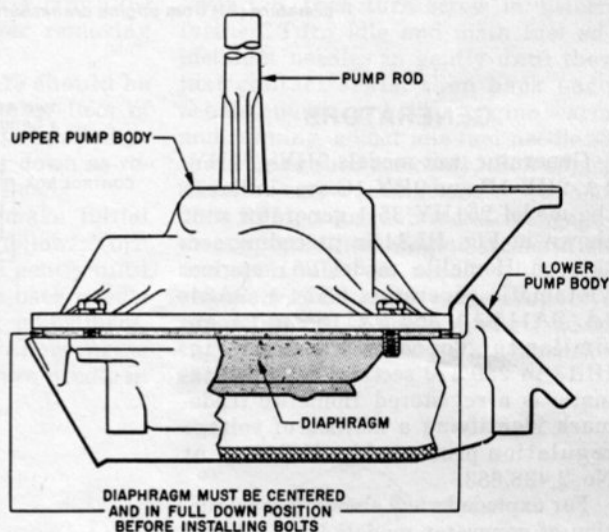
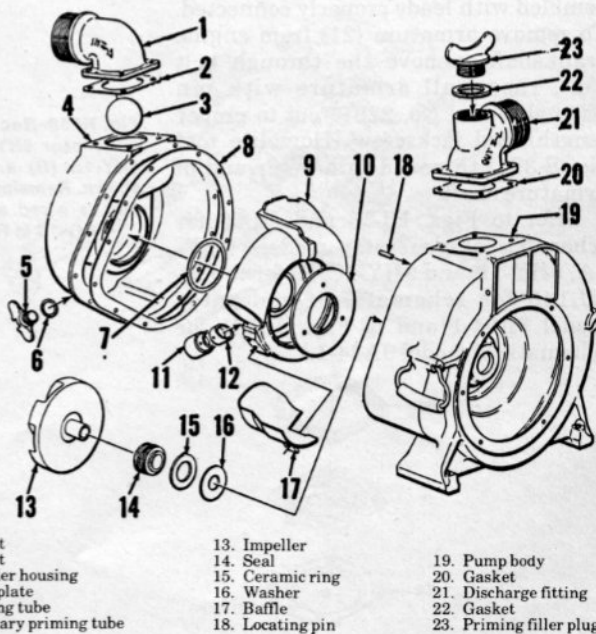


Fig. HL56—Exploded view of early type centrifugal type pump assembly. Pump impeller (13) is mounted on engine crankshaft. Pump seals (14, 15 & 16) are the later ceramic type; earlier pumps with rubber seal may be converted by installing new impeller (13). Refer to Figs. HL31 and HL32 in preceding section for views of later type pumps.



1. Suction fitting
2. Gasket
3. Check ball
4. End plate
5. Drain plug
6. Gasket

7. Gasket
8. Gasket
9. Impeller housing
10. Wear plate
11. Priming tube
12. Auxiliary priming tube

13. Impeller
14. Seal
15. Ceramic ring
16. Washer
17. Baffle
18. Locating pin

19. Pump body
20. Gasket
21. Discharge fitting
22. Gasket
23. Priming filler plug

peller and discard shim or shims as required from between impeller and crankshaft so that rubbing condition is eliminated. Install assembled impeller housing, then install pump end plate (4) with new gasket (8) and one or two new gaskets (7) as required so that end plate holds impeller housing securely against pump body. Note: End plate should rock slightly before being tightened.

TRASH PUMP

Trash pump used on the models in this section is the same as the pump shown in Fig. HL32. Refer to TRASH PUMP in model 251 section for overhaul of trash pump.

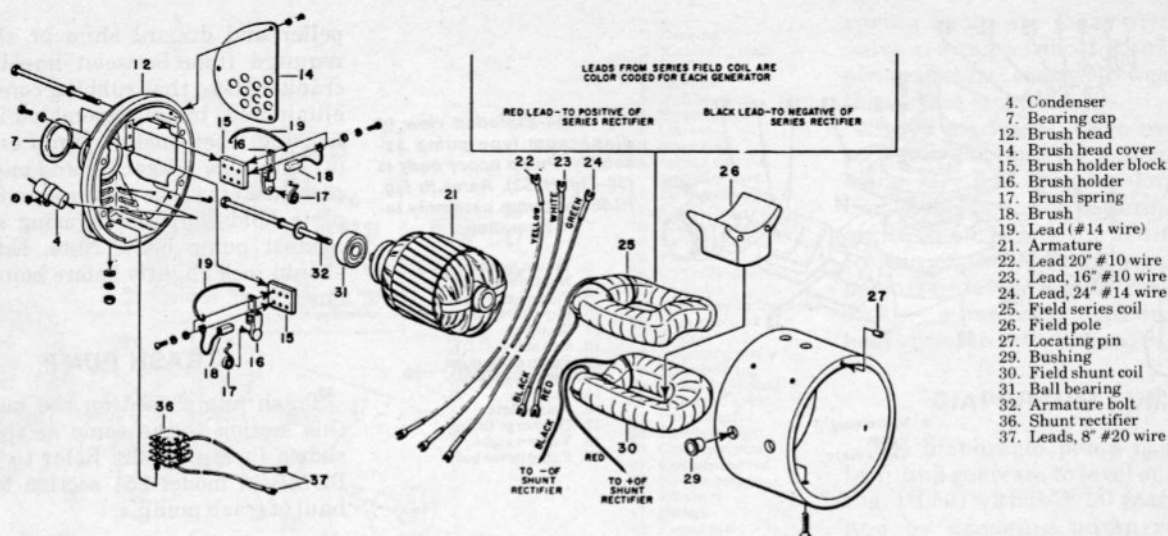


Fig. HL57—Exploded view showing construction of model 9A115-1 and 9A115/230-1 generator units. It will be necessary to remove armature (21) from engine crankshaft to service crankshaft seal, bearing and crankcase.

GENERATORS

Generator unit models 9HY-1, 9HY-1A, 9HY-1B and 9HY-1C are similar to the model 251HY 35-1 generator unit shown in Fig. HL34 in preceding section on Homelite model 251 engine. Voltamatic generators 9A34-1, 9A34-1A, 9A115-1A and 9A115/230-1A are similar to generator shown in Fig. HL13 in 250/270 section. Note: Voltamatic is a registered Homelite trademark identifying a method of voltage regulation protected by U.S. Patent No. 3,428,883.

For exploded view showing construction of generator models 9A115-1 and 9A115/230-1, refer to Fig. HL57. Identify each generator lead as it is disconnected so that the unit may be reassembled with leads properly connected. To remove armature (21) from engine crankshaft, remove the through bolt (32), then pull armature with pin (Homelite tool No. 22271 cut to proper length) and jackscrew (Homelite tool No. S-394) threaded into outer end of armature shaft.

Refer to Figs. HL58 and HL59 for schematic of generator models 9HY-1A, 9HY-1B and 9HY-1C. Refer to Fig. HL140 for schematic of generator model 9A34-1 and to Fig. HL141 for schematic of model 9A34-1A.

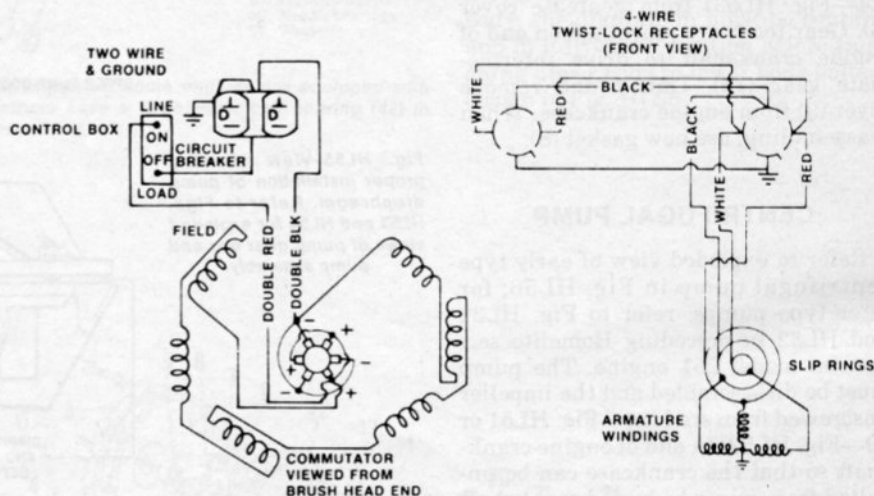
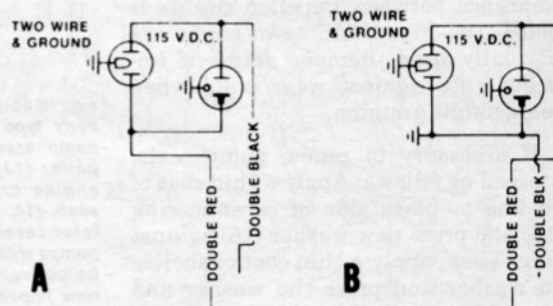


Fig. HL58—Schematic of 9HY-1C generator. Refer to Fig. HL59 for schematic variations for generators 9HY-1A and 9HY-1B.

Fig. HL59—Receptacles on generator 9HY-1A (A) and 9HY-1B (B) are wired as shown. Remainder of generator is wired as shown for 9HY-1C in Fig. HL58.



HOMELITE®

A **textron** DIVISION, PORT CHESTER, N.Y. 10573

Model	Bore Inches	Stroke Inches	Displ. Cu. In.	Reed Type
XL-12	1¾	1¾	3.3	Flat
Super XL	1-13/16	1¾	3.55	Pyramid

This section covers service of Homelite model XL-12 and Super XL engines that are used in the following Homelite tools and equipment.

XL Brushcutter
XL100 Circular Saw
XL120 Circular Saw
XLA115 Generator
XLS1½-1 Centrifugal Pump

MAINTENANCE

SPARK PLUG. A Champion TJ-8J spark plug or equivalent is used in generator, XL-100 saw and brushcutter application; for extended plug life, a Champion UTJ-11P platinum tip spark plug may be used. On model XL-120 circular saw, use Champion CJ-6 or equivalent spark plug. A Champion CJ-8 spark plug is recommended for model XL100A. For pump application, use a Champion TJ-6J or equivalent spark plug. Set electrode gap to 0.025 for all engine applications.

CARBURETOR. Refer to Fig. HL60 for exploded view of Tillotson HS diaphragm type carburetor with integral fuel pump used on XL-12 and Super XL engines. Carburetor is accessible after removing air box cover (Fig. HL61). **NOTE:** If early type cover gasket becomes damaged when air box cover is removed, install new gasket as follows: Carefully remove old gasket from air box and be sure that surface is free of all dirt, oil, etc. Apply "3M" or Homelite No. 22788 cement to new gasket and carefully place gasket, adhesive side down, on lip around air box chamber. On later engines, gasket is bonded to filter element; install new filter element if either gasket or filter is damaged.

When disassembling carburetor, slide the diaphragm assembly towards adjustment needle side of carburetor body to disengage diaphragm from fuel inlet control lever. To remove welch plugs, carefully drill through large plug (27—Fig. HL60) with a ⅛-inch drill or through small plug (24) with a 1/16-inch drill and pry plugs out with a

pin inserted through the drilled hole. Caution should be taken that the drill just goes through the welch plug as deeper drilling may seriously damage the carburetor. Note channel screen (26) and screen retaining ring (25) which are accessible after removing welch plug (24).

Inlet control lever (17) should be flush with metering chamber floor of carburetor body. If not, bend diaphragm end of lever up or down as required so that the lever is flush.

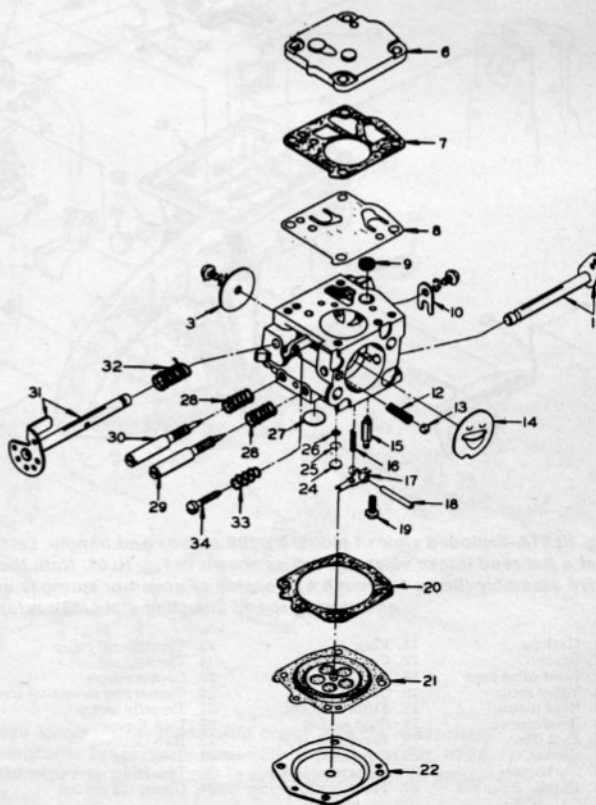
On generator engine, make initial carburetor adjustment as follows: Turn fuel adjustment needle in gently until it just contacts seat, then back needle out 1¼ turns. For final adjustment, apply load to generator to allow engine to warm up, then slowly turn needle in

until engine speed starts to drop. Correct final setting is ⅛-turn open from this point.

On brushcutter, turn idle speed stop screw in until it just contacts throttle lever tab, then turn screw in ¼-turn further. Turn idle and main fuel adjustment needles in gently until they just contact seats, then back each needle out ⅝-turn. With engine warm and running, adjust idle fuel needle so that engine runs smoothly, then adjust idle stop screw so that engine runs at 2600 RPM, or just below clutch engagement speed. Check engine acceleration and open idle fuel needle slightly if engine will not accelerate properly. Adjust main fuel needle under load so engine will neither slow down or smoke excessively.

Fig. HL60—Exploded view of typical Tillotson series HS carburetor used on XL-12 and Super XL engines. Carburetor used on generator engine does not have idle fuel mixture adjustment needle (30). On some models, idle speed adjustment screw (34) is located in air box casting and is adjustable without removing cover (8—Fig. HL61).

3. Throttle disc
6. Pump cover
7. Gasket
8. Pump diaphragm
9. Inlet screen
10. Throttle shaft clip
11. Choke shaft & lever
12. Detent spring
13. Choke detent ball
14. Choke disc
15. Inlet needle
16. Spring
17. Diaphragm lever
18. Lever pin
19. Pin retaining screw
20. Gasket
21. Diaphragm
22. Diaphragm cover
24. Welch plug
25. Retaining ring
26. Channel screen
27. Welch plug
28. Springs
29. Main fuel needle
30. Idle fuel needle
31. Throttle shaft & lever
32. Throttle spring
33. Idle speed screw spring
34. Idle speed adjustment screw



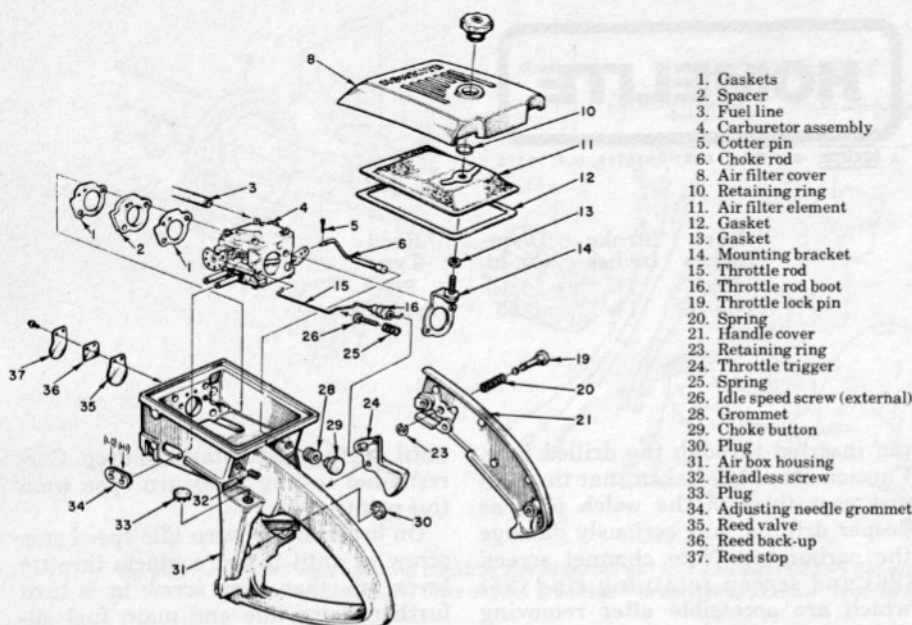


Fig. HL61—Exploded view of handle and air box assembly used on early XL100 saw; model XL120 handle and air box assembly is shown in Fig. HL61A. Late model XL-100 has air vane governor similar to that shown in Fig. HL62 and HL63 for differences in brushcutter, generator and pump air box construction.

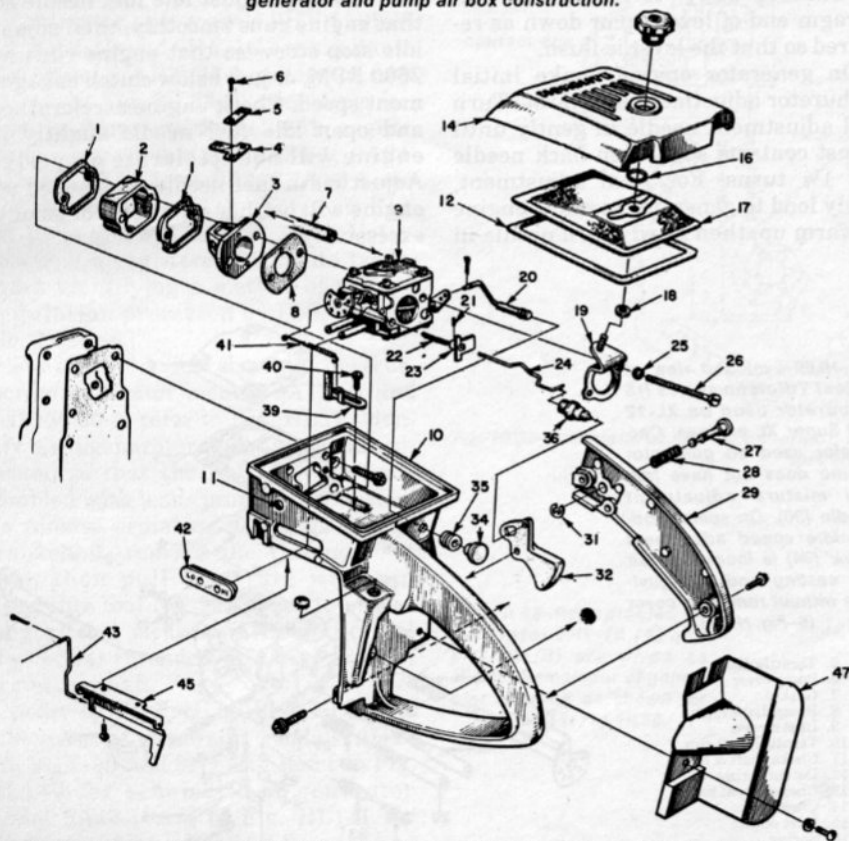


Fig. HL61A—Exploded view of model XL-120 air box and handle. Late model XL-100 is similar except that a flat reed intake valve is used as shown in Fig. HL61. Note the Super XL engine pyramid reed valve assembly (items 1 through 6). Tension of governor spring is adjusted by loosening screw (40) and moving speed adjusting plate (39); refer to text.

- | | | | |
|---------------------|-------------------------|--------------------------------|------------------------------|
| 1. Gaskets | 11. Plug | 23. Throttle rod collar | 35. Grommet |
| 2. Spacer | 12. Cover gasket | 24. Throttle rod | 36. Choke rod boot |
| 3. Reed valve seat | 13. Air box cover | 25. Lock washers | 37. Speed adjusting plate |
| 4. Valve reeds | 14. Snap ring | 26. Carburetor mounting screws | 38. Plate retaining screw |
| 5. Reed plates | 15. Stud gasket | 27. Throttle lock pin | 39. Governor spring |
| 6. Fuel line | 16. Bracket & stud | 28. Lock spring | 40. Adjusting needle grommet |
| 7. Gasket | 17. Choke rod | 29. Handle cover | 41. Governor link |
| 8. Carburetor | 18. Set screw | 30. Snap ring | 42. Governor air vane |
| 9. Handle & air box | 19. Throttle rod spring | 31. Throttle trigger | 43. Governor air vane |
| | | 32. Choke rod button | 44. Muffler shield |

On pump engine, set idle stop screw so that it does not interfere with full travel of throttle stop lever. Open idle fuel adjustment needle one turn and leave needle at this setting; all adjustment should be made with main needle. Open main fuel adjustment needle one turn for initial adjustment, be sure pump is filled with water and start engine. Pump water until engine is at full operating temperature, then turn main fuel needle in slowly until engine begins to lose speed under load. Correct final adjustment is $\frac{1}{8}$ -turn open from this point.

On circular saw, turn idle speed stop screw in until it just contacts throttle stop lever plus $\frac{3}{4}$ -turn additional. Open both the idle fuel needle and the main fuel needle one turn each. With engine warm and running, adjust idle speed stop screw so that engine runs at just below clutch engagement speed, or about 2600 RPM. Check engine acceleration and open idle fuel needle slightly if engine does not accelerate properly on initial adjustment. Adjust main fuel needle with engine under load so that engine runs at highest practicable speed obtainable without excessive smoke.

GOVERNOR. The early XL100 Circular Saw engine is nongoverned.

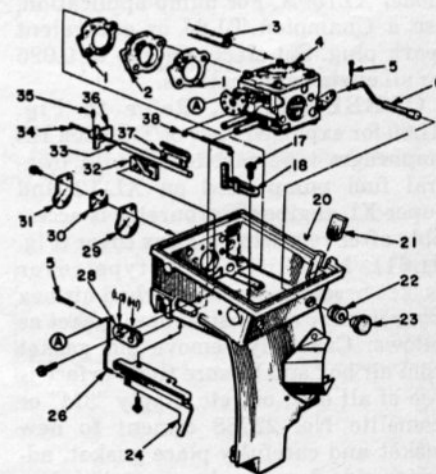


Fig. HL62—Exploded view of air box assembly used on brushcutter; pump air box is similar except that throttle control parts (items 32 through 37) are not used. Air filter cover and element as shown in Fig. HL61 are used.

- | | |
|------------------------------|-------------------------------|
| 1. Gaskets | 26. Governor link |
| 2. Spacer | 28. Adjustment needle grommet |
| 3. Fuel line | 29. Reed valve |
| 4. Carburetor assy. | 30. Reed back-up |
| 5. Cotter pins | 31. Reed stop |
| 6. Choke rod | 32. Clamp spacer |
| 7. Choke rod | 33. Throttle cable casing |
| 8. Air filter cover | 34. Throttle cable |
| 9. Retaining ring | 35. Set screw |
| 10. Air filter element | 36. Collar |
| 11. Gasket | 37. Clamp |
| 12. Mounting bracket | 38. Governor spring |
| 13. Throttle rod | |
| 14. Throttle rod boot | |
| 15. Throttle lock pin | |
| 16. Spring | |
| 17. Handle cover | |
| 18. Retaining ring | |
| 19. Throttle trigger | |
| 20. Throttle rod collar | |
| 21. Choke button | |
| 22. Plug | |
| 23. Adjusting needle grommet | |
| 24. Reed valve | |
| 25. Reed back-up | |
| 26. Reed stop | |
| 27. Clamp spacer | |
| 28. Throttle cable casing | |
| 29. Throttle cable | |
| 30. Set screw | |
| 31. Collar | |
| 32. Clamp | |
| 33. Governor spring | |

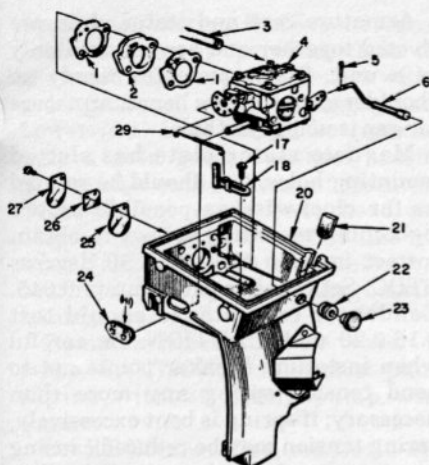


Fig. HL63—Exploded view of XLA115-1 generator engine air box assembly. Mechanical governor parts are shown in exploded view of generator in Fig. HL70.

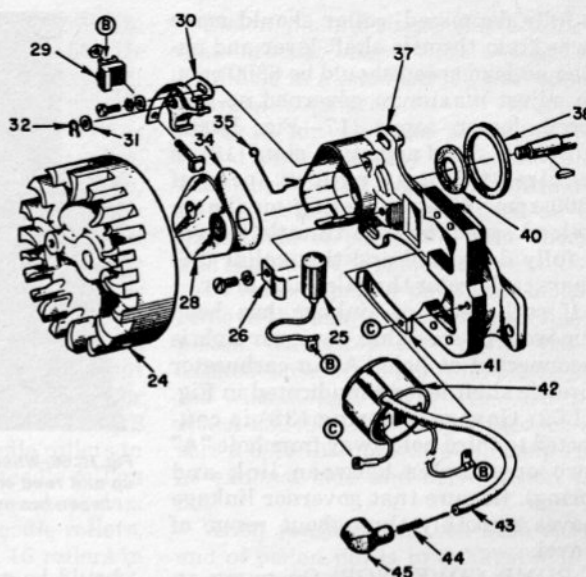
- | | |
|----------------------|-------------------------------|
| 1. Gaskets | 22. Grommet |
| 2. Spacer | 23. Choke button |
| 3. Fuel line | 24. Adjustment needle grommet |
| 4. Carburetor assy. | 25. Reed valve |
| 5. Cotter pin | 26. Reed back-up |
| 6. Choke rod | 27. Reed stop |
| 17. Screws (2) | 29. Throttle opening spring |
| 18. Adjustment plate | |
| 20. Air box | |
| 21. Felt plug | |

Refer to appropriate following paragraph for information on other units which are equipped with governors.

CIRCULAR SAW GOVERNOR. Refer to exploded view of air box and handle assembly in Fig. HL61A. To

Fig. HL64—Exploded view of the flywheel type magneto. Connect condenser and low tension leads as indicated by letters "B" and "C".

- | |
|------------------------------|
| 24. Flywheel |
| 25. Condenser |
| 26. Condenser clamp |
| 28. Breaker box cover |
| 29. Terminal block |
| 30. Breaker point set |
| 31. Washer |
| 32. Pivot post clip |
| 34. Gasket |
| 37. Plate and armature assy. |
| 38. Gasket |
| 40. Felt seal |
| 41. Coil retaining clip |
| 42. Ignition coil assy. |
| 43. High tension wire |
| 44. Connector spring |
| 45. Spark plug boot |



adjust governed speed, loosen screw (40) and move slotted speed adjusting plate (39) to obtain desired maximum speed, then tighten screw. Maximum governed no-load speed should be 5000 rpm.

BRUSHCUTTER GOVERNOR. The engine used in Brushcutter application is equipped with an air-vane type governor; refer to Fig. HL62. Air vane (24) is connected to throttle shaft through link (26) and is balanced by tension of spring (38). When throttle trigger (62

—Fig. HL71) is fully depressed, collar (36—Fig. HL62) on remote control cable moves away from throttle shaft lever allowing governor to control engine speed.

