HOMELITE®

SHOP SERVICE MANUAL

ALL-PURPOSE SAWS
CHAIN SAWS
BRUSH CUTTERS
MISTERS/BLOWERS
GENERATORS
PUMPS
STRING TRIMMERS

FIFTH EDITION
Volume 2

HOMELITE®
SHOP SERVICE MANUAL

(FIFTH EDITION)
Vol. 2

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HOMELITE TEXTRON

Homelite Division of Textron Inc.

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

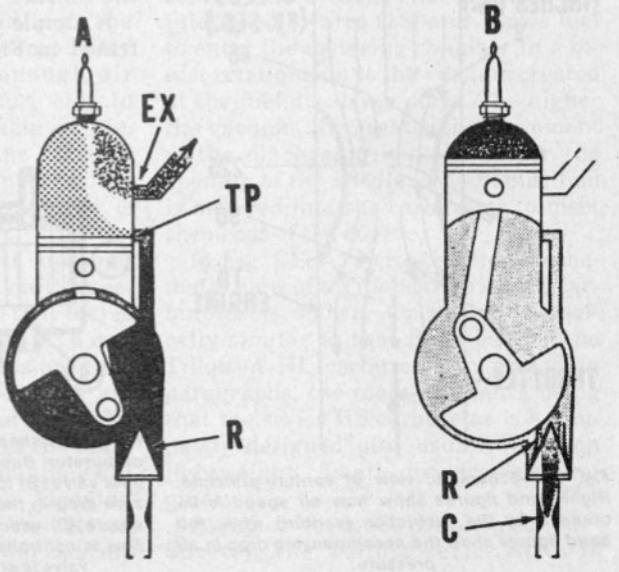

Fig. CS1–Schematic view of two-stroke cycle, crankcase scavenged engine used in most chain saws. The series of events comprising the Otto cycle takes place in one revolution of the crankshaft by using the crankcase as a scavenging pump.

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

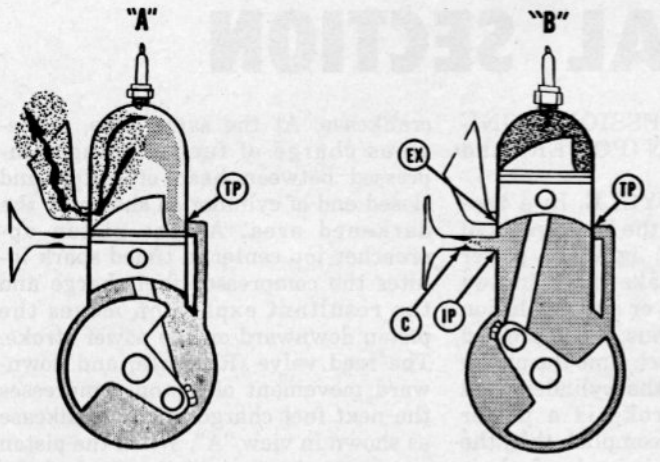

Fig. CS2–Two stroke, three port engine. Principles are similar to reed valve or rotary valve types except that a third, intake port is located in cylinder wall and opened and closed by the piston skirt.

C. Carburetor
EX. Exhaust port
IP. Intake port
TP. Transfer port

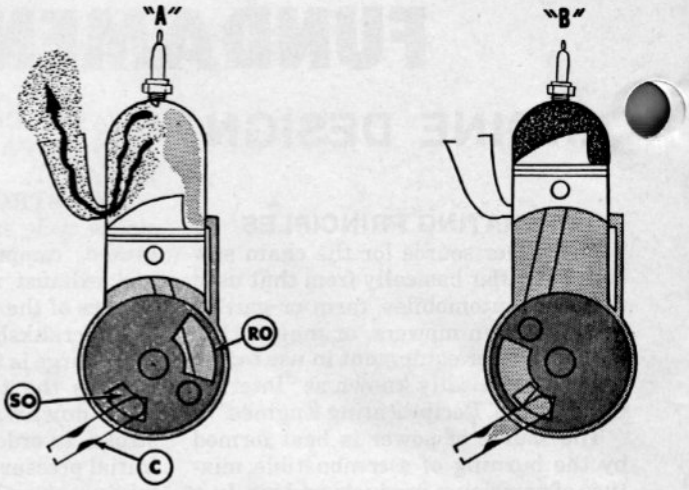

Fig. CS3–Two stroke, rotary valve engine. The incoming fuel charge is controlled by a rotary valve attached to the crankshaft. The opening in valve (RO) and crankcase (SO) align at the proper time to admit a fresh charge, then close to allow initial crankcase compression.

C. Carburetor
RO. Opening in rotating member
SO. Opening in crankcase wall

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 operating 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 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

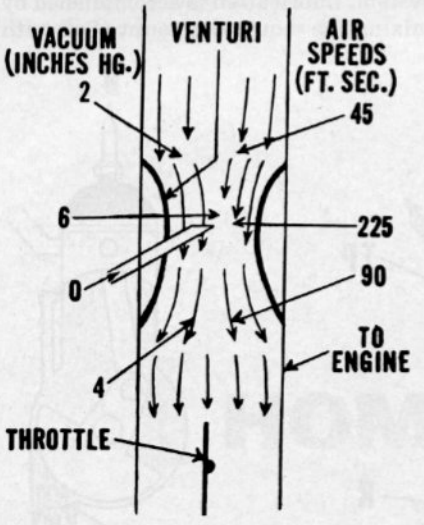

Fig. CS5–Schematic view of venturi principle. Right hand figures show how air speed is increased by the restriction (venturi) while left hand figures show the accompanying drop in air pressure.

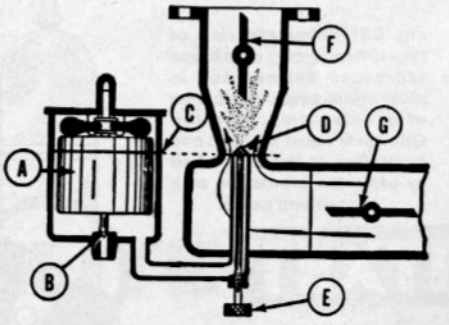

Fig. CS6–Schematic view of simple float-type carburetor. Buoyancy of float (A) closes the fuel inlet valve (B) to maintain fuel level at (C). Pressure drop in the venturi causes fuel to flow out nozzle (D) which is just above fuel level. Fuel flow is controlled by mixture valve (E). Throttle valve is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

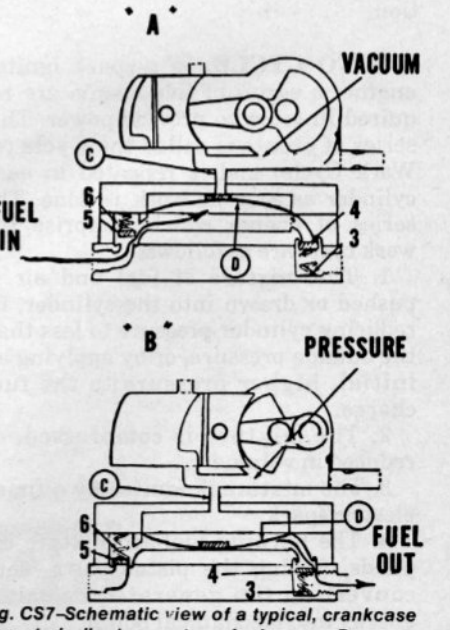

Fig. CS7–Schematic view of a typical, crankcase operated, diaphragm type fuel pump. Pressure and vacuum pulsations from crankcase pass through connection (C) to rear of diaphragm (D) which induces a pumping action on fuel line as shown.

3. Valve spring
4. Outlet check valve
5. Inlet check valve
6. Valve spring

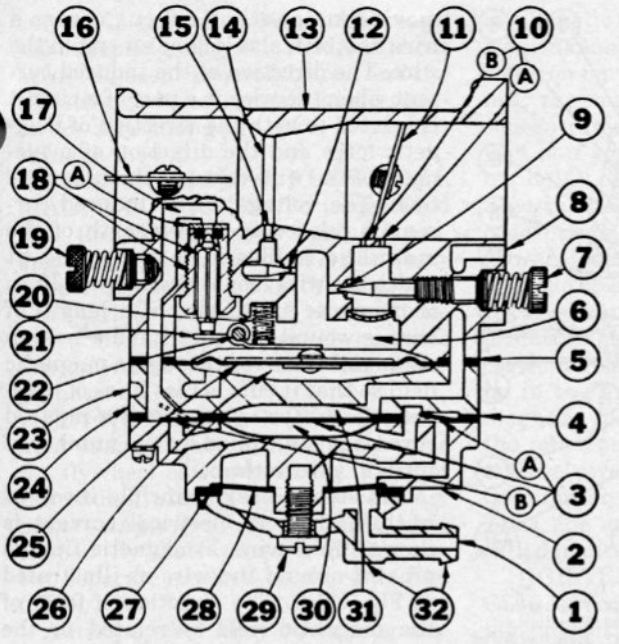

Fig. CS8–Cross-sectional schematic view of Tillotson series HL diaphragm carburetor. Some models of this type carburetor are equipped with an accelerator pump.

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

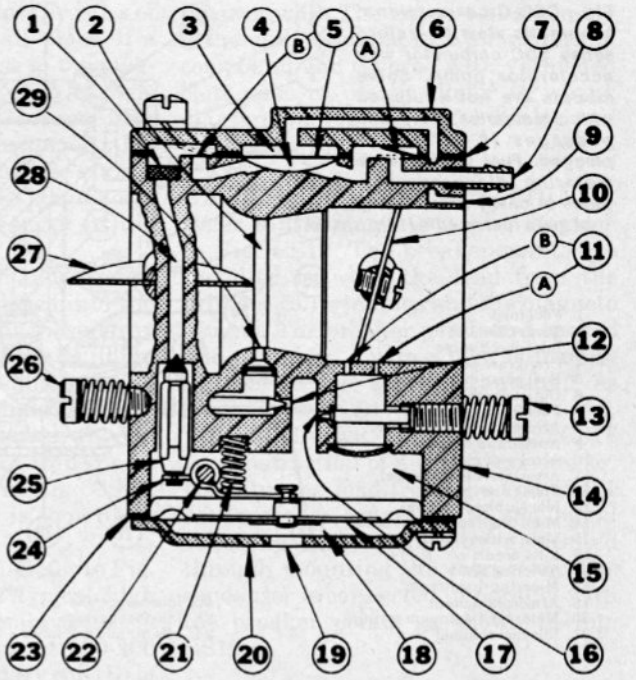

Fig. CS8A–Cross-sectional view of typical Series HS Tillotson diaphragm type carburetor.

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

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 carburetor 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 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

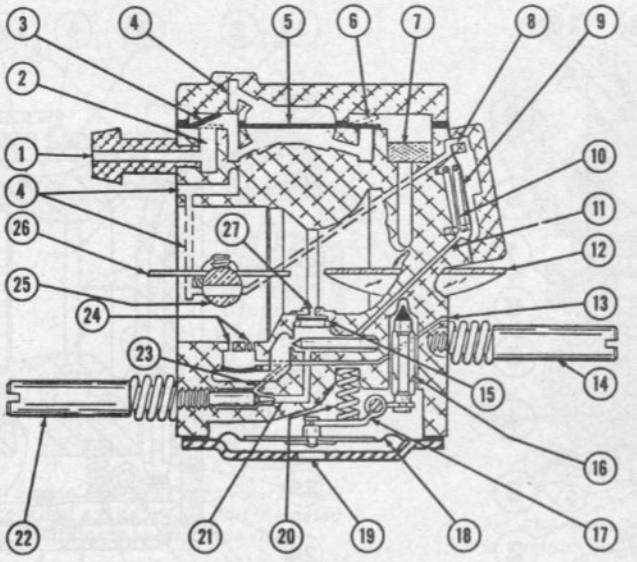

Fig. CS9–Cross-sectional schematic view of Walbro series SDC carburetor with accelerator pump. Some models are not equipped with accelerator pump and passages (8 & 11) are plugged. Fuel cavity above metering diaphragm extends to cavity shown at tip of main fuel needle (14).

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 in what is called the "emulsion channel". More air enters idle fuel cavity through the two idle holes (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 information 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 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.

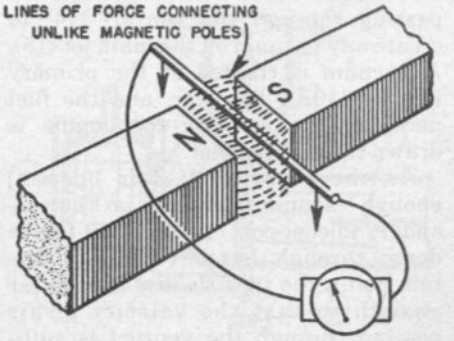

Fig. CS10–When a wire (conductor) is moved through a magnetic field across lines of magnetic force, an electro-motive force is induced into the wire. If the wire is a part of an electrical circuit, current will flow in the circuit as shown.

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

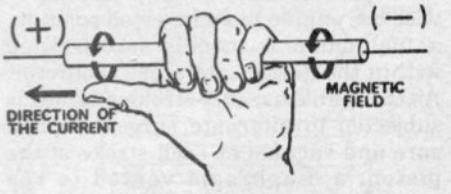

Fig. CS11–A field of magnetic force is always present around a wire through which current is flowing. The direction of magnetic force is related to the direction of electrical current as shown.

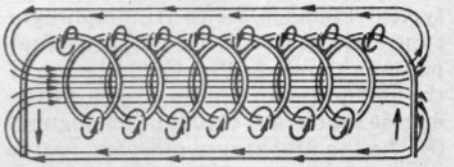

Fig. CS12–When a wire carrying an electrical current is wound in the shape of a coil or helix, the magnetic field surrounding loops of the wire tend to converge into a single electro-magnetic field as shown. If the loops of the coil are wound closely together, there is very little tendency for the electro-magnetic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

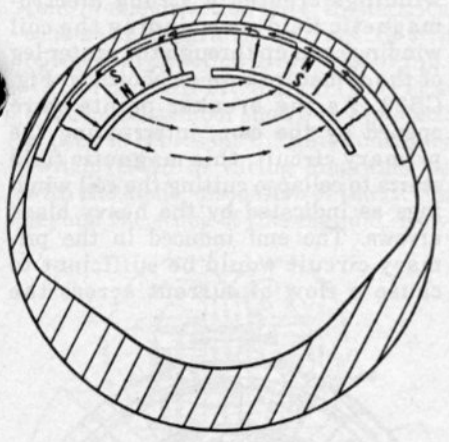

Fig. CS13–Cut-away of typical flywheel used for magneto rotor. The permanent magnets are usually cast into the flywheel. For flywheel magnetos having the ignition coil and core mounted to outside of flywheel, magnets would be flush with outer diameter of flywheel.

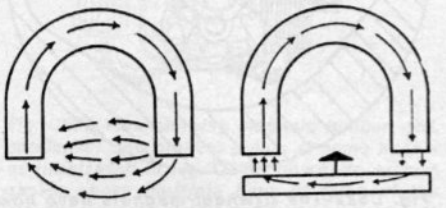

Fig. CS14–Drawing showing function of magneto armature core. At left, lines of force of permanent magnet are dispersed in the air. When a soft iron bar, which is an excellent conductor of magnetism, is moved close to the magnetic poles, the magnetic field becomes concentrated in the bar.

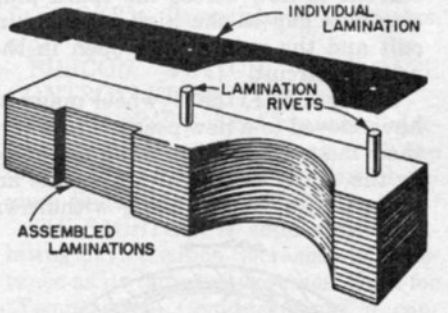

Fig. CS15–To prevent stray electrical currents (eddy currents) from building up within armature core and creating opposing magnetic fields that would decrease efficiency of magneto, armature core is constructed of thin plates (laminations) that are insulated from each other. (Oxide on surfaces of laminations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

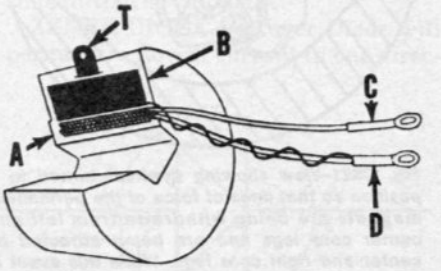

Fig. CS16–Cross-sectional view of a typical high tension coil. Primary windings (A) consist of 100-200 turns of copper wire. Secondary windings consist of about 10,000 turns of very fine wire. Lead (C) is to insulated terminal of breaker points. Lead (D) is to ground. Spark plug (high tension wire) attaches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

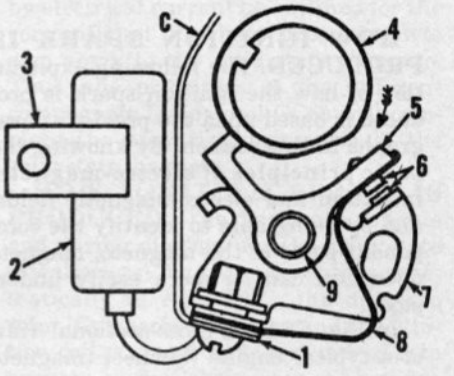

Fig. CS17–Typical flywheel magneto breaker point unit. Cam (4) is driven by engine crankshaft. Breaker arm spring (8) connects insulated contact point on breaker arm (5) to terminal (1).

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

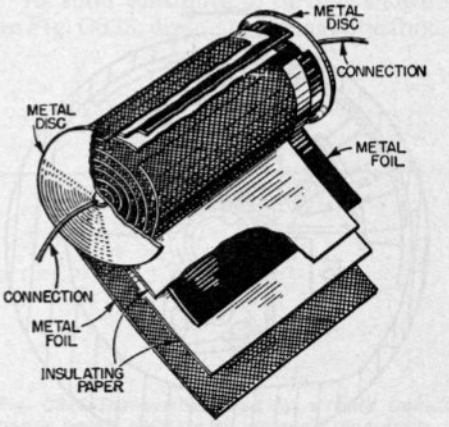

Fig. CS18–View showing construction of typical condenser. One connection is usually made to the metal housing of the condenser and is grounded to the magneto base plate through the condenser mounting strap (3–Fig. CS17).

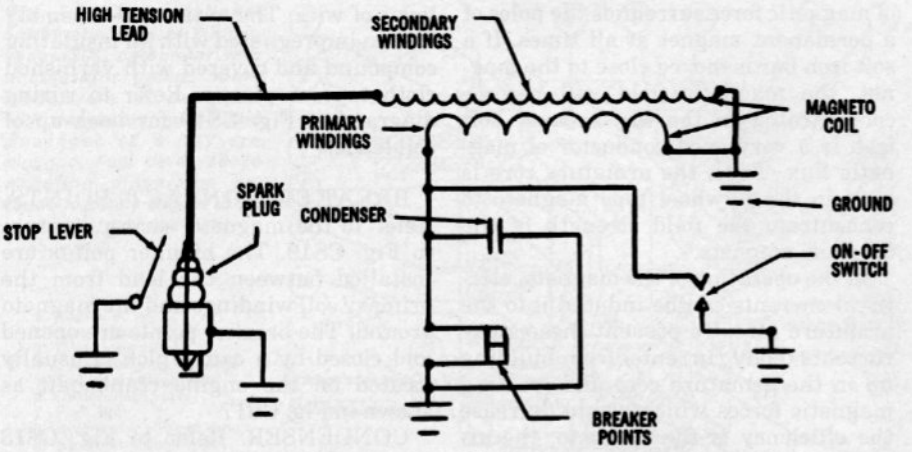

Fig. CS19–Typical wiring diagram for conventional flywheel type magneto. An on-off switch to stop the engine may be attached to the magneto primary circuit to ground out the system, or a stop lever may be used to ground out the center electrode of the spark plug.

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

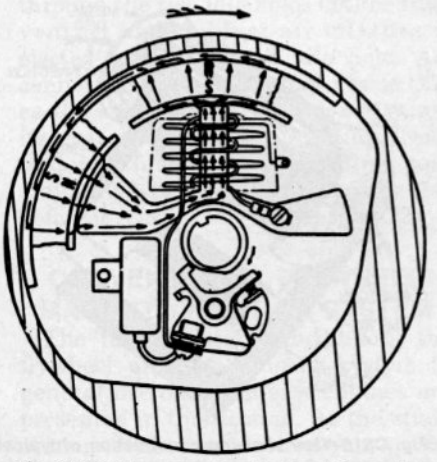

Fig. CS20–View showing flywheel turned to a position so that lines of force of the permanent magnets are concentrated in the left and center core legs and are interlocking the coil windings.

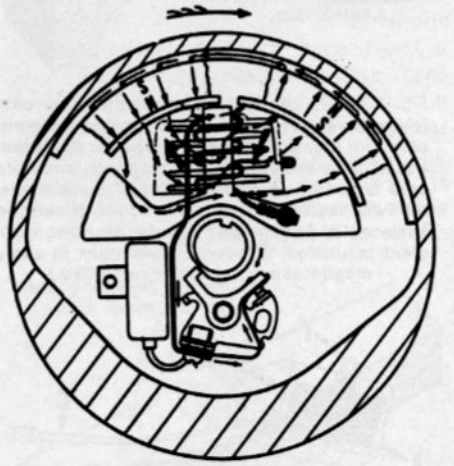

Fig. CS21–View showing flywheel turned to a position so that lines of force of the permanent magnets are being withdrawn from left and center core legs and are being attracted by center and right core legs. While this event is happening, the lines of force are cutting up through the coil windings section 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.

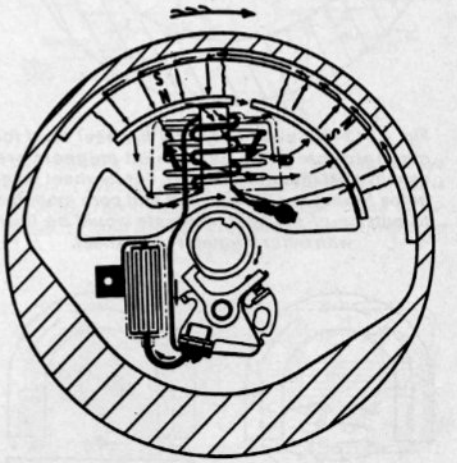

Fig. CS22–The flywheel magnets have now turned slightly past position shown in Fig. CS21 and rate of movement of lines of magnetic force cutting through coil windings is at maximum. At this instant, the breaker points are opened by the cam and flow of current in primary circuit is being absorbed by the 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. However, 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 direction, and will also permit current to flow in the opposite direction when the voltage reaches a pre-determined level.

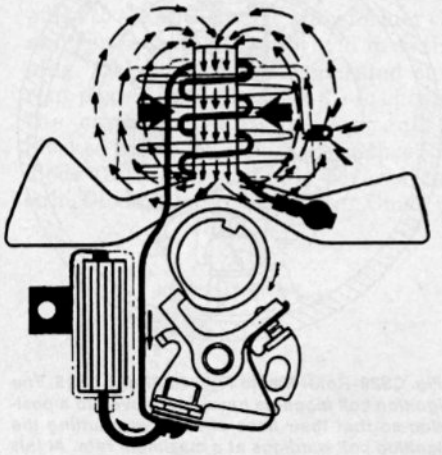

Fig. CS23–View showing magneto ignition coil, condenser and breaker points at same instant as illustrated in Fig. CS22; however, arrows shown above illustrate lines of force of the electro-magnetic field established by current in primary coil windings rather than the lines of force of the permanent magnets. 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.

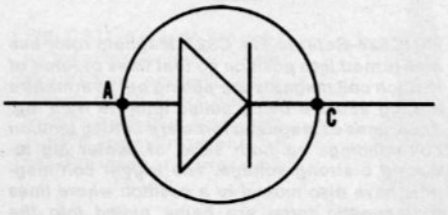

Fig. CS24–In a diagram of an electrical circuit, the diode is represented by the symbol shown above. The diode will allow current to flow in one direction only (from cathode "C" to anode "A" terminal of diode).

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

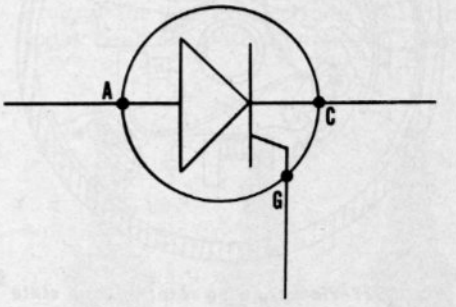

Fig. CS25–The symbol used for a Gate Controlled Switch (GCS) in an electrical diagram is shown above. The GCS will allow current to flow from cathode (C) terminal to anode (A) terminal when "turned on" by a positive electrical charge at gate (G) terminal. A negative electrical charge at gate (G) terminal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

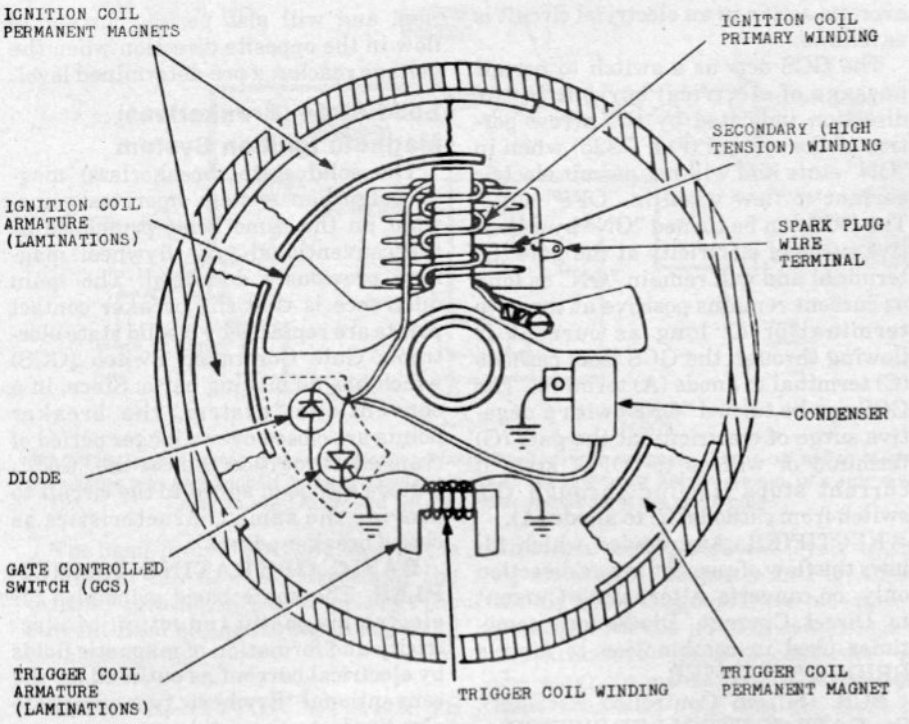

Fig. CS26–Schematic diagram of solid state (breakerless) flywheel magneto. The diagram is drawn to follow the schematic drawings of a conventional type magneto as shown in Figs. CS20, CS21, CS22 and CS23. Refer to Figs. CS24 and CS25 for diode and Gate Controlled Switch (GCS) symbols. Refer to Figs.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

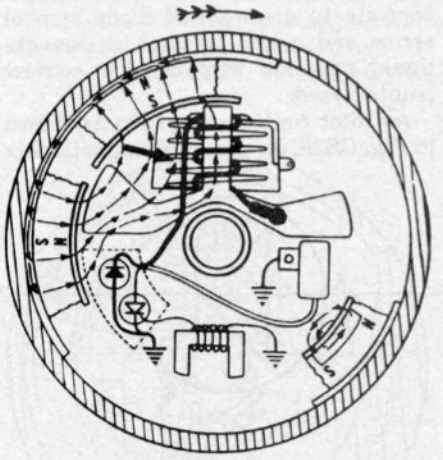

Fig. CS27–View showing rotor of solid state magneto at instant in rotation where lines of force of ignition coil magnets are being drawn into left and center legs of magneto armature. The diode (see Fig. CS24) acts as a closed set of breaker points in completing the primary ignition circuit at this time,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

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 triggering 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.

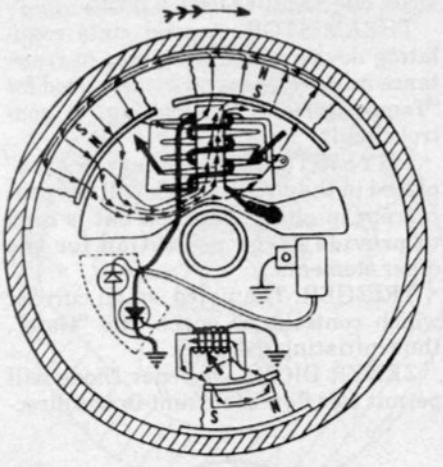

Fig. CS28–Refer to Fig. CS27. Magneto rotor has now turned into position so that lines of force of ignition coil magnets are pulling out of armature left leg and are being pulled into the right leg. Thus, lines of magnetic force are cutting ignition coil windings on both sides of center leg inducing 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.

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-

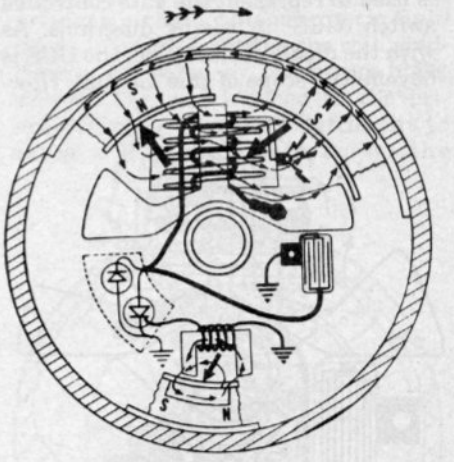

Fig. CS29–Refer first to Figs. CS27 and CS28. The ignition coil magnets have now moved to a position so that their lines of force are cutting the ignition coil windings at a maximum rate. At this same instant, movement of the trigger coil magnets is pulling lines of force away from the trigger coil armature 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.

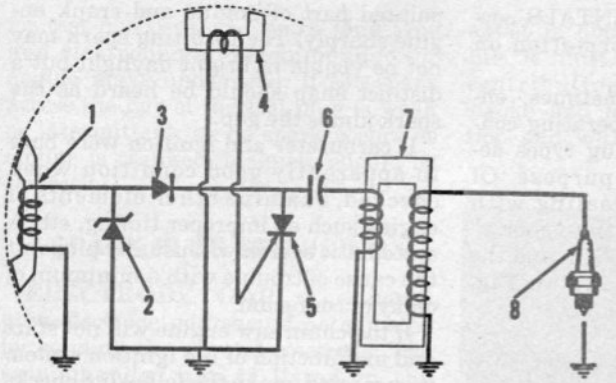

Fig. CS30–Schematic diagram of a simple Capacitor Discharge "Solid State" ignition system.

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, ⅞ inch and ½ 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: ⅜-inch, 7/16-inch, ½-inch and ¾-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-

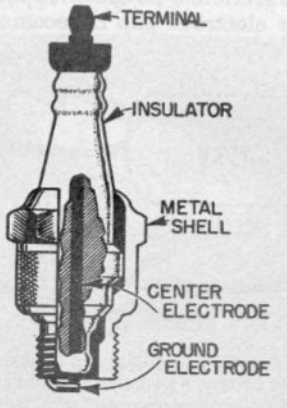

Fig. CS31–Cross sectional view of spark plug showing construction and nomenclature.

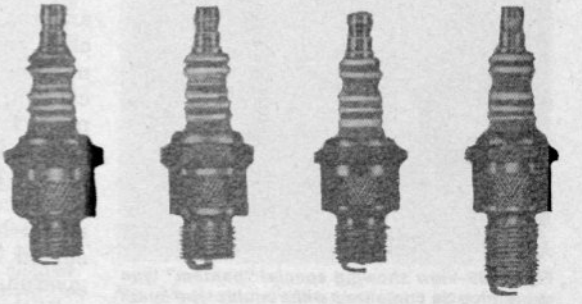

Fig. CS32–Various "reaches" of plugs available. Chain saw engines normally use a ⅜-inch reach spark plug. A ⅜-inch reach plug measures ⅜-inch from firing end of shell to gasket surface of shell.

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.

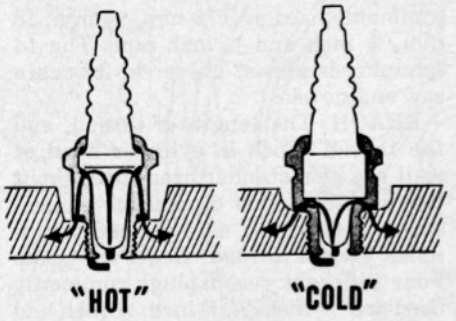

Fig. CS33–Spark plug tip temperature is controlled by the length of the path heat must travel to reach the cooling surface of the engine cylinder head.

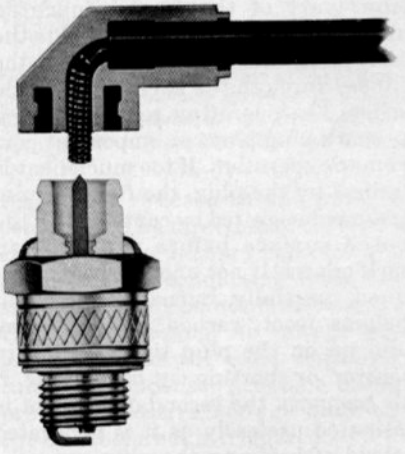

Fig. CS34–Cut-away view of special "shorty" type spark plug and terminal available for chain saw engines. Refer to Fig. CS35 for a second type special plug.

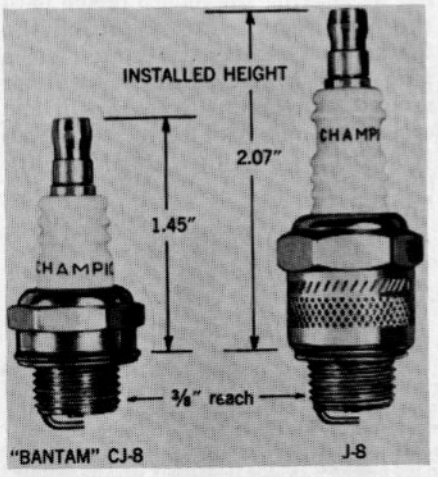

Fig. CS35–View showing special "bantam" type spark plug as compared with regular type spark plug of same heat range. Refer also to Fig. CS34 for view of special "shorty" type plug.

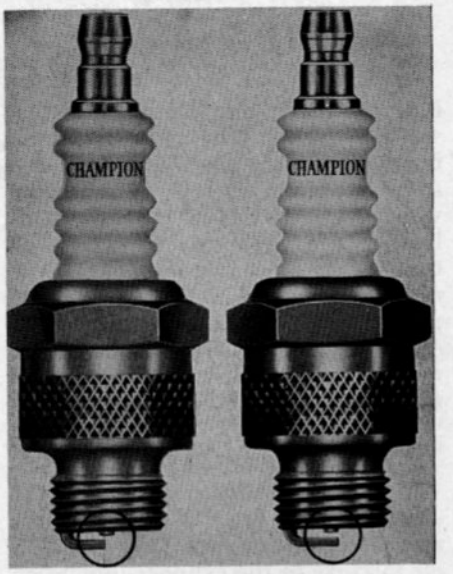

Fig. CS36–The two stroke (left) differs from conventional plug in that the grounded electrode is shortened to minimize carbon fouling.

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 ⅛ to ¼ inch away from an unpainted 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

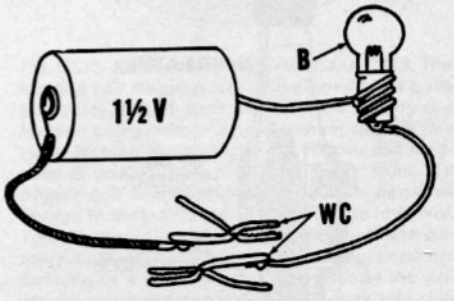

Fig. S1–A static timing light can be made from a flashlight battery, a bulb (B), two wire clips (WC) and short pieces of insulated wire. Bulb should light when clips are touched together. Refer to Fig. S2.

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.

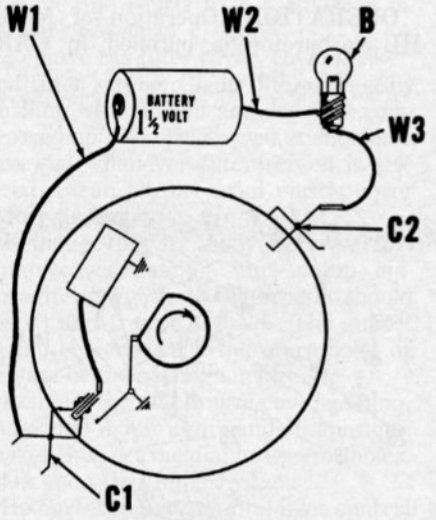

Fig. S2–When connecting timing light (see Fig. S1), first disconnect primary coil wire from breaker point terminal, then connect one wire clip (C1) to terminal and other clip (C2) to magneto back plate or engine. Bulb should be out when points are open and light when points close.

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

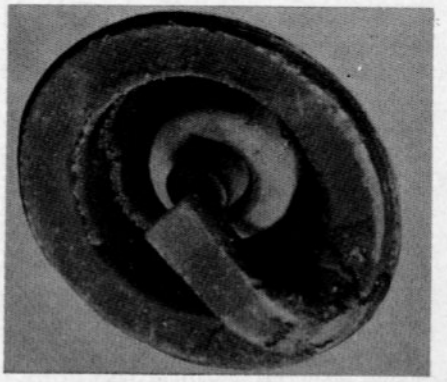

Fig. S3–Two stroke engine plug of correct heat range. Insulators light tan to gray with few deposits. Electrodes not burned.

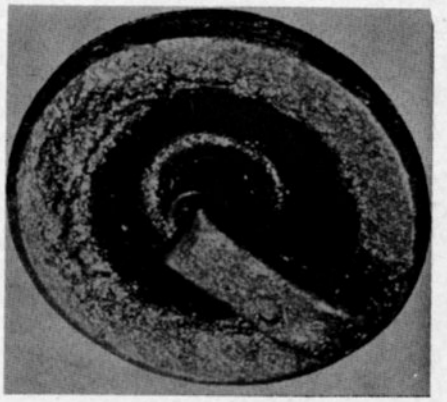

Fig S4–Damp or wet black carbon coating over entire firing end of plug. Could be caused by rich carburetor mixture, too much oil in fuel, or low ignition voltage. Could also be caused by incorrect heat range (too cold) for operating conditions. Correct the defects or install a hotter plug.

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.

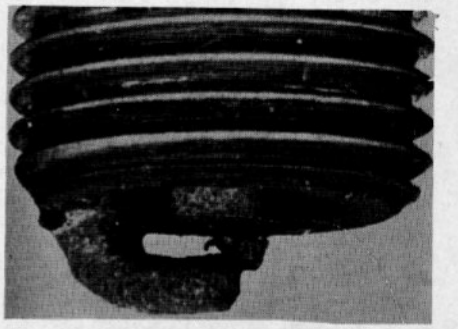

Fig. S6–Gap bridging. Usually results from the same causes outlined in Fig. S5.

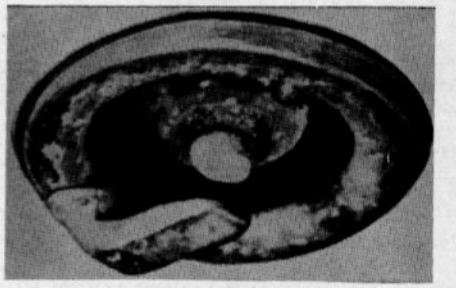

Fig. S7–Electrodes badly eroded, deposits white or light gray and gritty. Insulator has "blistered" appearance. Could be caused by lean carburetor mixture, fast timing, overloading, or air intake screen and engine cooling fins blocked with sawdust or other debris. Could also be caused by incorrect heat 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.

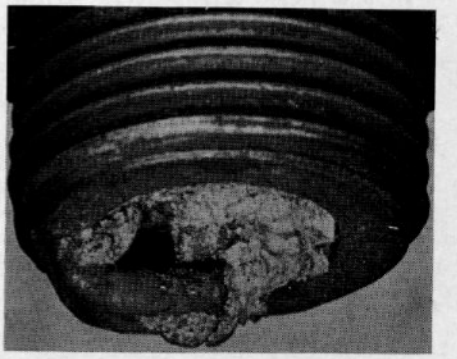

Fig. S8–Gray metallic aluminum deposits on plug. (Seldom encountered.) Piston damage due to pre-ignition. Overhaul engine and determine cause of pre-ignition.

CARBURETOR SERVICING

Troubleshooting

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 lever 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.

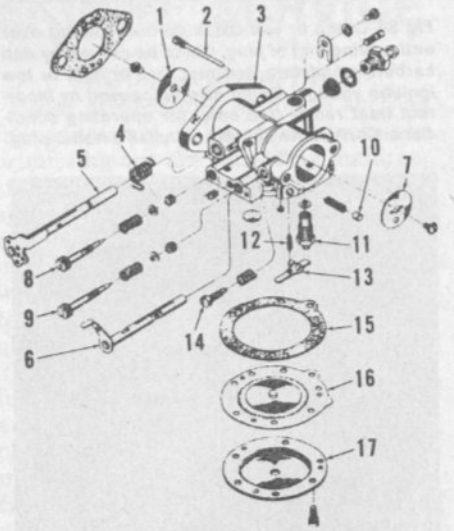

Fig. S9—Exploded view of Tillotson Model HC carburetor. Model HJ is similar.

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

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 CAR-

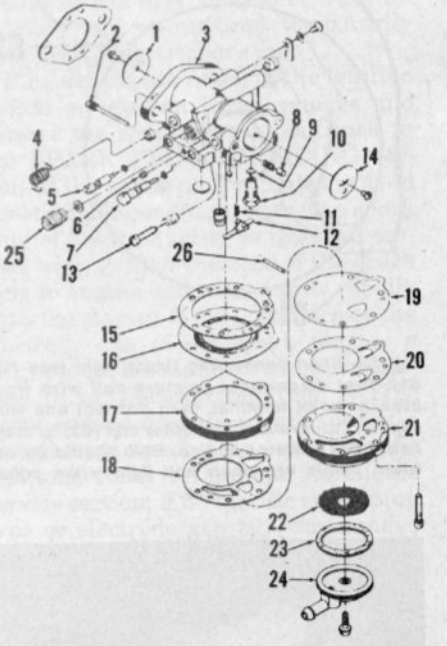

Fig. S10—Exploded view of Tillotson Model HL carburetor. On some HL carburetors, pump diaphragm (19) and valves (20) are one-piece. Governor valve (25) is not used on all carburetors.

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

BURETION 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 enrichens 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.

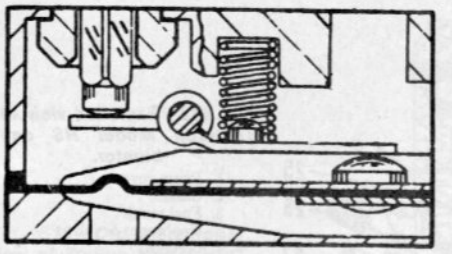

Fig. S11—Diaphragm lever should be flush with diaphragm chamber floor.

OVERHAUL. Since the Model HL carburetor is the most widely used carburetor, overhaul procedures for the Model HL will be covered. Overhaul of Models HC and HJ 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.

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 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 overtighten as distortion will result. Install new welch plugs if they were removed. Place the new welch plug into the casting counterbore 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 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 diaphragm so that the flap valves will seat against 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

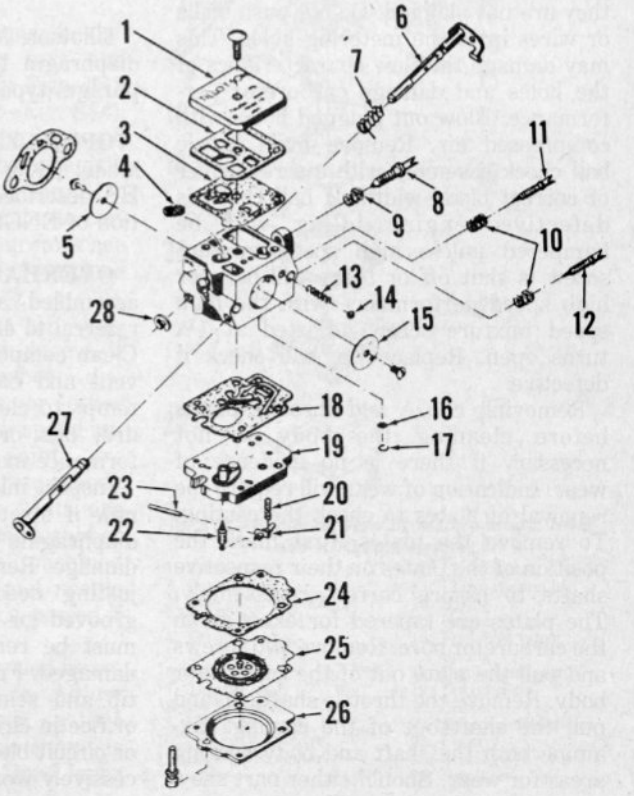

Fig. S11A—Exploded view of Tillotson Model HK carburetor.

1. Pump cover
2. Gasket
3. Fuel pump diaphragm & valves
4. Screen
5. Throttle plate
6. Throttle shaft
7. Throttle return spring
8. Idle speed screw
9. Spring
10. Idle mixture screw
12. High speed mixture screw
13. Spring
14. Detent ball
15. Choke plate
16. Screen
17. Retainer
18. Gasket
19. Circuit block
20. Spring
21. Diaphragm lever
22. Fuel inlet needle
23. Lever pin
24. Gasket
25. Metering diaphragm
26. Cover
27. Choke shaft
28. "E" ring

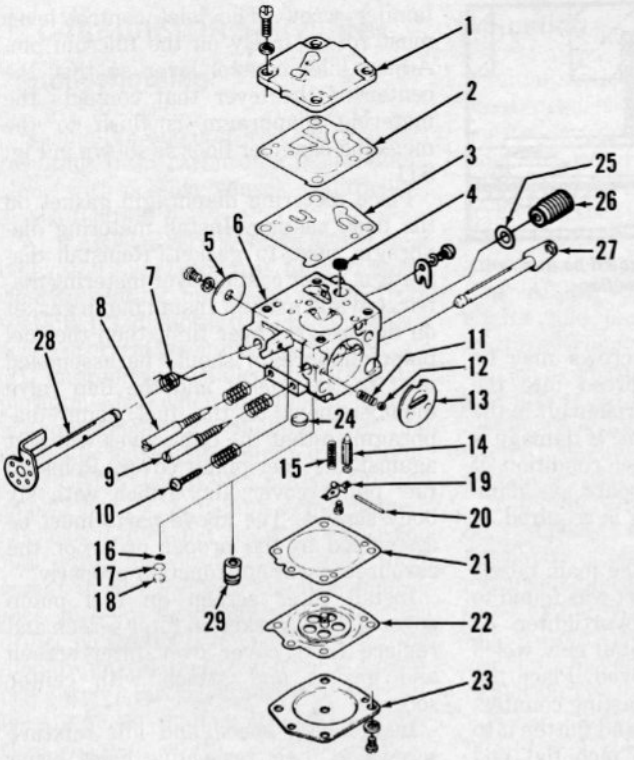

Fig. S12—Exploded view of Tillotson Model HS carburetor.

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

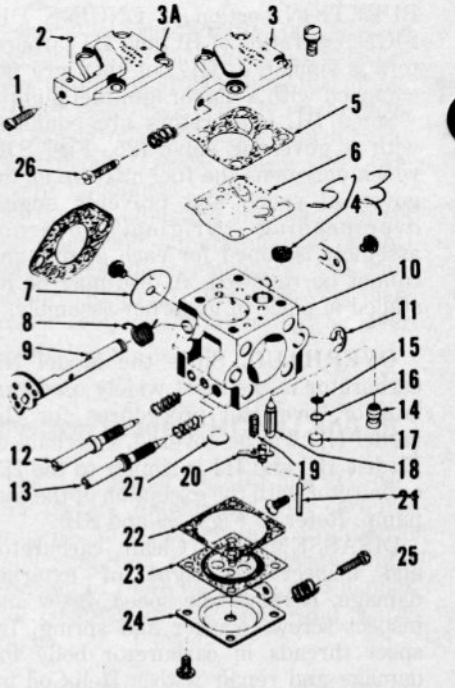

Fig. S13—Exploded view of Tillotson Model HU carburetor. Note difference in idle speed screw location used on fuel pump covers (3 & 3A) of some carburetors. Idle speed screw (25) may be located in cover (24).

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

the mixture screw holes. If removal of the welch plugs is necessary, drill through the welch plug using a ⅛ 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 in to 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 at 1¼ 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 re-assembly. 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 out of the casting. Inspect the shaft and bushings for wear.

Tillotson Model HK

Tillotson Model HK carburetor is a diaphragm type with an integral diaphragm type fuel pump.

OPERATION. Operation of Tillotson Model HK is similar to Tillotson Model HS described in CARBURETION section of ENGINE DESIGN.

OVERHAUL. Carburetor may be disassembled after inspecting unit and referral to exploded view in Fig. S11A. Clean components using a suitable solvent and compressed air. Do not attempt to clean metered passages with drill bits or wire as carburetor performance may be affected.

Inspect inlet lever spring (20) and renew if 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 circuit block (19). Inlet needle or circuit block should be renewed if excessively worn.

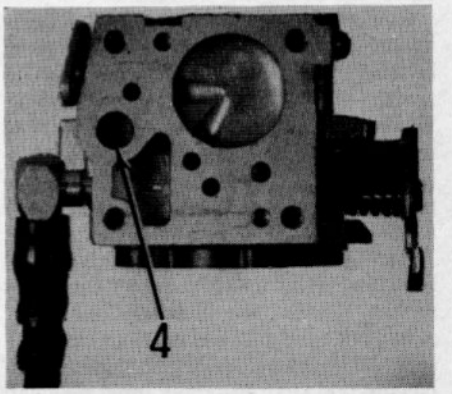

Fig. S14—Be sure to clean filter screen (4—Fig. S12 or S13) when servicing carburetor.

With circuit block components installed, note height of long end of diaphragm lever (21). Lever end should be flush with chamber floor in circuit block. Bend lever adjacent to spring to obtain correct lever height.

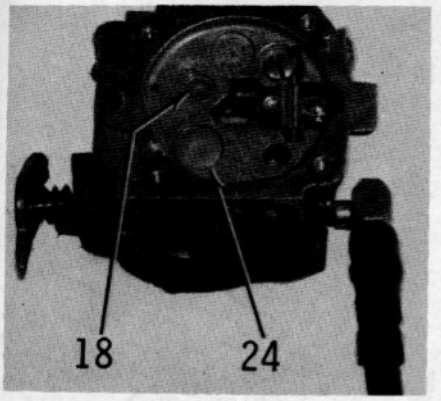

Fig. S15—View showing location of welch plugs (18 & 24—Fig. S12).

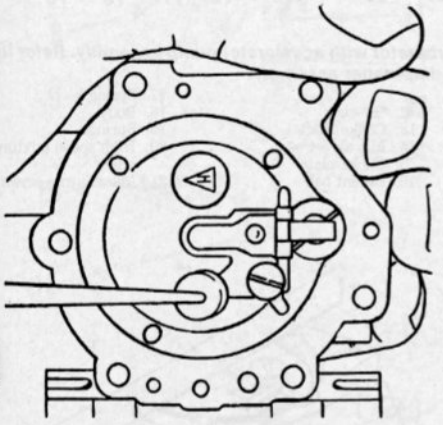

Fig. S16—A punch can be used to remove welch plugs as shown.

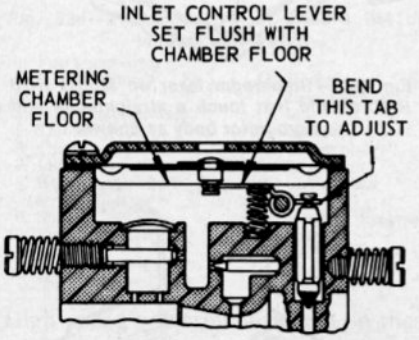

Fig. S17—Diaphragm lever on Models HS and HU should be flush with diaphragm chamber floor as shown above.

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.

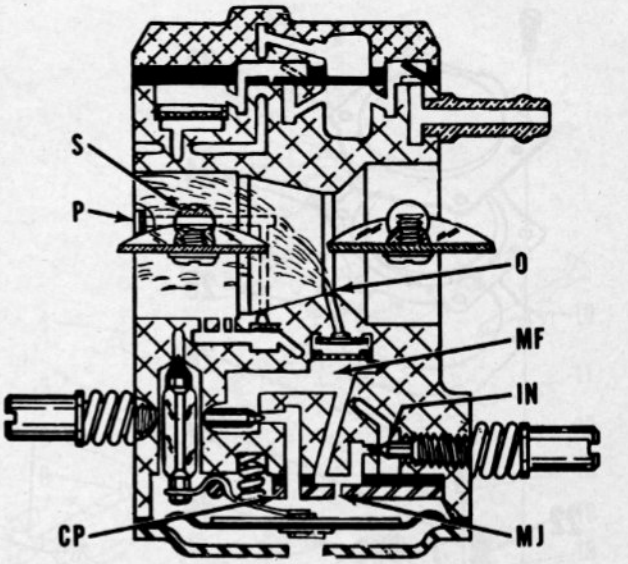

Fig. S18—Cross-sectional view of Walbro Model HDC carburetor showing accelerator pump pulse passage (P). Refer to text for operation.

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. Some Model HS carburetors are equipped with a governor valve (26—Fig. S12) which resonates at a desired engine speed and directs excess fuel into carburetor bore to prevent overspeeding. Governor valve is designed for specific engines and should not be altered.

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. S15) 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. Some HS carburetors are equipped with a check valve (29) in place of components (16, 17 and 18).

Inspect inlet lever spring (15—Fig. S12 or 19—Fig. S13) and renew if 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 that lever is flush with diaphragm chamber floor as shown in Fig. S17. Bend lever

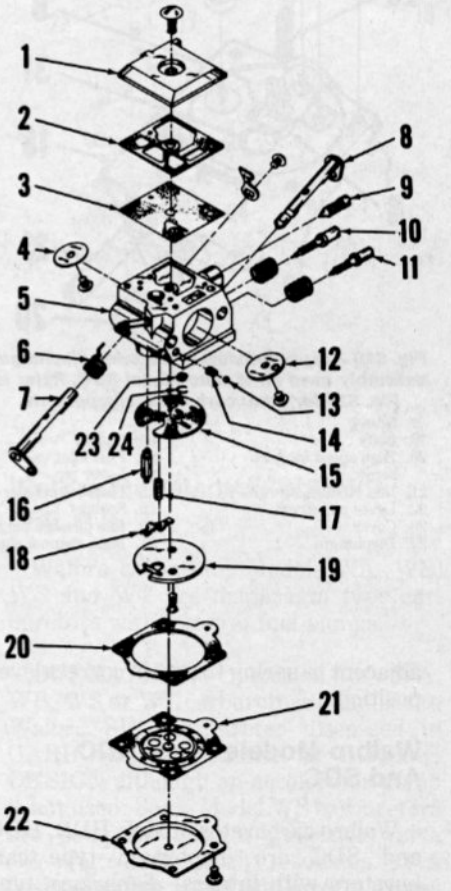

Fig. S19—Exploded view of Walbro Model HDB and HDC carburetors.

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

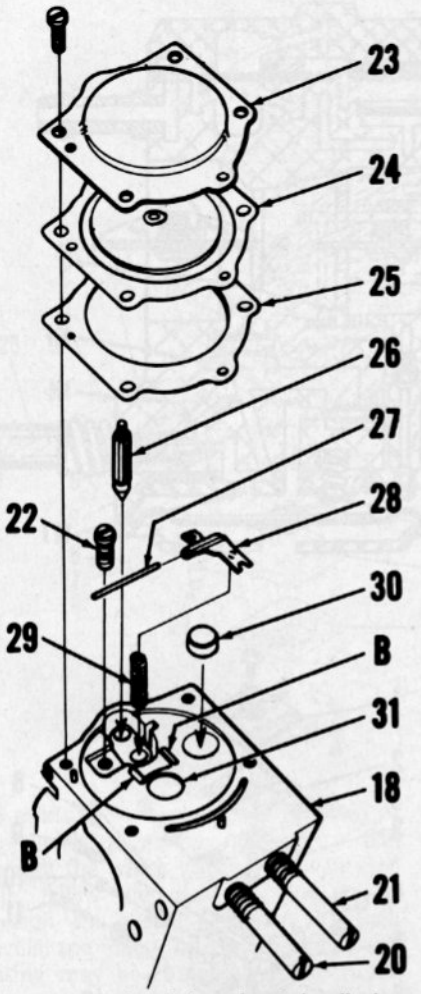

Fig. S20 – Exploded view of metering diaphragm assembly used on Walbro Model SDC. Refer to Fig. S21 for other carburetor components.

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

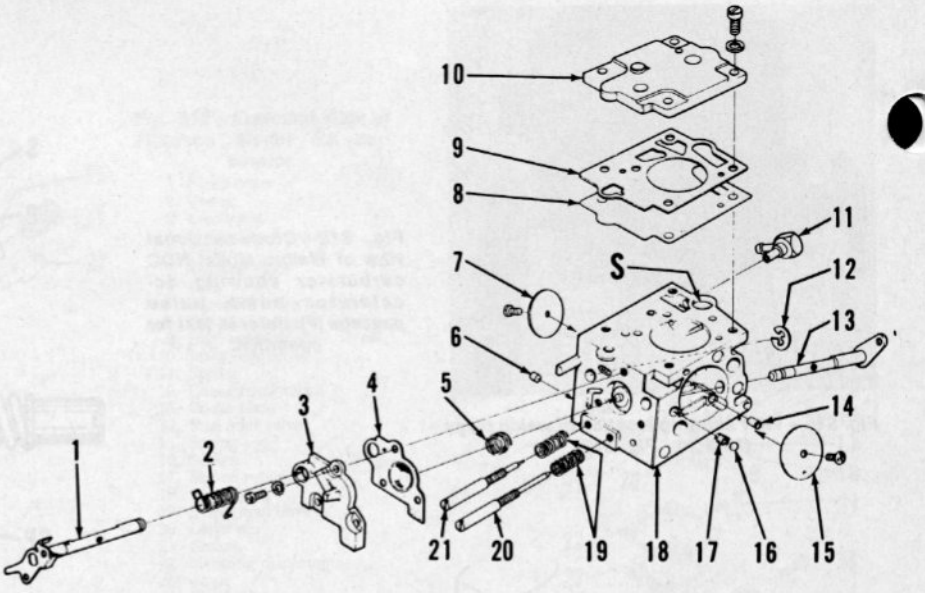

Fig. S21 – Exploded view of Walbro Model SDC carburetor with accelerator pump assembly. Refer to Fig. S20 for metering diaphragm assemply.

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

adjacent to spring to obtain correct lever position.

Walbro Models HDB, HDC And SDC

Walbro carburetor Models HDB, 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 HDB or 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 Models HDB and HDC is similar to Model SDC and discussion will also apply to Models HDB and HDC except for explanation of Model HDC accelerator pump.

Model HDC carburetors with accelerator pump, except HDC 70, 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). Passage is closed when throttle is open. 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 mail 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.

The accelerator pump of Model HDC 70 uses a rubber bladder which accumulates fuel. Fuel in the bladder is ejected through the main fuel orifice when low vacuum occurs in the carburetor bore. Operation is similar to SDC carburetor described on page A-6.

Model HDC circuit plate (CP) may have a hole (MJ) to serve as main jet.

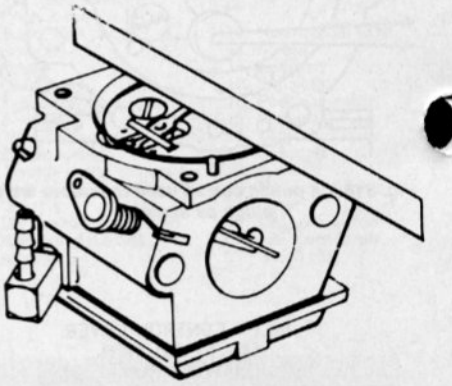

Fig. S22 – Diaphragm lever on Model HDB or HDC should just touch a straightedge laid on carburetor body as shown.

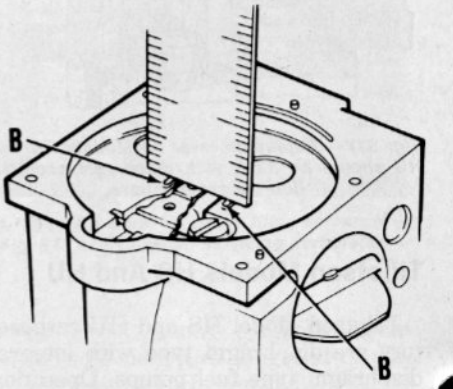

Fig. S23 – Diaphragm lever on Model SDC should just touch straightedge placed on bosses (B) adjacent to lever.

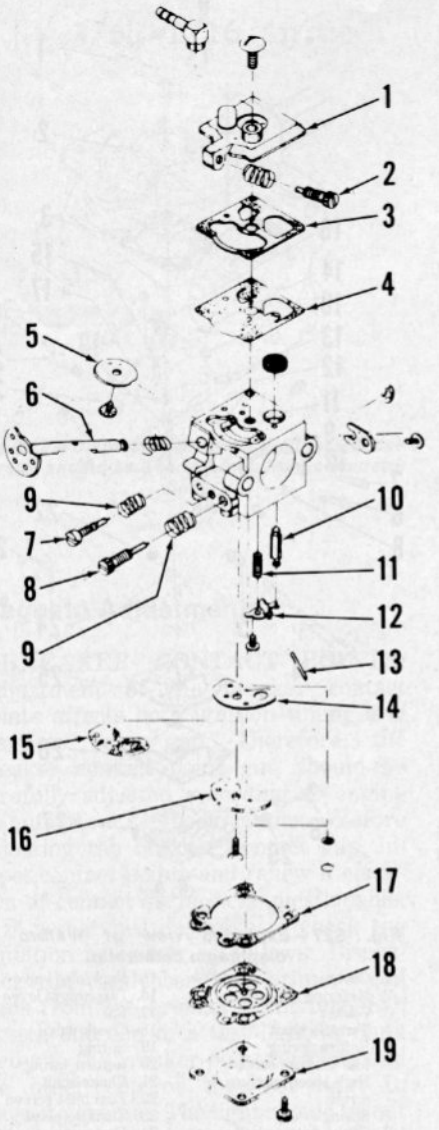

Fig. S24—Exploded view of Walbro WA diaphragm carburetor.

1. Fuel pump cover
2. Idle speed screw
3. Gasket
4. Fuel pump diaphragm
5. Throttle plate
6. Throttle shaft
7. Idle mixture screw
8. High speed mixture screw
9. Springs
10. Fuel inlet valve
11. Spring
12. Diaphragm lever
13. Pin
14. Gasket
15. Circuit plate diaphragm
16. Circuit plate
17. Gasket
18. Metering diaphragm
19. Cover

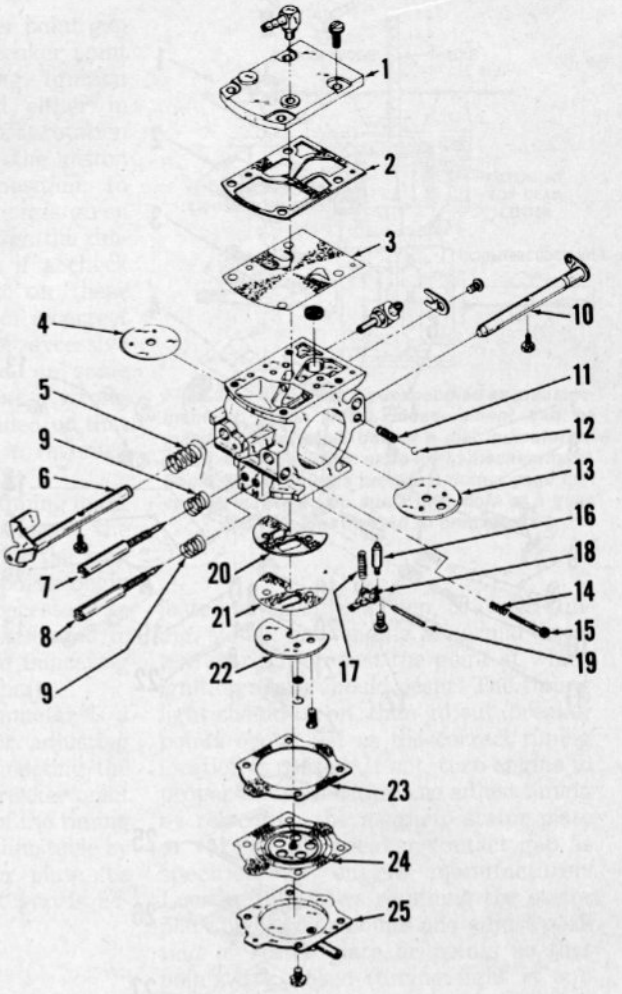

Fig. S25—Exploded view of Walbro WB diaphragm carburetor.

1. Fuel pump cover
2. Gasket
3. Diaphragm
4. Throttle plate
5. Spring
6. Throttle shaft
7. Idle mixture screw
8. High speed mixture screw
9. Springs
10. Choke shaft
11. Spring
12. Choke friction ball
13. Choke plate
14. Spring
15. Idle speed screw
16. Fuel inlet valve
17. Spring
18. Diaphragm lever
19. Pin
20. Gasket
21. Circuit plate valve
22. Circuit plate
23. Gasket
24. Metering diaphragm
25. Cover

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 HDB or 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.

Walbro Models WA, WB, WS And WT

Walbro carburetor Models WA, WB, WS and WT are diaphragm type carburetors with integral fuel pumps.

OPERATION. Operation of WA, WB, WS or WT carburetors is similar to Walbro SDC carburetor discussed in CARBURETION section of ENGINE DESIGN although an accelerator pump is not used. Some Model WS carburetors are equipped with a governor valve (13–Fig. S26) which resonates at a desired engine speed and directs excess fuel into carburetor bore to prevent overspeeding. Governor valve is designed for specific engines and should not be altered.

OVERHAUL. Thoroughly clean carburetor prior to disassembly. Disassembly of carburetor is evident after referral to exploded view (Figs. S24, S25, S26 or S27) and inspection of carburetor.

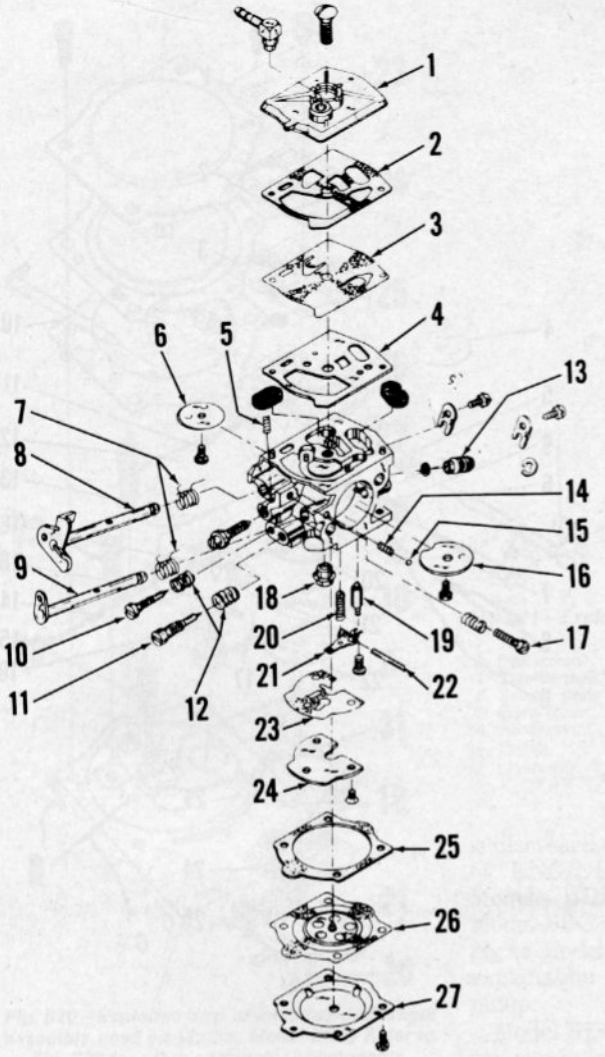

Fig. S26—Exploded view of Walbro WS diaphragm carburetor.

1. Fuel pump cover
2. Gasket
3. Fuel pump diaphragm
4. Plate
5. Spring
6. Throttle plate
7. Springs
8. Throttle shaft
9. Choke shaft
10. Idle mixture needle
11. High speed mixture needle
12. Springs
13. Governor
14. Spring
15. Choke friction ball
16. Choke plate
17. Idle speed screw
18. Nozzle
19. Fuel inlet valve
20. Spring
21. Diaphragm lever
22. Pin
23. Gasket
24. Circuit plate
25. Gasket
26. Metering diaphragm
27. Cover

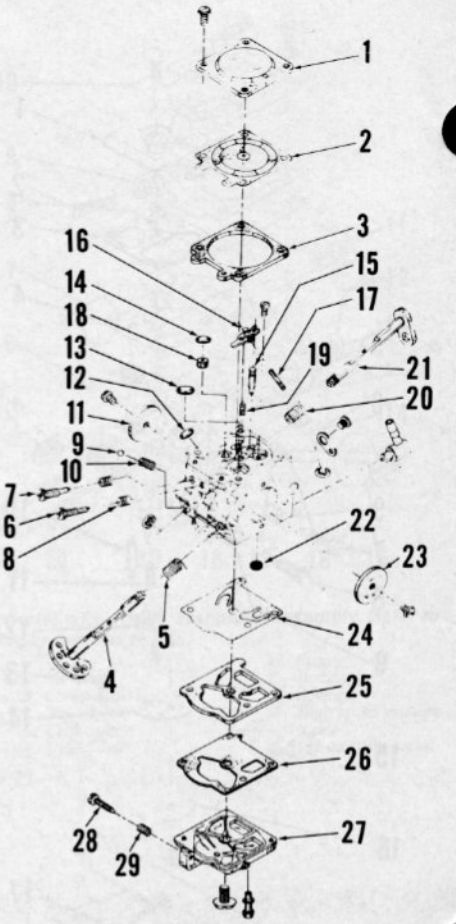

Fig. S27—Exploded view of Walbro WT diaphragm carburetor.

1. Cover
2. Metering diaphragm
3. Gasket
4. Throttle shaft
5. Return spring
6. Idle mixture screw
7. High speed mixture screw
8. Spring
9. Choke friction ball
10. Spring
11. Choke plate
12. Welch plug
13. Welch plug
14. Welch plug
15. Fuel inlet valve
16. Diaphragm lever
17. Pin
18. Check valve
19. Spring
20. Return spring
21. Choke shaft
22. Fuel inlet screen
23. Throttle plate
24. Fuel pump diaphragm
25. Gasket
26. Surge diaphragm
27. Cover
28. Idle speed screw
29. Spring

Clean and inspect all components. Inspect metering diaphragm for punctures or tears 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. 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. Fuel screen should be cleaned. On WS and WT models, do not direct compressed air through main nozzle check valve (18—Fig. S26 or S27) as check valve will be damaged.

To reassemble carburetor, reverse order of disassembly. On Models WA and WS, fuel metering lever should be flush with circuit plate as shown in Fig. S28. On Model WT, fuel metering lever should be flush with carburetor body. To measure height of fuel metering lever on Model WB, lay a straight edge across carburetor body with diaphragm gasket removed. Gap between fuel metering lever and straight edge should be 3/64-1/16 inch (See Fig. S29). Gently bend lever to obtain desired lever height.

IGNITION SYSTEM

In servicing a chain saw ignition system, the mechanic is concerned with troubleshooting, 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.

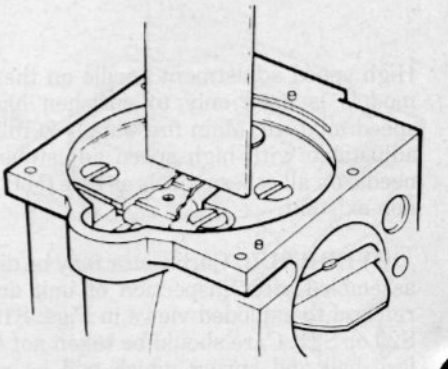

Fig. S28—Diaphragm lever on Walbro WA and WS carburetors should be flush with circuit plate.

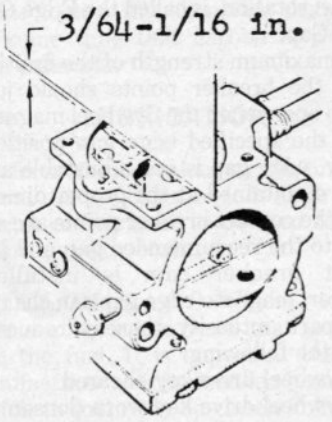

Fig. S29—Diaphragm lever on Walbro WB carburetor should be 3/64-1/16 inch from carburetor body.

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, inspect contact points and renew if condition of contact surfaces is questionable. It is sometimes desirable to check the 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 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. S35) 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 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. S36 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 adjustable 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.

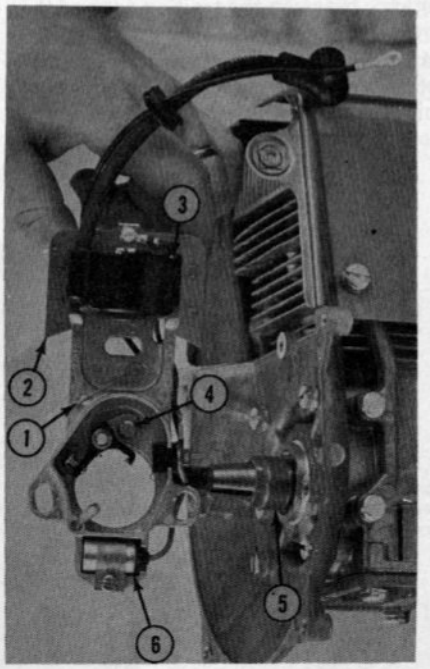

Fig. S35—On some chain saw engines, the magneto stator plate mounting holes are slotted as shown so that ignition timing can be adjusted by relocating position of stator plate.

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

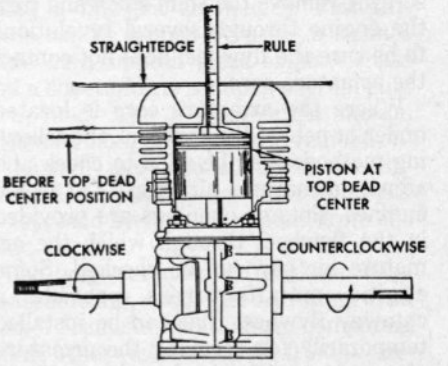

Fig. S36—Where timing is specified as measurement of piston travel, measurement can be made as illustrated. Use of a dial indicator instead of ruler will give more exact measurement. Some manufacturers provide a timing gage that can be screwed into spark plug hole or a gage that can be attached to crankshaft.

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 magnets and armature core. The magnets will pull the armature core against the shim stocks. If 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. 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 cutaway 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. S38), or out of a new flywheel if service volume on a particular engine warrants 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.

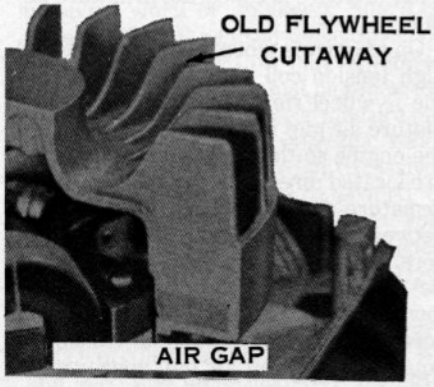

Fig. S38 – Where armature core and ignition coil are located inside of flywheel, an old discarded flywheel can be cut away as shown to provide air gap adjustment fixture.

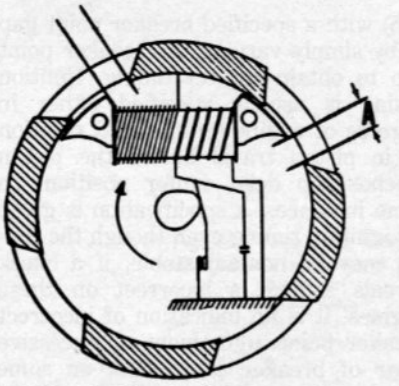

Fig. S39 – The distance (A) between trailing edge of magnet and leading edge of pole shoe when primary voltage is highest is known as EDGE GAP.

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. S39. 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 (loosen)
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 buildup. 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 that 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

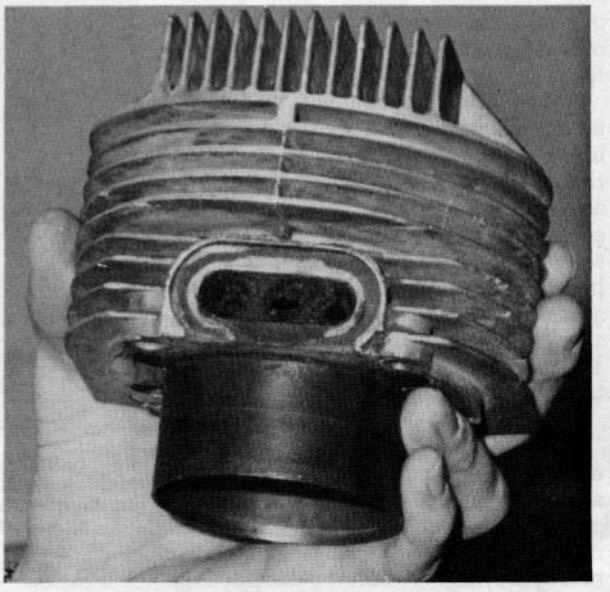

Fig. S40 – Example of severe case of port carbon. Carbon must be removed to restore performance.

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.

FUEL:OIL RATIO. Chain saw engines are lubricated by oil that is 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 buildup. 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. If Homelite oil is not used, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 careless over-tightening of fasteners or in 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. S41 and S42. Thermal crayons are available which can be used to determine 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 PERMALOCK or other similar product.

REPAIRING DAMAGED THREADS

Damaged threads in casting 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. S43 through S45 which illustrate the use of Heli-Coil thread repair kits that are manufactured by the Heli-Coil Corporation, Danbury, Connecticut, and available from Homelite.

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

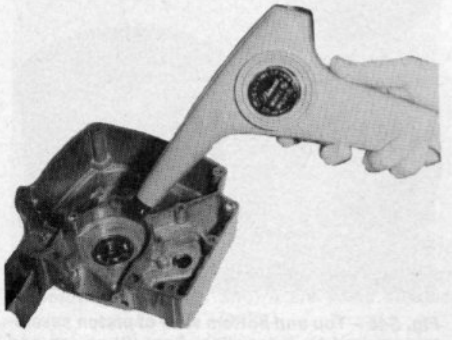

Fig. S41—Heat can be used efficiently as a service tool. Shown is an Electric Heat Gun available from UNGAR, 233 East Manville, Compton, California 90220.

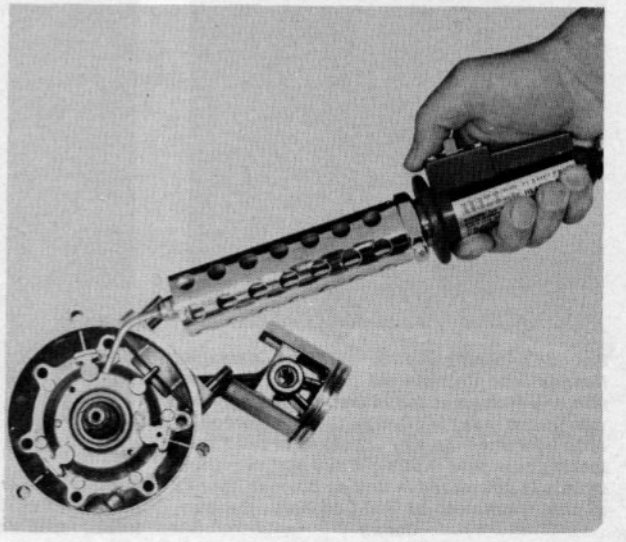

Fig. S42—Heat Torch delivers hot air to a smaller area than Heat Gun shown in Fig. S41. Dry compressed air is electrically heated and temperature (up to 1000° F.) is varied by controlling air pressure. The torch shown is available from Master Appliance Corp., 1745 Flett Ave., Racine, Wis. 53403.

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-stroke experts. Because the 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 and 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.

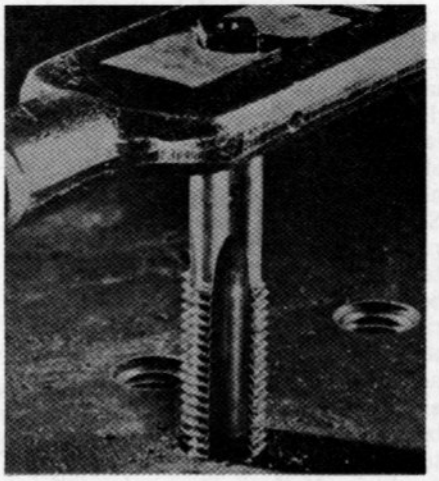

Fig. S44—Special drill taps are provided in thread repair kit for threading drilled hole to correct size for outside of thread insert. A standard tap cannot be used.

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. S46. 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 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 scor-

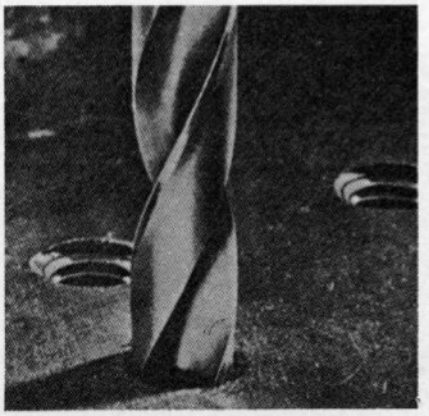

Fig. S43—First step in repairing damaged threads is to drill out old threads using exact size drill recommended in instructions provided with thread repair kit. Drill all the way through an open hole or all the way to bottom of blind hole, making sure hole is straight and that centerline of hole is not moved in drilling process. (Series of photos provided by Heli-Coil Corp., Danbury, Conn.)

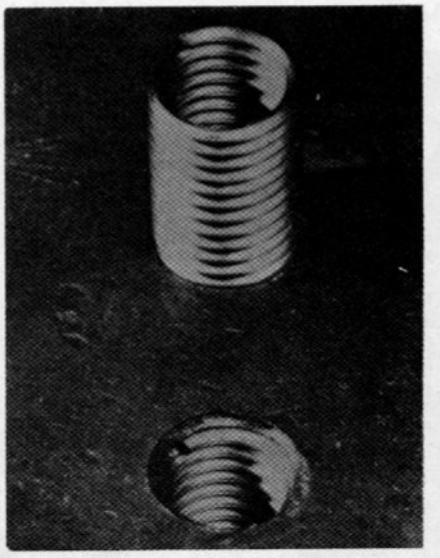

Fig. S45—A thread insert and a complete repair are shown above. Special tools are provided in thread repair kit for installation of thread insert.