To adjust governor using vibrating reed or electronic tachometer, proceed as follows: With engine warm and running and throttle trigger released, adjust position of collar on remote control cable so that engine slow idle speed is 2500 rpm, or just below clutch engagement speed. Then when throttle trigger

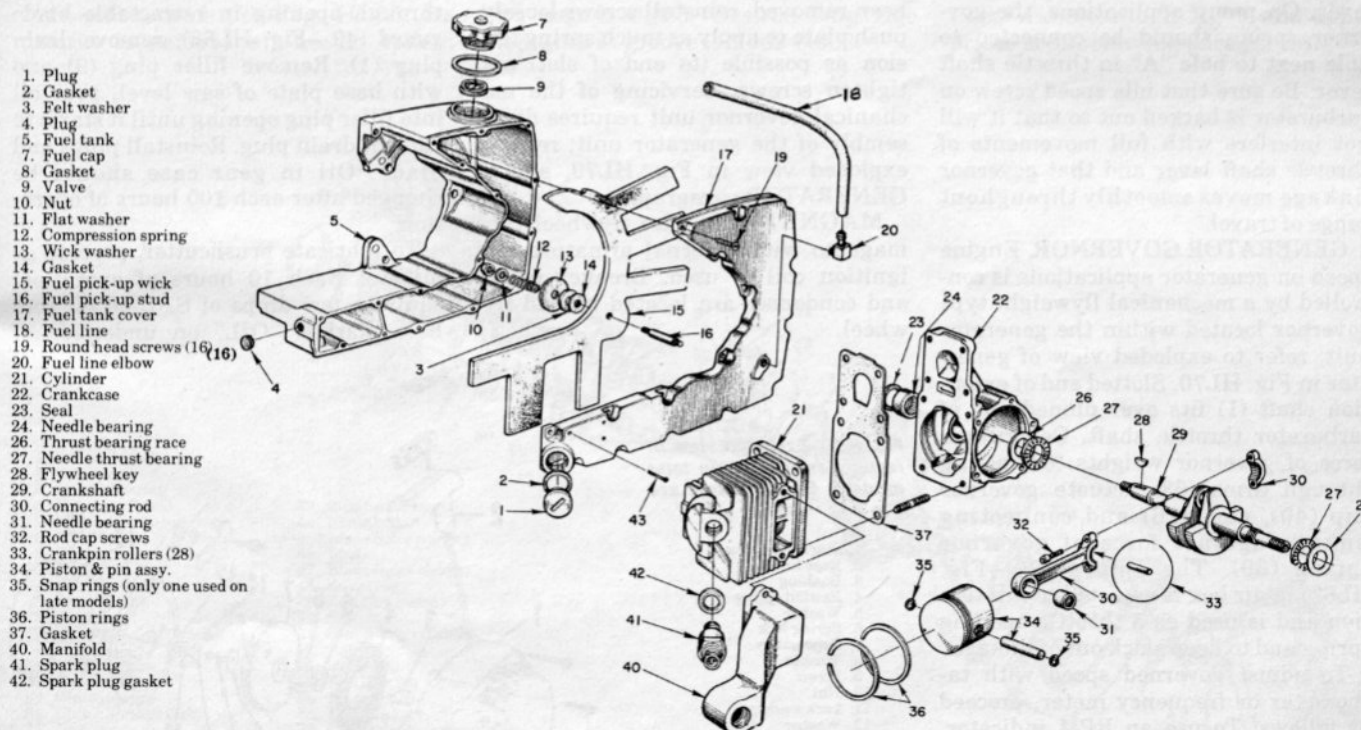


Fig. HL65—Exploded view of early XL-12 engine assembly. Later models are similar. Crankcase side cover, needle roller main bearing and the crankshaft seal are a part of the circular saw, pump, generator or brushcutter assembly as shown in Fig. HL68, HL69, HL70, or HL71. Saw, pump, generator or brushcutter must be disassembled to gain access to crankshaft; refer to appropriate unit paragraph.

is fully depressed, collar should move away from throttle shaft lever and engine no-load speed should be 6300 rpm. To adjust maximum governed no-load speed, loosen screw (17—Fig. HL62) and move speed adjusting plate (18) as required to obtain no-load speed of 6300 rpm. When adjusting maximum no-load speed, be sure throttle trigger is fully depressed and that collar (36) clears carburetor throttle shaft lever.

If carburetor or linkage has been removed, be sure that governor link is reconnected at hole "A" in carburetor throttle shaft lever as indicated in Fig. HL62. Governor spring (38) is connected to third hole away from hole "A" (two open holes between link and spring). Be sure that governor linkage moves smoothly throughout range of travel.

PUMP GOVERNOR. On pump applications, engine is equipped with air-vane type governor as shown in Fig. HL62; however, no control linkage is used (items 32 through 37).

With engine running under no load (CAUTION: Be sure pump housing is filled with water), engine speed should be 6400 to 6600 rpm. If not, loosen screw (17) and move speed adjusting plate (18) as necessary so that engine governed speed is 6500 rpm.

If carburetor has been removed or linkage has been disconnected, be sure that governor link (26) is reconnected in hole "A" in carburetor throttle shaft lever. On pump applications, the governor spring should be connected to hole next to hole "A" in throttle shaft lever. Be sure that idle speed screw on carburetor is backed out so that it will not interfere with full movements of throttle shaft lever and that governor linkage moves smoothly throughout range of travel.

GENERATOR GOVERNOR. Engine speed on generator applications is controlled by a mechanical flyweight type governor located within the generator unit; refer to exploded view of generator in Fig. HL70. Slotted end of extension shaft (1) fits over pinned end of carburetor throttle shaft. Centrifugal force of governor weights (64) acting through arms (63) actuate governor cup (40), cam (16) and connecting linkage against force of governor spring (39). The spring (29—Fig. HL63) in air box is adjusted to full tension and is used as a throttle opening spring and to keep slack out of linkage.

To adjust governed speed with tachometer or frequency meter, proceed as follows: To use an RPM indicator, remove receptacle housing (52—Fig. HL70) to gain access to end of generator shaft. With engine at operating temperature, governed no-load speed

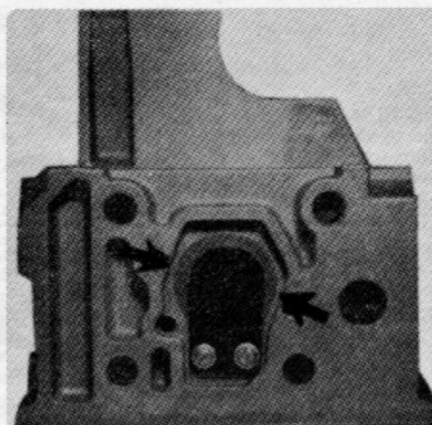


Fig. HL66—When installing reed valve, reed back-up and reed stop, be sure reed is centered between two points indicated by black arrows.

should be approximately 3750 rpm, or a reading of 63 cycles per second should be indicated on frequency meter. If engine speed or cycles per second is not as specified, loosen the two screws clamping governor shaft guide (10) to bearing housing (13) and move guide towards engine to increase speed, or towards generator to decrease speed. Note: Only one mounting hole of governor shaft guide is slotted and guide pivots on opposite screw. Tighten screws when proper speed is obtained.

If carburetor has been removed, reconnect throttle opening spring as indicated in Fig. HL63. If plate (18) has been removed, reinstall screws loosely, push plate to apply as much spring tension as possible (to end of slot) and tighten screws. Servicing of the mechanical governor unit requires disassembly of the generator unit; refer to exploded view in Fig. HL70, and to GENERATOR paragraph.

MAGNETO. A Wico flywheel type magneto with external armature and ignition coil is used. Breaker points and condenser are located behind flywheel.

Armature core and stator plate are riveted together and are serviced only as a unit. Stator plate fits firmly on shoulder of crankcase; hence, armature air gap is non-adjustable.

Magneto stator plate has slotted mounting holes, and should be rotated as far clockwise as possible before tightening mounting screws to obtain correct ignition timing of 30 degrees BTDC. Set breaker point gap to 0.015. Condenser capacitance should test 0.16-0.20 mfd. CAUTION: Be careful when installing breaker points not to bend tension spring any more than necessary; if spring is bent excessively, spring tension may be reduced causing improper breaker point operation.

LUBRICATION. The engine on all models is lubricated by mixing oil with regular gasoline. Fuel:oil ratio should be 32:1 when Homelite® SAE 40 Premium Motor Oil is mixed with fuel. Fuel:oil ratio should be 16:1 if Homelite® SAE 30 2-Cycle oil or another good grade of oil designed for air cooled two stroke engines is used.

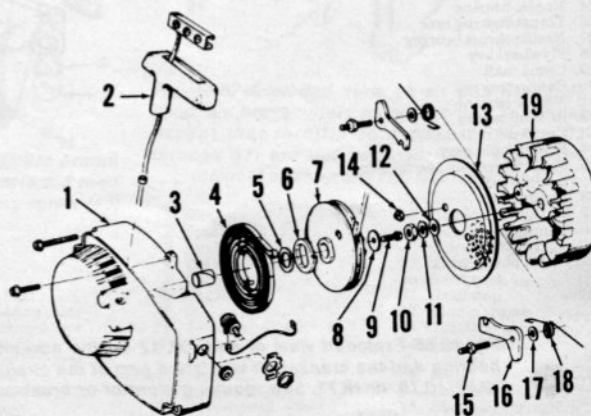
Lubricate generator by removing receptacle cover (52—Fig. HL70) from end of generator and applying 4 or 5 drops of oil to the felt washer (47) after each 200 hours of operation.

Gear case of circular saw must be filled to proper level with SAE 90 gear oil (Homelite part no. 55291-C) as follows: Remove saw blade and working through opening in retractable blade guard (49—Fig. HL68), remove drain plug (1). Remove filler plug (9) and with base plate of saw level, pour oil into filler plug opening until it starts to run out drain plug. Reinstall plugs and blade. Oil in gear case should be changed after each 100 hours of operation.

To lubricate brushcutter, proceed as follows: Each 10 hours of operation, squirt a few drops of SAE-30 oil into hole marked "OIL" on underside of

Fig. HL67—Exploded view of recoil starter used on later models. Early models are similar.

1. Starter housing
2. Rope handle
3. Bushing
4. Rewind spring
5. Washer
6. Spring lock
7. Rope pulley
8. Washer
9. Screw
10. Nut
11. Lock washer
12. Washer
13. Screen
14. Lock nut
15. Stud
16. Pawl
17. Washer
18. Spring
19. Flywheel



upper head casting. Remove driveshaft each 50 hours of operation, clean the shaft and lubricate it full length with a good grade of wheel bearing grease. Lower gear head should be repacked with a good grade of wheel bearing grease after each 50 hours of operation. Note: Do not wash lower head and bearing housing in solvent as this will wash lubricant from the sealed ball bearings, causing premature bearing failure.

Pump is lubricated by water in pump. CAUTION: Do not start pump engine without filling pump with water.

CARBON. Muffler, manifold and cylinder exhaust ports should be cleaned periodically to prevent loss of power through carbon build up. Remove muffler and scrape free of carbon; a bent wire can be inserted through hole in housing pump and generator mufflers to clean outer shell. With muffler or manifold removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. Do not run engine with muffler removed.

REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Refer to Fig. HL65. Be careful to remove all needle rollers

when detaching rod from crankpin. Early models have 28 loose needle rollers while later models have 31 needle rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23756. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. On early models with 28 needle rollers, stick 14 needle rollers in the rod and remaining 14 needle rollers in rod cap with light grease or beeswax. On late models with 31 needle rollers, stick 16 rollers in rod and 15 rollers in rod cap. Assemble rod to cap with match marks aligned, and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured mating surfaces of rod and cap.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.0035.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are available in a matched set, and are not available separately.

Piston pin has one open and one closed end and may be retained in piston with snap rings or a Spirol pin. A wire retaining ring is used on exhaust side of piston on some models and should not be removed.

To remove piston pin on all models, remove the snap ring at intake side of piston. On piston with Spirol pin at exhaust side, drive pin from piston and rod with slotted driver (Homelite tool No. A-23949). On all other models, insert a 3/16-inch pin through snap ring at exhaust side and drive piston pin out.

When reassembling, be sure closed end of piston pin is to exhaust side of piston (away from piston ring locating pin). Install Truarc snap ring with sharp edge out.

CRANKSHAFT. The crankshaft is supported in two caged needle roller bearings and crankshaft end play is controlled by a roller bearing and hardened steel thrust washer at each end of the shaft. Refer to Fig. HL65. On generator, crankshaft end play is taken up by a loading spring (12—Fig. HL70).

To remove crankshaft, it will be necessary to disassemble the circular saw drive case, pump, generator or brush-cutter upper drive housing. Refer to Figs. HL68 through HL71 and appropriate accompanying paragraphs.

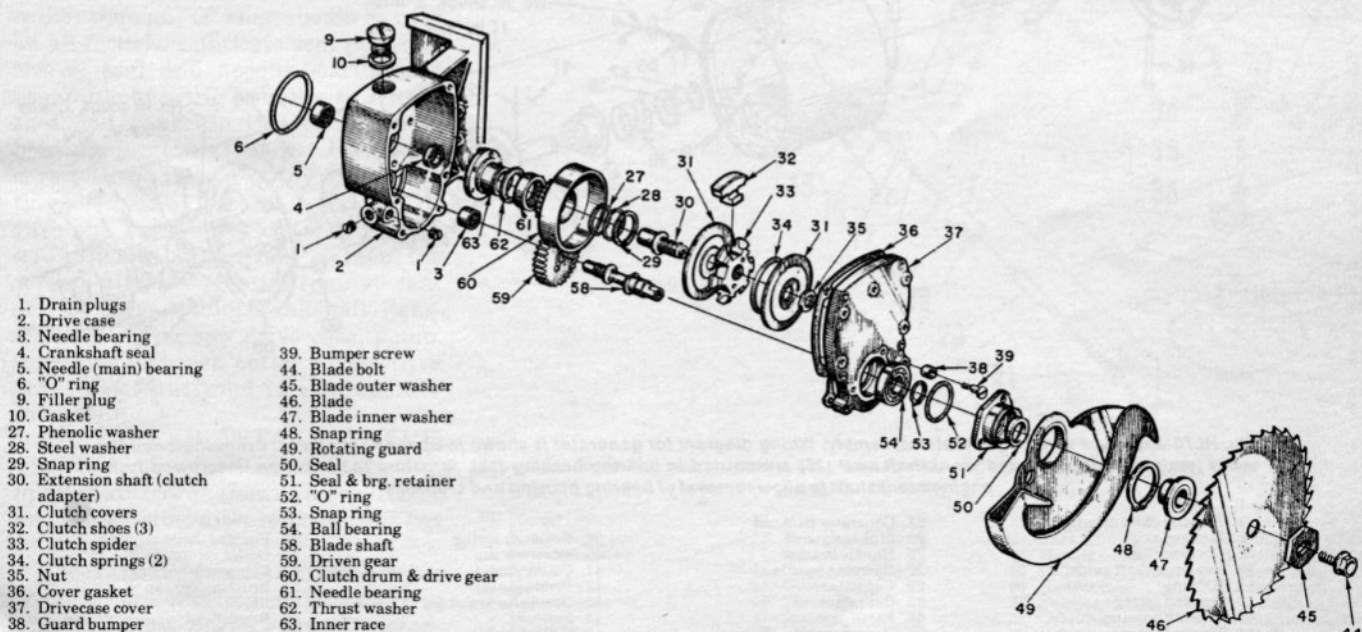


Fig. HL68—Exploded view of circular saw drive case assembly. Drive case (2) carries crankshaft needle roller bearing (5) and crankshaft seal (4). "O" ring (6) seals drive case to engine crankcase.

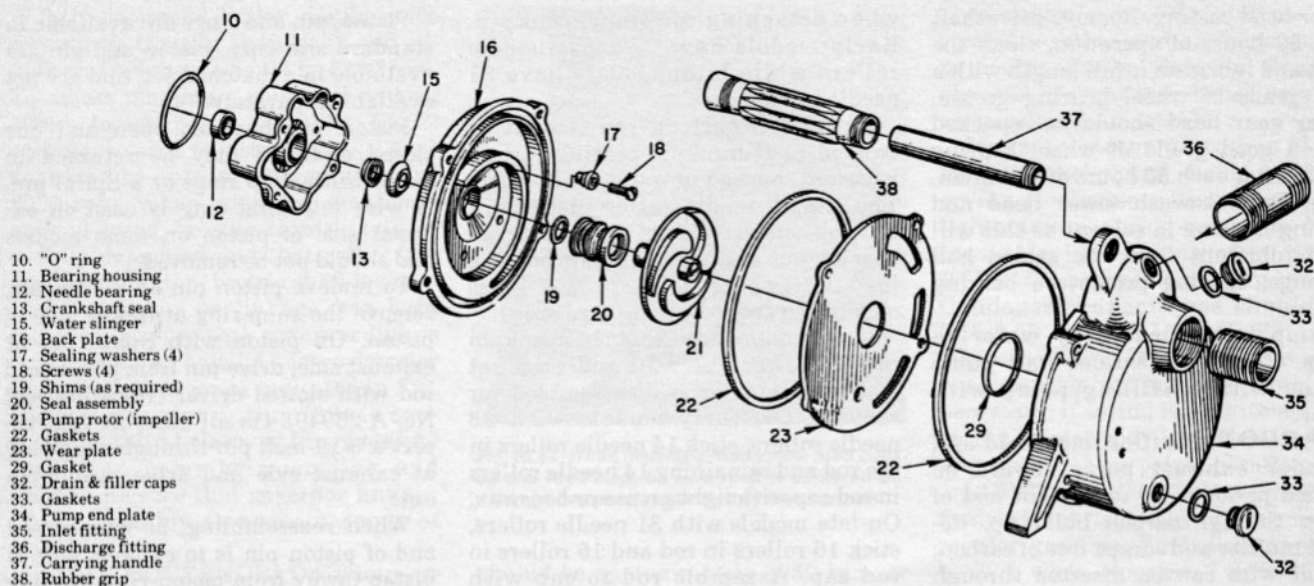


Fig. HL69—Exploded view of centrifugal pump assembly. Pump rotor (21) must be unscrewed from engine crankshaft and back plate (16) be removed to allow removal of bearing housing (11) and engine crankshaft. Bearing housing retains crankshaft needle roller bearing (12) and crankshaft seal (13).

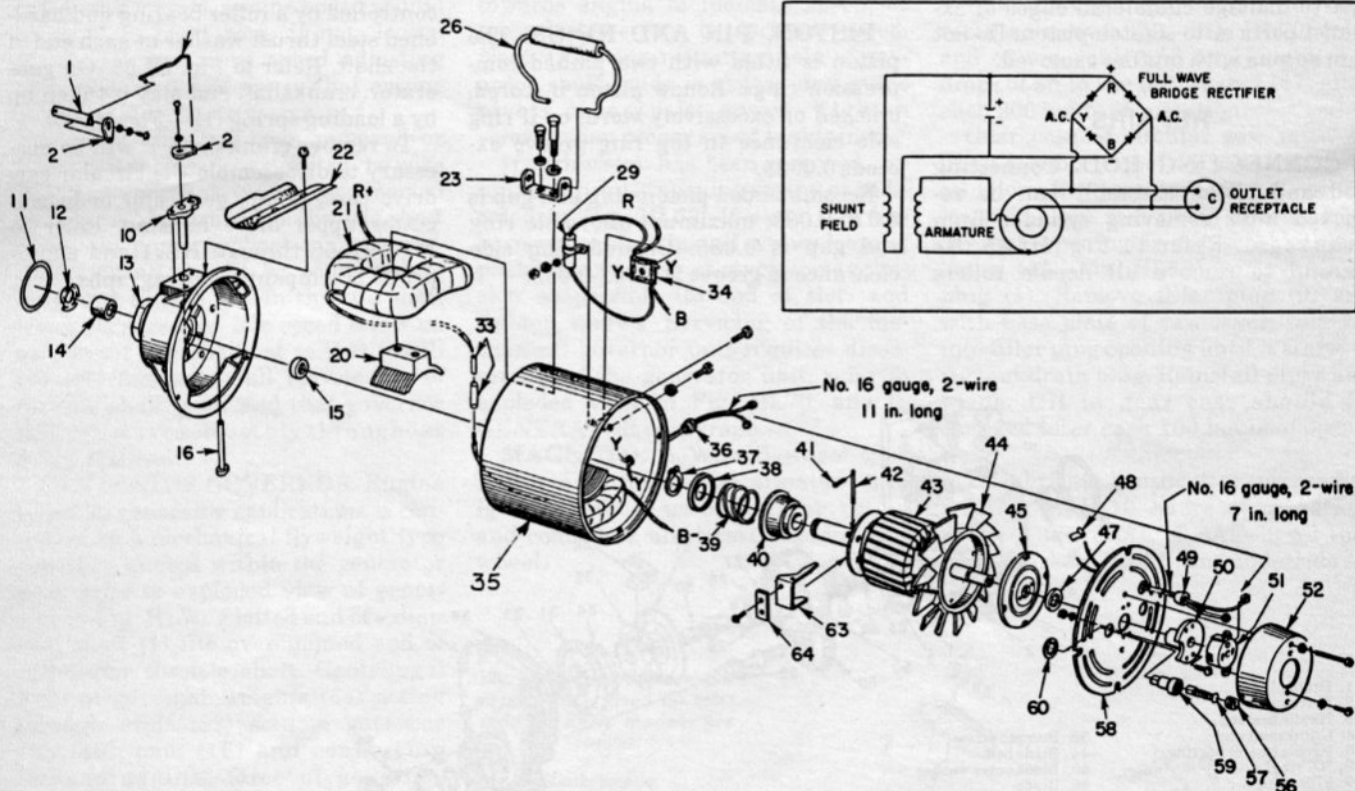


Fig. HL70—Exploded view of generator assembly. Wiring diagram for generator is shown in upper right corner. Crankshaft needle roller (main) bearing (14) and crankshaft seal (15) are carried in bearing housing (13). Armature (43) must be unscrewed from engine crankshaft to allow removal of bearing housing and crankshaft.

CYLINDER. The cylinder bore is chrome plated. Renew the cylinder if chrome plating is worn away exposing the softer base metal.

CRANK CASE, BEARING HOUSING AND SEALS. CAUTION: Do not lose bearing housing-to-crankcase screws. New screws of same length must be installed in place of old screws. Refer to parts book if correct screw length is unknown.

The needle roller main bearings and crankshaft seals in crankcase and bearing housing can be renewed using Homelite tool Nos. 23757 and 23758. Press bearings and seals from crankcase or bearing housing with large stepped end of tool No. 23757, pressing towards outside of either case.

To install new needle bearings, use the shouldered short end of tool No. 23757 and press bearings into bores from inner side of either case. Press on lettered end of bearing cage only.

To install new seals, first lubricate the seal and place seal on long end of tool No. 23758 so that lip of seal will be towards needle bearing as it is pressed into place.

To install crankshaft, lubricate thrust bearings (27—Fig. HL65) and place on shaft as shown. Place a hardened steel thrust washer to the outside of each thrust bearing. Insert crankshaft into crankcase being careful not to damage seal in crankcase. Place a seal protector sleeve (Homelite tool No. 23759) on crankshaft and large "O" ring or gasket on shoulder of bearing housing. Note: On early production, crankcase was sealed to drivecase with an "O" ring; however, use of "O" ring has been discontinued and a gasket, rather than an "O" ring, should be used on all models. Lubricate seal protector sleeve, seal and needle bearing and assemble bearing housing to crankshaft and crankcase. Use **NEW** bearing housing retaining screws. Clean the screw threads and apply Loctite to threads before installing screws. Be sure the screws are correct length; screw length is critical. Tighten the screws alternately and remove seal protector sleeve from crankshaft. Reassemble circular saw drive case, pump, generator or brush cutter upper drive housing as outlined in appropriate paragraph.

FLAT REED INTAKE VALVE.

The reed valve is attached to the carburetor air box as shown in Fig. HL66, and is accessible after removing air box from crankcase.

Check the reed seating surface on air box to be sure it is free of nicks, chips or burrs. Renew valve reed if rusted, pitted or cracked, or if it does not seat flatly against its seat.

The reed stop is curved so that measurement of reed lift distance is not practical. However, be sure that reed is centered over opening in air box and reed stop is aligned with reed.

NOTE: If air box has been removed to service reed valve (35—Fig. HL61 or 4—Fig. HL61A), inspect gasket between air box and crankcase. If gasket is damaged and cylinder is not being removed for other purposes, it is suggested that the exposed part of the old gasket be carefully removed and the new gasket be cut to fit between the air box and crankcase. Also, refer to note in CARBURETOR paragraph in MAINTENANCE section.

REWIND STARTER. To disassemble starter, refer to exploded view in Fig. HL67 and proceed as follows: Pull starter rope out fully, hold pulley (11) and pry rope knot from pulley. Let pulley rewind slowly. Hold pulley while removing screw (14) and washer (13). Turn pulley counterclockwise until disengaged from spring, then carefully lift pulley off starter post.

Turn open side of housing down and rap housing sharply against top of work bench to remove spring. **CAUTION:** Be careful not to dislodge spring when removing pulley as spring could cause injury if it should recoil rapidly.

Install new spring with loop in outer end over pin in blower housing and be sure spring is coiled in direction shown in Fig. HL67. Install pulley (11), turning pulley clockwise until it engages spring and secure with washer and screw. Insert new rope through handle and hole in blower housing. Knot both ends of the rope and harden the knots with heat or cement. Turn pulley clockwise eight turns and slide knot in rope into slot and keyhole in pulley. Let starter pulley rewind slowly.

Starter pawl spring outer ends are hooked behind air vanes on flywheel in line with starter pawls when pawls are resting against flywheel nut. Pull starter rope slowly when installing blower housing so that starter cup will engage pawls.

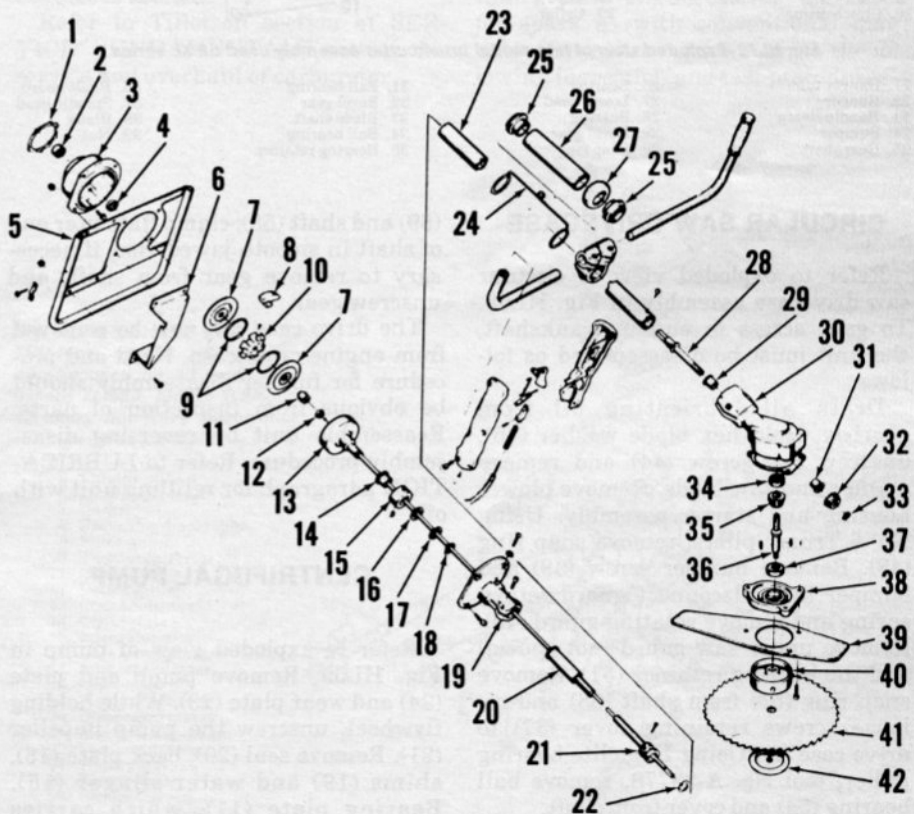


Fig. HL71—Exploded view of early type brushcutter assembly. Refer to Fig. HL72 for later brushcutter.

- | | | | |
|--------------------------|------------------------------|-----------------|----------------------|
| 1. Gasket | 12. Nut | 22. "O" ring | 33. Snap ring |
| 2. Needle roller bearing | 13. Driveshaft & clutch drum | 23. Tube | 34. Ball bearing |
| 3. Bearing housing | 14. Flanged bearing | 24. Hanger | 35. Bevel gear |
| 4. Seal | 15. Collar | 25. Collar | 36. Blade shaft |
| 5. Frame assy. | 16. Thrust washer | 26. Hanger tube | 37. Ball bearing |
| 6. Exhaust deflector | 17. Spacer | 27. Bumper | 38. Bearing retainer |
| 7. Clutch cover | 18. Snap ring | 28. Gear shaft | 39. Blade guard |
| 8. Clutch shoe | 19. Upper head | 29. Bearing | 40. Spindle head |
| 9. Clutch spring | 20. Shaft casing | 30. Lower head | 41. Blade |
| 10. Clutch hub | 21. Split bushing | 31. Bearing | 42. Nut |
| 11. Spacer | | 32. Bevel gear | |

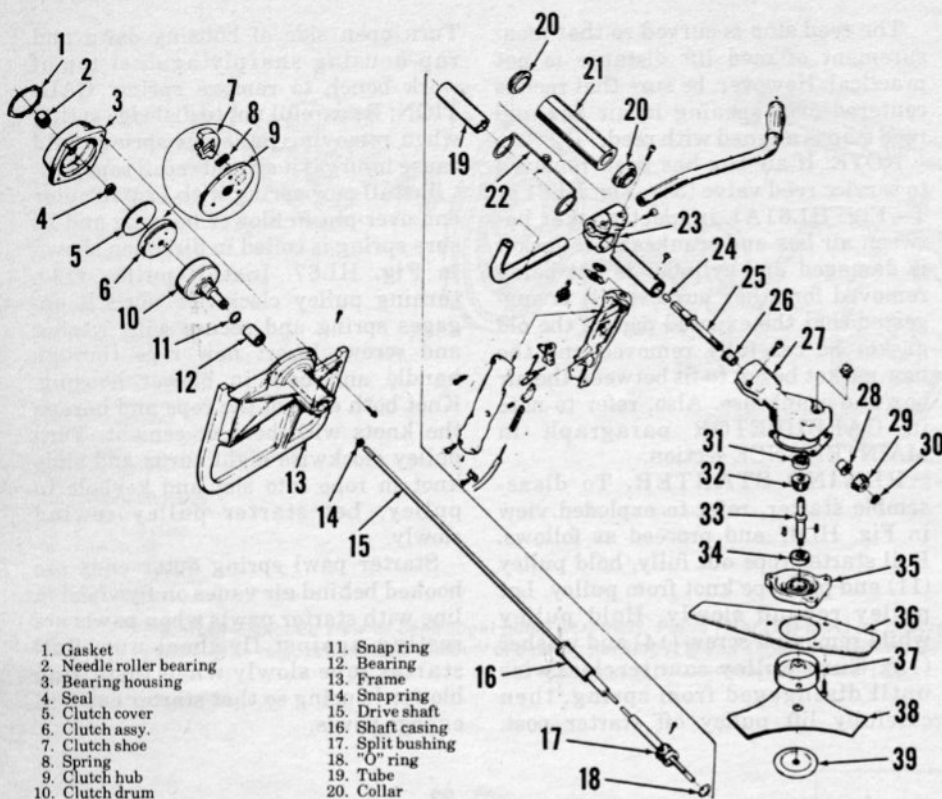


Fig. HL72—Exploded view of late model brushcutter assembly used on XL series.

1. Gasket
2. Needle roller bearing
3. Bearing housing
4. Seal
5. Clutch cover
6. Clutch assy.
7. Clutch shoe
8. Spring
9. Clutch hub
10. Clutch drum

11. Snap ring
12. Bearing
13. Frame
14. Snap ring
15. Drive shaft
16. Shaft casing
17. Split bushing
18. "O" ring
19. Tube
20. Collar

21. Hanger tube
22. Hanger
23. Handle clamp
24. Bumper
25. Gear shaft

26. Bearing
27. Lower head
28. Bearing
29. Bevel gear
30. Snap ring

31. Ball bearing
32. Bevel gear
33. Blade shaft
34. Ball bearing
35. Bearing retainer

36. Blade guard
37. Spindle head
38. Blade
39. Nut

CIRCULAR SAW DRIVECASE

Refer to exploded view of circular saw drivecase assembly in Fig. HL68. To gain access to engine crankshaft, the unit must be disassembled as follows:

Drain all lubricating oil from gearbox. Hold hex blade washer (45), unscrew cap screw (44) and remove washer and saw blade. Remove blower housing and starter assembly. Using No. 6 Truarc pliers, remove snap ring (48). Remove bumper screw (39) and bumper (38), disconnect guard return spring and remove rotating guard (49). Remove upper saw guard (not shown) and the bearing retainer (51). Remove snap ring (53) from shaft (58) and remove screws retaining cover (37) to drive case (2). Using Homelite bearing puller, tool No. A-23778, remove ball bearing (54) and cover from shaft.

While holding flywheel with Homelite tool #A-23761, remove nut (35), clutch cover (31) and unscrew clutch rotor using Homelite tool No. A-23696. Remove extension shaft (30) from crankshaft with a socket head screw (Allen) wrench. Remove snap ring (29) and pull clutch drum (60) from flanged bushing (63). Withdraw driven gear

(59) and shaft (58); clamp flat outer end of shaft in smooth jawed vise, if necessary to remove gear from shaft, and unscrew gear.

The drive case can now be removed from engine crankcase. Need and procedure for further disassembly should be obvious from inspection of parts. Reassemble unit by reversing disassembly procedure. Refer to LUBRICATION paragraph for refilling unit with oil.

CENTRIFUGAL PUMP

Refer to exploded view of pump in Fig. HL69. Remove pump end plate (34) and wear plate (23). While holding flywheel, unscrew the pump impeller (21). Remove seal (20), back plate (16), shims (19) and water slinger (15). Bearing plate (11), which carries crankshaft needle roller bearing (12) and seal (13) can then be removed.

When reassembling unit, use all new seals and gaskets. Shims (19) are available in thicknesses of 0.010 and 0.015; install shims to provide minimum clearance between impeller (21) and wear plate (23) without causing impeller to rub against the plate.

Refill pump assembly with water before attempting to start engine. Water in pump is necessary to lubricate pump seal (20).

GENERATOR

Refer to exploded view of the generator unit in Fig. HL70. To gain access to the engine governor unit or engine crankshaft, proceed as follows:

Remove two outside screws holding receptacle cover (52) to brush head (58) and move receptacle assembly aside. Remove brush holder caps (56) and brushes, taking particular care to note position and location of brushes so that they may be reinstalled in same position and location. Remove brush head (58), bearing (50) and felt washer (47). Remove screws retaining collector ring (45) and remove collector ring from fan. Remove fan (44), from armature (43) taking care not to lose the Woodruff key (not shown). Unbolt generator yoke (35) from bearing housing (13) and slide yoke from armature. Using a strap wrench, unscrew the armature from engine crankshaft while holding engine flywheel. Procedure and need for further disassembly is obvious from inspection of unit. After reassembly check adjustment of governor as outlined in GOVERNOR paragraph.

BRUSHCUTTER

To gain access to crankshaft bearing housing (3—Fig. HL71 or HL72), or engine crankshaft, proceed as follows:

On early models, unbolt upper head (26—Fig. HL71) from bearing housing and remove brushcutter unit and frame (5). While holding engine flywheel, remove nut (12), spacer (11) and outer clutch cover; then unscrew clutch hub (10) from engine crankshaft. Remove inner clutch cover. Bearing housing can now be removed from engine crankcase. Note: Some early models have a flexible driveshaft instead of the rigid driveshaft shown in Fig. HL71. To remove nut (42) from blade shaft, insert a ¼ inch steel rod in hole in spindle head (40) to hold shaft from turning.

On later models, unscrew capscrews securing frame (13—Fig. HL72) to bearing housing (3) and separate brushcutting unit from engine. Remove snap ring (11) and clutch drum (10). Rotate clutch hub in counter-clockwise direction to remove clutch assembly. Bearing housing can now be removed from engine as previously outlined. To remove nut (39) from blade shaft, insert a ¼ inch steel rod in hole in spindle head (27) to prevent shaft from turning.

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N.Y. 10573

Model	Bore Inches	Stroke Inches	Displ. Cu. In.
XL-88, XL-98, XL-98A, XLS2-1, XLS2-1A	2 1/16	1 1/2	5.0

This section covers service of the model XL-88, XL-98 and XL-98A Multi-Purpose saw and XLS2-1 and XLS2-1A pump. The saw may be equipped with either an abrasive wheel or carbide tipped wheel. Caution should be taken that abrasive wheels installed on this unit are rated for spindle speeds of 5000 rpm or higher.

MAINTENANCE

SPARK PLUG. A Champion model CJ-6 spark plug is used. For heavy duty operation, a Champion HO-8A platinum tip or UJ-11-G gold palladium tip spark plug can be used, though it will be necessary to pull the plug wire further out of the retaining clip in air box. Set electrode gap to 0.025 on all models.

CARBURETOR. All models are equipped with a Tillotson model HS diaphragm carburetor. Refer to Figs. HL75 and HL76 for exploded views of carburetor. Carburetor used on model XL-98A (See Fig. HL76) has a fixed main jet (19) and a governor valve (6) which is designed to maintain a governed speed of about 5000 rpm. Neither main jet nor governor valve is adjustable. Carburetor on model XLS2-1A does not have adjustable idle or high speed mixture screws.

Initial carburetor adjustment on saw models is one turn open for idle mixture and high speed mixture screw, if so equipped. Adjust idle mixture screw and idle speed screw to obtain smooth idle with engine warm and running at 2400-2600 rpm which should be just below clutch engagement speed. Adjust high speed mixture screw, on models so equipped, to obtain optimum engine performance at cutting speed with saw under normal load. Do not adjust mixture screws too lean as engine damage may result.

To adjust carburetor on XLS2-1 pump models, turn idle and high speed mixture screws until they are 1 1/2 turns open. Start engine and allow to run until warm. Adjust high speed mixture screw for highest pumping speed obtainable then turn high speed mixture screw 1/4 turn counterclockwise. Note: Governor is designed to limit maximum no-load speed to 6400 rpm. Ad-

just idle mixture screw by pulling throttle button all the way out and turn idle mixture screw to obtain highest and smoothest idle speed. Turn idle speed screw to obtain idle speed of approximately 3000 rpm. Adjustment of one mixture screw will require checking adjustment of remaining mixture screw as operation of mixture needles is related.

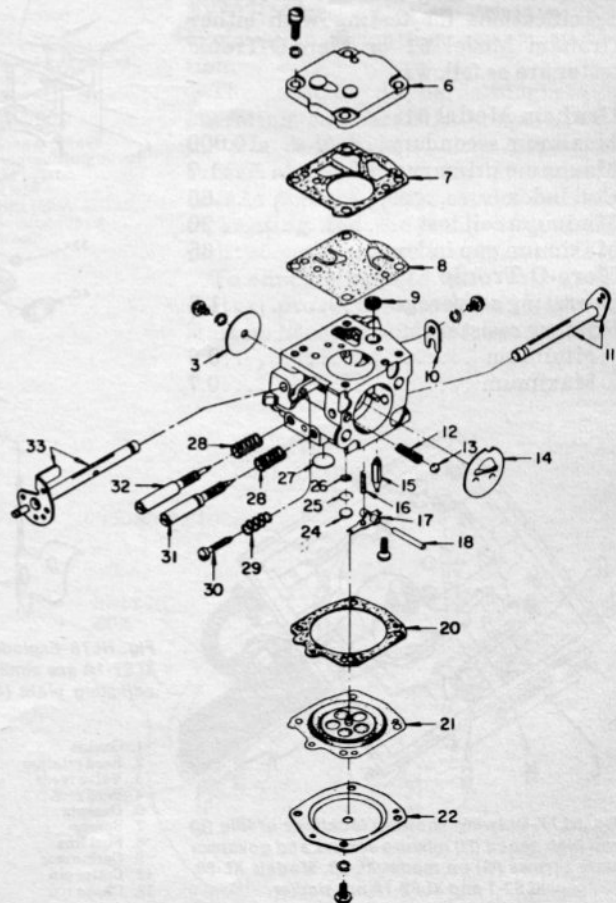
Refer to Tillotson section of SERVICE FUNDAMENTALS section for service and overhaul of carburetor.

MAGNETO. (MODEL XL-88) Model XL-88 is equipped with a Wico breakerless solid state magneto; refer to exploded view of magneto in Fig. HL80.

To check the solid state magneto, disconnect spark plug wire, turn ignition switch on and crank engine while holding terminal about 1/4-inch away from ground (engine casting) and check for spark as with conventional magneto. If no spark occurs, refer to the following inspection and test procedure:

Fig. HL75—Exploded view of Tillotson series HS carburetor used on all models except XL-98A. Model XLS2-1A does not have mixture needles (29 & 30).

3. Throttle plate
6. Diaphragm cover
7. Gasket
8. Fuel pump diaphragm
9. Filter screen
10. Throttle shaft clip
11. Choke shaft
12. Detent spring
13. Choke detent ball
14. Choke plate
15. Inlet valve needle
16. Inlet lever spring
17. Inlet control lever
18. Lever hinge pin
19. Pin retainer screw
20. Diaphragm gasket
21. Metering diaphragm
22. Diaphragm cover
24. Welch plug-3/16
25. Retainer ring
26. Channel screen
27. Welch plug-11/32
28. Mixture needle springs (2)
29. Idle fuel needle
30. Main fuel needle
31. Throttle shaft
32. Throttle spring
33. Idle speed screw spring
34. Idle speed screw



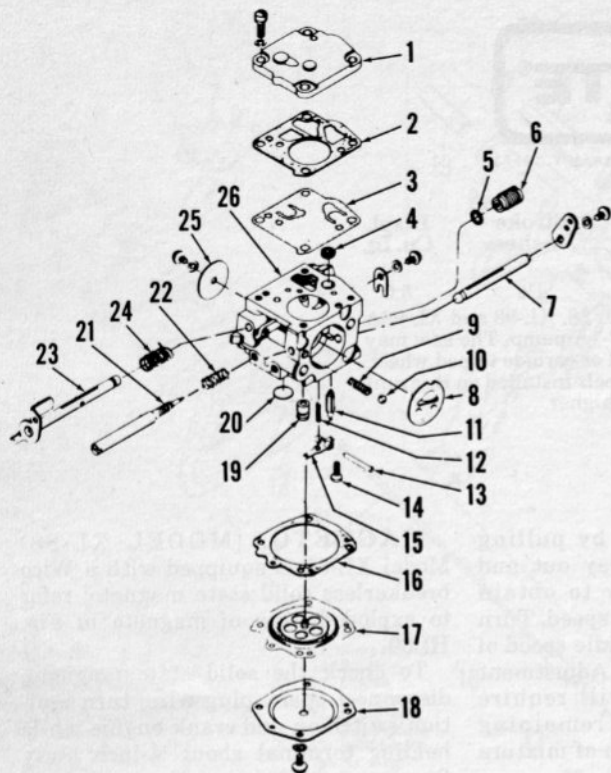


Fig. HL76—Exploded view of Tillotson model HS carburetor used on model XL-98A. Note governor valve (6). There is no high speed mixture needle on this carburetor.

1. Diaphragm cover
2. Gasket
3. Fuel pump diaphragm
4. Filter screen
5. Gasket
6. Governor valve
7. Choke shaft
8. Choke plate
9. Spring
10. Choke detent ball
11. Inlet valve needle
12. Inlet lever spring
13. Lever pin
14. Screw
15. Inlet control lever
16. Diaphragm gasket
17. Metering diaphragm
18. Diaphragm cover
19. Main jet
20. Welch plug
21. Idle mixture screw
22. Spring
23. Throttle shaft
24. Spring
25. Throttle plate
26. Body

Visually inspect rotor (flywheel) for damage. Check for broken or frayed wires.

To test the ignition coil, disconnect the wires at insulating sleeve (39) and test coil according to tester procedure. Specifications for testing with either Graham Model 51 or Merc-O-Tronic tester are as follows:

Graham Model 51:

Maximum secondary	10,000
Maximum primary	1.7
Coil index	65
Minimum coil test	20
Maximum gap index	65

Merc-O-Tronic

Operating amperage	1.3
Primary resistance:	
Minimum	0.6
Maximum	0.7

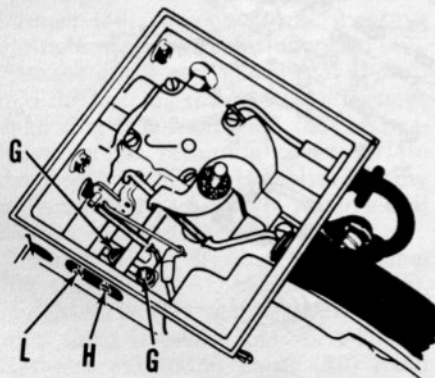


Fig. HL77—Drawing showing locations of idle (L) and high speed (H) mixture screws and governor plate screws (G) on model XL-88. Models XL-98, XLS2-1 and XLS2-1A are similar.

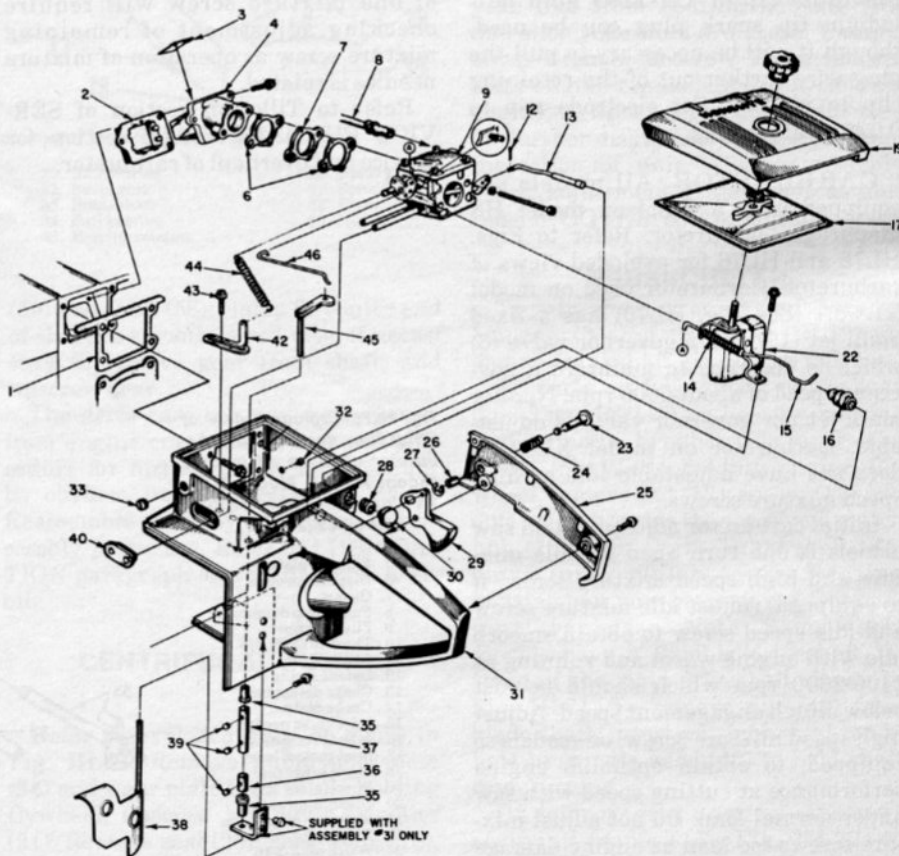


Fig. HL78—Exploded view of model XL-88 air box and handle assembly. Models XL-98, XLS2-1 and XLS2-1A are similar. Governed speed is adjusted by loosening screw (43) and moving slotted speed adjusting plate (42). Reed retainer (2) should be installed in engine intake port, then install reed seat (4) with reeds (3).

- | | | | |
|------------------|--------------------------|----------------------|---------------------------|
| 1. Gasket | 14. Return spring | 27. Snap ring | 38. Air vane & shaft |
| 2. Reed retainer | 15. Throttle rod | 28. Grommet | 39. Set screws |
| 3. Valve reeds | 16. Boot | 29. Throttle trigger | 40. Grommet |
| 4. Reed seat | 17. Filter element | 30. Choke button | 42. Speed adjusting plate |
| 5. Gaskets | 18. Air filter cover | 31. Handle & air box | 43. Adjusting plate screw |
| 6. Spacer | 19. Air deflector | 32. Plug | 44. Governor spring |
| 7. Fuel line | 20. Throttle lock pin | 33. Plug | 45. Governor arm & shaft |
| 8. Carburetor | 21. Throttle lock spring | 34. Bushing | 46. Carburetor link |
| 9. Cotter pin | 22. Handle cover | 35. Collar | |
| 10. Choke rod | 23. Nylon bushing | 36. Coupling | |

Secondary continuity:

Minimum	50
Maximum	60

Renew the ignition coil if found faulty and again check for spark. If no spark then occurs or if ignition coil checked OK, proceed as follows:

Remove the flywheel and again check for broken or frayed wires. If no defect is noted, remove the screw attaching condenser to magneto back plate and be sure condenser is not touching back plate or other ground. Push a pin through the condenser lead and using condenser tester, check for short, series resistance and capacitance; condenser capacitance should be 0.16-0.20 mfd. If condenser is faulty, renew the switch box and condenser assembly (26). If condenser tested OK, proceed as follows:

Disconnect coil primary at insulating sleeve (39) and disconnect

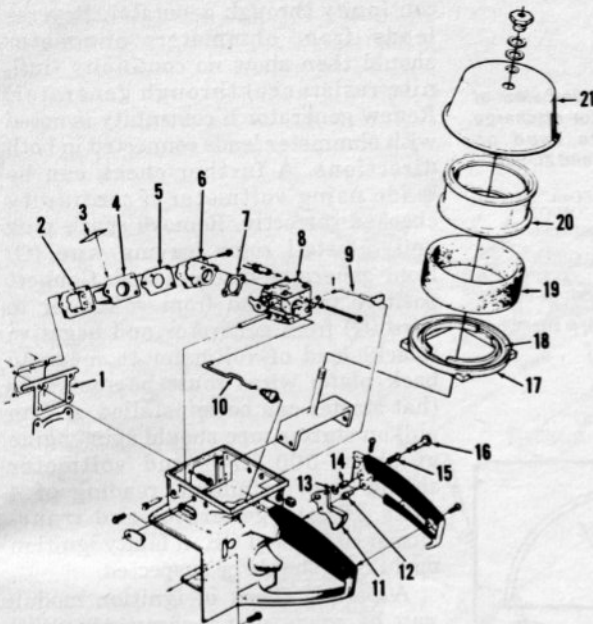


Fig. HL79—Exploded view of air box assembly used on model XL-98A.

1. Gasket
2. Reed retainer
3. Reed petal
4. Reed seat
5. Gasket
6. Intake manifold
7. Gasket
8. Carburetor
9. Choke button
10. Throttle rod
11. Throttle trigger
12. Pin
13. Snap ring
14. Nylon bushing
15. Lock spring
16. Throttle lock
17. Air cleaner base
18. Gasket
19. Filter element
20. Filter mount
21. Filter cover

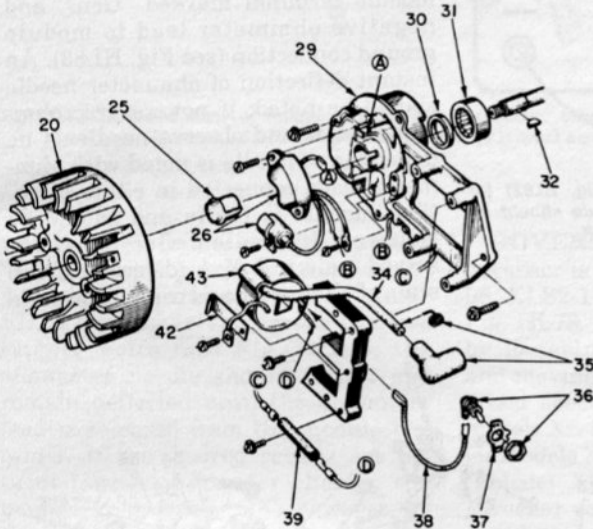
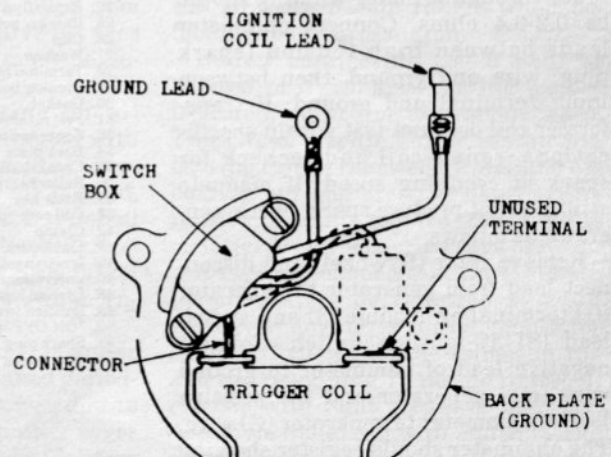


Fig. HL80—Exploded view of the solid state (breakerless) magneto used on model XL-88. Trigger switch and condenser (26) are available as assembly only. The trigger coil is molded into back plate (29).

20. Flywheel (rotor)
25. Dust cap
26. Trigger switch & condenser
29. Back plate & trigger coil
30. Crankshaft seal
31. Roller bearing
32. Woodruff key
34. Spark plug wire
35. Spark plug terminal
36. Magneto grounding switch
37. "ON-OFF" plate
38. Ground lead
39. Insulating sleeve
42. Coil retaining clip
43. Ignition coil

switch box ground lead from back plate (See Fig. HL81). Remove the screw attaching condenser to back plate and be sure condenser is insulated from any ground. Be sure the switch box ground lead and ignition coil lead are not touching anything and connect leads of an ohmmeter to the two leads. Meter should read either between 1 megohm and infinity or between 5 and 25 ohms; with ohmmeter leads reversed, reading should be opposite that of preceding test. That is, if first reading obtained was 5-25 ohms, second reading should be 1 megohm to infinity. If ohmmeter readings are not as specified, renew the switch box and condenser assembly. If switch box tested OK, test trigger coil as follows:

Fig. HL81—Drawing showing points for ohmmeter test lead connections for checking solid state magneto trigger coil, condenser and switch box. Refer to text for procedure and specifications.