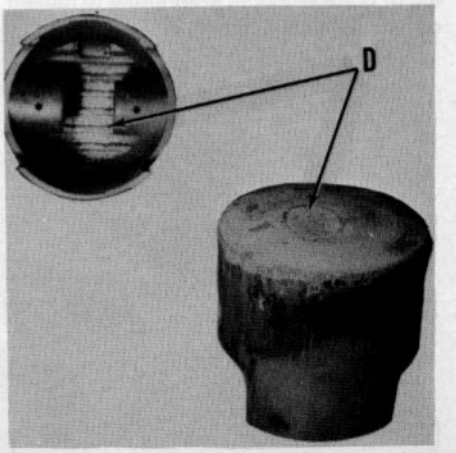

Fig. S46—Top and bottom view of piston severely damaged by detonation. Spot (D) on top and bottom of crown show where metal has started to melt. Absence of scoring on skirt rule out seizure, overheating or lack of lubrication as a contributing cause.

ing of piston above the piston pin is due to overheating. Damage below the pin is more likely due to insufficient lubrication or improper fit. Overheating 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. S47). 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, installation 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. S50 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. S48. 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. Refer to Fig. S47. When installing rings on piston, expand only far enough to slip over the piston and do not twist rings.

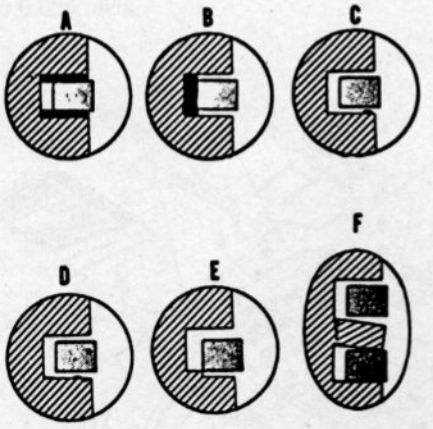

Fig. S47 – Examine piston for damage before removing old rings. Shown are some common faults.

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

Fig. S48 – Clearance between ends of ring (ring end gap) should be measured with feeler gage as shown. Make sure ring is straight in cylinder.

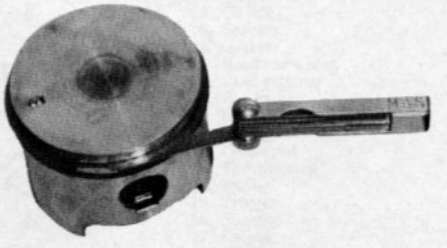

Fig. S49 – Ring side clearance in groove should be measured with feeler gage as shown. Clearance should be within recommended limits and the same all the way around piston.

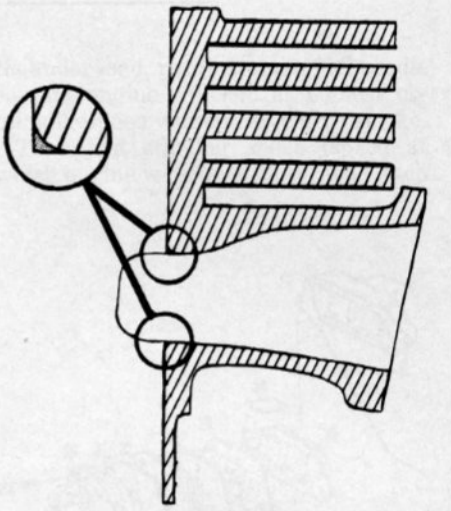

Fig. S50 – Some manufacturers recommend that edges of ports be chamfered as shown in insert, after reboring.

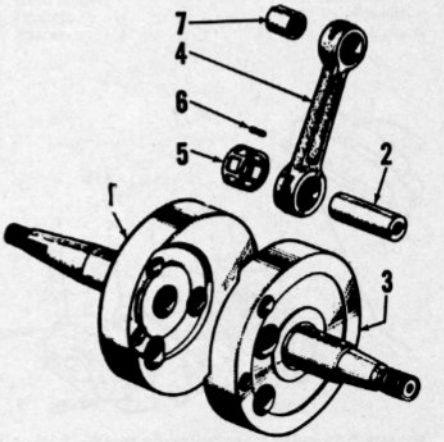

Fig. S51 – Exploded view of typical built-up crankshaft.

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

After installing rings on piston, use feeler gage to measure ring side clearance in groove as shown in Fig. S49. 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.

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 (antifriction 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. S51. 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

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Charlotte, NC 28217

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

*Later models are equipped with solid-state ignition system.

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 magneto

MAINTENANCE

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

CARBURETOR. A Walbro Model HDC diaphragm type carburetor is used on all models. Refer to Walbro section of CARBURETOR SERVICE 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

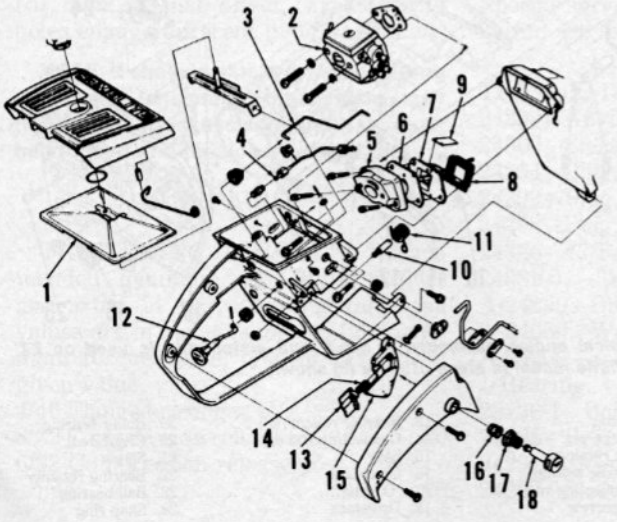


Fig. HL1 – Exploded view of handle assembly and related assemblies.

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

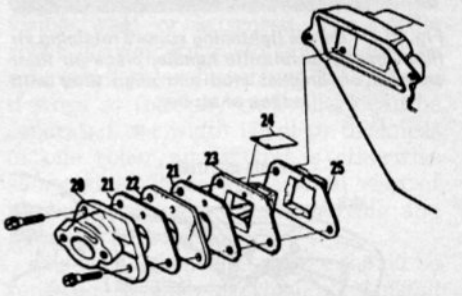


Fig. HL2 – View showing earliest production reed valve and spacer installation.

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

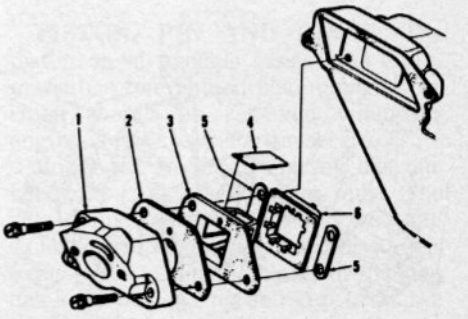


Fig. HL3 – View showing reed valve and spacer installation used later in production than parts shown in Fig. HL2, but prior to installation shown in Fig. HL1.

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

engaged), stop engine and remove chain, guide bar, air filter cover and air filter. Open trigger adjusting screw 1/8-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 counterclockwise 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 rapidly with throttle latched, repeat adjustment procedure to set starting speed slower.

MAGNETO AND TIMING. A conventional flywheel type magneto ignition system is used on early models while later Super EZ Automatic models are equipped with solid-state ignition. The solid-state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module. Remove shim stock.

Note the following on breaker point equipped models: Breaker points are contained in a breaker box under the flywheel. Ignition timing is not adjustable. Breaker point gap should be 0.015 inch and must be correct or ignition timing will be affected. Condenser capacity should be approximately 0.2 mfd. Air gap between flywheel and coil should be 0.015 inch.

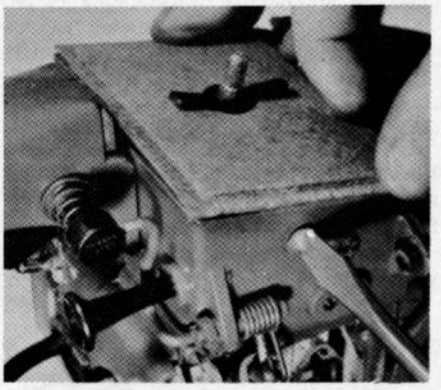


Fig. HL4 — Before tightening screws retaining air filter bracket in throttle handle, place air filter element on bracket stud and align filter with edges of air box.

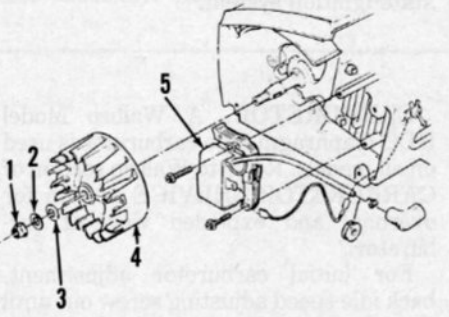


Fig. HL6A — Exploded view of solid-state ignition used on later Super EZ Automatic models.

1. Nut
2. Lockwasher
3. Washer
4. Flywheel
5. Ignition module

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. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for

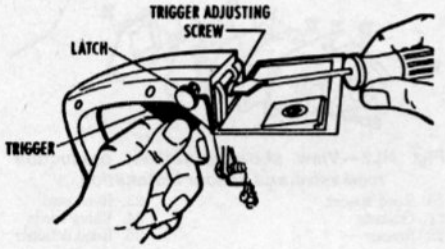


Fig. HL5 — Adjusting starting speed for Models EZ and XL-Mini. Refer to text for procedure.

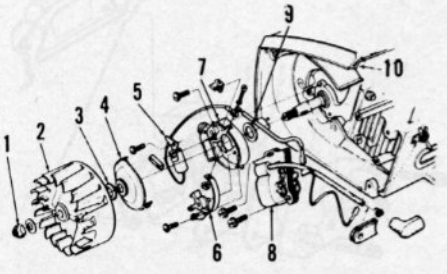


Fig. HL6 — Exploded view of ignition assembly. Felt seal (3) is cemented to breaker box cover (4).

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

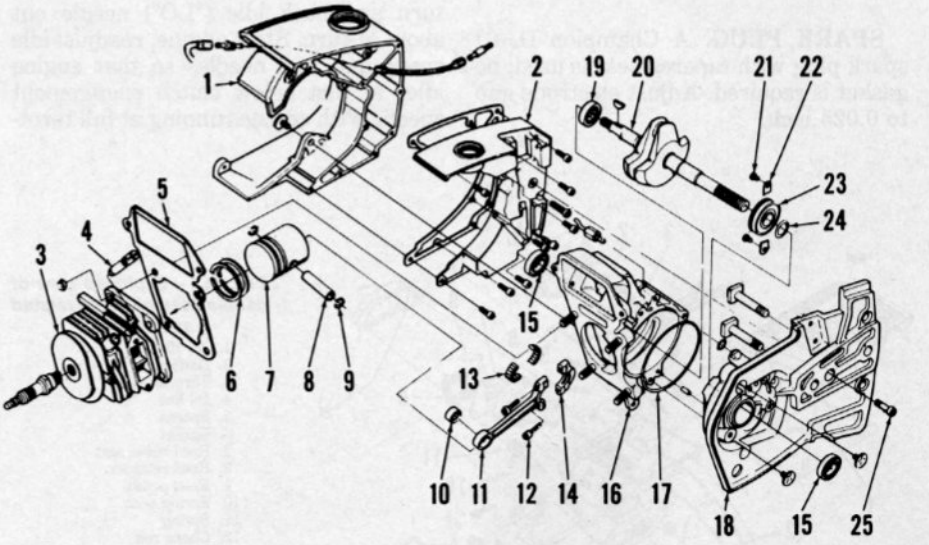


Fig. HL7 — Exploded view of typical engine assembly. A head land piston ring is used on EZ Automatic model in place of rings (6) shown.

1. Fuel tank
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

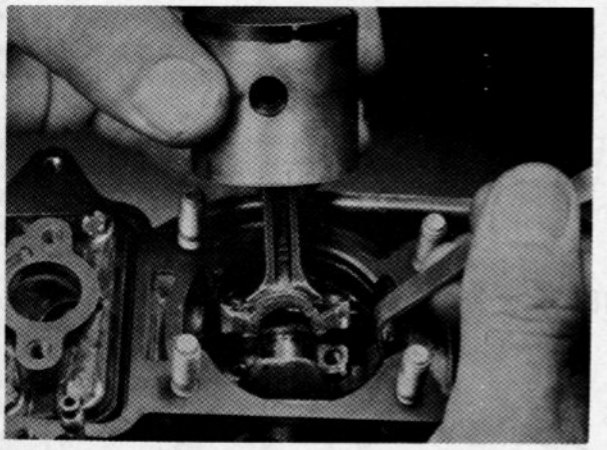


Fig. HL8—Installing piston and connecting rod assembly using locally made tool to hold rod cap in position. Tool can be made from flat strip of metal. Using grease, stick 14 rollers in cap and 14 rollers in rod; make sure that match marks on rod and cap are aligned.

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

two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 counter-clockwise 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	100
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.
24982-01—Torx driver bit.
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.

COMPRESSION PRESSURE. For optimum performance of Model Super EZ Automatic, cylinder compression pressure should be 155-185 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CONNECTING ROD. Connecting rod and piston assembly can be detached from crankshaft after removing 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 spots 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 headland ("L" shaped) ring only. The ring should be renewed if ring end gap exceeds 0.015 in.; desired ring end gap is 0.006-0.015 in. 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.

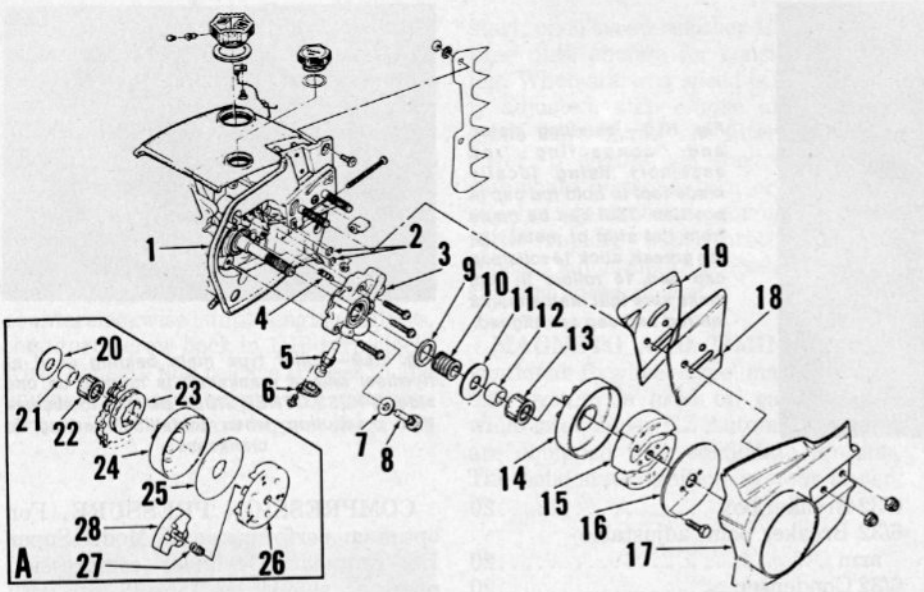


Fig. HL10—Exploded view of automatic oil pump and clutch assemblies. Inset A shows three-shoe type clutch. Sprocket (23) and clutch drum (24) are integral on some models.

1. Drivecase
2. "O" rings
3. Oil pump body
4. Tube
5. Gear
6. Cap
7. Gasket
8. Cam screw
9. Seal
10. Worm gear
11. Thrust washer
12. Inner race
13. Bearing
14. Clutch drum
15. Hub
16. Cover
17. Drivecase cover
18. Outer guide plate
19. Inner guide plate
20. Thrust washer
21. Inner race
22. Bearing
23. Sprocket
24. Clutch drum
25. Thrust washer
26. Clutch hub
27. Spring
28. Clutch shoe

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.

Fig. HL10A—View of correct installation of "S" type clutch hub in drum.

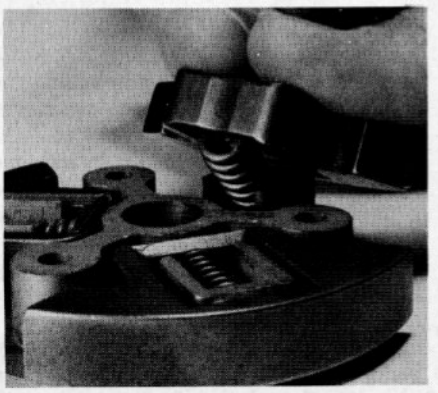


Fig. HL11—View showing easy method of installing clutch shoes and springs. Model EZ clutch is not shown; however, method is same.

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 drivecase (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" or "Torx" screwdriver bit, according to type of screw head, 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. 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.

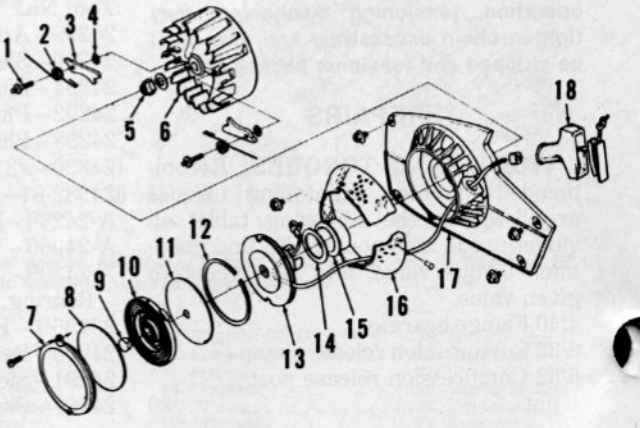
Service of compression release valve usually consists of cleaning valve seat and port in cylinder as carbon may gradually fill the port.

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

Fig. HL12—Exploded view of recoil starter used on early models.

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



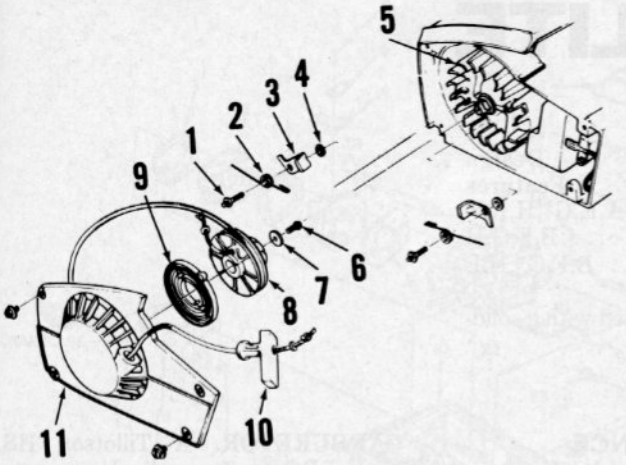


Fig. HL13—Exploded view of recoil starter used on late models.

1. Stud
2. Spring
3. Pawl
4. Washer
5. Flywheel
6. Screw
7. Washer
8. Rope pulley
9. Rewind spring
10. Rope handle
11. Starter housing

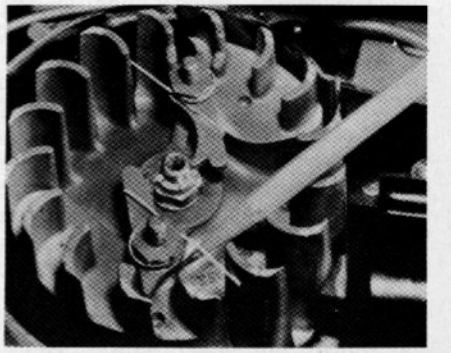


Fig. HL14—View showing proper installation of pawl springs.

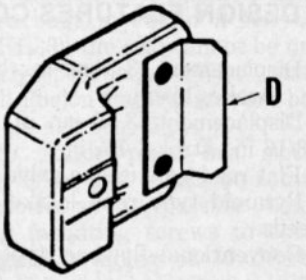


Fig. HL15—View of Super EZ Automatic muffler #96580 with exhaust gas deflector (O).

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 exploded 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. Two types of clutches have been used. Refer to Fig. HL10 for an exploded view of "S" type clutch (15) and three-shoe type clutch shown in inset A.

The clutch hub on both types has left-hand threads. Special tool no. A93791 may be used when removing or installing "S" type clutch while tool no. A24060 may be used when removing or installing three-shoe type clutch.

Clean and inspect clutch hub, drum and bearing for damage or excessive wear. Inspect crankshaft for wear or damage caused by a defective clutch bearing. Refer to Fig. HL10A for correct installation of "S" type clutch. On models equipped with three-shoe type clutch, refer to Fig. HL11 for easy method of installing clutch shoes and springs on clutch hub.

REWIND STARTER. Exploded view of early production rewind starter is shown in Fig. HL12 and late production rewind starter is shown in Fig. HL13. Starter can be removed as a complete unit by removing housing retaining screws.

To disassemble starter on early models, hold cover (7—Fig. HL12) 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.

To disassemble starter on late models, pull starter rope fully out, hold starter pulley (8—Fig. HL13) from turning, pull all slack in rope out inner side of fan housing and allow pulley to unwind slowly until spring tension is relieved. Remainder of disassembly is evident from inspection of unit and with reference to exploded view.

Fig. HL14 shows correct installation of starter dogs on flywheel for early models, late models will be similar. When installing a new starter rope, knot rope ends and coat with Duxseal, then trim excess rope next to knot. Rewind spring is wound in clockwise direction in cover (7—Fig. HL12) or housing (11—Fig. HL13).

Set rewind spring tension as follows: On early models, turn cover (7—Fig. HL12) in a clockwise direction to pull rope handle against starter housing, then continue turning cover three more times.

On late models, hook rope in notch on flywheel side of pulley (8—Fig. 13), then pull up loop of cord between notch and housing (11). Turn pulley in a clockwise direction three turns and hold. Pull rope handle, removing all slack in rope and disengage rope from notch. Release rope handle. If handle is not snug against starter housing, repeat tensioning procedure turning pulley only one turn at a time.

MUFFLER. Some later Super EZ Automatic models may experience vapor lock due to exhaust gas directed toward drivecase cover. The air filter and carburetor may be discolored due to heat. Muffler #A96580 with deflector (D—Fig. HL14) may be installed to prevent hot exhaust gas from reaching drivecase cover.

HOMELITE

Chain Saw Model	Design Features
XL-12	A,E,G*,H,K,F
Super XL	B,F,G,H
Super XL Automatic	B,F,G*,H,L

*Later models are equipped with a solid-state ignition system.

DESIGN FEATURES CODE

A – Displacement, 3.3 cu. in.; bore, 1¾ in.; stroke, 1⅜ in.
B – Displacement, 3.55 cu. in.; bore, 1 13/16 in.; stroke, 1⅜ in.
E – Flat reed type intake valve.
F – Pyramid type reed intake valve, 4 reeds.
G – Conventional flywheel type magneto.
H – Direct drive.
K – Manual chain oiler only.
L – Automatic chain oiler; manual chain oiler pump.

MAINTENANCE

SPARK PLUG. Model XL-12 is equipped with a Champion CJ-8 spark plug while Models Super XL and Super XL Automatic use a CJ-6. For heavy duty service, a Champion UTJ-11P gold-paladium tip spark plug can be used on all models.

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

CARBURETOR. A Tillotson HS, Walbro SDC or Zama diaphragm carburetor is used. Refer to CARBURETOR SERVICE section for service on Tillotson or Walbro carburetor. Refer to Fig. HL29 for an exploded view of Zama carburetor.

Initial adjustment of idle mixture screw is 1¾ turns open and for high speed mixture screw is 1¼ turns open.

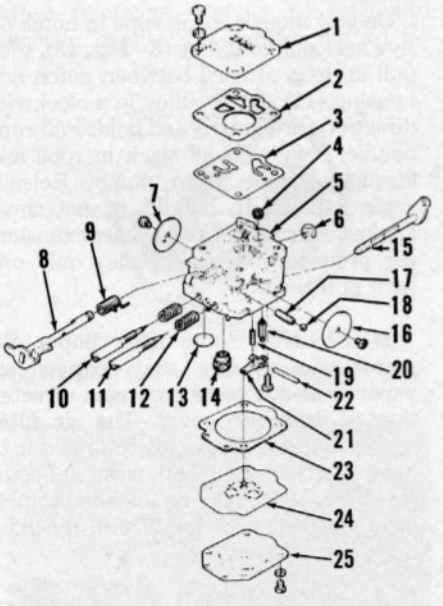


Fig. HL29 – Exploded view of Zama carburetor.

1. Fuel pump cover
2. Gasket
3. Fuel pump diaphragm & valves
4. Screen
5. Body
6. "E" ring
7. Throttle plate
8. Throttle shaft
9. Return spring
10. Idle mixture screw
11. High speed mixture screw
12. Spring
13. Plug
14. Check valve
15. Choke shaft
16. Choke plate
17. Spring
18. Detent ball
19. Spring
20. Fuel inlet valve
21. Metering diaphragm lever
22. Lever pin
23. Gasket
24. Metering diaphragm
25. Cover

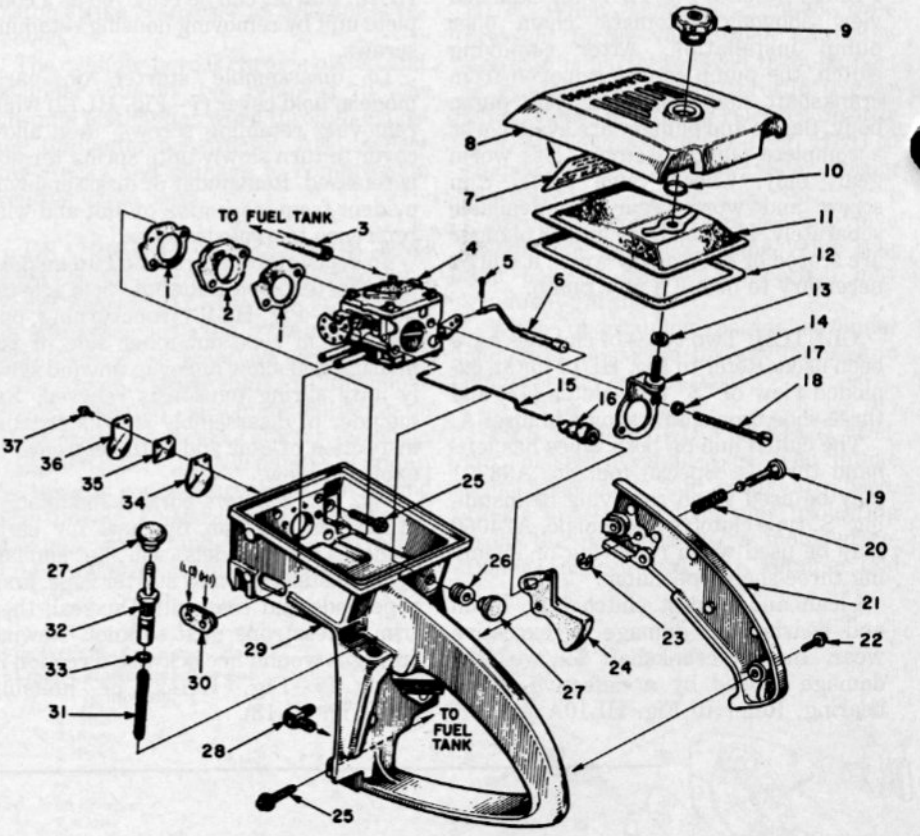


Fig. HL30 – Exploded view of air box (throttle handle) and related parts on models with flat reed intake valve (34). Refer to Fig. HL31 for models equipped with pyramid reed valve.

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

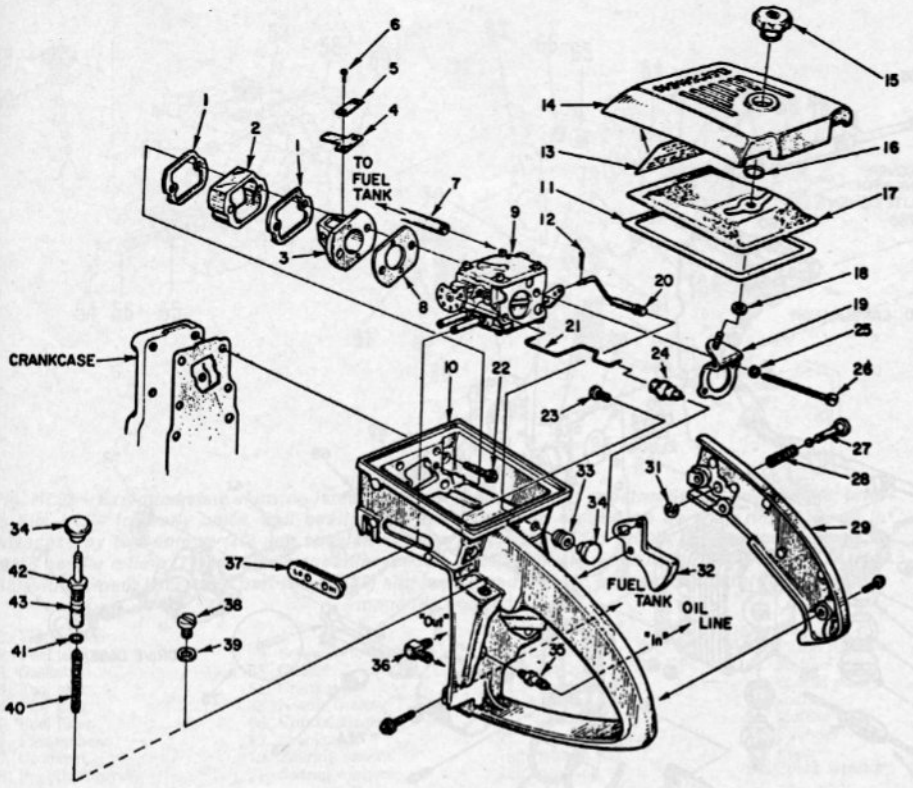


Fig. HL31 — Exploded view of air box and throttle handle assembly for models equipped with pyramid reed type intake valve. Idle speed adjusting screw (23) on some models, is located in air box instead of on carburetor body; remove idle speed adjusting screw and spring from new service carburetor before 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
2. Spacer
3. Reed seat
4. Valve reeds (4)
5. Retaining plates
7. Fuel line
8. Gasket
9. Carburetor
10. Air box
11. Gasket
14. Cover
17. Filter
18. Gasket
19. Bracket
20. Choke rod
21. Throttle rod
23. Idle speed screw
24. Boot
27. Throttle latch pin
28. Spring
29. Handle cover
31. Snap ring
32. Throttle trigger
33. Grommet
35. "In" check valve
36. "Out" check valve
37. Grommet
38. Plug (AO models)
39. Gasket
40. Spring (manual oiler)
41. "O" ring
42. Manual pump plunger
43. "O" ring

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.

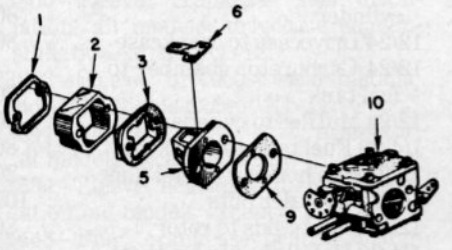


Fig. HL32 — View showing late type Delrin plastic reed seat (5) and moulded reed retainer (3). Reeds (6) are held on pins protruding from seat by the retainer. Refer to text for assembly instructions.

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

MAGNETO AND TIMING. A Wico or Phelon flywheel type magneto with external armature is used on early models while late models are equipped with solid state ignition. The solid state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module. Remove shim stock.

Note the following on breaker point equipped models: 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).

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 inch. Condenser capacity 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. Late Wico units have a retaining clip and flat washer to secure breaker arm on pivot post.

LUBRICATION. The engine is lubricated mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel

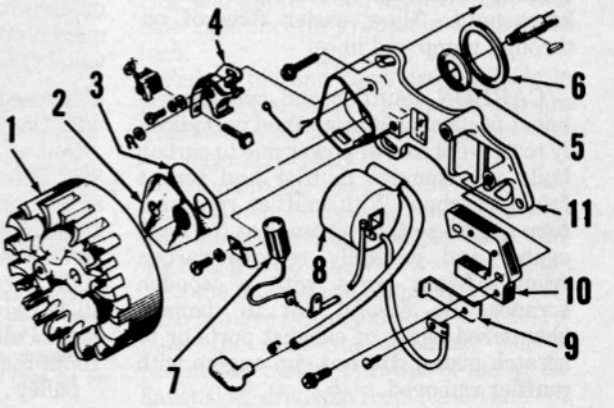


Fig. HL33 — Exploded view of Wico magneto used on some models. Phelon magneto used on other models is similar. Felt seal (5) is not used on early models.

1. Flywheel
2. Cover
3. Gasket
4. Breaker points
5. Felt seal
6. Gasket
7. Condenser
8. Ignition coil
9. Coil clip
10. Armature core
11. Stator plate

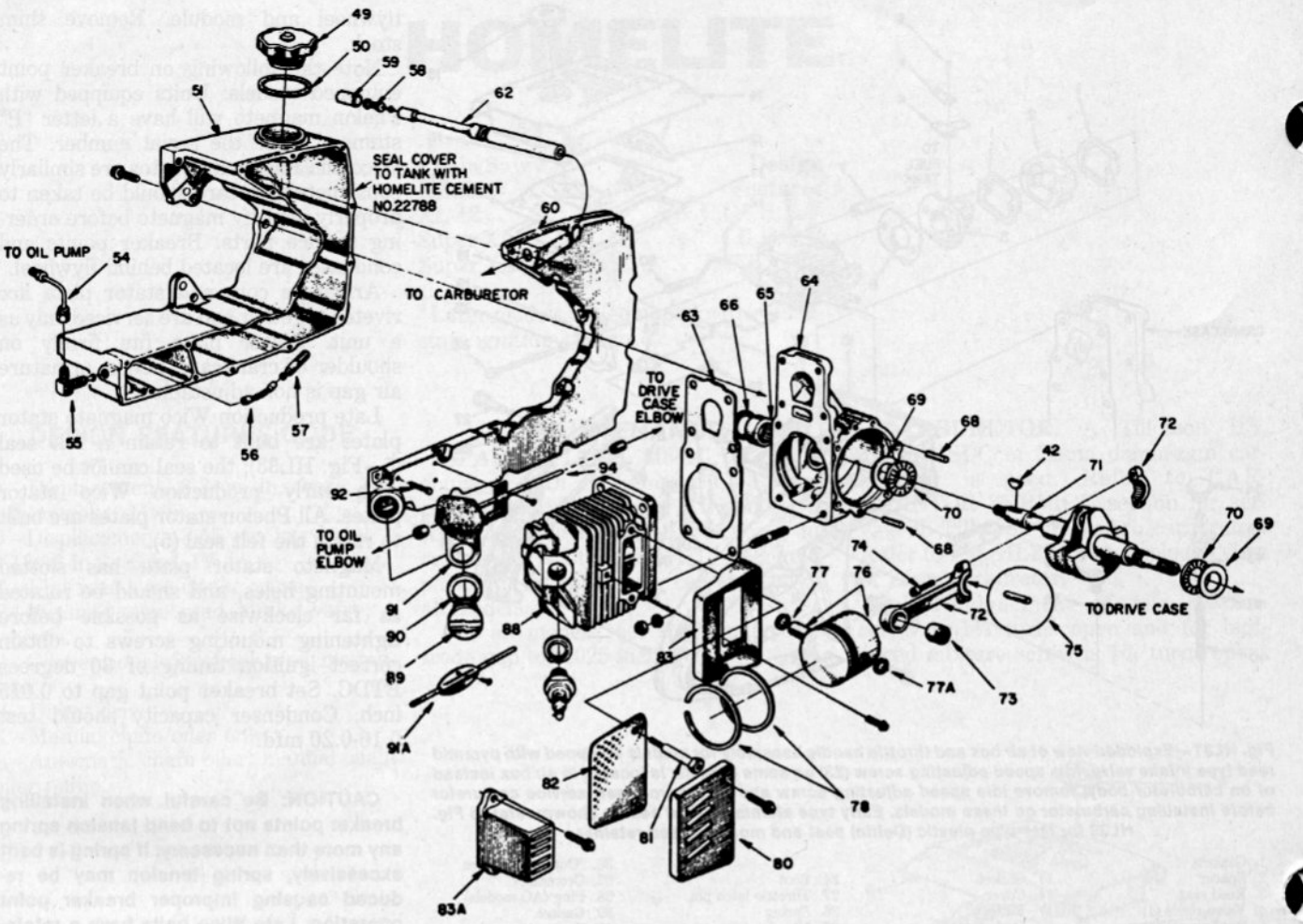


Fig. HL34 — Exploded view showing powerhead and fuel tank construction of Model XL-12; refer to Fig. HL35 for other models. Dowel pins (68) are used on later models. Refer to text. Single or two-piece muffler may be used. Shield (91) is not used on later models.

42. Woodruff key
49. Fuel tank cap
50. Gasket
51. Fuel tank
54. Oil line
55. Check valve
56. Oil line
57. Oil filter
58. Fuel pickup
59. Fuel filter
60. Tank cover (late)
62. Flexible fuel line
63. Gasket
64. Crankcase
65. Needle bearing
66. Crankshaft seal
68. Dowel pins
69. Thrust washers
70. Thrust bearings
71. Crankshaft
72. Connecting rod & cap
80. Muffler cap
81. Special studs
82. Baffle
83. Muffler body
83A. Muffler
88. Cylinder
89. Oil cap
73. Needle bearing
74. Rod cap screws
75. Needle rollers
76. Piston & pin
77. Snap ring
77A. Snap ring
78. Piston rings
90. Gasket
91. Shield
91A. Plate
92. Cotter pin (breather)
94. Oil line

stabilizer so the fuel mix will stay fresh up to one year.

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.

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 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
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 Muffler 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
14 mm Spark plug 250
Clutch spider 180

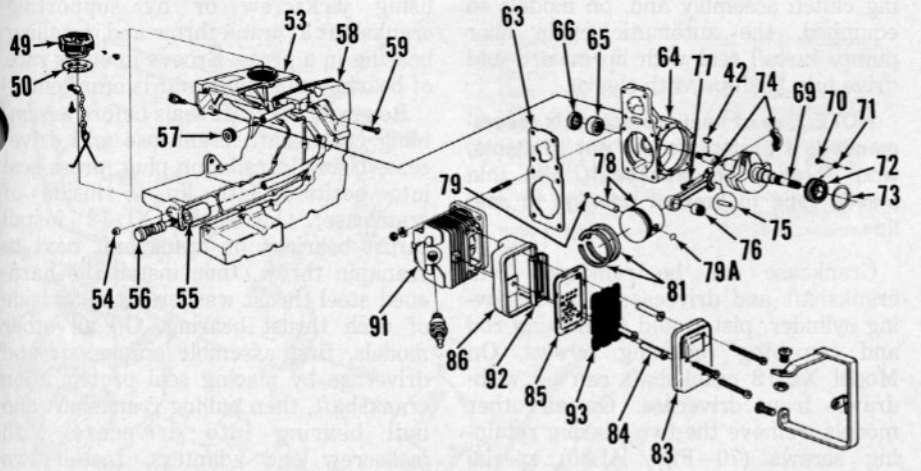


Fig. HL35 – Exploded view showing latest type fuel tank and later construction of power head; refer to Fig. HL34 for early units. Ball bearing (72) is retained on crankshaft by snap ring (73) and in drivecase by two screws (70) and special washers (71); refer to Fig. HL36. Latest models have 31 loose 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). Later tanks are permanently bonded.

42. Woodruff key
49. Fuel tank cap
50. Gasket
53. Fuel tank
54. Pipe plug
55. Fuel filter
56. Pick-up head
57. Grommet
58. Fuel tank cover
59. Screws (16)
63. Gasket
64. Crankcase
65. Needle bearing
66. Crankshaft seal
69. Crankshaft
70. Bearing screws
71. Special washers
72. Ball bearing
73. Snap ring
74. Connecting rod
75. Needle rollers
76. Needle bearing
77. Rod cap screws
78. Piston & pin
79. Snap ring
79A. Snap ring
81. Piston rings
83. Muffler cap
84. Special studs
85. Baffle
86. Muffler body
91. Cylinder
92. Plate
93. Spark arrestor

HOMELITE SERVICE TOOLS. Listed below are Homelite tool numbers, tool description and model application of tools for servicing.

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, Model XL-12.

23759 – Sleeve, crankcase seal protector, all models; drivecase seal protector, Model XL-12.

23800 – Sleeve, crankcase seal installation, all models; drivecase seal installation, Model XL-12.

23843 – Sleeve, drivecase seal installation, all models except XL-12.

23844 – Sleeve, drive seal protector, all models except XL-12.

23884 – Sleeve, bearing and shaft installation, all models except XL-12.

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

23845 – Plug, drivecase seal installation, all models except XL-12.

23846 – Anvil, crankshaft installation, all models except XL-12.

A-23137 – Jackscrew, crankshaft assembly & installation, all models except 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.

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

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

COMPRESSION PRESSURE. For optimum performance on all models, cylinder compression pressure should be 130-155 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

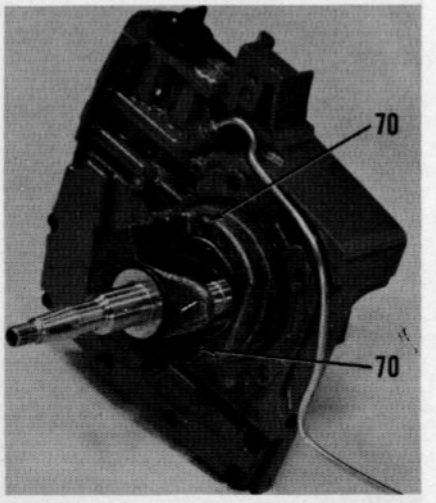


Fig. HL36 – View showing crankcase removed from drive case and crankshaft on models equipped with ball bearing at drive end of crankshaft. To remove crankshaft from drivecase, bearing retaining screws (70) must first be removed.

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 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 inch.

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

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 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 locating 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 Model XL-12 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 0.020 inch; renew thrust bearings if end play is excessive. Normal end play is approximately 0.010 inch.

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.

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 Model XL-12 crankshaft can be withdrawn from drivecase. On all other models, remove the two bearing retaining screws (70–Fig. HL35) 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 Model XL-12, the needle roller bearing in drivecase. Bearings should be renewed if any needle roller has flat spots or is otherwise damaged, or if rollers are worn so that any two rollers may 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 Model XL-12 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 Model XL-12 place seal protector on crankshaft and insert crankshaft in crankcase. Then, on all models, assemble 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 in-

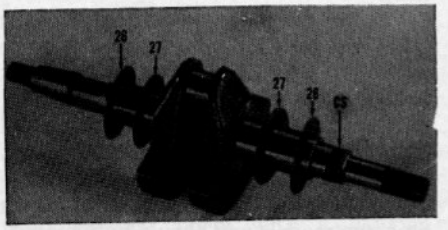


Fig. HL38—Be sure the steel thrust washers (26) are to outside of thrust bearings (27) when installing crankshaft on Model XL-12. Other models do not use thrust washers or thrust bearings.

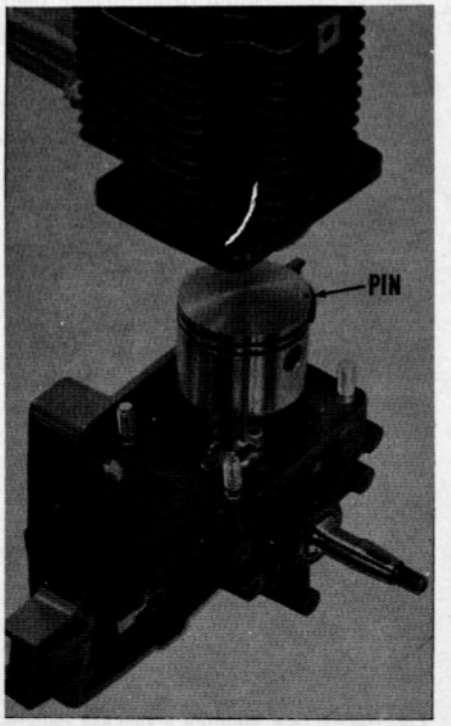


Fig. HL39—Piston and connecting rod assembly can be removed from crankpin after removing cylinder from crankcase. Note piston ring locating pin on intake side of piston.

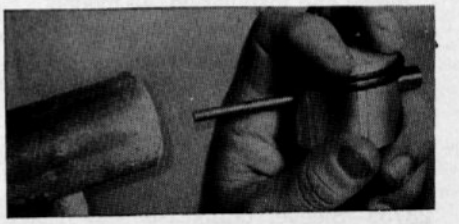


Fig. HL40—After removing snap rings, the piston pin can be tapped out using a 3/16-inch rod as shown or, on pistons with Spirol pin at exhaust side, by driving piston pin out with slotted driver (Homelite tool No. 23949).

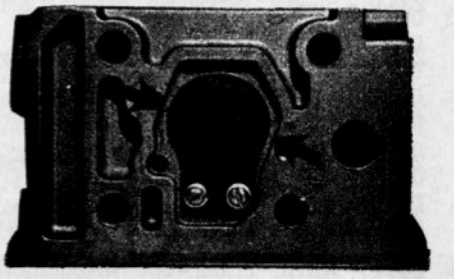
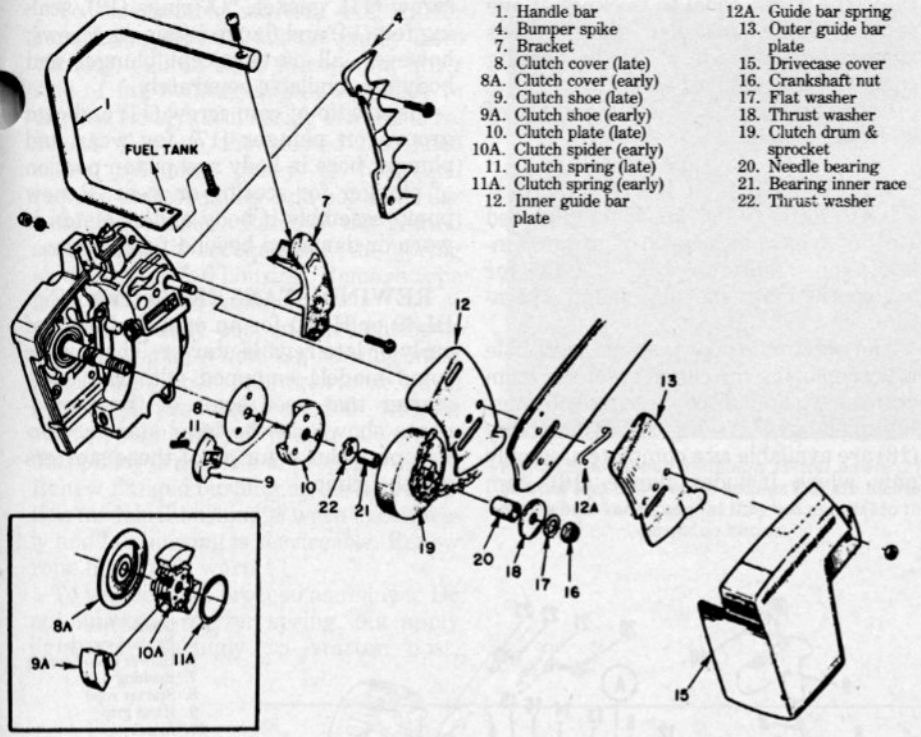


Fig. HL41—When installing reed valve on air box (models with flat reed intake valve only), be sure reed is centered between the two points indicated by arrows.



1. Handle bar
4. Bumper spike
7. Bracket
8. Clutch cover (late)
8A. Clutch cover (early)
9. Clutch shoe (late)
9A. Clutch shoe (early)
10. Clutch plate (late)
10A. Clutch spider (early)
11. Clutch spring (late)
11A. Clutch spring (early)
12. Inner guide bar plate
12A. Guide bar spring
13. Outer guide bar plate
15. Drivecase cover
16. Crankshaft nut
17. Flat washer
18. Thrust washer
19. Clutch drum & sprocket
20. Needle bearing
21. Bearing inner race
22. Thrust washer

Fig. HL42—Exploded view of typical direct drive clutch assembly. 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.

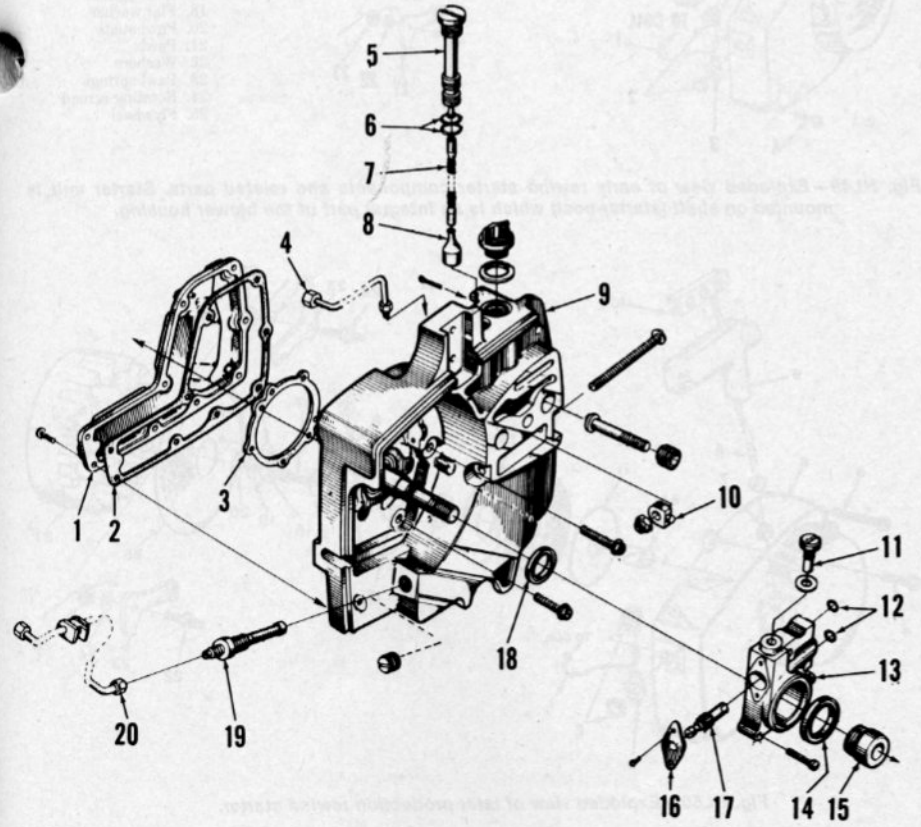


Fig. HL43—Exploded view of automatic chain oil pump on models so equipped.

1. Oil reservoir cover
2. Gasket
3. Gasket
4. Oil line
5. Oil line tube
6. "O" rings
7. Oil line
8. Oil filter
9. Drivecase
10. Bar adjusting pin
11. Cam screw
12. "O" rings
13. Pump body
14. Felt seal
15. Worm gear
16. Flange
17. Plunger
18. Crankshaft seal

stalled in new crankcase; install dowel pins so they protrude 0.165-0.180 inch from crankcase.

PYRAMID REED VALVE. All models 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 seal 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 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 and 9).

CLUTCH. Refer to Fig. HL42 for exploded view of typical clutch assembly. 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 spots or is damaged, or if worn to extent that any two rollers can be separated the width equal to thicknes 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.

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 (17 – Fig. HL43) and body (13) are available as a complete assembly only which includes flange (16), cam screw (11), gasket, "O" rings (12), sealing felt (14) and flange retaining screws; however, all parts except plunger and body are available separately.

Inspect tip of cam screw (11) and cam groove on plunger (17) 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. Refer to Fig. HL49 or HL50 for an exploded view of early or late rewind starter. 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.

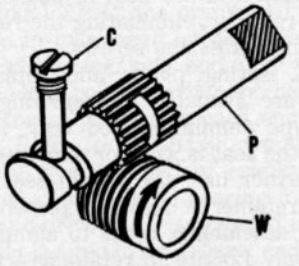


Fig. HL44 – Automatic oil pump worm gear (W) driven by crankshaft turns plunger (P) at 1/20 engine speed. As plunger turns, cam on end of plunger engages cam screw (C) causing the plunger to go back and forth. Flat end of plunger acts as inlet and outlet valve.

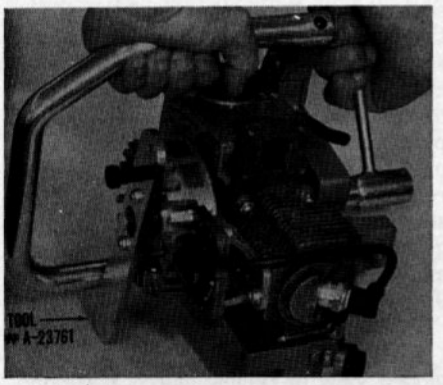


Fig. HL45 – Using Homelite tool No. A-23761 to keep crankshaft from turning while removing clutch retaining nut and clutch rotor. Homelite tool No. A-23696 is used to remove or install clutch rotor.

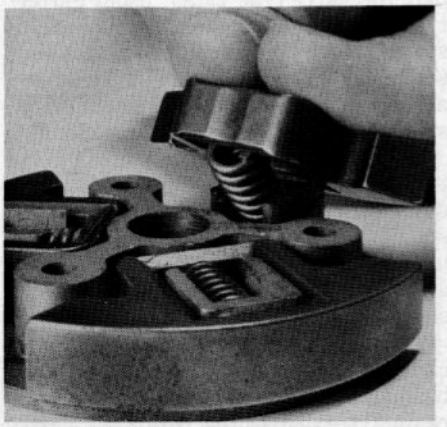
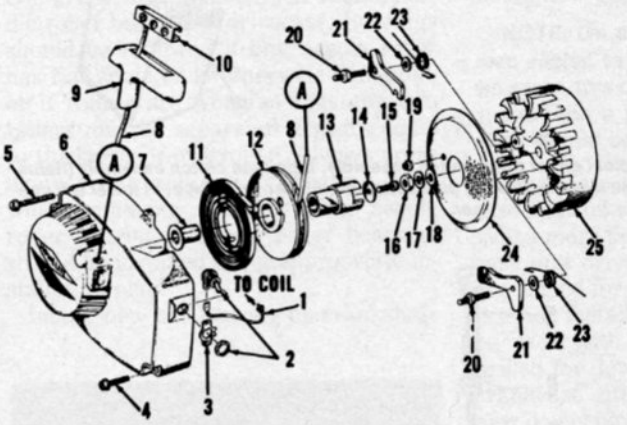


Fig. HL47 – View showing easy method for installing late type clutch shoes and springs on clutch plate.



1. Ground wire
2. Ignition switch
6. Blower (fan) housing
7. Bushing
8. Starter rope
9. Hand grip
10. Insert
11. Rewind spring
12. Rope pulley
13. Starter cup
14. Washer
15. Socket head screw
16. Flywheel nut
17. Lock washer
18. Flat washer
20. Pawl studs
21. Pawls
22. Washers
23. Pawl springs
24. Rotating screen
25. Flywheel

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.

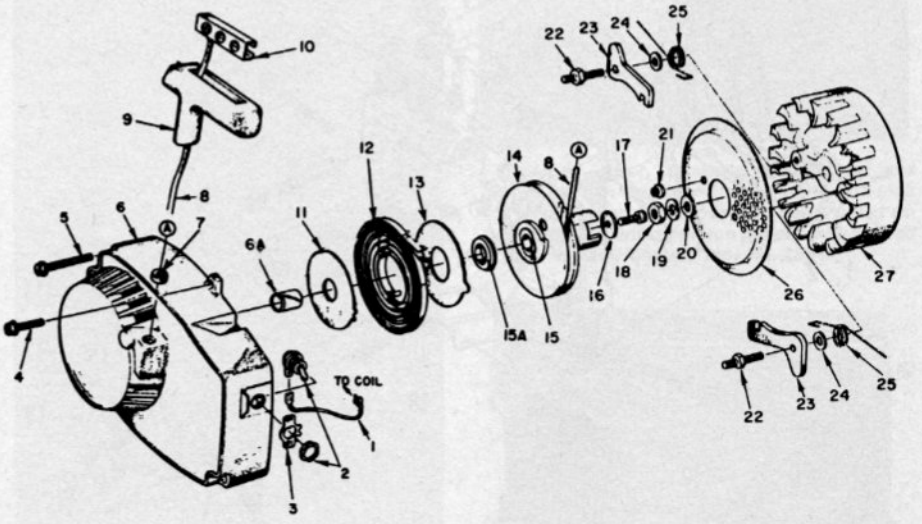


Fig. HL50 – Exploded view of later production rewind starter.

1. Ground lead
2. "ON-OFF" switch
3. Switch plate
6. Fan housing
6A. Bushing
7. Rope bushing
8. Starter rope
9. Starter handle
10. Insert
11. Inner spring shield
12. Rewind spring
13. Outer spring shield
14. Starter pulley
15. Spring lock
15A. Spring lock bushing
16. Retaining washer
17. Hex head screw
18. Crankshaft nut
19. Lock washer
20. Flat washer
21. Screen retaining nuts
22. Pawl studs
23. Starter pawls
24. Washers
25. Pawl springs
26. Air screen
27. Rotor (flywheel)

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 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.

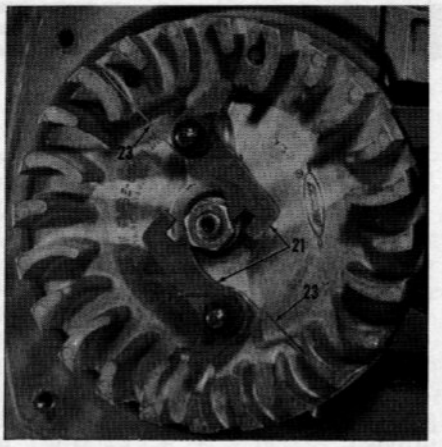


Fig. HL50A — When installing starter pawls (21), be sure that pawl return springs (23) are located in flywheel vanes so that they are parallel to the pawls as shown.

HOMELITE

Chain Saw Model	Design Features
C-52	A,F,K,M,Q
C-72	B,F,K,M,Q
S1050 Automatic	D,G,K.L.R
S1130G	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.
D – Displacement, 6.1 cu. in.; bore, 2 3/16 in.; stroke, 1⅝ 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.
K – Conventional flywheel type magneto.
L – Direct drive.
M – Direct drive, convertible to planetary gear drive.
O – Three gear transmission with optional ratios of 2:1 and 3:1.
Q – Manual chain oiler.
R – Automatic and manual chain oiler.

MAINTENANCE

SPARK PLUG. Recommended Champion spark plug is as follows:

Saw Model	Plug Type
C-52, C-72	J-6J
S1050 Auto	CJ-6
S1130 G	CJ-6
2000 Series	UCJ-7G
2100	UCJ-7G
2100S, 3100G	CJ-6

Recommended spark plug electrode gap is 0.025.

CARBURETOR. A Tillotson HL diaphragm carburetor is used on all models except the S1050 and S1130G which may be equipped with a Tillotson HL or Walbro SDC carburetor. Refer to Tillotson or Walbro section of CARBURETOR SERVICE section for carburetor overhaul and exploded views.

Initial carburetor adjustment for C-52 and C-72 saws is ½-¾ 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 (later S1050 Auto models are not equipped with high speed mixture screw). Note that on early model

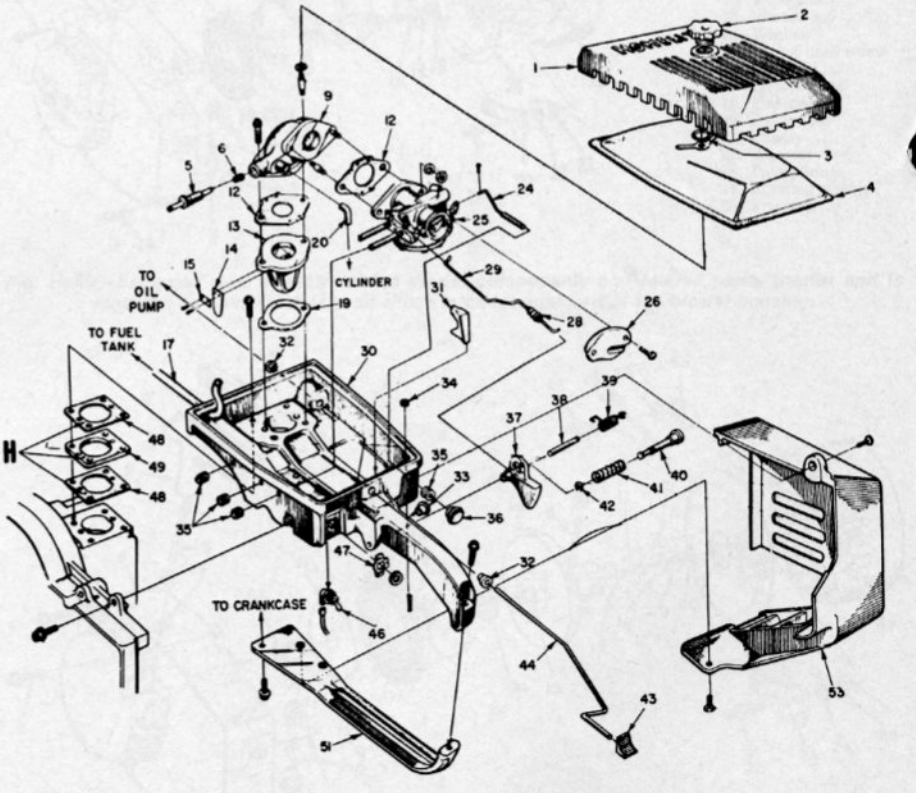


Fig. HL53 – Exploded view of air box assembly for S1050 Auto and S1130G. Note idler air (speed) adjusting screw (5) in elbow (intake manifold) (9). Tube (20) is connected between intake manifold and cylinder transfer port. Align holes (H) in gaskets (48) and spacer (49) with holes in air box and crankcase as shown. Air filter element (4) has integral air box sealing gasket.

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

S1050 Automatic and S1130G saws, idle speed is adjusted by turning air screw (5–Fig. HL53) in intake manifold. Turning screw clockwise will increase idle speed while turning screw counterclockwise will decrease idle speed. Initial setting is ⅜ turn open. Make final adjustments with engine at running temperature. Adjust high speed screw, on models so equipped, to obtain optimum performance with engine under cutting load.

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 is 0.015 inch for all models.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

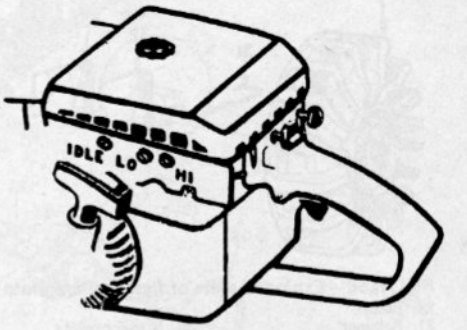


Fig. HL55—View showing carburetor adjustment points for early model S1050 Automatic and S1130G. Refer to exploded view in Fig. HL53 for view showing idle adjusting screw (5), spring (6), and intake manifold (9).

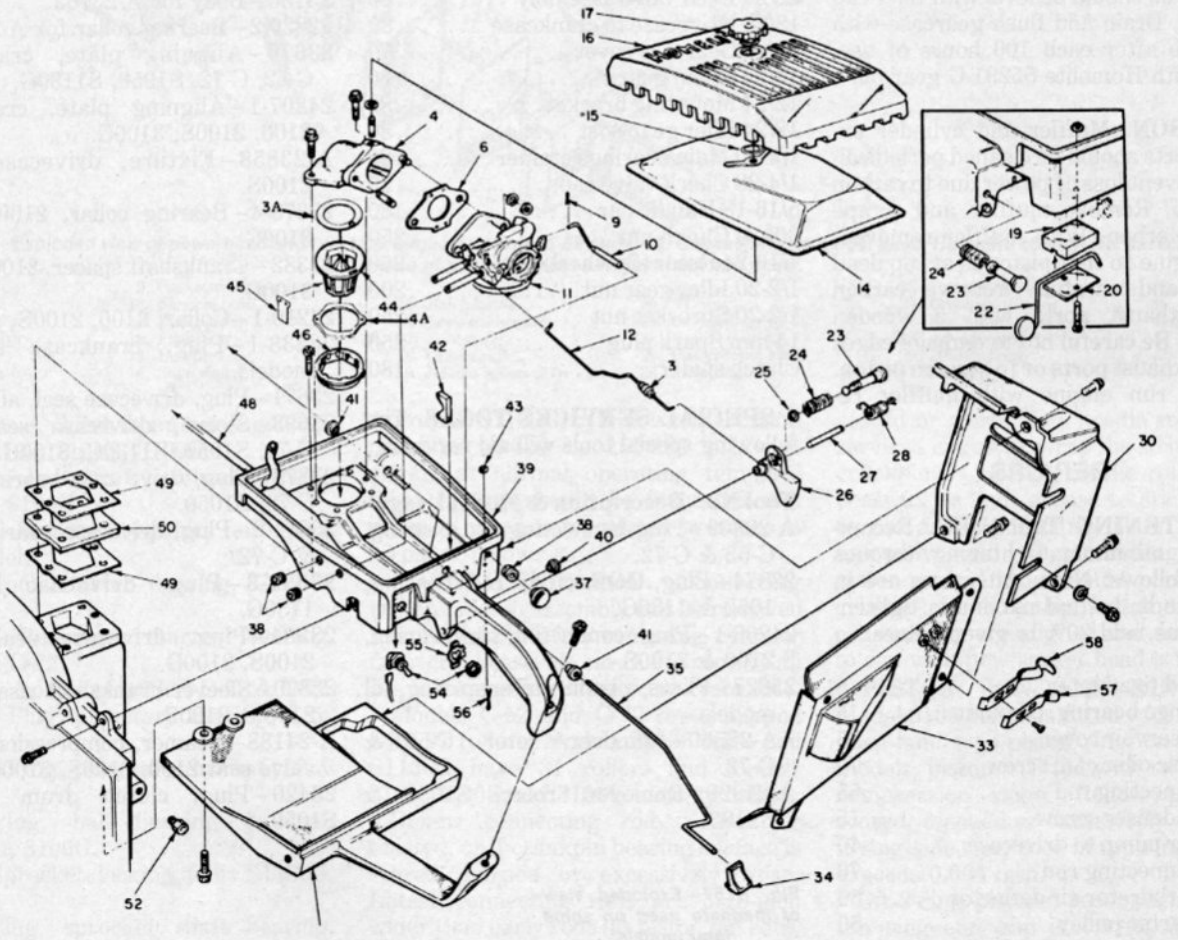


Fig. HL54—Exploded view of typical air box and throttle assembly used on Models 2100, 2100S and 3100G. Compression release and throttle lock mechanism is shown in inset at upper right. Early models did not use gaskets (3A and 4A); do not install gaskets on early models unless a new intake manifold is also installed.

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

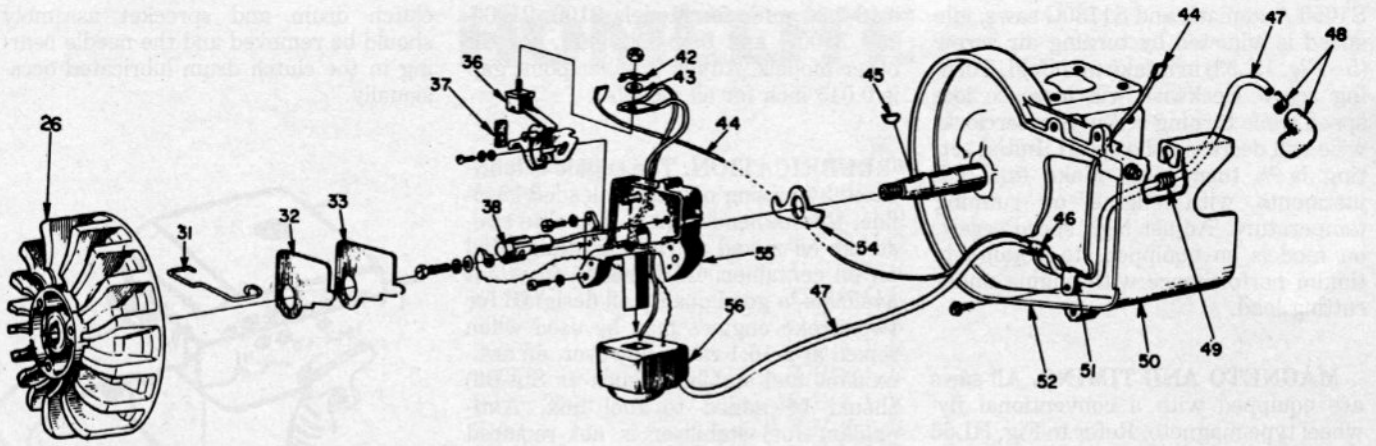


Fig. HL56 – Exploded view of flywheel magneto assembly used on some models. Refer to Fig. HL57 for magneto which is also used on some models.

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

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 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 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 Connecting rod 55
8/32 Condenser screw 15
8/32 Oiler pump to drivecase 40
10/32 Connecting rod 70
10/32 Carburetor air deflector 50
10/32 Starter pulley 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
14 mm Spark plug 250
Clutch spider 180

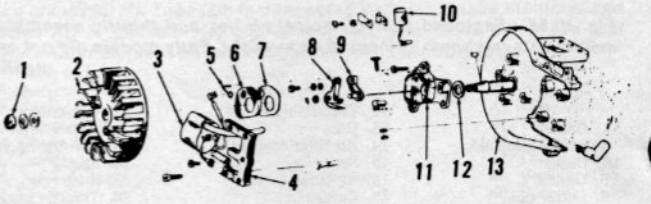
SPECIAL SERVICES TOOLS. The following special tools will aid servicing.

Tool No. Description & Model Usage

A-23809 – Plug connecting rod bearing, C-52 & C-72.
23874 – Plug, connecting rod bearing, 1050 & 1130G.
24206-1 – Plug, connecting rod bearing, 2100 & 2100S.
22828 – Pliers, piston pin snap ring, all models.
AA-22560 – Remover, rotor, C-52 & C-72.
A-24028 – Remover, rotor, S1050 & S1130G.
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-52, C-72, S1050, S1130G.
24207-1 – Aligning plate, crankshaft, 2100, 2100S, 3100G.
A-23858 – Fixture, drivecase, 2100, 2100S.
23373-4 – Bearing collar, 2100, 2100S, 3100G.
23382 – Crankshaft spacer, 2100, 2100S, 3100G.
24210-1 – Collar, 2100, 2100S.
23233-1 – Plug, crankcase seal, all models.
23671 – Plug, drivecase seal, all models.
23693 – Sleeve, drivecase seal, C-52, C-72, S1050, S1130G, 3100G.
23876 – Plug, drive case bearing, C-52, C-72, S1050.
23391-2 – Plug, drivecase bearing, C-52 & C-72.
23391-3 – Plug, drivecase bearing, 1130G.
23384 – Plug, drivecase seal, 2100, 2100S, 3100G.
23390 – Sleeve, crankshaft assembling, 2100 & 2100S.
A-24138 – Reamer, compression release valve seat 2100, 2100S, 3100G.
23420 – Plug, clutch drum bearing, S1050.

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



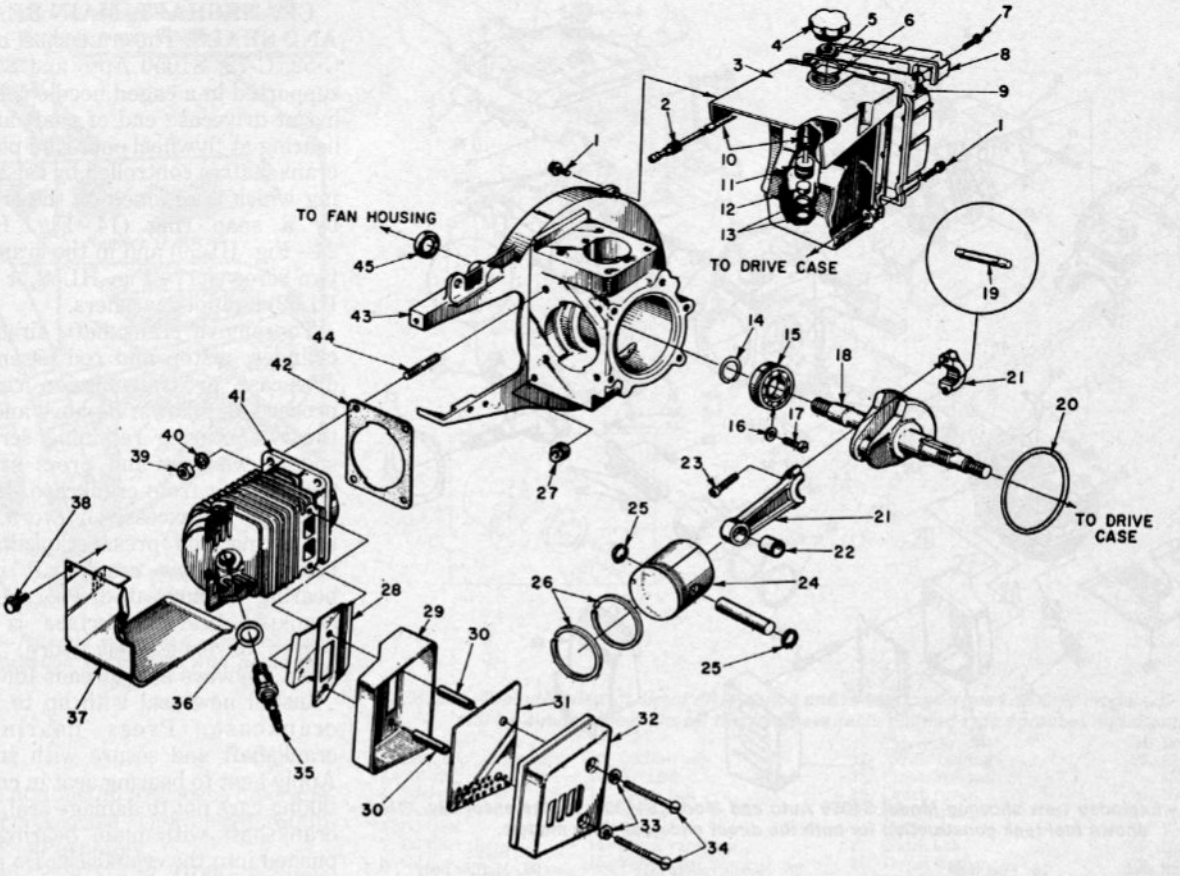


Fig. HL58 – Exploded view of powerhead and fuel tank similar to Model C-52 and C-72. Gasket (9) is no longer used. Homelite cement No. 22788 is used in place of gasket to seal between tank and cover.

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

23139 – Plug, clutch drum bearing, C-52, C-72, 2100, 2100S, 3100G.

A-23137 – Jackscrew, clutch, 2100, 2100S, 3100G.

A-23696 – Remover, spider, sun gear, all models.

23678 – Tool, starter bearing, C-52 & C-72.

A-23679 – Remover, starter bearing, C-52 & C-72.

A-23713 – Sprocket holder, C-52 & C-72.

23725A – Plug, planetary bearing, C-52 & C-72.

23726A – Plug, planetary drum, C-52 & C-72.

23913 – Plug, ball bearing & seal, S1130G, 3100G.

22750 – Sprocket locking tool, S1130G, 3100G.

23228 – Plug, sprocket shaft bearing, S1130G, 3100G.

23528 – Wrench, conn. rod screw, S1050, S1130G, 2100S, 2100, 3100G.

A-23960 – Puller, magneto, 2100, 2100S, 3100G.

24397-1 – Plug, conn. rod bearing, 3100G.

COMPRESSION PRESSURE. For optimum performance of Models S1050 Auto and S1130G, cylinder compression pressure should be 155-185 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CONNECTING ROD. Connecting rod and piston assembly can be removed from crankpin after removing cylinder from crankcase. Be careful to remove all the loose needle rollers from crankcase.

Models C-52 and C-72 are equipped with 27 rollers, Models S1050 Auto and S1130G have 31 rollers 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 pin 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 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 inch.

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

Several different methods of retaining piston pin have been used; pin may be retained by two Waldes Truarc snap rings,

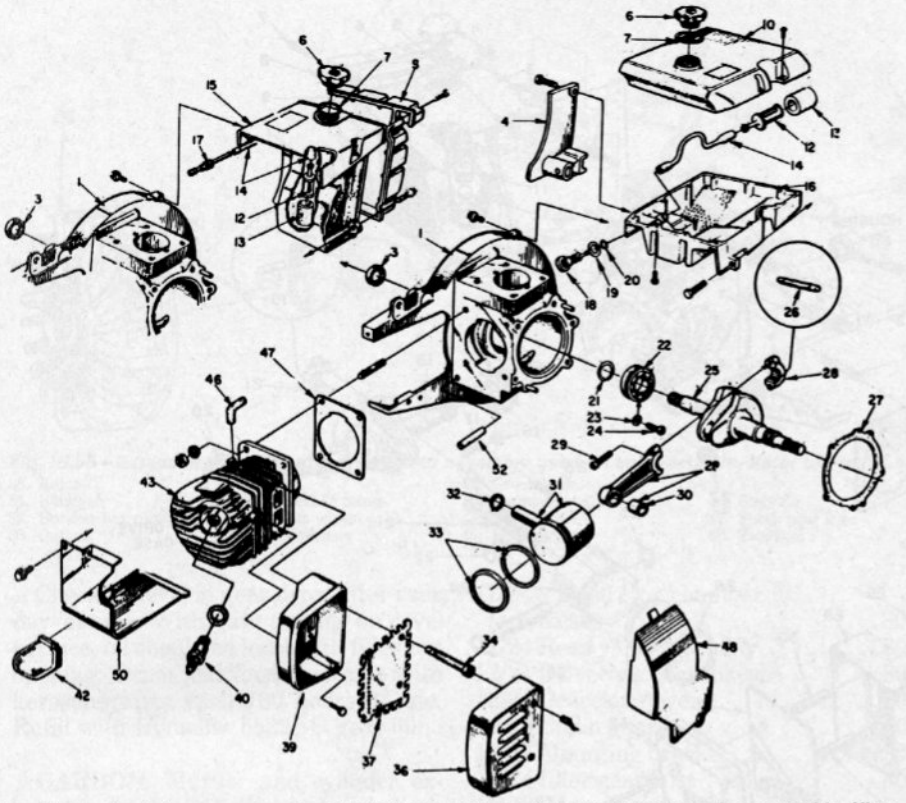


Fig. HL59—Exploded view showing Model S1050 Auto and Model S1130G engine assembly. View shows fuel tank construction for both the direct and gear drive models.

1. Crankcase
3. Crankshaft seal
4. Handle brace
6. Filler cap
7. "O" ring
9. Tank cover
10. Tank cover
12. Fuel pickup
13. Filter
14. Flex hose
15. Fuel tank
16. Fuel tank
17. Fitting
18. Fitting
19. Gasket
20. "O" ring
21. Snap ring
22. Ball bearing
23. Lock washers (2)
24. Screws (2)
25. Crankshaft
26. Needle rollers (31)
27. Gasket
28. Connecting rod
29. Screws
30. Needle bearing
31. Piston & pin
32. Snap ring
33. Piston rings
34. Muffler studs
36. Muffler cap
37. Baffle
39. Muffler body
40. Spark plug
42. Spark plug cap
43. Cylinder
46. Idle tube (20—Fig. HL53)
47. Gasket
48. Heat exchanger (optional)
50. Cylinder shield

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. 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. The crankshaft of Models C-52, C-72, S1050 Auto and S1130G 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 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 drive case 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 in drivecase, if necessary, by removing seal (18—Fig. HL62 or 1—Fig. HL64) and pressing bearing 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

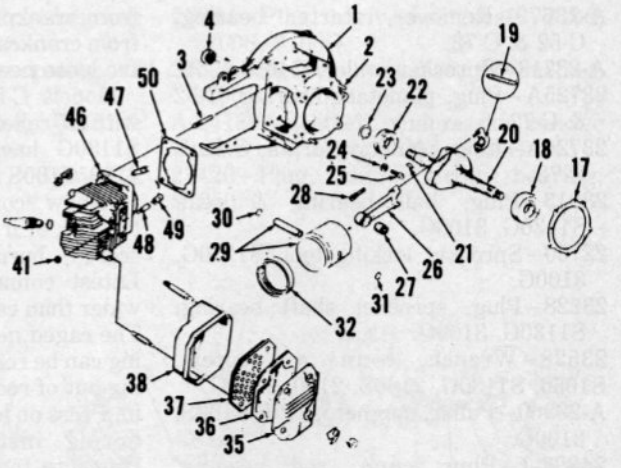


Fig. HL60—Exploded view of powerhead used on Model 2100. Models 2100S and 3100G are similar. Some models use two conventional piston rings instead of head land type ring shown. Be sure piston rings are of same type.

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. Piston & pin
30. Snap ring
31. Snap ring
32. Head land ring
35. Muffler cover
36. Spark arrester
37. Muffler baffle
38. Muffler body
41. Self-locking nut
46. Cylinder
47. Compression release valve
48. Spring post
49. Spring
50. Cylinder gasket

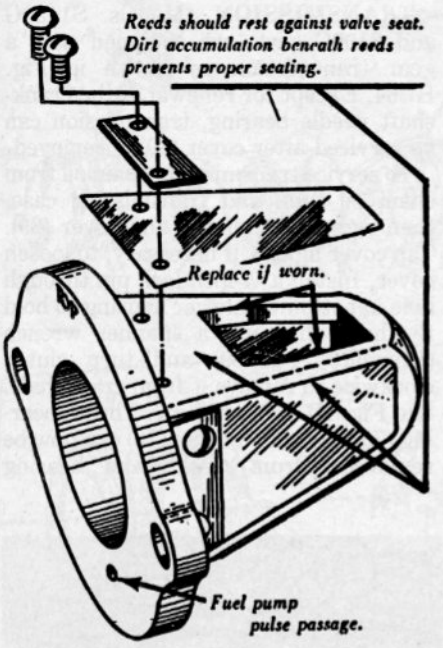


Fig. HL61—Pyramid type reed valve, showing proper installation for models with metal reed seat.

shoulder; and install drivecase on crankshaft and crankcase. Tighten the retaining screws alternately.

On 2100, 2100S and 3100G engines, both ends of crankshaft are supported in ball bearings. Ball bearing (22—Fig. HL60) at magneto side is retained in crankcase 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. (Models C-52, C-72, S2050 Auto and S1130G) The reed inlet valve on Models C-52 and C-72 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 Models S1050 Auto and S1130G. 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 and HL53.

Reed lift distance on Models C-52 and C-72 should be 0.172-0.177 inch. The pyramid structure reeds on other models have no reed stops.

REED VALVE. (Models 2100, 2100S and 3100G) A Delrin plastic pyramid reed seat (44—Fig. HL54) with six inlet

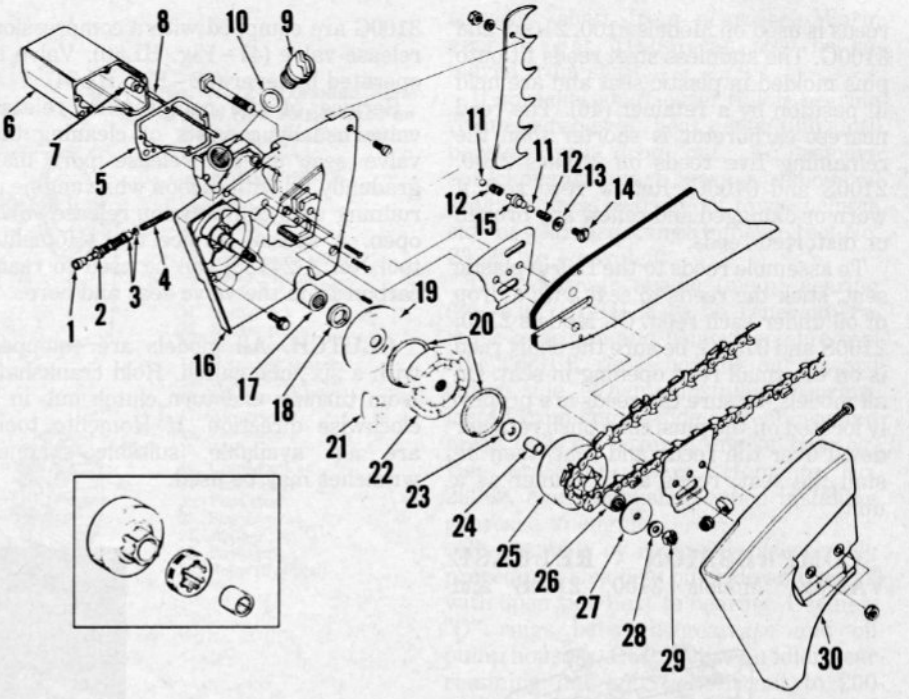


Fig. HL62—Exploded view of direct drive clutch and related parts used on C-72 models. C-52 models will be similar. Inset shows the other available splined type sprocket and drum.