Connect one ohmmeter lead to connector between switch box and trigger coil and other ohmmeter lead to back plate (ground). Reading should be either between 0 to 85 ohms or between 85 to 150 ohms. Reverse the leads; second reading on ohmmeter should be opposite first reading. That is, if first reading was in specified range of 0-85 ohms, second reading should be within range of 85-150 ohms. Then, connect the ohmmeter leads to unused terminal of trigger coil and to magneto back plate. Ohmmeter reading should then be 20 to 26 ohms. If trigger coil does not test within specifications, renew the magneto back plate and trigger coil assembly.

When reassembling magneto, check back plate and remove any sharp edges, especially where wires may contact the back plate. Be sure all leads are in place as shown in Fig. HL81. Be sure the back plate is clean and check all screws for tightness. If there is any doubt about the strength of the rotor (flywheel) magnets, install a new flywheel; be sure to remove "keeper" plates from new flywheel before installing it.

(MODELS XL-98, XL-98A). Models XL-98 and XL-98A are equipped with the capacitor discharge ignition system shown in Fig. HL82. Refer to CAPACITOR DISCHARGE IGNITION SYSTEM section of this manual for explanation of ignition system operation.

The capacitor discharge magneto is operating satisfactorily if spark will jump a $\frac{3}{8}$ -inch gap when engine is turned at cranking speed. If magneto fails to produce spark, service consists of locating and renewing inoperative unit; no maintenance is necessary.

To check magneto with volt-ohmmeter, proceed as follows: Remove starter housing and disconnect wire

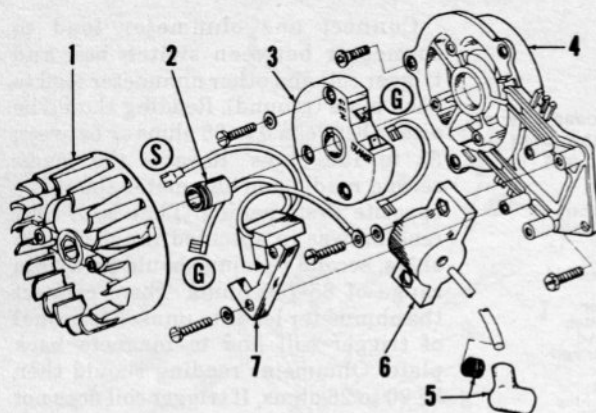


Fig. HL82-Exploded view of Phelon capacitor discharge type magneto used on models XL-98 and XL-98A.

- G. Connector to "Gen." terminal
- S. Connector to "ON-OFF"
- 1. Magneto rotor (flywheel)
- 2. Dust cap
- 3. Ignition module
- 4. Back plate
- 5. High tension wire & terminal
- 6. Transformer coil
- 7. Generator coil & armature

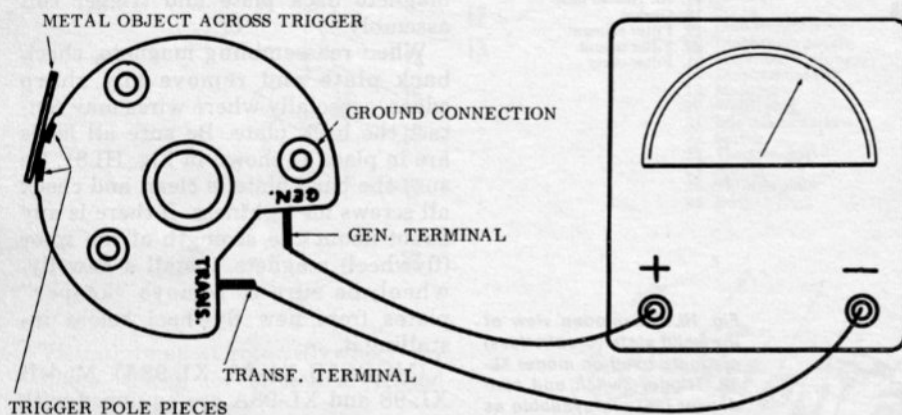


Fig. HL83-Drawing showing volt-ohmmeter connections to ignition module (3-Fig. HL82) for checking module. It should be noted that this is not a conclusive test and module should be renewed in event of spark failure when other magneto components test OK.

from ignition switch. Check to be sure there is no continuity through switch when in "ON" position to be sure a grounded switch is not cause of trouble and inspect wiring to be sure it is not shorted. CAUTION: Be sure that storage capacitor is discharged before touching connections; flip ignition switch to "OFF" position or ground switch lead (S).

Resistance through secondary (high tension) winding of transformer coil should be 2400 to 2900 ohms and resistance through primary winding should be 0.2-0.4 ohms. Connect ohmmeter leads between high tension (spark plug) wire and ground, then between input terminal and ground. If transformer coil does not test within specifications, renew coil and recheck for spark at cranking speed. If magneto still does not produce spark, check generator as follows:

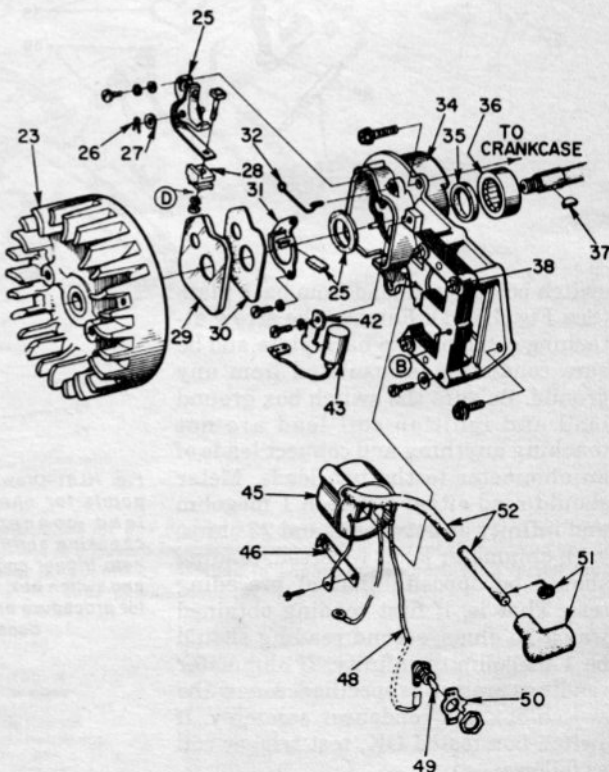
Remove rotor (flywheel) and disconnect lead from generator to generator (G) terminal on module (3) and switch lead (S) at ignition switch. Connect negative lead of ohmmeter to ground wire from generator and the positive lead of ohmmeter to generator (G) wire. The ohmmeter should register showing

continuity through generator. Reverse leads from ohmmeter; ohmmeter should then show no continuity (infinite resistance) through generator. Renew generator if continuity is noted with ohmmeter leads connected in both directions. A further check can be made using voltmeter if continuity checked correctly. Remove spark plug and reinstall rotor leaving wire (G) from generator disconnected. Connect positive (red) lead from voltmeter to wire (G) from generator and negative (black) lead of voltmeter to magneto back plate; wires must be routed so that starter can be reinstalled. A firm pull on starter rope should spin engine at about 500 RPM and voltmeter should show minimum reading of 4 volts. If both generator and transformer coil tested OK, a faulty ignition module (3) should be suspected.

A partial check of ignition module can be made using ohmmeter. With ohmmeter set to R X 1000 scale, connect positive (red) lead of ohmmeter to module terminal marked "Gen." and negative ohmmeter lead to module ground connection (see Fig. HL83). An instant deflection of ohmmeter needle should be noted; if not, reverse ohmmeter leads and observe needle. If no deflection of needle is noted with ohmmeter leads connected in either direction, module is faulty and should be renewed. If needle deflection is observed, select R X 1 (direct reading) scale of ohmmeter and connect positive

Fig. HL84-Exploded view of conventional flywheel type magneto used on models XLS2-1 and XLS2-1A. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D".

- 23. Rotor (flywheel)
- 25. Breaker point set
- 26. Clip
- 27. Washer
- 28. Terminal block
- 29. Breaker box cover
- 30. Gasket
- 31. Felt retainer
- 32. Cover spring clip
- 34. Back plate
- 35. Crankshaft seal
- 36. Roller bearing
- 37. Rotor key
- 38. Coil core (armature)
- 42. Clamp
- 43. Condenser
- 45. Ignition coil
- 46. Coil retaining clip
- 48. Ground lead
- 49. Ignition switch
- 50. "ON-OFF" plate
- 51. Spark plug terminal
- 52. Spark-plug wire



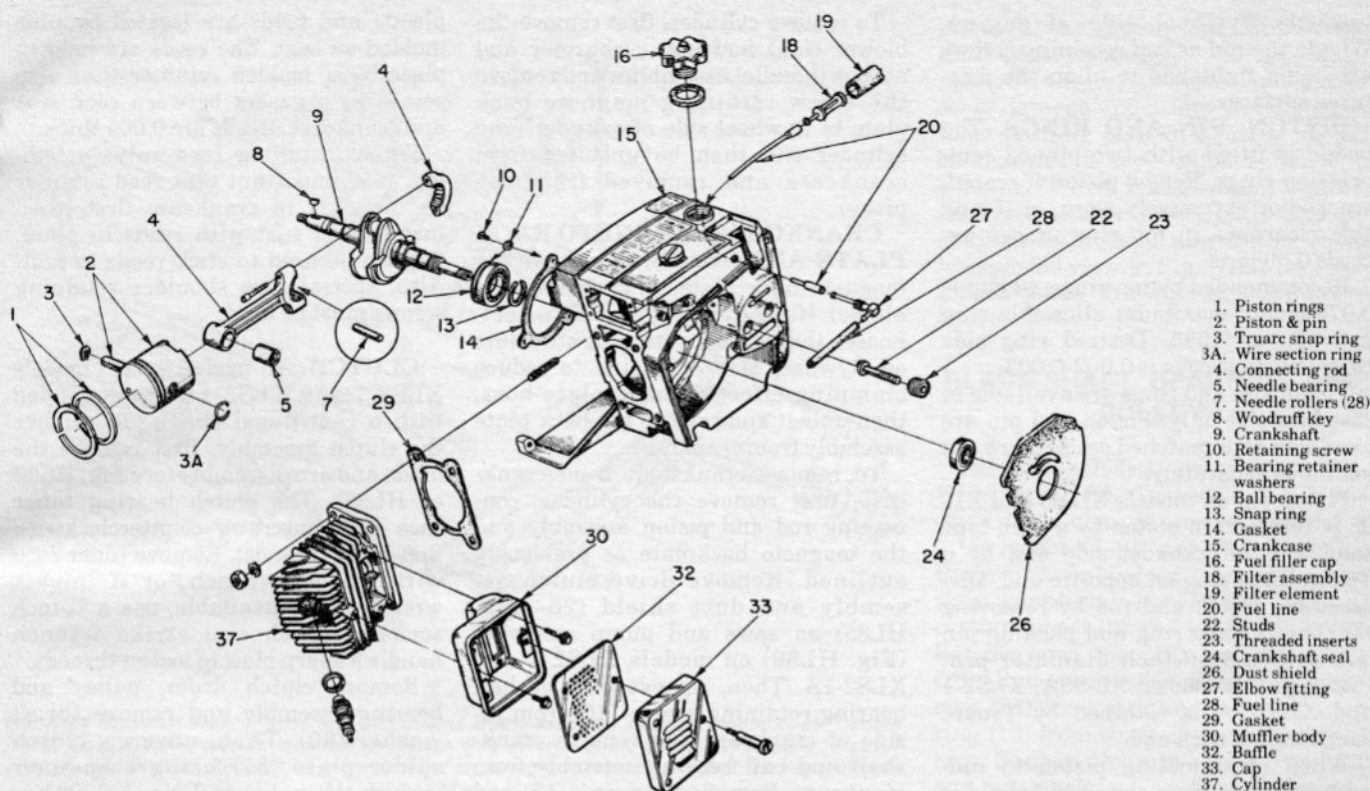


Fig. HL85—Exploded view of model XL-88 engine assembly; other models are similar. Magneto back plate (29—Fig. HL81) carries magneto end of crankshaft. Model XL-88 saw arm stud retainers (23) must be unscrewed to remove the captive studs (22); do not attempt to uncrew the studs.

(red) lead to module terminal marked "Gen." and place negative (black) lead against terminal marked "Trans." Place a screwdriver across the two trigger poles (see Fig. HL83); the ohmmeter needle should deflect and remain deflected until the ohmmeter lead is released from the module terminal. If the desired results are obtained with ohmmeter checks, the module is probably OK; however, as this is not a complete check and other magneto components and wiring check OK, renew module if no ignition spark can yet be obtained.

(MODELS XLS2-1, XLS2-1A). Models XLS2-1 and XLS2-1A are equipped with a conventional flywheel magneto ignition system as shown in Fig. HL84. Breaker points and condenser are accessible after removal of starter housing, flywheel and breaker box cover. Adjust breaker point gap to 0.015. Condenser capacity should test 0.18-0.22 mfd. Ignition timing is fixed at 30° BTDC. After reinstalling flywheel, check armature air gap which should be 0.005-0.007. To adjust air gap, turn flywheel so that magnets are below legs of armature core and place plastic shim (Homelite part No. 23987) between armature and magnets. Loosen then tighten armature retaining screws and remove shim.

GOVERNOR. An air vane type governor is used on models XL-88, XL-98, XLS2-1 and XLS2-1A as shown in Fig. HL78. Governed speed is adjusted by loosening screws (43—Fig. HL78) and moving plate (42). Maximum governed speed should be 5000 rpm for models XL-88 and XL-98 and 6400 rpm for models XLS2-1 and XLS2-1A.

Model XL-98A is equipped with a governor valve (6—Fig. HL76) located in the carburetor. At the desired governed speed, the governor valve will open and allow additional fuel into the engine. This excessively rich fuel mixture will prevent engine overspeeding. Governed speed should be 5000 rpm and is not adjustable. If valve (6) does not function properly, it must be renewed as a unit.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler cover and baffle plate and scrape muffler free

of carbon. With muffler cover removed, turn engine so that piston is at top dead center and carefully remove carbon from exhaust ports with wooden scraper. Be careful not to damage the edges of exhaust ports or to scratch piston. Do not attempt to run engine with muffler baffle plate or cover removed.

REPAIRS

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Be careful to remove all of the 28 loose needle rollers when detaching rod from crankpin.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23955. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. Stick 14 needle rollers in rod and the remaining 14 needle rollers in rod cap with light grease or beeswax. Assemble rod to cap with match marks aligned and with open end of piston pin

towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured surfaces.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.0035.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003.

Piston, pin and rings are available in standard size only. Piston and pin are available as a matched set and are not available separately.

Piston pin on models XL-88 and XL-98 is retained in piston by a wire type snap ring on exhaust side and by a Truarc snap ring on opposite end. Disassemble piston and rod by removing the Truarc snap ring and pushing pin out with a 3/16-inch diameter pin. Piston pin on models XL-98A, XLS2-1 and XLS2-1A is retained by Truarc snap rings at each end.

When reassembling piston to connecting rod, be sure closed end of pin is towards exhaust port. Install piston pin retaining Truarc snap rings with sharp side out. Rotate snap ring to be sure it is secure in retaining groove, then turn gap toward closed end of piston.

CRANKSHAFT. Flywheel end of crankshaft is supported in a roller bearing in magneto back plate and drive end is supported in a ball bearing located in crankcase. End play is controlled by the ball bearing.

Renew the crankshaft if the flywheel end main bearing or crankpin bearing surface or sealing surfaces are scored, burned or excessively worn. Renew the ball bearing if excessively loose or rough. Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged.

CYLINDER. The cylinder bore is chrome plated. Renew cylinder if chrome plating is worn away exposing the softer base metal.

To remove cylinder, first remove the blower (fan) housing, carburetor and air box (handle) assemblies and remove the screw retaining magneto back plate to flywheel side of cylinder. The cylinder can then be unbolted from crankcase and removed from the piston.

CRANKCASE, MAGNETO BACK PLATE AND SEALS. To remove the magneto back plate, first remove the blower (fan) housing and flywheel. Loosen the cylinder retaining stud nuts on flywheel side of engine to reduce clamping effect on back plate boss, then unbolt and remove the back plate assembly from crankcase.

To remove crankshaft from crankcase, first remove the cylinder, connecting rod and piston assembly and the magneto backplate as previously outlined. Remove drive clutch assembly and dust shield (26—Fig. HL85) on saws and pump assembly (Fig. HL89) on models XLS2-1 and XLS2-1A. Then, remove the two ball bearing retaining screws (10) from inside of crankcase and remove crankshaft and ball bearing assembly from crankcase. Remove snap ring (13) and press crankshaft from bearing if necessary.

REED VALVES. The pyramid type reed valve seat is made of "Delrin"

plastic and reeds are located by pins molded on seat. The reeds are held in place by a molded retainer that also serves as a gasket between reed seat and crankcase. Reeds are 0.004 thick.

When installing reed valve assembly, it is important that reed retainer be installed in crankcase first, then install reed seat with reeds in place. Oil can be used to stick reeds to seat. Also, special type shoulder retaining screws must be used.

CLUTCH. All models except models XLS2-1 and XLS2-1A are equipped with a centrifugal clutch. To remove the clutch assembly, first remove the blade and arm assembly (see Fig. HL87 or HL88). The clutch bearing inner race (27) unscrews counterclockwise (left-hand threads). Remove inner race with impact wrench, or if impact wrench is not available, use a 3/4-inch socket wrench and strike wrench handle a sharp blow to loosen threads.

Remove clutch drum, pulley and bearing assembly and remove thrust washer (30). Then, unscrew clutch spider plate (31) using a spanner wrench (Homelite tool No. A-23934 or equivalent) in counterclockwise direction. Remove clutch cover (34).

Inspect clutch drum and pulley for excessive wear or scoring. Inspect all

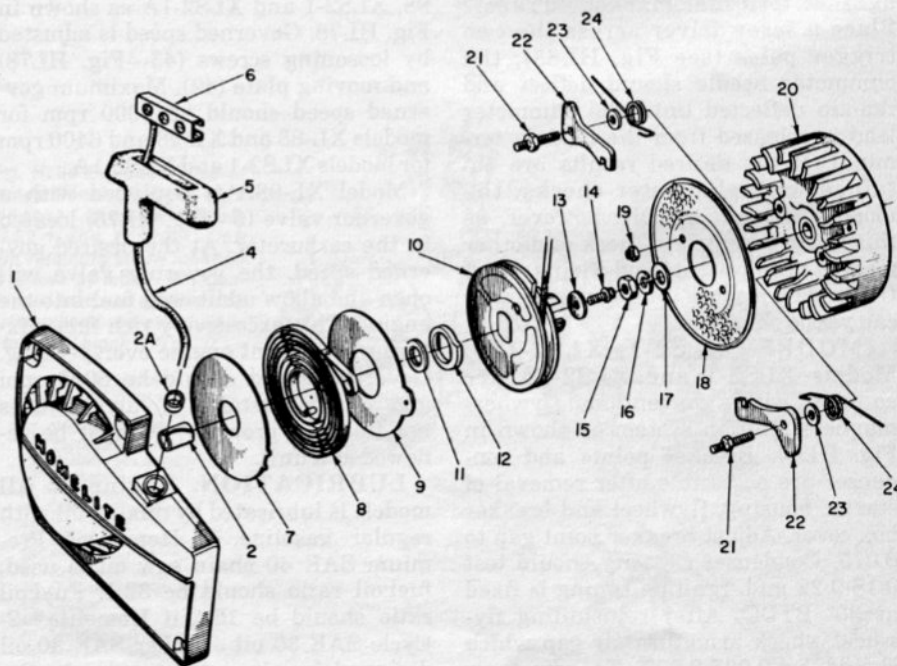


Fig. HL87—Exploded view of typical rewind starter assembly and engine flywheel.

- | | | | |
|------------------------|------------------------|-----------------------|------------------------------|
| 1. Starter housing | 8. Rewind spring | 14. Cap screw | 20. Flywheel (magneto rotor) |
| 2. Bushing | 9. Outer spring shield | 15. Flywheel nut | 21. Shoulder studs |
| 2A. Rope bushing | 10. Pulley & cup assy. | 16. Lock washer | 22. Starter pawls |
| 4. Starter rope | 11. Bushing | 17. Flat washer | 23. Washers |
| 5. Hand grip | 12. Spring lock | 18. Rotating screen | 24. Pawl springs |
| 6. Insert | 13. Washer | 19. Self-locking nuts | |
| 7. Inner spring shield | | | |

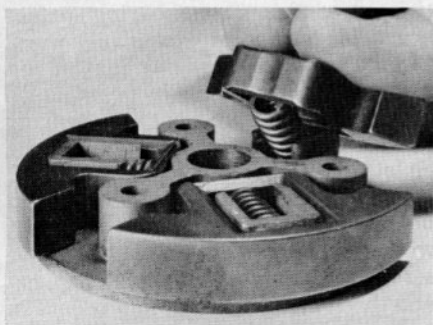


Fig. HL86—Installing shoes and springs on clutch spider plate.

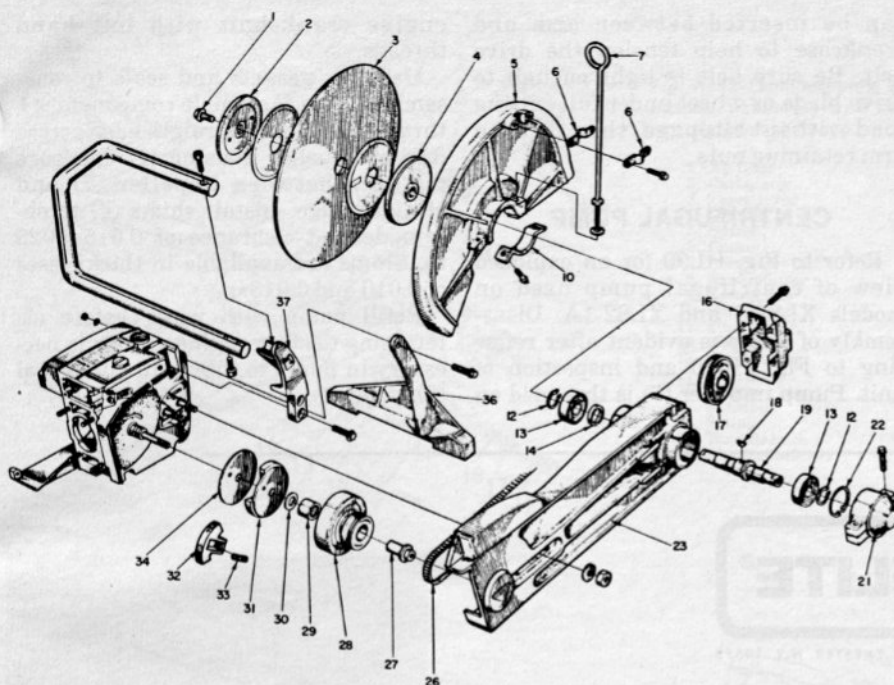


Fig. HL88—Exploded view of drive arm and cutting wheel assembly used on model XL-88. Cutting wheel or saw blade can be mounted on either side of arm. Shaft guard (21) is used to cover opposite end of shaft. Belt can be renewed after removing arm from engine and the cap (16) from end of arm.

- | | | | |
|-----------------------|-------------------|--------------------------|------------------------|
| 1. Cap screw | 12. Snapping | 21. Shaft guard | 30. Thrust washer |
| 2. Outer blade washer | 13. Ball bearing | 22. Snapping | 31. Spider plate |
| 3. Cutting wheel | 14. Spacer | 23. Arm | 32. Clutch shoes |
| 4. Inner washer | 15. Arm cap | 24. Drive belt | 33. Clutch springs |
| 5. Guard | 16. Driven pulley | 25. Clutch bearing race | 34. Clutch cover |
| 6. Clamps | 17. Woodruff key | 26. Clutch drum & pulley | 35. Saw support |
| 7. Eye or hook bolt | 18. Blade shaft | 27. Needle bearing | 36. Handle bar bracket |
| 10. Guard clamp | | | |

needle bearing rollers for scoring, excessive wear or flat spots, and renew bearing if such defect is noted. Bearing is excessively worn if rollers can be separated more than the width of one roller.

Pry clutch shoes from spider plate with screwdriver. To install new shoes and/or springs, refer to Fig. HL86. Reinstall clutch by reversing removal procedure. Lubricate needle roller bearing in clutch drum with a small amount of Homelite® ALL-TEMP Multi-Purpose Grease or a high temperature grease such as Texaco Uni-temp #500 or Humble (Esso) Nebula EP1. Note: The bearing should be cleaned and repacked after each 45 to 50 hours of operation.

REWIND STARTER. Refer to Fig. HL87 for exploded view of rewind starter. To disassemble starter after removing housing and starter assembly from engine, proceed as follows:

Pull rope out a short distance, hold rope and pry retainer (6) from hand grip. Untie knot in end of rope, then allow pulley to rewind slowly. Remove hex head screw (14) and remove rope pulley. **CAUTION:** Be careful not to dislodge spring (8) while removing

pulley as the rapidly uncoiling spring could cause injury.

Check all starter parts for wear or other damage and renew as necessary. Rope bushing (2A) in housing should be renewed if rope notch is worn in bushing. When reassembling starter, lubricate starter post lightly and install spring without lubrication. Refer to exploded view in Fig. HL87 for reassembly guide. Pre-wind the spring 2 to 4 turns.

BLADE SHAFT, BEARINGS AND PULLEY

Refer to exploded view of unit in Fig. HL88 or HL89. To renew the blade drive mechanism, proceed as follows:

On model XL-88, unbolt and remove the arm assembly from engine. Remove shaft guard (21—Fig. HL88), blade or cutting wheel (3) and blade guard (5). Remove arm cap (16) and drive belt (26). Remove the large internal snapping (22) from arm and external snapping (12) from shaft at opposite side of arm. Support the arm and press shaft and outer bearing out towards outside of arm. Remove the driven sheave from arm. Press bearing from inner side of arm. Remove snapping retaining outer bearing to shaft, then press shaft from bearing.

To disassemble blade drive on models XL-98 and XL-98A, remove

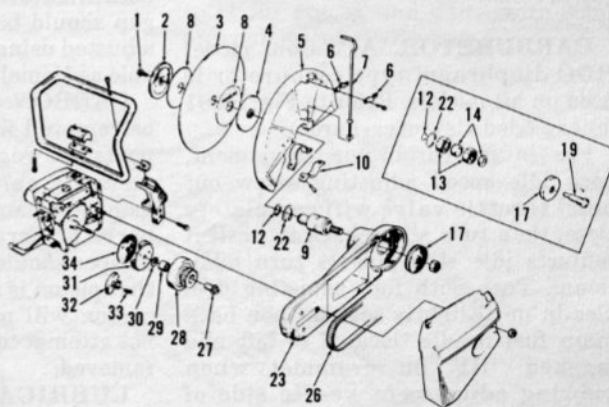
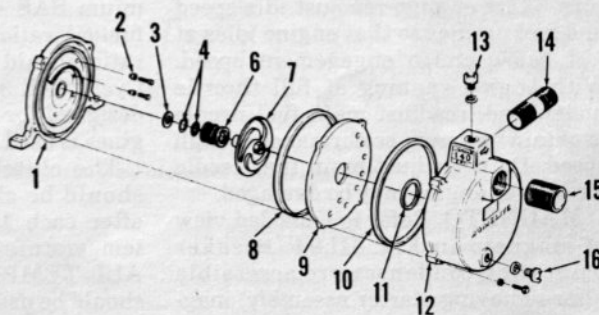


Fig. HL89—Exploded view of clutch and cutting wheel assembly used on model XL-98A. Blade shaft assembly on model XL-98 is shown in inset. Refer to Fig. HL88 for parts identification except for: 8. Spacer; 9. Bearings & shaft.