1. Connector
2. Oil pump plunger
3. "O" ring
4. Spring
5. Gasket
6. Oil tank
7. Oil filter
8. Oil line
9. Oil filler cap
10. "O" ring
11. Check ball
12. Spring
13. Gasket
14. Check valve cap
15. Valve seat
16. Drivecase
17. Needle bearing
18. Crankshaft seal
19. Clutch cover
20. Clutch springs
21. Clutch shoe
22. Clutch hub
23. Thrust washer
24. Bearing race
25. Clutch drum & sprocket assy.
26. Needle bearing
27. Thrust washer
28. Washer
29. Nut
30. Cover

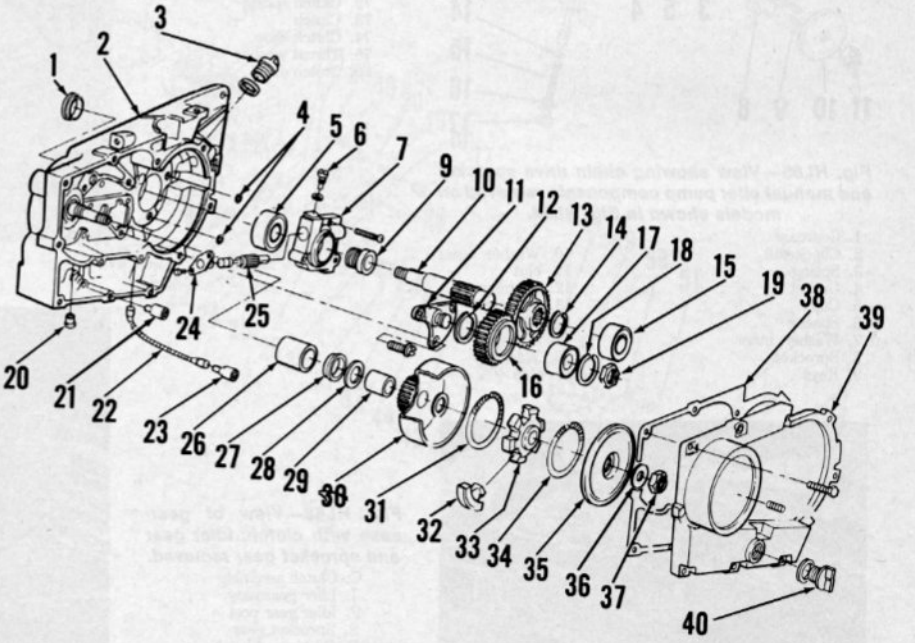


Fig. HL64—Exploded view of gear drive assembly used on Models S1130G and 3100G. Refer to Fig. HL65 for view of opposite side of gearcase and chain drive sprocket. Ratios of 2:1 and 3:1 can be obtained by changing gear (13) and repositioning idler gear assembly to accommodate the different gear diameter. The 2:1 ratio gear has 42 teeth and the 3:1 ratio gear has 64 teeth.

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

reeds is used on Models 2100, 2100S and 3100G. 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 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 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. Models 2100, 2100S and 3100G are equipped with a compression 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 six-shoe clutch. Hold crankshaft from turning and turn clutch hub in a clockwise direction. If Homelite tools are not available, suitable spanner wrenches may be used.

TRANSMISSION. Models S1130G and 3100G saws are equipped with a gear transmission as shown in Fig. HL64. Except for renewal of the crankshaft needle bearing, transmission can be serviced after cover (39) is removed.

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 ¼-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 and bearing

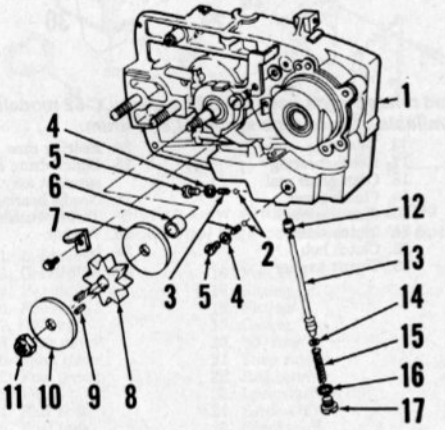


Fig. HL65—View showing chain drive sprocket and manual oiler pump components removed on models shown in Fig. HL64.

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

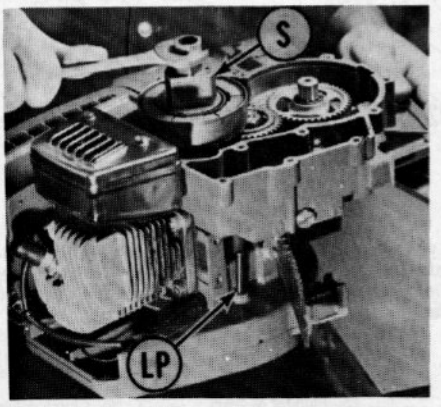


Fig. HL66—When removing clutch spider, use lock pin (LP) inserted as shown and turn clutch spider clockwise using a spanner wrench (S). Homelite number for spanner is A-23969.

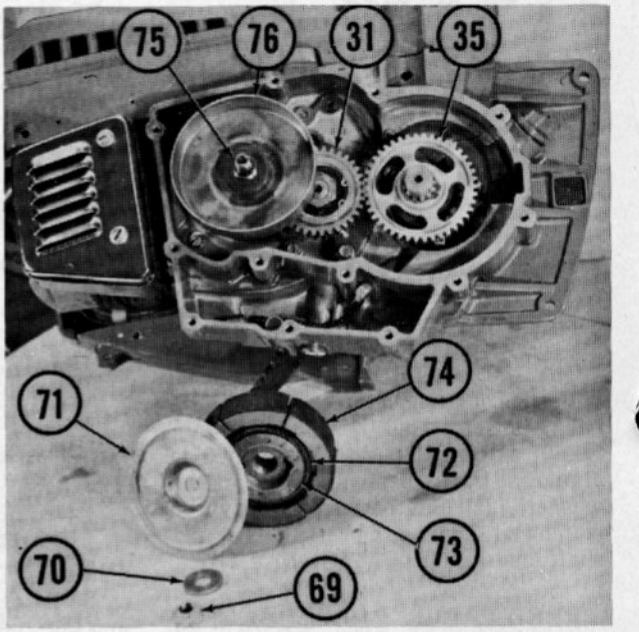


Fig. HL67—View of transmission with cover off and clutch assembly removed.

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

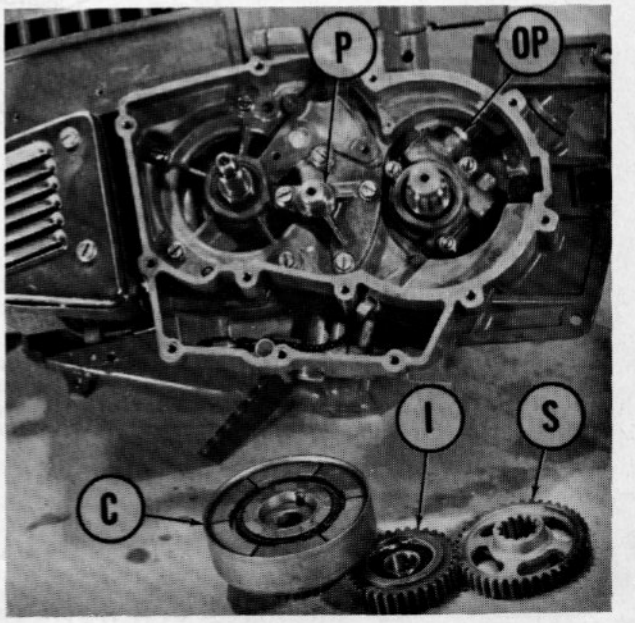


Fig. HL68—View of gearcase with clutch, idler gear and sprocket gear removed.

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

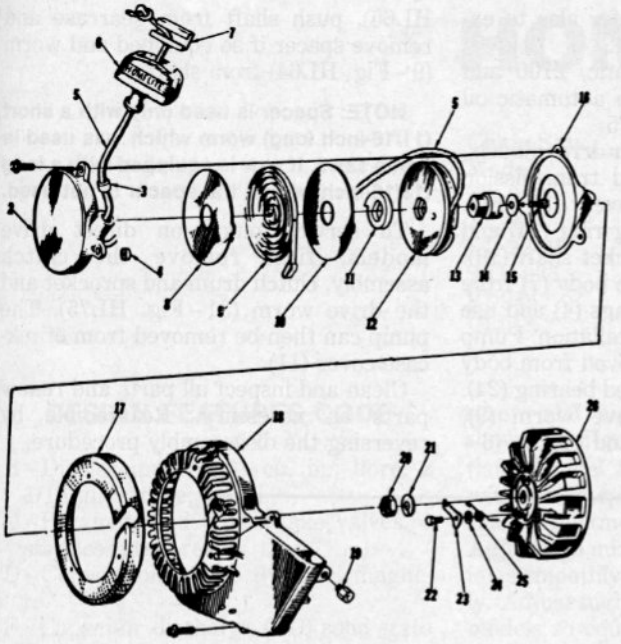


Fig. HL72—Exploded view of pawl type starter used on models outlined in text.

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)

(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 (18). 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 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. Worm gear (9–Fig. HL64) can now be removed from shaft.

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.

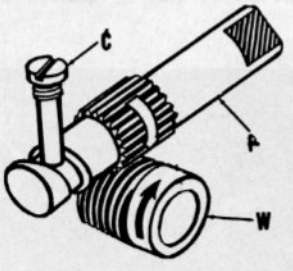


Fig. HL74—View showing operation of automatic chain oiler pump. Worm (W) mounted on crankshaft or sprocket shaft turns the plunger (P). As the plunger turns, it is moved back and forth by the cam groove cut in plunger riding on the cam screw (C). Flat on piston end of plunger acts as inlet and outlet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

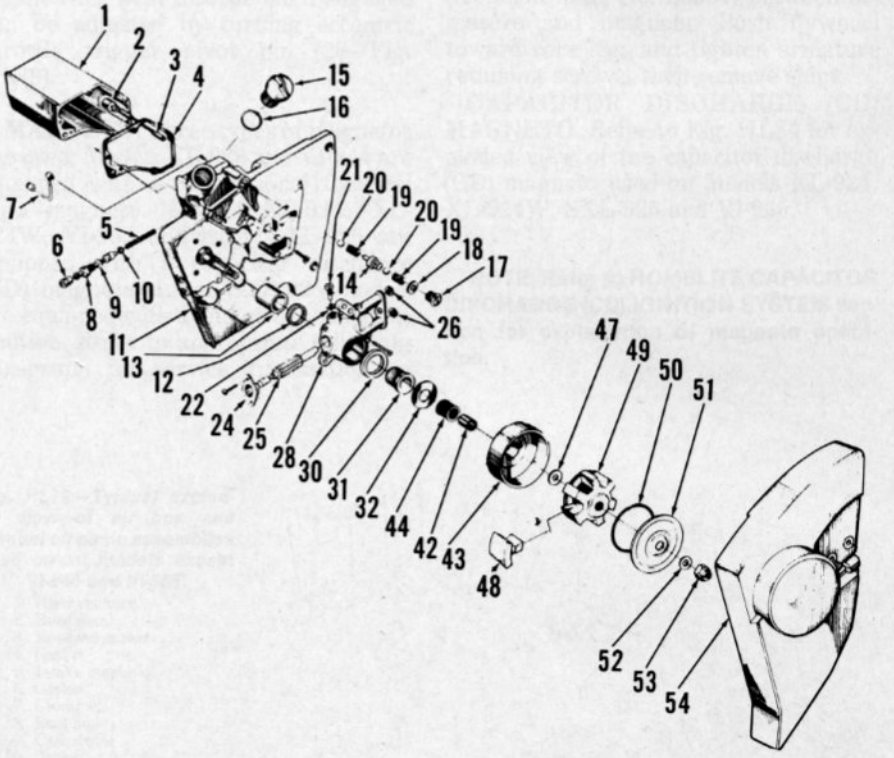


Fig. HL75—Exploded view of Model 1050 Automatic chain oiler pump and related parts; other models are similar except for ball bearing main instead of needle bearing. Refer to Fig. HL74 for view showing pump operation.

1. Oil reservoir
2. Oil pickup
3. Flexible tube
4. Gasket
5. Spring
6. Connector
7. Oil line
8. Plunger (manual)
9. "O" ring
10. "O" ring
11. Drivecase
12. Seal
13. Needle bearing
14. Valve seat
15. Filler cap
16. Gasket
17. Check valve cap
18. Gasket
19. Spring
20. Check ball
21. Cam screw
22. Gasket
24. Flange bearing
25. Plunger & gear
26. "O" rings
28. Pump housing
30. Felt seal
31. Worm gear
32. Thrust washer
42. Inner race
43. Sprocket & drum
44. Needle bearing
47. Thrust washer
48. Clutch shoes
49. Clutch hub
50. Clutch springs
51. Clutch cover
52. Washer
53. Nut
54. Drivecase cover

REWIND STARTER. All models except Model C-52 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. If Model C-52 starter renewal is required, a starter from a later model saw covered in this section must be installed.

AUTOMATIC CHAIN OILER. Gear drive Models S1130G 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 S1050 Automatic, 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 (9), remove chain sprocket and spacer (6–HL65), push shaft from gearcase and remove spacer if so equipped and worm (9–Fig. HL64) from shaft.

NOTE: Spacer 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.

HOMELITE

Chain Saw Model	Design Features
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

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.
F – Capacitor discharge (CD) solid state magneto.
G – Decompression valve (Simplex starting).
H – Direct drive.
J – Manual chain oiler only.
L – Automatic and manual chain oiler.

MAINTENANCE

SPARK PLUG. Models so equipped with a solid-state, one-piece ignition module (above lot number C246) use a Champion DJ6Y spark plug. Early models (below lot number C246) use Champion CJ6, or Champion UJ11G for heavy duty operation. It will be necessary to pull the plug wire further out of the retaining clip in the air box when using UJ11G spark plug. Set electrode gap to 0.025 inch on all models.

CARBURETOR. All models are equipped with a Tillotson Model HS diaphragm carburetor. Refer to Tillotson section of CARBURETOR SERVICE 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 (later Model SXL-925 is not equipped with a high speed mixture screw). Make final adjustments with engine warm. Adjust idle mixture screw so that engine idles smoothly and will accelerate cleanly. Adjust high speed mixture screw, on models so equipped, 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 (28 – Fig. HL79).

MAGNETO. Three types of magnetos are used. Models XL-923 and VI-944 are equipped with a conventional flywheel type magneto. Models XL-924, XL-924W, VI-955 and early SXL-925 are equipped with a capacitor discharge (CD) magneto. Later SXL-925 models are equipped with a one-piece solid-state ignition. 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. Breaker points and condenser are accessible after removing starter housing, flywheel and breaker box cover. Adjust breaker point gap to 0.015 inch. Condenser capacity should test 0.18-0.22 mfd. After reinstalling flywheel, check armature air gap which should be 0.005-0.007 inch. 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.

CAPACITOR DISCHARGE (CD) MAGNETO. Refer to Fig. HL84 for exploded view of the capacitor discharge (CD) magneto used on Models XL-924, XL-924W, SXL-925 and VI-955.

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

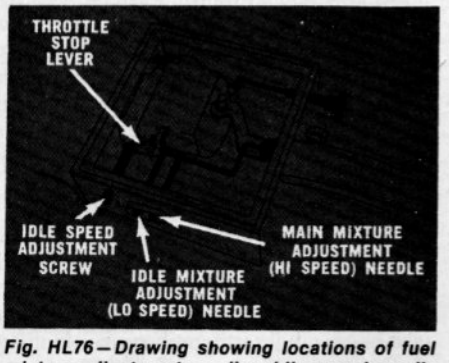


Fig. HL76 – Drawing showing locations of fuel mixture adjustment needles, idle speed needle and throttle stop lever.

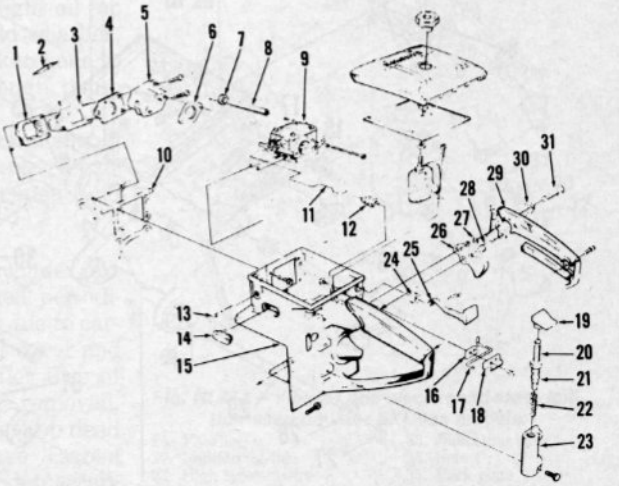


Fig. HL79 – Typical exploded view of air box and manual oil pump assemblies used on all models except VI-944 and VI-955.

1. Reed retainer
2. Reed petal
3. Reed valve seat
4. Gasket
5. Intake manifold
6. Gasket
7. Grommet
8. Fuel line
9. Carburetor
10. Gasket
11. Throttle rod
12. Boot
13. Idle speed screw
14. Grommet
15. Air box
16. Plate
17. Compression release lever
18. Clamp
19. Manual oiler button
20. Oil pump plunger
21. "O" rings (2)
22. Spring
23. Oil pump body
24. Grommet
25. Choke rod
26. Throttle trigger
27. "E" ring
28. Eccentric pin
29. Handle cover
30. Spring
31. Throttle latch pin

The capacitor discharge magneto can be considered OK if spark will jump a 3/8-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 correct-

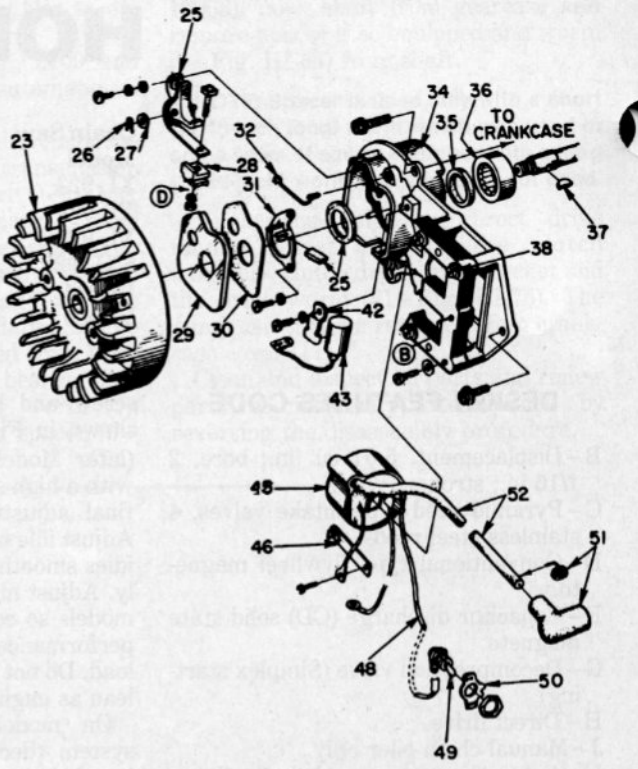


Fig. HL81—Exploded view of conventional flywheel type magneto. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D".

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

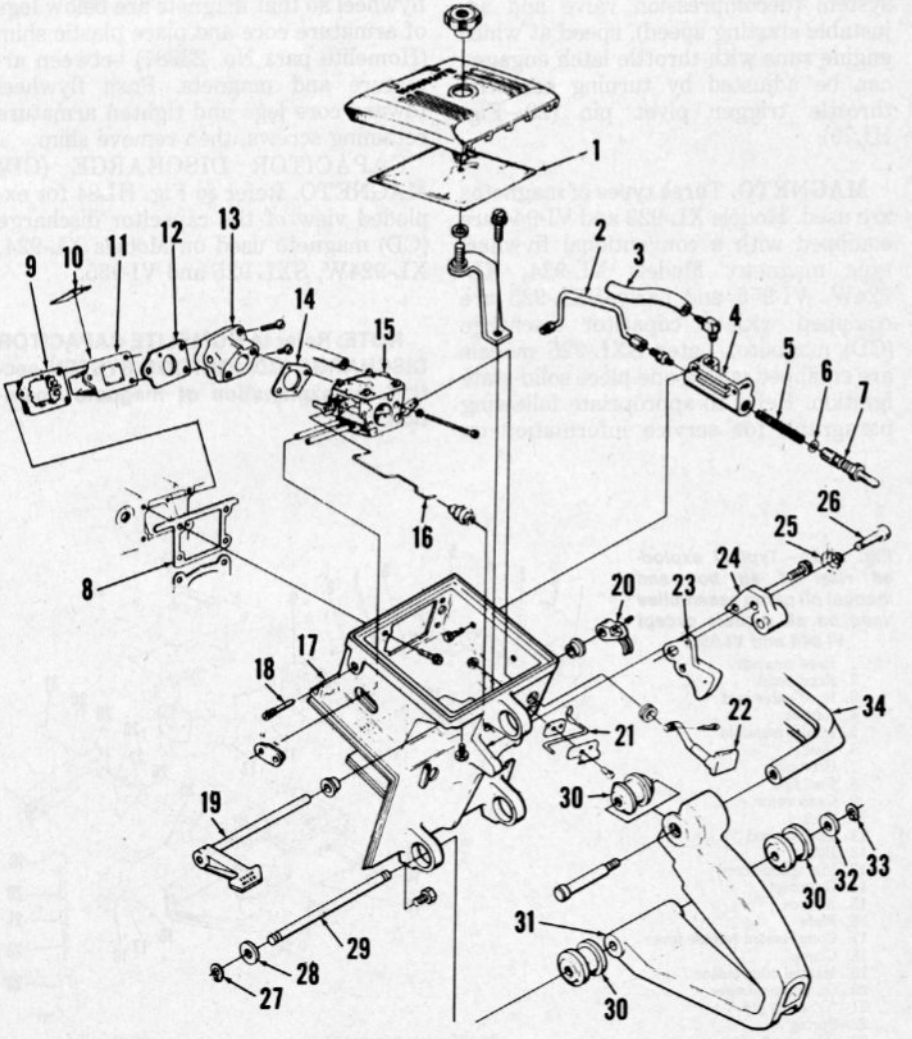


Fig. HL80—Exploded view of Models VI-944 and VI-955. Note vibration isolating bushings (30).

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

ly. 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. 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.

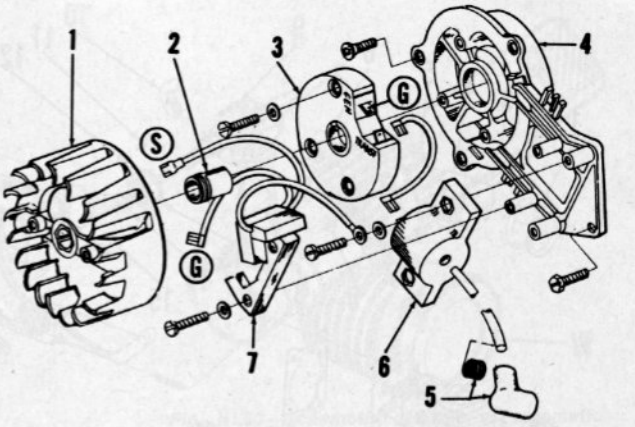


Fig. HL84—Exploded view of Phelon capacitor discharge type magneto used on Models XL-924, XL-924W, SXL-925 and VI-955.

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

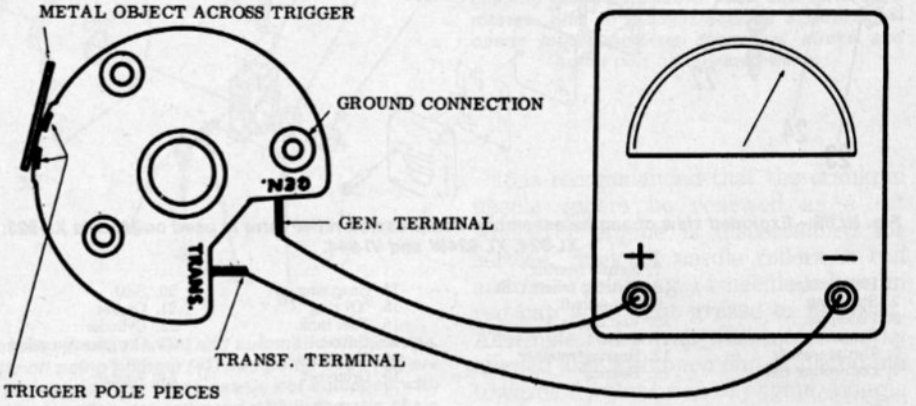


Fig. HL85—Drawing showing volt-ohmmeter connections to ignition module (3—Fig. HL84) for checking module. It should be noted that this is not a conclusive test and module should be renewed in event of spark failure when other magneto components test OK.

SOLID-STATE IGNITION. Later SXL-925 models are equipped with a one-piece solid-state ignition module (27—Fig. HL85A). The solid-state ignition system is serviced by renewing the spark plug or ignition module, however, be sure all wires are connected properly and the ignition switch functions correctly before renewing ignition module. Air gap between ignition module and flywheel is adjustable. Loosen module retaining screws and place a 0.015 inch shim between flywheel and module. Hold module against shim, tighten module retaining screws and remove shim.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 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.

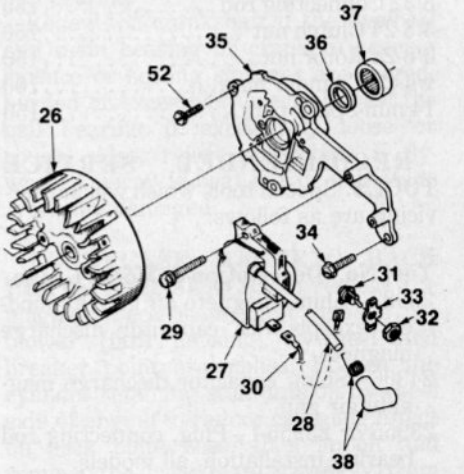


Fig. HL85A—View of one-piece solid-state ignition used on later SXL-925 models.

26. Flywheel
27. Ignition module
28. High tension wire
29. Sems screw
30. Ground lead
31. Ignition switch
32. Nut
33. Indicating plate
34. Screw
35. Back plate
36. Crankshaft seal
37. Roller bearing
38. Spark plug terminal
52. Screw

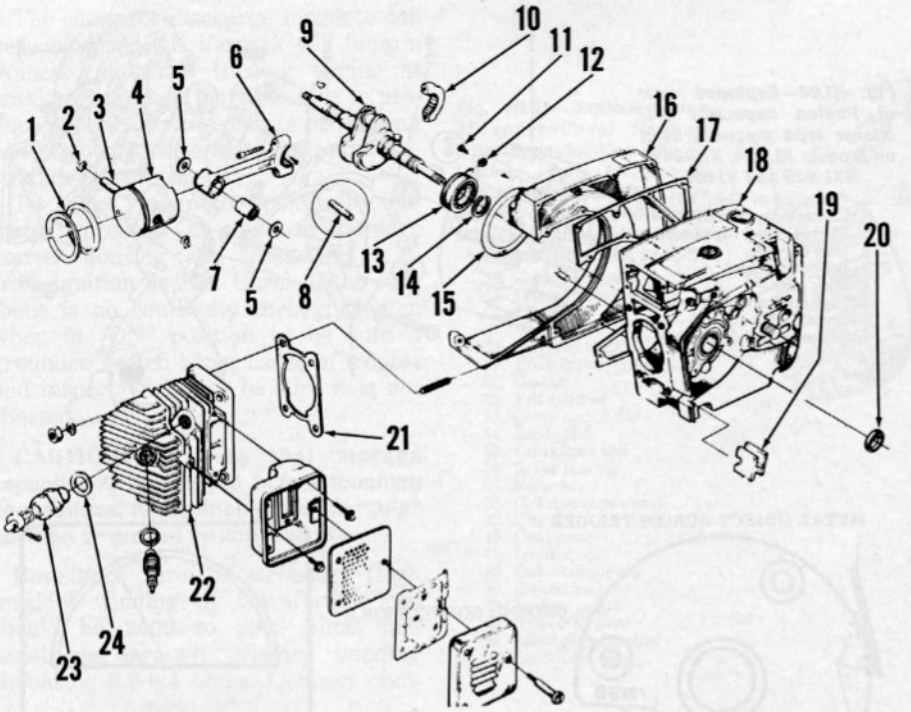


Fig. HL86—Exploded view of engine assembly. Compression relief valve is used on Models XL-923, XL-924, XL-924W and VI-944.

1. Piston rings
2. Snap ring
3. Piston pin
4. Piston
5. Thrust washer
6. Connecting rod
7. Needle bearing
8. Bearing rollers (28)
9. Crankshaft
10. Rod cap
11. Screw
12. Bearing retainer
13. Bearing
14. Snap ring
15. "O" ring
16. Fuel tank
17. Gasket
18. Crankcase
19. Grommet
20. Seal
21. Gasket
22. Cylinder
23. Compression relief valve
24. Washer

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values 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.

8/32 Connecting rod.....55
3/8-24 Clutch nut.....150
3/8-24 Rotor nut.....150
1/4-28 Cylinder nuts.....100
14 mm Spark plug.....150

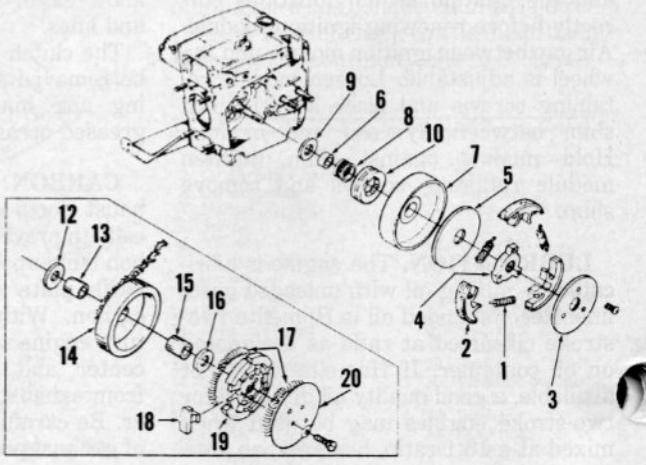
RECOMMENDED SERVICE TOOLS. Special tools which will aid servicing are as follows:

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-23965—Jackscrew, crankshaft and bearing.
23136-1—Jackscrew body.
22820-4—Collar, main bearing installation.
23971—Sleeve, crankcase seal protector.
23972—Sleeve, crankcase seal installation, all models.
23957—Plug, crankcase seal installation, all models.
A-23696-A—Wrench, clutch spider, all models with 6-shoe spring type clutch.
A-17146—Wrench, clutch plate, all models with 3-shoe type clutch.
A-23960—Puller, flywheel (magneto rotor), all models.
23420—Plug, sprocket bearing, all models.
23956—Plug, back plate bearing and seal, Model XL-923.
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.
23846-2—Anvil, back plate bearing, all models.
24006-1—Aligning plate, crankshaft installation, all models.
24304—"Pozidriv" screwdriver bit.
24230—"Pozidriv" hand screwdriver.
24982-01—"Torx" bit, ¼ in. shank.
24982-02—"Torx" bit, 5/16 in. shank.
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.

Fig. HL87—Models covered in this section may be equipped with clutch components (1 through 10) or clutch components (12 through 20).

1. Spring
2. Clutch shoe
3. Cover
4. Hub
5. Thrust washer
6. Inner race
7. Drum
8. Bearing
9. Thrust washer
10. Sprocket
12. Thrust washer
13. Inner race
14. Drum
15. Bearing
16. Thrust washer
17. Spring
18. Clutch shoe
19. Hub
20. Cover



COMPRESSION PRESSURE. For optimum performance of Model SXL-925, cylinder compression pressure should be 155-185 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

COMPRESSION RELIEF VALVE. Models 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. HL86. 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.

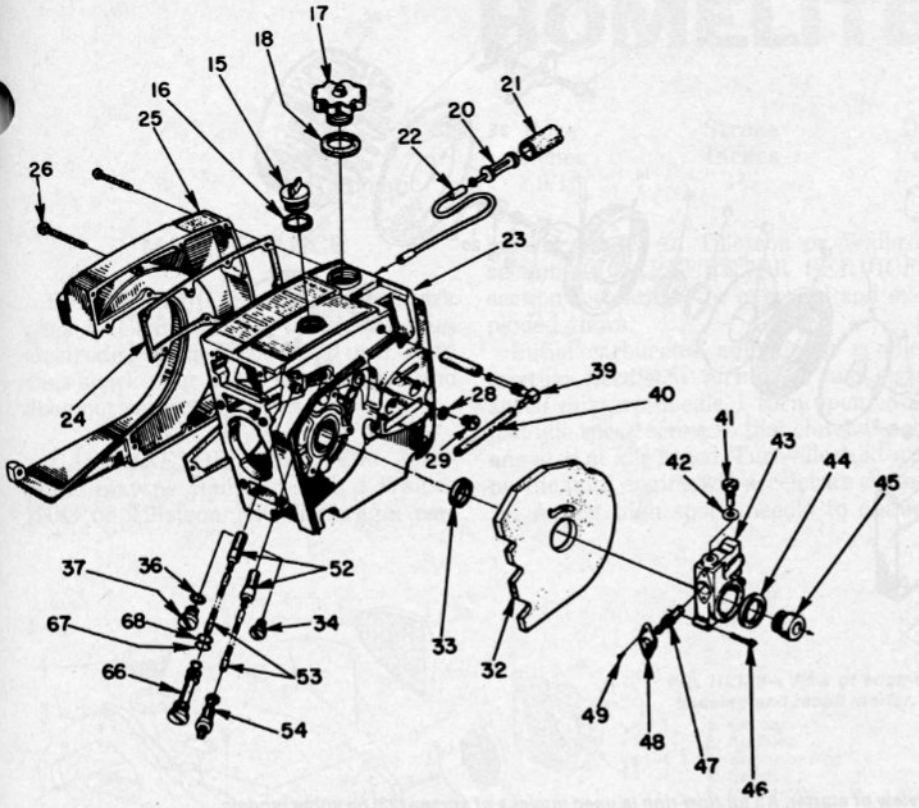


Fig. HL89—Exploded view showing automatic chain oiler pump, manual and automatic oil pick-ups, crankcase and oil reservoir and fuel tank. Automatic oil pump plunger (47) and pump body (43) are available as a matched set only. Plug (34) is used to seal opening when saw is not equipped with manual chain oiler; plug (37) and washer (36) are used on models not equipped with automatic chain oiler.

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
66. Oil line tube
67. Gasket
68. "O" ring

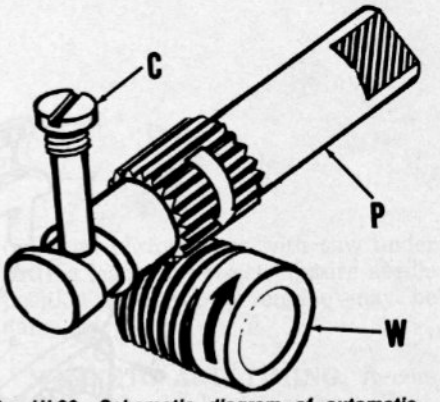


Fig. HL90—Schematic diagram of automatic chain oiler pump operation. Worm gear (W) on crankshaft drives (rotates) pump plunger (P). Cam cut in plunger rides against cam screw (C) causing plunger to move back and forth as it rotates. Flat on plunger acts as a valve as it opens intake port on downward stroke and outlet port on upward stroke.

Copper sealing washer is available separately.

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.

PISTON, PIN AND RINGS. All models are equipped with piston fitted with two pinned compression rings. Desired ring side clearance in groove is 0.002-0.003 inch; renew the piston if side clearance in top groove with new ring is 0.0035 inch or more. Recommended piston ring end gap is 0.070-0.080 inch; maximum allowable ring end gap is 0.085 inch. Piston, pin and rings are available in standard size only. Pin and piston are available as a fitted set only.

When installing piston pin, be sure closed end is towards exhaust side of piston (away from piston ring locating pin). Insert piston pin snap rings using special pliers; sharp edge of snap ring must be out and locate end gap towards closed end of piston.

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 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 auto-

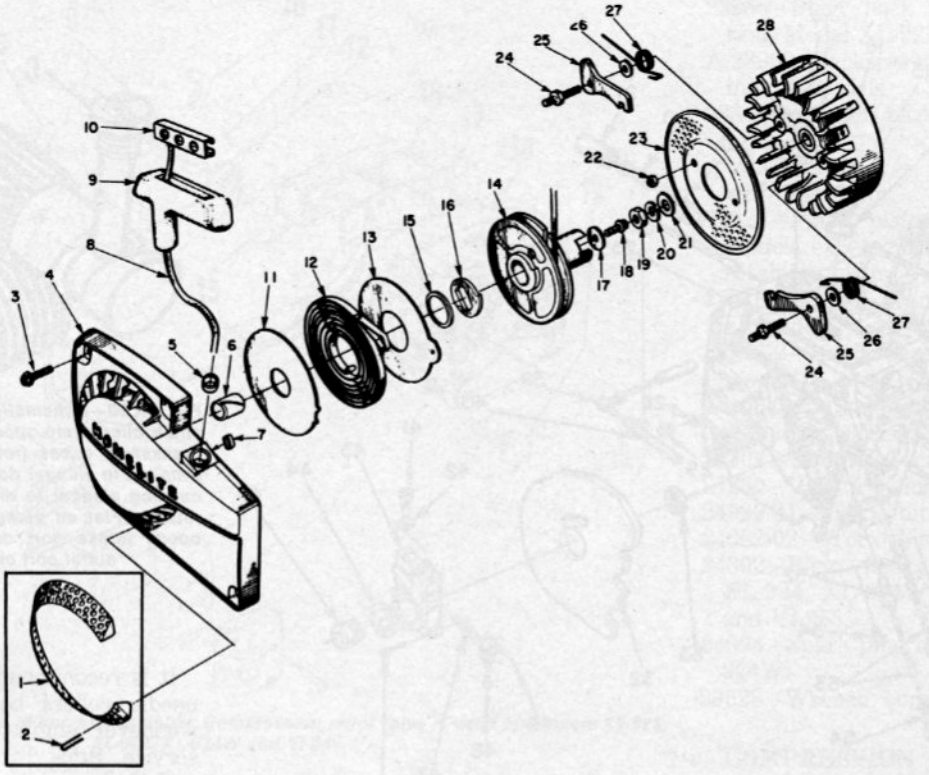


Fig. HL92 – Exploded view of starter. An air flow ring is used in place of screen (23) on some models.

1. Screen
2. Fastener clips
3. Hex head screws
4. Fan housing
5. Rope bushing
6. Starter post bushing
7. Rewind spring bushing
8. Starter rope
9. Handle
10. Rope retainer
11. Inner spring shield
12. Rewind spring
13. Outer spring shield
14. Starter pulley
15. Spring lock bushing
16. Spring lock
17. Retaining washer
18. Hex head screw
19. Flywheel (rotor) nut
20. Lock washer
21. Flat washer
22. Lock nuts
23. Rotating screen
24. Pawl studs
25. Starter pawls
26. Washers
27. Pawl springs
28. Flywheel (rotor)

matic chain oiler drive worm and pump from drive end of crankcase and shaft. Then, remove the two ball bearing retaining screws (11 – Fig. HL86) from inside of crankcase and remove the crankshaft and ball bearing assembly from crankcase. Remove snap ring (14) and press crankshaft from bearing if necessary.

REED VALVES. All models are equipped with pyramid reed valves. The pyramid seat is of "Delrin" plastic and the 0.004 inch 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. When installing intake elbow and "Delrin" seat assembly, insert reed retainer into crankcase first. Stick reeds to seat with oil, then insert seat with reeds.

CLUTCH. Model SXL-925 is equipped with either a three or six-shoe clutch while all other models are equipped with a six-shoe clutch. See Fig. HL87.

To remove clutch, first remove screws retaining clutch cover to clutch hub and remove cover. Torx screws are used on three-shoe clutch and may be removed with tool Nos. 24982-01 or 24982-02. Unscrew clutch hub (L.H. thread) from crankshaft using a spanner wrench (Homelite tool No. A-17146 for three-shoe clutch or tool No. A-23696-A for six-shoe clutch). The clutch drum, bearing and inner race can then be removed from crankshaft.

Clutch shoes and springs on all models should be renewed as a set. When reassembling six-shoe clutch, be sure the identifying marks on the shoes are all to same side of the assembly. Inspect bearing and lubricate with Homelite ALL-TEMP Multi-Purpose Grease (#24551) or a lithium base grease.

CHAIN OILER. Saws may be equipped with manual chain oiler pump only or with both a manual pump and an automatic chain oiler pump.

The manual oiler pump is installed as shown in Fig. HL79 or Fig. HL80; 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. HL92 for exploded view of rewind 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 post 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. HL92 as a guide. Prewind spring about 2-4 turns.

HOMELITE

Model	Bore Inches	Stroke Inches	Displ. Cu. In.	Drive Type
150 Automatic	1-9/16	1⅜	2.64	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ-7J. Spark plug electrode gap should be 0.025 inch. Note that spark plug has a tapered seat and does not require a gasket.

CARBURETOR. Model 150 Automatic may be equipped with a Walbro HDC or Tillotson HK diaphragm carburetor. Refer to Tillotson or Walbro section of CARBURETOR SERVICE section for carburetor overhaul and exploded views.

Initial carburetor adjustment is idle mixture needle ¾ 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 conventional flywheel type magneto ignition system is used on early models while late models are equipped with solid-state ignition. Breaker-point models may be converted to solid-state ignition without removing breaker box by using kit #A-97026.

The solid-state ignition system is serviced by renewing the spark plug and/or ignition module, however, be sure all wires are connected properly and the ignition switch functions correctly before renewing ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and placing a 0.015 inch shim stock between flywheel and module. Tighten module screws and remove shim stock.

Note the following on breaker point equipped models: Breaker points are contained in a breaker box under the flywheel. Ignition timing is not adjustable. Breaker point gap should be 0.015 inch 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 should be 0.015 inch and is adjusted in the same manner as the solid state ignition previously outlined.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated

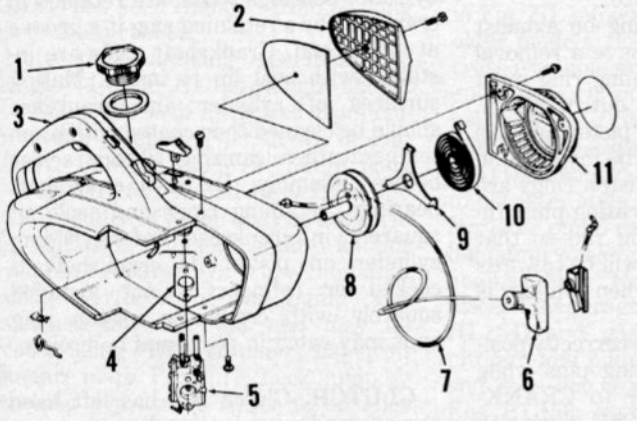


Fig. HL150—View of engine housing and recoil starter.

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

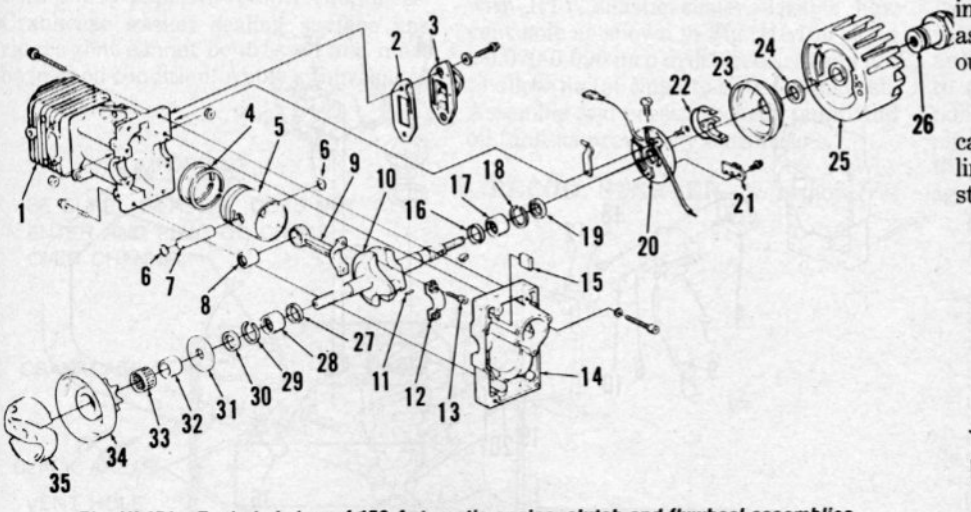


Fig. HL151—Exploded view of 150 Automatic engine, clutch and flywheel assemblies.

1. Cylinder
2. Gasket
3. Intake manifold
4. Piston rings
5. Piston
6. Pin retainers
7. Piston pin
8. Needle bearing
9. Connecting rod
10. Crankshaft
11. Roller bearing (18)
12. Rod cap
13. Screw
14. Crankcase
15. Oil tank vent seal
16. Thrust washer
17. Roller bearing
18. Retaining ring
19. Seal
20. Breaker plate
21. Fixed breaker point
22. Movable breaker point
23. Breaker box
24. Seal
25. Flywheel
26. Flywheel nut
27. Thrust bearing
28. Roller bearing
29. Retaining ring
30. Seal
31. Thrust washer
32. Bearing race
33. Roller bearing
34. Clutch drum
35. Clutch hub

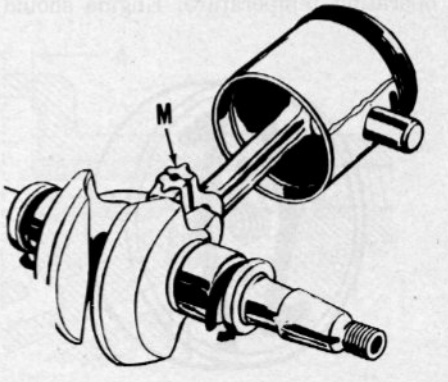


Fig. HL152—View of connecting rod match marks (M).

on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 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

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 120-140 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

Fig. HL153—View of correct installation of clutch hub in drum.

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. 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 damage or excessive wear. Inspect crankshaft for

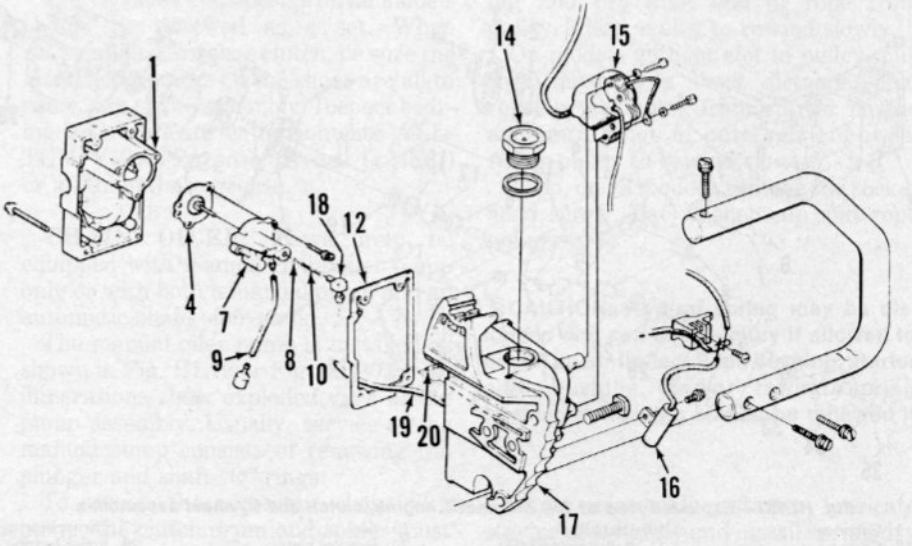


Fig. HL154—Exploded view of oil tank and related assemblies. On models equipped with solid-state ignition, condenser (16) is not used and ignition module is located in place of ignition coil (15).

1. Crankcase
4. Diaphragm & plunger
7. Oil pump body
8. Ball
9. Oil intake
10. Spring
12. Gasket
14. Oil tank cap
15. Ignition coil or module
16. Condenser
17. Oil tank
18. Elbow fitting
19. Hose
20. Outlet fitting

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. Refer to exploded view of oiler pump shown in Fig. HL154. Crankcase pulses actuate diaphragm and plunger to force oil out oil outlet.

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 on clutch side of crankcase which must be clear to vent tank. Air vent seal (15–Fig. HL151) has been changed from packing felt to foam rubber.

Note the following specifications: Plunger (4–Fig. HL154) length should be 0.620-0.630 inch 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 inch from face of pump body as shown in Fig. HL158. Plunger guide is not available separately from housing. Mating surfaces of oil pump and crankcase must be flat and may be dressed using #180 grit emery paper on a surface plate. Pressure check pump by attaching a pressure tester to oil inlet line; pump and inlet line must be full of oil during test. Pump should maintain pressure of 8-10 psi. Oil tank gasket surface should be flat and can be dressed with emery paper to remove roughness. Crankcase gasket sealing surface has ridges that cannot be dressed and must be in good condition. Apply a thin coat of RTV silastic sealer to gasket sealing surfaces of crankcase and oil tank. Note gray and black areas of crankcase shown in Fig. HL155 which must be coated. On older models, do not apply sealer in oil crossover hole or allow excess sealer to enter hole. Oil tank should maintain 6-8 psi pressure if tested after assembly.

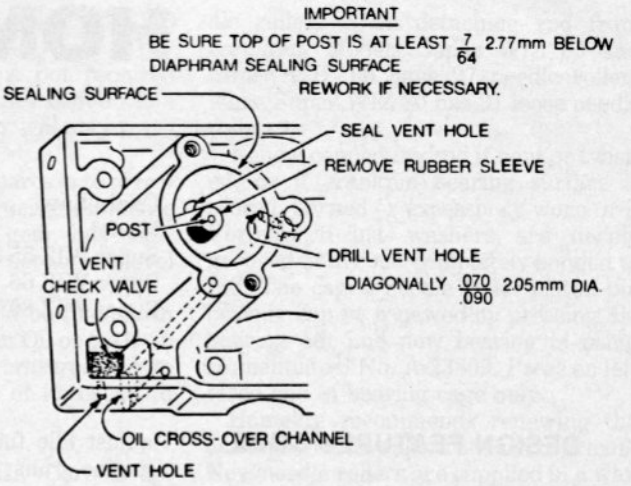


Fig. HL156–View showing modifications of crankcase when installing later oil pump components on early models. See text.

Model 150 saws prior to serial number 42411584 should be modified as follows to use later style pump components. Using later pump components and modifying pump will stop pump oil output when engine idles. Remove oil pump and discard diaphragm and plunger (4–Fig. HL154) and gaskets. New style diaphragm and plunger is 0.025 inch thick and does not require gaskets. Refer to Fig. HL156. Remove then discard rubber sleeve attached to post. Shorten post by breaking or filing so top of post is 7/64 in. below diaphragm sealing surface. Clean old vent hole and block hole with RTV silastic sealer. Drill a new vent hole as shown in Fig. HL156 using a 0.070-0.090 inch drill bit; be careful not to allow metal chips to enter crankcase. Assemble and pressure check pump and oil tank as previously outlined.

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 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.

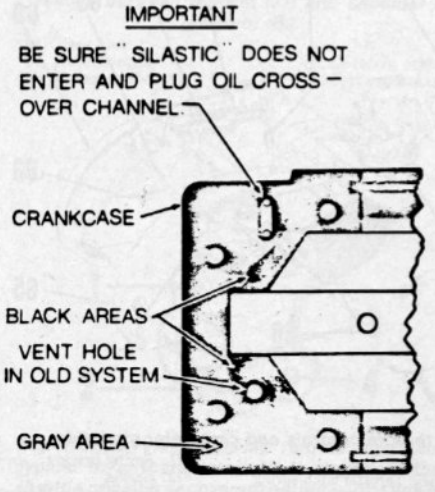


Fig. HL155–Apply RTV silastic sealer to gray and black areas of crankcase as shown.

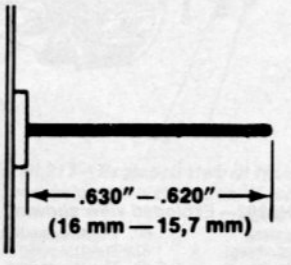


Fig. HL157–Plunger length must be 0.620-0.630 inch from collar to end.

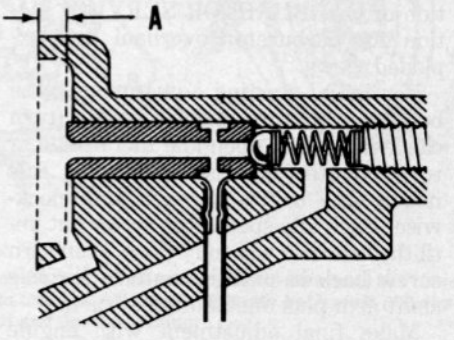


Fig. HL158–Plunger guide should be 0.125-0.155 inch (A) from end of guide to face of oil tank.

HOMELITE

Chain Saw Model	Design Features
Super WIZ 55	B,F,J,K,M,O
Super WIZ 66	A,F,H,K,M,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, 1⅜ in.
C – Displacement, 5.8 cu. in.; bore, 2-3/16 in.; stroke, 1-35/64 in.
F – Pyramid reed type intake valve, 4 reeds.
H – Equipped with air-vane type governor.
J – Non-governed.
K – Conventional type flywheel magneto.
M – Reduction drive, 2-gear transmission.
O – Manual chain oiler only.

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion J6J for Super WIZ 55 and Super WIZ 66 and Champion UJ11G for Super WIZ 80. Electrode gap should be 0.025 inch. In high temperatures or for heavy duty operation, use UJ7G plug in place of J6J or UJ11G. In extremely cold weather, a UJ12 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 CARBURETOR SERVICE section for carburetor overhaul and exploded views.

For initial starting adjustment, close both fuel mixture needles lightly (turn clockwise), then open idle fuel needle ¾ turn counterclockwise and main fuel needle one to 1¼ turns counterclockwise. 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 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 Super WIZ 55 are equipped with an air vane type governor to prevent overspeeding 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

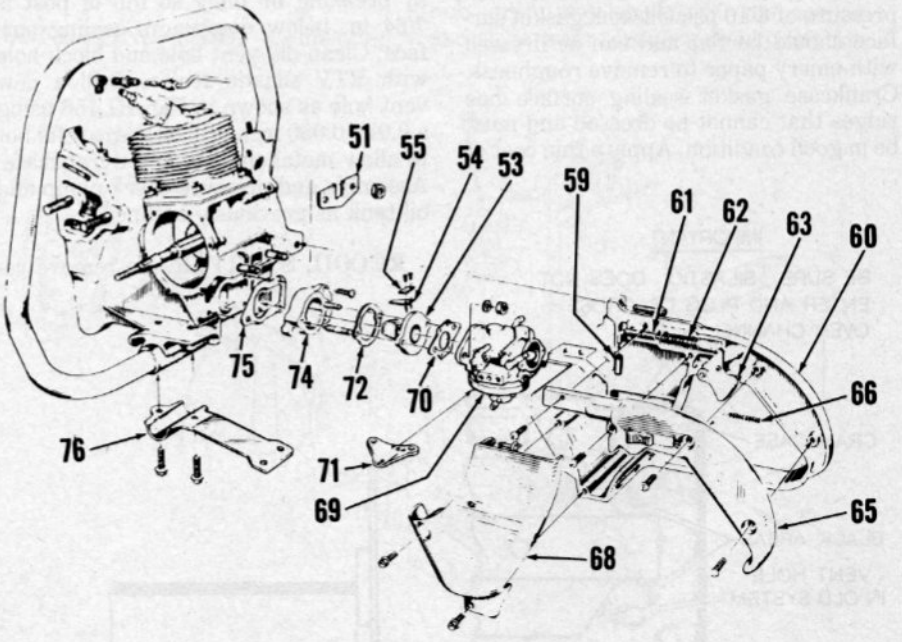


Fig. HL202 – Exploded view showing typical throttle controls and carburetor mounting.

51. Fuel tank strap
53. Pyramid reed seat
54. Inlet reeds
55. Reed clamps
59. Throttle rod sleeve
60. Throttle handle
61. Throttle rod
62. Throttle spring
63. Throttle trigger
65. Handle cover
66. Throttle latch spring
68. Carburetor shield
69. Carburetor
70. Gasket
71. Spring bracket
72. Gasket
74. Pyramid reed spacer
75. Gasket
76. Brace

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 flywheel. Homelite rotor removing tool No. AA-22560 should be used.

Adjust breaker point gap to 0.015 inch. 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. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

Maintain oil level in gearcase 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.

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 removed after removing cylinder from crankcase. Be careful to remove all of the loose needle rollers when detaching rod from crankpin. Models Super WIZ 55 and Super WIZ 66 have 27 needle rollers while Super WIZ 80 has 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 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. A-23809. 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 Super WIZ 55 and Super WIZ 66, tighten the connecting rod cap screws to 55-60 in.-lbs. On Model Super WIZ 80, tighten rod cap screws to a torque of 70-80 in.-lbs. Wiggle rod and cap as the screws are tightened to align fracture mating surfaces.

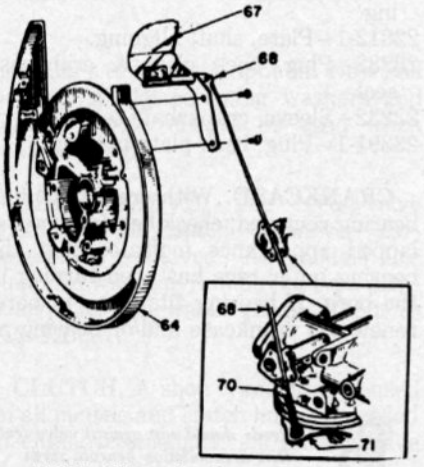


Fig. HL211—View showing governor hookup used on Super WIZ 66 and Super WIZ 80. Refer to Fig. HL215; throttle rod is connected at hole numbered (3). Governor spring (70) is compressed between bracket (71) and shoulder on governor rod.

64. Back plate
67. Governor assy.
68. Governor rod
70. Governor spring
71. Spring bracket

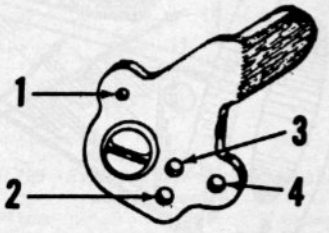


Fig. HL215—View showing throttle shaft arm typical of all carburetors. It is important that throttle opening or governor spring and/or link be hooked into proper hole. Refer also to Fig. HL211.

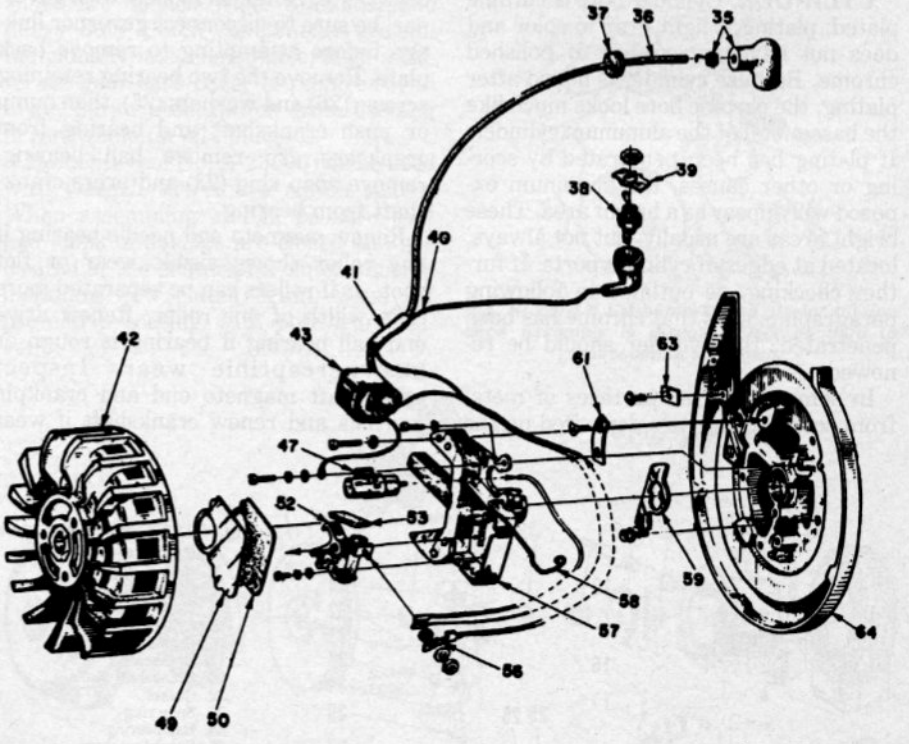


Fig. HL217—Exploded view of typical REPCO magneto used on all models. Rotor (flywheel) has three tapped holes for installation of remover (Homelite tool No. AA-22560). Magneto back plate (64) supports crankshaft seal and needle bearing.

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

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 inch and end gap should be 0.070-0.080 inch. Rings should be renewed if end gap exceeds 0.100 inch. Minimum ring side clearance is 0.0025 inch; maximum ring side clearance in ring groove is 0.004 inch. 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 inch. Refer to CYLINDER paragraph for information from cylinder bore.

Assemble piston to connecting rod or install piston and rod assembly so that piston 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 ¼-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 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 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 inch.

New crankshaft seals and sealing gasket should always be installed when reassembling engine. Install new seal in crankcase 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 new gasket.

Homelite special tools for installing bearings, crankshaft seals and crankshaft are follows:

A-23137 – Jackscrew, crankshaft and bearing.
23136 – Jackscrew body.
22820-1 – Collar, crankshaft and bearing.
22812-1 – Plate, shaft aligning.
23233 – Plug, back plate & crankcase seal.
23232 – Sleeve, crankshaft seal.
23391-1 – Plug, back plate bearing.

CRANKCASE. With crankshaft and bearing removed, check bearing 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

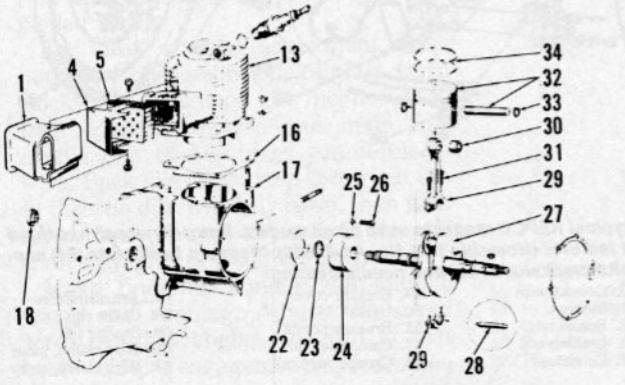


Fig. HL219 – Exploded view of typical engine.

1. Heat damper
4. Exhaust cap
5. Muffler element
13. Cylinder
16. Gasket
17. Crankcase
18. Crankshaft seal
22. Gasket
23. Snap ring
24. Ball bearing
25. Special washers
26. Special screws
27. Crankshaft
28. Needle rollers
29. Connecting rod & cap
30. Needle bearing
31. Connecting rod screws
32. Piston & pin
33. Snap rings
34. Piston rings

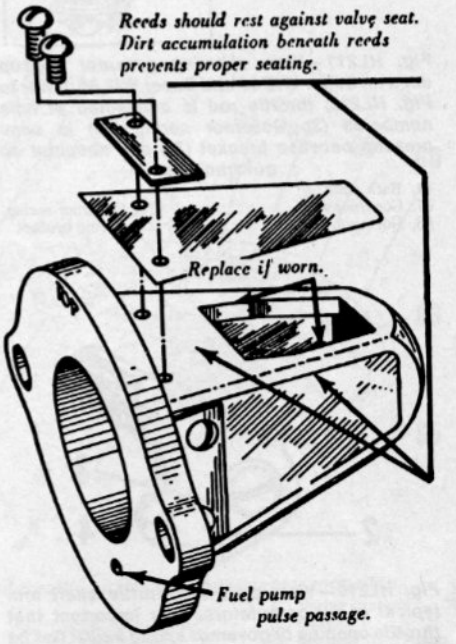


Fig. HL221 – Inspection points for pyramid reed seat and reeds.

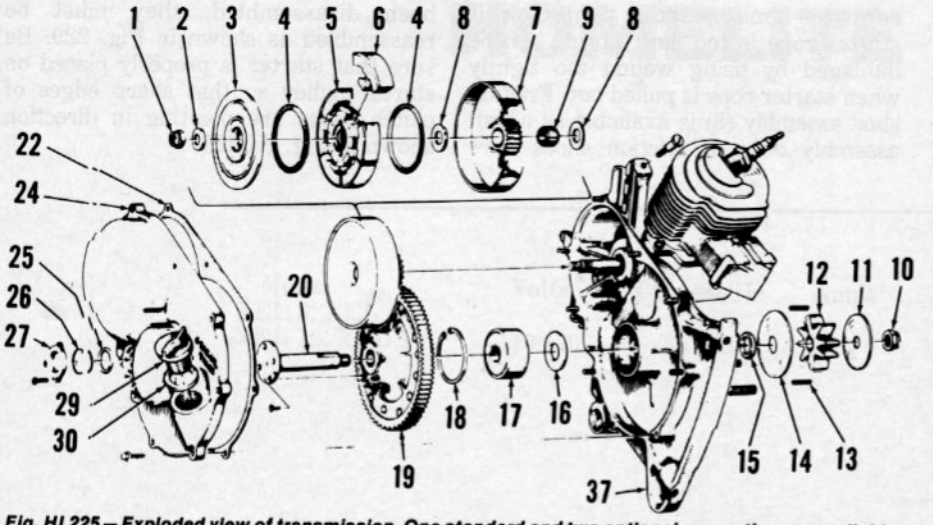


Fig. HL225 – Exploded view of transmission. One standard and two optional gear ratios are available. Standard gear ratio of 3.57:1 is provided by output gear with 75 teeth and clutch drum with 21 teeth. Optional 2.84:1 ratio requires output (driven) gear with 71 teeth and clutch drum gear with 25 teeth. On 2:1 optional gear ratio, output gear has 64 teeth and clutch drum gear has 32 teeth.

1. Crankshaft nut
2. Flat washer
3. Clutch cover
4. Clutch springs
5. Clutch spider
6. Clutch shoes
7. Clutch drum & gear
8. Thrust washer
9. Bronze bushing
10. Sprocket shaft nut
11. Sprocket washer
12. Chain sprocket
13. Sprocket keys
14. Sprocket washer
15. Sprocket spacer
16. Formica seal
17. Ball bearing
18. Snap ring
19. Driven (output) gear
20. Sprocket shaft
22. Gasket
24. Transmission cover
25. "O" ring
26. Window
27. Window plate
29. Filler cap
30. Gasket
37. Crankcase & gear case

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. All models are equipped with a pyramid reed type valve which has renewable reeds. Refer to Fig. HL221.

CLUTCH. A shoe type clutch is used on all models and clutch hub is threaded to engine crankshaft. All models have right hand threads. Refer to Fig. HL225 for exploded view.

On Models Super WIZ 55 and Super WIZ 66, standard clutch shoes are 5/8-inch wide; optional heavy duty clutch shoes are 3/4-inch wide. Standard and heavy duty clutch components are not individually interchangeable; also, a different gear case cover is required with heavy duty clutch. Clutch drum bushing is renewable on all models.

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. All 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.

To disassemble transmission, remove nut (1–Fig. HL225) from crankshaft, remove washer and clutch cover (3) and using Homelite special tool No. A-23696, turn clutch hub counterclockwise 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.

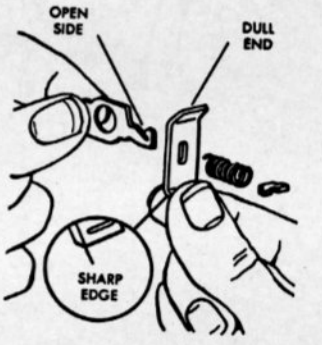


Fig. HL229 – If Fairbanks-Morse starter friction shoe assembly is disassembled, be sure to reassemble as shown.

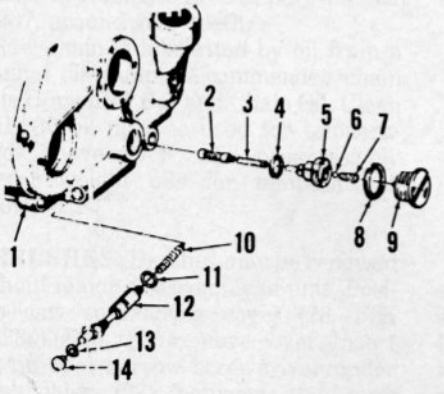


Fig. HL226 – Exploded view of typical manual oil pump assembly.

1. Fuel tank
2. Oil filter
3. Oil line
4. Gasket
5. Valve seat
6. Check ball
7. Check valve spring
8. Gasket
9. Plug
10. Spring
11. "O" ring
12. Pump plunger
13. "O" ring
14. Button

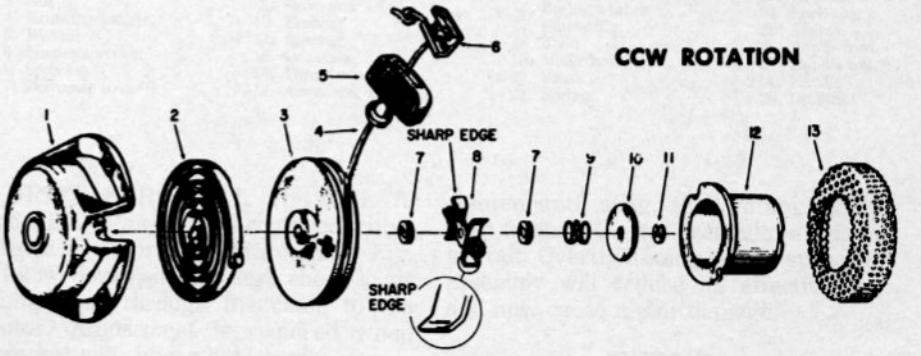


Fig. HL228 – Exploded view of Fairbanks-Morse starter. Fig. HL229 shows proper method of assembling friction shoe assembly if it has been disassembled for some reason; individual parts of friction shoe assembly are not available. Note direction for shaft edges of shoes when reassembling starter.

1. Cover
2. Rewind spring
3. Rope pulley
4. Starter rope
5. Handle grip
6. Grip insert
7. Brake washers
8. Friction shoe assy.
9. Brake spring
10. Retaining washer
11. Retaining ring
12. Starter cup
13. Starter screen

STARTER. Refer to Fig. HL228 for exploded view of starter. When installing rewind spring, pulley and rope, spring should be pretensioned 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. Friction shoe assembly (8) is available as a unit assembly only. If friction shoes have been disassembled, they 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. HL228.

HOMELITE

Model	Volts	Current/Hz	Amps	HP	Drive Type
XEL 8, XEL 10, XEL 12, XEL 14	110-120	AC/60	11	1.5	Gear

ELECTRICAL REQUIREMENTS

The XEL series electric saw is designed to be used on electrical circuits with 115-120 volt alternating current. The XEL series 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. Oilite bushings (8, 10 and 11 – Fig. HL230) and rear bearing (15) do not require lubrication. Drive gear (9 or 9A) should have 2½ to 3 ounces of Homelite grease, part number 17237, around gear teeth.

Saw chain is lubricated by oil from a manual oil pump. Recommended chain oil is Homelite® Bar and Chain Oil. Clean SAE 30 oil may be used for temperatures above 40°F. and progressively lighter weight oils for temperatures below 40°F.

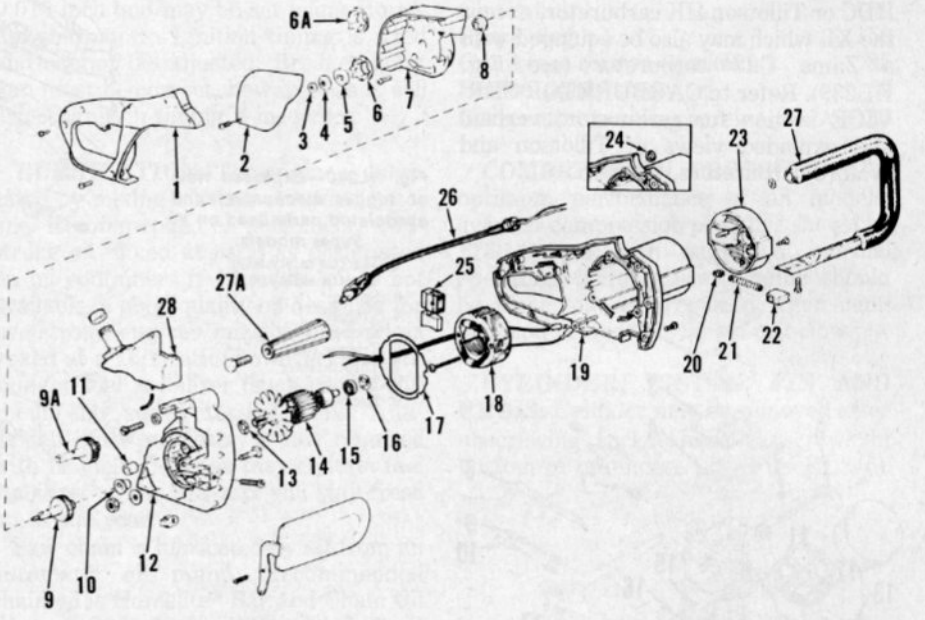


Fig. HL230 – Exploded view of XEL electric chain saw. Components 6A, 9A and 27A are used on XEL 8 and XEL 10 saws.

1. Handle cover
2. Sprocket cover
3. Nut
4. Belleville washer
5. Washer
6. Slipper sprocket
6A. Sprocket
7. Drivecase cover
8. Bushing
9. Slipper drive gear
9A. Drive gear
10. Bushing
11. Bushing
12. Drivecase
13. Thrust washer
14. Armature
15. Bearing
16. Spring washer
17. Fan baffle
18. Field
19. Motor housing
20. Brush
21. Spring
22. Brush holder
23. Housing cover
24. Lock ring
25. Switch
26. Power cord
27. Handle bar
27A. Handle
28. Oil tank

BRUSHES. Brushes may be renewed without major disassembly of unit. Position saw so housing cover (23 – Fig. HL230) is up, then remove cover. Insert the tip of a narrow screwdriver under brushholder (22) between the commutator and housing and pry up to unsnap holder. Disconnect brush lead, then carefully withdraw brush assembly.

When reinstalling, make certain brush holder is snapped fully into place and brush leads are positioned properly.

DRIVE SPROCKET. The XEL 12 and XEL 14 models are equipped with a slipper drive sprocket (3 through 6 – Fig. HL230) designed to absorb shock loads transmitted through the chain to the motor. Adjustment is required when sprocket slips under light loads.

To adjust, first remove sprocket cover (2), chain and guide bar. Using a suitable tool to prevent sprocket (6) from turning, tighten retaining nut (3) to 30-35 in.-lbs. torque or back nut (3) off and retighten until snug, then rotate nut ⅜ turn further. Do not overtighten retaining nut. Overtightening slipper sprocket assembly will reduce its effectiveness and may cause motor damage.

REPAIR

Major component disassembly and reassembly procedures are evident after inspection of unit and referral to exploded view in Fig. HL230.

HOMELITE

Model	Bore	Stroke	Displ.	Drive Type
XL, XL2	1-5/16 in. 33.34 mm	1-3/16 in. 30.16 mm	1.6 cu. in. 26.2 cc	Direct
Super 2, VI Super 2, VI Super 2SL	1-7/16 in. 36.51 mm	1-3/16 in. 30.16 mm	1.9 cu. in. 31.2 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion DJ7J. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. The VI Super models are equipped with a Walbro HDC diaphragm carburetor while all remaining models may have a Walbro HDC or Tillotson HK carburetor, except the XL which may also be equipped with a Zama C2S carburetor (see Fig. HL239). Refer to CARBURETOR SERVICE section for carburetor overhaul and exploded views of Tillotson and Walbro carburetors.

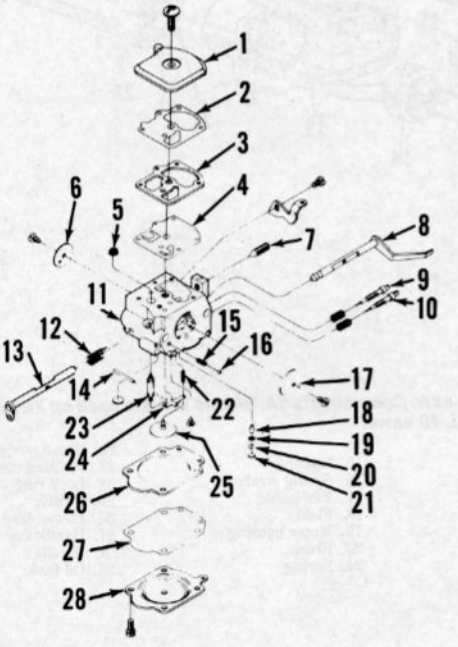


Fig. HL239—Exploded view of Zama C2S carburetor used on later XL models.

1. Fuel pump cover
2. Gasket
3. Plate
4. Fuel pump diaphragm
5. Screen
6. Throttle plate
7. Idle speed screw
8. Choke shaft
9. Idle mixture screw
10. High speed mixture screw
11. Body
12. Spring
13. Throttle shaft
14. Pin
15. Spring
16. Detent ball
17. Choke plate
18. Check valve
19. Screen
20. Clip
21. Plug
22. Spring
23. Fuel inlet valve
24. Metering lever
25. Metering disc
26. Gasket
27. Metering diaphragm
28. Cover

and Walbro carburetors.

Initial adjustment of idle and high speed mixture screws (early models are not equipped with a high speed 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. On models so equipped, adjust high speed mixture screw to obtain optimum performance under cutting load. Final adjustments should be made with engine warm.

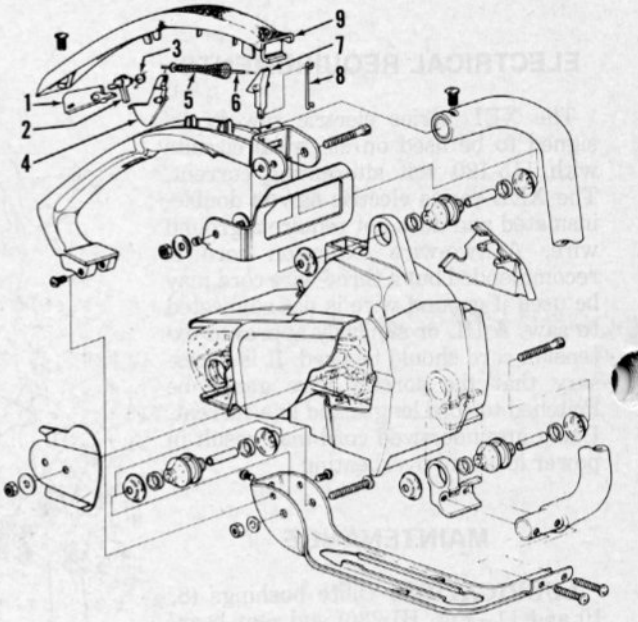


Fig. HL240—Exploded view of trigger mechanism and associated parts used on VI Super models.

1. Throttle safety lever
2. Throttle safety stop
3. Spring
4. Trigger
5. Spring
6. Trigger rod
7. Throttle lever
8. Throttle rod
9. Handle cover

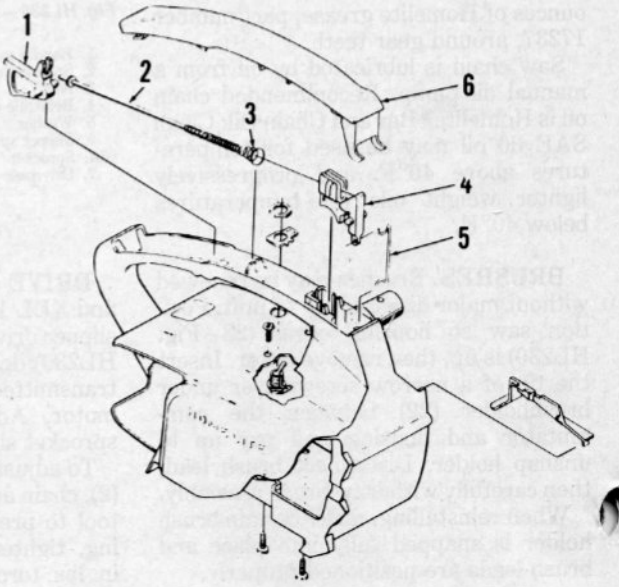


Fig. HL240A—View showing dual trigger mechanism.

1. Rear trigger
2. Trigger rod
3. Spring
4. Front trigger
5. Throttle rod
6. Handle cover

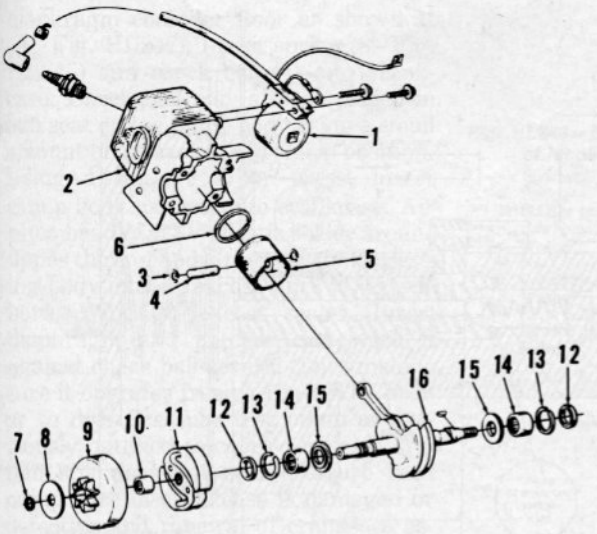


Fig. HL241—Exploded view of cylinder, crankshaft and clutch assemblies.

1. Ignition coil
2. Cylinder
3. Retainer
4. Piston pin
5. Piston
6. Piston ring
7. Snap ring
8. Washer
9. Clutch hub
10. Bearing
11. Clutch drum
12. Seal
13. Seal spacer
14. Bearing
15. Thrust washer
16. Crankshaft assy.

MAGNETO AND TIMING. A conventional flywheel type magneto ignition system is used on early models while later models are equipped with solid-state ignition. The solid-state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module. Remove shim stock.

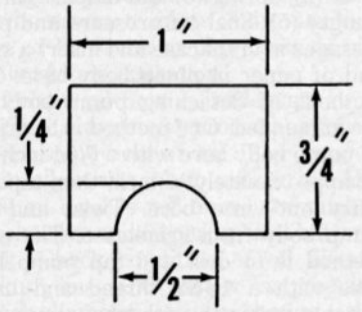


Fig. HL243—Shims used in crankshaft assembly may be made by cutting 0.015 inch thick plastic, metal or other suitable material in the outline shown above. Refer to Fig. HL244 and text.

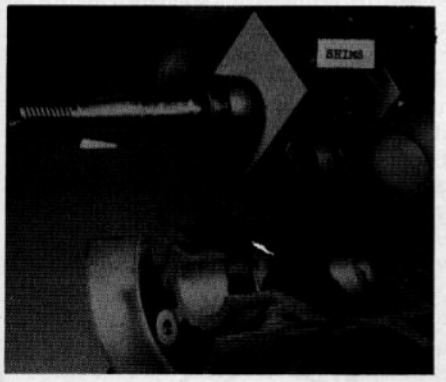


Fig. HL244—View showing placement of shims (Fig. HL243) between thrust washers (15—Fig. HL241) and bearings (14) for correct crankshaft assembly. Refer to text.

Note the following on breaker point equipped models: Breaker point gap should be 0.015 inch. Air gap should be 0.015 inch and may be set using Homelite shim stock. Ignition timing is fixed and cannot be adjusted. Breaker point gap must be correct, however, as it will affect ignition timing if incorrect.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

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 percent.

Flywheel	100
Clutch hub	100
Spark plug	150
Crankcase screws—socket hd.	35
Starter pulley screw	35
Carburetor retaining screws	35

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 115-145 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CYLINDER, PISTON, PIN AND RINGS. Cylinder may be removed after unscrewing socket head capscrews in bottom of crankcase (25—Fig. HL245).

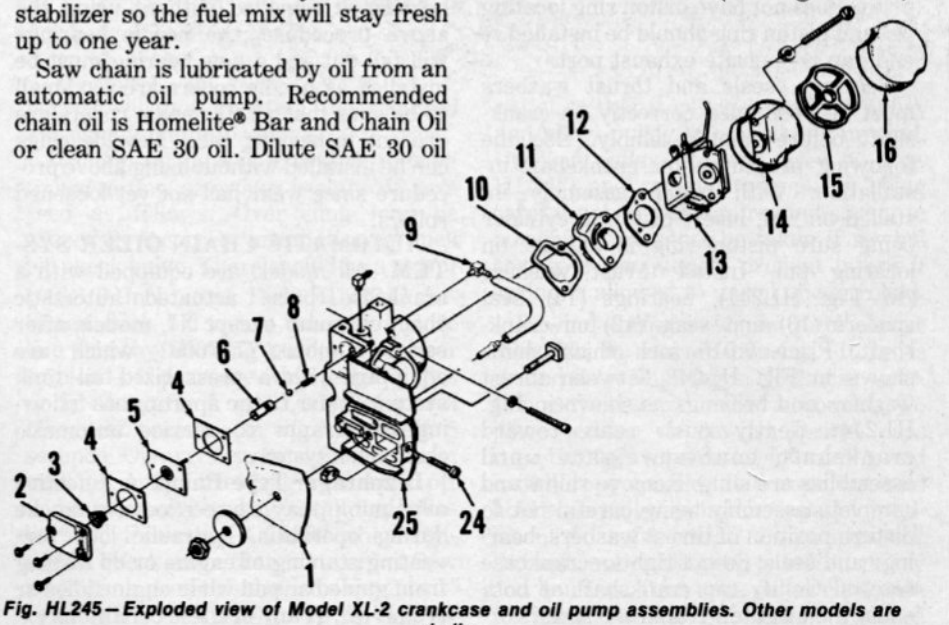


Fig. HL245—Exploded view of Model XL-2 crankcase and oil pump assemblies. Other models are similar.

1. Bar plate
2. Pump cover
3. Spring
4. Gasket
5. Diaphragm & plunger
6. Oil pump cylinder
7. Check ball
8. Spring
9. Oil line
10. Gasket
11. Intake manifold
12. Gasket
13. Carburetor
14. Filter housing
15. Retainer
16. Air filter
24. Chain Tension Adjusting Screw
25. Crankcase

Fig. HL246—View of correct installation of clutch hub in drum.

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.

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.

Early model cylinders are equipped with an open exhaust port while a bridged exhaust port is used on late model cylinders. Early model piston is equipped with a piston ring locating pin in the piston ring groove. Piston ring installed on early model piston must be positioned so end gap indexes with locating pin in ring groove. Install early model piston so piston ring locating pin is opposite exhaust port. Late Model piston does not have piston ring locating pin and piston ring should be installed so end gap is opposite exhaust port.

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. HL243 between thrust washers and bearings as shown in Fig. HL244. 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; do not tighten crankcase screws. Gently tap crankshaft at both ends, then tighten crankcase screws.

CLUTCH. Clutch hub has left-hand threads and must be installed as shown in Fig. HL246. 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 can be installed without using above procedure since wear has not yet loosened rollers.

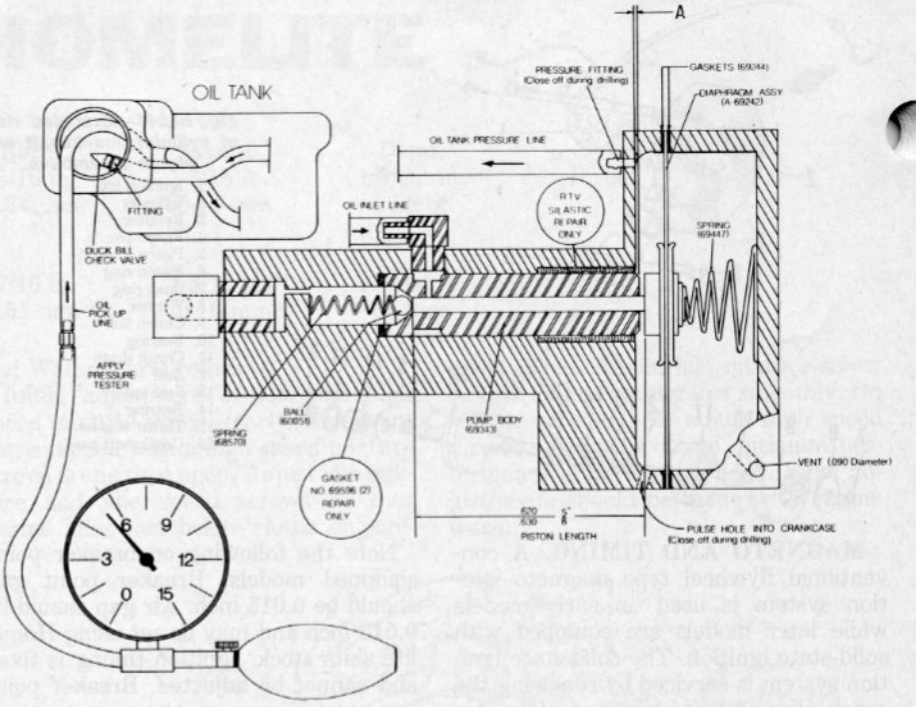


Fig. HL247—Diagram showing pressure tester hook-up and diaphragm oil pump components.

AUTOMATIC CHAIN OILER SYSTEM. All models are equipped with a crankcase pulse actuated automatic chain oil pump except XL models after serial number 77276001 which are equipped with a pressurized oil tank system. Refer to the appropriate following paragraphs to service automatic chain oiler systems.

Diaphragm Type Pump. A defective oiler pump may cause excessive smoke during operation, hydraulic lock preventing starting of engine or oil leaking from guide bar pad while engine idles or is shut off. If any of these conditions exist and excessive smoke is not due to improperly mixed fuel, proceed as follows: Attach a suitable carburetor tester to oil pickup line as shown in Fig. HL247 and pressurize to 5-8 psi. If system does not hold pressure, then oil is leaking past pump body (6—Fig. HL245) and crankcase (25); renew pump body.

To remove pump body, remove pump cover (2), spring (3) and diaphragm and plunger (5). Seal off pressure and pulse passages in crankcase and insert a small wad of paper in pump body bore. Two methods of detaching pump body are recommended. One method is to drill into pump body bore with a 7/64-inch drill bit approximately ½-inch, then tap a #2 "easy out" into bore. Twist and pull pump body from crankcase. The other method is to drill and tap pump body bore with a 10-32 thread and use a suitable puller to withdraw pump body from crankcase. Make certain check ball (7) and spring (8) are not lost when pump body is removed.

Thoroughly clean all parts and pump bore in crankcase. Measure length of new pump body and related bore in crankcase, then install required number of Homelite 0.015 inch thick gaskets no. 69596 to position diaphragm end of pump body 0.000-0.015 inch above

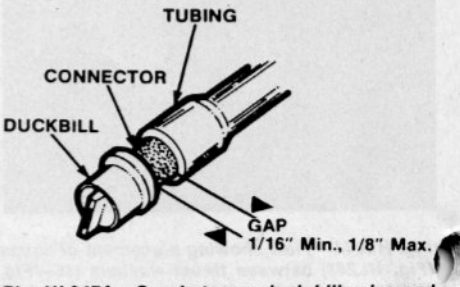


Fig. HL247A—Gap between duck bill valve and tubing end must be 1/16-1/8 in.

diaphragm chamber floor as shown at (A–Fig. HL247). Insert spring (8–Fig. HL245) and check ball (7) into crankcase. Check ball may also be placed in ball seat end of pump body using a small amount of grease to hold ball in position. Using a suitable arbor press, insert pump body halfway into crankcase. Apply a bead of RTV silastic sealer around upper third of body, then continue pressing body into crankcase until it seats in bore. Wipe off excess sealer. Insert diaphragm and plunger and work it against check ball several times making sure it operates freely. Allow RTV sealer to dry. Pressure test pump as previously outlined to check repair. If system still does not hold pressure then pump bore in crankcase is damaged or defective and renewal of crankcase assembly is required. If system holds pressure, reassemble remaining components and fill oil tank.

With bar and chain removed, start and run saw at wide open throttle in 15 second intervals. Oil pump should deliver 12-17 cc/min. during test and 5-12 cc/min. under actual operating conditions. Shut off engine and check for leaks.

Pressurized Oil Tank System. Crankcase pulses pressurize the oil tank forcing oil directly from the oil tank to the outlet. In temperatures below 32°F., it is necessary to dilute chain oil with one part of kerosene to four parts of oil to allow system operation.

If chain oil flow is inadequate or has stopped completely, proceed as follows: Check condition of oil filler cap, cap must allow oil tank to pressurize. Make sure oil level is not above the duck bill check valve and oil pickup is at bottom of tank. Check condition of oil filter on pickup line and renew as required. Check diameter of oil metering orifice located in oil pickup line above oil filter. Diameter of orifice should not be less than 0.0465 inch. Oil pickup line should be 4-4⅛ inch long on outside of tank and positioned under the carburetor throttle stop. Check for a pinched or restricted oil pickup line using a suitable carburetor tester with test cap attached. Pressurize tank to 4-5 psi and check for free flowing oil at guide bar. With pressure tester still attached, start and run saw at wide open throttle. Tank should pressurize to 2½-6 psi. While engine idles or is shut off, pressure should drop to zero after approximately 5 seconds. If tank fails to pressurize, check condition of crankcase pulse line by submerging the duck bill check valve shown in Fig. HL247A in oil and running saw. Constant bubbles should emit from check valve with slight bubbling from porous connector between check valve and line. A connector that is too porous will not maintain the required 2½ psi minimum for oiling.

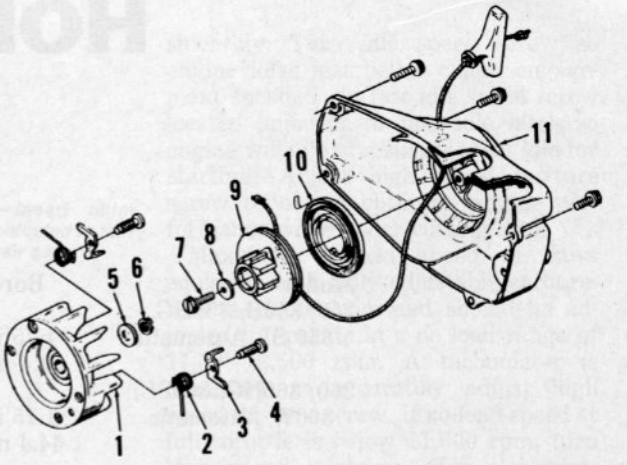


Fig. HL248–Exploded view of recoil starter.

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

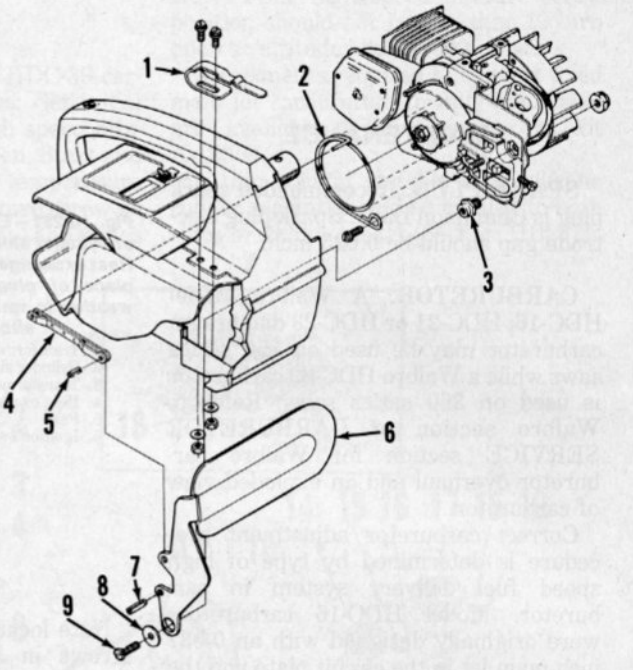


Fig. HL249–Exploded view of chain brake used on some models.

1. Clip
2. Brake band
3. Post
4. Pivot link
5. Spring pin
6. Lever
7. Roll pin
8. Washer
9. Screw

If chain oil flow is excessive or continues to flow after saw is shut off, proceed as follows: Over-oiling may be caused by incorrect installation of duck bill check valve. There should be a gap of 1/16-1/8 inch (See Fig. HL247A) between duck bill check valve and pulse line thereby allowing porous connector to bleed off pressure while engine idles or is shut off. A good connector will bleed off pressure in approximately 5 seconds. Oil may also be siphoning from tank to outlet after engine is shut off and can be corrected by installing Homelite® Oil Filter no. A-78889 which contains a check valve that shuts off oil flow when tank pressure drops below 2 psi.

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. HL247) 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.

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

Model	Bore	Stroke	Displ.	Drive Type
350, 350B, 350HG, 350 SL Automatic	1.75 in. 44.4 mm	1.44 in. 36.6 mm	3.5 cu. in. 57 cc	Direct
360, 360HG, 360SL, 360W Automatic	1.75 in. 44.4 mm	1.44 in. 36.6 mm	3.5 cu. in. 57 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ6J. 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 on 350 series saws while a Walbro HDC-39 carburetor is used on 360 series saws. Refer to Walbro section of CARBURETOR SERVICE section for Walbro carburetor overhaul and an exploded view of carburetor.

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 enrichen the high speed fuel mixture. Later Model 350 saws are equipped with Model HDC-21 carburetors which have an 0.033 inch main jet in the circuit plate.

Fig. HL250—View of carburetor idle speed screw (I), high speed mixture screw (H) and idle mixture screw (L).

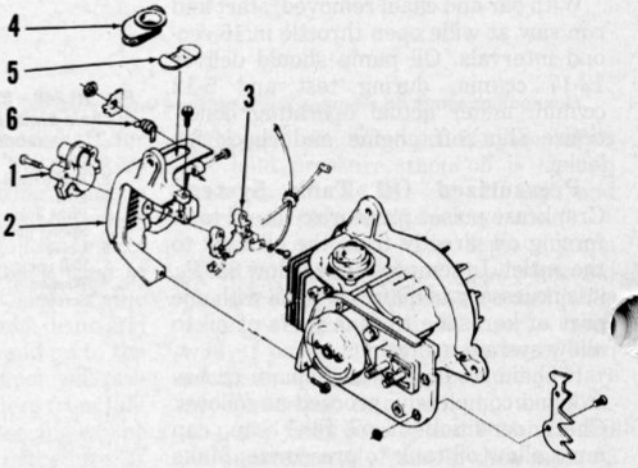


Fig. HL251—Exploded view of cylinder shield assembly. Heat exchanger (4) is used in place of plug (5) in cold weather to warm carburetor airbox.

1. Transformer
2. Cylinder shield
3. Transformer receptacle
4. Heat exchanger
5. Plug
6. Ignition switch

Note location of carburetor adjusting screws in Fig. HL250 and refer to following paragraphs for carburetor adjustment.

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 (counter-clockwise). 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 counter-clockwise ½ 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 ⅛ 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

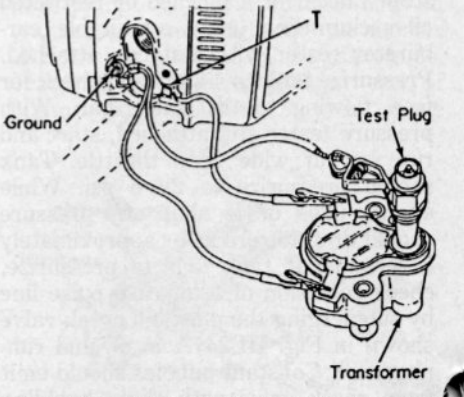


Fig. HL252—A test plug may be used to determine if ignition system is operating correctly. See text.

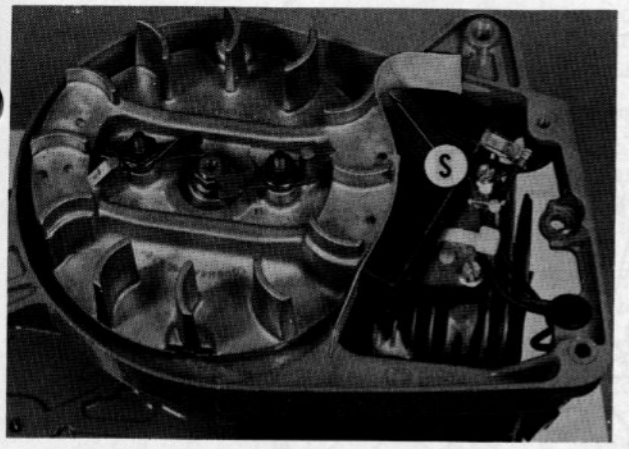


Fig. HL253—Insert shim stock (S) as indicated in text to set air gap.

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 1¼ turns open for high speed mixture screw and 1-3/16 turns open for idle mixture screw. Turn screw counter-clockwise 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 counter-clockwise 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 2500-2800 rpm) and not fluctuate when attitude of saw is changed.

To adjust Walbro Model HDC-39 carburetor, proceed as follows: Set initial adjustment of idle and high speed mixture screws at 1¼ turns open. Start and run engine until operating temperature is reached. Adjust idle mixture screw so engine accelerates cleanly and idles smoothly. Turn idle speed screw so engine idles just below clutch engagement speed. Turn fast idle speed screw located adjacent to fast idle latch so engine will idle at a suitable fast idle for starting. Adjust high speed mixture screw to obtain optimum engine performance while under cutting load.

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 ⅞ 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).

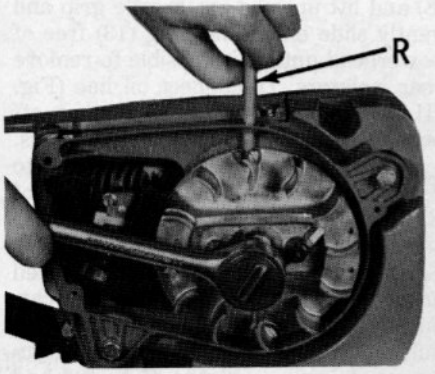


Fig. HL254—Removal of flywheel or clutch is facilitated by preventing flywheel rotation with a ¼ inch rod stuck through hole in back plate into notch in flywheel.

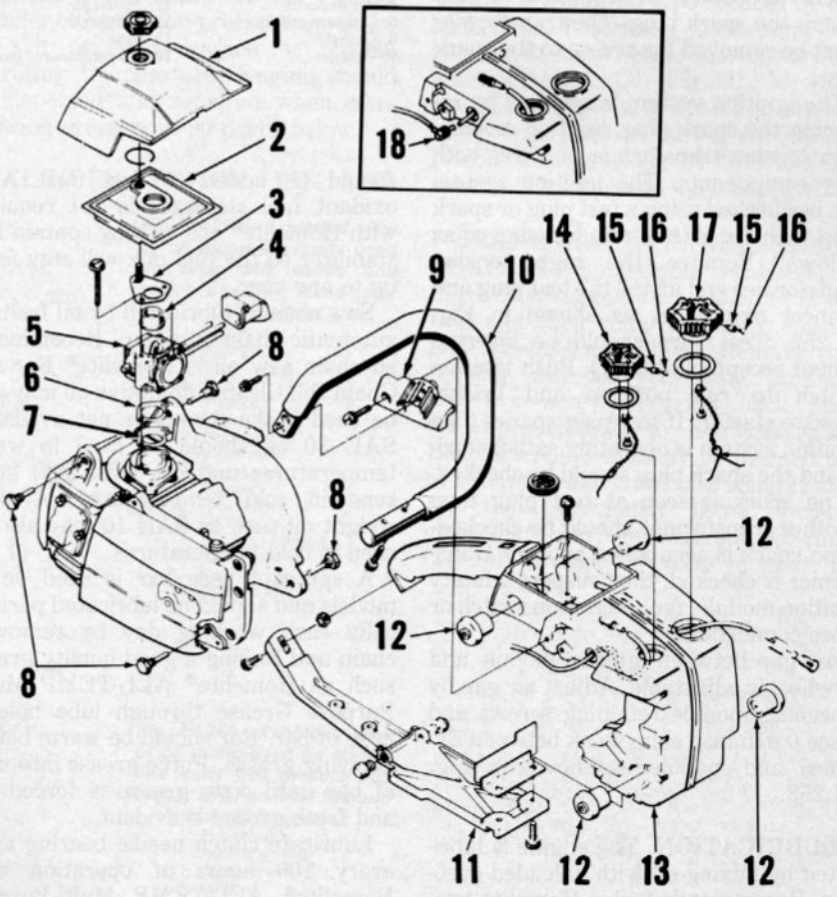


Fig. HL255—Exploded view of engine housing assembly. Some housings will use a threaded elbow fitting (18) on oil pickup tube as shown in inset.

1. Filter cover
2. Air filter
3. Spring plate
4. Flange bushing
5. Carburetor
6. Gasket
7. Flange bushing
8. Isolator pins
9. Handle bar bracket
10. Handle bar
11. Handle brace
12. Vibration isolators
13. Engine housing
14. Oil cap
15. Duckbill valve
16. Bronze filter
17. Fuel cap
18. Elbow fitting

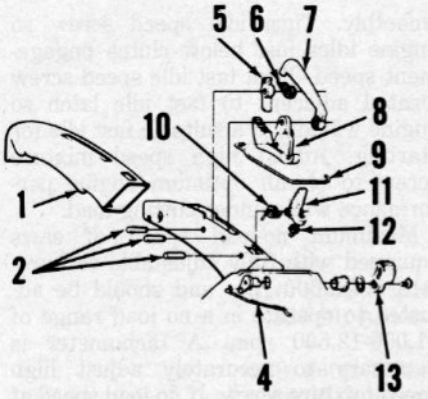


Fig. HL256 – Exploded view of trigger assembly.

1. Handle grip
2. Dowel pin
4. Choke rod
5. Trigger lock lever
6. Spring
7. Trigger lock
8. Trigger
9. Throttle rod
10. Spring
11. Trigger latch
12. Screw
13. Choke knob

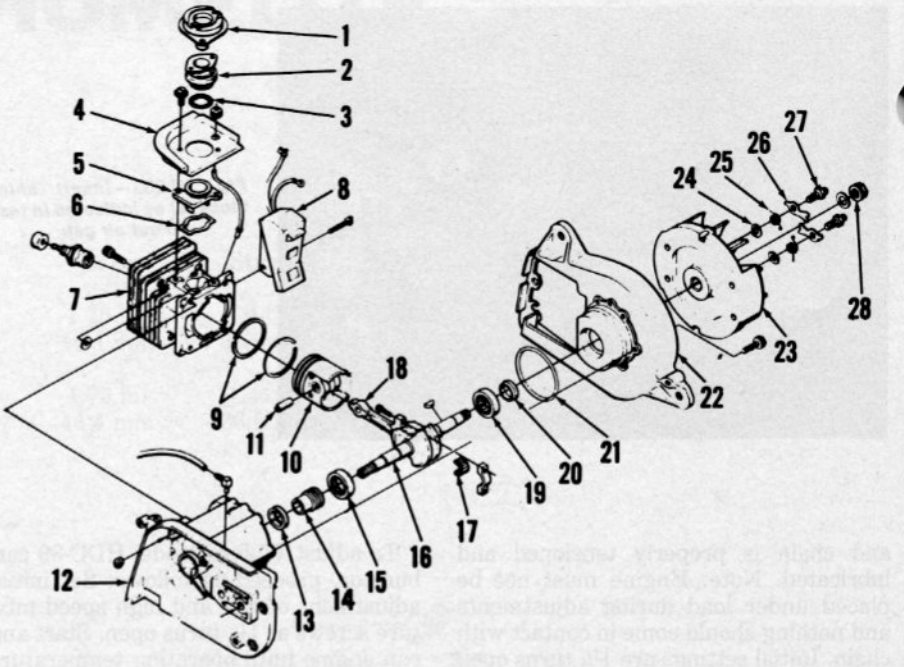


Fig. HL257 – Exploded view of engine.

1. Carburetor flange
2. Connector
3. Garter spring
4. Air deflector
5. Intake manifold
6. Gasket
7. Cylinder
8. Ignition module
9. Piston rings
10. Piston & bearings
11. Piston pin
12. Crankcase
13. Seal
14. Oil pump worm gear
15. Roller bearing
16. Crankshaft
17. Needle bearing
18. Connecting rod
19. Roller bearing
20. Seal
21. "O" ring
22. Back plate
23. Flywheel
24. Lockwasher
25. Spring
26. Starter pawl
27. Pawl stud
28. Nut

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 transformer is mounted on the cylinder shield as shown in Fig. HL251 and covers the spark plug. The transformer must be removed for access to the spark plug.

The ignition system is serviced by replacing the spark plug, ignition module, high tension transformer or wires with new components. The ignition system can be checked using a test plug or spark plug with the side electrode removed as follows: Remove the high tension transformer and install the test plug and connect test wires as shown in Fig. HL252. Test wire should be inserted behind receptacle tab (T). Push ignition switch to run position and briskly operate starter. If test plug sparks then ignition system is operating satisfactorily and the spark plug should be checked. If no spark is seen at test plug then another transformer should be checked. If no spark is seen when another transformer is checked, then suspect a faulty ignition module, faulty ignition switch or loose connections.

Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place 0.015 inch shim stock between flywheel and module as shown in Fig. HL253.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 (12 – Fig. HL255) between powerhead and housing assembly (13). Isolators may be renewed as follows:

Remove air filter cover, filter, drive case cover and guide bar. Remove handle brace (11 – 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 (8) and lift upward on throttle grip and gently slide engine housing (13) free of powerhead until it is possible to remove rear isolators. Disconnect oil line (Fig. HL265) 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 (8 – Fig. HL255) to 80 in.-lbs. Tighten handle brace (11) screws to 45 in.-lbs.

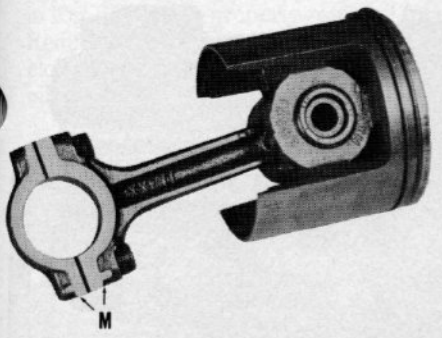


Fig. HL258—Alignment marks (M) on rod must match and arrow adjacent to "EXH" on piston pin boss must point towards exhaust port for proper installation of piston and connecting rod.

REPAIRS

TIGHTENING TORQUES. Tightening torque values in inch-pounds 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
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:

Tool No. Description & Model Usage
A-17146—Clutch wrench (3-shoe; 360 Series)
A-23696-A—Clutch wrench ("S" clutch)
A-23934—Clutch wrench (3-shoe; 350 Series)
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
14868—Oil pump alignment plug
A-24994—Ignition tester

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 140-170 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

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 (13—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. Unscrew 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 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 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

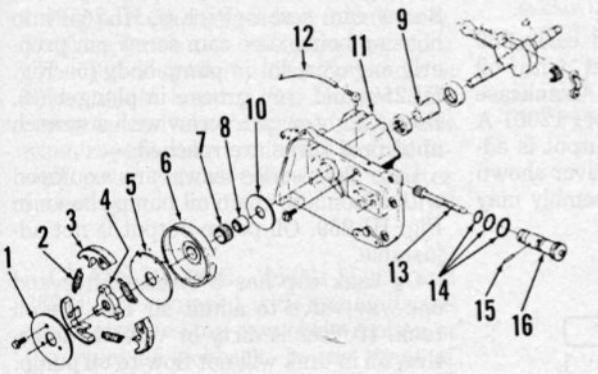


Fig. HL259—Exploded view of oil pump assembly used on later 360 series and clutch used on some later 360 models.

1. Cover
2. Spring
3. Shoe
4. Hub
5. Washer
6. Clutch drum
7. Bearing
8. Inner race
9. Worm gear
10. Washer
11. Crankcase
12. Oil line
13. Oil pump plunger
14. "O" rings
15. Pin
16. Pump Body

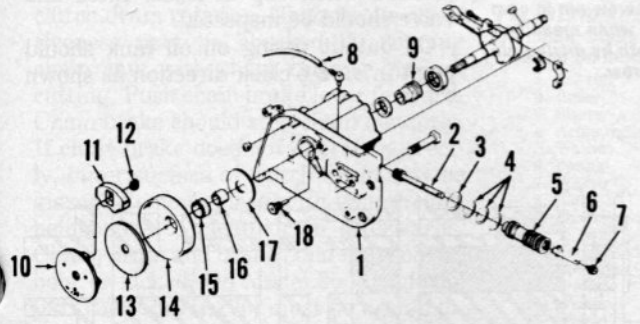


Fig. HL260—Exploded view of oil pump used on all 350 and early 360 models and clutch used on later 350 and early 360 models.

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 hub
11. Clutch shoe
12. Spring
13. Washer
14. Clutch drum
15. Bearing
16. Bearing race
17. Washer
18. Cam screw

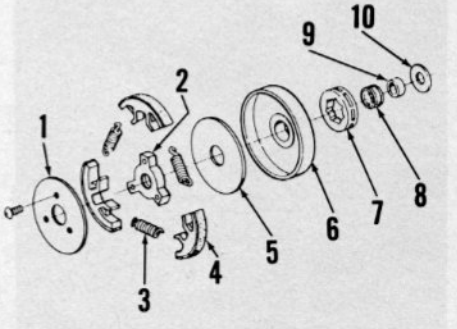


Fig. HL261—Exploded view of clutch assembly used on late Model 360 series.

1. Cover plate
2. Hub
3. Spring
4. Shoe
5. Washer
6. Clutch drum
7. Sprocket
8. Bearing
9. Inner race
10. Washer

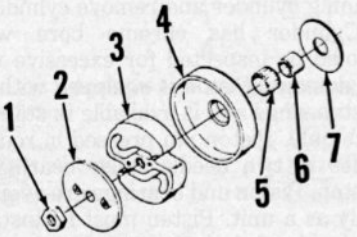


Fig. HL262—View of "S" clutch used on some models. Cover (2) is threaded on some models and nut (1) is not used. Note correct installation of hub (3) in upper view.

1. Nut
2. Cover
3. Hub
4. Clutch drum
5. Bearing
6. Inner race
7. Washer

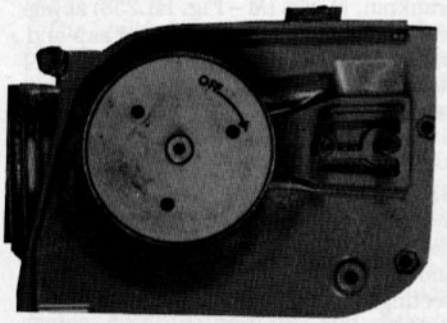


Fig. HL263—Clutch hub is removed by unscrewing clockwise as indicated on hub. Refer to Fig. HL254.

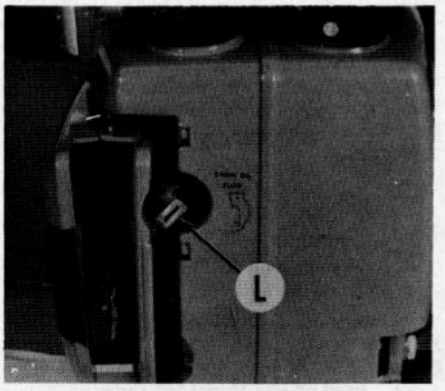


Fig. HL264—Oil pump output on all 350 series and early 360 series saws is adjusted by turning lever (L) counterclockwise to increase oil flow or clockwise to decrease oil flow.

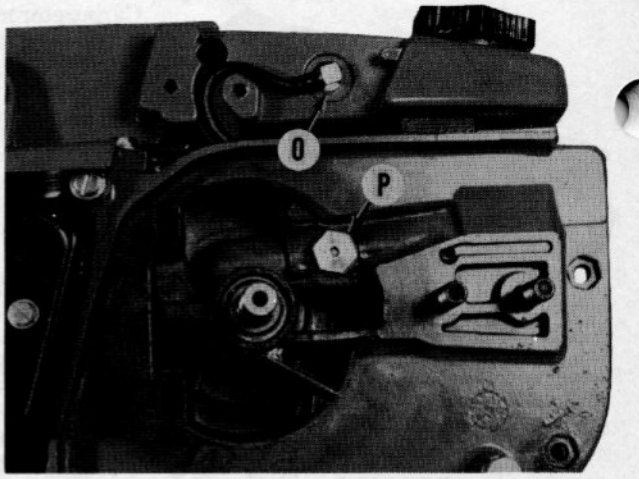


Fig. HL265—Oil line fitting (O) must be pointing towards 8 o'clock position and oil line routed as shown. Cam screw (P) must be installed carefully on models so equipped to insure proper meshing with cam in plunger (2—Fig. HL259).

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, HL260 or HL261 or a 1-piece "S" configuration clutch similar to that shown in Fig. HL262. Clutch may be removed by holding flywheel with a ¼ inch rod (Fig. HL254) and turning clutch hub clockwise as shown in Fig. 263.

CHAIN OIL PUMP. All models are equipped with a plunger type automatic chain oil pump as shown in Fig. HL259 or HL260. The pump is driven by worm (9) on the engine crankshaft.

All 350 series models and early 360 series models are equipped with oil pump shown in Fig. HL260. Crankcase (1) may be identified by number 12061-A stamped in crankcase. Oil output is adjusted by turning adjusting lever shown in Fig. HL264. Oil pump assembly may be withdrawn after unscrewing cam screw (P—Fig. HL265). Measure depth of cam screw pin as shown in Fig. HL266. 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. HL267) in pump bore. Plug should be 2.011-2.016 inches from end of pump as shown in Fig. HL267. Lubricate pump components prior to assembly. Align cam groove in plunger with slot in pump body using tool no. 24868. Carefully install pump assembly in housing to prevent plunger from moving out of alignment with pump body slot. Screw cam screw (P—Fig. HL265) into housing being sure cam screw pin properly engages slot in pump body (5—Fig. HL260) and cam groove in plunger (2). Do not tighten cam screw with a wrench until final turns are reached.

Late 360 series saws are equipped with automatic chain oil pump shown in Fig. HL259. Oil pump output is not adjustable.

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

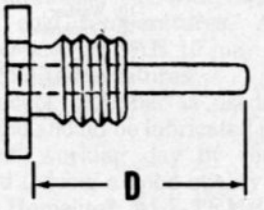


Fig. HL266—Depth (D) of cam screw pin in cam screw must be 0.553-0.557 inch when measured as shown above. Adjust pin depth by driving pin in or out of cam screw.

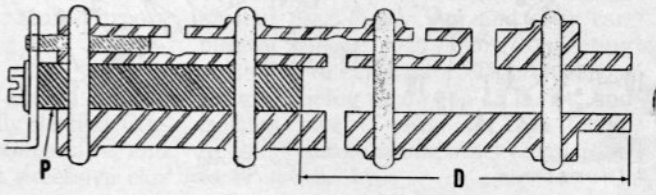


Fig. HL267—Plug (P) in pump bore must be 2.011-2.016 inches (D) from end of pump bore as shown above.

in Fig. HL265 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. HL268 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. HL268. 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 washer (3) with concave side towards pulley. Install spring and cover assembly on housing but do not install 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.

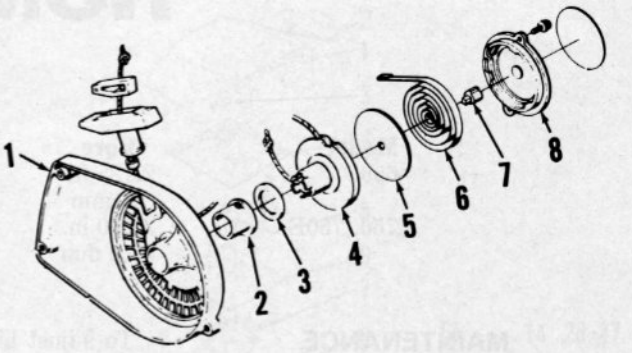


Fig. HL268—Exploded view of recoil starter.

1. Starter housing
2. Bushing
3. Spring washer
4. Rope pulley
5. Washer
6. Rewind spring
7. Spring post
8. Cover

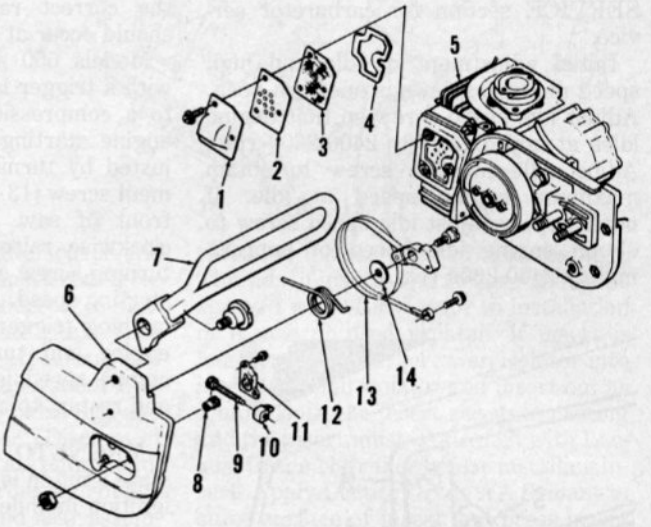


Fig. HL269—Exploded view of chain brake and muffler on Model 350SL.

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

CHAIN BRAKE. Models 350SL and 360SL are 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. HL269 or 4—HL270) forward and brake band 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. On Model 360SL, dowel pin (12—Fig. HL270) must be driven into crankcase so 0.375 inch of pin stands out from crankcase.

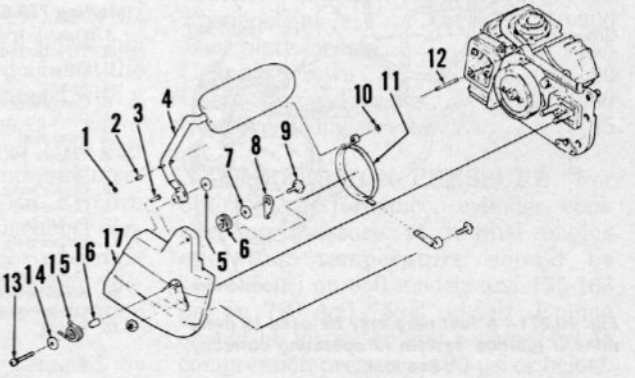


Fig. HL270—Exploded view of chain brake mechanism used on Model 360SL.

1. "E" ring
2. Roller
3. Sleeve
4. Actuating lever
5. Washer
6. Spring
7. Washer
8. Latch
9. Shoulder screw
10. "E" ring
11. Brake band
12. Dowel pin
13. Screw
14. Washer
15. Spring
16. Sleeve
17. Cover

HOMELITE

Model	Bore	Stroke	Displ.	Drive Type
650	2.125 in.	1.720 in.	6.1 cu. in.	Direct
	54 mm	43.7 mm	100 cc	
750, 750E	2.250 in.	1.720 in.	6.8 cu. in.	Direct
	57.2 mm	43.7 mm	112 cc	

MAINTENANCE

SPARK PLUG. Recommended spark plug is champion CJ4 for Model 650 and CJ3 for Model 750. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. All models are equipped with a Walbro WB diaphragm carburetor. Refer to CARBURETOR SERVICE section for carburetor service.

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 obtain engine idle speed of approximately 2400-2600 rpm.

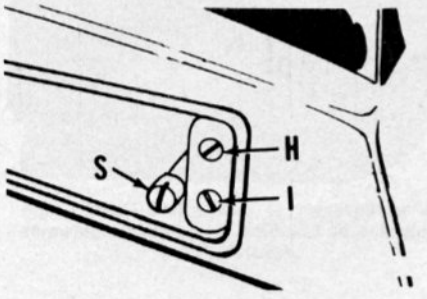


Fig. HL270—View showing location of carburetor high speed mixture screw (H), idle mixture screw (I) and idle speed screw (S).

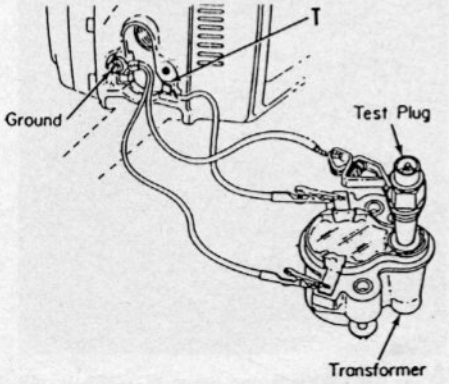


Fig. HL271—A test plug may be used to determine if ignition system is operating correctly. See text.

To adjust high speed mixture screw, proceed as follows: Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle counter-clockwise approximately 1/8-1/4 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.

Models 650 and 750E are 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 counter-clockwise 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 all models. The ignition module is mounted adjacent to the flywheel while the high tension transformer covers the spark plug and is mounted on the cylinder shield. The high tension transformer must be removed for access to spark plug.

The ignition system is serviced by replacing the spark plug, ignition module, high tension transformer or wires with new components. The ignition system can be checked using a test plug or spark plug with the side electrode removed as follows: Remove the high tension transformer and install the test plug and connect test wires as shown in Fig. HL271. Test wire should be inserted behind receptacle tab (T). Push ignition switch to run position and briskly operate starter. If test plug sparks then ignition system is operating satisfactorily and the spark plug should be checked. If no spark is seen at test plug then another transformer should be checked. If no spark is seen when another transformer is checked, then suspect a faulty ignition module, faulty ignition switch or loose connections.

High tension transformer and leads may be checked by disconnecting wires at ignition module which lead from ignition module to transformer 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 transformer 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 ig-

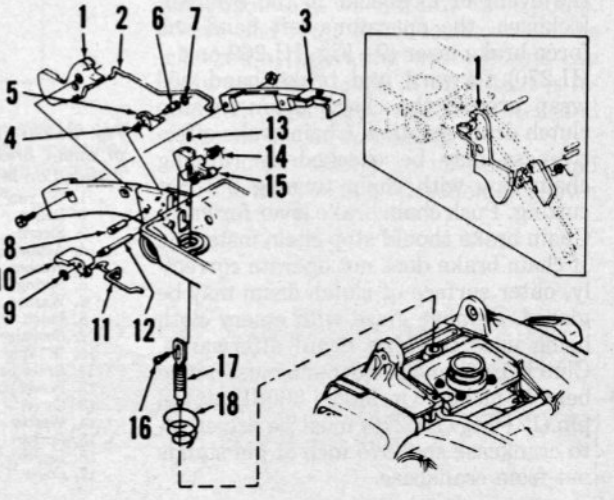


Fig. HL272—Exploded view of handle components. Inset shows trigger lock mechanism used to aid in cold starting 750 E models.

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

nition 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.

If the flywheel is removed using Homelite tool A-17106-B, which attaches to starter pawl studs, the starter pawl studs must be retightened to 70-90 in.-lbs. to restore any possible torque loss.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 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. All models are 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 carburetor. 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.

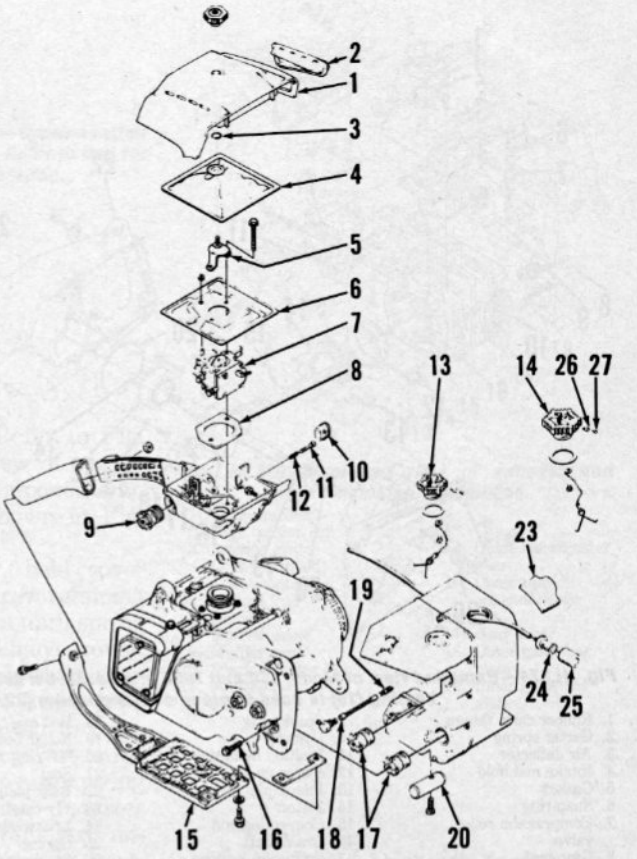


Fig. HL273–View of induction, fuel and oil assemblies.
1. Air filter cover
2. Air intake
3. Retaining ring
4. Air filter
5. Bracket
6. Airbox shield
7. Carburetor
8. Spacer plate
9. Rear vibration isolator
10. Grommet
11. Idle speed screw
12. Spring
13. Oil tank cap
14. Fuel tank cap
15. Handle brace
16. Vibration isolator screw
17. Front vibration isolator
18. Oil line
19. Oil pickup
20. Chain stop
23. Fuel tank bumper
24. Fuel pickup
25. Fuel filter
26. Check valve
27. Filter

Unscrew two front vibration isolators 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 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 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

COMPRESSION PRESSURE. For optimum performance, cylinder compression pressure at normal engine operating temperature should be 155-185 psi on 650 models and 135-165 psi on 750 and 750E models. Engine should be inspected and repaired when compression pressure is 90 psi or below.

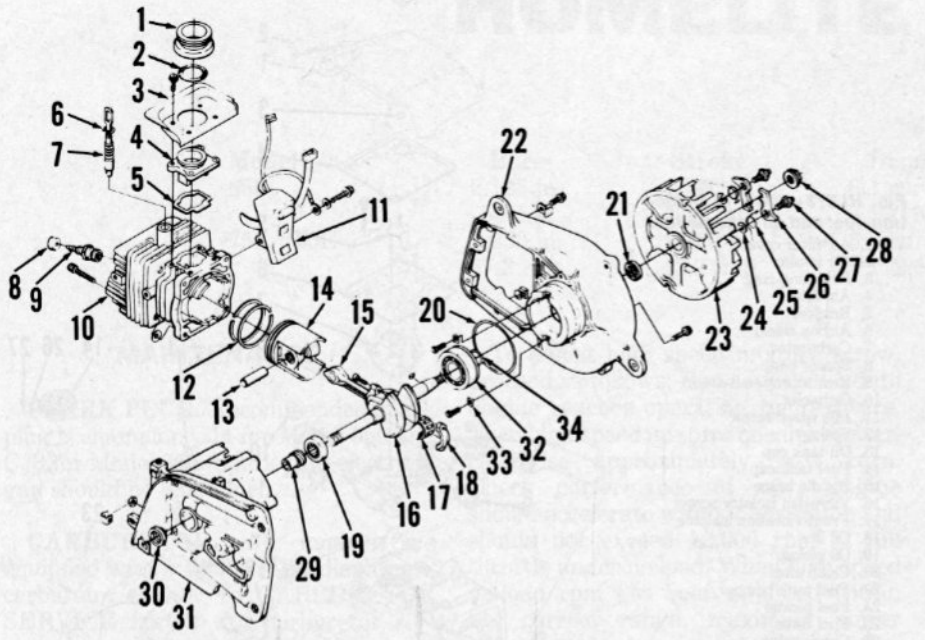


Fig. HL274—Exploded view of Model 750 and 750E engine. Model 650 is similar except second roller bearing (19) is used in place of components (32, 33 and 34).

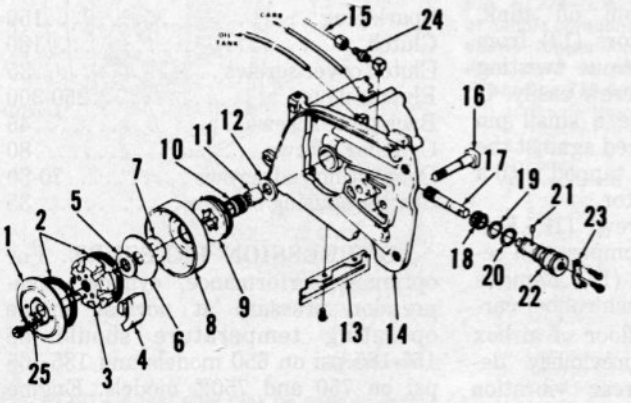
1. Rubber carb. flange
2. Garter spring
3. Air deflector
4. Intake manifold
5. Gasket
6. Snap ring
7. Compression relief valve
8. Grommet
9. Spark plug
10. Cylinder
11. Ignition module
12. Piston rings
13. Piston pin
14. Piston
15. Connecting rod
16. Crankshaft
17. Split cage bearing
18. Rod cap
19. Roller bearing
20. "O" ring
21. Seal
22. Back plate
23. Flywheel
24. Lockwasher
25. Spring
26. Starter pawl
27. Pawl stud
28. Roller bearing
29. Oil pump worm
30. Seal
31. Crankcase
32. Ball bearing
33. Bearing retainer
34. Snap ring

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. Homelite tool A-24871 may be used to remove or install piston pin. 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 on 750 and 750E models is supported by roller bearing (19–Fig. HL274) and ball bearing (32).



1. Cover
2. Clutch spring
3. Clutch hub
4. Clutch shoe
5. Thrust washer (1")
6. Thrust washer (2")

Fig. HL275—Exploded view of clutch and oil pump assemblies.

7. Thrust washer (1⅛")
8. Clutch drum
9. Sprocket
10. Bearing
11. Bearing race
12. Thrust washer (1⅛")
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

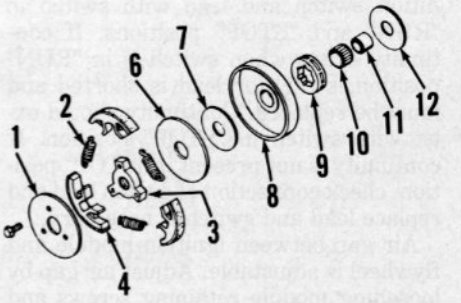


Fig. HL275A—Exploded view of late model clutch assembly.

1. Cover
2. Clutch spring
3. Clutch hub
4. Clutch shoe
6. Thrust washer
7. Thrust washer
8. Clutch drum
9. Sprocket
10. Bearing
11. Bearing race
12. Thrust washer

Crankshaft on 650 models is supported by roller bearings (19) in the back plate and crankcase. Crankcase on 650 models may be removed after unscrewing crankcase screws. To remove crankcase on 750 models, unscrew crankcase screws and remove crankcase (31). Remove bearing retainers (33), heat back plate (no more than 300°F) and remove crankshaft with bearing (32). Wrap tape around crankshaft end to protect crankshaft and remove snap ring (34). Press bearing (32) off crankshaft.

On all models, roller bearings and seals may be pressed out of crankcase and back plate using Homelite or other suitable tools. When removing crankcase seal (30), force oil pump worm (29) and seal (30) to outside of crankcase by inserting driver from inside of crankcase. Force bearing (19) to inside of crankcase for removal.

Inspect bearings, seals and "O" ring (20) for damage or excessive wear. When reassembling crankcase, be sure "O" ring (20) is properly seated. Install bearings so unstamped side is towards inside of crankcase and back plate.

CLUTCH. Refer to Fig. HL275 or HL275A for exploded view of clutch assembly. To remove clutch, prevent flywheel rotation by inserting 3/16 inch rod through hole located in 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. Clutch shoes (4) should be renewed as a complete set.

AUTOMATIC CHAIN OIL PUMP. All models are equipped with an automatic oil pump driven by worm (29–Fig. HL274) on crankshaft. Oil is pumped by

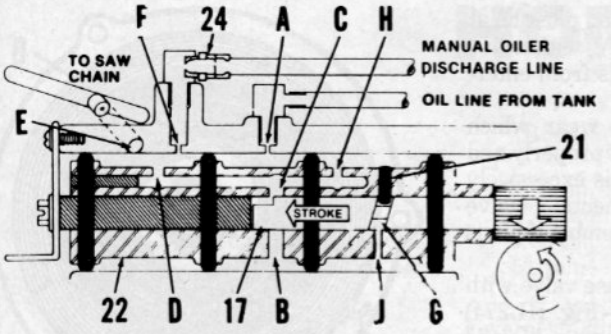


Fig. HL276—Cross-section of oil pump. Refer to text for operation.

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 wall to provide an angle of as close to 90° as shown in Fig. HL278 without pinching line. Elbow threads should be coated with thread sealant.

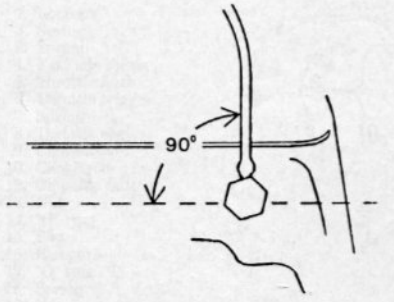


Fig. HL278—Oil line and fitting in oil tank must be angled close to 90° as shown above.

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 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

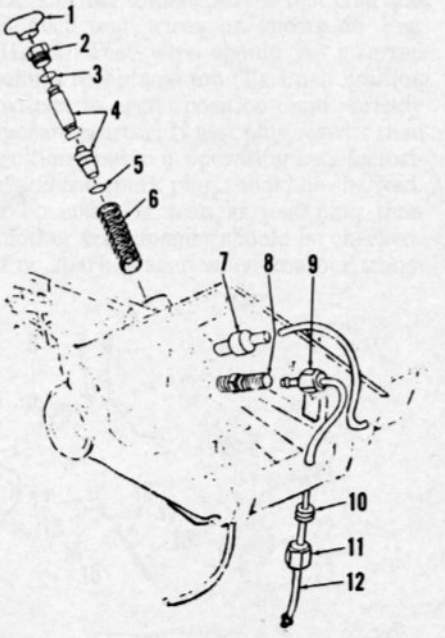


Fig. HL279—Exploded view of manual oil pump. End of oil line (12) is connected to fitting (24—Fig. HL276). Oil line (12) must be disconnected from fitting and pulled into air box for removal.

1. Button
2. Plunger nut
3. "O" ring
4. Plunger assy.
5. "O" ring
6. Spring
7. Check valve
8. Check valve
9. Compression nut
10. Grommet
11. Compression nut

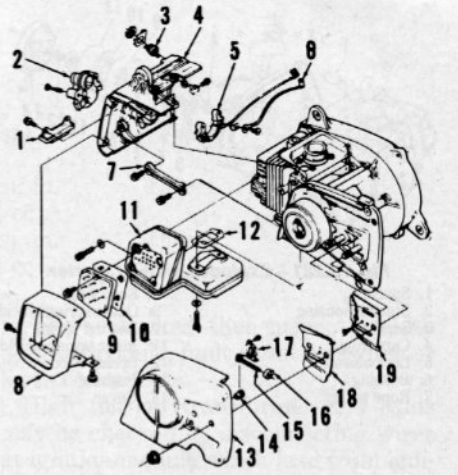


Fig. HL280—Exploded view of exhaust and chain tensioning assemblies.

1. Rear snubber
2. High tension coil
3. Ignition switch
4. Cylinder shield
5. Coil receptacle
6. Ground lead
7. Brace
8. Muffler shield
9. Muffler cap
10. Spark arrestor
11. Muffler
12. Gasket
13. Cover
14. Guide bar adjuster gear
15. Chain tension adjuster screw
16. Pin
17. Gear cover
18. Outer guide bar plate
19. Inner guide bar plate

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 capscrew (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.

COMPRESSION RELEASE. All models are 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

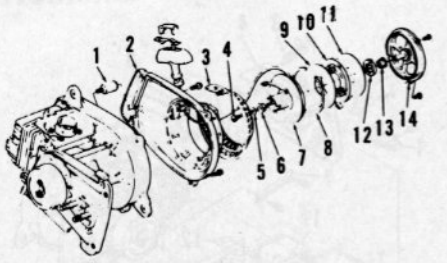


Fig. HL281—Exploded view of starter.

1. Spacer
2. Starter housing
3. Screen
4. Capscrew
5. Lockwasher
6. Bushing
7. Rope pulley
8. Snap ring
9. Outer spring shield
10. Rewind spring
11. Inner spring shield
12. Spring lock
13. Bushing
14. Cover

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 tool A-24876 may be used to seat snap ring in groove.

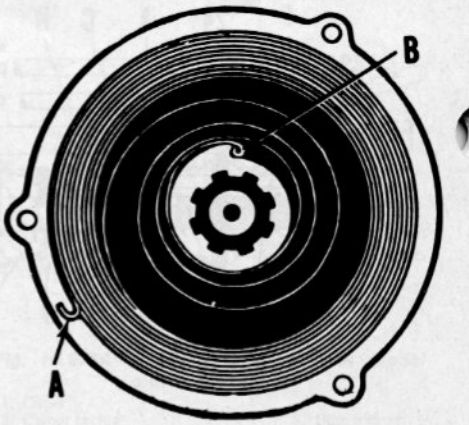


Fig. HL282—View of rewind spring installation in starter cover. Hook outer loop (A) of spring in notch as shown. Inner loop (B) of spring must be curved inward to engage notch of spring lock.

HOMELITE

Model	Bore	Stroke	Displ.	Drive Type
450, 450W 450HG, 450SL	1.875 in. 47.6 mm	1.625 in. 41.3 mm	4.5 cu. in. 74 cc	Direct
550, 550W, 550SL	2.00 in. 51 mm	1.625 in. 41.3 mm	5.1 cu. in. 84 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ6J for all models. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. All models are equipped with a Walbro SDC diaphragm carburetor. Refer to Walbro section of CARBURETOR SERVICE section for carburetor service.

Initial adjustment of idle and high speed mixture screws is one turn open except on 450, 450W, 450HG and 450SL which has a fixed high speed jet and high speed mixture is not adjustable. Adjust idle speed screw so that engine idles at approximately 2400-2600 rpm. Adjust idle mixture screw so engine will accelerate cleanly without bogging. If necessary, readjust idle speed screw to obtain engine idle speed of approximately 2400-2600 rpm.

To adjust high speed mixture screw on 550, 550W and 550SL, proceed as follows: Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle to obtain optimum performance with saw under cutting load.

Starting speed is adjusted by turning slotted head adjustment screw in fast idle latch. See Fig. HL283A. 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 all models. The ignition module is mounted adjacent to the flywheel while the high tension transformer covers the spark plug and is mounted on the cylinder shield. The high tension transformer must be removed for access to spark plug. The ignition module on 450, 450W, 450HG and 450SL uses an electronic governor to prevent overspeeding of engine.

The ignition system is serviced by replacing the spark plug, ignition module, high tension transformer or wires with new components. The ignition system can be checked using a test plug or spark plug with the side electrode removed as follows: Remove the high tension transformer and install the test plug and connect test wires as shown in Fig. HL284. Test wire should be inserted behind receptacle tab (T). Push ignition switch to run position and briskly operate starter. If test plug sparks then ignition system is operating satisfactorily and the spark plug should be checked. If no spark is seen at test plug then another transformer should be checked. If no spark is seen when another transformer is checked, then suspect a faulty ignition module, faulty ignition switch or loose connections.

High tension transformer and leads may be checked by disconnecting wires at ignition module which lead from ignition module to transformer 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 transformer 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

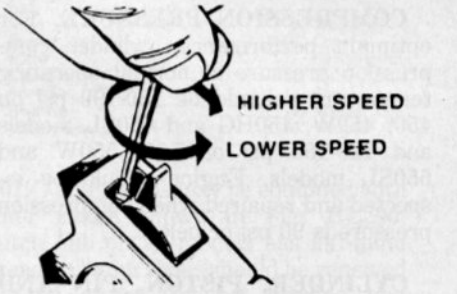


Fig. HL283A — View showing location of fast idle screw.

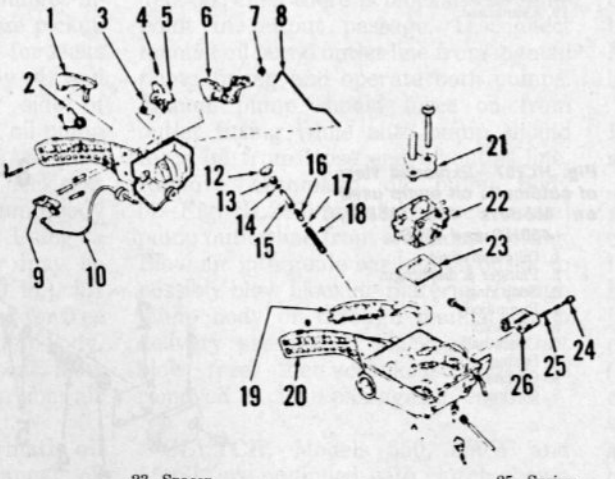


Fig. HL283 — Exploded view of handle, airbox and manual oil pump assemblies.

1. Lockout
2. Spring
3. Spring
4. Fast idle screw
5. Throttle latch
6. Throttle trigger
7. Spring
8. Throttle rod
9. Choke lever
10. Choke rod
12. Oil pump button
13. Nut
14. "O" ring
15. Rod
16. Plunger
17. "O" ring
18. Spring
19. Handle cover
20. Handle & airbox
21. Bracket
22. Carburetor
23. Spacer
24. Idle speed screw
25. Spring
26. Grommet

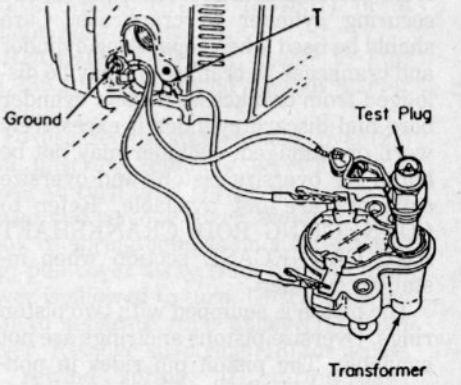


Fig. HL284 — A test plug may be used to determine if ignition system is operating correctly. See text.

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.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

REPAIRS

COMPRESSION PRESSURE. For optimum performance, cylinder compression pressure at normal operating temperature should be 160-190 psi on 450, 450W, 450HG and 450SL models and 125-155 psi on 550, 550W and 550SL models. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CYLINDER, PISTON, PIN AND RINGS. The cylinder may be separated from crankcase after removing screws securing cylinder to crankcase. Care should be used when separating cylinder and crankcase as crankshaft may be dislodged from crankcase. Inspect cylinder bore and discard cylinder if excessively worn or damaged. Cylinder may not be bored for oversize pistons and oversize cylinders are not available. Refer to CONNECTING ROD, CRANKSHAFT AND CRANKCASE section when installing cylinder.

The piston is equipped with two piston rings. Oversize pistons and rings are not available. The piston pin rides in non-renewable needle bearings in piston. Piston and bearings are available only as a unit assembly.

CONNECTING ROD, CRANKSHAFT AND CRANKCASE. Refer to preceding section and remove cylinder. Separate crankshaft assembly from crankcase and disassemble as required. Inspect components and renew any which are damaged.

Connecting rod (11–Fig. HL286) rides on twelve caged bearing rollers (12). The crankshaft is supported by roller bearings (16) which are installed so lettered end is towards snap rings (15).

Tighten connecting rod screws to 65-75 in.-lbs. When assembling crankcase and cylinder, use a suitable sealant on mating surfaces. Be sure components are properly assembled and snap rings (15) engage grooves in cylinder and crankcase. Before final tightening of crankcase screws, lightly tap both ends of crankshaft to obtain proper crankshaft end play. Tighten crankcase retaining screws to 60-70 in.-lbs.

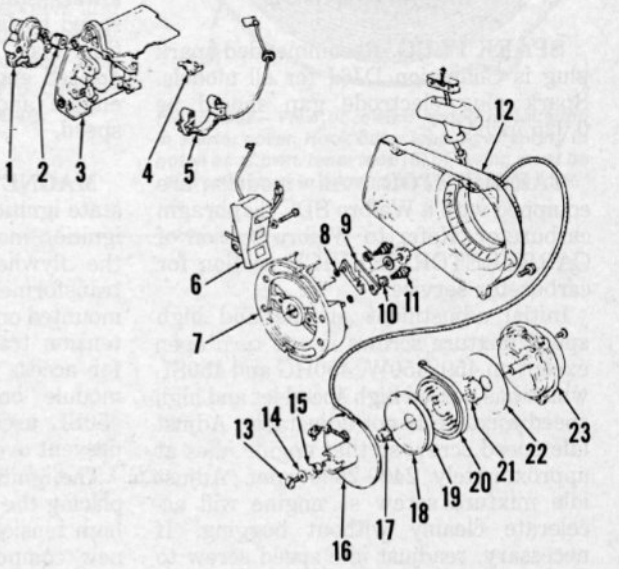


Fig. HL285—Exploded view of ignition system and rewind starter.

1. Transformer
2. Grommet
3. Shield
4. Ignition switch
5. Transformer receptacle
6. Ignition module
7. Flywheel
8. Lockwasher
9. Starter pawl
10. Spring
11. Stud
12. Starter housing
13. Screw
14. Washer
15. Bushing
16. Rope pulley
17. Bushing
18. Snap ring
19. Outer spring shield
20. Rewind spring
21. Spring lock
22. Inner spring shield
23. Cover

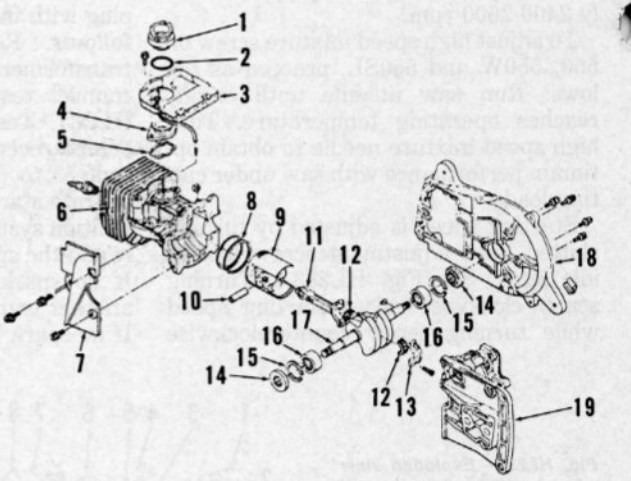


Fig. HL286—Exploded view of engine.

1. Connector
2. Garter spring
3. Air deflector & seal
4. Intake manifold
5. Gasket
6. Cylinder
7. Shield
8. Piston rings
9. Piston
10. Piston pin
11. Connecting rod
12. Bearing
13. Rod cap
14. Seal
15. Snap ring
16. Bearing
17. Crankshaft
18. Backplate
19. Crankcase

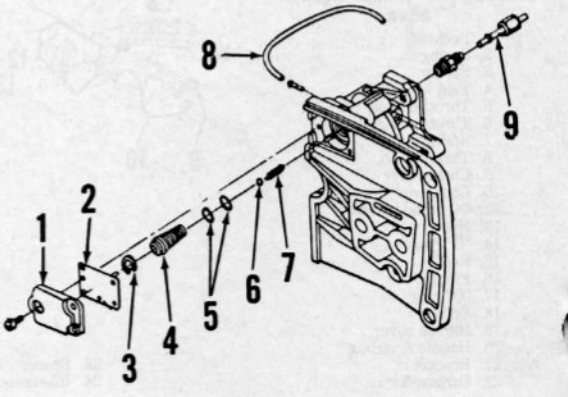


Fig. HL287—Exploded view of automatic oil pump used on Models 450, 450W, 450HG and 450SL.

1. Oil pump cover
2. Plunger & diaphragm
3. Snap ring
4. Pump body
5. "O" rings
6. Check ball
7. Spring
8. Oil line
9. Oil line

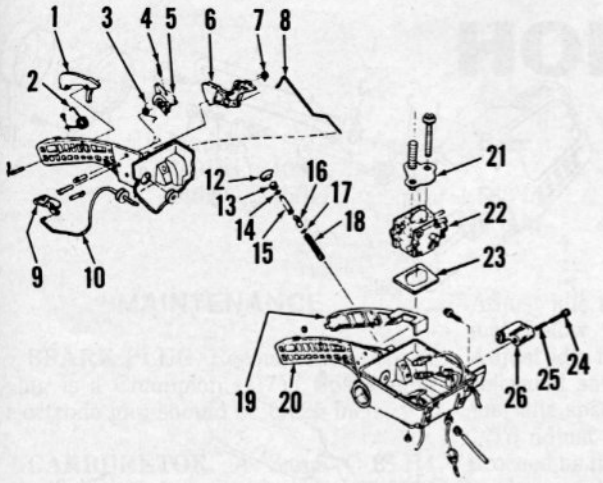


Fig. HL288—Exploded view of automatic oil pump used on Models 550, 550W and 550SL.

1. Oil pump cover
2. Gaskets
3. Plunger & diaphragm
4. Spring
5. Snap ring
6. "O" rings
7. Pump body
8. Check ball
9. Spring
10. Oil line
11. Oil line

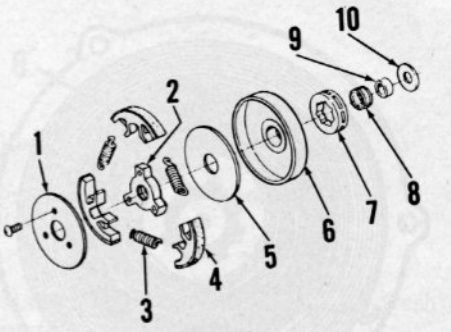


Fig. HL289—View of Model 550, 550W and 550SL clutch.

1. Cover plate
2. Hub
3. Spring
4. Shoe
5. Washer
6. Clutch drum
7. Sprocket
8. Bearing
9. Inner race
10. Washer

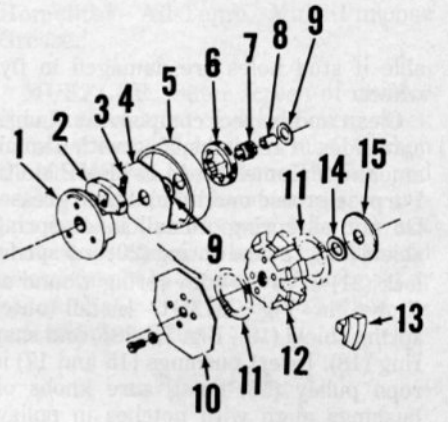


Fig. HL290—Exploded view of two clutches which may be used on Models 450, 450W, 450HG and 450SL.

1. Hub
2. Shoe
3. Spring
4. Plate
5. Clutch drum
6. Sprocket
7. Bearing
8. Inner race
9. Washer
10. Cover
11. Garter spring
12. Hub
13. Shoe
14. Washer
15. Washer

AUTOMATIC OIL PUMP. All models are equipped with an automatic oil pump. Refer to Fig. HL287 or HL288 for an exploded view of oil pump. Check ball must move freely for proper pump operation. Oil pump output is not adjustable. Note the following trouble-shooting procedure:

Automatic oil pump fails but manual oiler functions: Check automatic oil pump pickup for blockage. Connect a vaccum gage to pickup line and run saw at wide open throttle under no load or while cutting and note vacuum gage reading. A good pump will develop 25-28 inches of vacuum (Mercury). Remove oil pump cover (1—Fig. HL287) and check for cracks, and on early models, be sure lead shot plug in cover is sealing properly, otherwise, the pump cover must be renewed. Lightly push on plunger (2) and note if plunger is lifting ball check valve (6) off its seat. Also check for binding of plunger in bore and for a defective diaphragm. Plunger must not turn in diaphragm. There must be sufficient oil film in pump body (4) so "O" ring on plunger of later models does not drag. Pulse and vent holes must be open. Blow air through system from strainer end of pickup; air should exit through plunger bore of pump body (4). With plunger inserted in pump body, pressurize pickup line at strainer end and check for leaks in line or between pump body (4) and plunger. Pressurize delivery side of automatic oil pump at manual oil pump fitting so air exits from guide bar pad, then plug guide bar pad hole. Check that check ball (6) is seating and pump body "O" rings (5) do not leak. Using a suitable tool (an old plunger may be reduced in diameter by 0.020 in.), lift check ball (6) off its seat to check for free flow through delivery end of pump body. With check ball lifted off its seat, blow air into strainer end of pickup line; air should exit from guide bar pad.

Manual oiler fails but automatic oil pump functions: Check manual oil pump pickup for blockage. Disconnect outlet line fitting from manual oil pump then blow air into outlet line; air should exit from guide bar pad. DO NOT USE EXCESSIVE AIR PRESSURE AS SEAL AT CRANKCASE MAY BE DAMAGED. If air does not exit from bar pad then blockage exists in line, crankcase fitting or in crankcase passage prior to joining common delivery passage with auto oil pump. This test will also reveal leaks in line and fittings. Pressurize pickup line at strainer end and check for leaks in line, fittings and around pump plunger "O" rings (14 and 17—Fig. HL283). Remove manual oil pump and inspect components and be sure all parts operate freely. Be sure spring returns pump to full up/intake position.

Automatic and manual oil pump malfunction: Be sure oil tank is filled with proper oil. Operate manual oil pump. If manual oil pump operates freely, check for blocked oil pickup strainers and improperly positioned pickup lines. Reinstall oil tank cap, but do not tighten. Operate both oil pumps. If pumps work satisfactorily, then renew oil tank cap as it is not venting properly.

If manual oil pump builds pressure when operated so that plunger will not depress, then there is blockage at some point in output passage. Disconnect manual oil pump outlet line from manual pump fitting and operate both pumps. Manual pump should force oil from outlet fitting while auto pump should force oil from loose end of outlet line. Remove automatic oil pump body (4—Fig. HL287) and disconnect manual pump outlet line from crankcase fitting. Blow air into guide bar pad oil outlet to possibly blow blocking material through pump body or through manual pump delivery passage. If blockage will not blow free, then crankcase must be removed to clean passages in engine.

CLUTCH. Models 550, 550W and 550SL are equipped with clutch shown in Fig. HL289 while Models 450, 450W, 450HG and 450SL may be equipped with either clutch shown in Fig. HL290. Clutch hub on all models has left-hand threads. Clutch shoes should be renewed only as a set. Inspect bearing and lubricate with Homelite ALL-TEMP Multi-Purpose Grease (#24551) or a lithium base grease.

RECOIL STARTER. Refer to Fig. HL285 for an exploded view of starter assembly.

To disassemble starter, hold cover (23) 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 (13) to separate rope pulley (16) from cover. Remove snap ring (18) for access to rewind spring. If starter pawl assemblies must be removed, unscrew housing screws and remove starter housing (12). Threaded inserts are avail-

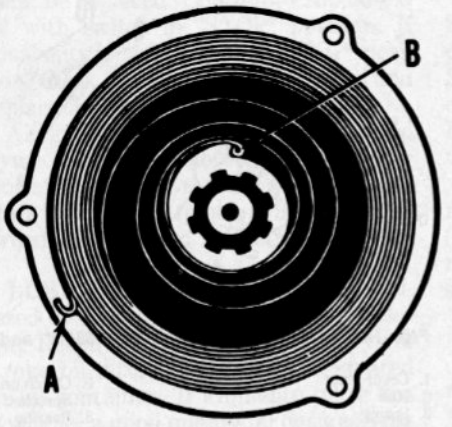


Fig. HL291—View of rewind spring installation in starter cover. Hook outer loop (A) of spring in notch as shown. Inner loop (B) of spring must be curved inward to engage notch of spring lock.

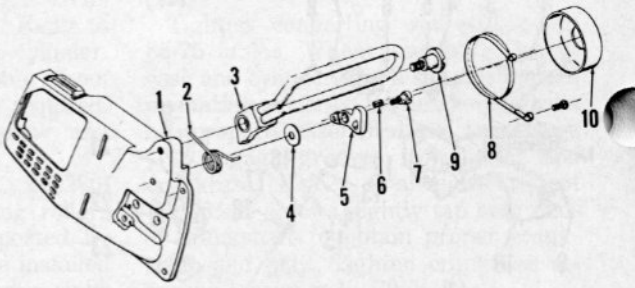


Fig. HL292—Exploded view of chain brake used on Model 450SL.

1. Cover
2. Spring
3. Actuating lever
4. Washer
5. Latch
6. Roll pin
7. Shoulder screw
8. Brake band
9. Shoulder screw
10. Drum

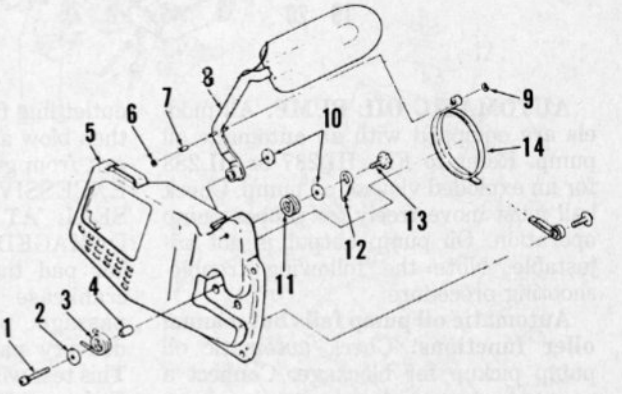


Fig. HL293—Exploded view of chain brake used on Model 550SL.

1. Screw
2. Washer
3. Spring
4. Sleeve
5. Cover
6. "E" ring
7. Roller
8. Actuating lever
9. "E" ring
10. Washers
11. Spring
12. Latch
13. Shoulder screw
14. Brake band

able 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 (22), rewind spring (20) and spring lock (21) in cover with spring wound as shown in Fig. HL291. Install outer spring shield (19—Fig. HL285) and snap ring (18). Insert bushings (15 and 17) in rope pulley (16) 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 capscrew (13) 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.

CHAIN BRAKE. Models 450SL and 550SL are equipped with a chain brake mechanism (Fig. HL292 or HL293) to stop saw chain motion in the event of kickback. In the event of kickback, the operator's left hand will force brake actuating lever forward and brake band 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 actuating 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.

HOMELITE

Model	Bore	Stroke	Disp.	Drive Type
240HG, 240SL, 245HG, 245SL	1.563 in. 40 mm	1.250 in. 32 mm	2.4 cu. in. 40 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion DJ7Y. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. A Zama C-1S-H4 diaphragm carburetor is used on 240HG and 240SL models while 245HG and 245SL models may be equipped with either a Walbro WT-19 or Zama C-1S-H8 diaphragm carburetor. Refer to Fig. HL300 for an exploded view of Zama C-1S-H4 carburetor; Zama C-1S-H8 carburetor is similar. Refer to CARBURETOR SERVICE section for an exploded view of Walbro WT carburetor.

Initial adjustment of idle and high speed mixture screws is one turn open. Adjust idle speed screw so engine idles just below clutch engagement speed. Adjust idle mixture screw so engine accelerates smoothly. If necessary, readjust idle speed screw.

To adjust high speed mixture screw, proceed as follows. Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle to obtain optimum performance with saw under cutting load.

MAGNETO AND TIMING. A solid-state ignition is used on all models. The solid-state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated an oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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 cleaned and lubricated periodically with Homelite® All-Temp Multi-Purpose Grease.

MUFFLER. Outer screen of muffler should be cleaned of debris every week or after each 50 hours of use. 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. Refer to Fig. HL302 when reassembling muffler.

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, re-

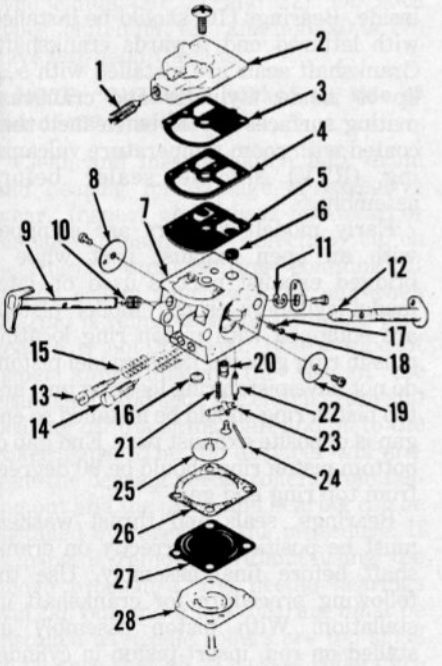


Fig. HL300—Exploded view of Zama C-1S-H4 carburetor. Zama C-1S-H8 carburetor is similar.

1. Idle speed screw
2. Fuel pump cover
3. Gasket
4. Plate
5. Fuel pump diaphragm
6. Screen
7. Body
8. Throttle plate
9. Throttle shaft
10. Spring
11. "E" ring
12. Choke shaft
13. Idle mixture screw
14. High speed mixture screw
15. Spring
16. Plug
17. Spring
18. Detent ball
19. Choke plate
20. Check valve
21. Spring
22. Fuel inlet valve
23. Metering lever
24. Pin
25. Metering disc
26. Gasket
27. Metering diaphragm
28. Cover

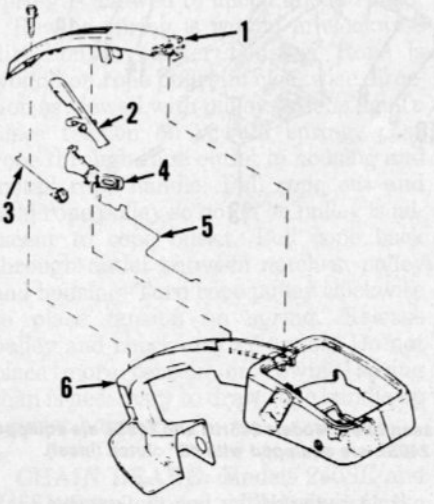


Fig. HL301—View of trigger assembly used on 240HG and 240SL models.