Fig. HL90—Exploded view of centrifugal pump used on models XLS2-1 and XLS2-1A.

1. Impeller housing
2. Seal washer
3. Washer
4. Shims
5. Seal
6. Impeller
7. Gasket
8. Wear plate
9. Gasket
10. Gasket
11. End housing
12. Fill plug
13. Discharge fitting
14. Inlet fitting
15. Drain plug



blade arm from engine and detach drive cover and components (1 thru 8—Fig. HL89) as well as clamp (10). Remove driven pulley (17) and drive belt (26). Note that pulley on model XL-98 is retained by a nut while blade shaft (19) holds pulley (17) in position and shaft must be removed with pulley. Remove snap rings and press bearings out of blade arm.

To reassemble, reverse disassembly procedure. Place belt over drive pulley on engine, then mount arm to engine crankcase. A wrench with tapered handle (Homelite tool No. A-24085)

can be inserted between arm and crankcase to help tension the drive belt. Be sure belt is tight enough to drive blade or wheel under full cutting load without slippage, then tighten arm retaining nuts.

CENTRIFUGAL PUMP

Refer to Fig. HL90 for an exploded view of centrifugal pump used on models XLS2-1 and XLS2-1A. Disassembly of pump is evident after referring to Fig. HL90 and inspection of unit. Pump impeller (7) is threaded on

engine crankshaft with left hand threads.

Use new gaskets and seals to reassemble pump. Assemble components (1 thru 7) and place a straight edge across face of impeller housing (1). Measure distance between impeller (7) and straight edge. Install shims (4) to obtain desired clearance of 0.015-0.025 in. Shims are available in thicknesses of 0.010 and 0.015 in.

Refill pump with water before attempting to start engine. Water is necessary in pump to lubricate pump seal (6).



Model	Bore Inches	Stroke Inches	Displ. Cu. In.
EZ-10, Chipper	1.4375	1.3	2.1

MAINTENANCE

SPARK PLUG. A Champion DJ-6J spark plug with tapered seat is used; no gasket is required. Adjust electrode gap to 0.025.

CARBURETOR. A Walbro model HDC diaphragm type carburetor is used on all models. Refer to Fig. HL91 for exploded view of carburetor.

For initial carburetor adjustment, back idle speed adjusting screw out until throttle valve will completely close, then turn screw back in until it contacts idle stop plus ½ turn additional. Turn both fuel adjusting needles in until lightly seated, then back main fuel needle (located to left and marked "HI" on grommet when viewing adjustment needle side of throttle handle) out about one turn and back idle ("LO") needle out about ¾ turn. Start engine, readjust idle speed and fuel needles so that engine idles at just below clutch engagement speed. With engine running at full throttle under load, readjust main fuel needle to obtain optimum performance at high speed. Do not adjust main fuel needle too lean as engine may be damaged.

MAGNETO. Refer to exploded view of magneto in Fig. HL94. Breaker points and condenser are accessible after removing starter assembly, mag-

neto rotor (flywheel) and breaker box cover.

Condenser capacity should test approximately 0.2 mfd. Adjust breaker points to 0.015. After reinstalling magneto rotor (flywheel), check magneto armature core to rotor air gap. Air gap should be 0.008-0.012 and can be adjusted using plastic shim stock available as Homelite part No. 24306.

CARBON. Carbon deposits should be removed from muffler and exhaust ports at regular intervals. When scraping carbon, be careful not to damage chamfered edges of exhaust ports or scratch piston. A wooden scraper should be used. Turn engine so that piston is at top dead center so that carbon will not fall into cylinder. Do not attempt to run engine with muffler removed.

LUBRICATION. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

The clutch needle roller bearing should be cleaned and relubricated after each 100 hours of use. A high temperature grease such as Homelite® ALL-TEMP Multi-Purpose Grease should be used.

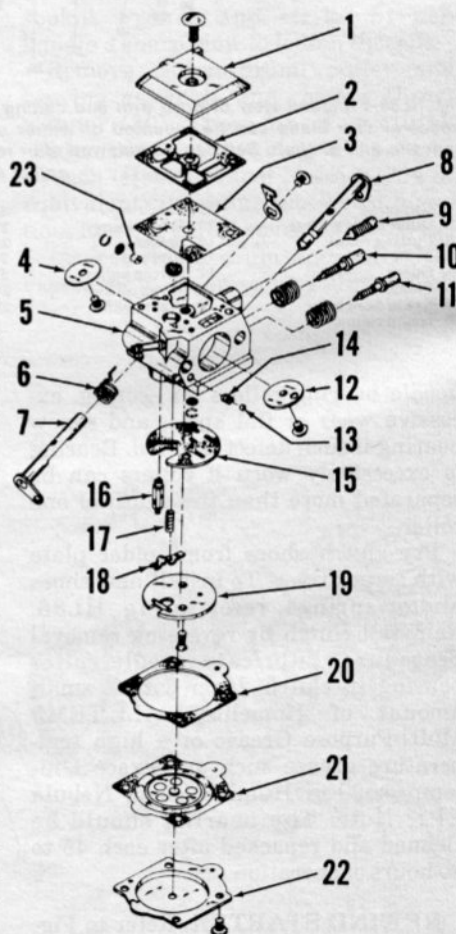


Fig. HL91—Exploded view of Walbro model HDC carburetor.

- | | |
|---------------------------------|-------------------------|
| 1. Pump cover | 12. Choke plate |
| 2. Gasket | 13. Choke friction ball |
| 3. Fuel pump diaphragm & valves | 14. Spring |
| 4. Throttle plate | 15. Gasket |
| 5. Body | 16. Fuel inlet valve |
| 6. Return spring | 17. Spring |
| 7. Throttle shaft | 18. Diaphragm lever |
| 8. Choke shaft | 19. Circuit plate |
| 9. Idle speed screw | 20. Gasket |
| 10. Idle mixture screw | 21. Metering diaphragm |
| 11. High speed mixture screw | 22. Cover |
| | 23. Limiting jet |

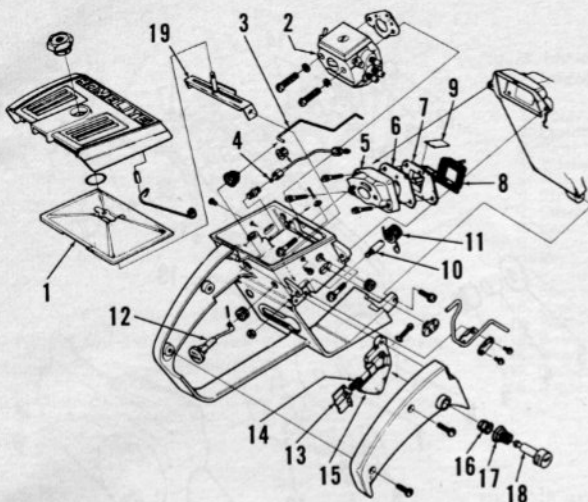


Fig. HL92—Exploded view of handle assembly and related assemblies.

1. Air filter
2. Carburetor
3. Throttle rod
4. Oil line
5. Spacer
6. Gasket
7. Reed valve seat
8. Reed retainer
9. Reed petals
10. Spring post
11. Spring
12. Choke rod
13. Throttle stop
14. Spring
15. Trigger
16. Bushing
17. Spring
18. Throttle latch
19. Air filter bracket



Fig. HL93—Before tightening screws retaining air filter bracket (19—Fig. HL92) in throttle handle, place air filter element on bracket stud and align filter with edges of air box.

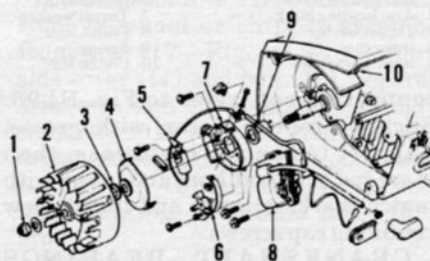


Fig. HL94—Exploded view of ignition assembly. Felt seal (3) is cemented to breaker box cover (4).

1. Nut
2. Flywheel
3. Felt seal
4. Box cover
5. Condenser
6. Breaker points
7. Breaker box
8. Ignition coil
9. Felt seal
10. Fuel tank

REPAIRS

TIGHTENING TORQUES. Recommended minimum tightening torques are listed in the following table; all values are in inch-pounds. To find maximum torque value, add 20 percent to given value.

6/32 Compression release clamp ...	20
6/32 Compression release post nut	20
6/32 Breaker box	20
6/32 Breaker point adjustable arm	20
6/32 Condenser	20
8/32 Air filter bracket	25
8/32 Connecting rod	55
8/32 Throttle handle cover	35
8/32 Rewind spring cover	35
8/32 Intake manifold (reed spacer)	20
8/32 Coil assembly	20
8/32 Fuel tank	35
10/32 Main bearing retainer screws	50
10/32 Muffler body	50
10/32 Starter housing	50
10/32 Carburetor	20

10/32 Starter pawl studs	50
10/32 Handle bar	50
12/24 Throttle handle	80
12/24 Fuel tank to crankcase	75
12/24 Drivecase	75
1/4-28 Cylinder nuts	100
5/16-24 Rotor (flywheel) nut	150
14mm Spark plug	120
Clutch hub	180

SPECIAL SERVICE TOOLS. Special service tools which may be required are listed as follows:

Tool No.	Description & Model Usage
24299	Anvil, crankshaft installation.
24300	Sleeve, crankshaft bearing.
24294	Plug, needle bearing assembly.
24292	Plug, seal removal.
24298	Plug, bearing and seal.
24320	#3 Pozidriv screwdriver bit.
A24290	Bracket, rotor remover.
A-24060	Wrench, clutch spanner.
A-24309	Jackscrew, crankshaft and bearing.
23136-1	Body for A-24309.
24295	Bearing collar for A-24309.
24291	Sleeve, drivecase seal.
24297	Sleeve, crankcase seal.

CYLINDER. The cylinder can be unbolted and removed from crankcase after removing starter housing and throttle handle. Be careful not to let piston strike crankcase as cylinder is removed.

The cylinder bore is chrome plated and cylinder should be renewed if the chrome plating has worn through exposing the softer base metal. Also inspect for cracks and damage to compression release valve bore.

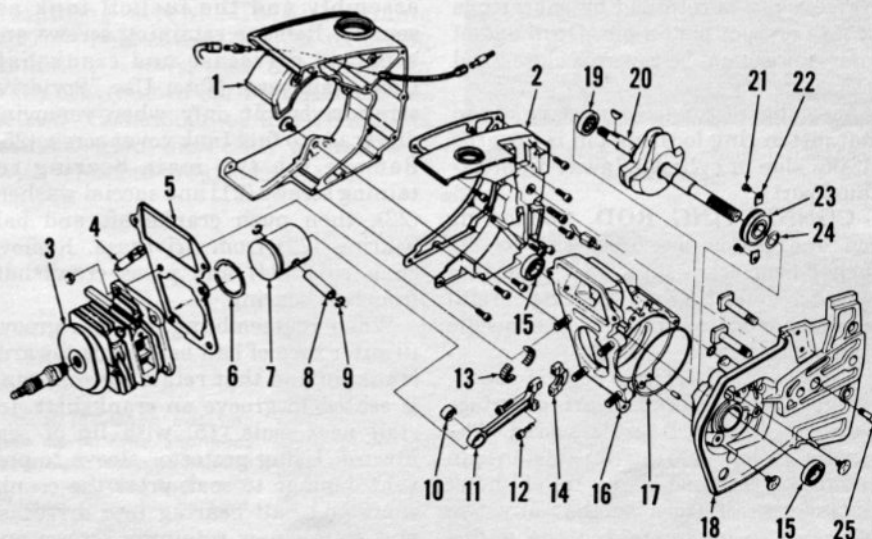


Fig. HL95—Exploded view of typical engine assembly.

1. Fuel tank
2. Oil tank
3. Cylinder
4. Compression release valve
5. Gasket
6. Piston rings
7. Piston
8. Piston pin
9. Pin retainer
10. Needle bearing
11. Connecting rod
12. Capscrew
13. Bearing rollers (28)
14. Connecting rod cap
15. Seal
16. Crankcase
17. "O" ring
18. Drivecase
19. Roller bearing
20. Crankshaft
21. Screw
22. Bearing retainer
23. Ball bearing
24. Snap ring

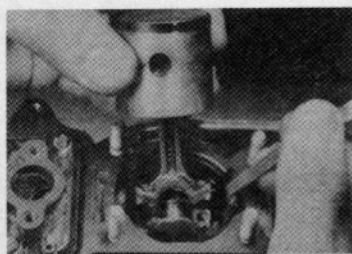


Fig. HL96—Installing piston and connecting rod assembly using locally made tool to hold rod cap in position. Tool can be made from flat strip of metal. Using grease, stick 14 rollers in cap and 14 rollers in rod; make sure that match marks on rod and cap are aligned.



Fig. HL97—Roller type main bearing used at fly-wheel end of crankshaft is marked on one side, "PRESS OTHER SIDE". Be sure to observe this precaution when installing bearing in crankcase.

PISTON, PIN AND RINGS. Model EZ-10 and Chipper piston has one Head land type ring. Piston ring should be renewed if ring end gap exceeds 0.016 inch; desired ring end gap is 0.006-0.016 inch. The base side of the ring has a cut-out at the end gap to fit the ring locating pin in piston ring groove.

Piston pin is retained by snap rings at both ends of piston pin. Open end of snap ring should be towards closed end of piston.

Assemble piston to connecting rod so that piston ring locating pin is towards intake side of cylinder (away from exhaust port).

CONNECTING ROD. Connecting rod and piston assembly can be detached from crankshaft after removing cylinder; refer to Fig. HL95. Be careful to remove all of the 28 loose needle bearing rollers.

Renew connecting rod if bent, twisted or if crankpin bearing surface shows visible wear or is scored. The needle roller bearing for piston pin should be renewed if any roller shows flat spot or if worn so that any two rollers can be separated the width equal to thickness of one roller and if rod is otherwise serviceable. Press on lettered side of bearing cage only when removing and installing bearing.

The crankpin needle rollers should be renewed at each overhaul. To install

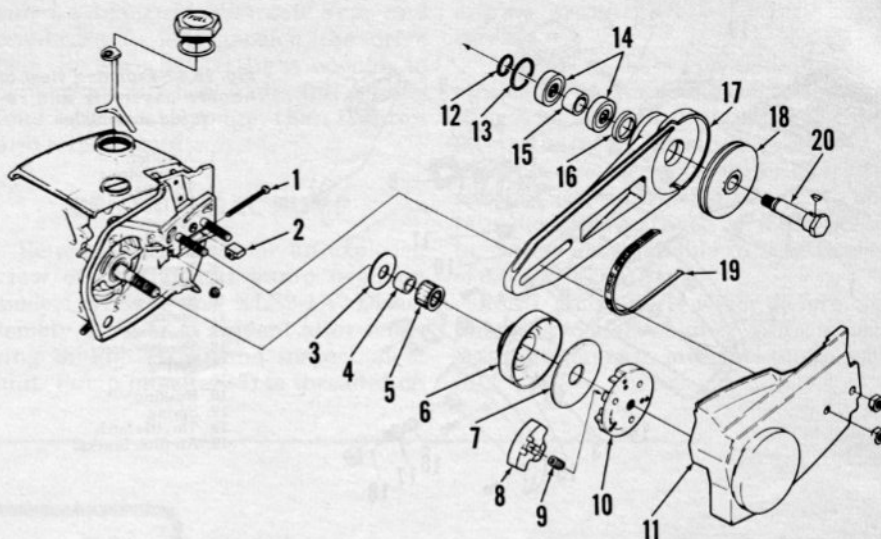


Fig. HL98—Exploded view of clutch and wheel arm assemblies.

1. Belt tension screw
2. Arm locating block
3. Thrust washer
4. Inner race
5. Needle bearing

6. Clutch drum
7. Thrust washer
8. Clutch shoe
9. Spring
10. Clutch hub

11. Side cover
12. Snap ring
13. Snap ring
14. Ball bearing
15. Spacer

16. Spacer
17. Wheel arm
18. Driven pulley
19. Belt
20. Shaft

connecting rod, refer to Fig. HL96. Stick 14 rollers in cap with grease. Support rod cap in crankcase, then place rod over crankpin and to cap with match marks aligned and install new retaining cap screws.

CRANKSHAFT, BEARINGS AND SEALS. Crankshaft is supported by a roller bearing (19—Fig. HL95) mounted in crankcase bore and by a ball bearing (23) mounted in drivecase (18).

To remove crankshaft, first remove blade arm, clutch assembly, starter housing, magneto rotor, throttle handle, cylinder, piston and connecting rod assembly and the fuel/oil tank assembly. Remove retaining screws and separate drivecase and crankshaft from crankcase. Note: Use "Pozidriv" screwdriver bit only when removing drivecase to fuel tank cover screw (25). Remove the two main bearing retaining screws (21) and special washers (22), then push crankshaft and ball bearing (23) from drivecase. Remove snap ring (24) and press crankshaft from ball bearing.

When reassembling, be sure groove in outer race of ball bearing is towards crankpin and that retaining snap ring is seated in groove on crankshaft. Install new seals (15) with lip of seal inward. Using protector sleeve to prevent damage to seal, press the crankshaft and ball bearing into drivecase and install new retaining screws and washers. Assemble crankcase to crankshaft and drivecase using new "O" ring (17) and protector sleeve to prevent damage to crankcase seal. Be sure bar studs are in place before installing fuel tank.

COMPRESSION RELEASE.

When throttle lock is pushed in, a lever connected to throttle lock lifts away from compression release valve (4—Fig. HL95). When engine is cranked, compression forces valve open and compression is partly relieved through port in cylinder. Squeezing throttle trigger after engine is running releases throttle lock, allowing spring (11—Fig. HL92) to snap lever against release valve, closing the valve.

Service of compression release valve usually consists of cleaning valve seat and port in cylinder as carbon may gradually fill the port.

When overhauling engine, cylinder should be inspected for any damage to compression release port.

PYRAMID REED VALVE. A "Delrin" plastic pyramid type reed intake valve seat and four reeds are used.

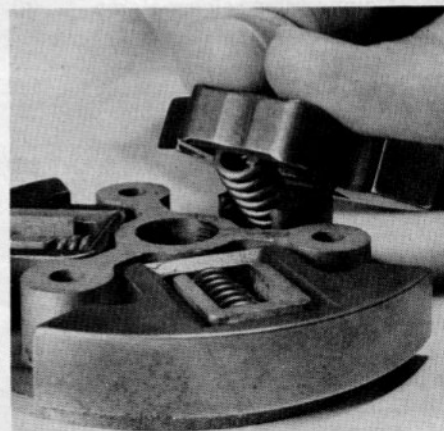


Fig. HL99—Although clutch shown above is not used on model EZ or Chipper, easy method of clutch spring and shoe installation is shown.

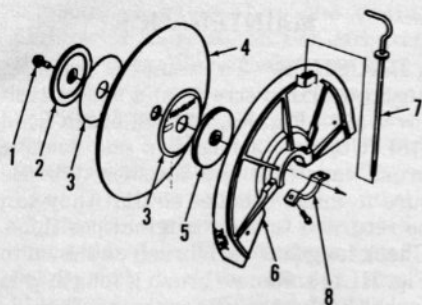


Fig. HL100—Exploded view of model EZ wheel assembly.

- | | |
|-----------------------|-----------------------|
| 1. Capscrew | 5. Inner wheel washer |
| 2. Outer wheel washer | 6. Guard |
| 3. Spacer | 7. Hook bolt |
| 4. Wheel | 8. Clamp |

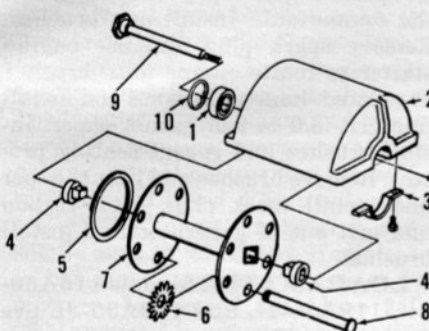


Fig. HL101—Exploded view of cutting assembly on Chipper.

- | | |
|-------------|---------------|
| 1. Bearing | 6. Cutters |
| 2. Guard | 7. Hub |
| 3. Clamp | 8. Cutter pin |
| 4. Insert | 9. Shaft |
| 5. Retainer | 10. Snap ring |

Reeds are retained on pins projecting from the reed seat by a moulded retainer. Inspect reed seat, retainer and reeds for any distortion, excessive wear or other damage.

To reinstall, use a drop of oil to stick each reed to the plastic seat, then push reed retainer down over the seat and reeds. Then install the assembly in crankcase; never install retainer, then attempt to install reed seat and reeds.

CLUTCH. Refer to Fig. HL98 for exploded view of the shoe type clutch. The clutch hub (10) is threaded to crankshaft; turn clutch hub in clockwise direction to remove from crankshaft.

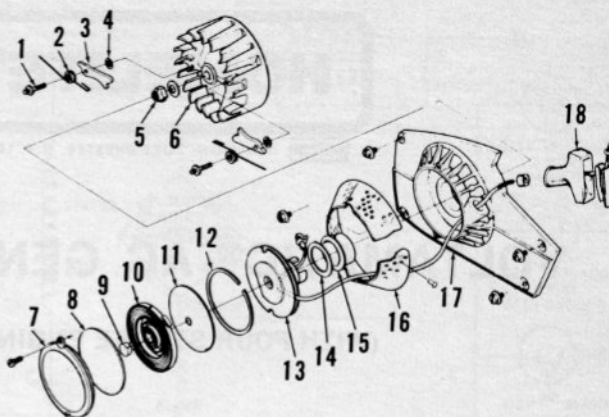
If clutch slips with engine running at high speed under load, check clutch shoes for excessive wear. If clutch will not release (cutting unit is driven at normal idle speed), check for broken or weak clutch springs.

Refer to Fig. HL99 for easy method of installing clutch shoes and springs on clutch hub.

CUTTING WHEEL AND CHIPPER. Model EZ-10 is equipped with an abrasive wheel (4—Fig. HL100) for cutting while Chipper

Fig. HL102—Exploded view of recoil starter.

1. Stud
2. Spring
3. Pawl
4. Washer
5. Nut
6. Flywheel
7. Cover
8. Spring shield
9. Spring lock
10. Rewind spring
11. Spring shield
12. Snap ring
13. Rope pulley
14. Washer
15. Bushing
16. Screen
17. Starter housing
18. Rope handle



models are equipped with the chipping device shown in Fig. HL101. The abrasive wheel or chipper is attached to the drive assembly shown in Fig. HL98.

To disassemble drive mechanism, remove wheel or chipper assembly from arm (17—Fig. HL98). Remove side cover (11) and belt (19). Separate arm assembly from engine. Remove snap rings (12 and 13), shaft (20) and driven pulley (18). Inspect components (14, 15 and 16) and remove if necessary. Bearings (14) are a press fit in arm.

Belt tension is adjusted by turning adjusting screw (1) with side cover (11) retaining nuts loosened to allow arm (17) to move. Belt tension should be adjusted so that belt is tight enough to prevent slippage under load.

REWIND STARTER. Exploded view of rewind starter is shown in Fig. HL102. Starter can be removed as a complete unit by removing housing retaining screws. To disassemble starter, hold cover (7) while removing retaining screws, then allow cover to turn slowly until spring tension is released. Remainder of disassembly is evident from inspection of unit and with reference to exploded view.

Refer to Fig. HL103 to correctly install starter dogs on flywheel. Rewind spring is wound in clockwise direction in cover (7—Fig. HL102). When installing a new starter rope, knot rope ends as shown in Fig. HL104, pull the knots tight and coat with Duxseal (Homelite part No. 24352). Before installing cover (7—Fig. HL103) retaining screws, turn cover to pull rope handle against starter housing, then continue turning cover three turns to properly tension the rewind spring.

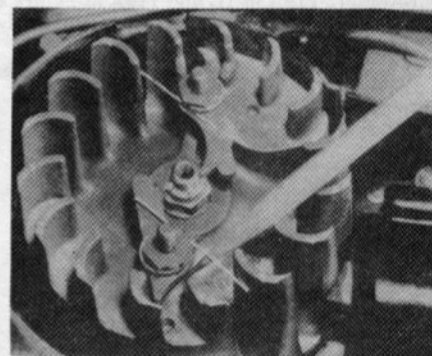


Fig. HL103—View showing proper installation of pawl springs.

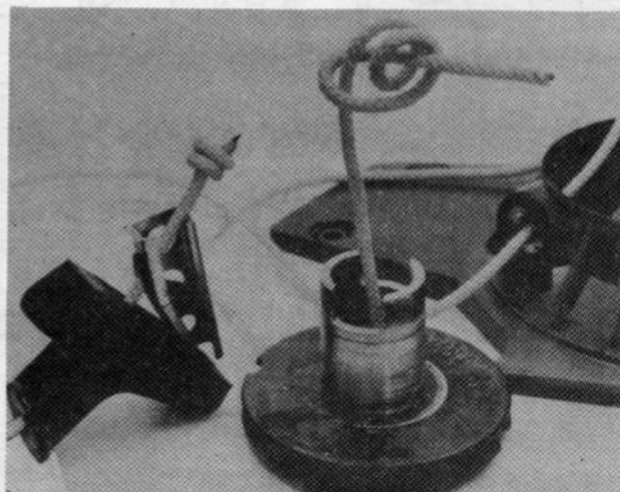


Fig. HL104—When installing new starter rope, knot ends as shown. Seal rope holes in pulley and coat knots with Duxseal (Homelite part No. 24382)

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VOLTAMATIC® AC GENERATORS

(WITH FOUR STROKE ENGINES)

Generator Model	Engine Make	Engine Model	Volts	Hz	Kilowatts
112A15-1	B&S	100232	115	60	1.5
113A25-1	B&S	146432	115	60	2.5
116A50-2	B&S	243431	115/230	60	5.0
116A50-2L	B&S	243431	115/230	60	5.0
118A35-1	Wisc.	S8D	115	60	3.5
118A35-2	Wisc.	S8D	115/230	60	3.5
119A35-1	B&S	200431	115	60	3.5
119A35-1L	B&S	200431	115	60	3.5
119A35-2	B&S	200431	115/230	60	3.5
119A35-2L	B&S	200431	115/230	60	3.5

The Homelite generators in this section are a rotating field type and produce alternating current. The generator is driven by the engine shown above. Refer to appropriate engine service manual for maintenance and overhaul of engine. All of the above generators are equipped with Voltamatic voltage control to regulate voltage. NOTE: Voltamatic is a registered trademark of Homelite and is covered by U.S. Patent No. 3,428,883. Generator models 116A50-2L, 119A35-1L and 119A35-2L are equipped with Loadamatic which is covered by U.S. Patent Nos. 3,612,892 and 3,626,197. Loadamatic is a registered trademark of Homelite.