1. Handle cover
2. Interlock
3. Spring
4. Throttle trigger
5. Throttle rod
6. Filter chamber

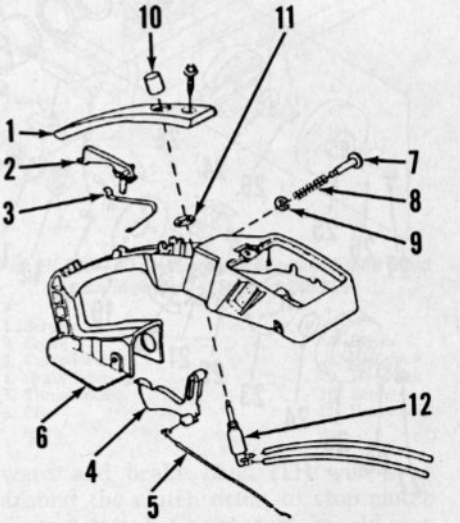


Fig. HL301A—View of trigger assembly and manual oil pump used on 245HG and 245SL models.

1. Handle cover
2. Interlock
3. Spring
4. Throttle trigger
5. Throttle cable
6. Filter chamber
7. Throttle lock pin
8. Spring
9. "E" ring
10. Button
11. Nut
12. Manual oil pump

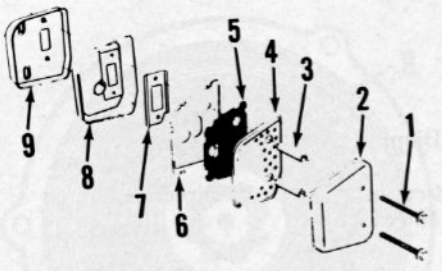


Fig. HL302—Exploded view of muffler.

1. Screw
2. Cap
3. Spacer
4. Outer baffle
5. Screen
6. Inner baffle
7. Support
8. Body
9. Deflector

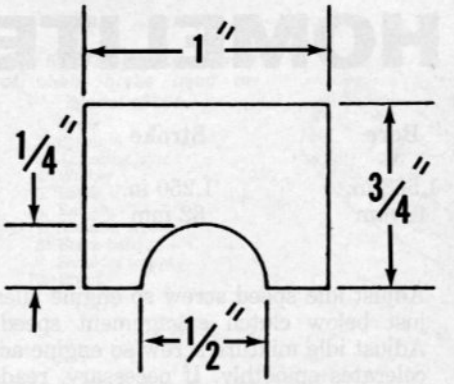


Fig. HL304—Shims used in crankshaft assembly may be made by putting 0.015 inch thick plastic, metal, or other suitable material in the outline shown above. Refer to Fig. HL305 and text.

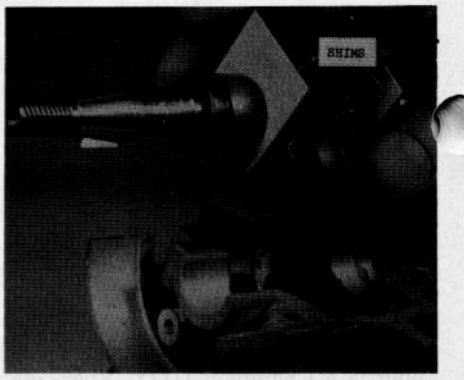


Fig. HL305—View showing placement of shims (Fig. HL304) between thrust washers (9—Fig. HL303) and bearings (10) for correct crankshaft assembly. Refer to text.

duce or increase given values by 10 percent.

Carburetor retaining screws	20-30
Chain brake band	30-40
Chain brake lever	40-50
Clutch hub	100-150
Clutch nut	75-100
Crankcase screws	60-75
Flywheel	100-150
Ignition module	30-40
Muffler	70-80
Spark plug	150
Starter pulley screw	40-50
Vibration isolator	40-50

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 130-160 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

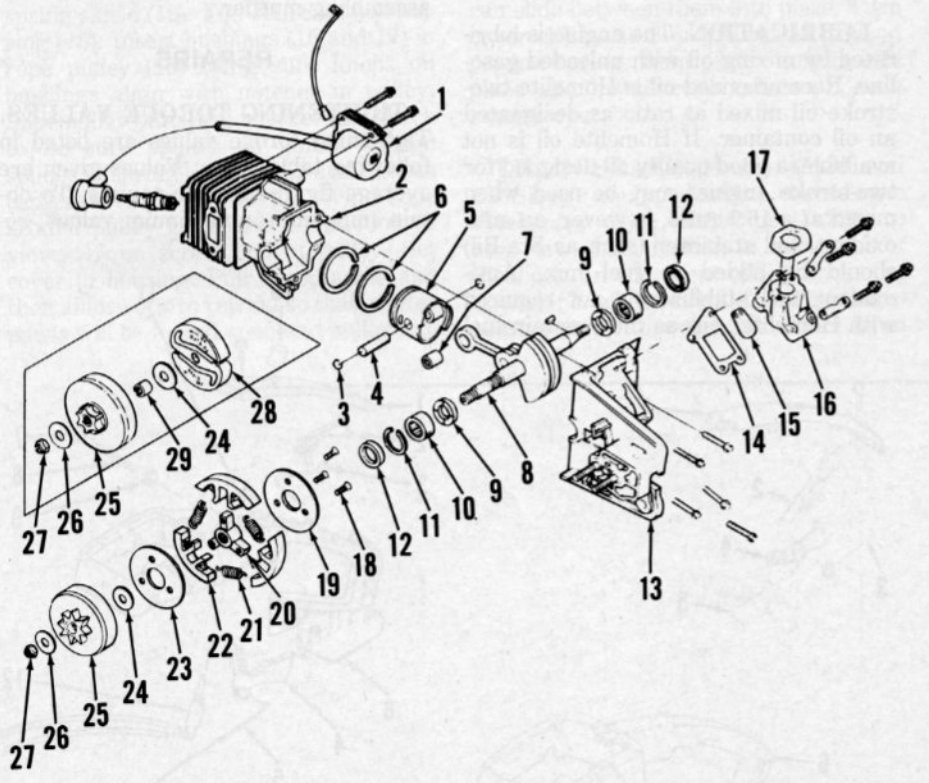


Fig. HL303—Exploded view of engine and clutch assemblies. Models 245HG and 245SL are equipped with three-shoe clutch. Models 240HG and 240SL are equipped with "S" clutch (inset).

1. Ignition module
2. Cylinder
3. Retainer
4. Piston pin
5. Piston
6. Piston rings
7. Needle bearing
8. Crankshaft
9. Thrust bearing
10. Needle bearing
11. Retaining ring
12. Seal
13. Crankcase
14. Gasket
15. Reed petal
16. Intake manifold
17. Gasket
18. Screw
19. Cover plate
20. Clutch hub
21. Clutch spring
22. Clutch shoe
23. Cover plate
24. Thrust washer
25. Clutch drum/bearing
26. Thrust washer
27. Nut
28. "S" clutch/hub
29. Needle bearing

CYLINDER, PISTON, PIN AND RINGS. Cylinder may be removed after unscrewing socket head capscrews in bottom of crankcase (13—Fig. HL303). 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.

Inspect crankshaft bearings and renew if scored or worn. Thrust washers (9) should be installed with shoulder to inside. Bearings (10) should be installed with lettered end towards crankshaft. Crankshaft seals are installed with seal lip to inside. Cylinder and crankcase mating surfaces should be cleaned then coated with room temperature vulcanizing (RTV) silicone sealer before assembly.

Early model cylinders are equipped with an open exhaust port while a bridged exhaust port is used on later model cylinders. Early model pistons are equipped with piston ring locating pins in ring groove. Later model pistons do not have piston ring locating pins and top piston ring should be installed so end gap is opposite exhaust port. End gap of bottom piston ring should be 90 degrees from top ring end gap.

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 rings are properly located. Install thrust washers (9), bearings (10), retaining rings (11) and seals (12) on crankshaft. Place 0.015 inch thick shims shown in Fig. HL304 between thrust washers and bearings as shown in Fig. HL305. 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. Before final tightening of

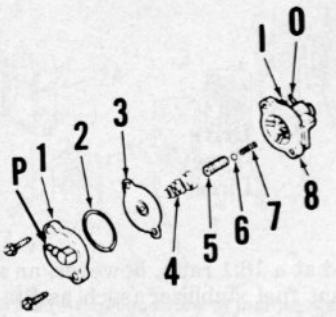


Fig. HL307—Exploded view of automatic oil pump. Oil enters pump through inlet tube (I) and exits through tube (E). Diaphragm (3) is actuated by crankcase pulsations through pulse fitting (P).

1. Cover
2. "O" ring
3. Diaphragm & plunger
4. Spring
5. Stud
6. Check ball
7. Spring
8. Body

crankcase screws, lightly tap both ends of crankshaft to obtain proper crankshaft end play, then tighten crankcase screws.

CLUTCH. Refer to Fig. HL303 for exploded view of clutch assemblies used. Models 240HG and 240SL are equipped with the "S" type centrifugal clutch (28) shown in inset while Models 245HG and 245SL are equipped with the three-shoe type clutch (20, 21 and 22). On both types, clutch nut (27) and hub (20 or 28) have left-hand threads.

NOTE: "OUTSIDE" marked on side of hub of "S" type clutch.

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 can be installed without using above procedure since wear has not yet loosened rollers.

CHAIN OIL PUMP. All models are equipped with a crankcase pulse actuated automatic chain oiler pump. Crankcase pulses actuate diaphragm and plunger (3—Fig. HL307) to force oil out oil outlet (0). Inspect diaphragm (3) and "O" ring (2) for leaks.

Models 245HG and 245SL are also equipped with a manual oil pump (12—Fig. HL301A) to supply additional lubrication when required. Individual manual oil pump components are not available and pump must be renewed as a unit assembly.

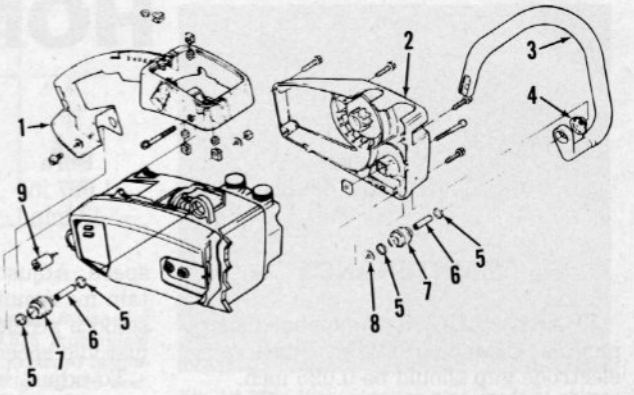


Fig. HL308—View showing vibration isolator assemblies.

1. Filter chamber
2. Starter housing
3. Handle
4. Washer
5. Ring
6. Spacer
7. Isolator
8. Washer
9. Shear isolator

VIBRATION ISOLATORS. All models are equipped with vibration isolators between engine and engine housing. Vibration isolators may be renewed after removing handle bar (3—Fig. HL308), starter housing (2) and air box (1). Use Fig. HL308 as a guide to reassemble vibration isolator components.

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. HL309) 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.

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.

CHAIN BRAKE. Models 240SL and 245SL are 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 (4—Fig. HL310) forward and brake band (11) will wrap around the clutch drum to stop clutch drum rotation. 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.

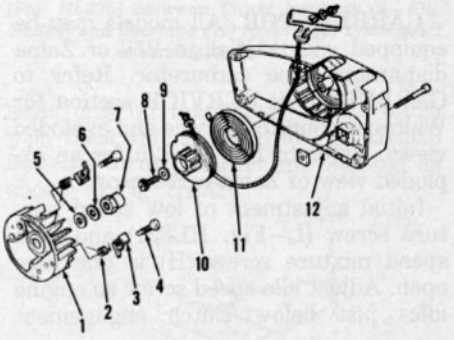


Fig. HL309—Exploded view of recoil starter.

1. Flywheel
2. Spring
3. Pawl
4. Pawl pin
5. Washer
6. Lockwasher
7. Nut
8. Screw
9. Washer
10. Rope pulley
11. Rewind spring
12. Starter housing

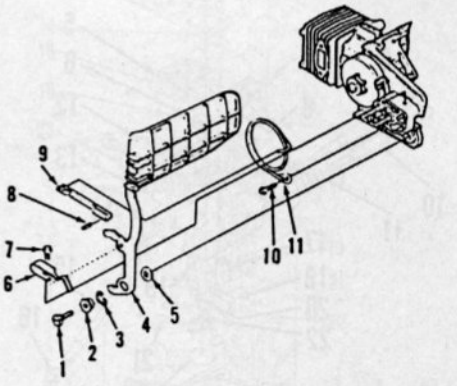


Fig. HL310—Exploded view of chain brake used on Models 240SL and 245SL.

1. Screw
2. Cam
3. Curved washer
4. Brake lever
5. Thrust washer
6. Clip
7. Screw
8. Roll pin
9. Pivot link
10. Screw
11. Brake band

HOMELITE

Model	Bore	Stroke	Displ.	Drive Type
330, 330SL, 330W	1.687 in. 43 mm	1.464 in. 37 mm	3.27 cu. in. 53.6 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ7Y. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. All models may be equipped with a Walbro WT or Zama diaphragm type carburetor. Refer to CARBURETOR SERVICE section for Walbro carburetor service and exploded views. Refer to Fig. HL320 for an exploded view of Zama carburetor.

Initial adjustment of low speed mixture screw (L–Fig. HL321) and high speed mixture screw (H) is one turn open. Adjust idle speed screw so engine idles just below clutch engagement speed. Adjust low mixture screw to obtain maximum engine speed at idle and smooth acceleration. If necessary readjust idle speed screw.

To adjust high speed mixture screw, proceed as follows: Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle to obtain optimum performance with saw under cutting load.

MAGNETO AND TIMING. A solid state ignition is used on all models. The solid state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module.

Although ignition system malfunctions are usually caused by spark plug and/or ignition module failure, erratic engine operation, especially under load, may be due to ignition switch lead wire grounding on the cylinder or muffler. Make certain switch lead wire is routed and secured as shown in Fig. HL322A and wire connections at ignition switch are properly positioned to prevent contact with cylinder or muffler. Ignition switch ground wire should be secured to saw at a 45-degree angle from saw centerline (not straight back).

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

MUFFLER. Muffler should be disassembled, cleaned of debris and inspected every week or as required. Renew muffler components that are cracked or worn excessively. Carbon should be removed from muffler and engine ports to

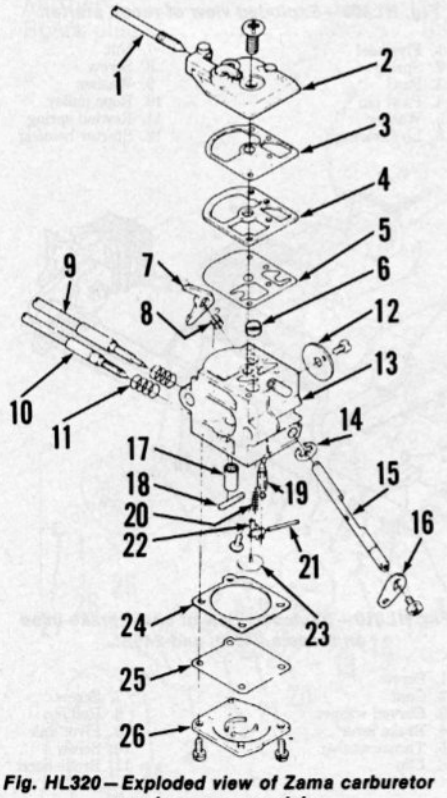


Fig. HL320—Exploded view of Zama carburetor used on some models.

1. Idle speed screw
2. Fuel pump cover
3. Gasket
4. Plate
5. Fuel pump diaphragm
6. Screen
7. Throttle stop lever
8. Spring
9. Idle mixture screw
10. High speed mixture screw
11. Spring
12. Throttle plate
13. Body
14. "E" ring
15. Throttle shaft
16. Lever
17. Check valve
18. Retainer
19. Fuel inlet valve
20. Spring
21. Pin
22. Metering lever
23. Metering disc
24. Gasket
25. Metering diaphragm
26. Cover

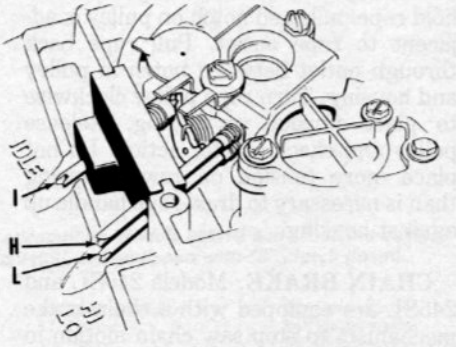


Fig. HL321—View showing location of idle speed screw (I), low speed mixture screw (L) and high speed mixture screw (H).

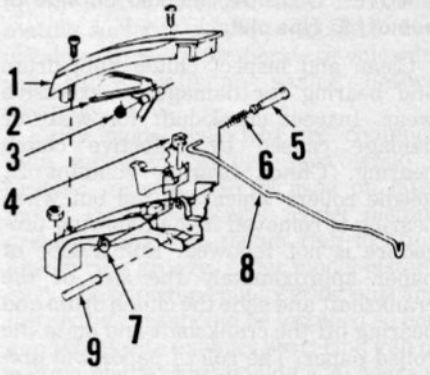


Fig. HL322—View of trigger assembly.

1. Handle cover
2. Interlock
3. Spring
4. Throttle trigger
5. Throttle lock pin
6. Spring
7. "E" ring
8. Throttle rod
9. Groove pin

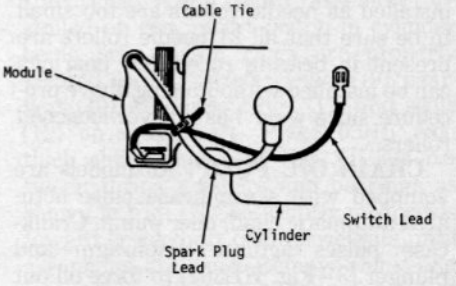


Fig. HL322A—Route and secure ignition switch lead as shown to prevent "shorting out" of ignition system. Refer to text.

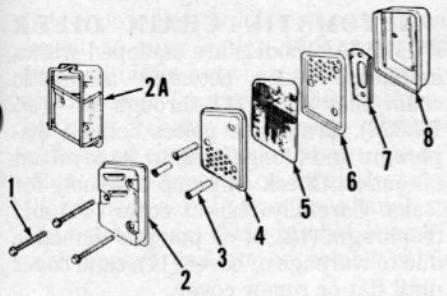


Fig. HL323—Exploded view of muffler. Cap (2A) is used on Model 330W.

1. Screw
2. Cap
3. Spacer
4. Outer baffle
5. Screen
6. Inner baffle
7. Plate
8. Body

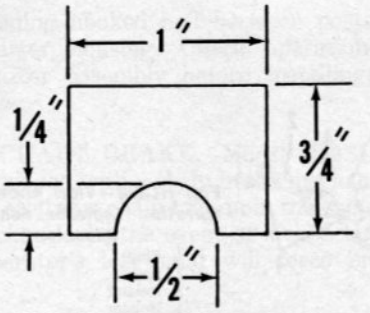


Fig. HL325—Shims used in crankshaft assembly may be made by cutting 0.015 inch thick plastic, metal or other suitable material in the outline shown above. Refer to Fig. HL326 and text.

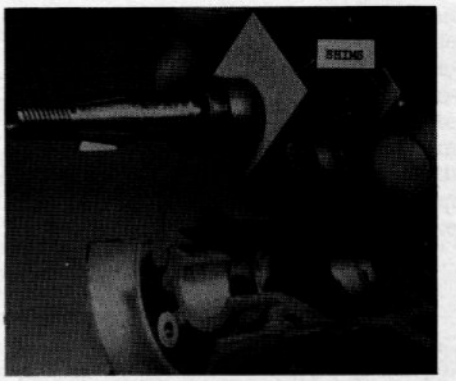


Fig. HL326—View showing placement of shims (Fig. HL325) between thrust washers (9—Fig. HL324) and bearings (10) for correct crankshaft assembly. Refer to text.

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. Refer to Fig. HL323 when reassembling muffler.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values are listed in following table. Note: Values given are average figures in inch-pounds.

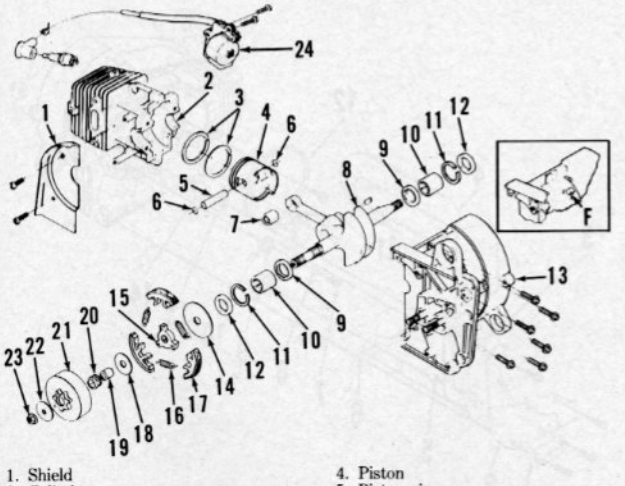
	Min.-Max.
Carburetor retaining screws	20-30
Chain brake band	70-80
Chain brake shield	40
Chain stop	30-40
Clutch nut	100-120
Crankcase screws	60-70
Flywheel	250-300
Ignition module	70-80
Muffler	60-70
Spark plug	120-180
Starter pulley	40-50
Vibration isolator	40-50

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 130-160 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CYLINDER, PISTON, PIN AND RINGS. Cylinder may be removed after unscrewing socket head cap screws in bottom of crankcase (13—Fig. HL324). 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.

Inspect crankshaft bearings (10) and renew if scored or worn. 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 rings are aligned on locating pins. Install thrust washers (9), bearings (10), retaining rings (11) and seals (12) on crankshaft. Place 0.015 inch thick shims shown in Fig. HL325 between thrust washers and bearings as shown in Fig. HL326.



1. Shield
2. Cylinder
3. Piston rings
4. Piston
5. Piston pin
6. Retainer

Fig. HL324—Exploded view of engine and clutch assemblies. Pulse fitting (F) is connected to oil pump pulse hose.

7. Needle bearing
8. Crankshaft
9. Thrust washer
10. Needle bearing
11. Retainer ring
12. Seal
13. Crankcase
14. Thrust washer
15. Hub
16. Spring
17. Shoe
18. Thrust washer
19. Inner race
20. Roller bearing
21. Clutch drum
22. Thrust washer
23. Nut
24. Ignition module

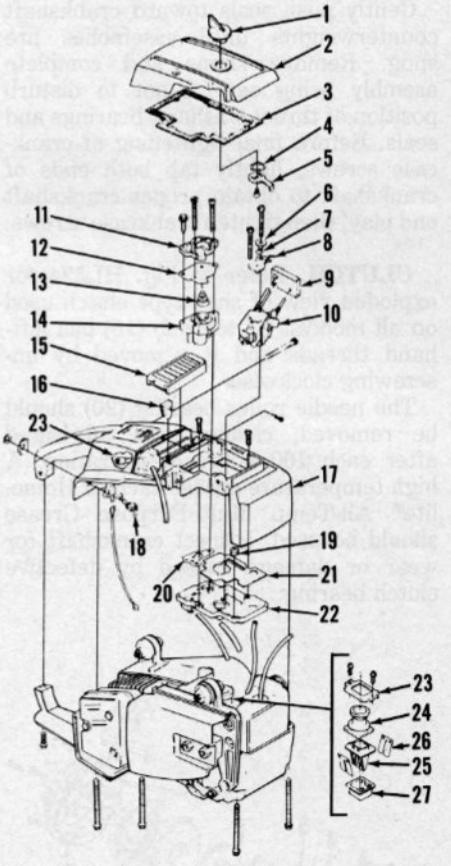


Fig. HL328—Exploded view of oil pump and air box assemblies.

1. Choke knob
2. Cover
3. Gasket
4. Wave washer
5. Choke lever
6. Spacer
7. Wave washer
8. Choke plate
9. Grommet
10. Carburetor
11. Oil pump cover
12. Diaphragm & plunger
13. Spring
14. Oil pump body
15. Air filter
16. Grommet
17. Top engine housing
18. Ignition switch
19. Grommet
20. Gasket
21. Gasket
22. Plate
23. Retainer
24. Boot
25. Reed seat
26. Reed valve
27. Reed retainer

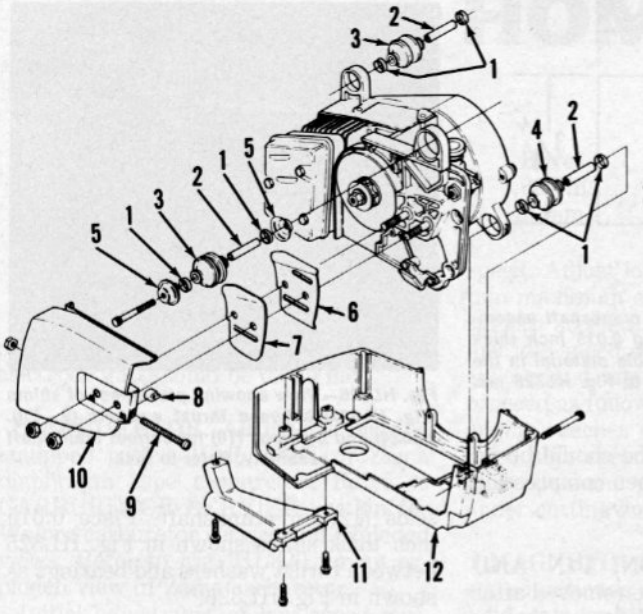


Fig. HL329—View showing vibration isolator assemblies.

1. Ring
2. Spacer
3. Isolator
4. Isolator
5. Washer
6. Inner guide plate
7. Outer guide plate
8. Bar adjusting pin
9. Bar adjusting screw
10. Cover
11. Handle brace
12. Bottom engine housing

Gently push seals toward crankshaft counterweights until assemblies are snug. Remove shims and complete asembly being careful not to disturb position of thrust washers, bearings and seals. Before final tightening of crankcase screws, lightly tap both ends of crankshaft to obtain proper crankshaft end play, then tighten crankcase screws.

CLUTCH. Refer to Fig. HL324 for exploded view of shoe type clutch used on all models. Clutch hub (15) has left-hand threads and is removed by unscrewing clockwise.

The needle roller bearing (20) should be removed, cleaned and lubricated after each 100 hours of operation. A high temperature grease such as Homelite® All-Temp Multi-Purpose Grease should be used. Inspect crankshaft for wear or damage caused by defective clutch bearing.

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), check for broken, weak or distorted clutch springs.

PYRAMID REED VALVE. A pyramid type reed intake valve seat (25—Fig. HL328) and four reeds (26) are used. Reeds are retained on pins projecting from the reed seat by retainer (27). 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 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. All models are equipped with a crankcase pulse actuated automatic chain oiler pump (11 through 14—Fig. HL328). Crankcase pulses actuate diaphragm and plunger (12) to force oil out oil outlet. Check oil pump assembly for leaks. Carefully inspect cover (11) and diaphragm (12). If oil pump is defective due to warpage of cover (11), sand cover until flat or renew cover.

VIBRATION ISOLATORS. All models are equipped with vibration isolators between engine and engine housing. Vibration isolators may be renewed after removing top engine housing (17—Fig. HL328) and bottom engine housing (12—Fig. HL329). Use Fig. HL329 as a guide to reassemble vibration isolator components.

RECOIL STARTER. To service recoil starter, unscrew mounting screws and remove starter housing (11—Fig. HL330). Rotate ratchet (6) until it stops at end of shaft on pulley (8), then slide ratchet lever (7) off ratchet. 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 (4) and disengage ratchet (6) from pulley shaft. Detach rope handle, then remove pulley from starter housing while being careful not to dislodge rewind spring in housing.

When assembling starter, wind rope around rope pulley in a clockwise direction as viewed with pulley in housing. Pass rope through rope outlet in housing and install rope handle. Place pulley in housing. Reinstall ratchet (6) on pulley shaft and secure assembly with flat washer (5) and screw (4). To place tension on rewind spring, pull rope out and

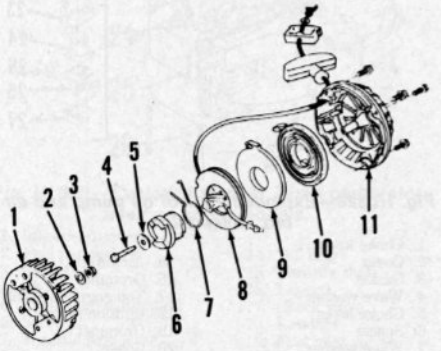


Fig. HL330—Exploded view of recoil starter.

1. Flywheel
2. Washer
3. Nut
4. Screw
5. Washer
6. Ratchet
7. Ratchet lever
8. Rope pulley
9. Spring case
10. Rewind spring
11. Starter housing

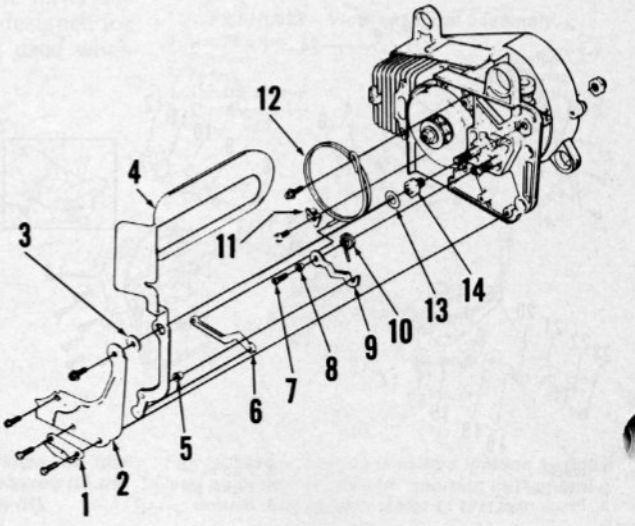


Fig. HL331—Exploded view of chain brake used on Model 330SL.

1. Chain stop
2. Shield
3. Washer
4. Brake lever
5. Bushing
6. Link
7. Screw
8. Spacer
9. Detent
10. Spring
11. Bracket
12. Brake band
13. Spring washer
14. Insert

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. Slide ratchet lever (7) with hooked end up, on ratchet while guiding hooked end between posts of starter housing. Check operation of starter assembly before installing on saw.

CHAIN BRAKE. Model 330SL 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 (4–Fig. HL331) forward and brake band (12) will wrap around the clutch drum to stop clutch drum rotation. 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.

HOMELITE

Model	Bore	Stroke	Displ.	Drive Type
410	1.937 in. 49 mm	1.375 in. 35 mm	4.10 cu. in. 67 cc	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ7Y. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. Model 410 is equipped with a Walbro WS diaphragm carburetor. Refer to Walbro section of CARBURETOR SERVICE section for carburetor overhaul and exploded view.

Remove carburetor cover to perform initial carburetor adjustments. Initial adjustment of idle speed screw (I–Fig. HL340) is ½-¾ turn clockwise after lobe on idle speed screw just contacts throttle stop lever (T). Initial adjustment of low speed mixture screw (L) is 1-1¾ turns open and high speed mixture screw (H) is 1-1¼ turns open. Install carburetor cover and start saw.

Adjust low mixture screw to obtain maximum engine speed at idle and smooth acceleration, then adjust idle speed screw so engine idles just below clutch engagement speed.

To adjust high speed mixture screw, proceed as follows: Run saw at idle until engine reaches operating temperature. Turn high speed mixture needle to obtain optimum performance with saw under cutting load.

Note check valve (20–Fig. HL341) and filter (19) which are used to vent fuel tank. Filter must be clean and valve must operate properly for required fuel flow to carburetor.

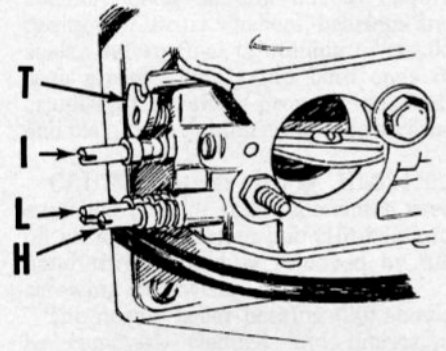


Fig. HL340—View of carburetor adjustment screws. Refer to text for adjustment.

MAGNETO AND TIMING. Model 410 is equipped with a solid-state ignition. The solid-state ignition system is serviced by renewing the spark plug and/or ignition module. Air gap between ignition module and flywheel is adjustable. Adjust air gap by loosening module retaining screws and place a 0.015 inch shim stock between flywheel and module.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

MUFFLER. Muffler should be disassembled and periodically cleaned. Renew muffler components that are cracked or worn excessively. Check engine exhaust port and remove excessive carbon build-up as required. Do not allow loose carbon to enter cylinder and be careful not to damage exhaust port on piston. Refer to Fig. HL342 when reassembling muffler.

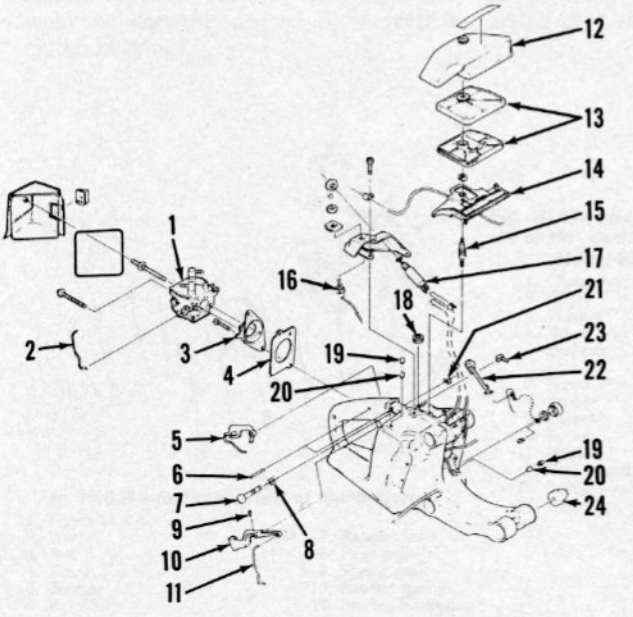


Fig. HL341—Exploded view of handle assembly.

1. Carburetor
2. Throttle rod
3. Plate
4. Spacer
5. Trigger lock
6. Pin
7. Throttle lock pin
8. Spring
9. Set screw
10. Trigger
11. Throttle rod
12. Cover
13. Air filter
14. Support
15. Stud
16. Ignition switch
17. Manual oil pump
18. Boot
19. Filter
20. Check valve
21. "E" ring
22. Choke rod
23. Retainer
24. Vibration isolator

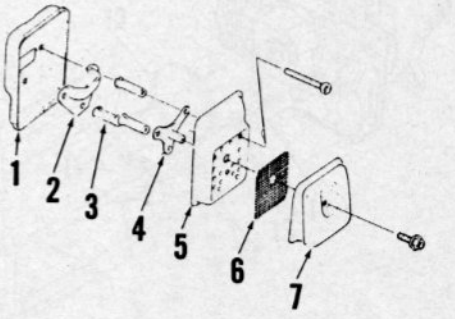


Fig. HL342—Exploded view of muffler.

1. Body
2. Plate
3. Spacer
4. Spacer plate
5. Cover
6. Screen
7. Cap

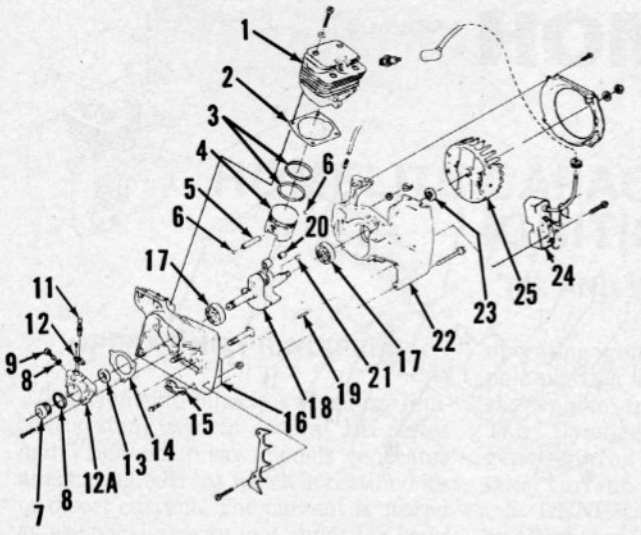


Fig. HL343—Exploded view of engine and oil pump.

1. Cylinder
2. Gasket
3. Piston rings
4. Piston
5. Piston pin
6. Retainer
7. Worm
8. Felt seal
9. Cam screw
10. Gasket
11. Plunger & gear
12. Retainer
12A. Auto. oil pump body
13. Seal
14. Gasket
15. Chain stop
16. Crankcase half
17. Ball bearing
18. Crankshaft
19. Dowel pin (2)
20. Needle bearing
21. Key
22. Crankcase half
23. Seal
24. Ignition module
25. Flywheel

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values are listed in following table. Note: Values given are average figures in inch-pounds.

	Min.-Max.
Auto oil pump	40-50
Auto oil pump cam screw	50-60
Carburetor adapter	30-40
Carburetor retaining screws	40-50
Chain stop	30-40
Clutch cover	40-50
Clutch hub	350-450
Crankcase screws	80-90
Flywheel	250-300
Ignition module	50-60
Muffler	80-90
Muffler exhaust cap	40-50
Spark plug	120-180
Starter pulley	10-20
Vibration isolator	60-70

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 140-170 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

PISTON, PIN, RINGS AND CYLINDER. The cylinder is secured to crankcase by four socket head screws. After removing cylinder, inspect cylinder bore for damage and excessive wear.

The piston pin is retained by clips at both ends of pin. The piston pin is supported by a renewable needle bearing in the connecting rod. Renew piston pin if worn or damaged.

The piston is equipped with two piston rings. Piston and piston rings are available in standard size only.

Late models are equipped with a longer piston pin bearing (20—Fig. HL343) than early models. Piston pin bosses on late model pistons are wider apart to accept the wider bearing. Long bearing cannot be installed in an early piston and short bearing must not be installed in a late piston as excessive side play will result in engine failure. Early bearing width is 0.506-0.512 inch while late bearing width is 0.568-0.574 inch.

CONNECTING ROD, CRANKSHAFT AND CRANKCASE. Crankcase halves must be split for access to crankshaft. The crankshaft is supported by ball bearings at both ends of shaft. Connecting rod, crankpin and

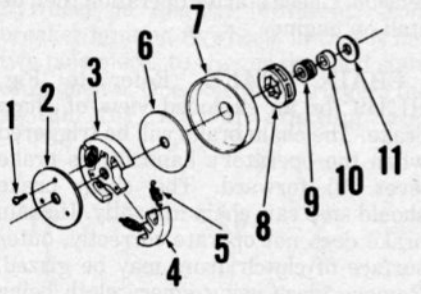


Fig. HL344—Exploded view of clutch.

1. Torx screw
2. Plate
3. Clutch hub
4. Clutch shoe
5. Spring
6. Thrust washer
7. Clutch drum
8. Sprocket
9. Roller bearing
10. Inner race
11. Thrust washer

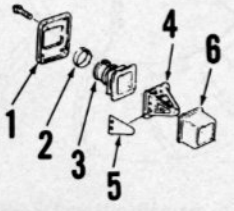


Fig. HL345—Exploded view of reed valve assembly.

1. Retainer
2. Stiffner
3. Connector
4. Seat
5. Reed
6. Retainer

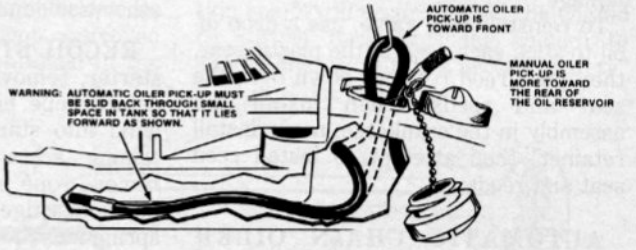


Fig. HL346—View showing installation of oil pick-up lines.

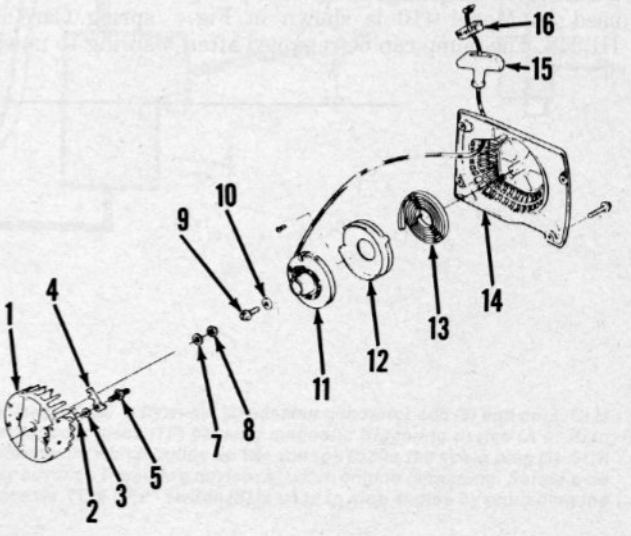


Fig. HL347—Exploded view of recoil starter.

1. Flywheel
2. Spring
3. Lockwasher
4. Pawl
5. Stud
7. Washer
8. Nut
9. Screw
10. Washer
11. Rope pulley
12. Spring retainer
13. Rewind spring
14. Starter housing
15. Rope handle
16. Rope retainer

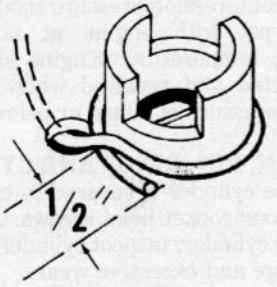
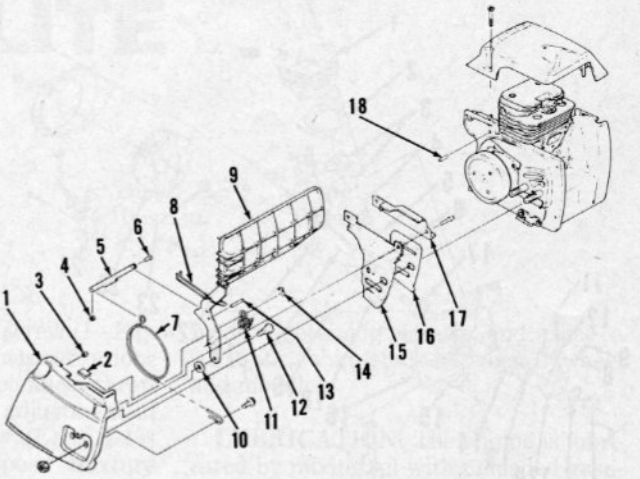


Fig. HL348—Insert rope through rope pulley hole and tie rope around pulley hub in a hitch as shown so ½ inch of rope end is exposed.

Fig. HL349—Exploded view of chain brake.

1. Cover
2. Clip
3. Bushing
4. Spacer
5. Pivot link
6. Rivet
7. Brake band
8. Spring
9. Brake lever
10. Washer
11. Spring
12. Shoulder screw
13. Dowel pin
14. Retainer
15. Outer guide bar plate
16. Inner guide bar plate
17. Shield
18. Pin



crankshaft are a pressed together assembly and separate components are not availble. Rod and crankshaft must be serviced as a unit assembly.

CLUTCH. Refer to Fig. HL344 for an exploded view of clutch. Cover plate (2) is retained by Torx head screws (1). Clutch hub (3) has left-hand threads. Clutch shoes and springs should be renewed only as sets. Inspect bearing (9) and lubricate with Homelite All-Temp Multi-Purpose Grease.

REED VALVE. Model 410 is equipped with a pyramid type reed valve as shown in Fig. HL345. Reeds are retained on pins projecting from the reed seat by a moulded retainer (6). Inspect reed seat, retainer and reeds for any distortion, excessive wear or other damage.

To reinstall reed valve, 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 the crankcase; never install retainer, then attempt to install reed seat and reeds.

AUTOMATIC CHAIN OILER PUMP. The automatic chain oiler pump used on Model 410 is shown in Fig. HL343. The pump can be removed after removing the clutch. Inspect all pump components and renew any part which is damaged or excessively worn. Oil pump output is not adjustable.

Note check valve (20—Fig. HL341) and filter (19) which are used to vent oil tank. Filter must be clean and valve must operate properly for oil to enter oil pumps. Refer to Fig. HL346 for view of correct installation of oil pick-up lines.

VIBRATION ISOLATORS. The engine assembly is supported in the handle assembly by six vibration isolators (24—Fig. HL341). The vibration isolators are held in place with Torx head threaded pins. Renew split or otherwise damaged vibration isolators.

RECOIL STARTER. To disassemble starter, remove starter from saw then detach rope handle and allow rope to wind into starter. Unscrew pulley retaining screw (9—Fig. HL347) and remove rope pulley while being careful not to dislodge rewind spring. If rewind spring must be removed, unscrew spring retainer screw and lift out retainer and spring. Care should be used not to allow spring to unwind uncontrolled.

Rope length should be 45 inches. Apply heat or cement to end of rope and insert rope end through hole in rope pulley and tie a hitch around pulley hub as shown in Fig. HL348. Wind rope around pulley in clockwise direction as viewed from hub side of pulley. Insert rope end through rope outlet of starter housing (14—Fig. HL347) and attach rope handle. Install washer (10) and screw (9). Pull rope back through rope outlet and engage rope in pulley notch. Turn rope pulley clockwise to apply tension to rewind spring. Two complete revolutions of the pulley should provide sufficient tension. Check starter operation then install on engine.

CHAIN BRAKE. Refer to Fig. HL349 for an exploded view of chain brake. The chain brake will be triggered when the operator's hand forces brake lever (9) forward. The chain brake should stop saw chain instantly. If chain brake does not operate correctly, outer surface of clutch drum may be glazed. Remove glaze using emery cloth being sure to clean drum afterwards. Clutch drum and brake band must not be bent or nicked.

HOMELITE

HOMELITE CAPACITOR DISCHARGE (CD) IGNITION SYSTEM

(XL AND VI SERIES MODELS)

OPERATING PRINCIPLES

The Homelite capacitor discharge ignition system used in several XL series and VI995 chain saw models 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. HL370 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"

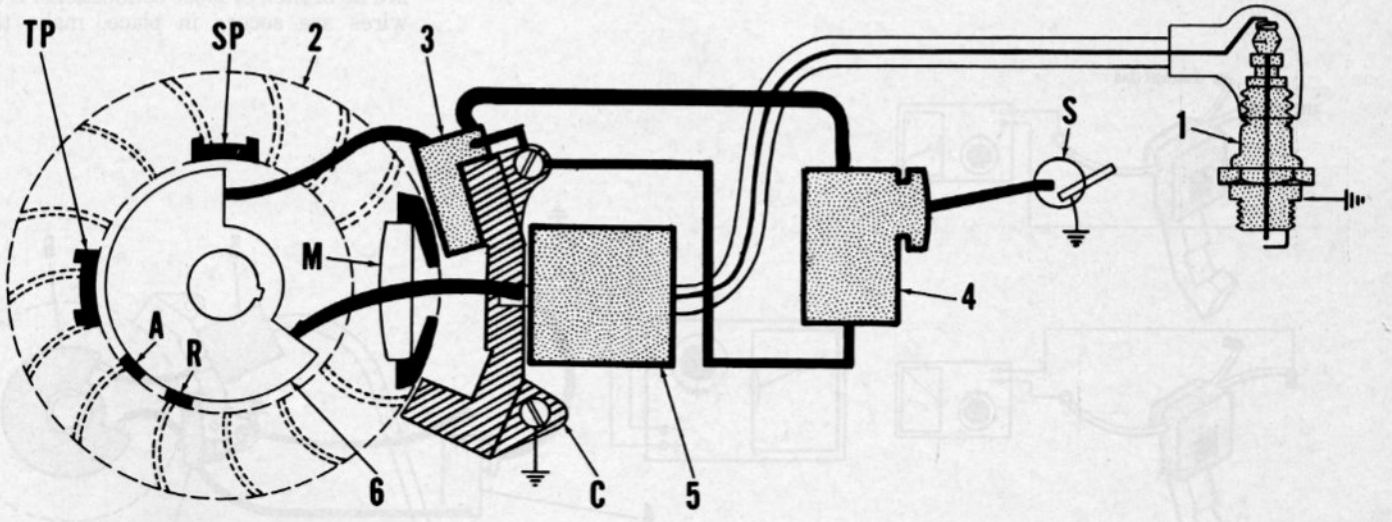


Fig. HL370—Schematic diagram of CD ignition system. Electrical energy created by magnet (M) in flywheel (2) passing generator coil (3) and core (C) is stored in the capacitor (4) until SCR switch in timing module (6) is turned on by timing pole piece (TP) passing magnetic triggering device (A or R) in 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.

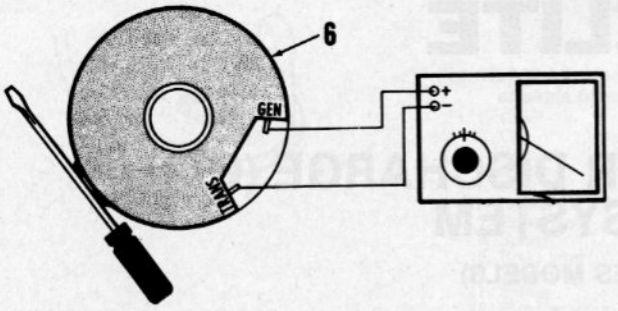


Fig. HL371—Checking the timing switch module using an ohmmeter; refer to text for procedure.

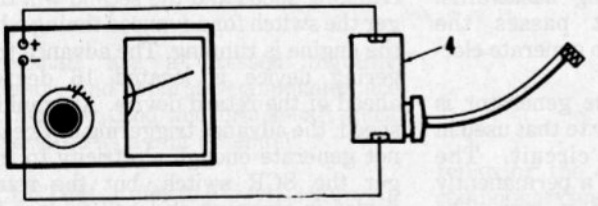


Fig. HL372—View showing ohmmeter connections for checking capacitor; refer to text for procedure.

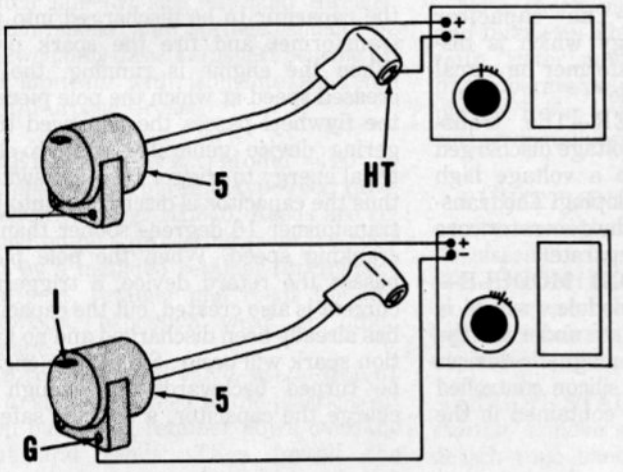


Fig. HL373—High tension coil of transformer should have between 2400 and 2900 ohms resistance; make ohmmeter connections as shown in top view. Resistance of input coil should be between 0.2 and 0.25 ohms with leads connected as shown in bottom view.

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 exhaust but a power stroke will not be created.

TESTING THE CD IGNITION SYSTEM

Models XL-114, XL-924, XL924W, SXL-925 and VI-955

Procedure and specifications for checking the capacitor discharge ignition 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. HL371 through HL375 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 ¼-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 in place, make the

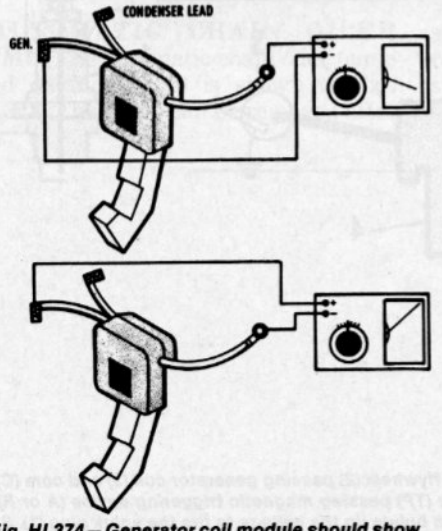


Fig. HL374—Generator coil module should show continuity in one direction only; reversing the leads should cause opposite reading to be observed.

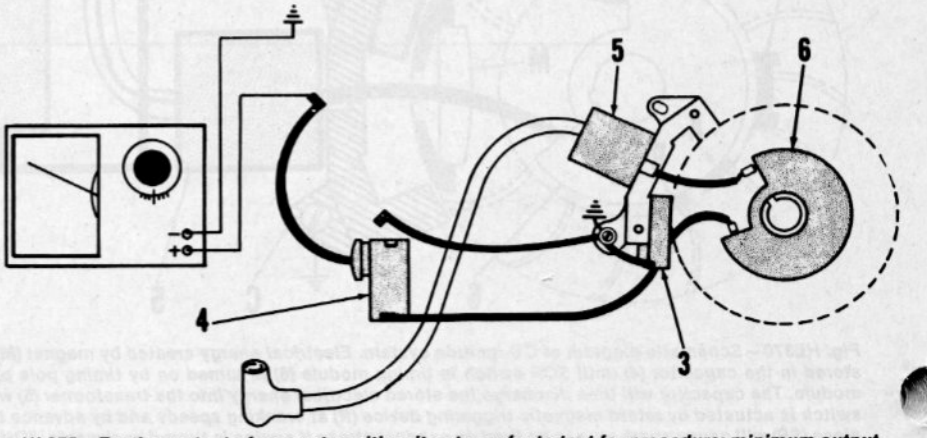


Fig. HL375—Testing output of generator with voltmeter; refer to text for procedure; minimum output should be 4 volts.

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 the other lead to terminal marked "GEN." as shown in Fig. HL371. 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 terminal 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. HL375. 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 4 volts should be observed on voltmeter.

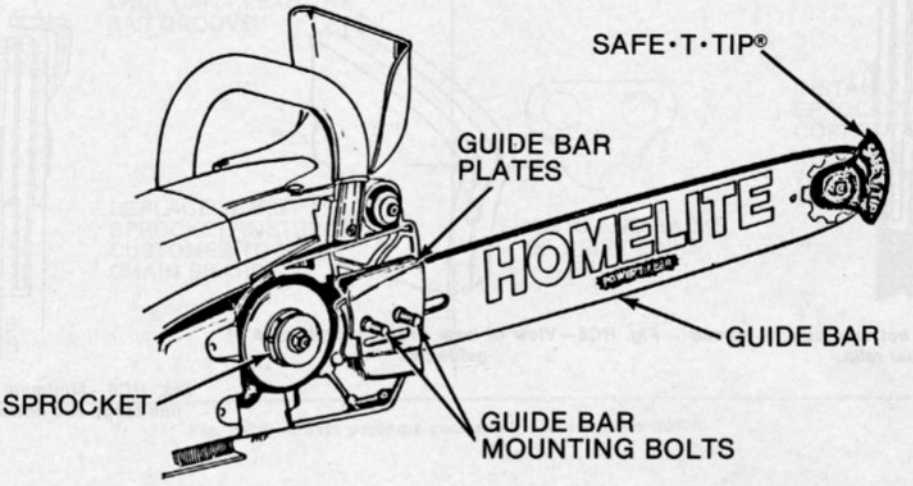
It is possible for some capacitor discharge ignition system components to be faulty, but not be detected by the volt-ohmmeter tests. If after testing, a faulty component is not located, renew the components one at a time until the trouble is located. the components should be renewed in the following order:

1. Capacitor
2. Generator coil and core
3. Transformer
4. Timing switch module.

NOTES

HOMELITE

SAW CHAINS, BARS AND SPROCKETS



A CHAINLESS PICTURE OF A SAW CHAIN. TO EMPHASIZE THAT CHAIN UPKEEP SHOULD BEGIN WITH A THOROUGH EXAMINATION OF THE GUIDE BAR AND SPROCKET, THE CHAIN WAS LEFT OUT OF THE PICTURE.

TROUBLE DIAGNOSES

Question: HOW MUCH SPROCKET WEAR IS TOO MUCH?

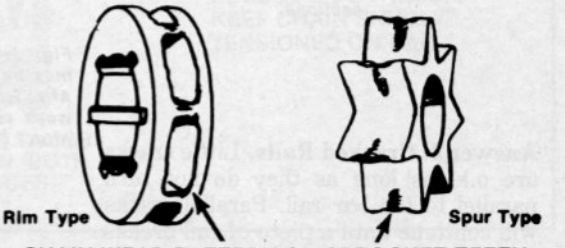
Answer: It depends on the following circumstances:

a) A sprocket is unserviceable when either the points of the chain drive link tangs become bent from "bottoming" against the sprocket, or when "slop" (too much space between the chain drive links and the sprocket teeth) allows the sprocket to pound the chain as illustrated in Fig. HC8.

b) Sprocket wear is difficult to measure, particularly when the sprocket is a rim type where the wear is inside the rims. (See Fig. HC1). Perhaps, sprocket tooth wear to a depth of two millimeters would produce the kinds of chain damage described above and illustrated in Fig. HC8. The normal service life of a sprocket is deemed to be twice that of a saw chain. Accordingly, a careful appraisal of the sprocket and old chain should be made when the first chain is being replaced. Note whether the sprocket damaged the chain. If you find no damage, examine the wear patterns on the sprocket teeth to see whether keeping the old sprocket in service is worthwhile. Remember this about the question of sprocket serviceability:

If in doubt, take it out.

c) When the clutch drum and sprocket are an integral assembly, the condition of the drum and the bearing as well as that of the sprocket must be taken into account.



CHAIN WEAR PATTERN ON SPROCKET TEETH

Fig. HC1—View of wear areas on rim and spur type sprockets.

Question: WHAT BAR TROUBLES SHOULD BE LOOKED FOR?

Answer 1: Bent bar. It will retard cutting, wear the chain drive links, and cause jumping out of the bar rails. If it can not be peened or bent back straight, discard the bar.

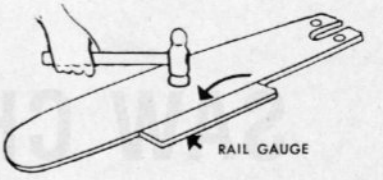


Fig. HC4—A screwdriver may be used to spread pinched guide bar rails. Insert a filler strip of drive link tang thickness and peen the guide bar rails to close rails which are spread.

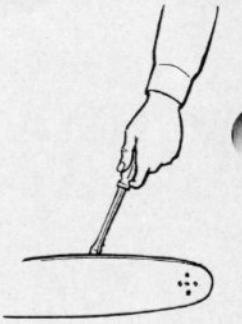


Fig. HC2—Chain will not run true in spread guide bar rails.

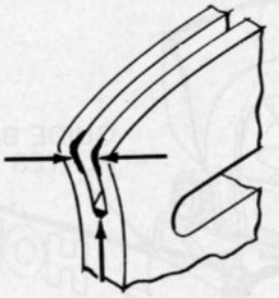


Fig. HC5—View of wear areas in entry area of guide bar.

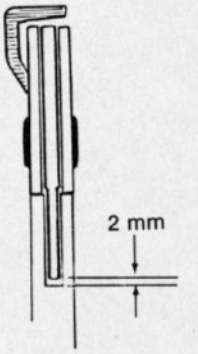


Fig. HC6—Minimum clearance between drive link tangs and bottom of bar groove is 2 mm.

Answer 2: Pinched or spread bar rails. Chain will run cocked to one side, or will not cut when the rails are too wide apart. Local peening of the rails after insertion of a filler strip of drive link tang thickness in the slot between the rails may restore pinched areas to normal clearance. Pinched rail areas can be spread to normal clearance with a screwdriver as shown in Fig. HC4.

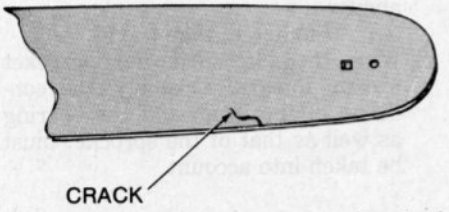


Fig. HC3—A cracked bar may be serviceable if parallel cracks do not result in broken off rail sections.

Answer 3: Cracked Rails. Little cracks are o.k. as long as they do not turn parallel to the bar rail. Parallel cracks will continue until a piece of rail breaks off.

Answer 4: Entry point of chain: The chain may not enter the bar groove smoothly if a bar with the wrong tail stock configuration was substituted for the original bar. Usually, however, peening of the chain against the bar, jumping off, and peening of the fronts of the chain tie-straps comes mostly from *too loose chain tension.* The *customer* should be warned about that, and shown how much tension is proper.

Answer 5: Shallow groove (Worn bar rails): Solid construction bars can often be ground (by bar shop) if the chain is not resting on top of sawdust packed in the groove. Clearance between drive link tangs and bottom of groove should be at least (2 mm) all around bar. NOTE: Bottoms of tangs will show wear from contact.

Answer 6: Unevenly worn bar rails: Owners manuals show these rail conditions, so there is no need to go into it in detail here. All these wear patterns can be due to improper chain tensioning or failure to maintain equal filing angles, cutter lengths or gauge depths. All you can do here is correct the damage, if possible, and tell the customer that a repeat of the damage can be avoided through proper chain filing and maintenance of proper tension.

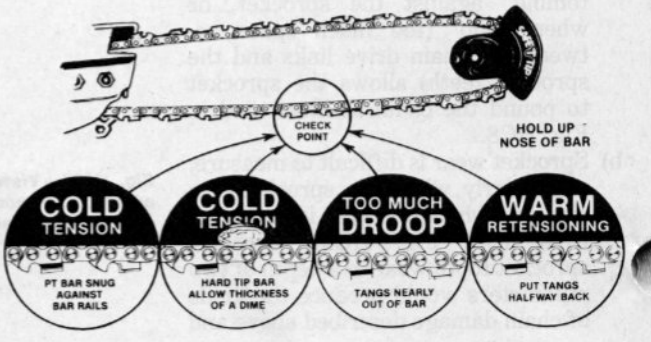


Fig. HC7—Chain tension may be checked as shown. After warm retensioning, always reset proper tension after chain has become "cold".

Condition	Procedure
 WORN, PEENED TIE-STRAP NOTCHES	EXAMINE FOR WORN SPROCKET
 DRIVE LINK TANGS BENT FORWARD FROM BOTTOMING IN SPROCKET	REPLACE SPROCKET FILE TANGS SO THEY CAN CLEAN THE BAR GROOVE.
 PEENED BACKS OF DRIVE LINKS	REPLACE WORN SPROCKET. INSTRUCT CUSTOMER TO KEEP CHAIN SHARP.

Condition	Procedure
 BACKS AND BOTTOMS OF DRIVE LINKS PEENED	REPLACE WORN SPROCKET. INSTRUCT CUSTOMER NOT TO RUN CHAIN "LOOSE."
 FRONTS AND BACKS OF DRIVE LINKS PEENED	INSTALL NEW SPROCKET OF CORRECT PITCH. KEEP THE CHAIN TENSION A BIT TIGHTER.

Fig. HC8—Chain patterns caused by sprocket mismatch.

Condition	Procedure
 BACKS NICKED SLIGHTLY	SHOW CUSTOMER HOW TO PROPERLY TENSION CHAIN
  FRONT OF DRIVE LINKS AND TIE-STRAPS PEENED	INCREASE TENSION. ALSO CHECK BAR RAILS FOR SMOOTHLY CHANNELED CHAIN ENTRY GROOVE.
 TANGS SCARRED FROM CHAIN JUMPING OFF BAR	TO PREVENT CHAIN FROM JUMPING OFF BAR REFILE CUTTERS TO UNIFORM ANGLES AND LENGTHS. MAKE SURE TOP PLATE ANGLE DOES NOT EXCEED 35°. TENSION CHAIN PROPERLY.

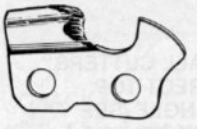
Condition	Procedure
 MOSTLY HEEL WEAR	SHARPEN CHAIN MORE OFTEN. TIGHTEN CHAIN TENSION. DO NOT KEEP DEPTH GAUGES SO LOW.
 CONCAVE BOTTOM WEAR	REDUCE CHAIN TENSION. KEEP CHAIN IN SHARPER CONDITION. AVOID HEAVY FEED PRESSURE TO CUT.
 DRIVE TANGS WORN, BOTH SIDES	REFILE ALL CUTTERS TO CORRECT TOP PLATE ANGLE (SEE FIG. HC28) TO REDUCE SIDE THRUST. KEEP CHAIN SNUGLY TENSIONED ON BAR.

Fig. HC9—Chain patterns caused by wrong tension or improper chain filing.

Condition	Procedure
BACKSLOPED AND BLUNT  TOO LOW EXCESSIVE HEEL WEAR	CORRECTIVELY FILE CUTTERS TO REDUCE GAUGE DEPTH. REMOVE BACK SLOPE AND INCREASE TOP PLATE ANGLE TO 35° AND CUTTING EDGE TO 60°. INCREASE CHAIN TENSION A BIT.
DULL OR BLUNT  TOO HIGH BOTTOM WEAR	REPLACE CHAIN. MAINTAIN PROPER (LOWER) DEPTH GAUGE SETTING OF NEW CHAIN. KEEP CHAIN SHARP AND FILED TO PROPER EDGE ANGLE.
 BOTTOMS PEENED AND BURRED	REFILE CHAIN TO ELIMINATE EXCESSIVE HOOK AND RESTORE PROPER TOOTH EDGE LEVEL OF 60°. FILE CHAIN MORE OFTEN TO MAINTAIN SHARPNESS.
HOOKED TOOTH THIN EDGE  REARS CRACKED	REPLACE CHAIN. FILE CHAIN TO ELIMINATE HOOK WHICH CAUSES CRACKS. KEEP CHAIN SHARP.

Condition	Procedure
TOO LITTLE DEPTH  FRONTS CRACKED	REPLACE CHAIN. KEEP GAUGES OF NEW CHAIN AT PROPER DEPTH SETTING.
 CRACKS UNDER FRONT AND REAR RIVETS	REPLACE CHAIN. KEEP NEW CHAIN SHARP AND PROPERLY TENSIONED (NOT TOO TIGHT ON BAR). LOWER DEPTH GAUGES TO PROPER HEIGHT.
 DRIVE LINKS WORN ONE SIDE	FILE LEFT AND RIGHT CUTTERS TO SAME ANGLES, CUTTER TOP PLATE LENGTHS AND UNIFORM GAUGE DEPTHS. ALSO CHECK THAT BAR RAILS ARE SAME HEIGHT

Fig. HC10—Chain patterns caused by wrong or irregular filing angles and gauge depths.

Condition	Procedure
 FRONTS OF RIVETS WORN, POLISHED	AVOID CUTTING INTO THE GROUND OR CUTTING DIRTY WOOD. USE SAFE·T·TIP® DEVICE TO PROTECT CHAIN
 SKID-NOSE WEAR CUTTING EDGES ABRADED	FILE TO REMOVE ENTIRE SKID-NOSE PORTION OF THE TEETH.
DULL CHAIN CUTTING EDGES BROKEN	CUT ONLY CLEAN WOOD, NO DIRT. NO NAILS, NO STONES.

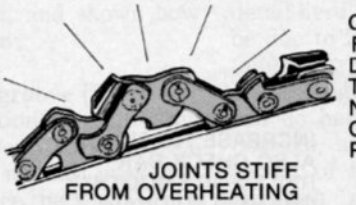
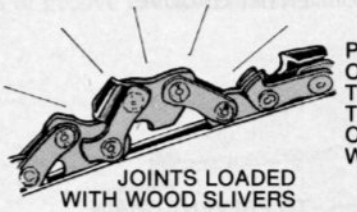
Condition	Procedure
 JOINTS STIFF FROM OVERHEATING	CHECK FOR PROPER FLOW OF OIL TO CHAIN. DO NOT CINCH CHAIN UP TIGHT ON BAR. WEAR IN NEW CHAIN WITH EXCESS OF OIL AND LIGHT FEED PRESSURE.
 JOINTS LOADED WITH WOOD SLIVERS	PENALTY FOR BORING OR RIP-CUTTING WITH THE GRAIN IN SOME TYPES OF WOOD. SOAK CHAIN IN LIGHT OIL. WORK JOINTS LOOSE.
 CHAIN STRETCHED. TOO LIMBER IN THE JOINTS	ABRASION, SPROCKET WEAR, BAR WEAR, ETC. TAKING THEIR TOLL ON THE CHAIN.

Fig. HC11—Chain conditions caused by abrasives or insufficient lubrication.

CHAIN CONSTRUCTION AND NOMENCLATURE

1. DRIVE LINK: THE LINK THAT IS DRIVEN BY THE DRIVE SPROCKET.

a) The back is slanted for contact against sprocket. Nicks and pounding marks indicate trouble such as pitch mismatch, too loose tension.

b) Tang portion is part that rides in bar groove. Side wear comes from loose chain, worn bar groove ("hour glass"), abrasive dirt.

c) Tang should be pointed. Not every tang has to be sharply pointed, but enough tangs should be sharp to keep sawdust from caking up in the bar groove. Tang points bent forward show chain is bottoming on worn sprocket. Peened, pounded, broken rear edges suggest sprocket is worn, or chain was too dull or run too loosely. See whether entry of bar is also scarred. Jumping off bar scars the sides of drive link tangs. Broken tangs occur from cinching chain up too tightly for a long time until the sprocket teeth are worn and the tangs break off against them.

d) Many types of chain have coined drive links. Coining is the process of pressing or stamping part of the metal to a narrower dimension than the original dimension. If the tang of a drive link has been coined, this thickness is the normal gauge of the saw chain. Your responsibility as a chain repairman is to be sure to use only the correct replacement parts.

e) Homelite® Raker III Saw Chain has two drive links, one with a coined depth gauge projection, and the other without it. The gaugeless drive links of 38ME50 Raker III chain also fit 38M series semi-chisel chain. The same interchangeability of tie-straps and drive links exists for type R37M50, R37ME50 Raker III and type R37C50 chains.

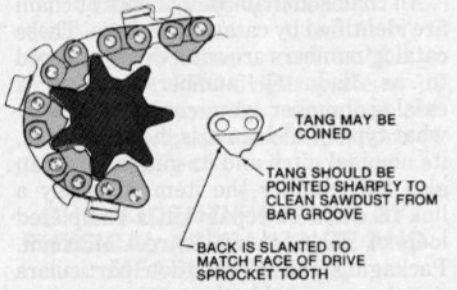


Fig. HC12— Note the areas shown above when inspecting drive links.

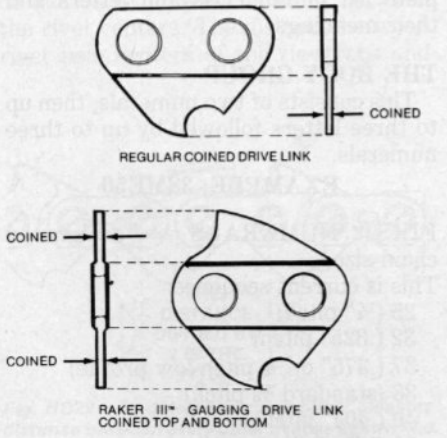


Fig. HC13— View of coined areas on drive links.

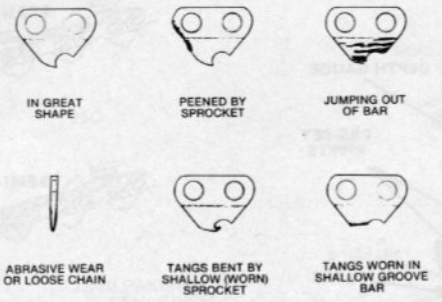
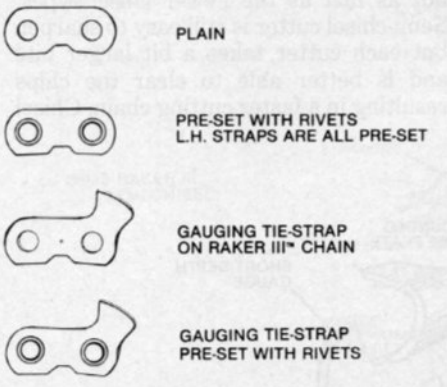


Fig. HC14— Some common problem areas on drive links are shown above.

2. TIE-STRAP: THE LINKS WHICH CONNECT THE DRIVE LINKS TOGETHER TO FORM THE LOOP OF CHAIN.



ON RAKER III™ CHAIN A GAUGING STRAP AND A CUTTER ARE PAIRED.

Fig. HC15— View of various types of tie-straps.

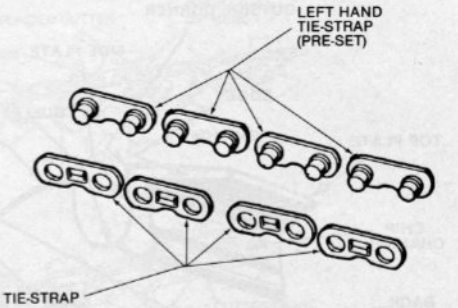


Fig. HC16— View showing right and left hand tie-straps. All left hand tie-straps have pre-set rivets.

a) Variations. Refer to Fig. HC15 for view of various types of tie-straps.

b) The construction order is that each end of one drive link is riveted between two tie-straps. Exception: When a cutter is put into the sequence then one L.H. (left-hand) cutter replaces one tie-strap on the left side, and a R.H. cutter replaces one tie-strap on the right side in the next sequence.

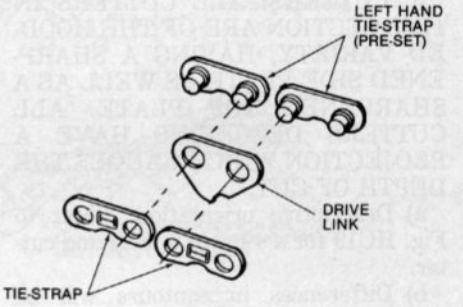


Fig. HC17— View showing right and left hand tie-straps with a drive link.

c) Tie-straps are subject to wear and breakage. Worn rivets display abrasion damage which may also be apparent on the tie-strap bottoms, cutter plates and edges, and drive link tangs. Cracks under the rivets come from combinations of wrong side plate angles, chronic cutter dullness or thin feathery cutting edges, and leaving depth gauges much too high.

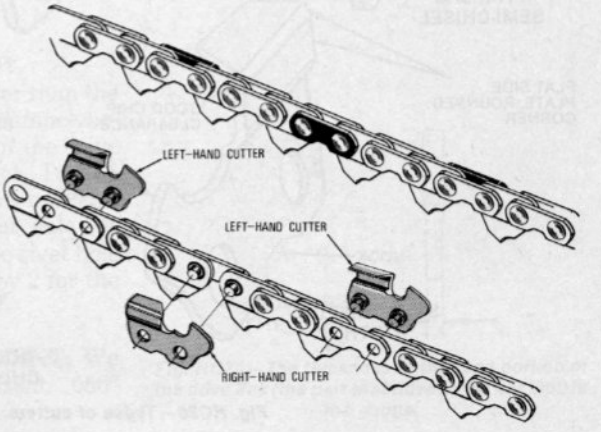


Fig. HC18— The top length of chain shown consists of tie straps and drive links. The bottom length of chain shows where cutters are installed in place of tie straps to form a cutting saw chain.

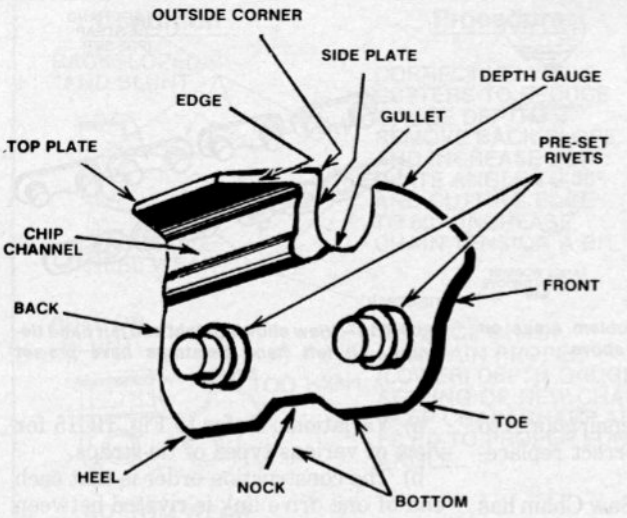


Fig. HC19—View of pre-set left-hand cutter.

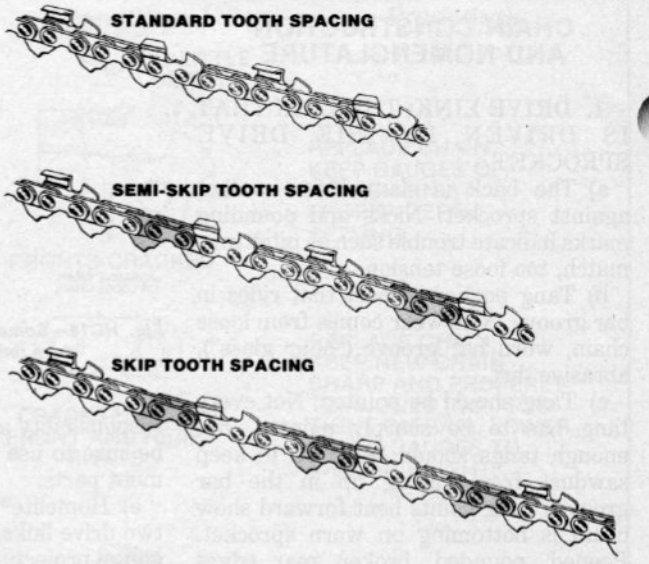


Fig. HC21—View showing various configurations of cutter spacing.

3. CUTTERS: ALL CUTTERS IN THIS SECTION ARE OF THE HOODED VARIETY, HAVING A SHARPENED SIDE PLATE AS WELL AS A SHARPENED TOP PLATE. ALL CUTTERS DESCRIBED HAVE A PROJECTION WHICH GAUGES THE DEPTH OF CUT.

a) Descriptive orientation. Refer to Fig. HC19 for a view of a left-hand cutter.

b) Differences in contours will be noticed from chain to chain. Some of these make a functional difference and others are purely evolvements of the engineers and designers who conceive them. Note types of cutters in Fig. HC20. Chipper cutter is easy to sharpen and edge holds up well, however, it is not as fast as the newer chisel types. Semi-chisel cutter is still easy to sharpen but each cutter takes a bit larger bite and is better able to clear the chips resulting in a faster cutting chain. Chisel cutter is fastest cutting type but will dull more rapidly. All Homelite branded saw chains are sharpened with a round file.

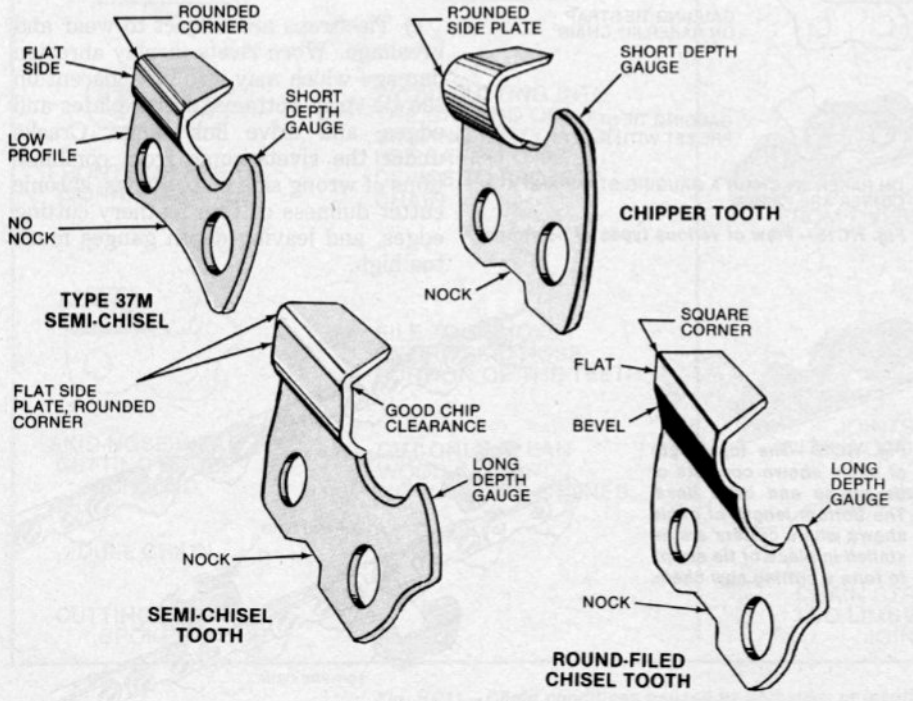


Fig. HC20—Types of cutters.

CHAIN IDENTIFICATION BY CATALOG NUMBERS

This is a typical catalog number describing one type of chain:

DR-37ME50-42

All chains and all components of chain are identified by catalog numbers. These catalog numbers are sometimes referred to as "industry numbers." From a catalog number you can tell exactly what type of a chain it is, how long it is, its nominal pitch and its gauge. You can also tell whether the item is merely a link of chain or repair kit, a completed loop of chain or whole reel of chain. Packaging and distribution particulars are also revealed in the catalog number. A prefix letter "D," for example, means "blister packed." Here is a more complete list of numerals and letters and their meanings:

THE BODY GROUP

This consists of two numerals, then up to three letters followed by up to three numerals.

EXAMPLE: 38ME50

FIRST NUMERALS = designated chain size.

This is current sequence:

25 (¼" pitch)
32 (.325" pitch)
37 (.375" or ⅜ pitch low profile)
38 (standard ⅜ pitch)
40 (.404" pitch)
50 (½" pitch)

MIDDLE LETTERS = design, style or type of chain. See Fig. HC20 and HC21. Letters currently in use include:

- C (chipper)
- E (3 depth gauges as in Raker III™ chain)
- J (Skip-tooth construction sequence)
- K (Semi-Skip tooth)
- L (Chisel)
- M (Semi-Chisel)

THE LAST NUMERALS = gauge of the drive links in thousandths of an inch. Homelite® chain gauges are as follows:

- 50 (.050" gauge)
- 63 (.063" gauge)

PREFIXES TO THE CATALOG NUMBER

D = blister packed
R = contoured for narrow nose bar.

SUFFIXES TO THE CATALOG NUMBER (coming after a dash)

- -xx = any two or three numerals immediately following the dash gives the number of drive links in the loop of chain.
- -7 = a repair kit.
- -7E = a repair kit—"low profile" designation.
- -7G = a repair kit—"low profile" PRO-CUT® Chain designation.
- -8 = a joining kit.
- -8 = a joining kit—"low profile" designation.
- -8G = a joining kit—"low profile" PRO-CUT® chain designation.
- -R25 = 25 foot reel
- -R50 = 50 foot reel
- -xxxCN = PRO-CUT® pattern of chain, otherwise described by main body and prefix portions of the number.

CHAIN IDENTIFICATION BY PHYSICAL APPEARANCE AND MEASUREMENTS

BY PITCH MEASUREMENT: Unlike bicycle chains, modern saw chains do not have uniform spacing between the rivet centers. The distance between rivet hole centers of the tie-straps and cutters of saw chains is greater than the true pitch of the chain. The distance between the rivet hole centers of the drive links is less than the true pitch. To find the true pitch of a saw chain, measure from the center of one rivet hole (or rivet head) to the center of the rivet hole two rivets away. Divide this by 2 for the pitch.

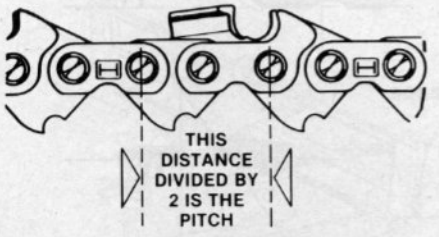


Fig. HC22—To determine chain pitch, measure distance between every other rivet as shown and divide by 2.

BY GAUGE MEASUREMENT: We have only two gauges at present: .050" and .063".

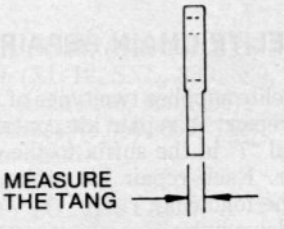


Fig. HC24—The thickness of the tang portion of the drive link (the part that rides in the bar slot) is the gauge.

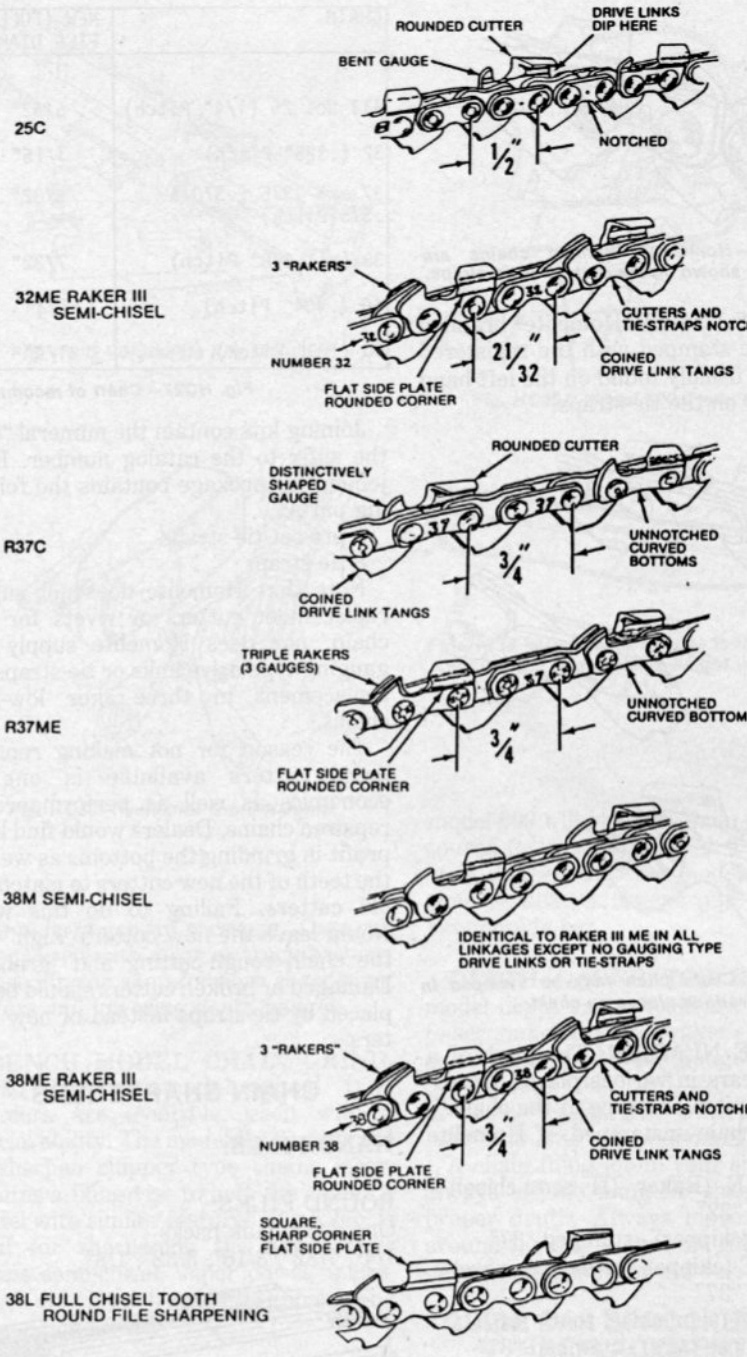


Fig. HC23—View showing various types of Homelite® chain and their identifying features.

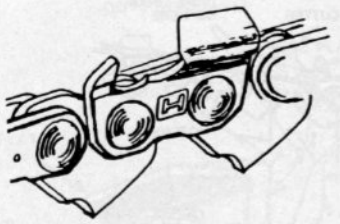


Fig. HC25—Homelite® branded chains are stamped as shown on the cutters or tie straps.

BY THE LABEL: Homelite® branded chains are stamped with the registered symbol H usually found on the left-hand cutters or on the tie-straps.

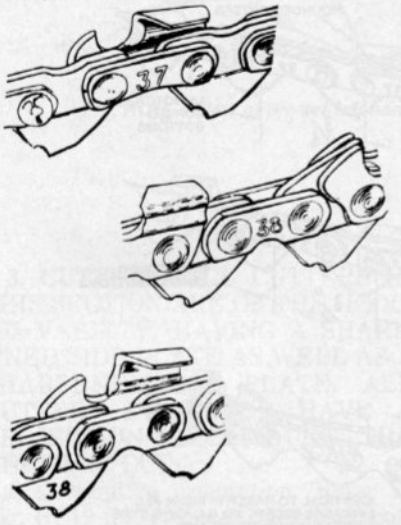


Fig. HC26—Chain pitch may be stamped in various places on chain.

BY THE NUMBER: The pitch of a chain appears in various places according to the pitch and type of the chain.

¼" pitch chain-unstamped, if Homelite brand.

Type 32ME (Raker III semi-chisel)—stamped "32"

Type 37C (chipper)—stamped "37"

Type R37C (chipper for narrow nose)—stamped "37"

Type R37M (semi-chisel tooth for narrow nose bars)—stamped "37"

Type R37ME50 (Raker III semi-chisel tooth for narrow nose bars)—stamped "37" on left drive links or tie-straps

Type 38C, 38M, 38L—stamped "38"

Type 40—stamped "40"

BY THE CONFIGURATION: See Fig. HC26.

HOMELITE CHAIN REPAIR KITS

Homelite supplies two types of kits for chain repair. A repair kit contains the numeral "7" in the suffix to the catalog number. Each repair kit package contains the following:

one drive link.
two preset tie-straps.
two plain tie-straps.

CHAIN	NEW (FULL LENGTH TOOTH) FILE DIAMETERS	DIAMETER WHEN LESS THAN HALF CHAIN LIFE REMAINS
All No. 25 (1/4" Pitch)	5/32" (4 mm)	1/8" (3.2 mm)
32 (.325" Pitch)	3/16" (4.8 mm)	5/32" (4 mm)
37 and .375 (.370 & .375 Pitch)	5/32" (4 mm)	1/8" (3.2 mm)
38 (all 3/8" Pitch)	7/32" (5.5 mm)	3/16" (4.8 mm)
40 (.404" Pitch)	1/4" (6.4 mm)	7/32" (5.5 mm)
50 (1/2" Pitch)	1/4" (6.4 mm)	7/32" (5.5 mm)

Fig. HC27—Chart of recommended file sizes when sharpening chain.

Joining kits contain the numeral "8" in the sufix to the catalog number. Each joining kit package contains the following parts:

8 pre-set tie-straps
8 tie-straps

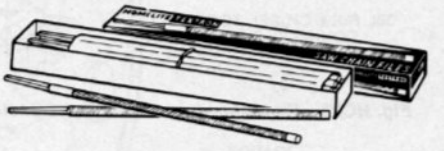
Note that Homelite does not supply replacement cutters or rivets for any chain, nor does Homelite supply the gauging type drive links or tie-straps for replacement in three-raker low-kick chains.

The reason for not making replacement cutters available is one of economics as well as performance of repaired chains. Dealers would find little profit in grinding the bottoms as well as the teeth of the new cutters to match the old cutters. Failing to do this work would leave the new cutters "high" and the chain rough-cutting and "grabby." Damaged or broken cutters should be replaced by tie-straps instead of new cutters.

CHAIN SHARPENERS

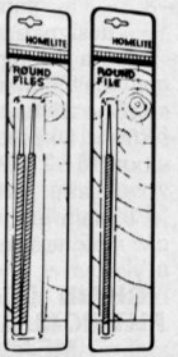
HAND FILES:

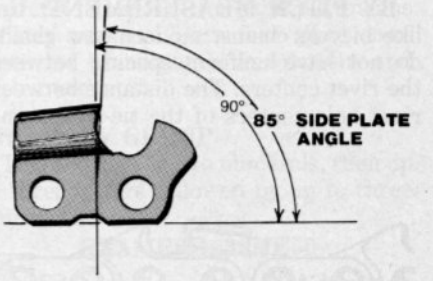
ROUND FILES:
One dozen bulk packs
1/4", 7/32", 3/16", 5/32", 1/8"

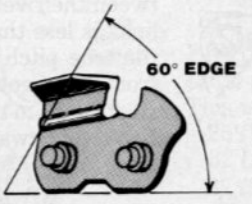


FILE AND GUIDES BLISTER PACKED IN THREE SIZES
5/32" dia.
7/32" dia.
1/4" dia.

ROUND FILES: BLISTER PACKED
5/32" dia. single pack
7/32" dia. single pack
5/32" double pack
7/32" double pack







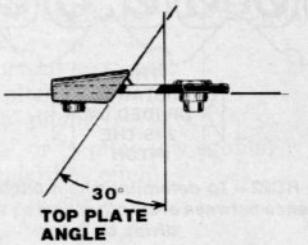


Fig. HC28—Recommended cutter sharpening angles. Top plate angle should be 30° for semi-chisel and chisel cutters, 35° for chipper cutters and 32° for Raker III® cutters.

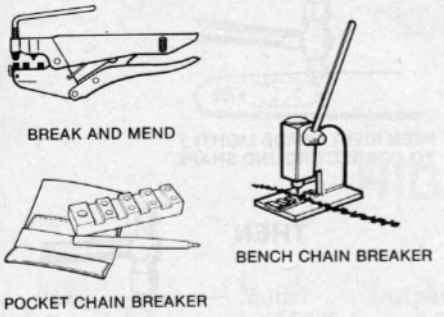


Fig. HC29—Types of chain breaker tools.

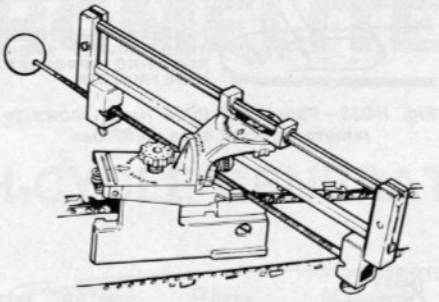


Fig. HC32—Homelite File-N-Guide®.

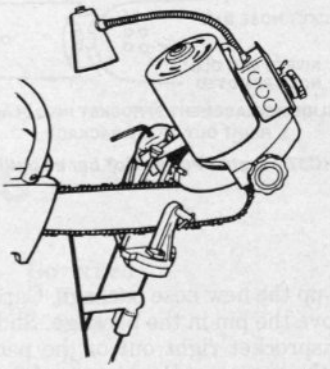


Fig. HC35—Model 600 Chain Grinder.

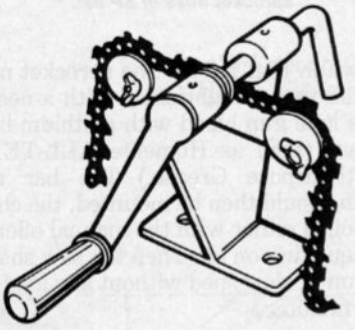


Fig. HC30—Homelite® Rivet Spinner.

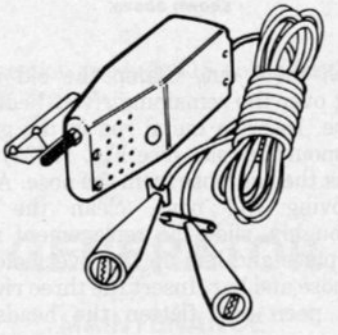


Fig. HC33—Homelite Grind-N-Joint®.

Fig. HC36—Use a depth gauge tool to accurately measure depth gauge height when filing.

FILE-N-JOINT® and FILE-N-GUIDE® FILE HOLDERS. These are file holders which clamp onto the guide bar. They are capable of being set for the exact filing angles, clearances and heights recommended for each chain.

They accommodate all 6" to 8" round chain saw files from 1/8" to 1/4" diameter. They also can be fitted with a 6-inch flat file for filing of the depth gauges.

GRIND-N-JOINT® CHAIN GRINDERS. These electric rotary files use replaceable grinding wheels available in the same diameters as our steel round files. The wheels are self-centering, screw into place, and can be tightened with only finger tip pressure. They can be powered with a car or truck battery, or used in the shop for both sharpening cutters and lowering depth gauges.

BENCH MODEL CHAIN GRINDERS. Various model wheel type grinders are available, each with a special ability. The model K-50, designed to sharpen chipper type chains incorporates a filing vise to hold the chain. A model with similar features, the K245, is ideal for sharpening the newer type chains semi-chisel, super chisel, micro-chisel, etc., as well as chipper chain. The model 600 will grind all chain that is contoured for sharpening with a round file. It is claimed that the model 600 saves time because it clamps onto the chain saw's guide bar.

DEPTH GAUGE TOOLS. Current model depth gauge tools are all slotted to accommodate three-raker style chains as well as single depth gauge chains.

Two sizes, .020" and .025" each come in blister backs. The other two sizes .030" and .035" are individually boxed.

A chain filing job in your shop should always include filing the gauges to the proper depth. Always move the chain around the bar so that the filing is done near the midpoint of the bar.

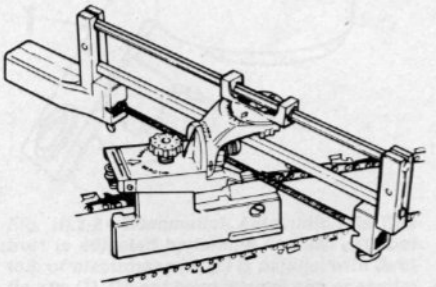


Fig. HC31—Homelite File-N-Joint®.

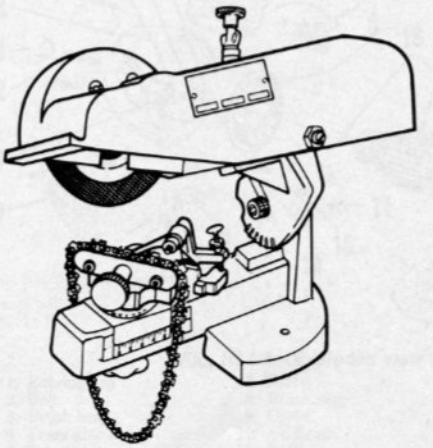


Fig. HC34—Model K245 Chain Grinder.

GUIDE BAR SPROCKET NOSE REPLACEMENT

POWER TIP® NOSE SPROCKETS
¼" pitch (early XL2)
.37" and .375" pitch (XEL, XL, XL2, Super 2 VI Super 2, 240 series)
⅜" pitch (150, SEZ, XL-12, SXL, 330, 360)

SP BAR NOSE SPROCKETS
⅜" pitch (XL-12, SXL, 330, 360, 410)
.050 ga. chain (450, 550, 750)
.404" pitch (450, 550, 650, 750)
.063" ga. chain

HOW TO INSTALL A POWER TIP® NOSE SPROCKET. Remove the retaining rivets and the old sprocket nose, thoroughly clean the bar nose.

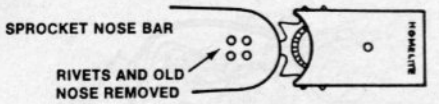


Fig. HC37—Install Power Tip® bar as outlined in text.

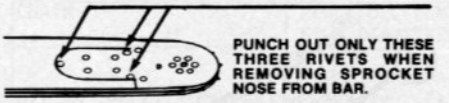
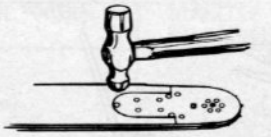


Fig. HC38—Punch out three rivets shown to remove sprocket nose on SP bar.



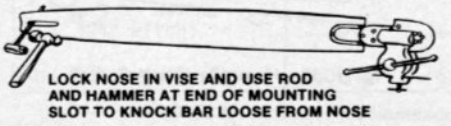


Fig. HC39—Separate sprocket nose from bar as shown above.

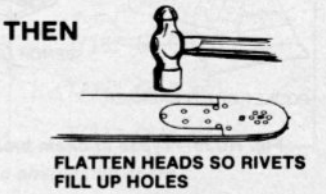


Fig. HC40—Peen and flatten rivets to fasten sprocket nose in SP bar.

Pick up the new nose package. Carefully remove the pin in the package. Slide the new sprocket right out of the package into the bar nose. Be very careful not to let any of the bearings fall out of place during this maneuver. Put in the new rivets, peen lightly at first to a round shape, then flatten the heads against the bar. Grease sprocket.

HOW TO CHANGE AN SP BAR SPROCKET NOSE. The SP replacement nose comes with three aluminum rivets and is ready for use as soon as installed. Refer to Fig. HC38 for location of the three rivets to be removed from the old bar nose and bar. Drill through the centers of these three rivets and punch them out. Clamp the old nose right over the remaining rivets heads in a vise. Insert a metal rod in the guide bar mounting slot (see Fig. HC39) and knock the bar loose from the nose. After removing the nose, clean the bar thoroughly, slide the replacement nose into place and line up the rivet holes in the nose and bar. Insert the three rivets, then peen and flatten the heads as shown in Fig. HC40. The sprocket nose should then be lubricated with a needle nose lube gun lubed with a lithium base grease (such as Homelite ALL-TEMP Multi-purpose Grease.) The bar and chain should then be mounted, the chain pre-oiled either with the manual oiler or by squirting on oil. Then the saw should be run at slow sped without any load for one minute.

HOMELITE

HIGH-CYCLE GENERATORS

Model	Output-kw	Voltage	Hertz	Engine Make	Engine Model	Governed Rpm
185HY35-1	2.5	115vdc		B&S	243431	3600
	3.5	230vac	180			
190HY50-1	2.5	115vdc		B&S	243431	3600
	5.0	230vac	180			

The generators in this section produce 115 volt direct current and 3-phase, 180 Hertz, 230 volt alternating current.

GENERATOR

MAINTENANCE

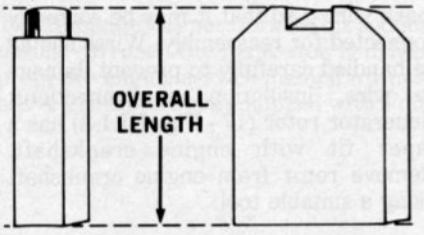


Fig. HL1-1—Measure brush length as shown.

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 cover (9—Fig. HL1-3). 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. HL1-1. Renew brush if length is 5/8 inch or shorter. Be sure to include 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

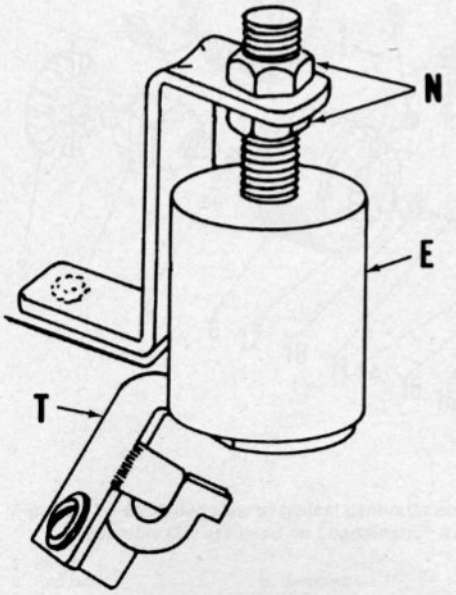


Fig. HL1-2—Loadmatic® Automatic Idle Control† is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

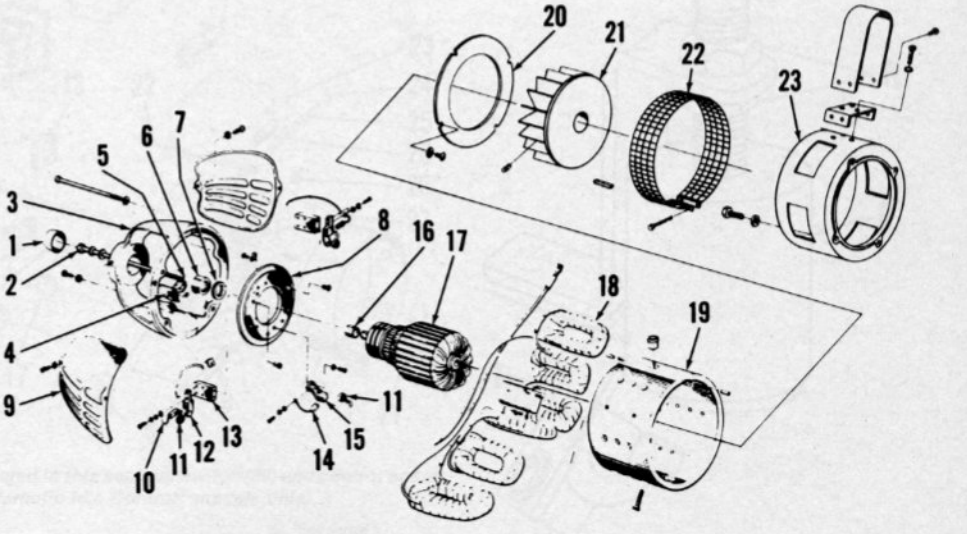


Fig. HL1-3—Exploded view of typical high-cycle generator.

1. Bearing cap
2. Bolt
3. Brush head
4. Transistor base
5. Transistor
6. Bearing
7. Seal
8. Brush ring
9. Cover
10. AC brush
11. Spring
12. AC brush holder
13. Brush holder block
14. DC brush
15. DC brush holder
16. Bearing race
17. Rotor
18. Field coil assy.
19. Housing
20. Baffle
21. Fan
22. Screen
23. Mounting ring

†Loadamatic® Automatic Idle Control system is covered by U.S. Patent No. 3,626,197.

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 185HY35-1 and 190HY50-1 are equipped with a Loadamatic® Automatic Idle Control. 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 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 Loadamatic® Automatic Idle Control, proceed as follows: Refer to Fig. HL1-2 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 idle control. 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 load to generator and then remove it. Engine speed should increase to governed speed and then return to idle after the load is removed.

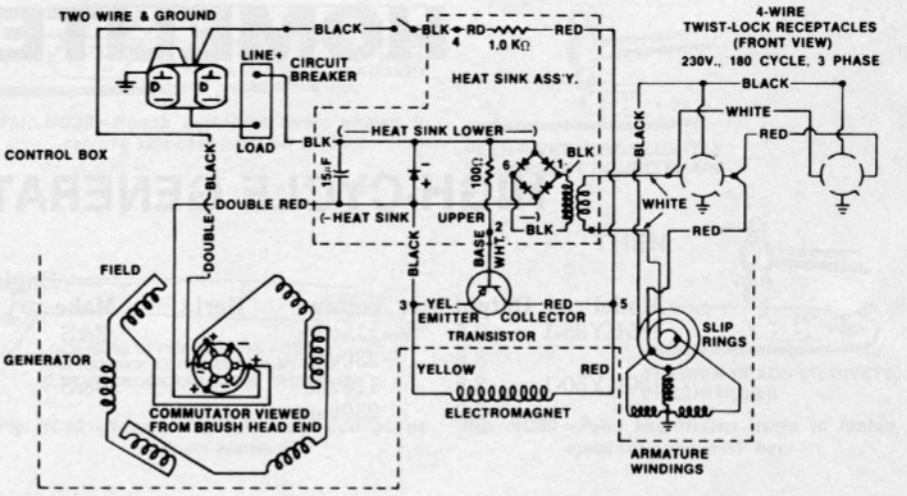


Fig. HL1-4—Schematic of high cycle generator.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL1-3 for an exploded view of generator and to appropriate schematic in Fig. HL1-4. 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. HL1-3) has a taper fit with engine crankshaft. Remove rotor from engine crankshaft using a suitable tool.

HOMELITE

VOLTAMATIC® AC GENERATORS*

				Engine		Governed
Model	Output-kw	Voltage	Hertz	Make	Model	Rpm
112A15-1	1.5	115	60	B&S	100232	3600
113A25-1	2.5	115	60	B&S	146432	3600
116A50-2	5.0	115/230	60	B&S	243431	3600
116A50-2L	5.0	115/230	60	B&S	243431	3600
118A35-1	3.5	115	60	Wisc.	S8D	3600
118A35-2	3.5	115/230	60	Wisc.	S8D	3600
119A35-1	3.5	115	60	B&S	200431	3600
119A35-1L	3.5	115	60	B&S	200431	3600
119A35-2	3.5	115/230	60	B&S	200431	3600
119A35-2L	3.5	115/230	60	B&S	200431	3600

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® control to regulate voltage.

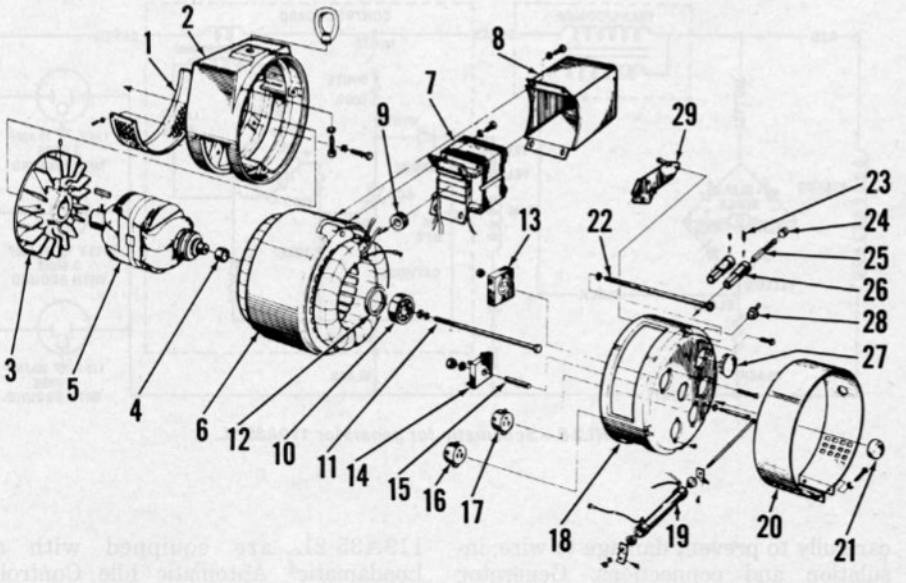


Fig. HL3-1 — Exploded view of typical generator covered in this section. Switch (28) and control board assembly (29) are used on Loadamatic® Automatic Idle Control† models only.

1. Shield
2. End bell
3. Fan
4. Inner race
5. Rotor
6. Stator
7. Transformer
8. Cover
9. Grommet
10. Ball bearing
11. Bolt
12. Seal
13. Receptacle
14. Rectifier
15. Roll pin
16. Receptacle
17. Receptacle
18. Brush head
19. Resistor
20. Cover
21. Bearing cap
22. Bolt
23. Set screw
24. Cap
25. Brush
26. Brush holder
27. Plug
28. Loadamatic switch
29. Loadamatic control board

*Voltamatic® Static Voltage Control system is covered by U.S. Patent No. 3,428,883.

†Loadamatic® Automatic Idle Control system is covered by U.S. Patent Nos. 3,612,892 and 3,626,197.

GENERATOR

MAINTENANCE

To remove brushes, unscrew clamp screws and slide brush cover (20 – Fig. HL3-1) off brush head (18). Unscrew set screws and remove brush caps (24) and brushes (25). Be sure to mark brushes so that they can be returned to their original positions. Check length of each brush as shown in Fig. HL3-2. Renew brush if length is 5/8-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.

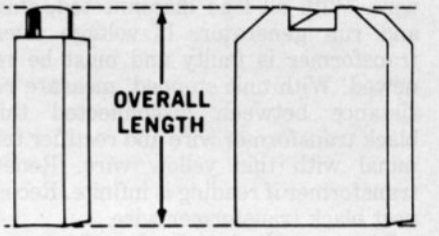


Fig. HL3-2 — Measure length of brushes as shown.

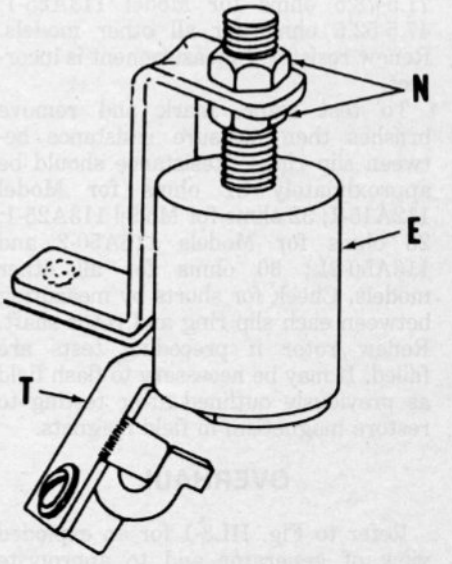


Fig. HL3-3 — Loadamatic® Automatic Idle Control is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.

TROUBLESHOOTING

If little or no output is generated, check the following: The engine must be in good condition and maintain 3600 rpm under load or a no-load governed speed of 3750 rpm. Brushes, commutator and slip rings must be in good condition. All wiring connections must be clean and tight.

If loss of field magnetism is suspected cause of low generator output, flash the field as follows: Run unit without a load connected while using a 6-volt dry cell battery, momentarily connect the negative battery terminal to the negative (black) brush and the positive battery terminal to the positive (red) brush. Disconnect battery as soon as generator voltage rises.

To test rectifier, mark and remove brushes and disconnect rectifier leads. Using an ohmmeter measure resistance between each brush and each rectifier lead then reverse ohmmeter leads and again measure resistance. Resistance should be 4-100 ohms for one reading and infinite for other reading. Renew rectifier if resistance measurements are incorrect.

Disconnect thin black transformer wire. With all load disconnected, start and run generator. If voltage rises, transformer is faulty and must be renewed. With unit stopped, measure resistance between disconnected thin black transformer wire and rectifier terminal with thin yellow wire. Renew transformer if reading is infinite. Reconnect black transformer wire.

Disconnect resistor leads and measure resistance. Resistor resistance should be 95-105 ohms for Model 112A15-1; 71.5-78.5 ohms for Model 113A25-1; 47.5-52.5 ohms for all other models. Renew resistor if measurement is incorrect.

To test rotor, mark and remove brushes then measure resistance between slip rings. Resistance should be approximately 31 ohms for Model 112A15-1; 32 ohms for Model 113A25-1; 26 ohms for Models 116A50-2 and 116A50-2L; 30 ohms for all other models. Check for shorts by measuring between each slip ring and rotor shaft. Renew rotor if preceding tests are failed. It may be necessary to flash field as previously outlined after testing to restore magnetism in field magnets.

OVERHAUL

Refer to Fig. HL3-1 for an exploded view of generator and to approprite schematic in Fig. HL3-4, HL3-5, HL3-6 or HL3-7. 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. HL3-1) has a taper fit with engine crankshaft and should be removed with a suitable tool.

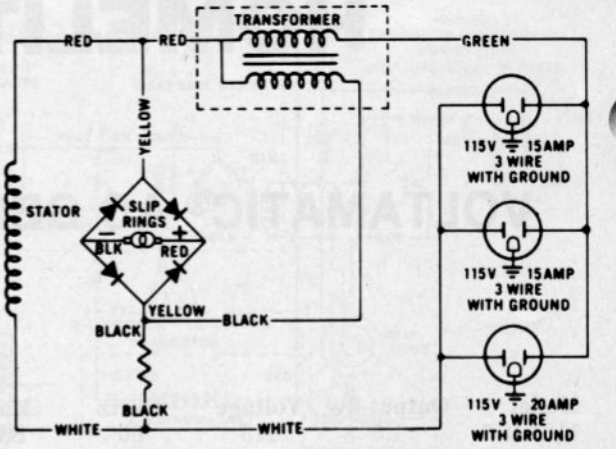


Fig. HL3-4—Schematic for generators 112A15-1, 113A25-1, 118A35-1 and 119A35-1.

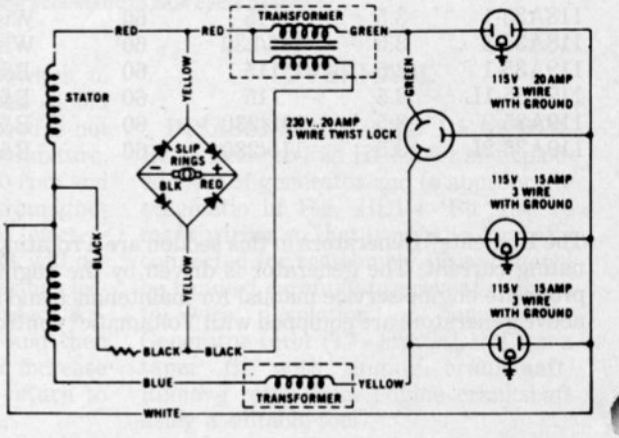


Fig. HL3-5—Schematic for generators 116A50-2, 118A35-2 and 119A35-2.

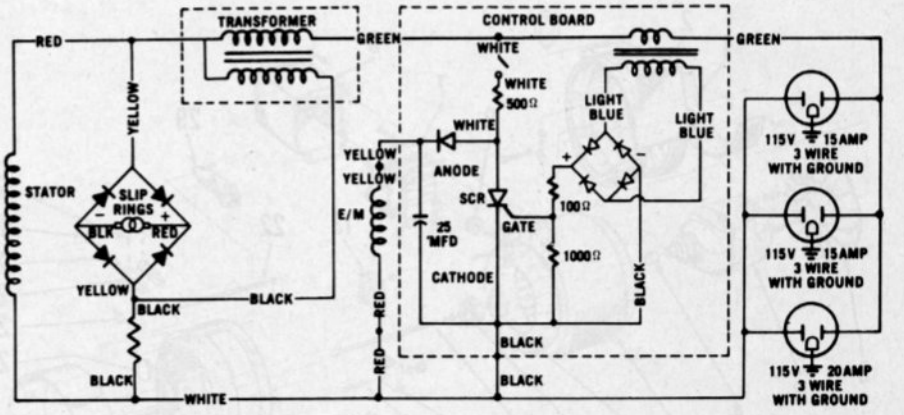


Fig. HL3-6—Schematic for generator 119A35-1L.

LOADAMATIC®

Models 116A50-2L, 119A35-1L and 119A35-2L are equipped with a Loadamatic® Automatic Idle Control. 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 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 Loadamatic Automatic Idle Control, proceed as follows: Refer to Fig. HL3-3 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 idle control. 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 will decrease 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.

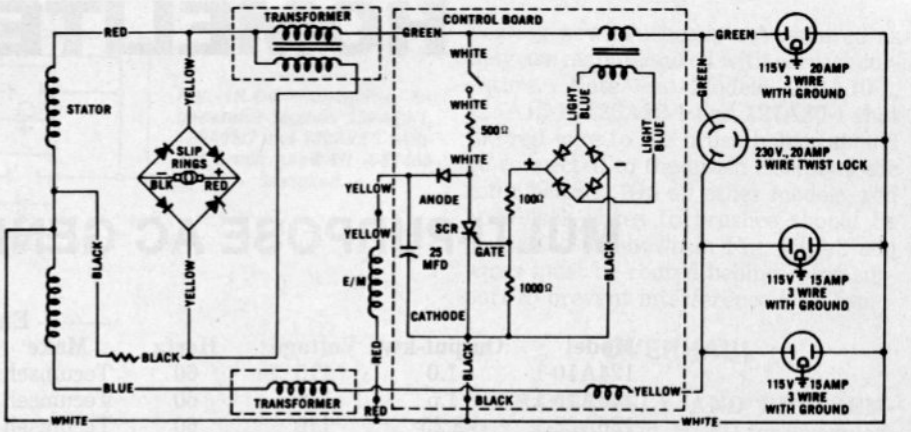


Fig. HL3-7—Schematic for generators 116A50-2L and 119A35-2L.

ENGINE

Engine make and model are listed at beginning of section. Refer to Briggs and Stratton or Wisconsin engine service manual for engine service.

HOMELITE

MULTI-PURPOSE AC GENERATORS

				Engine		Governed
Model	Output-kw	Voltage	Hertz	Make	Model	Rpm
124A10-1	1.0	115	60	Tecumseh	H30	3600
125A15-1	1.5	115	60	Tecumseh	H35	3600
126A22-1	2.25	115	60	Tecumseh	H50	3600
127A30-1	3.0	115	60	Tecumseh	H70	3600
128A10-1	1.0	120	60	Tecumseh	H30	3600
128A10-1B	1.0	120	60	Tecumseh	H30	3600
129A15-1	1.5	120	60	Tecumseh	H35	3600
129A15-1B	1.5	120	60	Tecumseh	H35	3600
130A22-1	2.25	120	60	Tecumseh	H50	3600
130A22-1B	2.25	120	60	Tecumseh	H50	3600
130A22-1C	2.25	120	60	Tecumseh	HS50	3600
131A30-1	3.0	120	60	Tecumseh	H70	3600
131A30-1B	3.0	120	60	Tecumseh	H70	3600
132A40-1	4.0	120	60	B&S	190412	3600
E1350-1	1.35	120	60	B&S	80212	3600
E1700-1	1.7	120	60	B&S	100212	3600
E2250-1	2.25	120	60	B&S	!130212	3600
E3000-1, E3000-1A	3.0	120	60	B&S	170412	3600
E4000-1, E4000-1A	4.0	120	60	B&S	190412	3600

GENERATOR

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. HL4-1), 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 ⅜ inch as shown in Fig. HL4-2. 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.

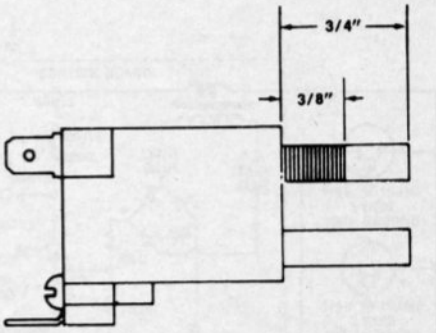


Fig. HL4-2 – Brush length should not be less than ⅜ inch when measured as shown above. Brush length of a new brush is ¾ inch.

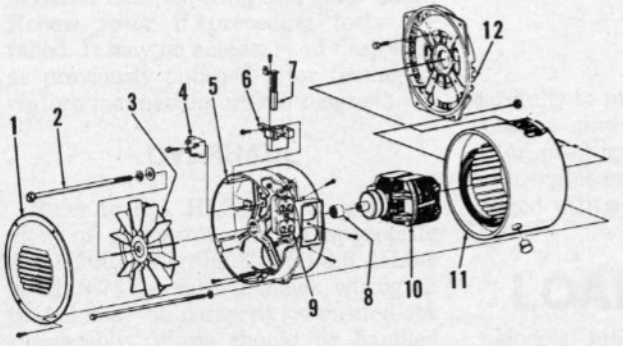


Fig. HL4-1 – Exploded view of generator.

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

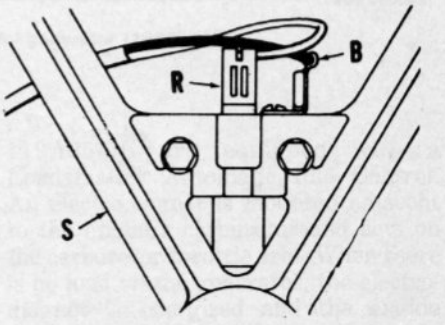


Fig. HL4-3 – On models indicated in text, red (R) and black (B) wires to brushes are connected and routed as shown.

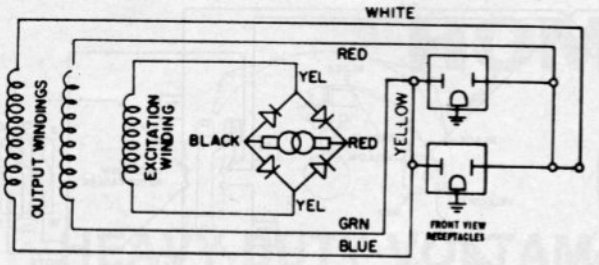


Fig. HL4-4—Schematic for generator Models 128A10-1, 129A15-1 and 130A22-1 without brush head kit A-51450 installed.

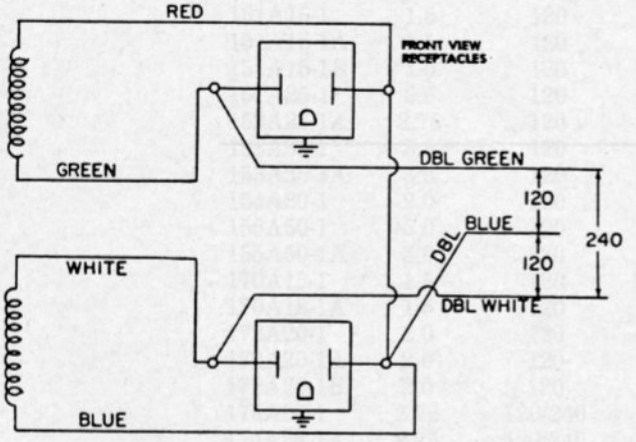
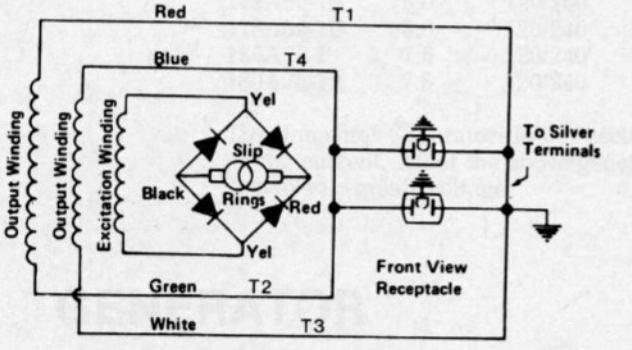


Fig. HL4-5—Schematic and practical diagram of Models E1350-1, E1700-1 and E2250-1 and Models 128A10-1, 128A10-1A, 128A10-1B, 129A15-1, 129A15-1A, 129A15-1B, 130A22-1, 130A22-1A, 130A22-1B and 130A22-1C with brush head kit A-51450 installed.



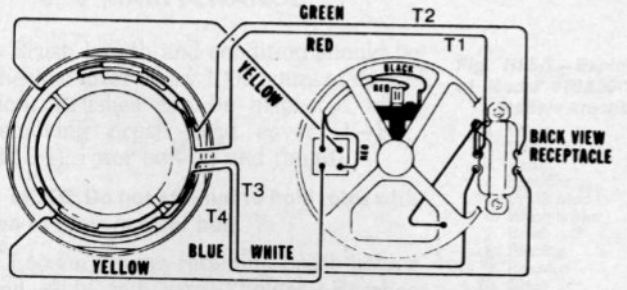


Fig. HL4-6—Schematic and practical diagram of Model E3000-1 and Models 131A30-1, 131A30-1A and 131A30-1B with brush head kit A-51450 installed.

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 in Fig. HL4-3 and wires must be routed behind rotor support to prevent interference with fan.

OVERHAUL

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL4-1 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) 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,

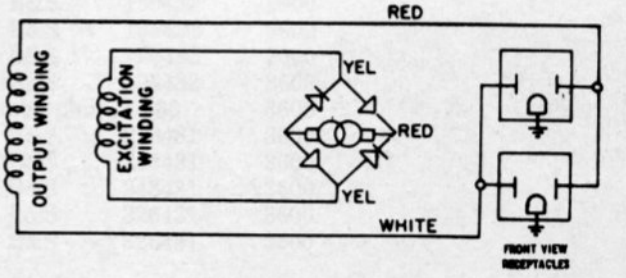


Fig. HL4-7—Schematic of Model 131A30-1 wired for 120 volts without brush head kit A-51450.

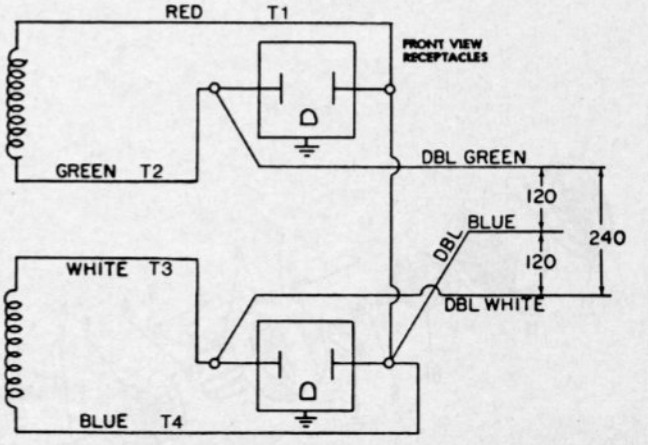


Fig. HL4-8—Schematic of Model 131A30-1 wired for 240 volts without brush head kit A-51450.

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 installation 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.

ENGINE

Engine make and model are listed at beginning of section. Refer to Biggs and Stratton or Tecumseh engine service manual for engine service.

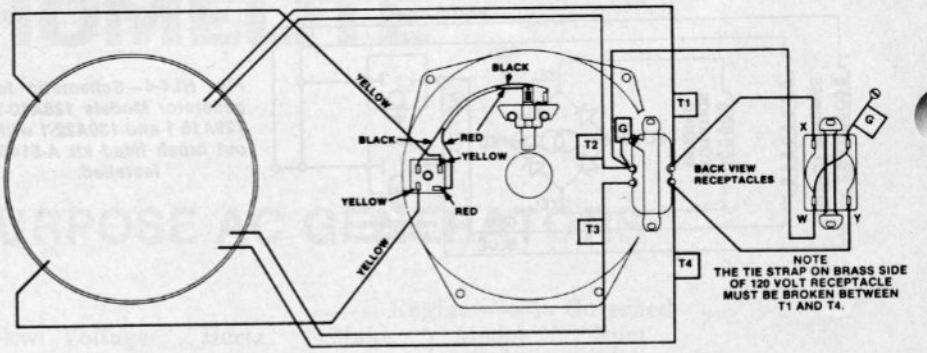


Fig. HL4-9—Wiring diagram for Models E3000-1A and E4000-1A.

HOMELITE

HEAVY-DUTY VOLTAMATIC® AC GENERATORS*

				Engine		Governed
Model	Output-kw	Voltage	Hertz	Make	Model	Rpm
151A15-1	1.5	120	60	B&S	100232	3600
151A15-1A	1.5	120	60	B&S	100232	3600
151A15-1B	1.5	120	60	B&S	100232	3600
151A25-1	2.5	120	60	B&S	170432	3600
152A27-1A	2.75	120	60	B&S	170432	3600
153A35-1	3.5	120	60	B&S	190432	3600
153A35-1A	3.5	120	60	B&S	190432	3600
154A20-1	2.0	120	60	B&S	130232	3600
155A50-1	5.0	120	60	B&S	243431	3600
155A50-1A	5.0	120	60	B&S	243431	3600
170A15-1	1.5	120	60	B&S	100232	3600
170A15-1A	1.5	120	60	B&S	100232	3600
172A20-1	2.0	120	60	B&S	130232	3600
172A20-1A	2.0	120	60	B&S	131232	3600
172A20-1B	2.0	120	60	B&S	131232	3600
174A27-1	2.75	120/240	60	B&S	170432	3600
174A27-1A	2.75	120/240	60	B&S	170432	3600
174A27-1B	2.75	120/240	60	B&S	170432	3600
175A42-1	4.2	115/230	50	B&S		3000
176A35-1	3.5	120/240	60	B&S	190432	3600
176A35-1A	3.5	120/240	60	B&S	195432	3600
176A35-1B	3.5	120/240	60	B&S	195432	3600
176A35-1C	3.5	120/240	60	B&S	195432	3600
177D38-1	3.8	120/240	60	Lombardini	530	3600
178A50-1	5.0	120/240	60	B&S	243431	3600
178A50-1A	5.0	120/240	60	B&S	243431	3600
178A50-1B	5.0	120/240	60	B&S	243431	3600
180A75-1	7.5	120/240	60	B&S	326431	3600
180A75-1A	7.5	120/240	60	B&S	326431	3600

The Homelite® Generators in this section are a rotating field type and produce alternating current. All of the above generators are equipped with Voltamatic® voltage control to regulate voltage.

GENERATOR

MAINTENANCE

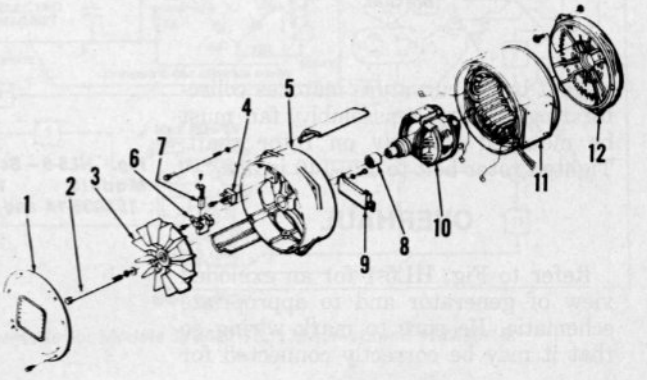
Brush length and condition should be checked after every 1000 hours of operation. Brushes can be inspected after removing brush head cover (1–Fig. HL5-1), rotor bolt (2) and fan (3).

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 ⅜ inch as shown in Fig. HL5-2. Be sure to reinstall a used brush

Fig. HL5-1–Exploded view of Model 170A20-1A. 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 & housing
12. End bell



*Voltamatic® Static Voltage Control system is covered by U.S. Patent No. 3,428,883.

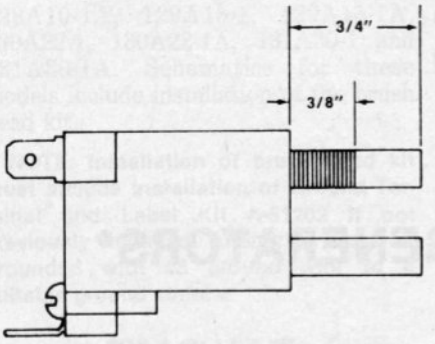


Fig. HL5-2—Brush length should not be less than ⅜ inch when measured as shown above. Brush length of a new brush is ¾ inch.

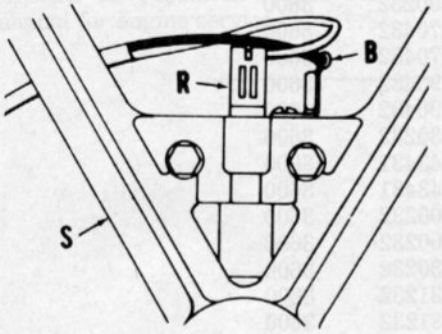


Fig. HL5-3—Red (R) and black (B) wires to brushes are connected and routed as shown.

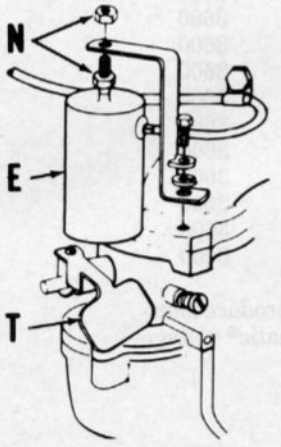


Fig. HL5-4—Loadamatic® Automatic Idle Control is adjusted by turning nuts (N) until bottom of electromagnet (E) is parallel with throttle arm (T). Do not bend throttle arm or electromagnet bracket.*

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.

OVERHAUL

Refer to Fig. HL5-1 for an exploded view of generator and to appropriate schematic. Be sure to mark wiring so that it may be correctly connected for

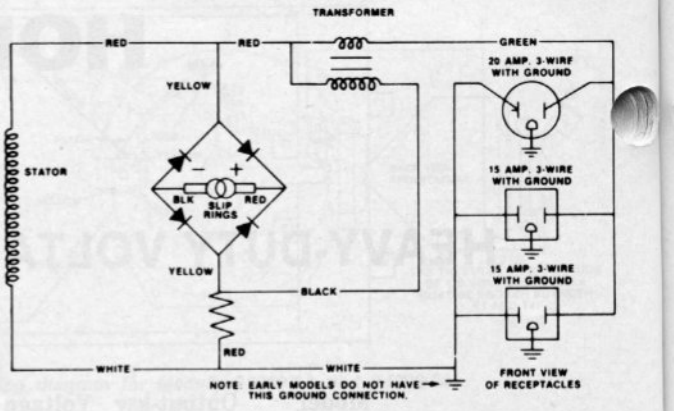


Fig. HL5-5—Schematic of Models 151A15-1 and 151A15-1A.

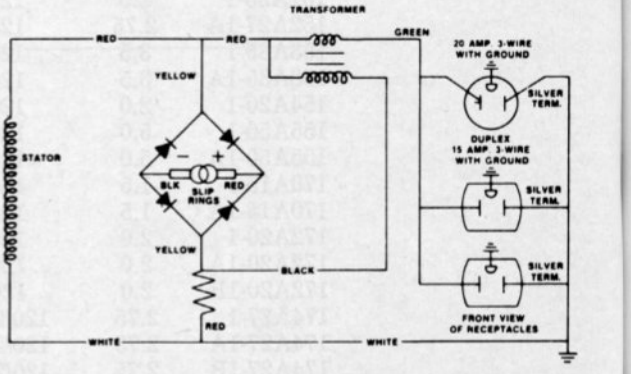


Fig. HL5-6—Schematic of Models 151A15-1B and 154A20-1. Models 172A20-1, 172A20-1A and 172A20-1B are similar but 20 amp outlet is not used.

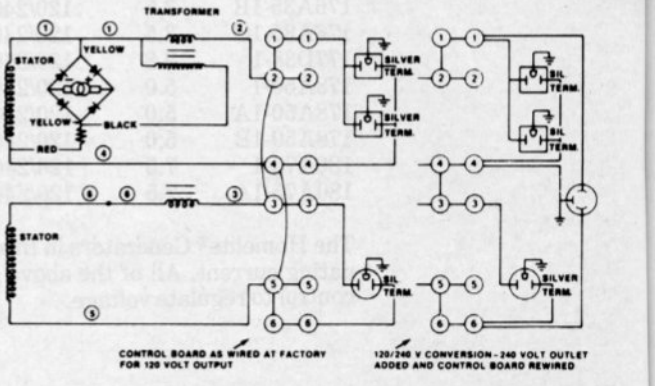


Fig. HL5-7—Schematic of Models 152A25-1, 153A35-1 and 155A50-1.

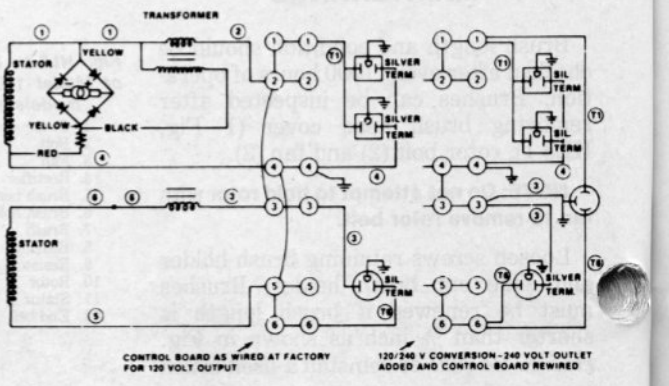


Fig. HL5-8—Schematic of Models 152A27-1A, 153A35-1A and 155A50-1A.

+ Loadamatic® Automatic Idle Control system is covered by U.S. Patent Nos. 3,612,892 and 3,626,197.

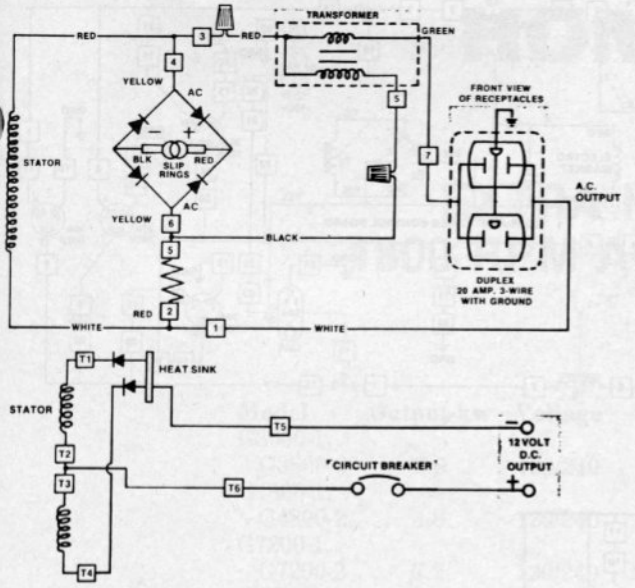


Fig. HL5-8A—Schematic of Model 170A15-1A.

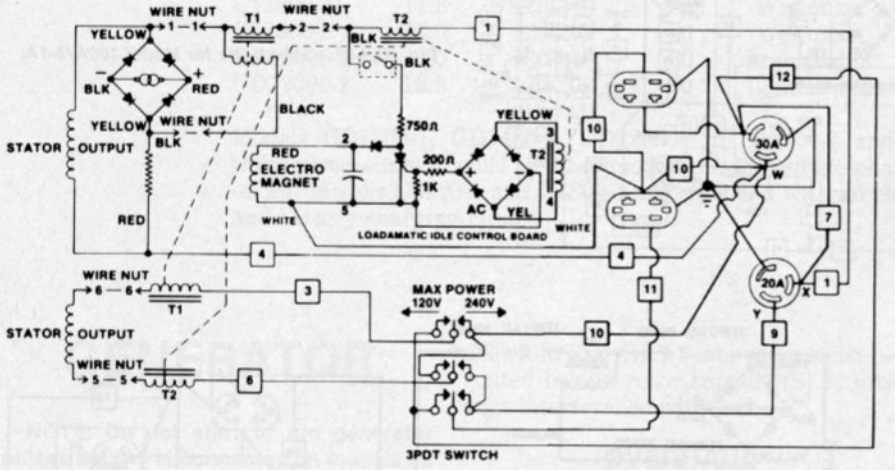


Fig. HL5-9—Schematic of Models 174A27-1A, 176A35-1A, 176A35-1B and 178A50-1A.

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 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 Loadamatic Automatic idle Control, proceed as follows: Refer to Fig. HL5-4 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 idle control. 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.

ENGINE

Engine make and model are listed at beginning of section. Refer to Briggs and Stratton service manual or Lombardini service section for engine service.

reassembly. Wires should be handled carefully to prevent damage to wire, insulation or connections. Generator rotor (10) has a taper fit with engine crankshaft and should be removed with a suitable tool.

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. HL5-3 and wires must be routed behind rotor support to prevent interference with fan.

LOADAMATIC®

Some models may be equipped with a Loadamatic® Automatic Idle Control.

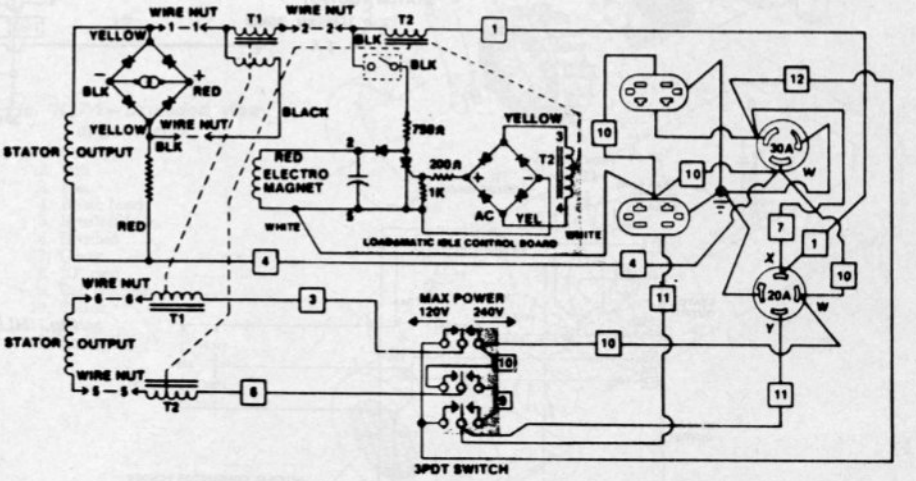


Fig. HL5-10—Schematic for Models 174A27-1B, 176A35-1C and 178A50-1B.

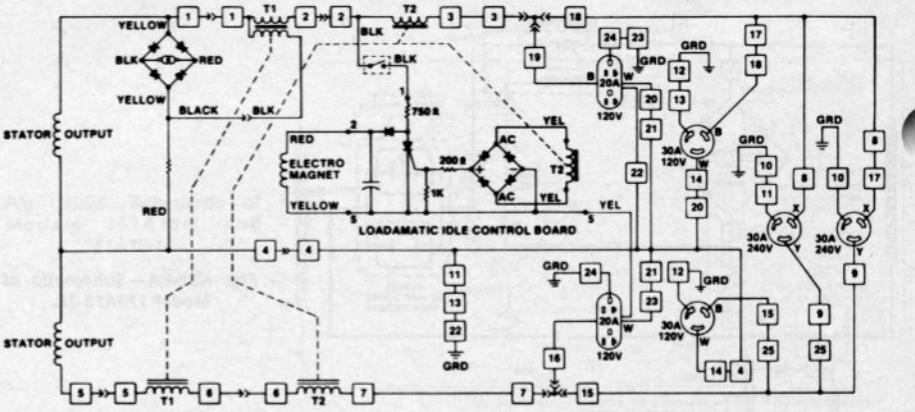


Fig. HL5-12—Schematic of Model 180A75-1.

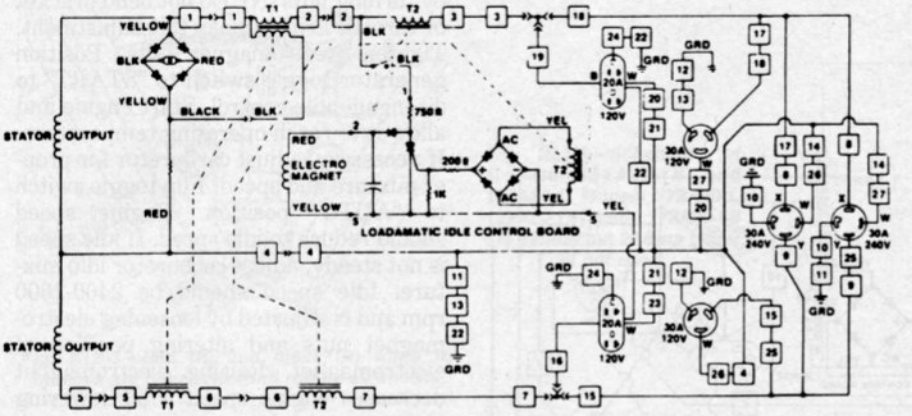


Fig. HL5-13—Schematic for Model 180A75-1A.

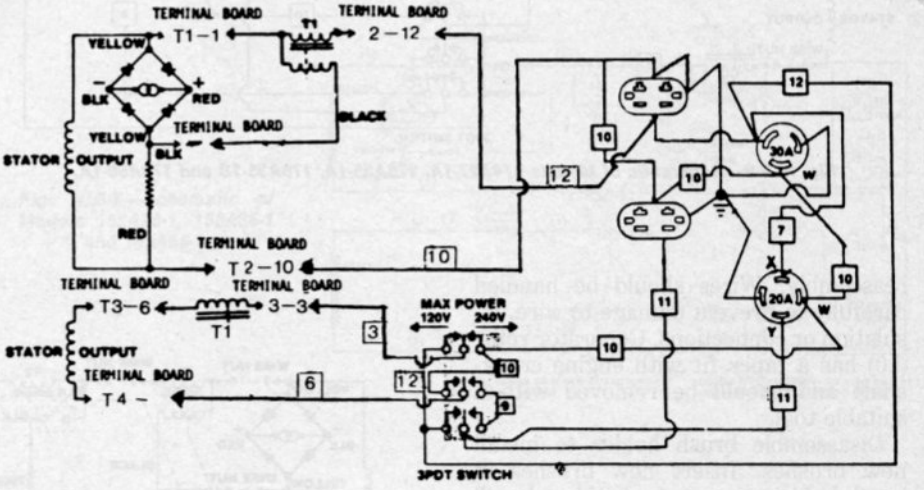


Fig. HL5-14—Schematic for Model 177D38-1.

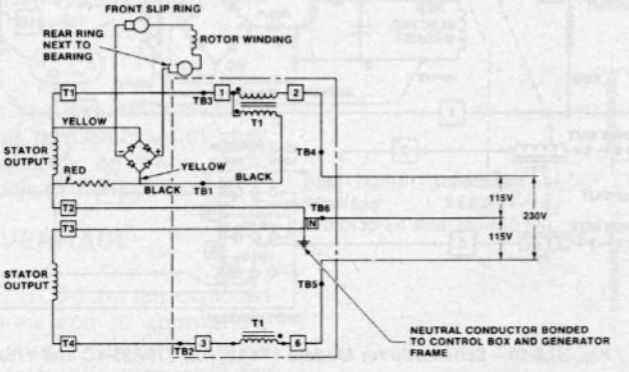


Fig. HL5-15—Schematic of Model 175A42-1.

HOMELITE

EXTRA HEAVY-DUTY 1800 RPM AC GENERATORS

Model	Output-kw	Voltage	Hertz	Engine Make	Engine Model	Governed Rpm
G3600-1, G3600-2	3.6	120/240	60	Kohler	K301	1800
G4800-1, G4800-2	4.8	120/240	60	Kohler	K341	1800
G7200-1, G7200-2	7.2	120/240	60	Kohler	K582	1800
GD7200-1	7.2	120/208	60	Lombardini	L20	1800
GD7400-2	7.4	120/208	60	Lombardini	L20	1800
G11800-1	11.8	120/240	60	Wisconsin	VH4D	1800
G12000-2	12.0	120/208	60	Wisconsin	VH4D	1800
GD12000-1	12.0	120/240	60	Lombardini	L27	1800
GD12300-2	12.3	120/208	60	Lombardini	L27	1800

Models GD7200-1, GD7400-2, GD12000-1, GD12000-2 and GD12300-2 produce three-phase current while all other models produce single-phase current. All models except Models G3600-1 and G4800-1 are equipped with an electric starter, battery and battery charging circuit.

GENERATOR

NOTE: Do not start or run generator unless battery is connected on models so equipped.

MAINTENANCE

Brush length and condition should be checked after every 1000 hours of operation. Brushes can be inspected after removing brush head cover (1 – Fig. HL7-1), 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 3/8 inch as shown in Fig. HL7-2. Be sure to reinstall a used brush so that brush curvature matches collector ring.

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 (No. 15) and black (No. 14) wires to brushes should be connected as shown in Fig. HL7-3 and wires must be routed behind rotor support (S) to prevent interference with fan.

OVERHAUL

Refer to Fig. HL7-1 for an exploded view of generator. Refer to Figs. HL7-4 through HL7-8 for wiring schematic. When installing brushes refer to MAINTENANCE section for proper brush installation.

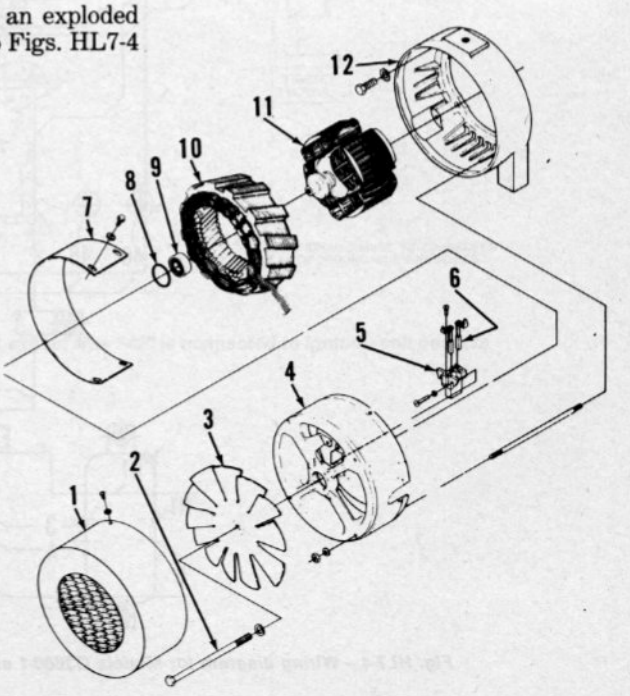


Fig. HL7-1 – Exploded view of generator.

1. Cover
2. Bolt
3. Fan
4. Brush head
5. Brush holder
6. Brushes
7. Cover
8. "O" ring
9. Ball bearing
10. Stator
11. Rotor
12. End bell

ENGINE

Engine make and model are listed at beginning of section. Refer to Kohler or Wisconsin service manuals or Lombardini engine section for engine service.

NOTE: These generators are designed for operation at 1800 rpm. Adjust governor as outlined in engine section but adjust governed speed so engine runs at 1800 rpm under load.

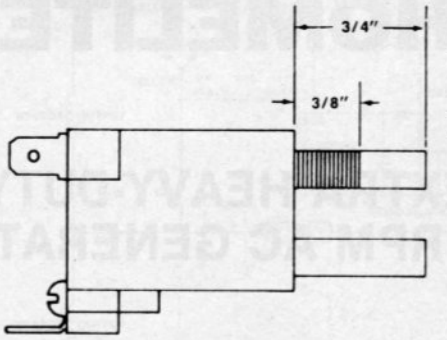


Fig. HL7-2—Brush length should not be less than ⅜ inch when measured as shown above. Brush length of a new brush is ¾ inch.

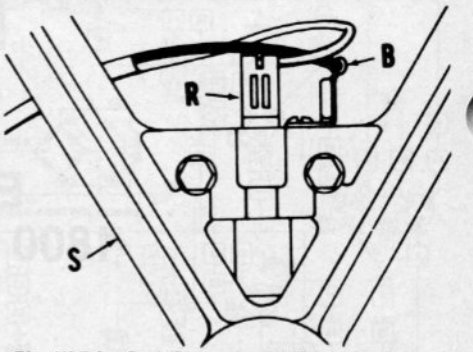


Fig. HL7-3—Red (R) number "15" brush wire and black (B) number "14" brush wire are connected and routed as shown.

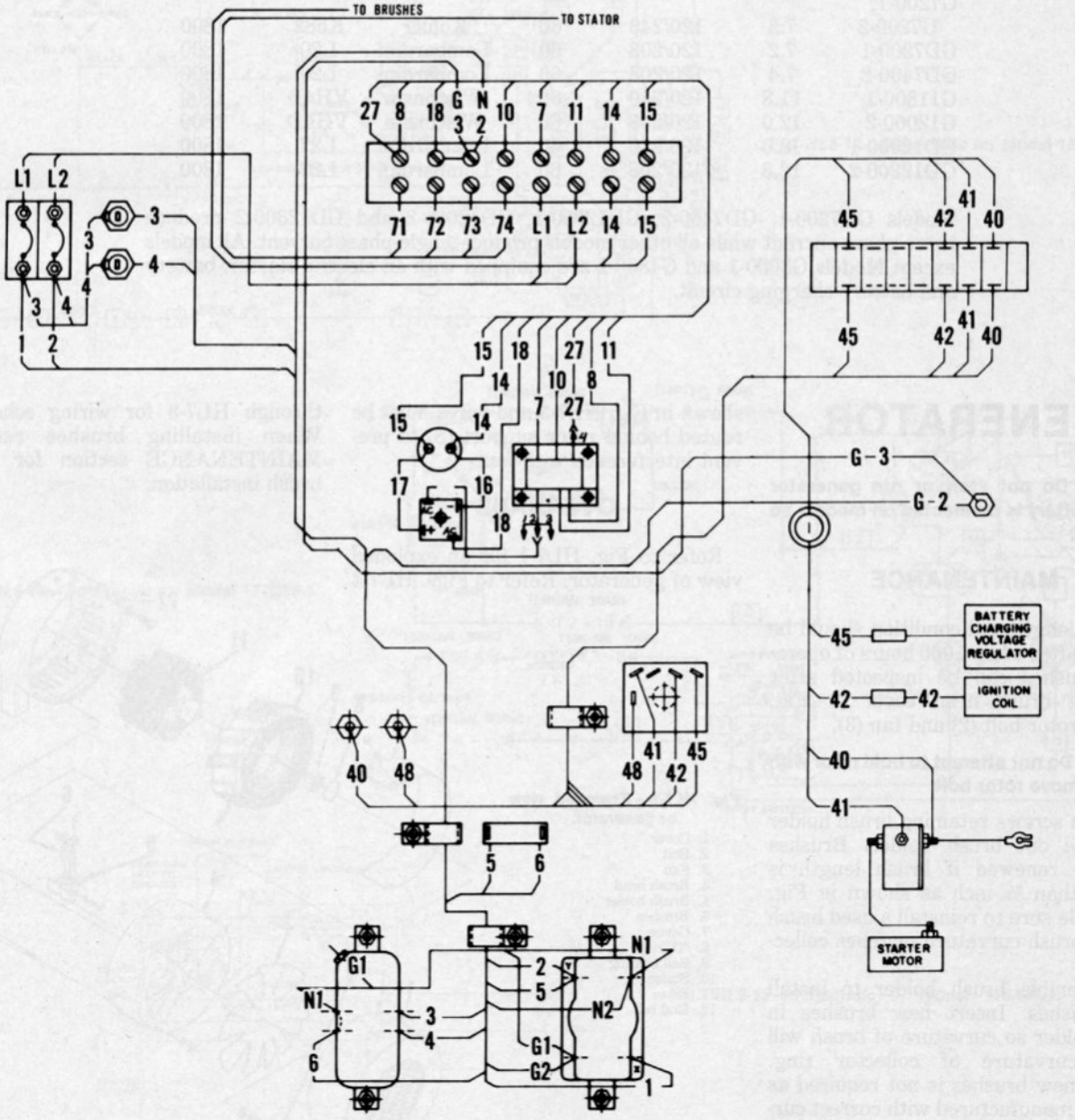


Fig. HL7-4—Wiring diagram for Models G3600-1 and G4800-1. Models G3600-2 and G4800-2 are similar except for engine circuit.

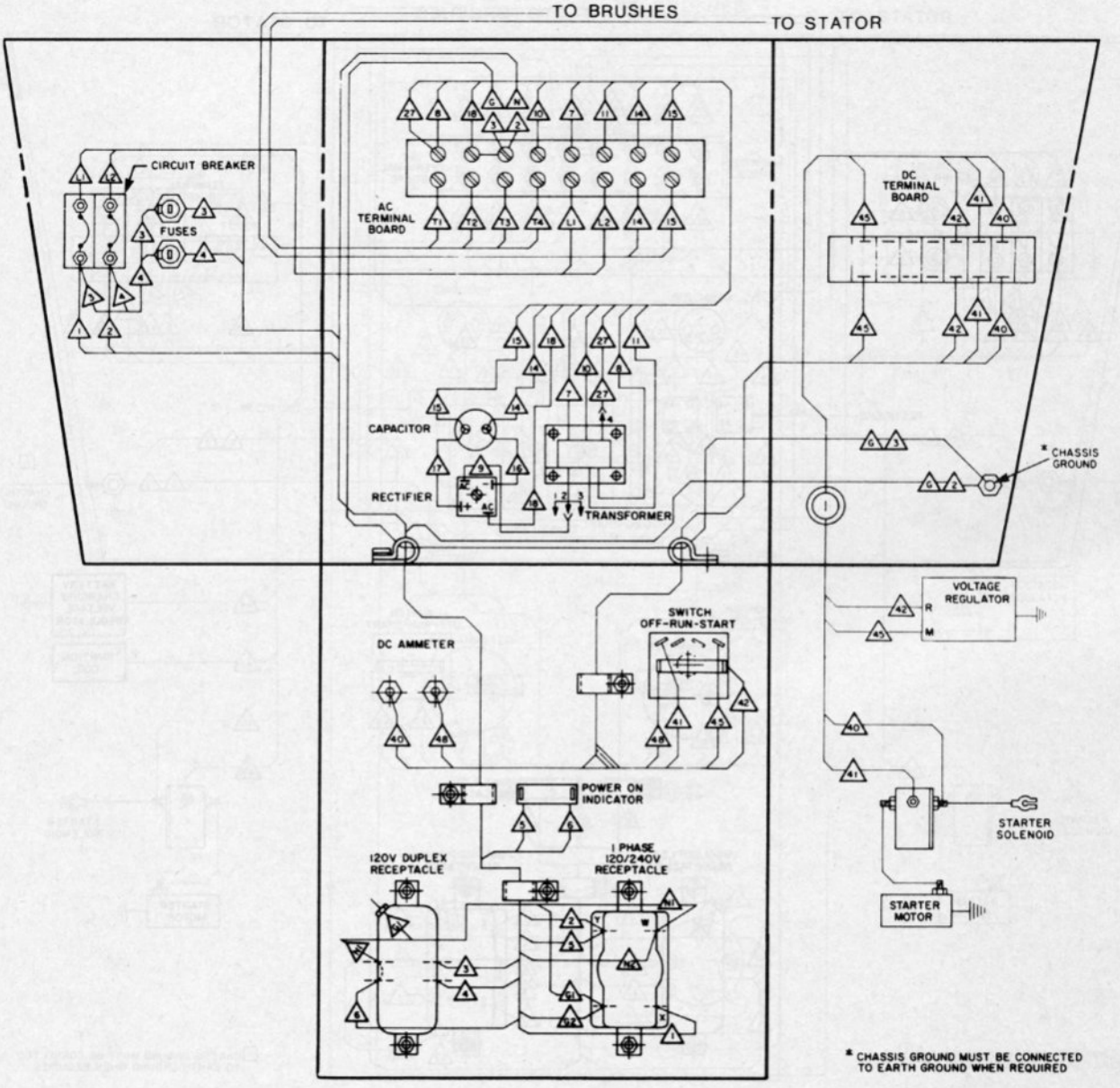


Fig. HL7-5 — Wiring diagram for Model GD7200-1. Model G7200-1 is similar except wire "42" is connected to ignition coil positive terminal.

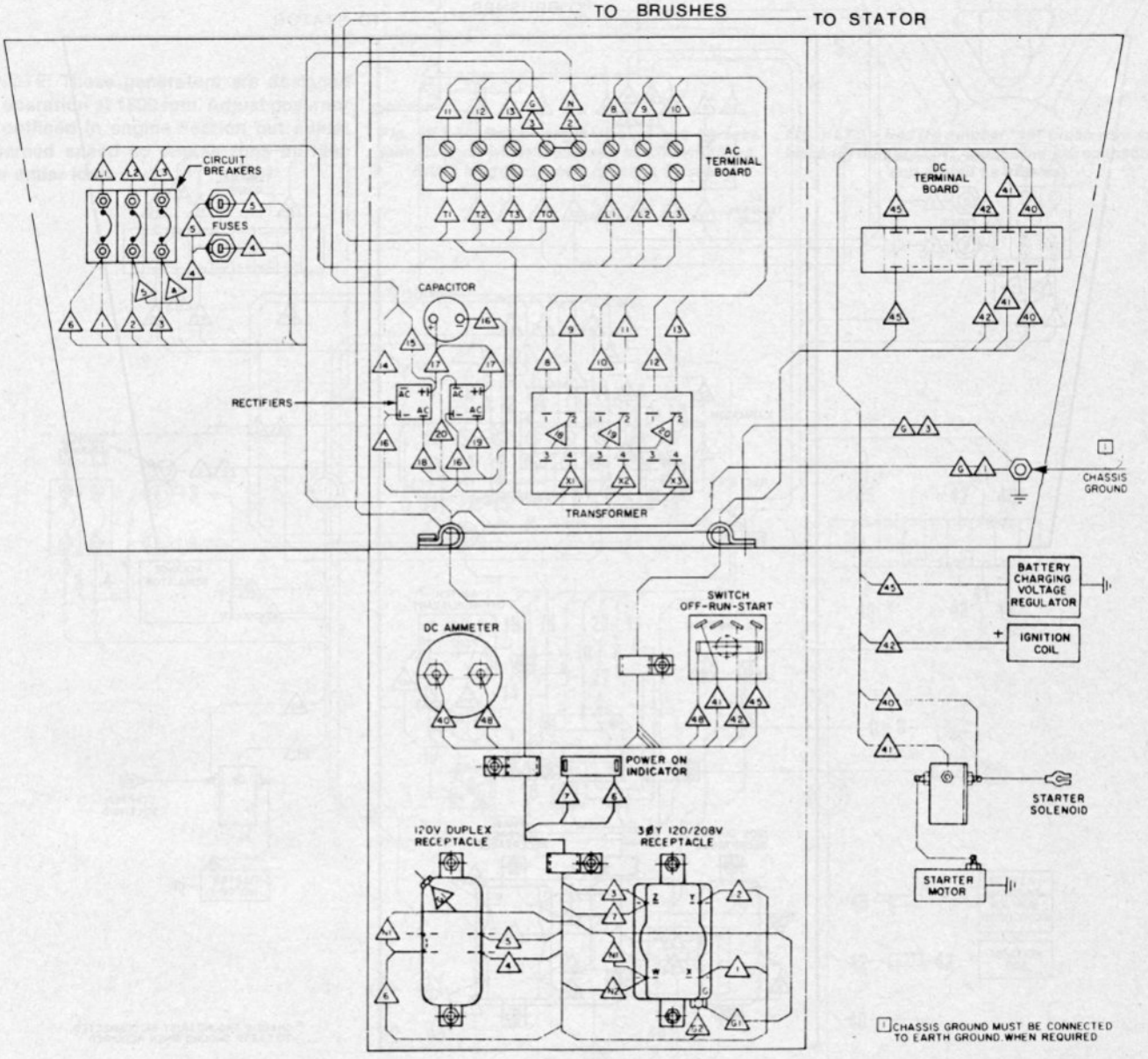


Fig. HL7-6—Wiring diagram for Model G7200-2.

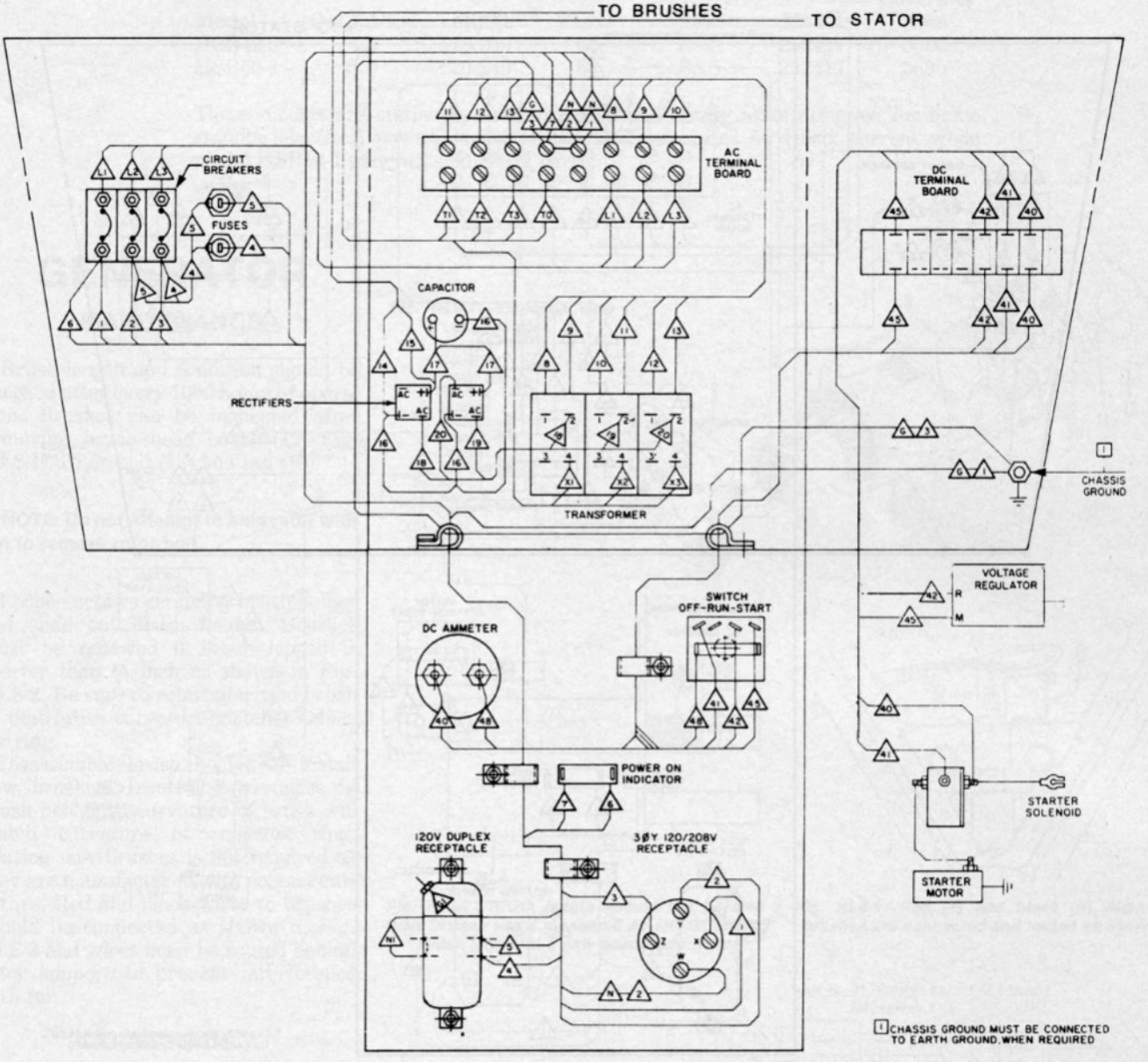


Fig. HL7-7—Wiring diagram for Models GD7400-2 and GD12300-2. Model G12000-2 is similar except wire "42" is connected to ignition coil positive terminal.