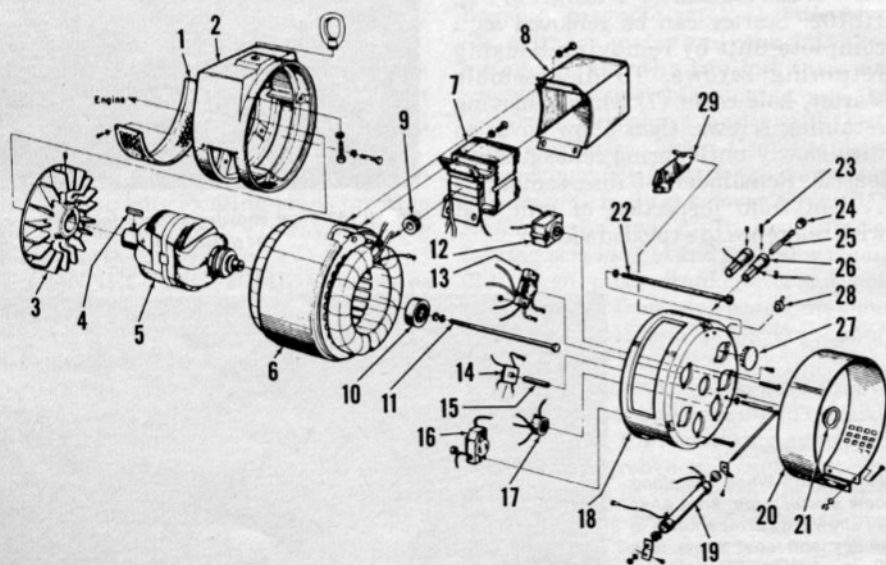


Fig. HL110—Exploded view of typical AC generator covered in this section. Switch (28) and control board assembly (29) are used on Loadamatic® models only.

- | | | | |
|----------------|-----------------------|-----------------------|-------------------------------|
| 1. Shield | 9. Grommet | 17. Receptacle (115v) | 24. Cap |
| 2. End bell | 10. Ball bearing | 18. Brush head | 25. Brush |
| 3. Fan | 11. Bolt | 19. Resistor | 26. Brush holder |
| 4. Key | 12. Receptacle (115v) | 20. Shield | 27. Plug |
| 5. Rotor | 13. Receptacle (230v) | 21. Bearing cap | 28. Loadamatic® switch |
| 6. Stator | 14. Rectifier | 22. Bolt | 29. Loadamatic® control board |
| 7. Transformer | 15. Roll pin | 23. Set screw | |
| 8. Cover | 16. Receptacle (115v) | | |

MAINTENANCE

BRUSHES. To remove brushes, unscrew clamp screws and slide brush cover (20—Fig. HL 110) off brush head (18). Unscrew set screws and remove brush caps (24) and brushes (26). Be sure to mark brushes so that they can be returned to their original positions. Check length of each brush as shown in Fig. HL111. Renew brush if length is $\frac{1}{8}$ inch or shorter. Be sure to include length of projections for brush springs when measuring brush length.

If new brushes must be installed, use the following procedure: Wrap the commutator with a medium grit (4/0 to 6/0) piece of garnet paper which will fit the commutator. Install new brushes. Remove spark plug and use engine starter to rotate engine until brushes are seated. Remove brushes and install fine grit (8/0 to 9/0) garnet paper. Install brushes and repeat seating process. Remove brushes and garnet paper and install spark plug. Blow carbon and grit out of generator and install brushes.

LOADAMATIC. Models 116A50-2L, 119A35-1L and 119A35-2L are equipped with an automatic idle control (Loadamatic®). An electromagnet

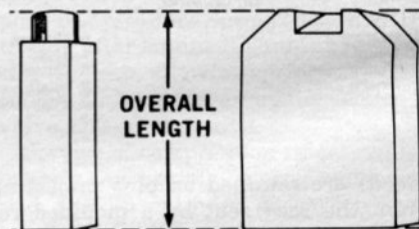


Fig. HL111—Measure length of brushes as shown.

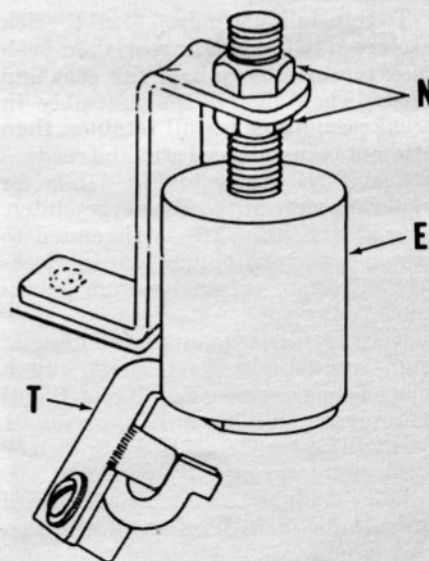


Fig. HL112—Loadamatic® is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

is mounted adjacent to the engine's carburetor and acts on the carburetor throttle arm. When there is no load on the generator, the electromagnet is energized and the engine governor is overridden as the electromagnet pulls the carburetor throttle arm to idle position. The governor resumes control of engine speed when a load is imposed on the generator. The electromagnet is deenergized and the throttle arm is released to be controlled by the governor.

To adjust automatic idle control (Loadamatic®), proceed as follows: Refer to Fig. HL 112 and adjust height of electromagnet parallel with throttle arm. Do not bend bracket or throttle arm to make this adjustment. Tighten electromagnet nuts. Position generator toggle switch to "START" to disengage Loadamatic. Start engine and allow it to reach operating temperature. If necessary, adjust carburetor for proper mixture and speed. Flip toggle switch to "AUTO" position. Engine speed should slow to idle speed. If idle speed is not steady, adjust carburetor idle mixture. Idle speed should be 2400-2600 rpm and is adjusted by loosening electromagnet nuts and altering position of electromagnet. Raising electromagnet will decrease engine speed while lowering electromagnet increases engine speed. Apply a light load to generator and then remove it. Engine speed should increase to governed speed and then return to idle after the load is removed.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL110 for an exploded view of generator and to ap-

Fig. HL113—Schematic for AC generators 112A15-1, 113A25-1, 118A35-1 and 119A35-1.

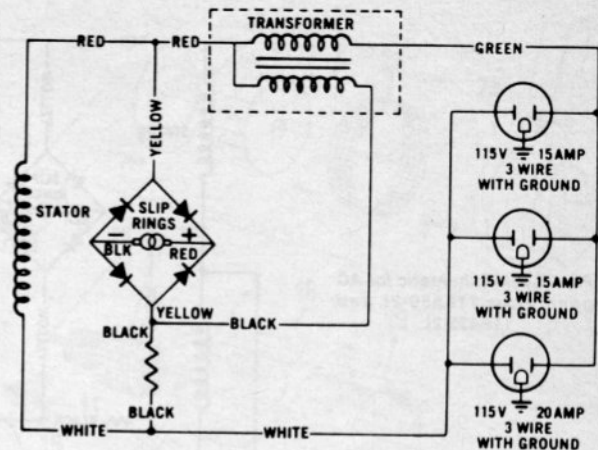
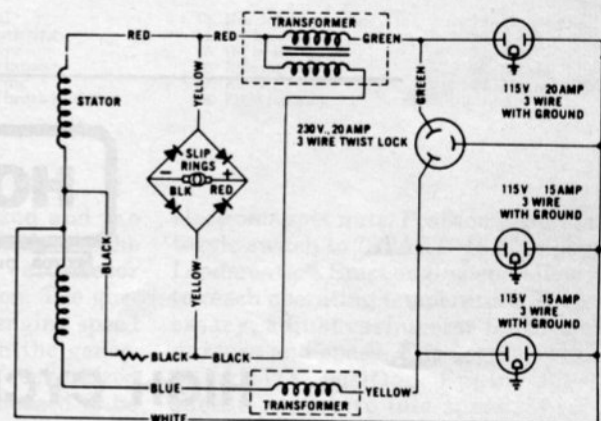


Fig. HL114—Schematic for AC generators 116A50-2, 118A35-2 and 119A35-2.



appropriate schematic in Fig. HL113, HL114, HL115 or HL116. Be sure to mark wiring so that it may be correctly connected for reassembly. Wires should be handled carefully to prevent

damage to wire, insulation and connections. Generator rotor (5—Fig. HL110) has a taper fit with engine crankshaft and should be removed with a suitable tool.

Fig. HL115—Schematic for AC generator 119A35-1L.

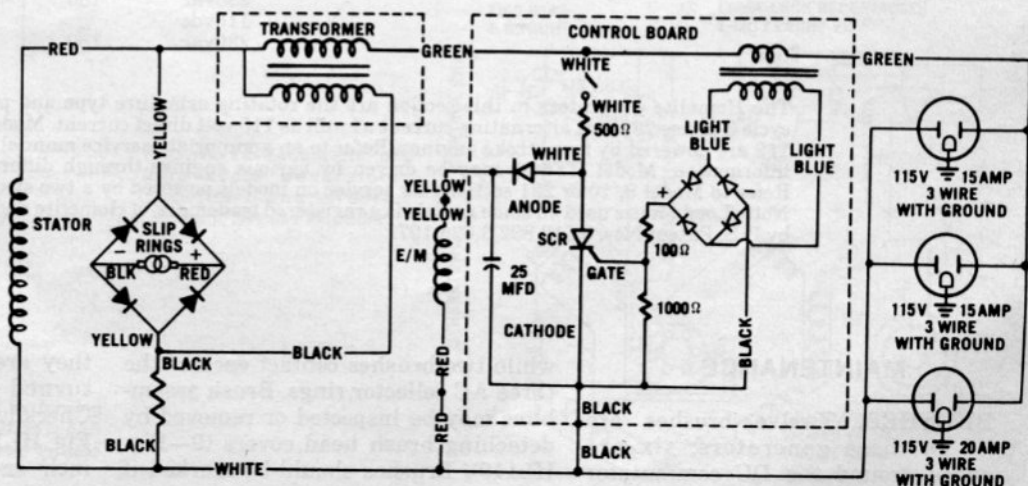
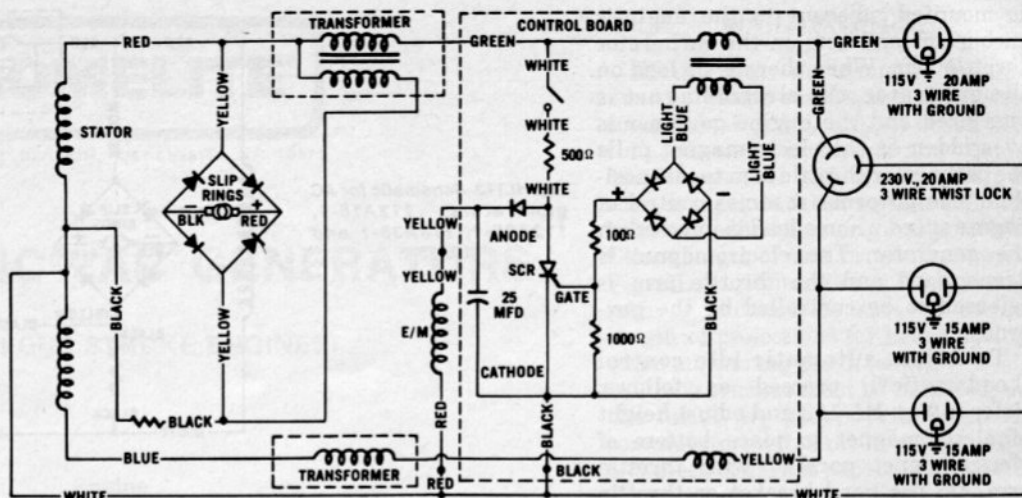


Fig. HL116—Schematic for AC generators 116A50-2L and 119A35-2L.



HIGH CYCLE GENERATORS

(WITH FOUR STROKE ENGINES)

Generator Model	Engine Make	Engine Model	Volts	Hz	Kilowatts
115HY40-1	B&S	233431	115vdc		2.5
			230vac	180	4.0
119HY35-1	B&S	200431	115vdc		2.5
			230vac	180	3.5
119HY35-2	B&S	200431	115vdc		2.5
			230vac	180	3.5
119HY35-2A	B&S	200431	115vdc		2.5
			230vac	180	3.5
119HY35-2B	B&S	200431	115vdc		2.5
			230vac	180	3.5
HY50-1	—	—	115vdc		2.5
			230vac	180	5.0

The Homelite generators in this section are the rotating armature type and provide 180 cycle 3-phase 230 volt alternating current as well as 115 volt direct current. Models 115 and 119 are powered by four stroke engines. Refer to an appropriate service manual for service information. Model HY50-1 may be driven by various engines through different drives. Refer to Model 9, 10 or 251 sections for service on models powered by a two stroke engine. Note: Loadomatic used on some models is a registered trademark of Homelite and is covered by U.S. Patent Nos. 3,612,892/3,626,197.

MAINTENANCE

BRUSHES. Twelve brushes are used in these generators; six are grouped around the DC commutator

while two brushes contact each of the three AC collector rings. Brush assemblies may be inspected or removed by detaching brush head covers (9—Fig. HL119). Brushes should be marked if

they are removed so they can be returned to their original positions. Check length of each brush as shown in Fig. HL117. Renew brush if length is $\frac{5}{8}$ inch or shorter. Be sure to include

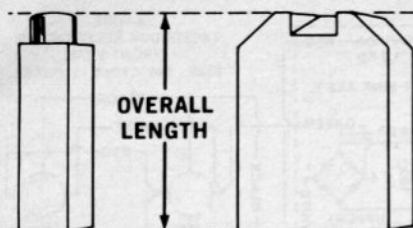


Fig. HL117—Measure brush length as shown.

length of projections for brush springs when measuring brush length.

If new brushes are required, use the following installation procedure: Wrap the commutator or collector ring with a medium grit (4/0 to 6/0) piece of garnet paper which will fit the commutator or collector ring. Install new brushes. Remove spark plug and use engine starter to rotate engine until brushes are seated. Remove brushes and install fine grit (8/0 to 9/0) garnet paper. Install brushes and repeat seating process. Remove brushes and garnet paper and install spark plug. Blow carbon and grit out of generator and install brushes.

LOADAMATIC®. Generator models 119HY35-2 and 119HY35-2A are equipped with an automatic idle control (Loadamatic®). A kit is available to add Loadamatic® to model 119HY35-1. An electromagnet is mounted adjacent to the engine's carburetor and acts on the carburetor throttle arm. When there is no load on the generator, the

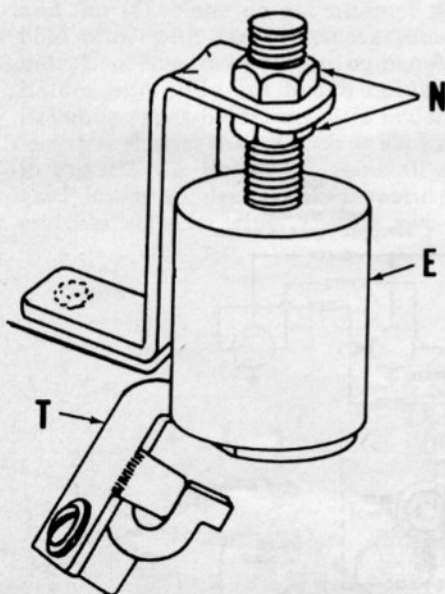


Fig. HL118—Loadamatic® is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

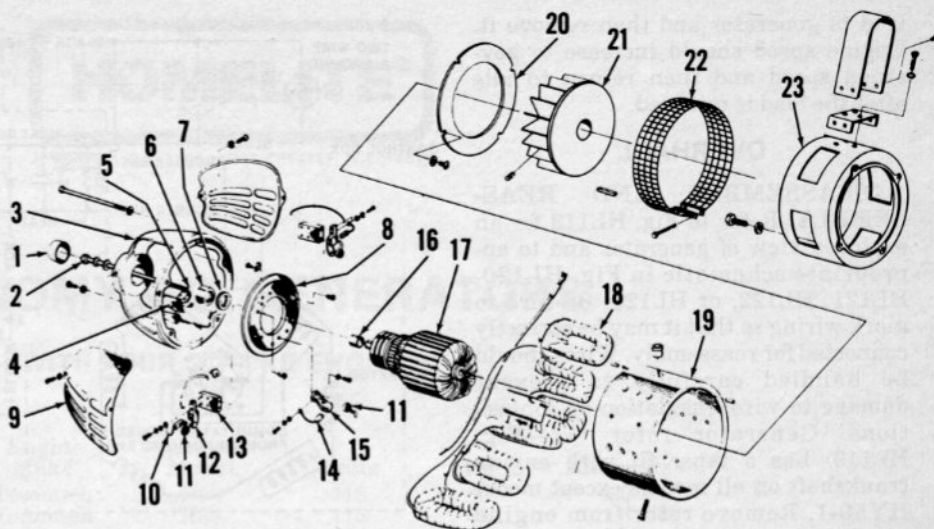


Fig. HL119—Exploded view of typical high cycle generator.

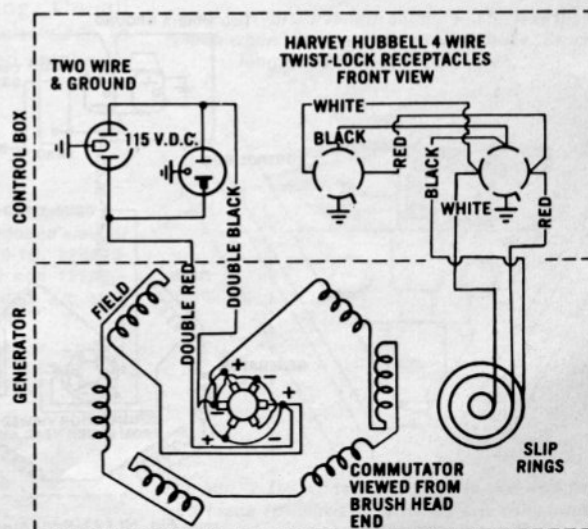
- | | | | |
|--------------------|---------------------|------------------------|-------------------|
| 1. Bearing cap | 7. Seal | 13. Brush holder block | 19. Housing |
| 2. Bolt | 8. Brush ring | 14. DC brush | 20. Baffle |
| 3. Brush head | 9. Cover | 15. DC brush holder | 21. Fan |
| 4. Transistor base | 10. AC brush | 16. Bearing race | 22. Screen |
| 5. Transistor | 11. Spring | 17. Rotor | 23. Mounting ring |
| 6. Bearing | 12. AC brush holder | 18. Field coil assy. | |

electromagnet is energized and the engine governor is overridden as the electromagnet pulls the carburetor throttle arm to idle position. The governor resumes control of engine speed when a load is imposed on the generator. The electromagnet is deenergized and the throttle arm is released to be controlled by the governor.

To adjust automatic idle control (Loadamatic®), proceed as follows: Refer to Fig. HL118 and adjust height of electromagnet to place bottom of electromagnet parallel with throttle arm. Do not bend bracket or throttle arm to make this adjustment. Tighten

electromagnet nuts. Position generator toggle switch to "START" to disengage Loadamatic®. Start engine and allow it to reach operating temperature. If necessary, adjust carburetor for proper mixture and speed. Flip toggle switch to "AUTO" position. Engine speed should reduce to idle speed. If idle speed is not steady, adjust carburetor idle mixture. Idle speed should be 2400-2600 rpm and is adjusted by loosening electromagnet nuts and altering position of electromagnet. Raising electromagnet will decrease engine speed while lowering electromagnet increases engine speed. Apply a light

Fig. HL120—Schematic of high cycle generators 119HY35-1 and HY50-1. Model 115HY40-1 is similar.



load to generator and then remove it. Engine speed should increase to governed speed and then return to idle after the load is removed.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL119 for an exploded view of generator and to appropriate schematic in Fig. HL120, HL121, HL122, or HL123. Be sure to mark wiring so that it may be correctly connected for reassembly. Wires should be handled carefully to prevent damage to wire, insulation or connections. Generator rotor (17—Fig. HL119) has a taper fit with engine crankshaft on all models except model HY50-1. Remove rotor from engine crankshaft using a suitable tool.

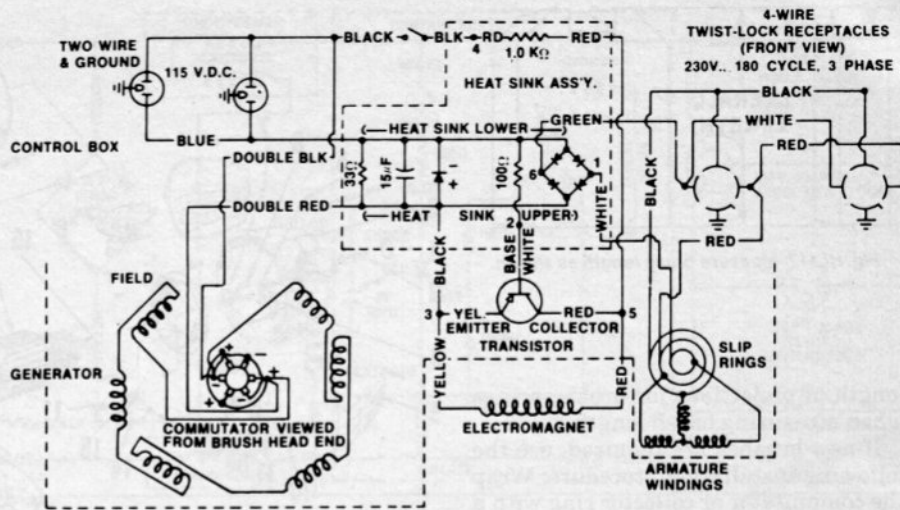


Fig. HL121—Schematic of high cycle generator 119HY35-1 with Loadamatic® and model 119HY35-2.

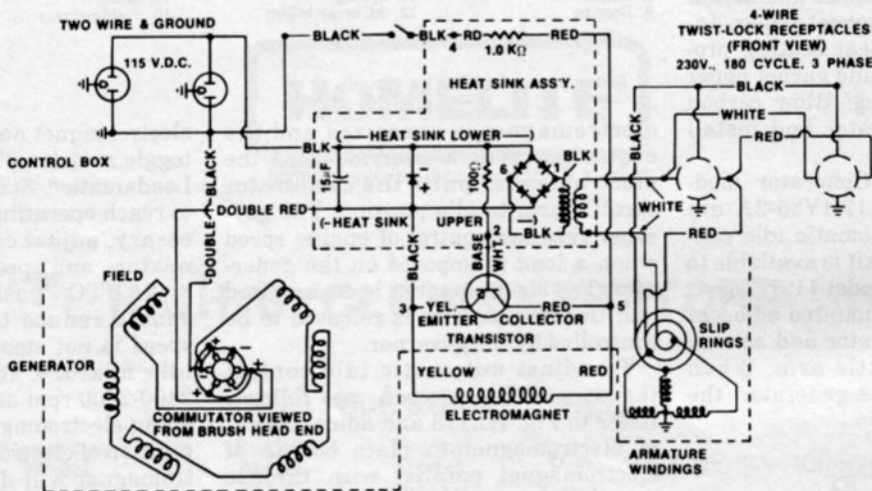


Fig. HL122—Schematic of high cycle generator 119HY35-2A.

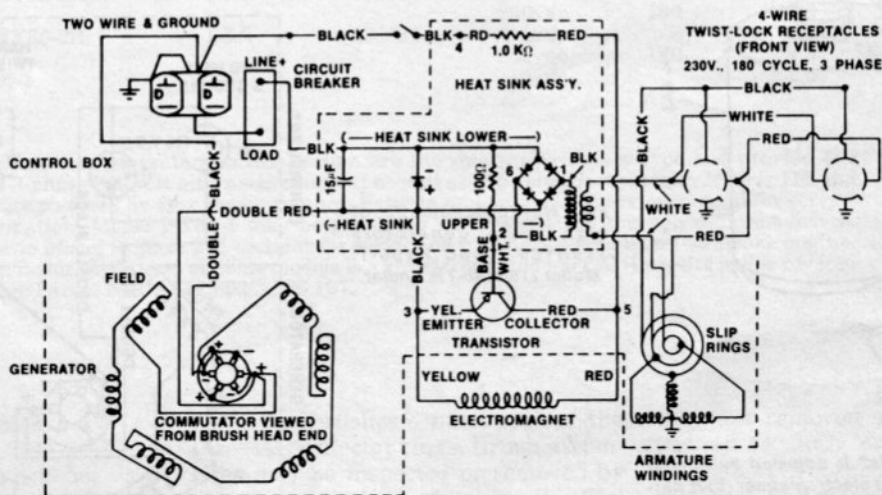


Fig. HL123—Schematic of high cycle generator 119HY35-2B.

HOMELITE®A **Textron** DIVISION, PORT CHESTER, N.Y. 10573**ECONOMY AC GENERATORS****(WITH FOUR STROKE ENGINES)**

Generator Model	Engine Make	Engine Model	Volts	Hz	Kilowatts
124A10-1	Tecumseh	H30	115	60	1.0
125A15-1	Tecumseh	H35	115	60	1.5
126A22-1	Tecumseh	H50	115	60	2.25
127A30-1	Tecumseh	H70	115	60	3.0
128A10-1	Tecumseh	H30	120	60	1.0
128A10-1B	Tecumseh	H30	120	60	1.0
129A15-1	Tecumseh	H35	120	60	1.5
129A15-1B	Tecumseh	H35	120	60	1.5
130A22-1	Tecumseh	H50	120	60	2.25
130A22-1B	Tecumseh	H50	120	60	2.25
130A22-1C	Tecumseh	HS50	120	60	2.25
131A30-1	Tecumseh	H70	120	60	3.0
131A30-1B	Tecumseh	H70	120	60	3.0

The Homelite generators in this section are a rotating field type and produce alternating current. The generator is driven by the engine shown above. Refer to appropriate engine service manual for maintenance and overhaul of engine.

MAINTENANCE

BRUSHES. Brush length and condition should be checked after every 1000 hours of operation. Brushes can be inspected after removing brush head cover (1—Fig. HL130), rotor bolt (2) and fan (3). Note: do not attempt to hold rotor with fan to remove rotor bolt. Loosen screws retaining brush holder and slide out brush holder. Brushes must be renewed if brush length is shorter than $\frac{3}{8}$ inch as shown in Fig. HL131. Be sure to reinstall a used brush so that brush curvature matches collector ring. During reas-

sembly, fan must be mounted squarely on rotor shaft. Tighten rotor bolt to 120-140 in.-lbs.

Disassemble brush holder to install new brushes. Insert new brushes in brush holder so curvature of brush will match curvature of collector ring. Seating new brushes is not required as they are manufactured with correct curvature. Note on models 124A10-1, 125A15-1, 126A22-1 and 127A30-1 that the red wire to the brush holder should be connected to the brush closest to the rotor bearing. On all other models, red and black wires to brushes should be connected as shown

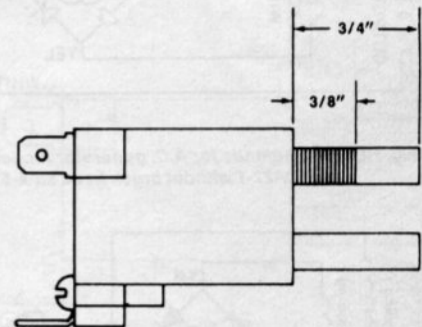


Fig. HL131—Brush length should not be less than $\frac{3}{8}$ inch when measured as shown above. Brush length of a new brush is $\frac{3}{4}$ inch.

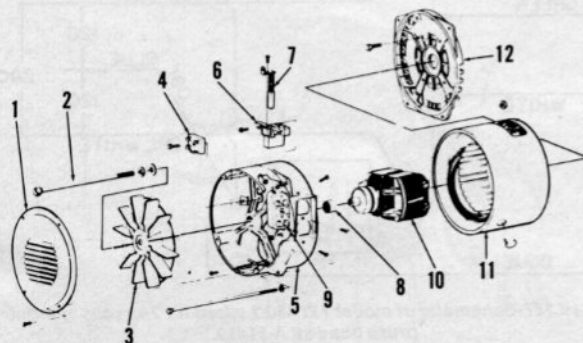


Fig. HL130—Exploded view of models 128A10-1B, 129A15-1B, 130A22-1B and 131A30-1B. Other models are similar.

1. Cover
2. Bolt
3. Fan
4. Rectifier
5. Brush head
6. Brush holder
7. Brush
8. Bearing
9. Receptacle
10. Rotor
11. Stator & housing
12. End bell

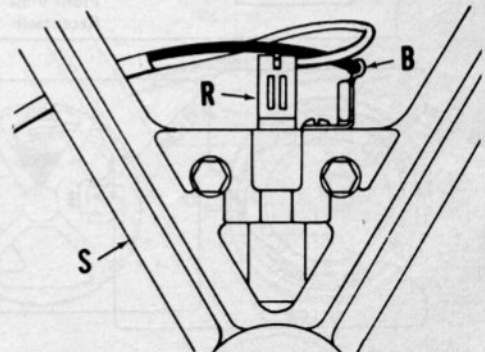


Fig. HL132—On models indicated in text, red (R) and black (B) wires to brushes are connected and routed as shown.

in Fig. HL132 and wires must be routed behind rotor support to prevent interference with fan.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. 130 for an exploded view of generator and to appropriate schematic. Be sure to mark wiring so that it may be correctly connected for reassembly. Wire should be handled carefully to prevent damage to wire, insulation or connections. Generator rotor (10—Fig. HL130) has a taper fit with engine crankshaft and should be removed with a suitable tool.

BRUSH HEAD KIT. Brush head kit A-51450 is available as a direct replacement for the brush head assembly on models 128A10-1B, 129A15-1B, 130A22-1B, 130A22-1C and 131A30-1B. Brush head kit A-51450 also supersedes brush head #53753-2 on models 128A10-1, 128A10-1A, 129A15-

1, 129A15-1A, 130A22-1, 130A22-1A, 131A30-1 and 131A30-1A. Schematics for these models include installation of the brush head kit. Note: Installation of brush head kit must include installa-

tion of Ground Terminal and Label Kit A-51202 if not previously installed. Alternator must be grounded with #8 ground wire to a suitable ground source.

Fig. HL135—Schematic and practical diagram of models 131A30-1, 131A30-1A and 131A30-1B with brush head kit A-51450 installed.

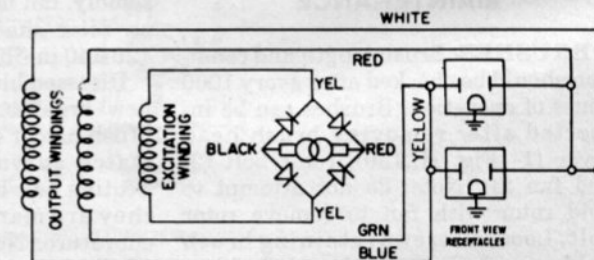
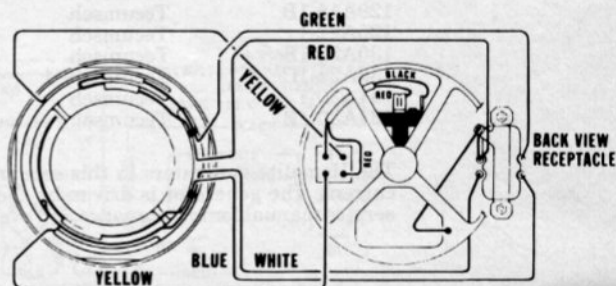
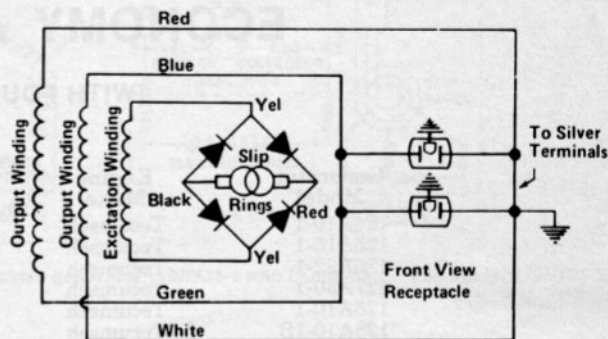


Fig. HL136—Schematic of model 131A30-1 wired for 120 volts without brush head kit A-51450.

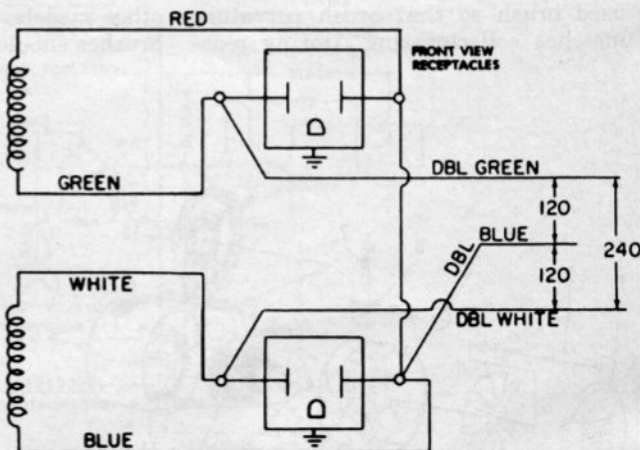


Fig. HL137—Schematic of model 131A30-1 wired for 240 volts without brush head kit A-51450.

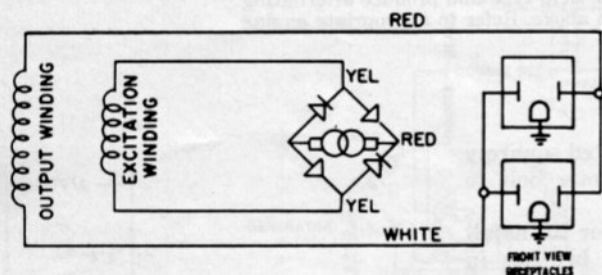


Fig. HL133—Schematic for A.C. generator models 128A10-1, 129A15-1 and 130A22-1 without brush head kit A-51450 installed.

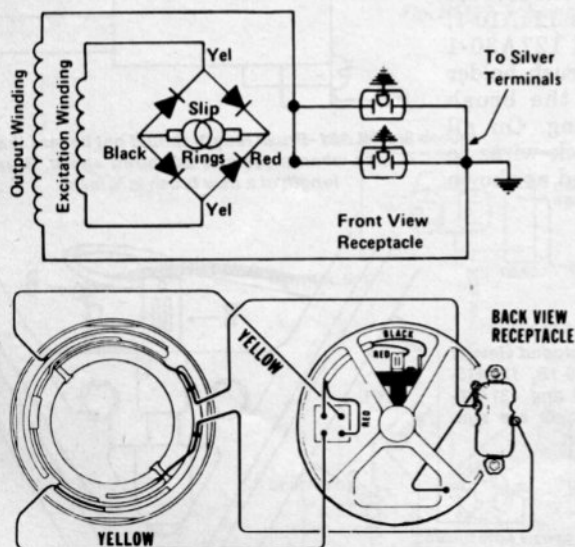


Fig. HL134—Schematic and practical diagram of models 128A10-1, 128A10-1A, 128A10-1B, 129A15-1, 129A15-1A, 129A15-1B, 130A22-1, 130A22-1A, 130A22-1B and 130A22-1C with brush head kit A-51450 installed.

HOMELITE®

A **Textron** DIVISION, PORT CHESTER, N.Y. 10573

HEAVY DUTY VOLTAMATIC® AC GENERATORS

(WITH FOUR STROKE ENGINES)

Generator Model	Engine Make	Engine Model	Volts	Hz	Kilowatts
151A15-1	B&S	100232	120	60	1.5
151A15-1A	B&S	100232	120	60	1.5
151A15-1B	B&S	100232	120	60	1.5
151A25-1	B&S	170432	120	60	2.5
152A27-1A	B&S	170432	120	60	2.75
153A35-1	B&S	190432	120	60	3.5
153A35-1A	B&S	190432	120	60	3.5
154A20-1	B&S	130232	120	60	2.0
155A50-1	B&S	243431	120	60	5.0
155A50-1A	B&S	243431	120	60	5.0

The Homelite generators in this section are a rotating field type and produce alternating current. The generator is driven by a four stroke engine. Refer to appropriate service manuals for service information. Heavy Duty Voltamatic Generators powered by two stroke engines are covered in Model 9 and 270 sections. All of the above generators are equipped with Voltamatic voltage control to regulate voltage. NOTE: Voltamatic is a registered trademark of Homelite and is covered by U.S. Patent No. 3,428,883. Generator models 116A50-2L, 119A35-1L and 119A35-2L are equipped with Loadamatic which is covered by U.S. Patent Nos. 3,612,892 and 3,626,197. Loadamatic is a registered trademark of Homelite.

MAINTENANCE

BRUSHES. Brush length and condition should be checked after every 1000 hours of operation. Brushes can be inspected after removing brush head cover (1—Fig. HL138), rotor bolt (2) and fan (3). Note: Do not attempt to hold rotor with fan to remove rotor bolt. Loosen screws retaining brush holder and slide out brush holder. Brushes must be renewed if brush length is shorter than $\frac{3}{8}$ inch as shown in Fig. HL139. Be sure to reinstall a used brush so that brush curvature matches collector ring. During reassembly, fan must be mounted squarely on rotor shaft. Tighten rotor bolt to 120-140 in.-lbs.

Disassemble brush holder to install new brushes. Insert new brushes in

brush holder so curvature of brush will match curvature of collector ring. Seating new brushes is not required as they are manufactured with correct curvature. Red and black wires to brushes should be connected as shown in Fig. HL140 and wires must be routed behind rotor support to prevent interference with fan.

LOADAMATIC. Some models may be equipped with a kit which provides automatic idle control (Loadamatic®). An electromagnet is mounted adjacent to the engine's carburetor and acts on the carburetor throttle arm. When there is no load on the generator, the electromagnet is energized and the engine governor is overridden as the electromagnet pulls the carburetor throttle arm to idle position. The governor resumes control of engine speed

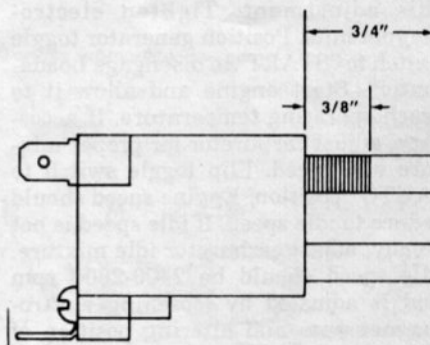


Fig. HL139—Brush length should not be less than $\frac{3}{8}$ inch when measured as shown above. Brush length of a new brush is $\frac{3}{4}$ inch.

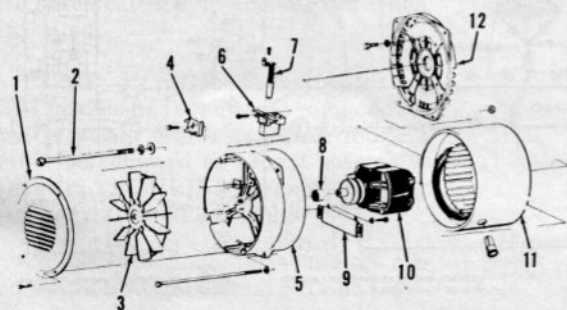


Fig. HL138—Exploded view of model 152A27-1A. Other models are similar.

1. Cover
2. Bolt
3. Fan
4. Rectifier
5. Brush head
6. Brush holder
7. Brush
8. Bearing
9. Resistor
10. Rotor
11. Stator and housing
12. End bell

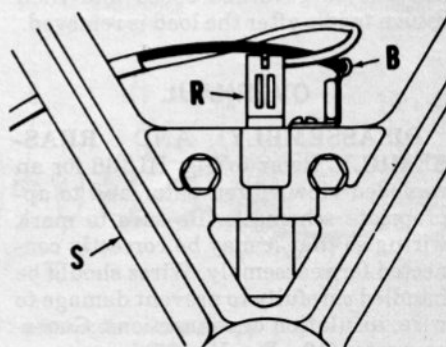


Fig. HL140—Red (R) and black (B) wires to brushes are connected and routed as shown.

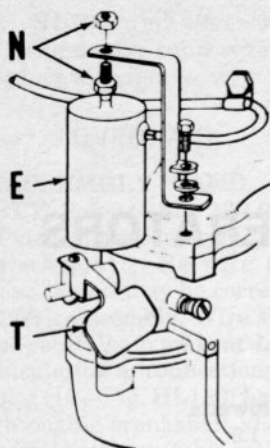


Fig. HL141—Loadamatic® is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

when a load is imposed on the generator. The electromagnet is deenergized and the throttle arm is released to be controlled by the governor.

To adjust automatic idle control (Loadamatic®), proceed as follows: Refer to Fig. HL141 and adjust height of electromagnet (E) to place bottom of electromagnet parallel with throttle arm (T), by turning nuts (N). Do not bend bracket or throttle arm to make this adjustment. Tighten electromagnet nuts. Position generator toggle switch to "START" to disengage Loadamatic®. Start engine and allow it to reach operating temperature. If necessary, adjust carburetor for proper mixture and speed. Flip toggle switch to "AUTO" position. Engine speed should reduce to idle speed. If idle speed is not steady, adjust carburetor idle mixture. Idle speed should be 2400-2600 rpm and is adjusted by loosening electromagnet nuts and altering position of electromagnet. Raising electromagnet decreases engine speed while lowering electromagnet increases engine speed. Apply a light load to generator and then remove it. Engine speed should increase to governed speed and then return to idle after the load is removed.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL138 for an exploded view of generator and to appropriate schematic. Be sure to mark wiring so that it may be correctly connected for reassembly. Wires should be handled carefully to prevent damage to wire, insulation or connections. Generator rotor (10—Fig. HL138) has a taper fit with engine crankshaft and should be removed with a suitable tool.

Fig. HL142—Schematic of models 151A15-1 and 151A15-1A.

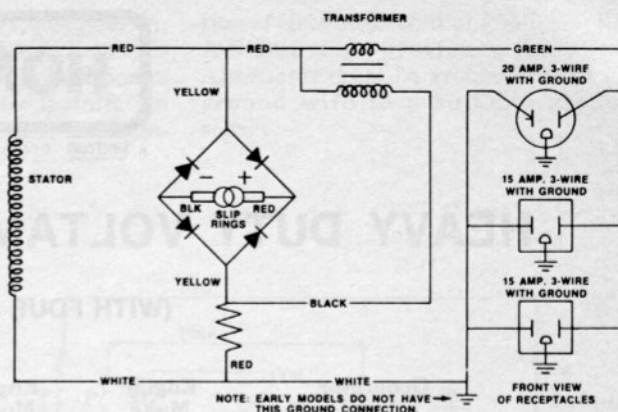


Fig. HL143—Schematic of models 151A15-1B and 154A20-1.

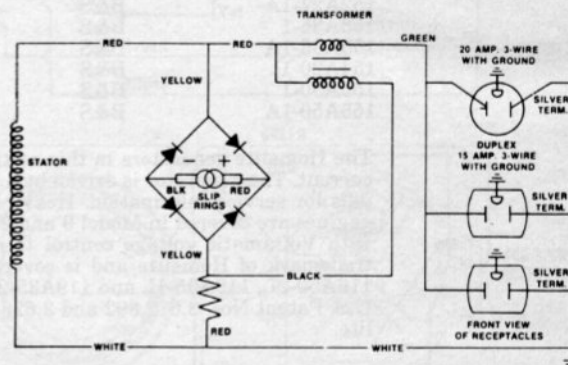


Fig. HL144—Schematic of models 152A25-1, 153A35-1 and 155A50-1.

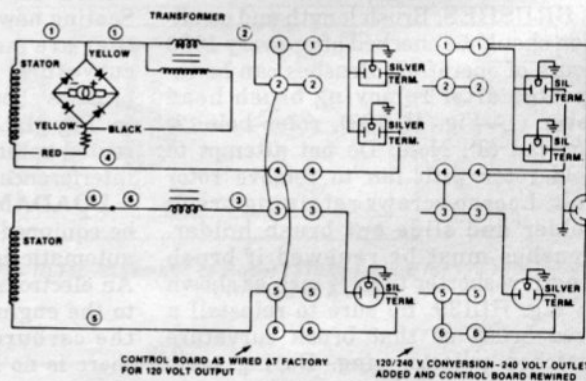
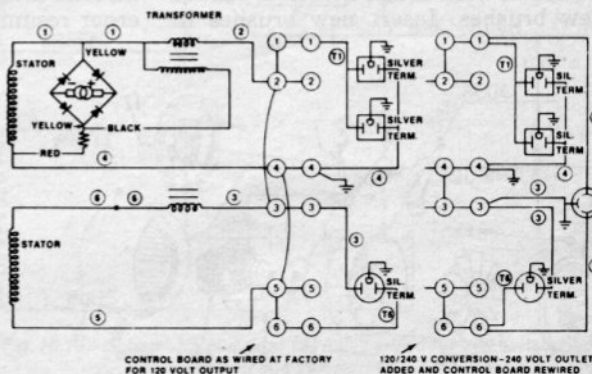


Fig. HL145—Schematic of models 152A27-1A, 153A35-1A and 155A50-1A.



HOMELITE®A **textron** DIVISION, PORT CHESTER, N. Y. 10573**SUBMERSIBLE PUMPS**

Pump Model	Volts	Amps	Cycle	Phase	GPH
LSP2-115/1-1	115	16	60	1	7,500
LSP2-220/1-1	230	8	60	1	7,500
SP2-115/1-1&1A	115	18	60	1	9,000
SP2-220/50/1-1&1A	220	12	50	1	7,500
SP2-220/1-1&1A	230	9	60	1	9,000
SP2-220/3-1&1A	230	6	60	3	9,000
SP2-380/3/50-1&1A	380	5	50	3	7,500
SP3-220/3-1, 1A&1B	230	15	60	3	18,500
SP3-440/3-1, 1A&1B	440	8	60	3	18,500

MAINTENANCE

LUBRICATION. All models are equipped with a transparent oil fill plug to indicate oil level. Oil should be changed after 200 hours of operation or after ten days of continuous usage. Recommended oil is clean SAE 30 oil or Texaco "Regal E" Turbine oil. Oil capacity of LSP2 models is approximately 8 oz. while oil capacity of SP2 and SP3 pumps is approximately 14 oz.

REPAIRS

IMPELLER & OIL SEALS. A new pump impeller should be installed if vanes are excessively worn or damaged. Install shims behind impeller to provide 0.015 inch clearance between impeller and wear plate (2—Fig. HL150), impeller housing (3—Fig. HL151) or strainer (2—Fig. HL152).

Oil seals shown in Figs. HL150, HL151 or HL152 should be renewed if oil is contaminated with dirt or water. Be sure seal is properly aligned when installed.

PUMP MOTOR. Pump motor on SP3 models has renewable components while pump motor on other models must be renewed as a unit assembly. Refer to Fig. HL151 for view of motor components on SP3 models.

Pumps with single phase motors are equipped with a thermal cut-out (14—

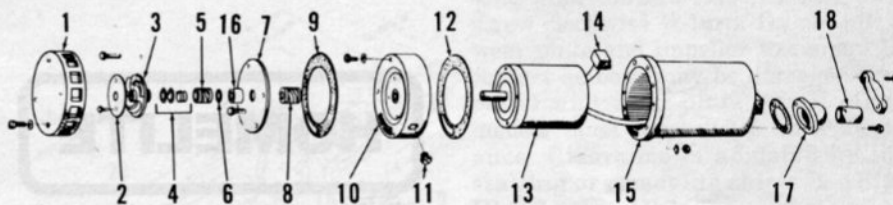


Fig. HL150—Exploded view of SP2 series submersible pumps.

- | | | | |
|---------------|-----------------|---------------------|--------------------|
| 1. Strainer | 6. Shim | 11. Oil fill plug | 15. Case |
| 2. Wear plate | 7. Seal plate | 12. Gasket | 16. Spacer |
| 3. Impeller | 8. Oil seal | 13. Motor | 17. Outlet flange |
| 4. Grit seal | 9. Gasket | 14. Thermal cut-out | 18. Outlet fitting |
| 5. Oil seal | 10. Frame plate | | |

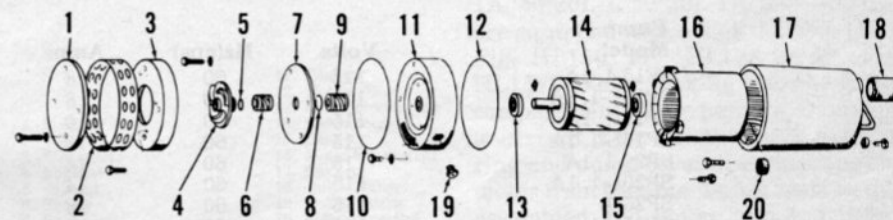


Fig. HL151—Exploded view of SP3 series submersible pumps.

- | | | | |
|---------------------|---------------|------------------|--------------------|
| 1. Strainer plate | 6. Oil seal | 11. Frame plate | 15. Ball bearing |
| 2. Strainer | 7. Seal plate | 12. Quad ring | 16. Motor case |
| 3. Impeller housing | 8. Retainer | 13. Ball bearing | 17. Pump case |
| 4. Impeller | 9. Oil seal | 14. Rotor | 18. Outlet fitting |
| 5. Shim | 10. Quad ring | | |

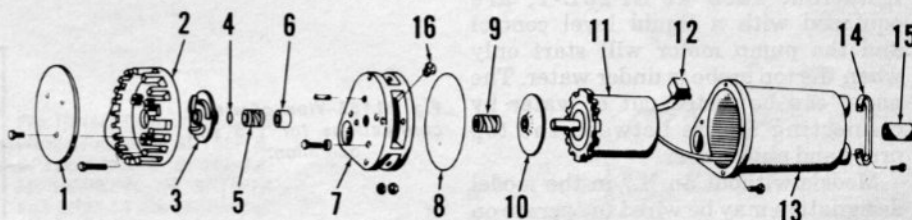


Fig. HL152—Exploded view of LSP2 series submersible pumps.

- | | | | |
|-------------------|----------------|---------------------|--------------------|
| 1. Strainer plate | 5. Oil seal | 9. Oil seal | 13. Pump case |
| 2. Strainer | 6. Spacer | 10. Seal seat | 14. Handle |
| 3. Impeller | 7. Frame plate | 11. Motor | 15. Outlet fitting |
| 4. Shim | 8. Quad ring | 12. Thermal cut-out | |

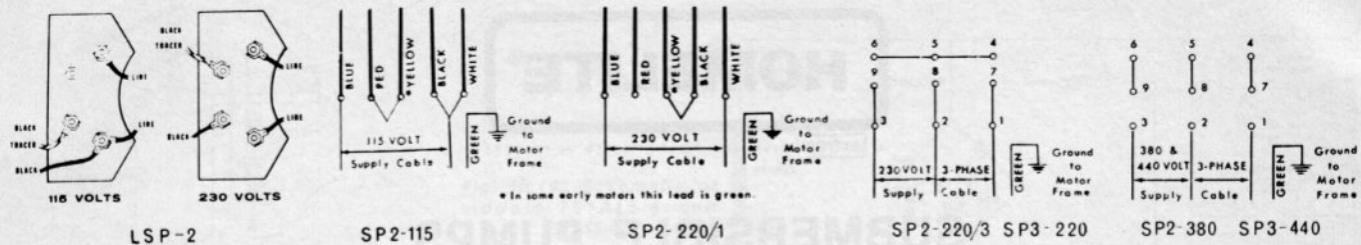


Fig. HL150 or 12—Fig. HL152), which opens the circuit if an overload occurs. Pumps with three phase motors are equipped with fuses in the control box for circuit protection.

Three phase motors will rotate in either direction and should be checked to insure proper wiring. Hold pump with strainer down and start motor

briefly. Pump should twist sharply counterclockwise if wired correctly. If direction of rotation is wrong, disconnect and interchange any two live leads.

Refer to Fig. HL153 for wiring diagrams. If motor is not wired as shown, refer to diagram on cover plate of motor.

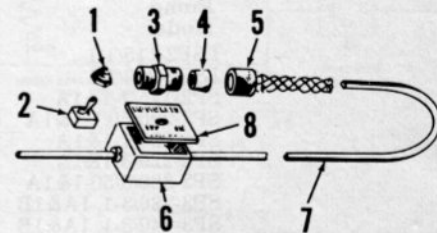


Fig. HL154—View of switch box used on all models.

- 1. Boot
- 2. Switch
- 3. Body & nut
- 4. Bushing
- 5. Collar
- 6. Switch box
- 7. Cable



SUBMERSIBLE PUMPS

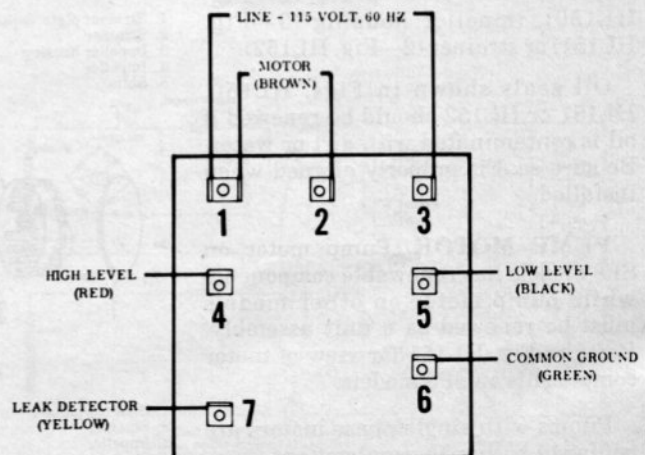
Pump Model	Volts	Hz(cps)	Amps	Phase	GPH
SP15-1, 1A	115	60	8	Single	5000
SP15L-1, 1A	115	60	8	Single	3000
SP16-1, 1A	115	60	10	Single	4600
SP16L-1, 1A	115	60	10	Single	4600
SP20-1, 1A	115	60	14	Single	7400
SP20L-1, 1A	115	60	14	Single	7400
SP25-1	115	60	18	Single	9000
SP25L-1	115	60	18	Single	9000

OPERATION

Models with an "L" in the model designation, such as SP20L-1, are equipped with a liquid level control and the pump motor will start only when the top probe is under water. The pump can be tested out of water by connecting a wire between the top probe and pump cover.

Models without an "L" in the model designation may be wired to operate on 230 volts. Refer to Fig. HL155 for 115 volt wiring schematic. Pumps with an "L" model designation cannot be operated on 230 volts as level control is designed to operate on 115 volts only.

Fig. HL155—View of wiring connections for 115 volt operation.