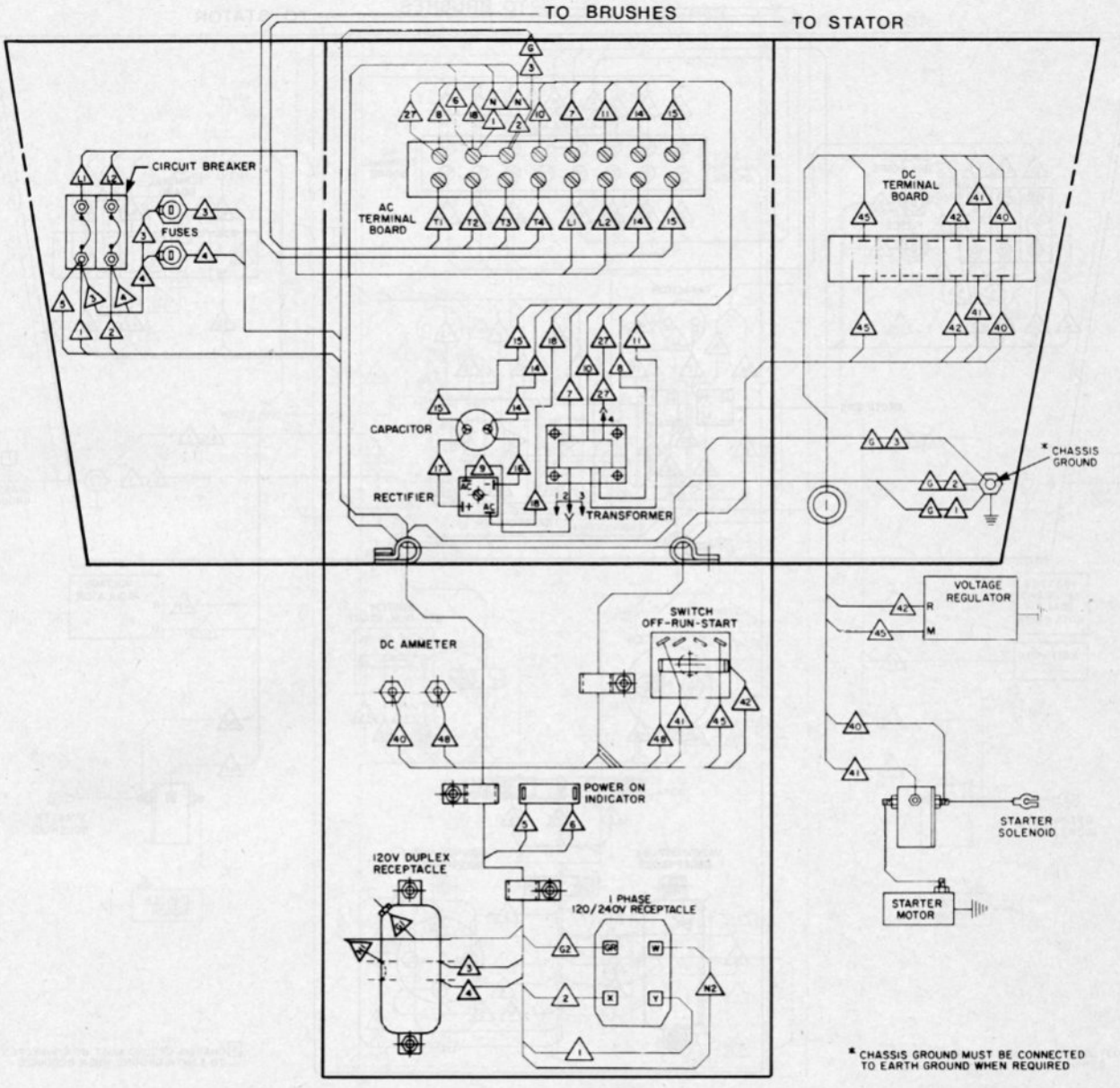


Fig. HL7-8 — Wiring diagram for Model GD12000-1. Model G11800-1 is similar except wire "42" is connected to ignition coil positive terminal.

HOMELITE

STANDBY GENERATORS

Model	Output-kw	Voltage	Hertz	Engine Make	Engine Model	Governed Rpm
HSB42/50-1	4.2	115/230	60	B&S	252417	3600
HSB50-1	5.0	120/240	60	B&S	252417	3600

These models are stationary, self-contained generating units designed for home standby electrical power. Model HSB42/50-1 generates 50 Hertz current while model HSB50-1 generates 60 Hertz current.

GENERATOR

MAINTENANCE

Brush length and condition should be checked after every 1000 hours of operation. Brushes can be inspected after removing brush head cover (12–Fig. HL8-1), rotor bolt (13) and fan (10).

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 ⅜ inch as shown in Fig. HL8-2. Be sure to reinstall a used brush so that brush curvature matches collector ring.

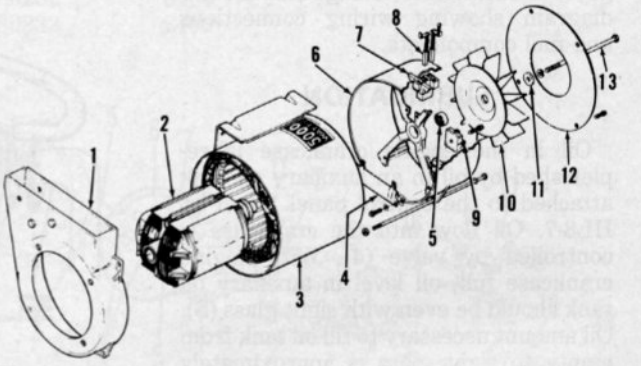
Disassemble brush holder to install new brushes. Insert new brushes in brush holder so curvature of brush will match curvature of collector ring. Seating new brushes is not required as they are manufactured with correct curvature. Red and black wires to brushes should be connected as shown in Fig. HL8-3 and wires must be routed behind rotor support to prevent interference with fan.

OVERHAUL

Refer to Fig. HL8-1 for an exploded view of generator. Refer to Fig. HL8-4 for wiring schematic. When installing brushes refer to MAINTENANCE section for proper brush installation.

Fig. HL8-1—Exploded view of generator.

1. End bell
2. Rotor
3. Stator assy.
4. Resistor
5. Bearing
6. Brush head
7. Brush holder
8. Brushes
9. Rectifier
10. Fan
11. Washer
12. Cover
13. Bolt



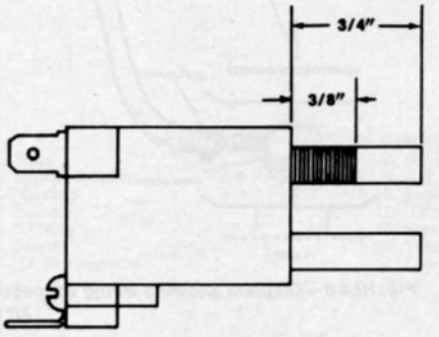


Fig. HL8-2—Brush length should not be less than ⅜ inch when measured as shown above. Brush length of a new brush is ¾ inch.

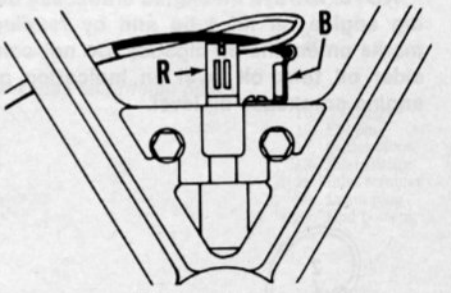


Fig. HL8-3—Red (R) and black (B) wires to brushes are connected and routed as shown.

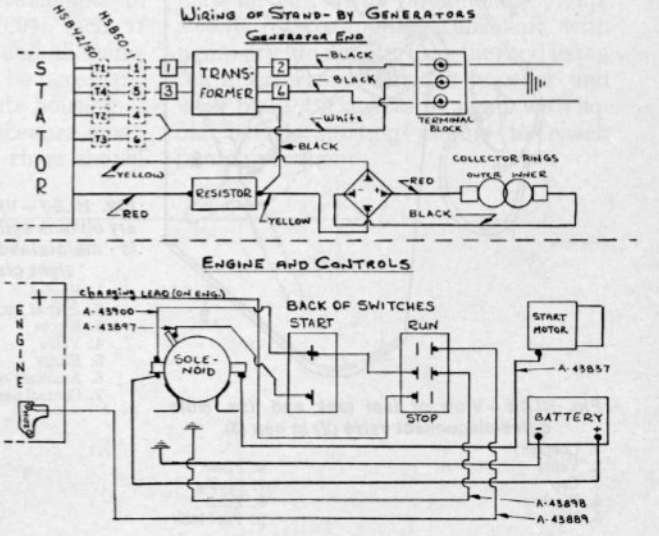


Fig. HL8-4—Wiring schematic for HSB42/50-2 and HSB50-1.

ENGINE

Engine make and model are listed at beginning of section. Refer to Briggs and Stratton service manual for engine service, however, note the following additional service areas.

FUEL SYSTEM

Fuel for gasoline-fueled engines is contained in the five gallon container shown in Fig. HL8-5. The engine fuel pump transfers fuel from the tank to the carburetor. Filters (6 and 8) must be clean and vents (2) in tank cap (3) must operate properly for adequate fuel movement. Vents (2) are one-way valves and must be installed in cap so one vent allows air in while other valve vents pressure in tank. Note quick-connect coupler (1) and valve (V) in tank cap which must also seal properly.

Conversion kit (#A-47499) may be installed to operate generator engine with gaseous fuel. Refer to Fig. HL8-6 for a diagram showing wiring connections and fuel components.

LUBRICATION

Oil in the engine crankcase is replenished by oil in an auxiliary oil tank attached to the control panel. See Fig. HL8-7. Oil flow into the crankcase is controlled by valve (4). With engine crankcase full, oil level in auxiliary oil tank should be even with sight glass (S). Oil amount necessary to fill oil tank from empty to sight glass is approximately one quart.

NOTE: Always fill engine crankcase using engine oil fill tube and by reading marks on engine oil dipstick. Do not consider oil tank oil level an indication of engine crankcase oil level.

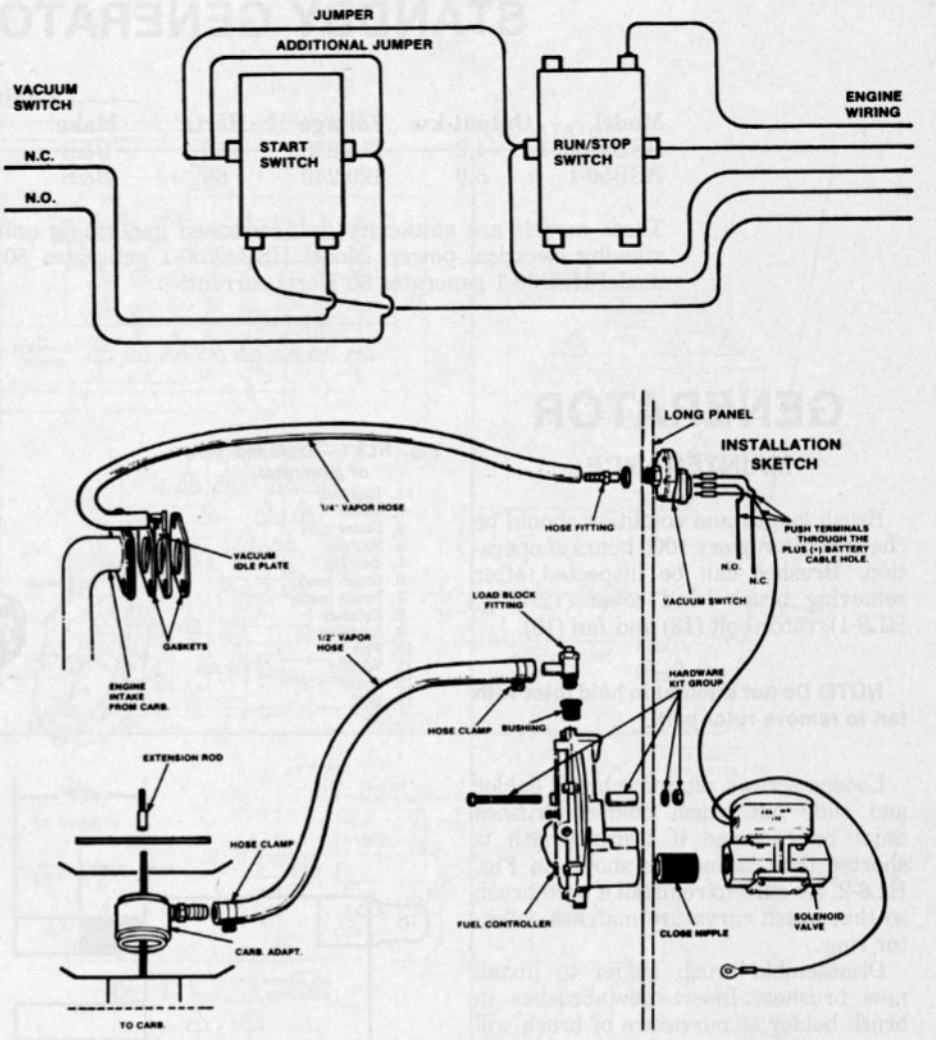


Fig. HL8-6 — Diagram showing wiring connections and fuel components of gaseous fuel conversion kit (#A-47499).

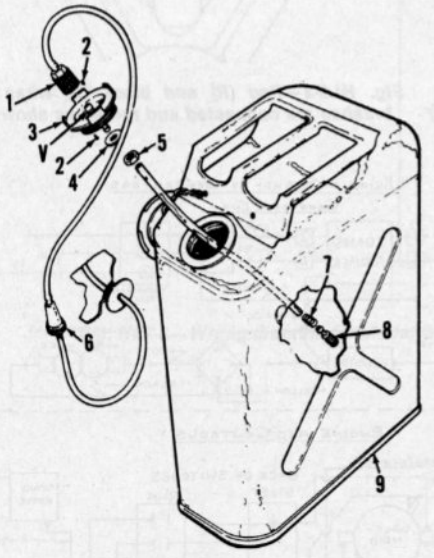


Fig. HL8-5 — View of fuel tank and line. Note quick-disconnect valve (V) in cap (3).

1. Coupler
2. Vents
3. Cap
4. Washer
5. Nut
6. Filter
7. Spring
8. Filter
9. Fuel tank

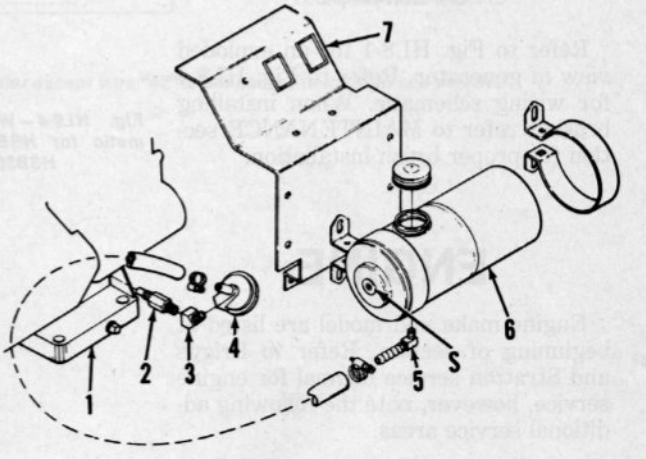


Fig. HL8-7 — View of auxiliary oil tank and line. Oil level is maintained even with sight glass (S).

1. Engine
2. Special fitting
3. Elbow
4. Valve
5. Elbow
6. Auxiliary oil tank
7. Control panel

HOMELITE

AP SERIES PUMPS

Pump Model	Engine Make	Engine Model	GPH
AP215-1	B&S	80232	6000
AP215-1A	B&S	80232	6000
AP220-1	B&S	80232	8400
AP220-1A	B&S	80232	8400
AP315-1	B&S	80232	6000
AP315-1A	B&S	80232	6000
AP320-1	B&S	80232	8400
AP320-1A	B&S	80232	8400

OPERATION

These centrifugal pumps are designed for pumping water and other non-flammable liquids. All pumps are self-priming but pump must be filled with liquid to prevent damage to pump shaft seal. Inlet connections must be air tight for efficient pump operation.

Pump seal, check valve and "O" rings are made of Buna N or EPDM elastomers and it may be necessary to install a different composition seal, check valve and "O" rings for compatibility with liquid. Consult Homelite publication ST-3048 when in doubt.

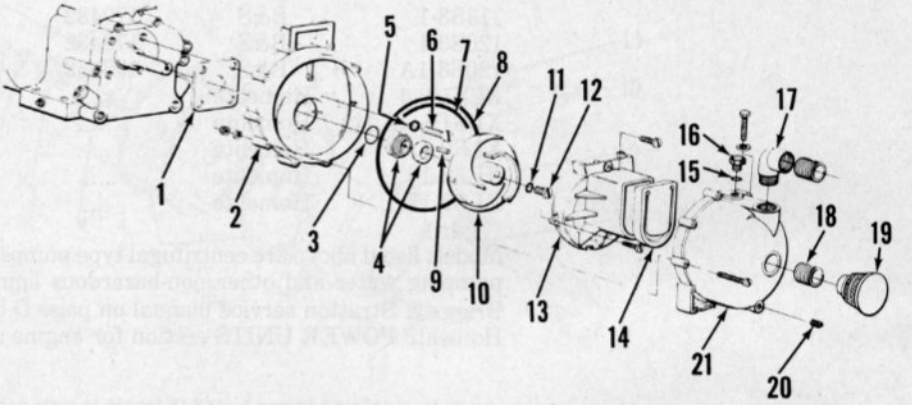


Fig. HL11-1—Exploded view of AP series centrifugal pump.

1. Shim
2. Impeller housing
3. "O" ring
4. Seal assy.
5. "O" ring
6. Screw
7. "O" ring segment
8. "O" ring
9. Key
10. Impeller
11. "O" ring
12. Screw
13. Volute housing
14. Check valve
15. "O" ring
16. Fill plug
17. Outlet elbow
18. Inlet fitting
19. Inlet strainer
20. Drain plug
21. End housing

REPAIRS

DISASSEMBLY AND REASSEMBLY. Disassembly and reassembly of pump is evident after inspection of unit and referral to exploded view in Fig. HL11-1. Impeller may be removed after unscrewing impeller retaining screw (12). Do not damage shims (1) when separating impeller housing (2) from engine. Inspect components and renew if excessively worn or damaged.

Before final assembly, make a trial assembly and check clearance between impeller and wear plate in volute housing (13). An approximate clearance of 0.015 inch between impeller and wear plate is desired. Install or remove shims (1) necessary to obtain desired impeller clearance. Shims (1) are available in thicknesses of 0.010 and 0.015 inch. If excessive clearance exists and all shims have been removed, it will be necessary to renew impeller and volute housing.

Reverse disassembly procedure when assembling pump. All "O" rings should be renewed. Do not overtighten volute housing retaining screws as "O" rings may be cut. After assembling pump, slowly rotate engine crankshaft with pump dry (do not start engine) and listen for interference between impeller and wear plate. Be sure to fill pump with liquid before starting engine to check pump operation.

HOMELITE

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
110SU1½-1B	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
111S2-1A	B&S	81232	8700
111SU2-1	B&S	80231	8500
113S3-1	B&S	170432	18000
120S3-1	B&S	170432	18000
120S3-1A	B&S	195432	17200
XLS1½-4	Homelite	.....	4300
XLS1½-4A	Homelite	.....	4300
XLS2-1	Homelite	.....	8400
XLS2-1A	Homelite	.....	8400
XLS2-1B	Homelite	.....	8400

Models listed above are centrifugal type pumps designed for pumping water and other non-hazardous liquids. Refer to Briggs & Stratton service manual on page D-52 or D-56 of Homelite POWER UNITS section for engine service.

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. HL12-1, HL12-2, HL12-3 or HL12-4. 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. On Models XLS1½-4 and XLS1½-4A, impeller housing (1–Fig. HL12-3) must be removed from engine to inspect and renew seal (17) and bearing (16).

Install sufficient shims (4–Fig. HL12-1, HL12-2, HL12-3 and HL12-4) to obtain clearance between impeller (6) and wear plate (8) of 0.020-0.030 inch on Models 120S3-1 and 120S3-1A, and 0.015-0.025 inch on all other models. Some pumps are equipped with seal shims in place of spacer (5–Fig. HL12-1). Install original seal shims or add seal shims if impeller shims (4) are added–delete seal shims if impeller shims are removed. 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.

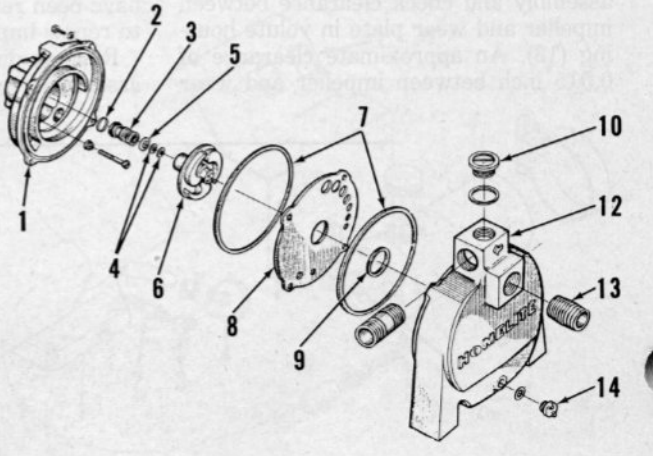


Fig. HL12-1–Exploded view of Model 111S2-1 centrifugal pump. Other models mounted on B&S engines are similar except Models 120S3-1 and 120S3-1A shown in Fig. HI12-2.

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

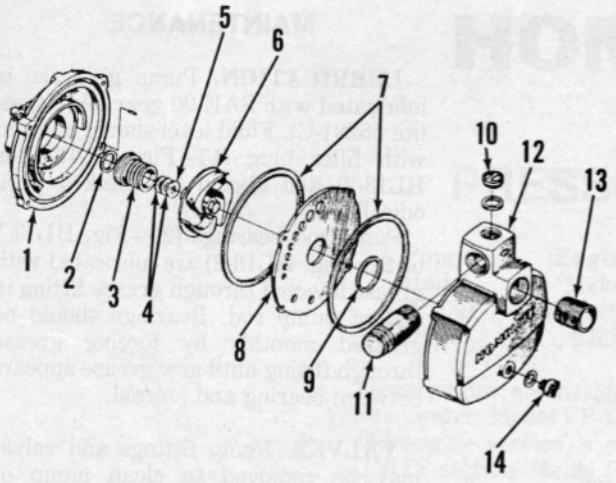


Fig. HL12-2—Exploded view of Model 120S3-1 and 120S3-1A centrifugal pumps. Refer to Fig. HL12-1 for parts identification.

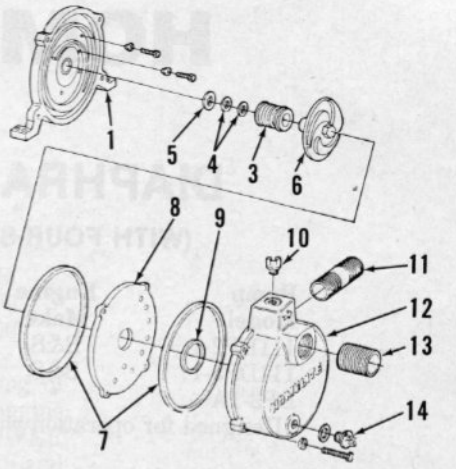


Fig. HL12-4—Exploded view of Model XLS2-1, XLS2-1A and XLS2-1B centrifugal pumps. Refer to Fig. HL12-1 for parts identification.

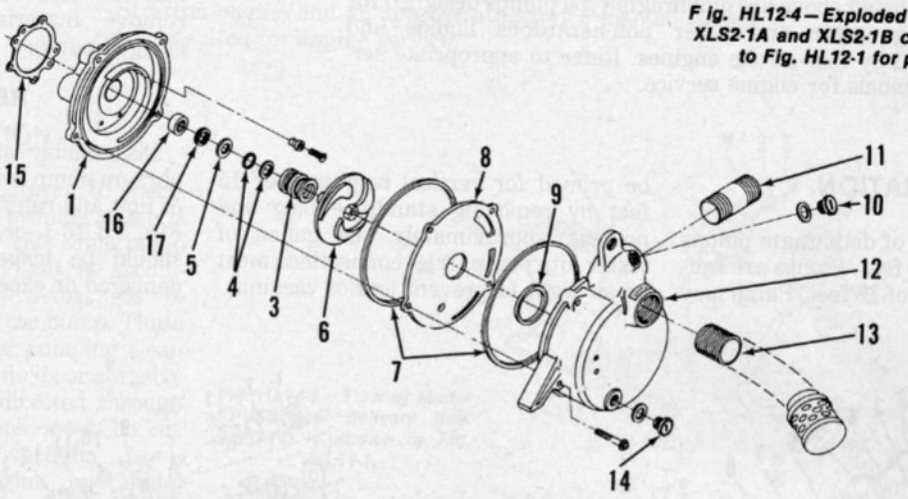


Fig. HL12-3—Exploded view of Model XLS1½-4 and XLS1½-4A centrifugal pumps.

1. Impeller housing
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
15. Gasket
16. Bearing
17. Seal

HOMELITE

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.

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 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. HL13-1 or HL13-2) and should be checked periodically.

Pump rod bearings (29–Fig. HL13-1 or 22–Fig. HL13-2) 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. HL13-1 or HL13-2. Components should be inspected and renewed if damaged or excessively worn.

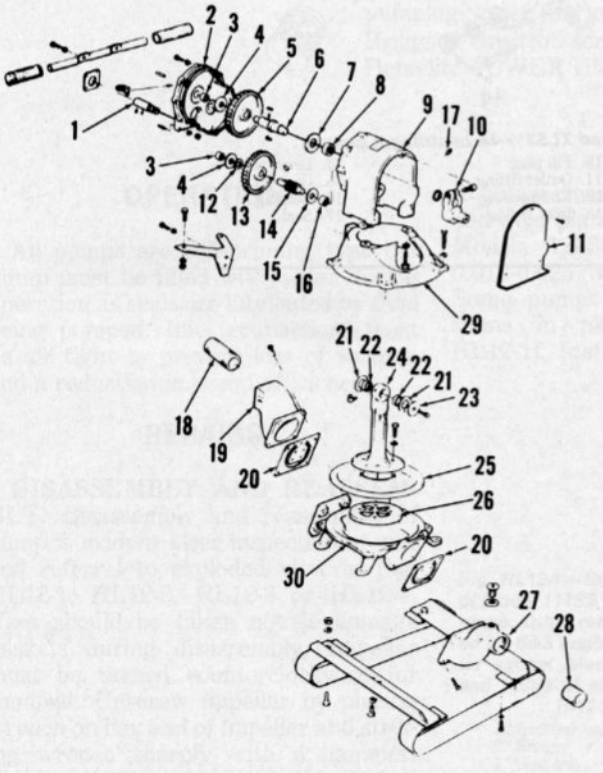


Fig. HL13-1–Exploded view of 111DP2-1 diaphragm pump.

1. Input shaft
2. Gearcase cover
3. Needle bearing
4. Thrust washer
5. Pump gear
6. Driveshaft
7. Thrust washer
8. Needle bearing
9. Gearcase
10. Crank
11. Shield
12. Spacer
13. Gear
14. Intermediate shaft
15. Thrust washer
16. Needle bearing
17. Fill plug
18. Outlet fitting
19. Outlet manifold
20. Valve
21. Thrust washer
22. Needle bearing
23. Washer
24. Rod
25. Diaphragm
26. Diaphragm cap
27. Inlet manifold
28. Inlet fitting
29. Pump body
30. Lower housing

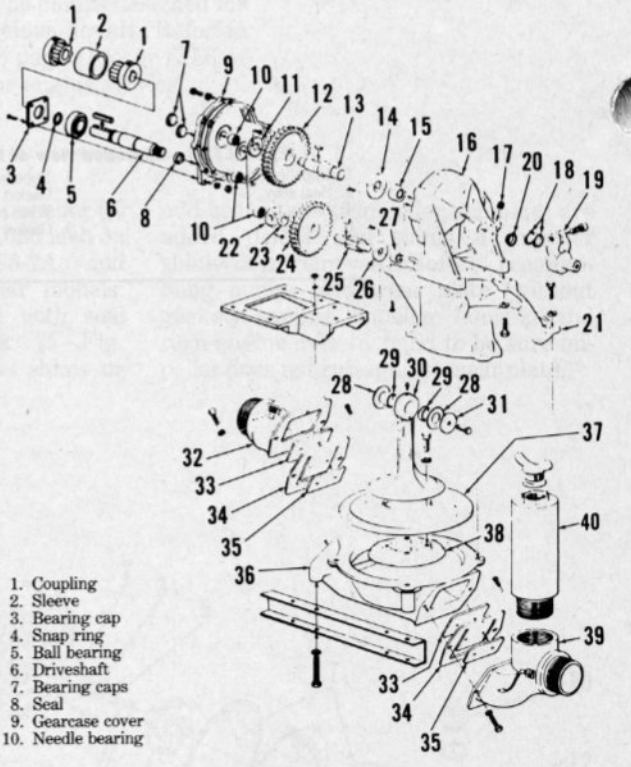


Fig. HL13-2–Exploded view of Model DP3-1A diaphragm pump. Model 111DP3-1 is similar.

1. Coupling
2. Sleeve
3. Bearing cap
4. Snap ring
5. Ball bearing
6. Driveshaft
7. Bearing caps
8. Seal
9. Gearcase cover
10. Needle bearing
11. Thrust washer
12. Pump gear
13. Driveshaft
14. Thrust washer
15. Needle bearing
16. Gearcase
17. Fill plug
18. Seal
19. Crank
20. Bearing cap
21. Pump housing
22. Thrust washer
23. Spacer
24. Gear
25. Intermediate shaft
26. Thrust washer
27. Needle bearing
28. Thrust washer
29. Needle bearing
30. Rod
31. Washer
32. Outlet manifold
33. Valve plate
34. Valve
35. Valve weight
36. Lower housing
37. Diaphragm
38. Diaphragm cap
39. Inlet manifold
40. Standpipe

HOMELITE

PRESSURE PUMPS

Pump Model	Engine Make	Engine Model	GPH
FP-150	Homelite	.....	3600
FP-250	B&S	221432	12500

These pumps are designed for high-pressure pumping of clean water. Model FP-150 is powered by a Homelite engine and engine service is covered on page D-49 in POWER UNITS section. Model FP-250 is powered by a Briggs and Stratton engine and an appropriate service manual should be consulted for engine service.

OPERATION

Pump must be primed prior to operation. A hand-operated priming pump is provided on Model FP-150 while pump priming on Model FP-250 is accomplished using engine exhaust gas to draw priming water to the pump. These pumps are designed for pumping clean water only. Hazardous fluids or abrasive material must not be directed through pump. Inlet connections must be air tight to prevent loss of vacuum.

Before starting engine on Model FP-150, connect fuel hose between fuel tank and engine, then open vent (V – Fig. HL14-1) by turning counterclockwise. Squeeze fuel hose primer bulb to transfer fuel from fuel tank to engine.

Model FP-150 pump is equipped with an automatic ignition system cut-off module (7 – Fig. HL14-2) which stops engine in case of overspeeding at full throttle, such as when prime is lost. The engine's ignition system must cut-off before engine speed exceeds 10000 rpm. Ignition system cut-off resets after engine stops so engine can be immediately restarted.

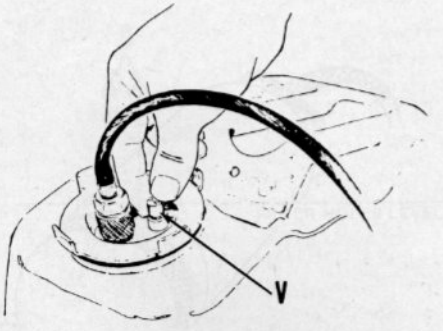


Fig. HL14-1 – Turn vent (V) counterclockwise to open and vent Model FP-150 fuel tank.

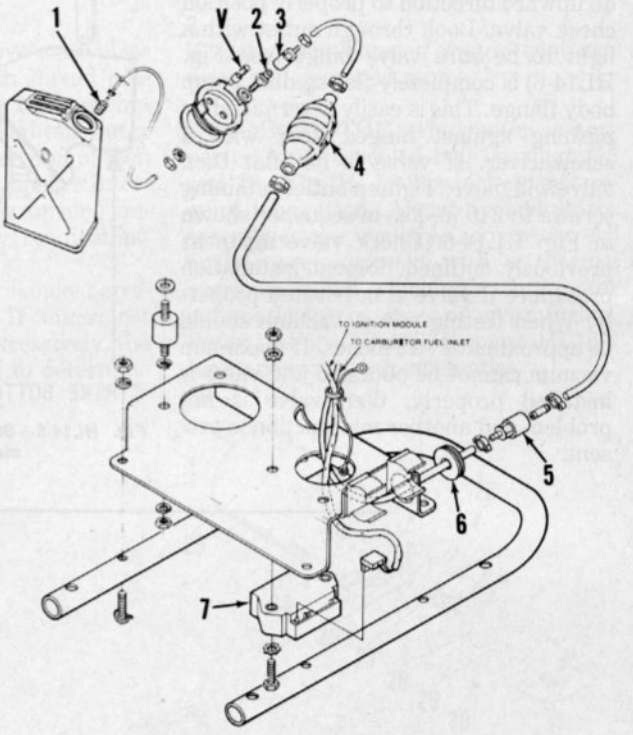


Fig. HL14-2 – View of Model FP-150 fuel delivery line. Vent (V) is shown in Fig. HL14-1.

1. Filter
2. Bushing
3. Coupler
4. Primer bulb
5. Coupler
6. Grommet
7. Ignition cut-off module

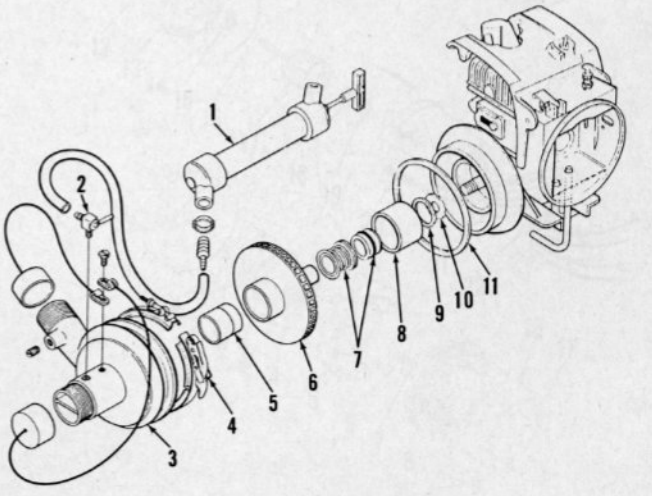


Fig. HL14-3 – Exploded view of Model FP-150 pump.

1. Primer pump
2. Valve
3. End housing
4. Clamp
5. Wear ring
6. Impeller
7. Seal assy.
8. Wear ring
9. Thrust washer
10. Washer
11. Square ring

PUMP REPAIR

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL14-3 or HL14-4 for an exploded view of pump. Internal components are accessible after removing clamp (4–Fig. HL14-3) on FP-150 models or after removing end housing (4–Fig. HL14-4) on FP-250 models. Impeller is threaded on engine crankshaft. Inspect components and renew any components which are excessively worn or damaged.

Before installing check valve (3-Fig. HL14-4) on Model FP-250, apply Dow Corning no. 4 lubricant compound (Homelite part no. 22636-B) to faces of outlet and pump body. Install check valve and outlet on pump but tighten retaining screws until snug, do not tighten. Strike bottom of outlet, as shown in Fig. HL14-5, several times in an upward direction to properly position check valve. Look through outlet with a light to be sure valve hinge (see Fig. HL14-6) is completely flat against pump body flange. This is easily determined by pushing against hinged area with a screwdriver. If valve is not flat then valve will move. Tighten outlet retaining screws to 240 in.-lbs. in sequence shown in Fig. HL14-6. Check valve again as previously outlined. Repeat installation procedure if valve is not seated properly. When testing pump, vacuum should be approximately 22 inches. If maximum vacuum cannot be obtained and valve is installed properly, then valve is not problem and another malfunction is present.

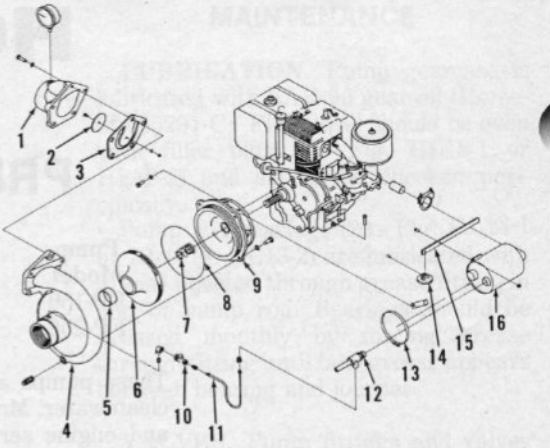


Fig. HL14-4–Exploded view of Model FP-250 pump.

1. Outlet
2. Weight
3. Check valve
4. End housing
5. Bushing
6. Impeller
7. Seal
8. "O" ring
9. Housing
10. Valve
11. Primer line
12. Primer venturi
13. Clamp
14. Diverter valve
15. Primer lever
16. Muffler

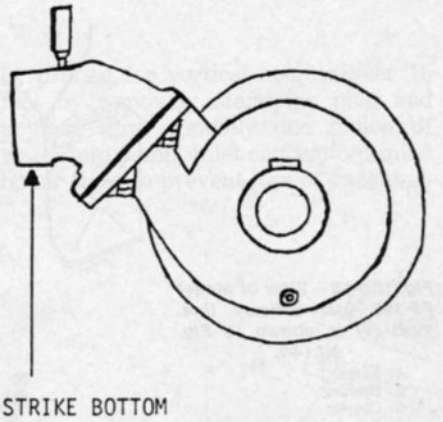


Fig. HL14-5–Strike bottom of outlet with a mallet to seat valve.

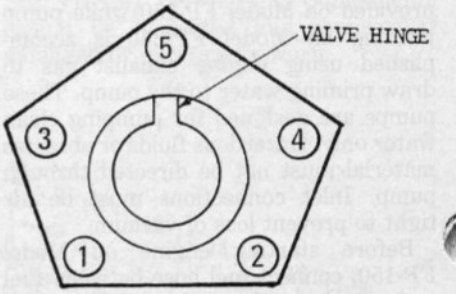


Fig. HL14-6–Tightening equence for outlet retaining screws.

HOMELITE

SUBMERSIBLE PUMPS

Pump Model	Volts	Amps	Hertz	Phase	GPH
SP150-1	*115	10.6	60	1	6500
SP150-1A	*115	10.6	60	1	6500
SP150-1B	*115	10.6	60	1	6500
SP200-1	230	21.0	60	1	13000
SP200-2	*115	21.0	60	1	13000
SP200-2A	*115	21.0	60	1	13000
SP200-2B	*115	21.0	60	1	13000
SP300-1	230	21.0	60	1	19000
SP300-1A	230	21.0	60	1	19000
SP300-1B	230	21.0	60	1	19000

*Models SP150 and SP200 may be converted to 230-volt operation using Homelite® Voltage Conversion Kit.

MAINTENANCE

The pump shaft is lubricated by oil contained in the back plate. Oil should be changed after every 500 hours or after one month of continuous operation. Remove oil plugs (9 – Fig. HL16-1) to drain oil. To refill pump, position pump on its side with oil plugs on top as shown in Fig. HL16-1, then fill cavity with SAE 30 non-detergent oil until oil level reaches bottom of plug holes. Inspect old oil for signs of contamination which may indicate faulty seals. Approximate oil capacity is 22 ounces.

REPAIRS

IMPELLER AND OIL SEALS. Pump impeller and wear plate should be renewed if excessively worn or damaged. The clearance between wear plate (2 – Fig. HL16-2) and impeller (4) should be 0.010-0.015 inch and is adjusted by turning stud nuts (N) as follows: While lightly pushing wear plate towards impeller, loosen inner nuts until wear plate contacts impeller evenly. Back off each inner nut ⅓ to ½ turn (move wear plate away from impeller) which should provide the desired clearance between impeller and wear plate. Tighten outer nuts against wear plate. Run pump, then stop pump and check for impeller interference with wear plate by turning impeller by hand. If necessary, readjust impeller clearance.

All seals and "O" rings should be renewed during overhaul. If innermost seal is damaged or worn excessively, the motor should be inspected to determine if water has entered motor compartment and damaged motor.

PUMP MOTOR. The motor is supported by two sealed ball bearings (15 and 18 – Fig. HL16-2) which do not require lubrication. Armature and stator assemblies are available separately. All models are equipped with a thermal overload switch which shuts off motor automatically in case of overheating. Refer to Figs. HL16-3 through HL16-8 for standard wiring schematics.

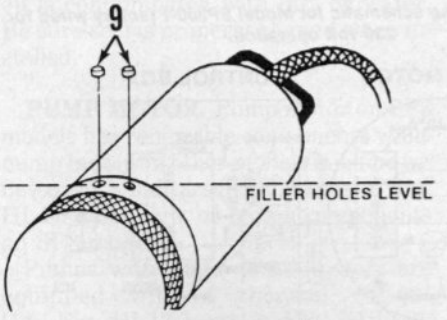


Fig. HL16-1 – Position pump as shown, remove plugs (9) and fill with oil until oil reaches bottom of plug holes.

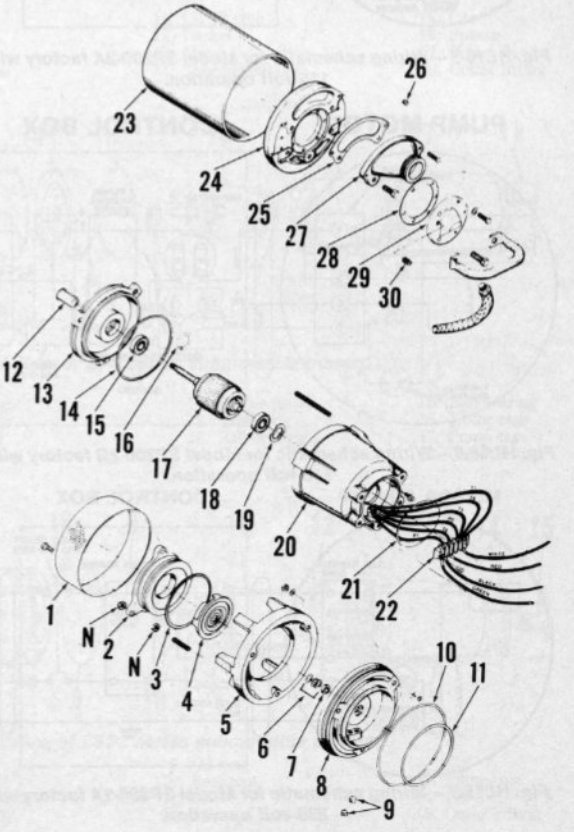


Fig. HL16-2 – Exploded view of Model SP300-1B pump. Other models are similar.

1. Strainer
2. Wear plate
3. "O" ring
4. Impeller
5. End plate
6. Shims
7. Spacer
8. Back plate
9. Plugs
10. "O" ring
11. "O" ring
12. Seal
13. Bearing housing
14. "O" ring
15. Bearing
16. Retaining ring
17. Armature
18. Bearing
19. Wave washer
20. Stator assy.
21. "O" ring
22. Terminal block
23. Shell
24. Top cap
25. Gasket
26. Threaded inserts
27. Outlet
28. Gasket
29. Cover
30. Plug

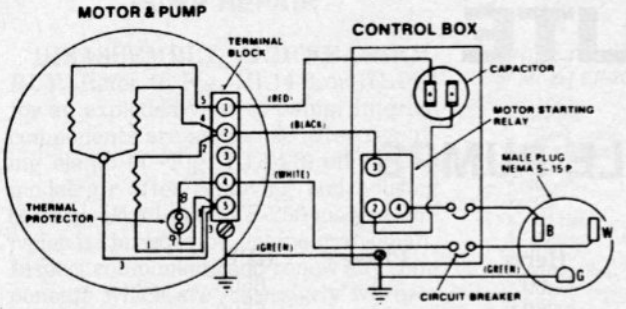


Fig. HL16-3 — Wiring schematic for Model SP150-1 factory wired for 115 volt operation.

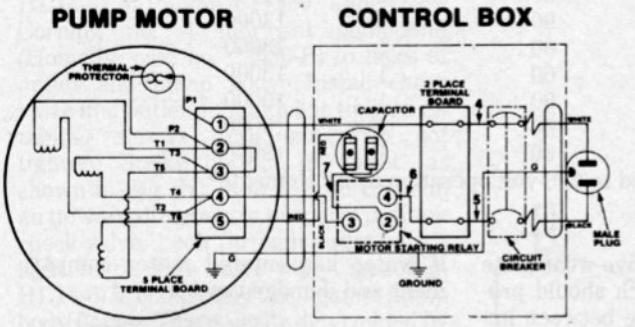


Fig. HL16-4 — Wiring schematic for Model SP150-1B factory wired for 115-volt operation.

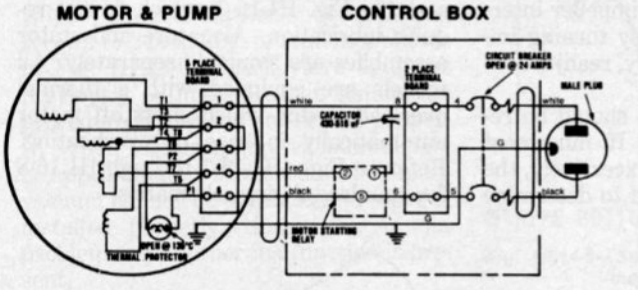


Fig. HL16-5 — Wiring schematic for Model SP200-2A factory wired for 115-volt operation.

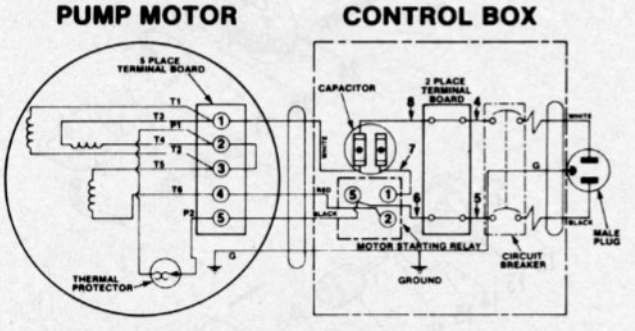


Fig. HL16-6 — Wiring schematic for Model SP200-2B factory wired for 115-volt operation.

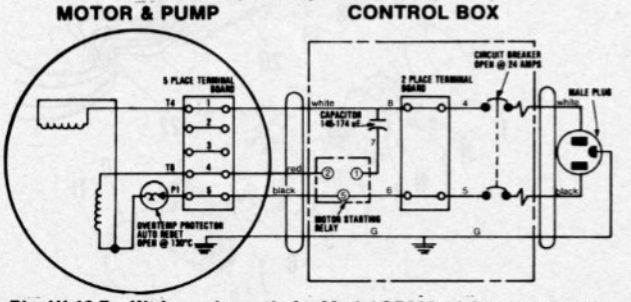


Fig. HL16-7 — Wiring schematic for Model SP300-1A factory wired for 230 volt operation.

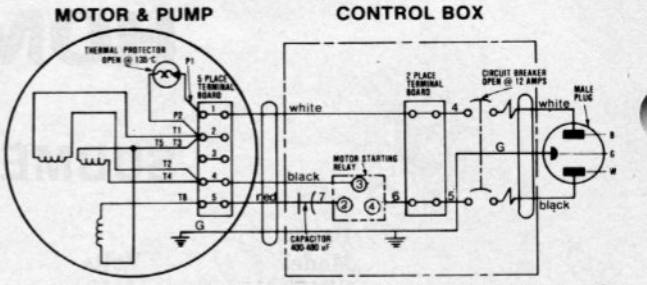


Fig. HL16-8 — Wiring schematic for Model SP150-1A factory wired for 115-volt operation.

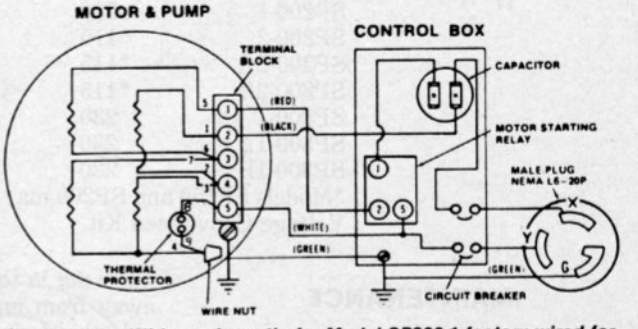


Fig. HL16-9 — Wiring schematic for Model SP200-1 factory wired for 230 volt operation.

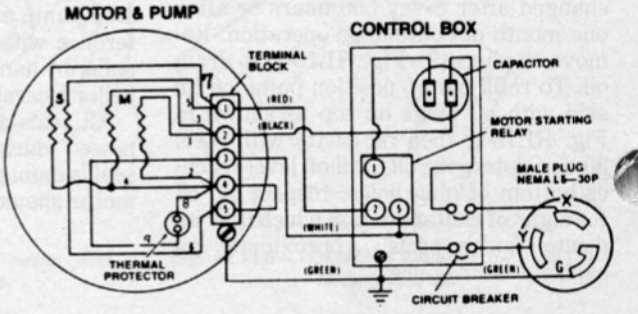


Fig. HL16-10 — Wiring schematic for Model SP200-2 factory wired for 115 volt operation.

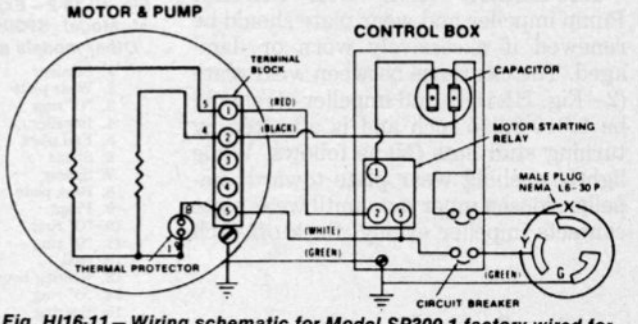


Fig. HI16-11 — Wiring schematic for Model SP300-1 factory wired for 230 volt operation.

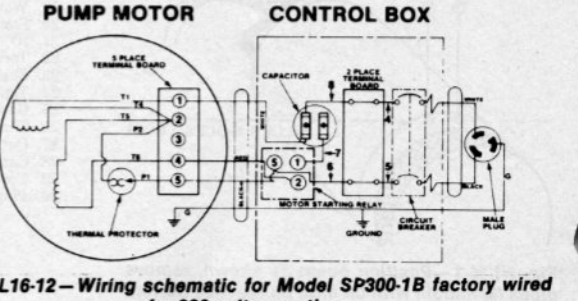


Fig. HL16-12 — Wiring schematic for Model SP300-1B factory wired for 230 volt operation.

HOMELITE

SUBMERSIBLE PUMPS

Pump Model	Volts	Amps	Hertz	Phase	GPH
LSP2-115/1-1	115	16	60	1	7500
LSP2-220/1-1	230	8	60	1	7500
SP2-115/1-1&1A	115	18	60	1	9000
SP2-220/50/1-1&1A	220	12	50	1	7500
SP2-220/1-1&1A	230	9	60	1	9000
SP2-220/3-1&1A	230	6	60	3	9000
SP2-380/3/50-1&1A	380	5	50	3	7500
SP3-220/3-1, 1A&1B	230	15	60	3	18500
SP3-440/3-1, 1A&1B	440	8	60	3	18500

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. HL17-1), impeller housing (3–Fig. HL17-2) or strainer (2–Fig. HL17-3).

Oil seals shown in Figs. HL17-1, HL17-2 or HL17-3 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. HL17-2 for view of motor components on SP3 models.

Pumps with single phase motors are equipped with a thermal cut-out (14–Fig. HL17-1 or 12–Fig. HL17-3), which opens the circuit if an overload occurs. Pumps with three phase motors

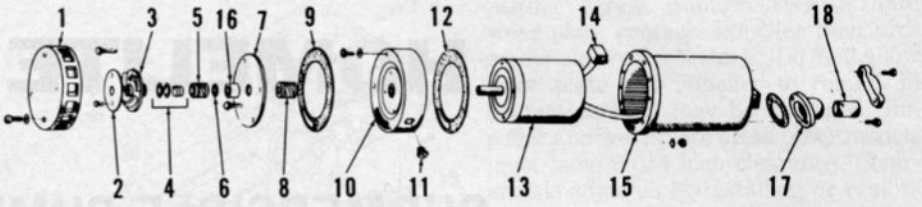


Fig. HL17-1–Exploded view of SP2 series submersible pumps.

1. Strainer
2. Wear plate
3. Impeller
4. Grit seal
5. Oil seal
6. Shim
7. Seal plate
8. Oil seal
9. Gasket
10. Frame plate
11. Oil fill plug
12. Gasket
13. Motor
14. Thermal cut-out
15. Case
16. Spacer
17. Outlet flange
18. Outlet fitting

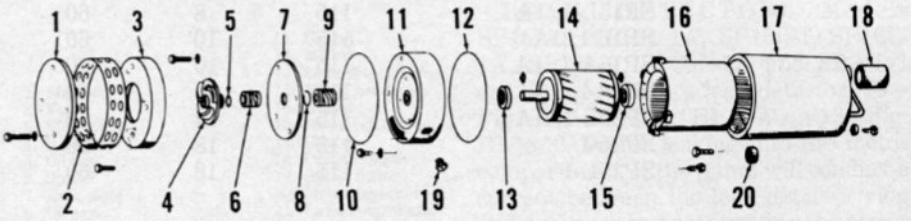


Fig. HL17-2–Exploded view of SP3 series submersible pumps.

1. Strainer plate
2. Strainer
3. Impeller housing
4. Impeller
5. Shim
6. Oil seal
7. Seal plate
8. Retainer
9. Oil seal
10. Quad ring
11. Frame plate
12. Quad ring
13. Ball bearing
14. Rotor
15. Ball bearing
16. Motor case
17. Pump case
18. Outlet fitting

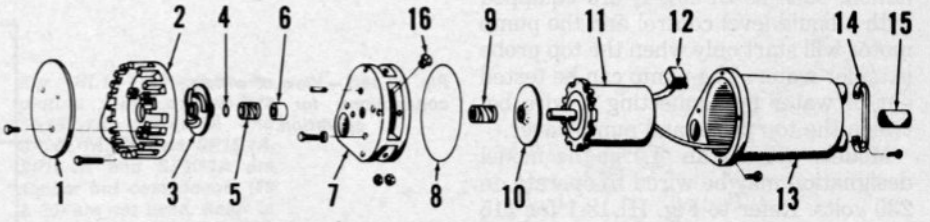


Fig. HL17-3–Exploded view of LSP2 series submersible pumps.

1. Strainer plate
2. Strainer
3. Impeller
4. Shim
5. Oil seal
6. Spacer
7. Frame plate
8. Quad ring
9. Oil seal
10. Seal seat
11. Motor
12. Thermal cut-out
13. Pump case
14. Handle
15. Outlet fitting

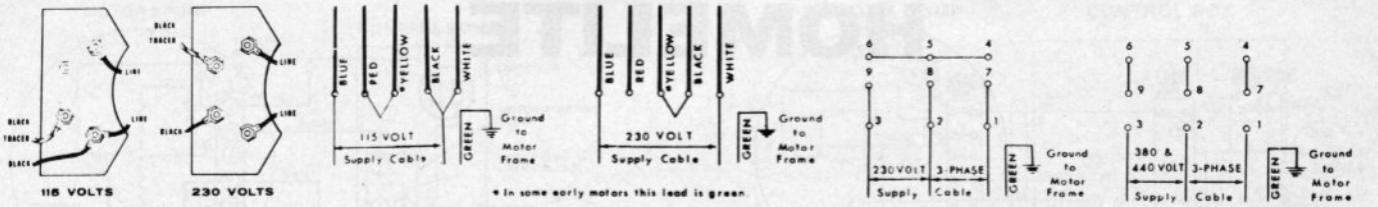


Fig. HL17-4—Use the above diagrams for checking pump wiring. If motor is not wired as shown, refer to diagram on cover plate of motor.

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. HL17-4 for wiring diagrams. If motor is not wired as shown, refer to diagram on cover plate of motor.

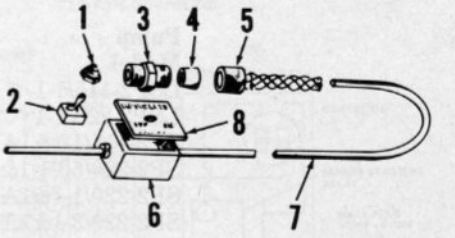


Fig. HL17-5—View of switch box used on all models.

1. Boot
2. Switch
3. Body & nut
4. Bushing
5. Collar
6. Switch box
7. Cable

HOMELITE

SUBMERSIBLE PUMPS

Pump Model	Volts	Amps	Hertz	Phase	GPH
SP15-1, 1A	115	8	60	Single	5000
SP15L-1, 1A	115	8	60	Single	3000
SP16-1, 1A	115	10	60	Single	4600
SP16A-1, 1A	115	10	60	Single	4600
SP20-1, 1A	115	14	60	Single	7400
SP20L-1, 1A	115	14	60	Single	7400
SP25-1	115	18	60	Single	9000
SP25L-1	115	18	60	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. HL18-1 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.

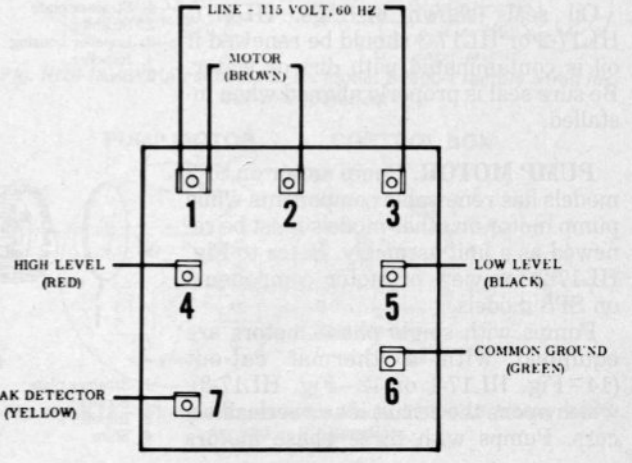


Fig. HL18-1—View of wiring connections for 115 volt operation.

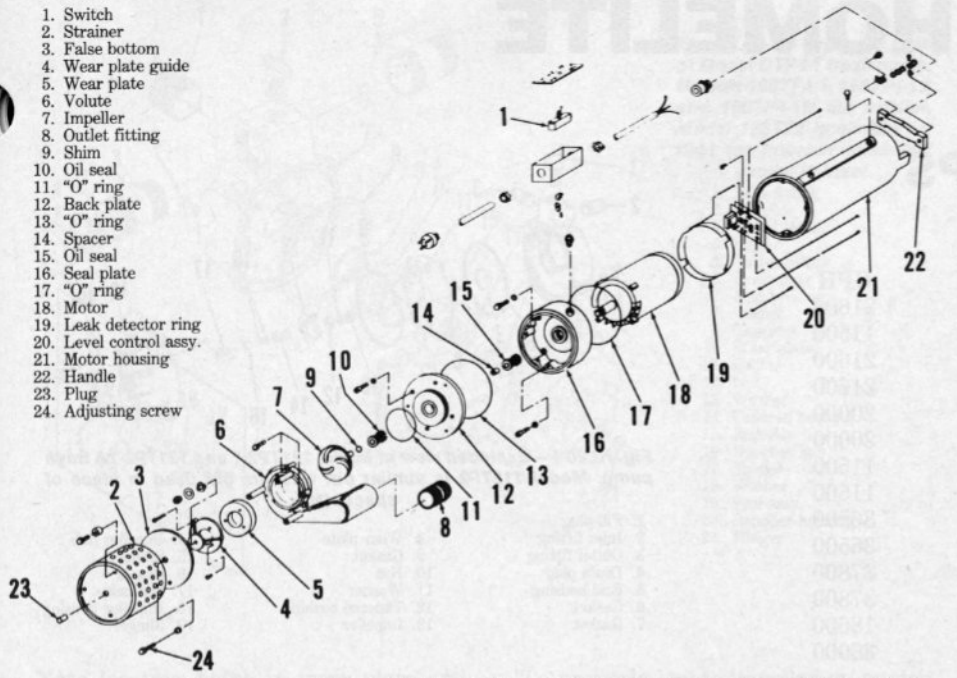


Fig. HL18-2—Exploded view of Models SP15-1, SP15L-1, SP16-1, SP16L-1, SP20-1 and SP20L-1. Components (19 & 20) are used only on models SP15L-1, SP16L-1 and SP20L-1.

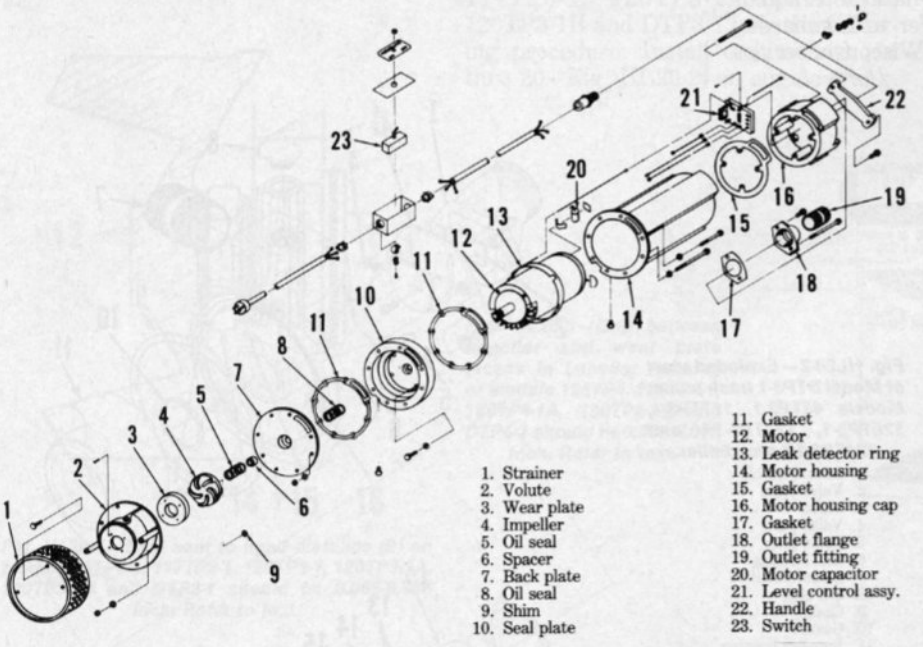


Fig. HL18-3—Exploded view of Model SP25L-1. Model SP25-1 is similar but components (13, 15, 16 and 21) are not used.

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 and SP16L-1A; and 48 ounces for models SP25-1 and SP25L-1.

REPAIRS

IMPELLER AND OIL SEALS. Pump impeller should be renewed if excessively worn or damaged. Desired clearance between impeller and wear plate (5–Fig. HL18-2, Fig. HL18-4 or 3–Fig. HL18-3) 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. HL18-2) and turning adjusting screw (24) with pump running. Slowly turn adjusting screw counterclockwise until wear plate contacts impeller then turn screw clockwise ¼ 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. HL18-3 or Fig. HL18-4).

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. HL18-2, Fig. HL18-4 or 13–Fig. HL18-3). 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.

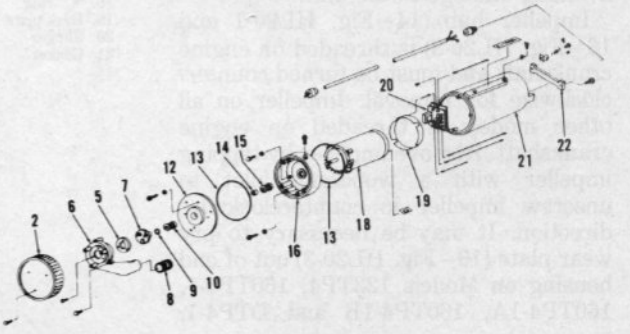


Fig. HL18-4—Typical exploded view of Models SP15L-1A, SP16L-1A and SP20L-1A. Models SP15-1A, SP16-1A and SP20-1A are similar but components (19 & 20) are not used. Refer to Fig. HL18-2 for parts identification.

HOMELITE

TRASH PUMPS

Pump Model	Engine Make	Engine Model	GPH
45TP3-1	B&S	170432	21600
112TP2	B&S	130232	11500
117TP3-1	Wisc.	S-7D	21600
120TP3-1	B&S	17432	21600
120TP3-1A	B&S	195432	20000
120TP3-1B	B&S	195432	20000
121TP2-1	B&S	130232	11500
121TP2-1A	B&S	131232	11500
123TP4	Wisc.	S-12D	36500
160TP4-1	B&S	326431	36500
160TP4-1A	B&S	326431	37800
160TP4-1B	B&S	326431	37800
DTP3-1	Lombardini	530	18600
DTP4-1	Lombardini	LDA510	36000

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 Lombardini engine section or Briggs and Stratton or Wisconsin service manual for engine service.

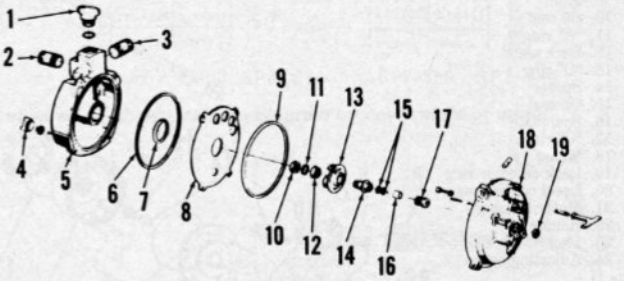


Fig. HL20-1—Exploded view of Model 121TP2-1 and 121TP2-1A trash pump. Model 112TP2 is similar but washers are used in place of spacer (16)

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

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 evident after inspection of unit and referral to exploded view in Fig. HL20-1, HL20-2 or HL20-3. Impeller on Models 112TP2, 121TP2-1, 121TP2-1A 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. HL20-1 and 16–Fig. HL20-3) is threaded on engine crankshaft and must be turned counterclockwise for removal. Impeller on all other models is threaded on engine crankshaft. Remove impeller by tapping impeller with a wooden mallet to unscrew impeller in counterclockwise direction. It may be necessary to pry wear plate (10–Fig. HL20-3) out of end housing on Models 123TP4, 160TP4-1, 160TP4-1A, 160TP4-1B and DTP4-1.

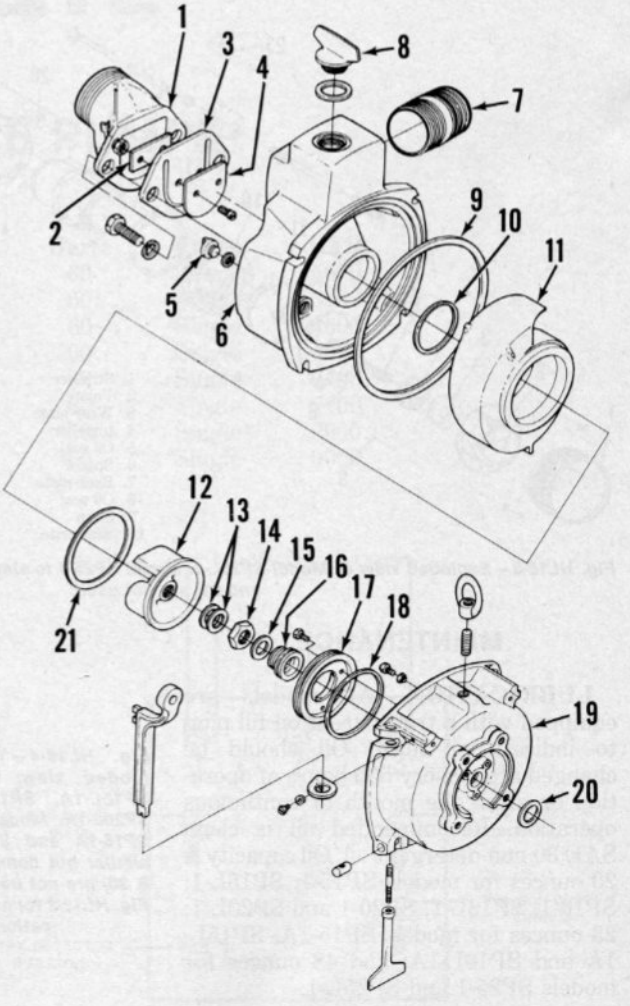


Fig. HL20-2—Exploded view of Model DTP3-1 trash pump. Models 45TP3-1, 117TP3-1, 120TP3-1, 120TP3-1A and 120TP3-1B are similar.

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. Wear plate
18. "O" ring
19. Back plate
20. Slinger
21. Gasket

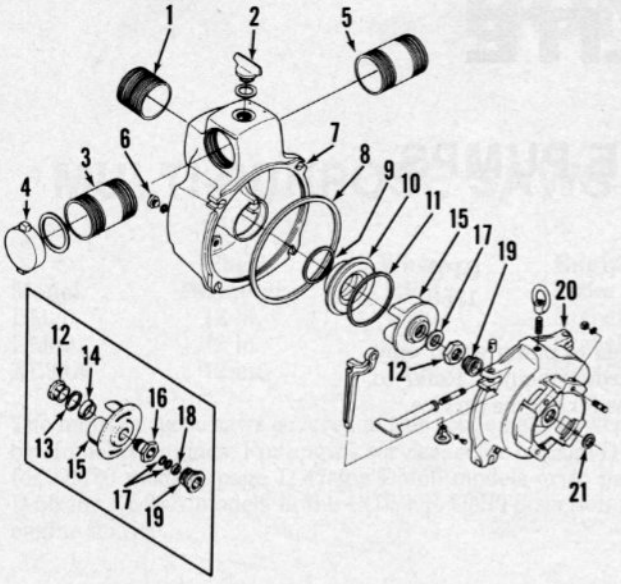


Fig. HL20-3—Exploded view of Model DTP4-1 trash pump. Models 160TP4-1, 160TP4-1A and 160TP4-1B are similar. Model 123TP4 is similar except for impeller assembly shown in inset.

1. Inlet fitting
2. Fill plug
3. Outlet fitting
4. Cap
5. Outlet fitting
6. Drain plug
7. End housing
8. Gasket
9. Gasket
10. Wear plate
11. Gasket
12. Nut
13. Washer
14. Tapered bushing
15. Impeller
16. Impeller hub
17. Shims
18. Washer
19. Seal assy.
20. Impeller housing
21. Slinger

Note locating notch in wear plate and corresponding locating boss in end housing.

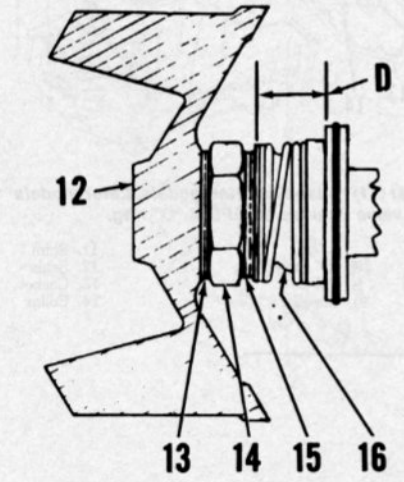


Fig. HL20-4—Seal seat to head distance (D) on Models 45TP3-1, 117TP3-1, 120TP3-1, 120TP3-1A, 120TP3-1B and DTP3-1 should be 0.865-0.885 inch. Refer to text.

To properly locate impeller on engine crankshaft of Models 45TP3-1, 117TP3-1, 120TP3-1, 120TP3-1A, 120TP3-1B and DTP3-1, use the following procedure: Install components (14 thru 20—Fig. HL20-2) on engine crankshaft, tighten nut (14) to 50 ft.-lbs., and measure distance between seal (16) seat and head as shown in Fig. HL20-4. Add or subtract shims (15) to obtain distance of 0.865-0.885 inch. Install impeller (12) and sufficient number or 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 Models 123TP4, 160TP4-1, 160TP4-1A, 160TP4-1B and DTP4-1 is determined as follows: Install components (15 thru 21—Fig. HL20-3) on engine crankshaft and measure depth of impeller vane adjacent to wear plate recess of impeller housing (20) as shown in Fig. HL20-5. Install shims (17—Fig. HL20-3) 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, 121TP2-1 and 121TP2-1A is determined by shims (15—Fig. HL20-1) 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).

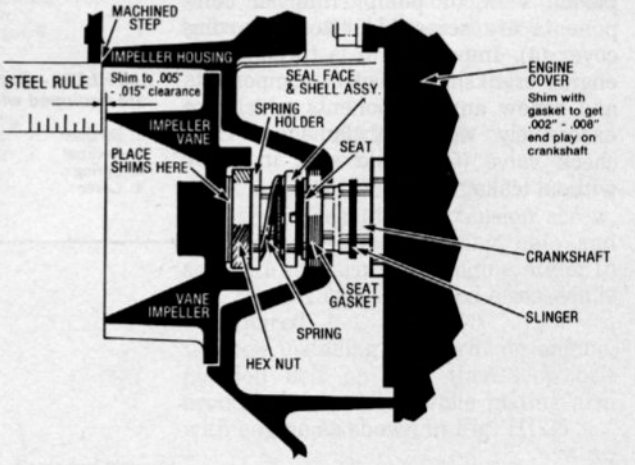


Fig. HL20-5—Gap between impeller and wear plate recess in impeller housing of Models 123TP4, 160TP4-1, 160TP4-1A, 160TP4-1B and DTP4-1 should be 0.005-0.015 inch. Refer to text.

HOMELITE

MULTI-PURPOSE PUMPS

Pump Model	Engine Make	GPH
P100-1	Homelite	1350

Model P100-1 (Waterbug™) is designed to pump water only and must not be used to pump hazardous liquids. Refer to page D-44 in POWER UNITS sections for engine service.

OPERATION

Model P100-1 is designed for pumping clean water only and hazardous fluids and abrasive material should not be directed through pump. The pump is self-priming, however, be sure pump is full of water before starting pump or seal may be damaged due to lack of lubrication. Inlet connections must be air tight to prevent vacuum loss.

PUMP REPAIR

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL22-1 for an exploded view of pump. Internal components are accessible after removing cover (4). Impeller (10) is threaded on engine crankshaft. Inspect components and renew any components which are excessively worn or damaged. Inlet check valve (5) should seat in cover without leakage.

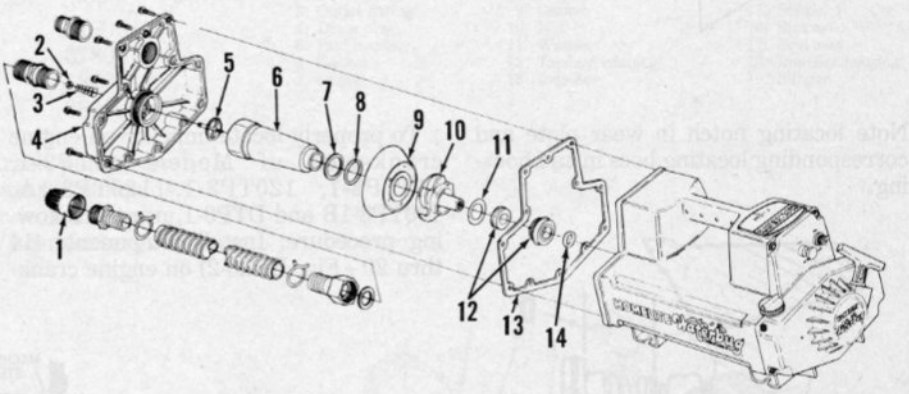


Fig. HL22-1 — Exploded view of Model P100-1 pump. Collar (11) is used on later models. Later models are equipped with EPDM seals and gaskets and check valve (5) uses an EPDM "O" ring.

1. Strainer
2. Locknut
3. Spring
4. Cover
5. Check valve
6. Inlet tube
7. Back-up ring
8. "O" ring
9. Volute
10. Impeller
11. Shim
12. Seals
13. Gasket
14. Collar

HOMELITE

MULTI-PURPOSE SAWS

Model	Wheel Diameter	Wheel RPM	Engine Make
DM20	12 in.	5500	Homelite
DM50	12 in.	5750	Homelite
XL98A	12 in.	5250	Homelite

The multi-purpose saws covered in this section are powered by Homelite engines. For engine service, refer to page D-52 for DM20 models, page D-47 for DM50 models or to page D-56 for XL98A models in the POWER UNITS section for engine service.

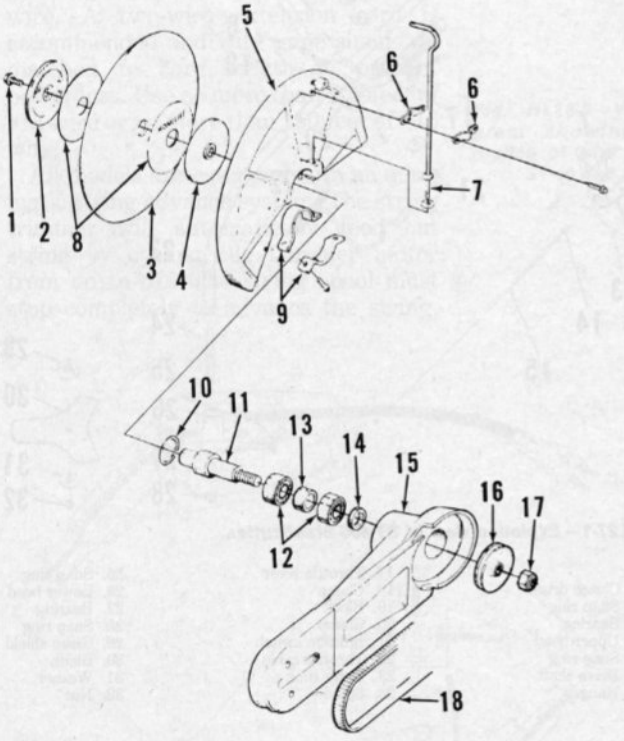


Fig. HL25-2—Exploded view of saw arm assembly used on Model XL98A.

1. Screw
2. Washer
3. Cutting wheel
4. Washer
5. Wheel guard
6. Clamps
7. Hook bolt
8. Spacer
9. Clamp
10. Snap ring
11. Spindle
12. Bearings
13. Spacer
14. Spacer
15. Arm
16. Pulley
17. Nut
18. Belt

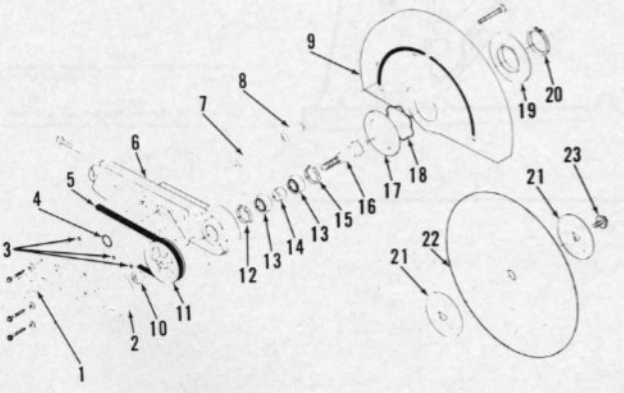


Fig. HL25-1—Exploded view of saw arm assembly used on Models DM20 and DM50.

1. Knob
2. Belt guard
3. "O" rings
4. Serrated washer
5. Belt
6. Arm
7. Spacer
8. Rubber tube
9. Wheel guard
10. Nut
11. Pulley
12. Snap ring
13. Bearings
14. Spacer
15. Snap ring
16. Spindle
17. Shim
18. Wave spring
19. Washer
20. Snap ring
21. Washers
22. Cutting wheel
23. Screw

OPERATION

The saw should be equipped with a cutting wheel rated for spindle speeds of 6000 rpm or higher. Maximum wheel diameter is 12 inches and maximum wheel thickness is 0.160 inch. Be sure wheel is not damaged and is otherwise safe for use.

The saw arm may be installed so the cutting wheel is inboard or outboard of the saw arm. After installing saw arm, install wheel guard so it is properly positioned, then adjust belt tension as outlined in following section.

BELT ADJUSTMENT

To adjust belt tension, loosen nuts securing saw arm then slide arm forward to remove belt slack. Turn tension adjusting screw until it contacts drive case cover or crankcase, then turn screw an additional 3 full turns. Tighten saw arm mounting nuts. Belt will stretch after an hour or two of operation and belt tension should be readjusted.

SAW ARM

R&R AND OVERHAUL. To remove saw arm, back off belt tension screw, remove saw arm mounting nuts and separate saw arm from engine. Refer to Fig. HL25-1 or HL25-2 and disassemble as required.

When installing saw arm on engine, position belt on arm then loop belt around clutch pulley while mating arm with engine as shown in Fig. HL25-3.

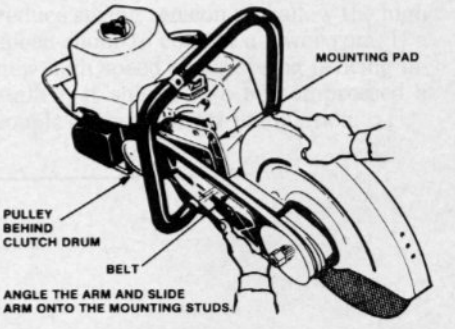


Fig. HL25-3—Hold saw arm as shown with belt in position, then loop belt around drive pulley while mating arm with engine.

HOMELITE

BRUSHCUTTER

Model	Blade Diameter	Engine Make
ST-400	10 in.	Homelite

Model ST-400 brushcutter is powered by a Homelite engine which is similar to XL-12 engine. Refer to page D-52 in POWER UNITS section for engine service.

SAW BLADE

The saw blade may be removed after unscrewing retaining nut. Prevent shaft rotation by inserting a suitable pin through the grass shield. Note when installing a toothed saw blade that shaft rotation is clockwise as viewed from underside.