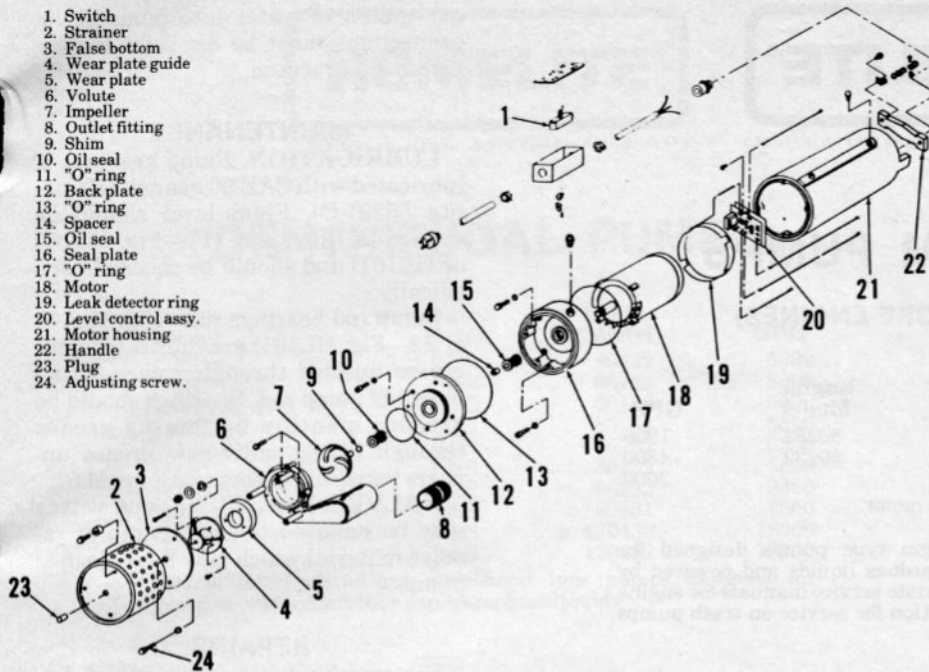


Fig. HL156—Exploded view of models SP15-1, SP15L-1, SP16-1, SP16L-1, SP20-1 and SP20L-1. Components (19 & 20) are used only on models SP15L-1, SP16L-1 and SP20L-1.

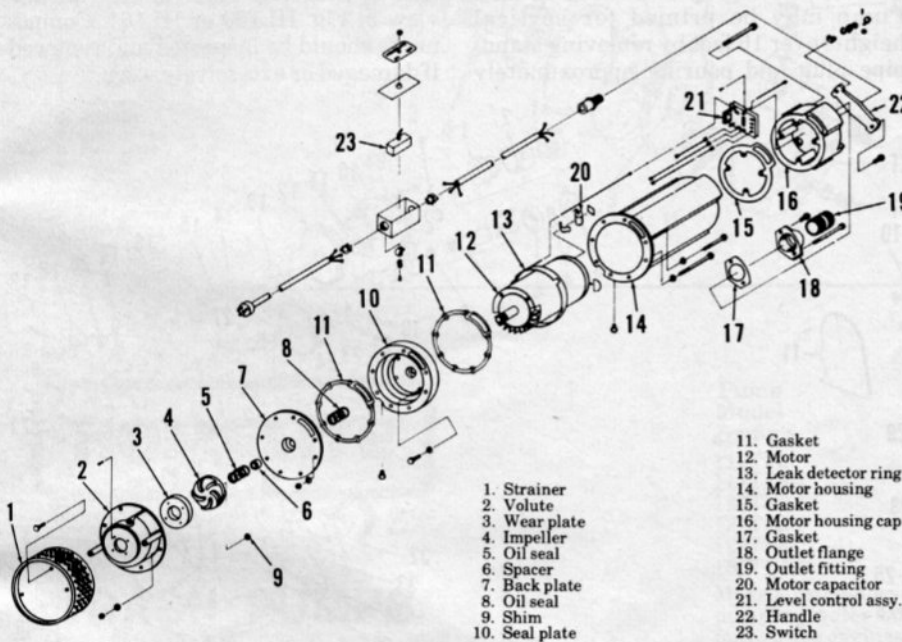
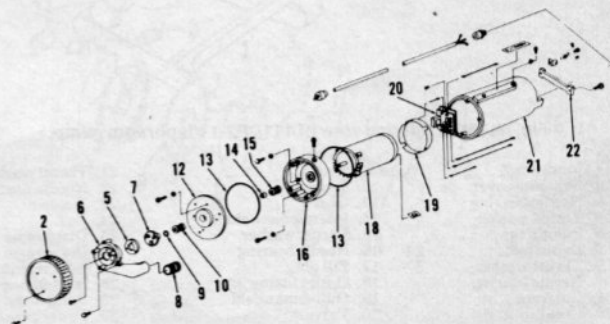


Fig. HL157—Exploded view of model SP25L-1. Model SP25-1 is similar but components (13, 15, 16 and 21) are not used.

MAINTENANCE

LUBRICATION. All models are equipped with a transparent oil fill plug to indicate oil level. Oil should be changed after every 500 hours of operation or after one month of continuous operation. Recommended oil is clean SAE 30 non-detergent oil. Oil capacity is 20 ounces for models SP15-1, SP15L-1, SP16-1, SP16L-1, SP20-1 and SP20L-1; 23 ounces for models SP15-1A, SP15L-1A, SP16-1A and SP16L-1A; and 48 ounces for models SP25-1 and SP25L-1.

Fig. HL158—Typical exploded view of models SP15L-1A, SP16L-1A and SP20L-1A. Models SP15-1A, SP16-1A and SP20-1A are similar but components (19 & 20) are not used. Refer to Fig. HL156 for parts identification.



REPAIRS

IMPELLER AND OIL SEALS.

Pump impeller should be renewed if excessively worn or damaged. Desired clearance between impeller and wear plate (5—Fig. HL156, Fig. HL158 or 3—Fig. HL157) is 0.015 inch and is obtained by installing shims (9).

Oil seals should be renewed if oil is contaminated with dirt or water. Be sure seal is properly aligned when installed. If inner seal is worn excessively, motor should be inspected to determine if water has entered motor case and damaged motor.

PUMP MOTOR. Pump motor must be renewed as a unit assembly. Starter capacitor and thermal protector are renewable as separate components on some models.

Clearance between impeller and wear plate on models SP15-1, SP15L-1, SP16-1, SP16L-1, SP20-1, and SP20L-1 is adjusted by removing plug (23—Fig. HL156) and turning adjusting screw (24) with pump running. Slowly turn adjusting screw counterclockwise until wear plate contacts impeller then turn screw clockwise $\frac{1}{4}$ turn. Do not allow wear plate and impeller to remain in contact as both may be damaged. Impeller and wear plate on all other models must have 0.015 inch clearance. Clearance is adjusted by installing or removing shims (9—Fig. HL157 or Fig. HL158).

All models are equipped with a thermal overload detector to protect the pump motor from overheating.

LEAK DETECTOR. Models SP15L-1, SP15L-1A, SP16L-1, SP16L-1A, SP20L-1, SP20L-1A and SP25L-1 are equipped with a leak detector (19—Fig. HL156, Fig. HL158 or 13—Fig. HL157). Water leaking into the motor compartment of the pump will conduct a current between the leak detector ring and pump cover disconnecting the motor from the line. Pump must be disassembled and water removed before motor will operate.

HOMELITE®

A **textron** DIVISION, PORT CHESTER, N.Y. 10573

DIAPHRAGM PUMPS

(WITH FOUR STROKE ENGINES)

Pump Model	Engine Make	Engine Model	GPH
111DP2-1	B&S	80232	1900
111DP3-1	B&S	80232	4800
DP3-1A	*	3000

*Designed for operation with electric motor.

Models listed above are diaphragm type pumps designed for pumping water and other non-hazardous liquids and powered by four stroke engines. Refer to appropriate service manuals for engine service. Refer to Model 9 or 270 section for service on trash pumps powered by two stroke engines.

OPERATION

Total suction lift of diaphragm pumps in this section is 25 feet. Pumps

are self-priming up to a lift of 15 feet. Pump may be primed for vertical heights over 15 feet by removing standpipe plug and pouring approximately

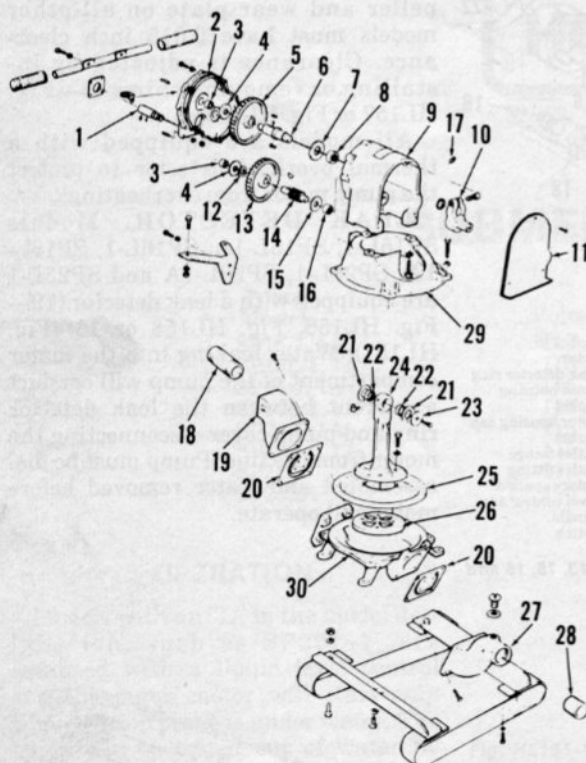


Fig. HL160—Exploded view of 111DP2-1 diaphragm pump.

- | | | |
|-------------------|------------------------|--------------------|
| 1. Input shaft | 11. Shield | 21. Thrust washer |
| 2. Gearcase cover | 12. Spacer | 22. Needle bearing |
| 3. Needle bearing | 13. Gear | 23. Washer |
| 4. Thrust washer | 14. Intermediate shaft | 24. Rod |
| 5. Pump gear | 15. Thrust washer | 25. Diaphragm |
| 6. Driveshaft | 16. Needle bearing | 26. Diaphragm cap |
| 7. Thrust washer | 17. Fill plug | 27. Inlet manifold |
| 8. Needle bearing | 18. Outlet fitting | 28. Inlet fitting |
| 9. Gearcase | 19. Outlet manifold | 29. Pump body |
| 10. Crank | 20. Valve | 30. Lower housing |

one gallon of water into pump. Inlet connections must be air tight to prevent loss of vacuum.

MAINTENANCE

LUBRICATION. Pump gearcase is lubricated with SAE 90 gear oil (Homelite 55291-C). Fluid level should be even with filler plug (17—Fig. HL160 or HL161) and should be checked periodically.

Pump rod bearings (29—Fig. HL160 or 22—Fig. HL161) are lubricated with grease injected through grease fitting in end of pump rod. Bearings should be greased monthly by forcing grease through fitting until new grease appears between bearing and journal.

VALVES. Pump fittings and valves may be removed to clean pump or remove material which may have clogged pump.

REPAIRS

Disassembly and reassembly of diaphragm pump is evident after inspection of unit and referral to exploded view in Fig. HL160 or HL161. Components should be inspected and renewed if damaged or excessively worn.

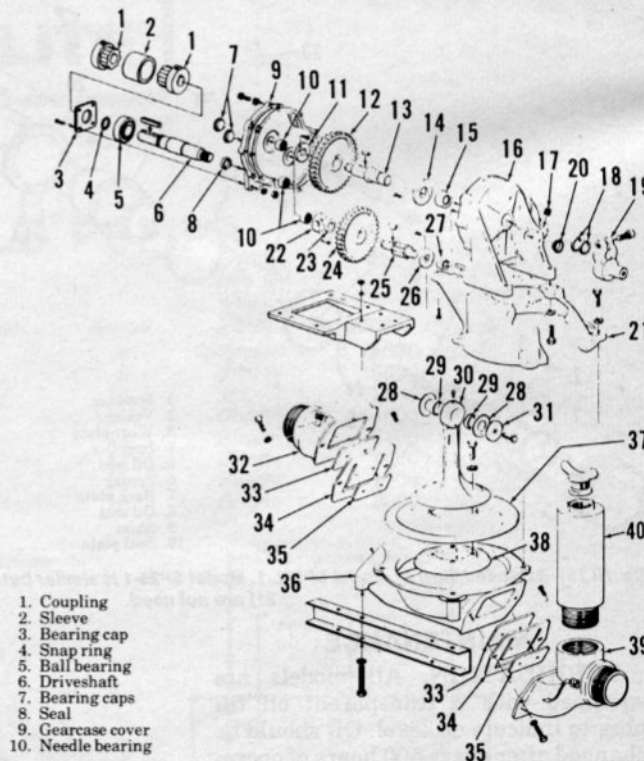


Fig. HL161—Exploded view of model DP3-1A diaphragm pump. Model 111DP3-1 is similar.

- | | | |
|--------------------|------------------------|---------------------|
| 11. Thrust washer | 21. Pump housing | 31. Washer |
| 12. Pump gear | 22. Thrust washer | 32. Outlet manifold |
| 13. Driveshaft | 23. Spacer | 33. Valve plate |
| 14. Thrust washer | 24. Gear | 34. Valve |
| 15. Needle bearing | 25. Intermediate shaft | 35. Valve weight |
| 16. Gearcase | 26. Thrust washer | 36. Lower housing |
| 17. Fill plug | 27. Needle bearing | 37. Diaphragm |
| 18. Seal | 28. Thrust washer | 38. Diaphragm cap |
| 19. Crank | 29. Needle bearing | 39. Inlet manifold |
| 20. Bearing cap | 30. Rod | 40. Standpipe |

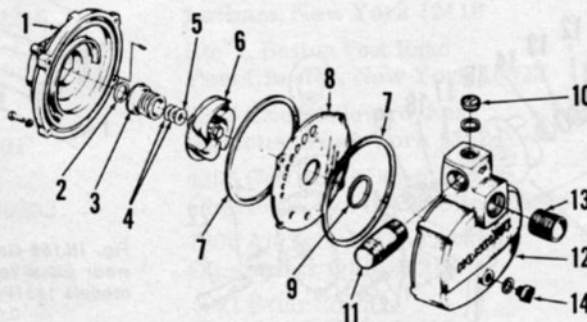
HOMELITE®A **textron** DIVISION, PORT CHESTER, N.Y. 10573**CENTRIFUGAL PUMPS**

Pump Model	Engine Make	Engine Model	GPH
110S1½-1	B&S	80232	5500
110SU1½-1	B&S	60132	5000
110SU1½-1A	B&S	60132	5000
110S1½-2	B&S	80232	5500
111S1½-1	B&S	80232	5500
111S1½-2	B&S	80232	5500
111S2-1	B&S	80232	9000
111SU2-1	B&S	80231	8500
113S3-1	B&S	170432	18000
120S3-1	B&S	170432	18000

Models listed above are centrifugal type pumps designed for pumping water and other non-hazardous liquids.

Fig. HL162—Exploded view of model 113S3-1 centrifugal pump. Other models are similar.

1. Impeller housing
2. Slinger
3. Seal assy.
4. Shims
5. Spacer
6. Impeller
7. Gasket
8. Wear plate
9. Gasket
10. Fill plug
11. Outlet fitting
12. End housing
13. Inlet fitting
14. Drain plug

**OPERATION**

All pumps are self-priming type but pump must be filled with water during operation as seals are lubricated by fluid being pumped. Inlet connections must be air tight to prevent loss of vacuum and a reduction in pump efficiency.

REPAIRS

DISASSEMBLY AND REASSEMBLY. Disassembly and reassembly of pump is evident after inspection of unit and referral to exploded view in Fig. HL162. Care should be taken not to damage gaskets during disassembly. Impeller must be turned counterclockwise for removal. Unscrew impeller by placing wrench on hex end of impeller and striking wrench sharply with a hammer. Take care not to damage or lose shims or seals.

Install sufficient shims (4—Fig. HL162) to obtain clearance between impeller (6) and wear plate (8) of 0.020-0.030 in. on model 120S3-1 and 0.015-0.025 in. on all other models. Before reassembling pump, hold wear plate (without gasket) against impeller housing and turn engine over by hand to be sure impeller does not rub against wear plate.

HOMELITE®A **textron** DIVISION, PORT CHESTER, N.Y. 10573**TRASH PUMPS****(WITH FOUR STROKE ENGINES)**

Pump Model	Engine Make	Engine Model	GPH
45TP3-1	B&S	170432	21,600
112TP2	B&S	130232	11,500
117TP3-1	Wisc.	S-7D	21,600
120TP3-1	B&S	17432	21,600
121TP2-1	B&S	130232	11,500
123TP4	Wisc.	S-12D	36,500
160TP4-1	B&S	326431	36,500

Models listed above are centrifugal type trash pumps designed for pumping water and other non-hazardous liquids and powered by four stroke engines. Refer to appropriate service manuals for engine service. Refer to previous Model 9, 251 and 270 sections for trash pumps powered by two stroke engines.

OPERATION

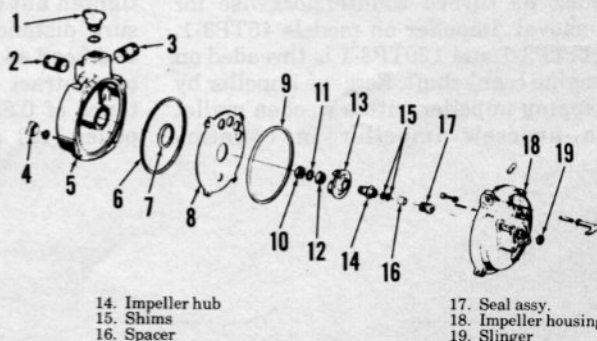
All pumps are self-priming but pump must be filled with water during operation to prevent damage to seals as seals are lubricated by fluid being pumped. Inlet connections must be air tight for efficient pump operations.

REPAIRS

DISASSEMBLY AND REASSEMBLY. Disassembly of pump is

Fig. HL165—Exploded view of model 121TP2-1 trash pump. Model 112TP2 is similar but washers are used in place of spacer (16).

1. Fill plug
2. Inlet fitting
3. Outlet fitting
4. Drain plug
5. End housing
6. Gasket
7. Gasket
8. Wear plate
9. Gasket
10. Nut
11. Washer
12. Tapered bushing
13. Impeller



14. Impeller hub
15. Shims
16. Spacer

17. Seal assy.
18. Impeller housing
19. Slinger

Fig. HL166—Exploded view of model 45TP3-1, 117TP3-1 or 120TP3-1 trash pump.

1. Inlet manifold
2. Valve plate
3. Valve
4. Valve plate
5. Drain plug
6. End housing
7. Outlet manifold
8. Fill plug
9. Gasket
10. Gasket
11. Impeller housing
12. Impeller
13. Shim
14. Nut
15. Shim
16. Seal assy.
17. Gasket
18. "O" ring
19. Back plate
20. Slinger

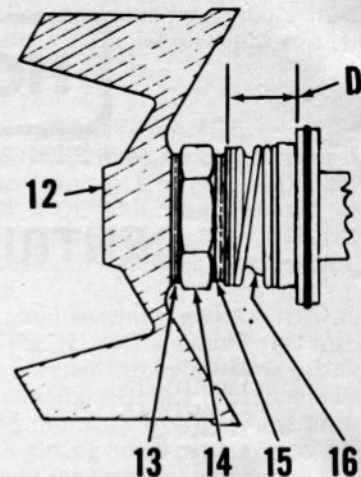
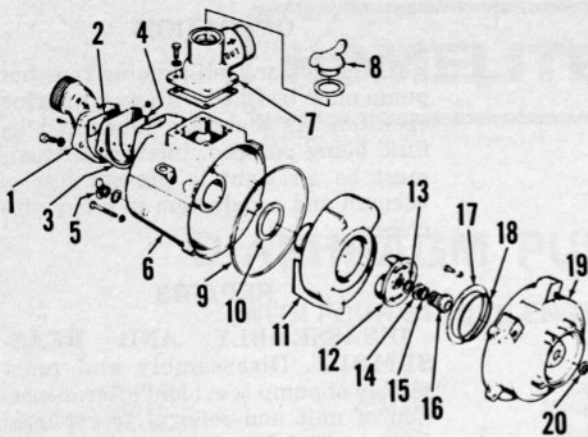


Fig. HL168—Seal seat to head distance (D) on models 45TP3-1, 117TP3-1 and 120TP3-1 should be 0.865-0.885 inch. Refer to text.

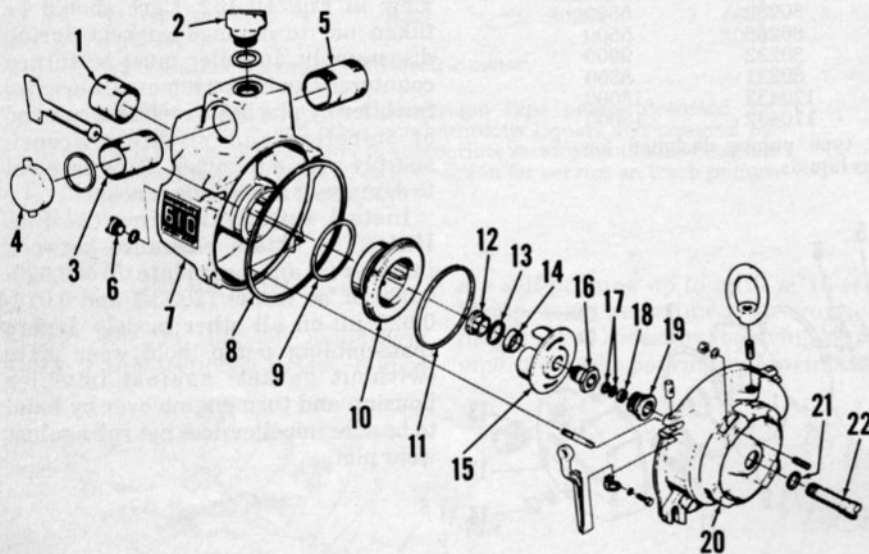


Fig. HL167—Exploded view of model 123TP4 trash pump. Model 160 TP4-1 is similar.

- | | | | |
|-------------------|----------------|---------------------|-----------------------|
| 1. Inlet fitting | 7. End housing | 13. Washer | 18. Washer |
| 2. Fill plug | 8. Gasket | 14. Tapered bushing | 19. Seal assy. |
| 3. Outlet fitting | 9. Gasket | 15. Impeller | 20. Impeller housing |
| 4. Cap | 10. Wear plate | 16. Impeller hub | 21. Slinger |
| 5. Outlet fitting | 11. Gasket | 17. Shims | 22. Engine crankshaft |
| 6. Drain plug | 12. Nut | | |

evident after inspection of unit and referral to exploded view in Fig. HL165, HL166 or HL167. Impeller on models 112TP2, 121TP2-1 and 123TP4 is resiliently mounted on a plastic bushing that allows the impeller to slip slightly when a solid object jams the impeller. This stalls the engine gradually, avoiding damage to the unit.

Impeller hub (14—Fig. HL165) is threaded on engine crankshaft and must be turned counterclockwise for removal. Impeller on models 45TP3-1, 117TP3-1 and 120TP3-1 is threaded on engine crankshaft. Remove impeller by tapping impeller with a wooden mallet to unscrew impeller in counter-

clockwise direction. It may be necessary to pry wear plate (10—Fig. HL167) out of end housing on model 123TP4. Note locating notch in wear plate and corresponding locating boss in end housing.

To properly locate impeller on engine crankshaft of models 45TP3-1, 117TP3-1 and 120TP3-1, use the following procedure: Install components (14 thru 20 Fig. HL166) on engine crankshaft, tighten nut (14) to 50 ft.-lbs., and measure distance between seal (16) seat and head as shown in Fig. HL168. Add or subtract shims (15) to obtain distance of 0.865-0.885 inch. Install impeller (12) and sufficient number or

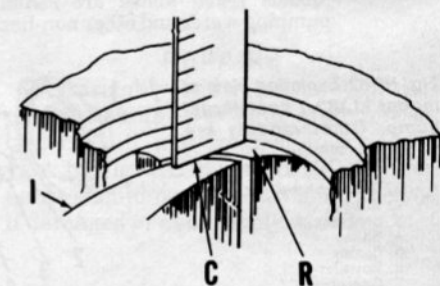


Fig. HL169—Gap (C) between impeller (I) and wear plate recess (R) in impeller housing of models 123TP4 and 160TP4-1 should be 0.005-0.015 inch. Refer to text.

thickness of shims (13) so that impeller just touches impeller housing. Remove 0.015 inch from shim pack to obtain proper impeller clearance. Shims (13 & 15) are available in thicknesses of 0.010, 0.015 and 0.032 inch.

Proper impeller location on model 123TP4 is determined as follows: Install components (15 thru 21—Fig. HL167) on engine crankshaft and measure depth of impeller vane adjacent to wear plate recess of impeller housing (20) as shown in Fig. HL169. Install shims (17—Fig. HL167) to obtain a depth of 0.005-0.015 inch. Shims are available in thicknesses of 0.010-0.015 inch.

Proper location of impeller on models 112TP2 and 121TP2-1 is determined by shims (15—Fig. HL165) which are available in thicknesses of 0.010 and 0.015 inch. There should be 0.020-0.030 inch clearance between impeller and wear plate (8).

HOMELITE AUTHORIZED FACTORY BRANCHES

(Arranged Alphabetically by States)

When communicating with any of the establishments listed below, insert the name "Homelite" before the listed address, except those in Canada and Europe.

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Monterey Park, California 91754

2234 Auburn Blvd.
Sacramento, California 95821

727 Airport Blvd.
So. San Francisco, California 94080

1300 S. Cherokee Street
Denver, Colorado 80223

164 E. Service Road
Hartford, Connecticut 06101

6965 Phillips Hwy. (U.S. No. 1 South)
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Smyrna, Georgia 30080

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Nashville, Tennessee 37210

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DePere, Wisconsin 54115

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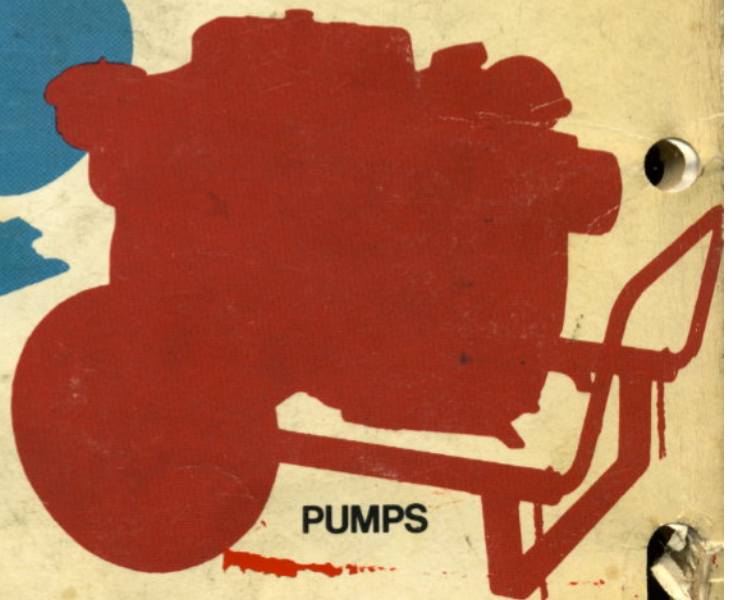
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