DRIVE SHAFT

The flexible drive shaft should be removed, inspected and lubricated after every 25 hours of operation. To remove drive shaft, loosen clamp screw and remove screw in front side of lower head (26–Fig. HL27-1). Slide head off drive tube (23) and pull flexible shaft (15) from tube. Clean and inspect shaft, then lubricate shaft with a lithium grease. Insert shaft into drive tube (shaft ends are identical and shaft ends may be reversed to extend shaft life). With 3-5 inches of shaft extending from drive tube, engage shaft in lower head. Then while turning lower head so upper end of shaft engages clutch drum, install lower head on drive tube. Align holes in front side of lower head and drive tube and install screw. Tighten clamp screw so lower head will not turn.

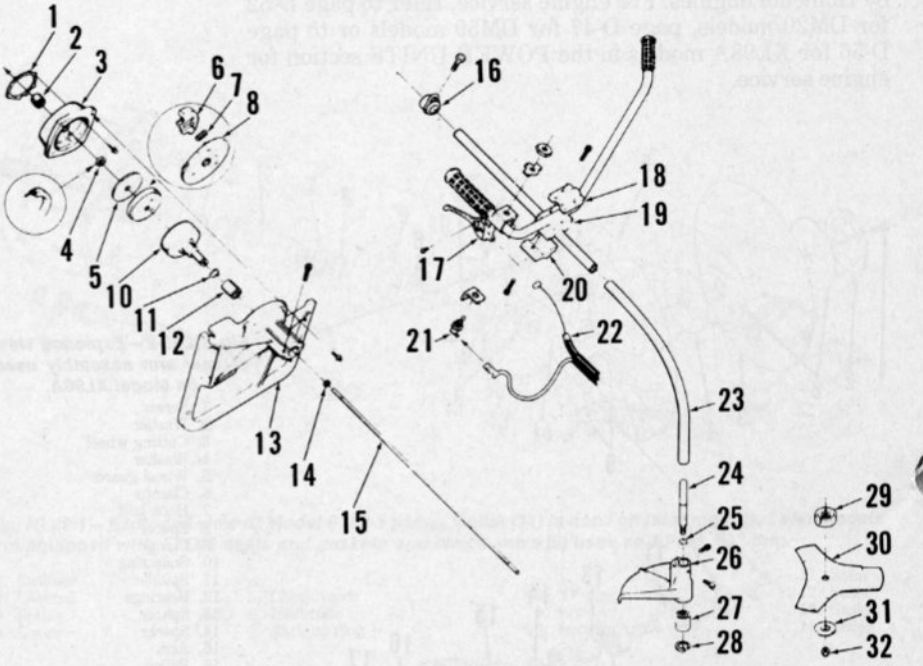


Fig. HL27-1—Exploded view of ST-400 brushcutter.

1. Gasket
2. Bearing
3. Drivecase
4. Seal
5. Cover
6. Clutch shoe
7. Spring
8. Clutch hub
10. Clutch drum
11. Snap ring
12. Bearing
13. Upper head
14. Snap ring
15. Drive shaft
16. Hanger
17. Throttle lever
18. Clamp
19. Block
20. Clamp
21. Ignition switch
22. Throttle cable
23. Drive tube
24. Spindle
25. Snap ring
26. Lower head
27. Bearing
28. Snap ring
29. Grass shield
30. Blade
31. Washer
32. Nut

HOMELITE

ELECTRIC STRING TRIMMERS

Model	Volts	Amps	Cutting Swath	Line Diameter
ST-20	120	2.2	10 in.	0.065 in.
ST-40	120	3.3	14 in.	0.065 in.
ST-60	120	4.0	16 in.	0.065 in.

ELECTRICAL REQUIREMENTS

Model ST-20, ST-40 and ST-60 string trimmers are designed to be used on electrical circuits with 120-volt alternating current. All models are double-insulated and do not require a ground wire. A two-wire extension cord is recommended and wire gage should be matched to cord length to prevent power loss. Use no more than 100 feet of #18 wire or no more than 150 feet of #16 wire.

All models are equipped with an automatic string advance system. The string trimmer will automatically feed out string by cycling the trimmer motor from on to off. The string spool must stop completely to advance the string, and if sufficiently short, it may be necessary to cycle the trimmer on and off several times. Operation is similar to that described in GASOLINE STRING TRIMMERS section.

If string will not advance on ST-40 or ST-60 models, it may be necessary to remove the high speed slider spring (the larger of the two springs) and compress the spring several times. This will reduce spring tension and allow the high speed slider to cock at a lower rpm. If a new high speed slider spring is being installed, it should also be compressed a couple of times before installation.

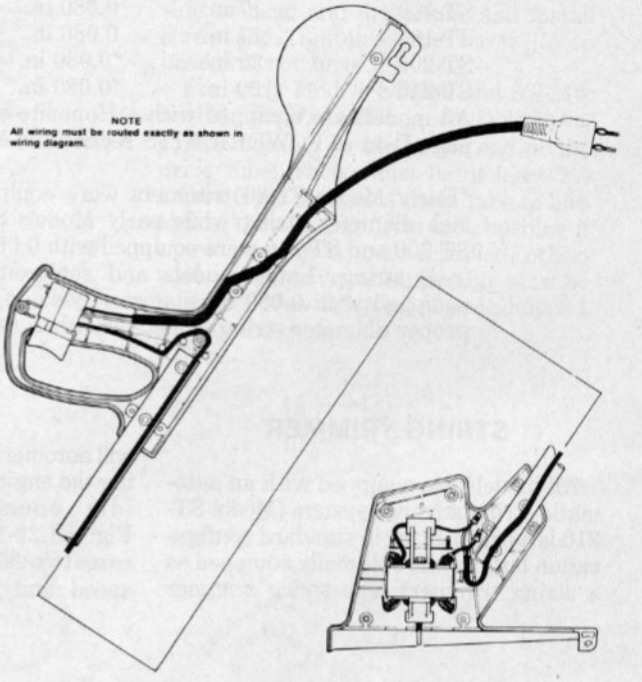


Fig. HL28-2—Wiring diagram showing correct routing of wire on Models ST-40 and ST-60.

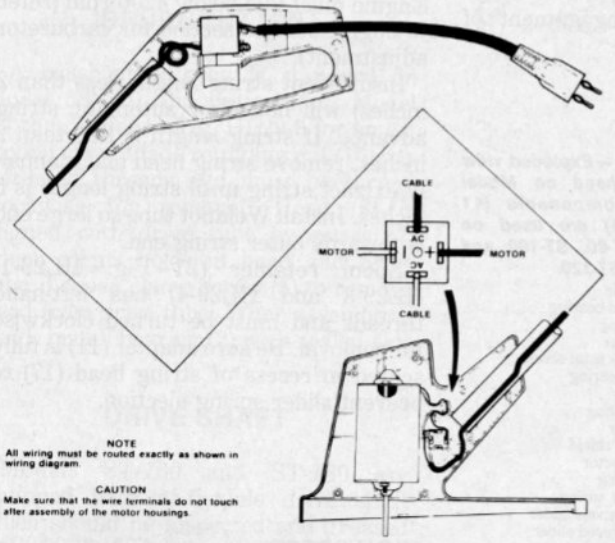


Fig. HL28-1—Wiring diagram showing correct routing of wire on Model ST-20.

HOMELITE

GASOLINE STRING TRIMMERS

Model	Cutting Swath	Line Diameter	Engine Make
ST-80	15 in.	*0.080 in.	Homelite
ST-100	20 in.	*0.080 in.	Homelite
ST-120	20 in.	*0.080 in.	Homelite
ST-160	17 in.	0.080 in.	Homelite
ST-180	17 in.	0.080 in.	Homelite
ST-200	20 in.	*0.080 in.	Homelite
ST-210	20 in.	*0.080 in.	Homelite

All models are equipped with a Homelite engine. Refer to page D-44 of POWER UNITS section for engine service.

*Early Model ST-80 trimmers were equipped with 0.065 inch diameter string while early Models ST-100, ST-120, ST-200 and ST-210 were equipped with 0.095 inch diameter (red) string. Later models and replacement spools are equipped with 0.080 in. diameter (yellow) string. Be sure proper diameter string is installed when restringing spool.

STRING TRIMMER

All models are equipped with an automatic string advance system (Model ST-210 is a brushcutter in standard configuration but may be optionally equipped as a string trimmer). The string trimmer will automatically feed out string by cycling the engine throttle from full speed to idle speed. String head (17 – Fig. HL29-1, HL29-3 and HL29-4) encases two slider and spring pairs for high speed and low speed engagement of string spool (18). Heavy spring (13) is used with high speed slider (14) and light spring (16) is used with low speed slider (15). Note position of lugs in Fig. HL29-2 to identify sliders. When string length is at desired cutting length engine speed is approximately 6500 rpm and high speed slider lug drives the string spool. As the string is shortened, engine speed will increase so that centrifugal force disengages the high speed slider lug from the string spool lug. The low speed slider lug picks up a string spool lug which allows the high speed slider to cock behind a string spool lug. When the engine is slowed to idle speed, the low speed slider will disengage and the high speed slider will engage the next string spool lug thereby allowing the string spool to rotate 1/6 turn and feed out string.

If automatic string advance malfunctions, be sure proper string is used, string advance components move freely and engine is properly tuned and will run at full speed of at least 7500 rpm. Engine must idle below 4200 rpm (refer to engine service section for carburetor adjustment).

Insufficient string length (less than 2 inches) will not allow automatic string advance. If string length is less than 2 inches, remove string head and manually extract string until string length is 5 inches. Install Weldnot tube so large end is towards outer string end.

Spool retainer (21 – Fig. HL29-1, HL29-3 and HL29-4) has left-hand threads and must be turned clockwise for removal. Be sure adapter (11) is fully seated in recess of string head (17) to prevent slider spring ejection.

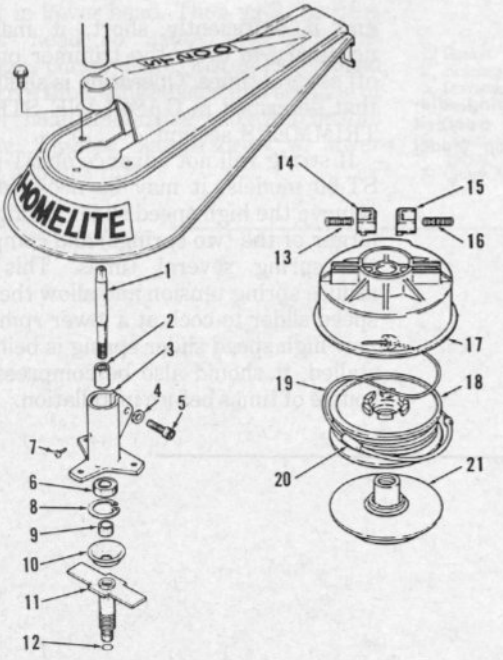


Fig. HL29-1 – Exploded view of lower head on Model ST-200. Components (11 through 21) are used on Models ST-80, ST-100 and ST-120.

1. Spindle
2. Needle bearing
3. Housing
4. Washer
5. Socket head screw
6. Ball bearing
7. Screw
8. Snap ring
9. Spacer
10. Grass shield
11. Connector
12. "O" ring
13. Heavy spring
14. High speed slider
15. Low speed slider
16. Light spring
17. String head
18. String spool
19. String
20. Weldnot tube
21. Retainer

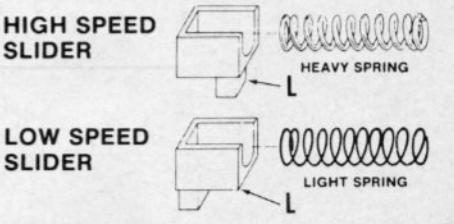


Fig. HL29-2 – Note position of lug (L) when identifying high and low speed sliders. Be sure correct spring is installed in slider.

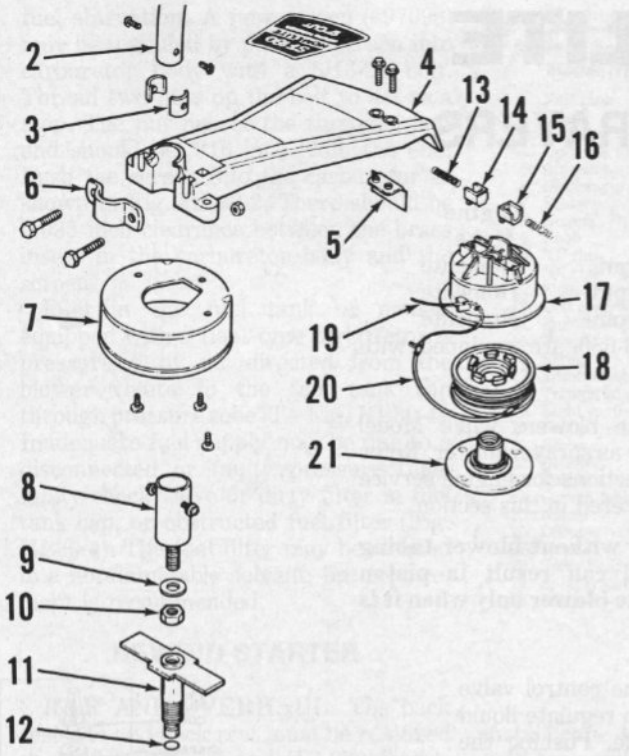


Fig. HL29-3—Exploded view of lower head on Models ST-160 and ST-180.

2. Drive tube
3. Inner clamp
4. Deflector
5. Cut-off blade
6. Clamp
7. Grass shield
8. Housing
9. Washer
10. Nut
11. Connector
12. "O" ring
13. Heavy spring
14. High speed slider
15. Low speed slider
16. Light spring
17. String head
18. String spool
19. String
20. Weldnot tube
21. Retainer

Models ST-200 and ST-210 are equipped with a flexible drive shaft between the engine and drive head. The flexible drive shaft should be removed, inspected and lubricated after every 25 hours of operation. To remove drive shaft, remove screw (7—Fig. HL29-1 or HL-29-5) and loosen clamp screw (5). Slide head off drive tube and pull flexible shaft from tube. Clean and inspect shaft, then lubricate shaft with lithium grease. Insert shaft into drive tube (shaft ends are identical and shaft ends may be reversed to extend shaft life). Install head while turning head to engage shaft ends in engine and head. Align holes in front side of head and drive tube and install screw (7). Tighten clamp screw (5) so head will not turn.

For early Models ST-200 and ST-210, bushing kit #A-96064 is available to install a bushing in the lower end of the drive tube. There must be at least 1¼ inches from bottom of drive tube to bottom of the existing drive tube bushing if a new bushing is to be installed, otherwise, a new drive tube assembly must be installed. New drive tubes are equipped with bushings.

BRUSHCUTTER

A brushcutter head is standard on Model ST-210 and optional on Model ST-200. Refer to Fig. HL29-5 for an exploded view. Blade retaining nut (15) has left-hand threads and must be turned clockwise for removal. Head (8) is aligned with drive tube by screw (7) which aligns holes in head and drive tube. Loosen clamp screw (5) to remove head from drive tube. When assembling head, install bearing (2) with sealed side up.

DRIVE SHAFT

Models ST-160 and ST-180 are equipped with a flexible drive shaft which should be inspected and greased annually. Detach drive tube from engine housing and pull drive shaft from drive tube. Clean drive shaft. Swap drive shaft end-to-end before inserting in drive tube to prolong shaft service life. While inserting drive shaft into drive tube, apply molybdenum disulfide grease to shaft; do not apply excess grease. Reconnect drive tube to engine housing while being sure drive shaft is properly connected.

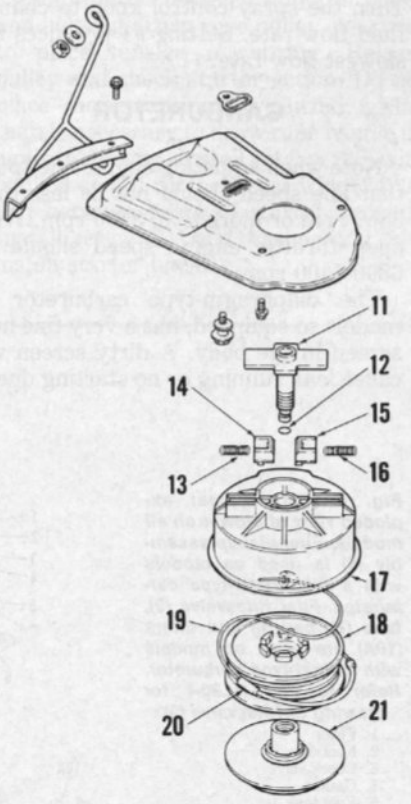


Fig. HL29-4—Exploded view of lower head on Model ST-80. Models ST-100 and ST-120 are similar.

11. Connector
12. "O" ring
13. Heavy spring
14. High speed slider
15. Low speed slider
16. Light spring
17. String head
18. String spool
19. String
20. Weldnot tube
21. Retainer

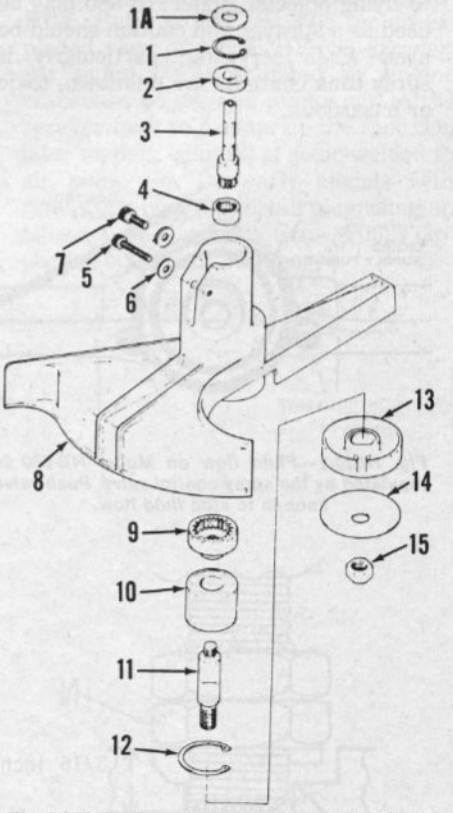


Fig. HL29-5—Exploded view of brushcutter head which is standard on Model ST-210 and optional on Model ST-200.

1A. Felt washer
2. Ball bearing
3. Pinion shaft
4. Needle bearing
5. Socket head screw
6. Washer
7. Socket head screw
8. Head
9. Ring gear
10. Ball bearing
11. Spindle
12. Snap ring
13. Shield
14. Cup washer
15. Nut

HOMELITE

BLOWER/SPRAYERS

Model	Maximum Air Volume	Engine Make
HB-280	245 cfm @ 7500 rpm	Homelite
HB-480	245 cfm @ 7500 rpm	Homelite
HB-680	245 cfm @ 7500 rpm	Homelite

* Early Models HB-480 and HB-680 are equipped with Homelite® XL engines.

Models HB-280 and HB-480 are blowers while Model HB-680 may be used as a blower or as sprayer/mister. Refer to page D-44 of POWER UNIT sections for engine service except rewind starter which is covered in this section.

CAUTION: Operation of blower without blower tubing allows engine to overheat and can result in piston seizure or worse damage. Operate blower only when it is fully assembled.

OPERATION

All models function as blowers and care must be exercised when operating blower to prevent injury or damage due to flying objects. Model HB-680 may be used as a sprayer and caution should be used when servicing, particularly if spray tank contents are unknown, toxic or hazardous.

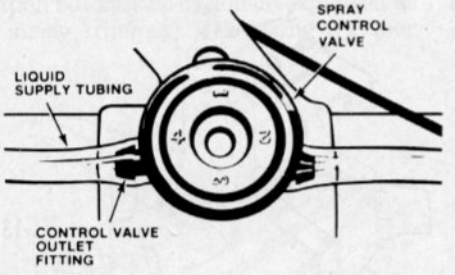


Fig. HL30-1—Fluid flow on Model HB-680 is regulated by the spray control valve. Push valve knob in to stop fluid flow.

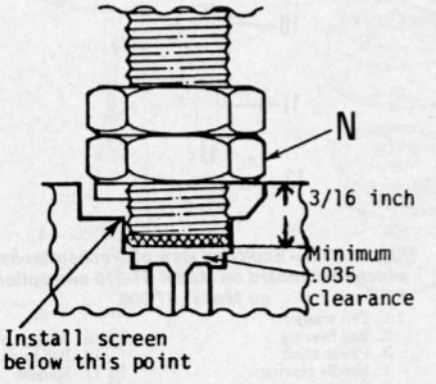


Fig. HL30-2—Install fuel inlet screen (S) as outlined in text. Face of nut (N) should be 3/16 inch from end of screw.

Model HB-680 uses the control valve shown in Fig. HL30-1 to regulate liquid flow to the spray nozzle. Pushing the spray control knob in will shut off flow while pulling out knob opens the valve. Turn the spray control knob to change fluid flow rate. Setting #1 produces the slowest flow rate.

CARBURETOR

Note when adjusting engine idle speed that idle speed should not be less than 3350 rpm or more than 3500 rpm. Wide open throttle engine speed should be 6800-7400 rpm.

The diaphragm-type carburetor on models so equipped, has a very fine inlet screen in the body. A dirty screen will cause lean running or no starting due to

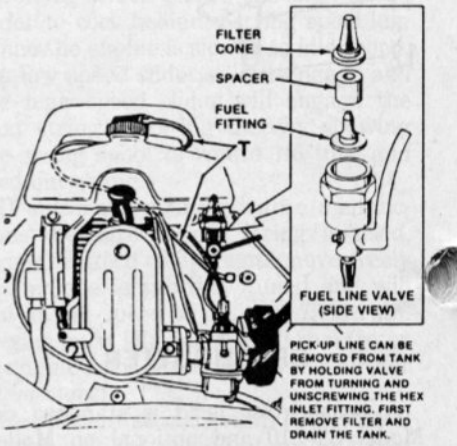
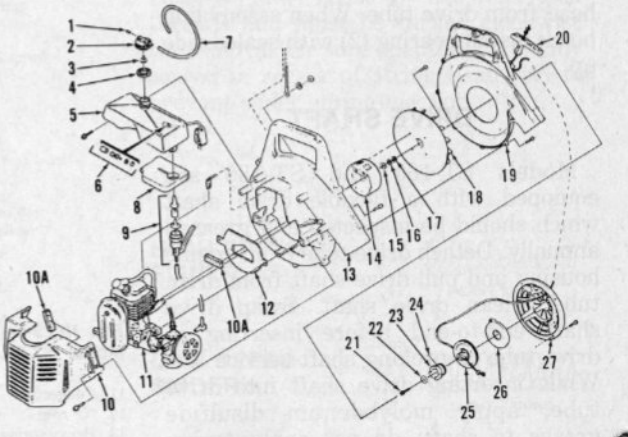


Fig. HL30-4—Drawing showing location of air pressure tube (T) to fuel tank. Fuel filter may be removed and cleaned.

Fig. HL30-3—Typical exploded view of blower on all models. Fuel pickup assembly (6) is used on models with a diaphragm-type carburetor. Fuel filter/valve (9), tube (7), pad (8) and filters (10A) are used on models with a float-type carburetor. Refer to Fig. HL30-4 for drawing of filter/valve (9).



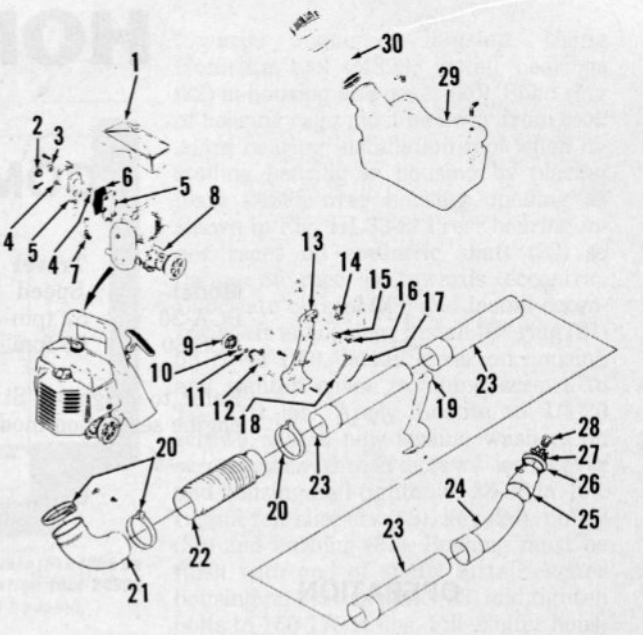
1. Filter
2. Fuel cap
3. Check valve
4. Gasket
5. Fuel tank
6. Fuel pickup assy.
7. Pressure tube
8. Pad
9. Filter/valve assy.
10. Shroud
10A. Filter
11. Engine
12. Backplate
13. Volute housing
14. Magneto rotor
15. Washer
16. Lockwasher
17. Nut
18. Fan
19. Volute housing
20. Rope handle
21. Screw
22. Washer
23. Ratchet
24. Ratchet lever wir
25. Rope pulley
26. Rewind spring
27. Starter housing

fuel starvation. A new screen (#97098) may be installed by pushing screen into carburetor body with a 5/16-24 bolt. Thread two nuts on the bolt to act as a stop. The nut nearer the threaded bolt end should be 3/16 inch from the end. Push the screen into the carburetor as shown in Fig. HL30-2. There should be 0.035 inch clearance between the brass insert in the carburetor body and the screen.

Fuel in the fuel tank of models equipped with a float-type carburetor is pressurized by air directed from the blower volute to the fuel tank cap through pressure tube (T – Fig. HL30-4). Inadequate fuel supply may be due to a disconnected or faulty pressure tube, faulty check valve or dirty filter in fuel tank cap, or obstructed fuel filter (Fig. HL30-4). The fuel filter may be cleaned in a nonflammable solvent, but replacement is recommended.

Fig. HL30-5 – Exploded view of sprayer components on Model HB-680.

1. Fuel tank
2. Plug
3. Filter
4. Umbrella valve
5. Air pump
6. Diaphragm
7. Elbow
8. Engine
9. Knob
10. "O" ring
11. "O" ring
12. Fluid control valve
13. Left control handle
14. Ignition switch
15. Trigger
16. Spring
17. Throttle cable
18. Trigger latch
19. Right control handle
20. Clamp
21. Elbow
22. Bellow
23. Tubing
24. Curved tubing
25. Nozzle
26. Diffuser
27. Vane
28. Spray head
29. Sprayer tank
30. Strainer



REWIND STARTER

R&R AND OVERHAUL. The back rest pad and back rest must be removed on Models HB-480 and HB-680 for access to starter. On all models, unscrew mounting screws and remove starter. Remove rope handle and allow rope to wind into starter. Unscrew retaining screw (21 – Fig. HL30-3) and remove ratchet (23) and pully while being careful not to dislodge rewind spring in housing.

When assembling starter, wind rope around rope pulley in a 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. Install ratchet (23) with hooked end of ratchet lever wire (24) up and between posts of starter housing. Install screw (21) and washer (22) then install starter housing.

SPRAYER

DISASSEMBLY AND REASSEMBLY. Refer to Fig. HL30-5 for an exploded view of Model HL-680 sprayer. Air pump (5) is actuated by engine crankcase pulses and pumps air to the sprayer tank to pressurize the fluid. On later models, plug (2) is sonic-welded to air pump (5). On early models with removable plug (2), install plug using an adhesive such as Zip Grip #70627 applied around plug periphery.

HOMELITE

COMPACTORS

Model	Travel Speed	Compaction Force	Engine Make	Engine Model
PCA-20	52 fpm	2000 lbs.	B&S	100232
PCS-30	63 fpm	3000 lbs.	Kohler	K91T

Refer to Briggs & Stratton or Kohler service manual for engine service on models listed above.

OPERATION

Model PCA-20 is designed for asphalt compaction while Model PCS-30 is designed for soil compaction but may be converted to asphalt compaction with the addition of a water kit.

Do not operate compactors on a hard, unyielding surface. If necessary, the compactor may be placed across an old tire for testing.

Asphalt compactors are equipped with a water system to distribute water to the bottom plate thereby preventing asphalt from sticking to plate. Drain holes must be clear and clean water should be used for proper operation.

MAINTENANCE

LUBRICATION. The exciter is lubricated by oil contained in the housing. Exciter oil level should be checked after every 25 hours of operation. With engine stopped unscrew dipstick (26–Fig. HL33-1) and note oil level (dipstick must be fully screwed into housing for an accurate reading). Recommended oil is SAE 30 with API rating SE. Exciter oil should be changed after 200 hours of operation or after one year, whichever comes first. Eight ounces of oil is required to fill an empty exciter housing to desired oil level.

BELT ADJUSTMENT. Drive belt (32–Fig. HL33-1) tension is correct if belt will deflect ⅜ inch to ½ inch when depressed at center. If upper deck (15) moves downward while depressing belt, then belt is too tight. If upper deck doesn't move and belt is depressed more than ½ inch, then belt is too loose. If belt adjustment is required, loosen engine mounting bolts and reposition engine. Retighten engine mounting bolts to 12-14 ft.-lbs. after adjustment.

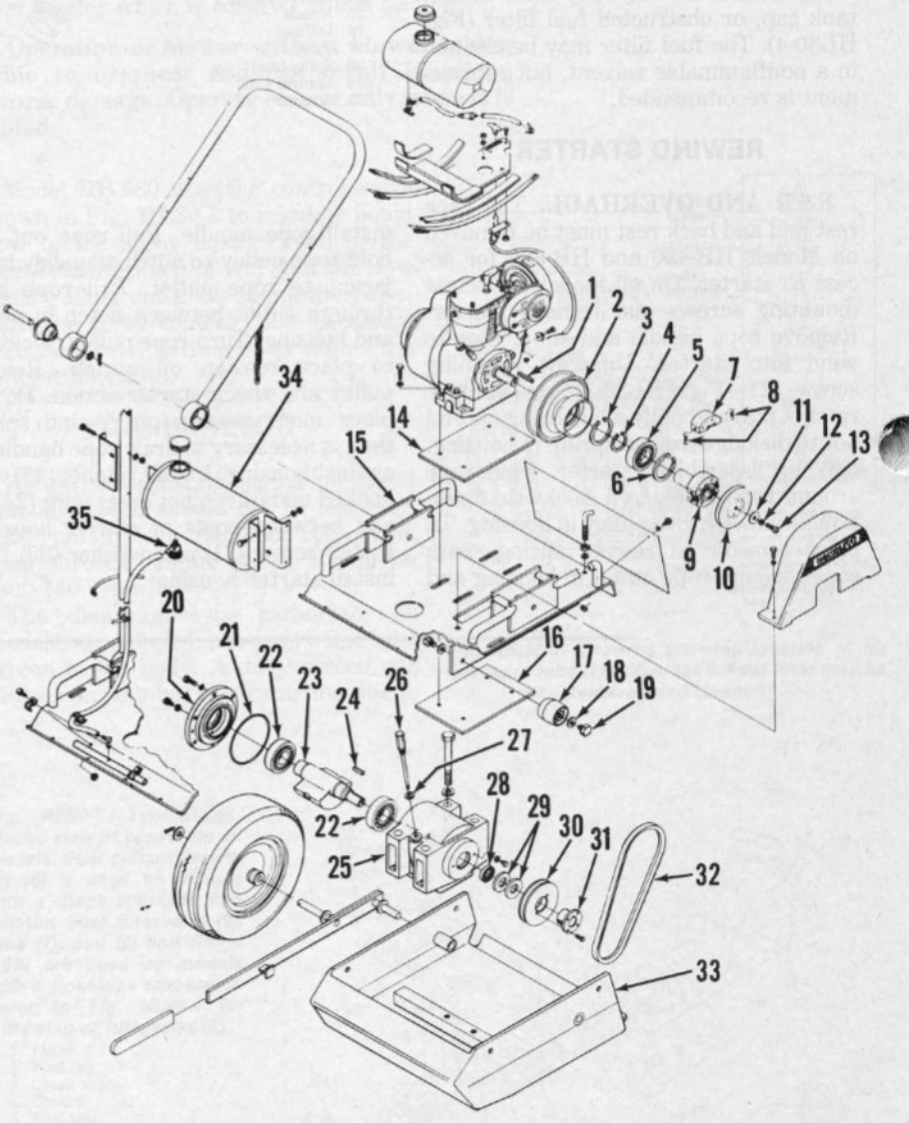


Fig. HL33-1–Exploded view of Model PCS-30 soil compactor. Model PCA-20 asphalt compactor is similar.

1. Key
2. Clutch drum
3. Snap ring
4. Snap ring
5. Ball bearing
6. Snap ring
7. Clutch shoe
8. Clutch springs
9. Clutch assy.
10. Clutch cover
11. Washer
12. Lockwasher
13. Screw
14. Plate
15. Upper deck
16. Plate
17. Isolator
18. Lockwasher
19. Capscrew
20. Cover
21. "O" ring
22. Roller bearing
23. Eccentric
24. Key
25. Housing
26. Dipstick
27. Washer
28. Oil seal
29. Felt slingers
30. Pulley
31. Bushing
32. Drive belt
33. Bottom plate
34. Water tank
35. Valve

EXCITER REPAIR

R&R AND OVERHAUL. To disassemble exciter, disconnect spark plug cable and remove belt guard. Loosen engine mounting bolts, slide engine forward and remove drive belt. Support upper deck (15) then remove four isolators (17). Lift off engine and upper deck as a unit. Remove four bolts securing exciter housing (25) and remove exciter housing. Clean housing then remove dipstick (26) and drain oil from housing. Unscrew bushing (31) screws, then thread screws into tapped holes of bushing and tighten screws to force bushing off shaft. Remove pulley (30), felt slingers (29) and key (24). Remove six 5/16-18 capscrews and two 1/4-20 capscrews from cover (20). Thread screws into the two tapped holes in the cover and tighten screws to force cover (20) off housing. Remove eccentric shaft (23) and using a suitable puller remove inner bearing races from shaft. Bearings (22) may be forced from housing cavities by threading jack screws into tapped holes in housing. Use Homelite tool 24893 and remove oil seal (28).

Inspect components and renew any parts which are damaged or excessively worn. New seal washers, felt slingers, "O" ring and oil seal should be installed.

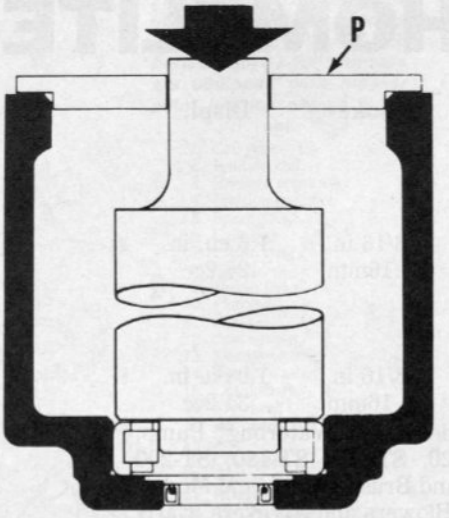


Fig. HL33-2 — Position aligning plate (P) 24895 as shown to center bearing installation tool 24893 when installing bearing in housing.

To reassemble exciter, proceed as follows: Using Homelite tool 24894, install oil seal (28) with open seal side towards inside of housing. Using Homelite tool 24893, install bearings (22) in housing and cover (20). Solid ring of bearing cage must be away from tool. Align bearing installation tool when installing bearing in housing by placing plate 24895 over housing opening as shown in Fig. HL33-2. Press bearing inner races on eccentric shaft (23) so flange of race is towards eccentric. Lubricate oil seal (28) and install eccentric shaft in housing. Install "O" ring (21) on cover (20), install cover on housing and tighten cover retaining screws to 12-14 ft.-lbs. Apply Loctite to 1/4-20 screws, install new sealing washers on screws then thread screws into cover and housing and tighten to 33-38 in.-lbs. Install felt slingers (29), key (24), pulley (30) and bushing (31). Bushing must be flush with end of shaft. Install exciter housing on bottom plate (33) and tighten bolts to 150-175 ft.-lbs. Fill exciter housing with oil as outlined in LUBRICATION section. Install engine and upper deck (15). Install four isolators (17) and tighten bolts to 56-65 ft.-lbs. Install drive belt and adjust belt tension as outlined in BELT ADJUSTMENT section. Install belt guard and tighten bolts to 12-14 ft.-lbs.

HOMELITE

CONCRETE VIBRATORS

Model	Volts	Amps	Hertz	Phase
VCH-178	230	3	180	3
VCH-250	230	6	180	3

OPERATION

Model VCH-178 and VCH-250 concrete vibrators operate on 3-phase, 180-Hertz, 230-volt current. Rotating frequency of both models is 9000-10000 rpm. Refer to Fig. HL32-1 for an exploded view of vibrator.

To check operation of vibrator, start vibrator then allow vibrator nose to touch the ground and hold in this position. Vibrator should walk in a clockwise circle around operator. If vibrator walks in a counterclockwise circle, immediately stop vibrator. Interchange any two current carrying leads and again check vibrator operation.

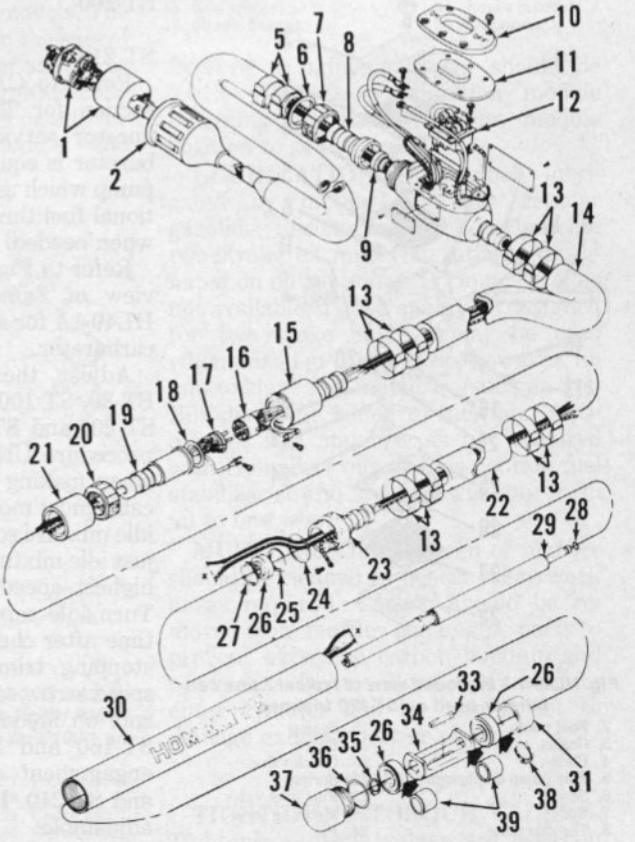


Fig. HL32-1 — Exploded view of concrete vibrator. Rotor (29) and eccentric (34) are a one-piece assembly on Model VCH-250. Snap ring (38) and spacers (39) are only used on Model VCH-250.

1. Plug
2. Cover
3. Grommet
4. Hose
5. Clamp
6. Sleeve
7. Nut
8. Connector
9. Seal
10. Cover
11. Gasket
12. Switch
13. Clamp
14. Hose
15. Housing
16. Female plug
17. Male plug
18. "O" ring
19. Housing
20. Nut
21. Spacer
22. Hose
23. Connector
24. "O" ring
25. Retaining ring
26. Ball bearing
27. Retaining ring
28. "O" ring
29. Rotor
30. Housing & stator
31. Bearing stop
33. Key
34. Eccentric
35. Snap ring
36. "O" ring
37. Nose
38. Snap ring
39. Spacer

HOMELITE

Model	Bore	Stroke	Displ.
HB-280, P100-1, ST-80, ST-100, ST-120, ST-160, ST-180	1-5/16 in. 33.34mm	1-3/16 in. 30.16mm	1.6 cu. in. 26.2cc
HB-480, HB-680, ST-200, ST-210	1-7/16 in. 36.51mm	1-3/16 in. 30.16mm	1.9 cu. in. 31.2cc

These engines are used on Model P100-1 Waterbug™ Pump, Models ST-80, ST-100, ST-120, ST-160, ST-180, ST-200 and ST-210 String Trimmers and Brushcutters, and Models HB-280, HB-480 and HB-680 Blowers and Sprayers. Early Models HB-480 and HB-680 are equipped with 1.6 cu. in. (26.2 cc) displacement engine.

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion DJ7Y for Models HB-280 (UT 08005), HB-480 (UT 08004), HB-680 (UT 08003), ST-160 and ST-180. Champion DJ7J is recommended for all other models. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. Refer to the following table for carburetor applications:

Model	Carburetor
HB-280, HB-480, HB-680	Walbro WA-95 Keihin
P100-1	Walbro HDC-68
ST-80	Walbro WA-83
ST-100	Zama C-1S-46 Walbro WA-130
ST-120	Walbro WA-43A Zama C1S-H2A
ST-160, ST-180	Walbro HDC-70
ST-200	Walbro HDC-59 Walbro HDC-69
ST-210	Walbro HDC-69

Refer to CARBURETOR SERVICE section for Tillotson and Walbro carburetor service. Walbro HDC-70 carburetor is equipped with an accelerator pump which uses a bladder to eject additional fuel through the main fuel orifice when needed.

Refer to Fig. HL40-1 for an exploded view of Zama carburetor or to Fig. HL40-1A for an exploded view of Keihin carburetor.

Adjust the carburetor on Models ST-80, ST-100, ST-120, ST-160, ST-180, ST-200 and ST-210 using the following procedure. UNIT MUST BE SHUT OFF when making adjustments and throttle cable must move freely. Initial setting of idle mixture screw is 1¼ turns open. Adjust idle mixture screw so engine idles at highest speed and accelerates cleanly. Turn idle mixture screw ⅛ turn each time after checking unit operation then stopping trimmer engine. Adjust idle speed screw so engine idles at 2800-3200 rpm on Models ST-80, ST-100, ST120, ST-160 and ST-180, or below clutch engagement speed on Models ST-200 and ST-210. High speed mixture is not adjustable.

There is no idle mixture or idle speed adjustment on P100-1 Waterbug™ models as pump engine runs at wide open throttle during operation. To adjust high speed mixture screw, run pump while pumping water so engine is loaded. Turn high speed mixture screw in until engine speed drops, then back out screw approximately ¼ turn or until maximum engine speed is obtained. Backing screw out too far will cause engine speed to drop and adjustment must be repeated.

Before adjusting carburetor on HB-280, HB-480 and HB-680 blowers, first be sure throttle cable is adjusted properly. With throttle trigger fully depressed, the carburetor throttle plate should be completely open; if not, adjust throttle cable. On models equipped with a Walbro carburetor, initial adjustment of idle and high speed mixture screws is one turn open. Adjust idle mixture screw so engine will accelerate cleanly, and adjust high speed mixture screw so maximum engine rpm is 7200-7800 for HB-280, 7800-8600 for HB-480 and 7600-8400 for HB-680. Idle mixture is not adjustable for Keihin carburetor and high speed mixture is controlled by main jet (14–Fig. HL40-1A) which

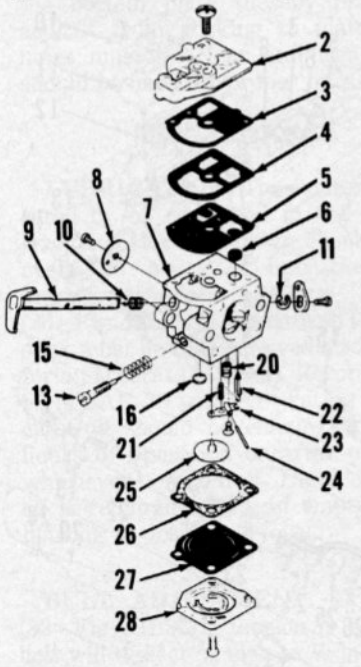
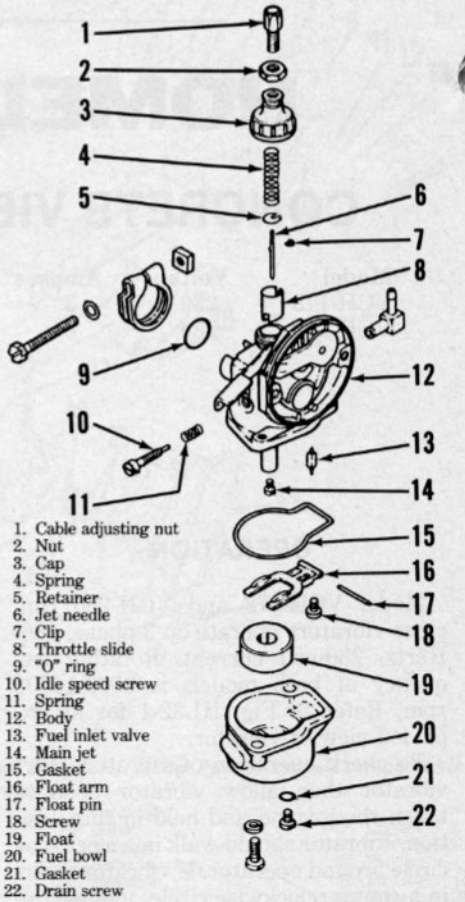


Fig. HL40-1 – Exploded view of typical Zama carburetor used on ST-120 trimmer.

2. Fuel pump
3. Gasket
4. Plate
5. Fuel pump diaphragm
6. Screen
7. Body
8. Throttle plate
9. Throttle shaft
10. Spring
11. "E" ring
13. Idle mixture screw
15. Spring
16. Plug
20. Check valve
21. Spring
22. Fuel inlet valve
23. Metering lever
24. Pin
25. Metering disc
26. Gasket
27. Metering diaphragm
28. Cover



1. Cable adjusting nut
2. Nut
3. Cap
4. Spring
5. Retainer
6. Jet needle
7. Clip
8. Throttle slide
9. "O" ring
10. Idle speed screw
11. Spring
12. Body
13. Fuel inlet valve
14. Main jet
15. Gasket
16. Float arm
17. Float pin
18. Screw
19. Float
20. Fuel bowl
21. Gasket
22. Drain screw

Fig. HL40-1A – Exploded view of Keihin float-type carburetor used on later Models HB-280, HB-480 and HB-680.

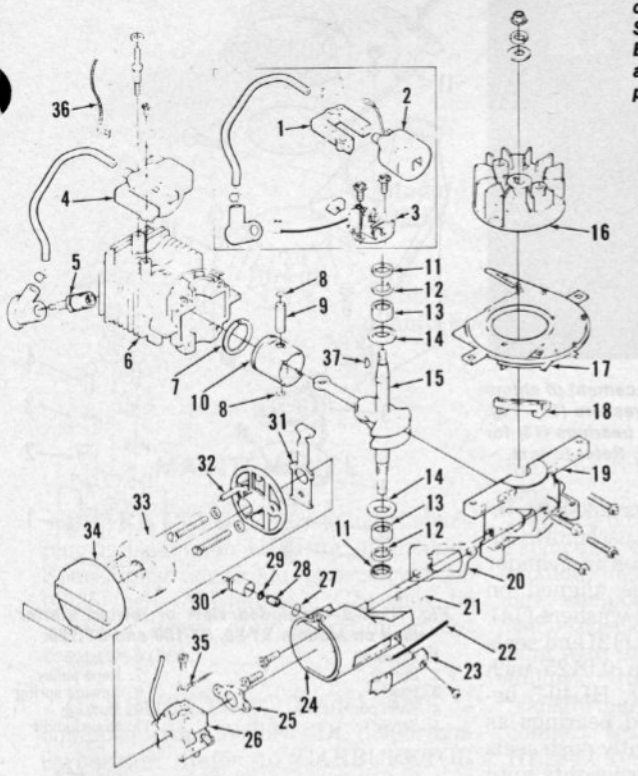


Fig. HL40-2—Exploded view of engine used on Models ST-80, ST-100 and ST-120. Early Model ST-100 trimmers are equipped with breaker point ignition shown in inset.

1. Coil core
2. Ignition coil
3. Breaker point assy.
4. Ignition module
5. Spark plug
6. Cylinder
7. Piston ring
8. Circlip
9. Piston pin
10. Piston
11. Seal
12. Seal spacer
13. Needle bearing
14. Thrust washer
15. Crankshaft
16. Flywheel
17. Air cover
18. Seal
19. Crankcase
20. Gasket
21. Reed valve petal
22. Throttle cable
23. Cable clamp
24. Carburetor housing
25. Gasket
26. Carburetor
27. "O" ring
28. Filter
29. Gasket
30. Fuel inlet
31. Choke
32. Filter support
33. Air filter
34. Cover
35. Ground wire (early ST-100)
36. Ground wire (solid-state ign.)
37. Key

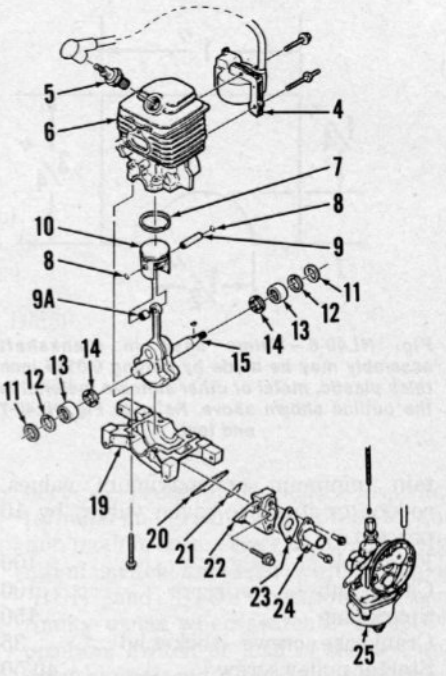


Fig. HL40-4—Typical exploded view of engine used on Model HB-280, HB-480 and HB-680 Blowers and Sprayers. Bearing (9A) is only used on later models HB-480 and HB-680.

4. Ignition module
5. Spark plug
6. Cylinder
7. Piston ring
8. Circlip
9. Piston pin
10. Piston
11. Seal
12. Seal spacer
13. Needle bearing
14. Thrust washer
15. Crankshaft
17. Key
19. Crankcase
20. Gasket
21. Reed valve petal
22. Carburetor spacer
23. Gasket
24. Intake manifold
25. Carburetor

should not require adjustment. Adjust idle speed screw of HB series models so idle speed is not less than 3350 rpm or more than 3500 rpm.

MAGNETO AND TIMING. Early Model ST-100 is equipped with a conventional breaker-point, flywheel magneto. Breaker point gap should be 0.015 inch. Ignition timing is not adjustable, however, an incorrect breaker point gap setting will affect ignition timing.

A solid-state ignition is used on all models except early ST-100 models. The ignition module is attached to the side of the engine cylinder. Ignition service is accomplished by replacing ignition components until faulty part is located. Air gap between ignition module and flywheel is adjustable and should be 0.015 inch. Loosen ignition module mounting screws and adjust module position to set air gap.

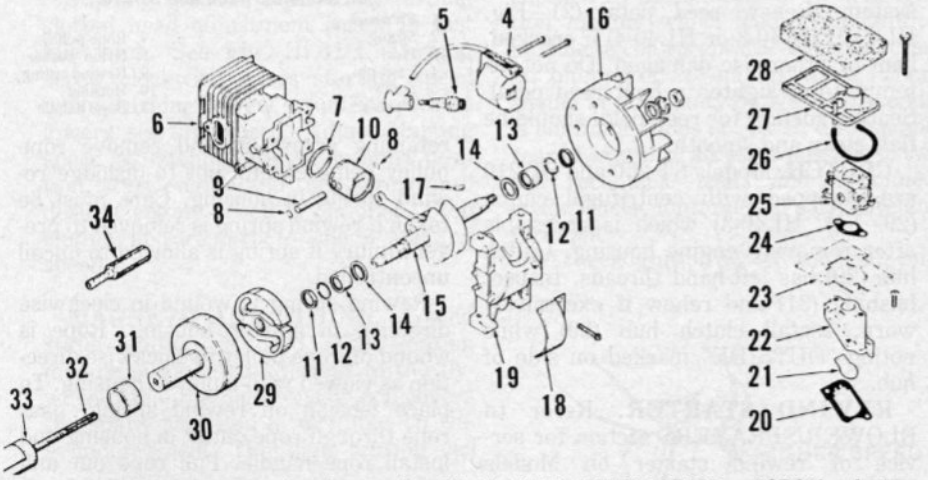


Fig. HL40-3—Exploded view of engine used on Models ST-160, ST-180, ST-200 and ST-210; adapter (34) is used in place of clutch components (29, 30 and 31) on Models ST-160 and ST-180. Model P100-1 Waterbug is similar but clutch components are not used. Thrust washers (14) on Model P100-1 are equipped with tangs which must index in crankcase (19).

4. Ignition module
5. Spark plug
6. Cylinder
7. Piston ring
8. Circlip
9. Piston pin
10. Piston
11. Seal
12. Seal spacer
13. Needle bearing
14. Thrust washer
15. Crankshaft
16. Flywheel
17. Key
18. Shroud
19. Crankcase
20. Gasket
21. Reed valve petal
22. Carburetor spacer
23. Air baffle
24. Gasket
25. Carburetor
26. Tubing
27. Filter support
28. Air filter
29. Clutch hub
30. Clutch drum
31. Bushing
32. Drive shaft
33. Drive tube
34. Adapter

LUBRICATION. The engine is lubricated by mixing oil with regular gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values are listed in following table. Note: Values given are average figures in inch-pounds. To ob-

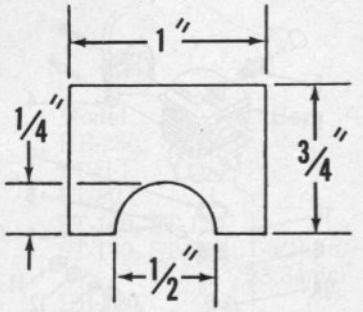


Fig. HL40-6—Shims used in crankshaft assembly may be made by cutting 0.0125 inch thick plastic, metal or other suitable material in the outline shown above. Refer to Fig. HL40-7 and text.

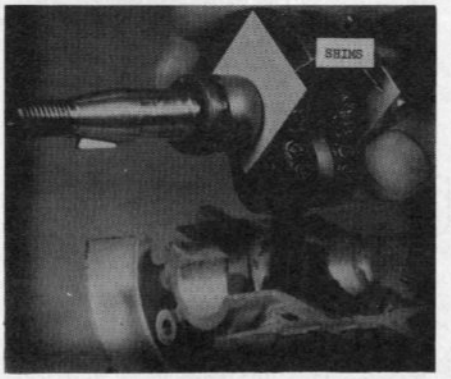


Fig. HL40-7—View showing placement of shims (Fig. HL40-6) between thrust washers (14—Fig. HL40-2, HL40-3 or HL40-4) and bearings (13) for correct crankshaft assembly. Refer to text.

tain minimum or maximum values, reduce or increase given values by 10 percent.

Flywheel	100
Clutch hub	100
Spark plug	150
Crankcase screws—socket hd	35
Starter pulley screw	40-50

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 115-145 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CYLINDER, PISTON, PIN AND RINGS. Cylinder may be removed after unscrewing four screws in bottom of crankcase (19—Fig. HL40-2, HL40-3 or HL40-4). Be careful when removing cylinder as crankshaft assembly will be loose in crankcase. Care should be taken not to damage mating surfaces of cylinder and crankcase.

Inspect crankshaft bearings and renew if scored or worn. Thrust washers (14) should be installed with shoulder to outside. On P100-1 Waterbug™ models, note tangs on thrust washers (14) which must index in crankcase (19). 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.

Early model cylinders are equipped with an open exhaust port while a bridged exhaust port is used on late model cylinders. Early model piston is equipped with a piston ring locating pin in the piston ring groove. Piston ring installed on early model piston must be positioned so end gap indexes with locating pin in ring groove. Late model piston does not have piston ring locating pin and piston ring should be installed so end gap is opposite exhaust port.

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 (14), bearings (13), seal spacers (12) and seals (11) on crankshaft. Place 0.0125 inch thick shims shown in Fig. HL40-5 between thrust washers and bearings as shown in Fig. HL40-6. 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. On P100-1 Waterbug™ models, be sure tangs on thrust washers index in recesses of crankcase. Before final tightening of crankcase screws, lightly tap both ends of crankshaft to obtain proper crankshaft end play, then tighten crankcase screws.

REED VALVE. All models are equipped with a reed valve induction system. Renew reed petal (21—Fig. HL40-2, HL40-3 or HL40-4) if cracked, bent or otherwise damaged. Do not attempt to straighten a bent reed petal. Seating surface for reed petal should be flat, clean and smooth.

CLUTCH. Models ST-200 and ST-210 are equipped with centrifugal clutch (29—Fig. HL40-3) which is accessible after removing engine housing. Clutch hub (29) has left-hand threads. Inspect bushing (31) and renew if excessively worn. Install clutch hub (29) while noting "OUTSIDE" marked on side of hub.

REWIND STARTER. Refer to BLOWER/SPRAYERS section for service of rewind starter on Models HB-280, HB-480 and HB-680. To service the rewind starter on other models, proceed as follows: Remove starter housing (10—Fig. HL40-8 or HL40-9). 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

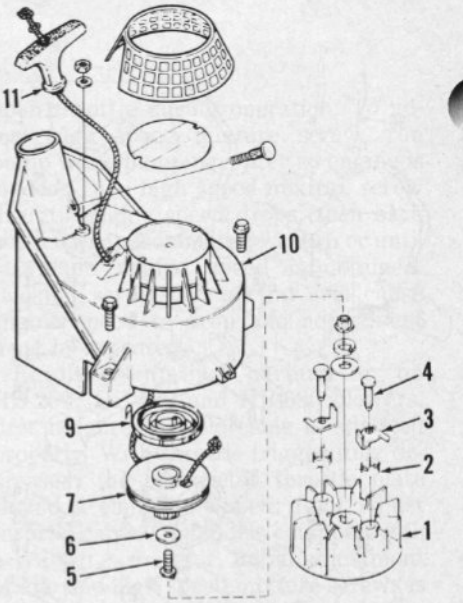
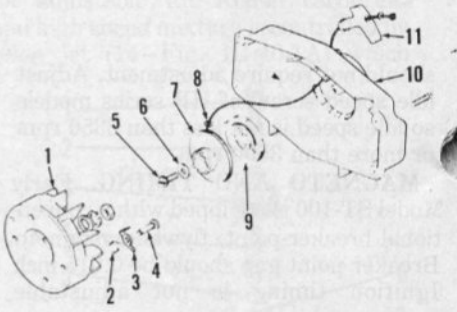


Fig. HL40-8—Exploded view of rewind starter used on Models ST-80, ST-100 and ST-120.

1. Flywheel
2. Spring
3. Pawl
4. Pawl pin
5. Screw
6. Washer
7. Rope pulley
9. Rewind spring
10. Housing
11. Rope handle



HL40-9—Exploded view of rewind starter used on Models ST-200 and ST-210.

1. Flywheel
2. Spring
3. Pawl
4. Pawl pin
5. Screw
6. Washer
7. Rope pulley
8. Nylon washer
9. Rewind spring
10. Housing
11. Rope handle

retaining screw (5) 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.

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

Model	Bore	Stroke	Displ.
DM50	1.875 in.	1.625 in.	4.5 cu. in.
	47.6 mm	41.3 mm	74 cc

This engine is used as the power unit on the Model DM50 Multi-Purpose Saw.

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ6J for all models. Spark plug electrode gap should be 0.025 inch. A Champion CJ4 may be used for heavy duty operation in hot temperatures.

CARBURETOR. Model 450 is equipped with a Walbro SDC diaphragm carburetor. Refer to CARBURETOR SERVICE section for carburetor service.

Initial adjustment of idle speed mixture screw is one turn open. High speed mixture is not adjustable. Adjust idle speed screw (S–Fig. HL41-1) so engine idles at approximately 2400-2600 rpm. Adjust idle mixture screw (I) so engine will accelerate cleanly without bogging. If necessary, readjust idle speed screw to obtain engine idle speed of approximately 2400-2600 rpm.

Starting speed is adjusted by turning slotted head adjustment screw in fast idle latch. See Fig. HL41-1. 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. 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 using a test plug or spark plug with the side electrode removed as follows: Remove the high tension transformer and install the test plug and connect test wires as shown in Fig. HL284. Test wire should be inserted behind receptacle tab (T). Push ignition switch to run position and briskly operate starter. If test plug sparks then ignition system is operating satisfactorily and the spark plug should be checked. If no spark is seen at test plug then another transformer should be checked. If no spark is seen when another transformer is checked, then suspect a faulty ignition module, faulty ignition switch or loose connections.

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 0.020 inch (yellow) shim stock between flywheel and module. Load crankshaft bearings during adjustment by applying pressure to flywheel in direction of ignition module.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Rcommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

Fig. HL41-1—View showing location of idle mixture screw (I) and idle speed screw (S).

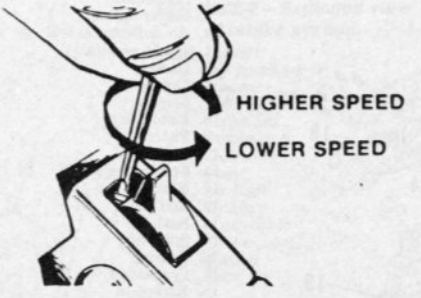


Fig. HL41-2—View showing location of fast idle screw.

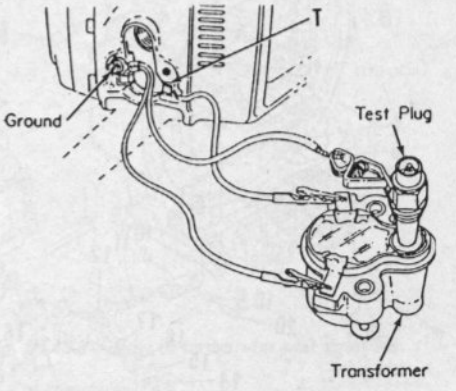
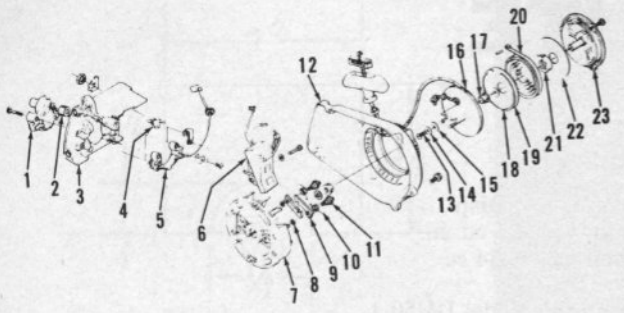


Fig. HL41-3—A test plug may be used to determine if ignition system is operating correctly. See text.



1. Transformer
2. Grommet
3. Shield
4. Ignition switch
5. Transformer receptacle
6. Ignition module

Fig. HL41-4—Exploded view of ignition system and rewind starter.

7. Flywheel
8. Lockwasher
9. Starter pawl
10. Spring
11. Stud
12. Starter housing
13. Screw
14. Washer
15. Washer
16. Rope pulley
17. Bushing
18. Snap ring
19. Outer spring shield
20. Rewind spring
21. Spring lock
22. Inner spring shield
23. Cover

REPAIRS

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 160-190 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CYLINDER, PISTON, PIN AND RINGS. The cylinder may be separated from crankcase after removing nuts securing cylinder to crankcase. Care should be used when separating cylinder and crankcase as crankshaft may be dislodged from crankcase. Inspect cylinder bore and discard cylinder if excessively worn or damaged. Cylinder may not be bored for oversize pistons and oversize cylinders are not available. Refer to CONNECTING ROD, CRANKSHAFT AND CRANKCASE section when installing cylinder.

The piston is equipped with two piston rings. Oversize pistons and rings are not available. The piston pin rides in non-renewable needle bearings in piston. Piston and bearings are available only as a unit assembly.

CONNECTING ROD, CRANKSHAFT AND CRANKCASE. Refer to preceding section and remove cylinder. Separate crankshaft assembly from crankcase and disassemble as required. Inspect components and renew any which are damaged.

Connecting rod (11—Fig. HL41-4) rides on twelve caged bearing rollers (12). The crankshaft is supported by roller bearings (16) which are installed so lettered end is towards snap rings (15).

Tighten connecting rod screws to 65-75 in.-lbs. When assembling crankcase and cylinder, use a suitable sealant on mating surfaces. Be sure components are properly assembled and snap rings (15) engage grooves in cylinder and crankcase. Tighten retaining screws to 60-70 in.-lbs.

CLUTCH. Model DM50 is equipped with clutch shown in Fig. HL41-5. Clutch hub on all models has left-hand threads. Clutch shoes should be renewed only as a set. Inspect bearing and lubricate with Homelite ALL-TEMP Multi-Purpose Grease (#24551) or a lithium base grease.

RECOIL STARTER. Refer to Fig. HL41-3 for an exploded view of starter assembly.

To disassemble starter, hold cover (23) 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 (13) to separate rope pulley (16) from cover. Remove snap ring (18) for access to rewind spring. If starter pawl assemblies must be removed, unscrew housing screws and remove starter housing (12). 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 (22), rewind spring (20) and spring lock (21) in cover with spring wound as shown in Fig. HL41-6. Install outer spring shield (19—Fig. HL41-3) and snap ring (18). Install inner washer (15). Insert bushing (17) in rope pulley (16) 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 capscrew (13) 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.

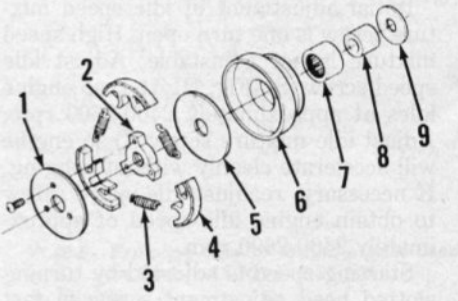


Fig. HL41-6—Exploded view of clutch used on DM-50 Multi-Purpose Saw.

1. Cover plate
2. Hub
3. Spring
4. Shoe
5. Washer
6. Clutch drum
7. Bearing
8. Inner race
9. Thrust washer

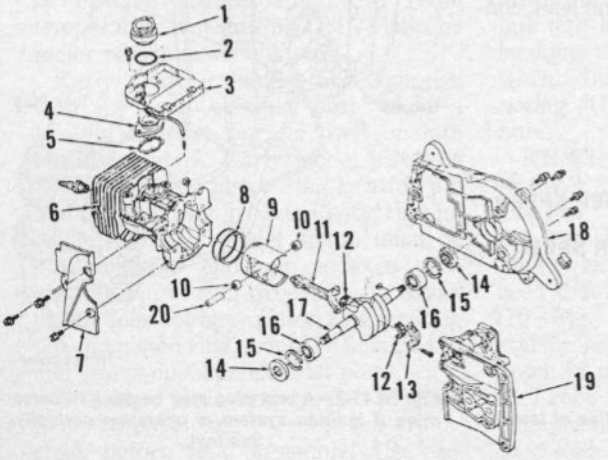


Fig. HL41-5—Exploded view of engine.

1. Connector
2. Garter spring
3. Air deflector & seal
4. Intake manifold
5. Gasket
6. Cylinder
7. Shield
8. Piston rings
9. Piston
10. Piston pin
11. Connecting rod
12. Bearing
13. Rod cap
14. Seal
15. Snap ring
16. Bearing
17. Crankshaft
18. Backplate
19. Crankcase

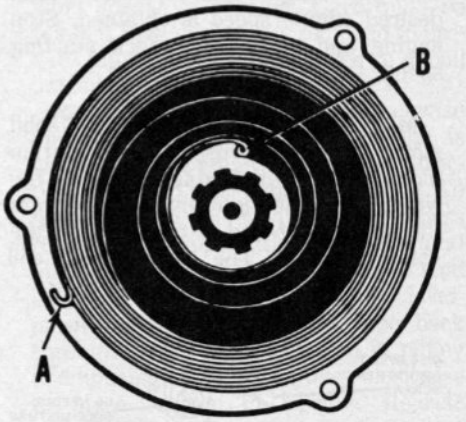


Fig. HL41-7—View of rewind spring installation in starter cover. Hook outer loop (A) of spring in notch as shown. Inner loop (B) of spring must be curved inward to engage notch of spring lock.

HOMELITE

Model	Bore	Stroke	Displ.
FP-150	2.250 in.	1.720 in.	6.8 cu. in.
	57.2 mm	43.7 mm	112 cc

This engine is used as the power unit on the Model FP-150 Pressure Pump.

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion CJ3. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. Model FP-150 pump is equipped with a Walbro WB-12 diaphragm carburetor. Refer to CARBURETOR SERVICE section for carburetor service.

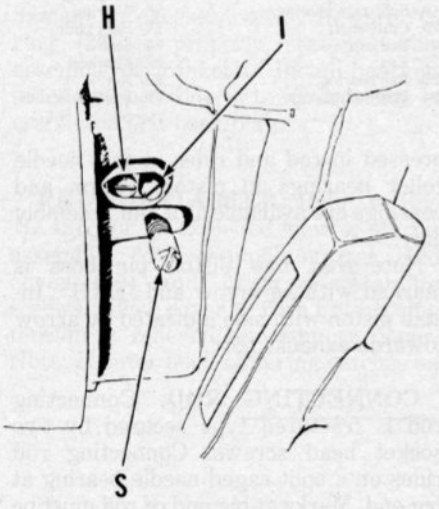


Fig. HL42-1 — View showing location of idle mixture screw (I), high speed mixture screw (H) and idle speed screw (S).

Before attempting carburetor adjustments, be sure pump is primed. Initial adjustment of idle and high speed mixture screws is one turn open. Adjust idle speed screw (S – Fig. HL42-1) so engine idles at 2600-3400 rpm. Adjust idle mixture screw (I) to obtain maximum idle speed, then readjust idle speed screw so engine idles as 2600-3400 rpm.

To adjust high speed mixture screw, close discharge valve until engine speed is 7000-7500 rpm or pump discharge pressure is 150-160 psi. Adjust high speed mixture screw so best lean power is obtained.

MAGNETO AND TIMING. A solid state ignition is used on Model FP-150 engine. 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 using a test plug or spark plug with the side electrode removed as follows: Remove the high tension transformer and install the test plug and connect test wires as shown in Fig. HL42-5. Test wire should be inserted behind receptacle tab (T). Push ignition switch to run position and briskly operate starter. If test plug sparks then ignition system is operating satisfactorily and the spark plug should be checked. If no spark is seen at test plug then another transformer should be checked. If no spark is seen when another transformer is checked, then suspect a faulty ignition module, faulty ignition switch or loose connections.

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 engine 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

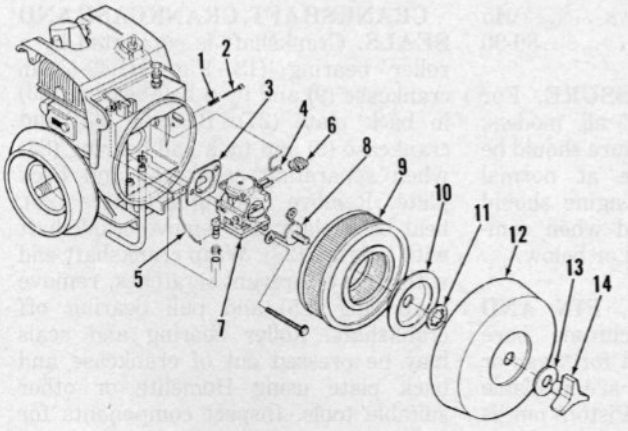


Fig. HL42-2 — Exploded view of intake system.

1. Spring
2. Idle speed screw
3. Spacer
4. Throttle link
5. Choke link
6. Grommet
7. Carburetor
8. Stud
9. Air filter
10. Retainer
11. Lockwasher
12. Cover
13. Washer
14. Knob

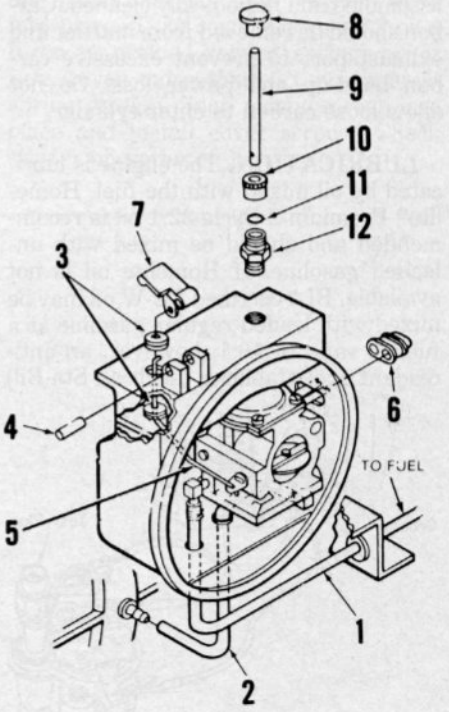


Fig. HL42-3 — View of carburetor and chamber.

1. Fuel line
2. Crankcase pulse line
3. Grommets
4. Pin
5. Choke link
6. Grommet
7. Choke lever
8. Throttle knob
9. Rod
10. Nut
11. "O" ring
12. Bushing

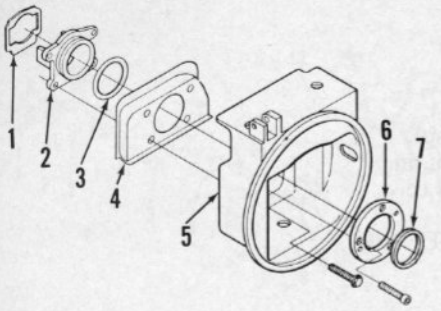


Fig. HL42-4—Exploded view of carburetor chamber assembly.

1. Gasket
2. Intake adapter
3. "O" ring
4. Air deflector
5. Carburetor chamber
6. Plate
7. Square ring

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.

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.

LUBRICATION. The engine is lubricated by oil mixed with the fuel. Homelite® Premium 2-Cycle 32:1 oil is recommended and should be mixed with unleaded gasoline. If Homelite oil is not available, BIA certified TC-W oil may be mixed with leaded regular gasoline at a fuel:oil ratio of 16:1, however, an antioxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Antioxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

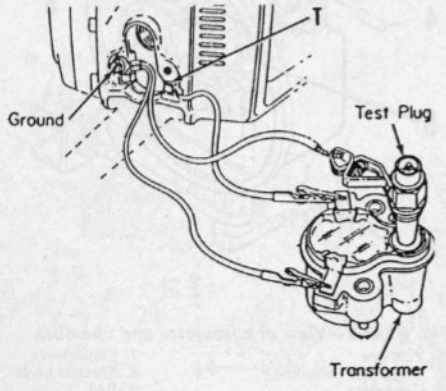


Fig. HL42-5—A test plug may be used to determine if ignition system is operating correctly. See text.

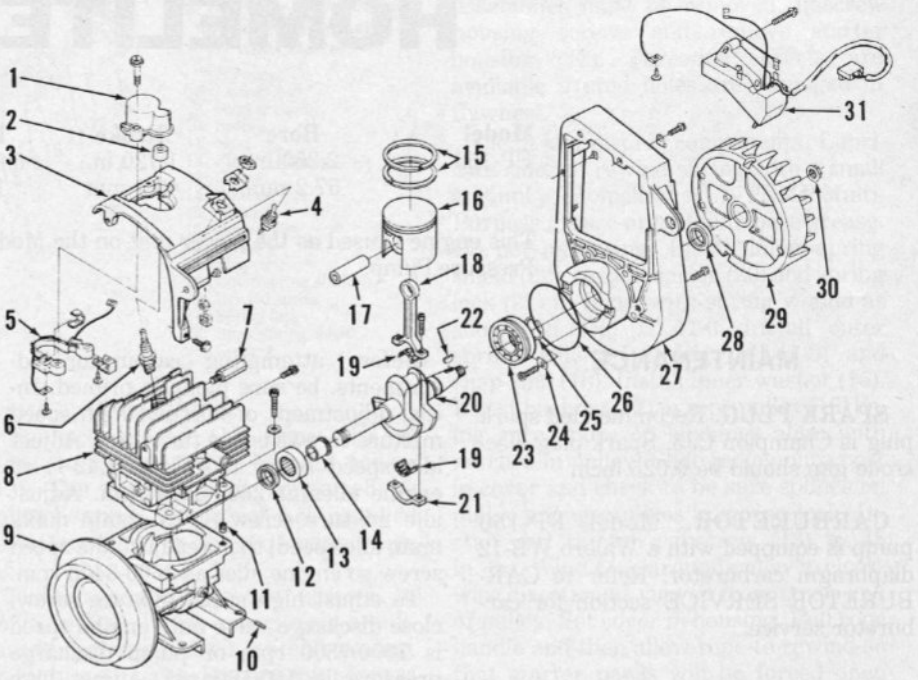


Fig. HL42-6—Exploded view of engine used on Model FP-150 pump.

1. High tension coil
2. Grommet
3. Shield
4. Ignition switch
5. Coil receptacle
6. Spark plug
7. Stud
8. Cylinder
9. Crankcase
10. Nipple
11. Helicoil insert
12. Seal
13. Roller bearing
14. Sleeve
15. Piston rings
16. Piston
17. Piston pin
18. Connecting rod
19. Split cage bearing
20. Crankshaft
21. Rod cap
22. Key
23. Ball bearing
24. Bearing retainer
25. Snap ring
26. "O" ring
27. Back plate
28. Seal
29. Flywheel
30. Nut
31. Ignition module

ENGINE REPAIRS

TIGHTENING TORQUES. Tightening torque values in inch-pounds are as follows:

Spark plug	150
Flywheel nut	250-300
Cylinder screws	80
Connecting rod screws	70-80
Starter housing screws	35
Ignition module screws	35
Transformer coil screws	27
Airbox to tank	45
Carburetor mounting screws	45
Starter pawl studs	80-90

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 135-165 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

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 a roller bearing (13—Fig. HL42-6) in crankcase (9) and by a ball bearing (23) in back plate (27). Bearing (23) and crankcase (9) and by a ball bearing (23) when separating crankcase and back plate. Remove bearing retainers (24), heat back plate and remove crankshaft with bearing (23). Wrap crankshaft end with tape to prevent scratches, remove snap ring (25) and pull bearing off crankshaft. Roller bearing and seals may be pressed out of crankcase and back plate using Homelite or other suitable tools. Inspect components for

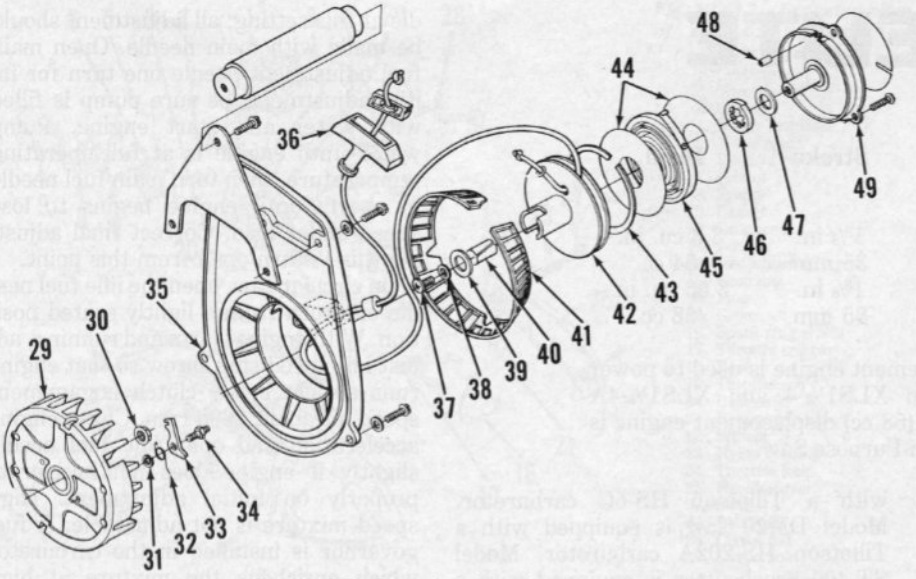


Fig. HL42-7—Exploded view of rewind starter.

29. Flywheel
30. Nut
31. Lockwasher
32. Spring
33. Pawl
34. Stud
35. Starter housing
36. Rope handle
37. Screw
38. Lockwasher
39. Washer
40. Bushing
41. Screen
42. Rope pulley
43. Snap ring
44. Spring shields
45. Rewind spring
46. Spring lock
47. Washer
48. Pin
49. Cover

damage or excessive wear. Be sure "O" ring (26) is properly seated during assembly of crankcase. Install bearings so unstamped side is towards inside of crankcase and back plate.

REWIND STARTER. Refer to Fig. HL42-7 for an exploded view of starter assembly. To disassemble starter, hold cover (49) 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 (37) to separate rope pulley (42) from cover. Remove snap ring (43) for access to rewind spring. If starter pawl assemblies must be removed, unscrew housing screws and remove starter housing (35). 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.

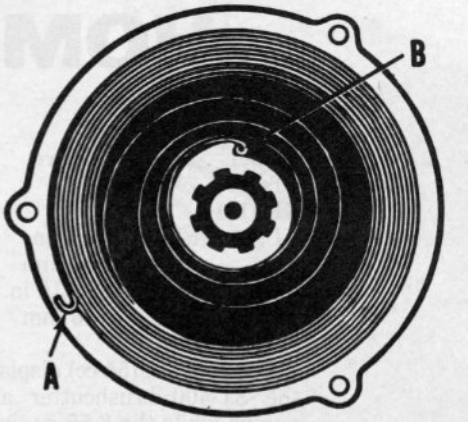


Fig. HL42-8—View of rewind spring installation in starter cover. Hook outer loop (A) of spring in notch as shown. Inner loop (B) of spring must be curved inward to engage notch of spring lock.

Do not oil spring. Install washer (47), inner spring shield (44), rewind spring (45) and spring lock (46) in cover with spring wound as shown in Fig. HL42-8. Install outer spring shield (44–Fig. HL42-7) and snap ring (43). Insert bushing (40) in rope pulley (42). Slide pulley onto post in cover and check to be sure splines on pulley engage splines in spring lock. Install and tighten screw (37) 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 3 or 4 turns to preload rewind spring; never turn cover more than 5 turns against spring tension. Snap plastic screen into place and install cover screws. Check starter operation.

HOMELITE

Model	Bore	Stroke	Displ.
ST-400, XLS1½-4, XLS½-4A	1¾ in.	1⅜ in.	3.3 cu. in.
	44 mm	35 mm	54 cc
DM20	1-13/16 in.	1⅜ in.	3.55 cu. in.
	46 mm	35 mm	58 cc

The 3.3 cu. in. (54 cc) displacement engine is used to power the ST-400 brushcutter and XLS1½-4 and XLS1½-4A pumps while the 3.55 cu. in. (58 cc) displacement engine is used to power the DM20 Multi-Purpose Saw.

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion CJ6. Spark plug electrode gap should be 0.035 inch on pump engine and 0.025 inch on brushcutter and saw engines.

CARBURETOR. Model XLS1½-4 and XLS1½-4A pumps are equipped with a Tillotson HS-5C carburetor. Model DM20 saw is equipped with a Tillotson HS-202A carburetor. Model ST-400 brushcutter is equipped with a Tillotson HS-207A carburetor. Refer to CARBURETOR SERVICE section for carburetor service.

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 ⅛-turn open from this point.

On circular saw, open the idle fuel needle one turn from a lightly seated position. 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. High speed mixture is not adjustable. A fuel governor is installed in the carburetor which enrichens the mixture at high speed to prevent overspeeding.

On brushcutter, turn idle speed stop screw in until it just contacts throttle lever tab, then turn screw in ½-turn further. Turn idle and main fuel adjustment needles in gently until they just contact seats, then back each needle out one 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.

PUMP GOVERNOR. On pump applications, engine is equipped with air-vane type governor as shown in Fig. HL43-1.

With engine running under no load (CAUTION: Be sure pump housing is

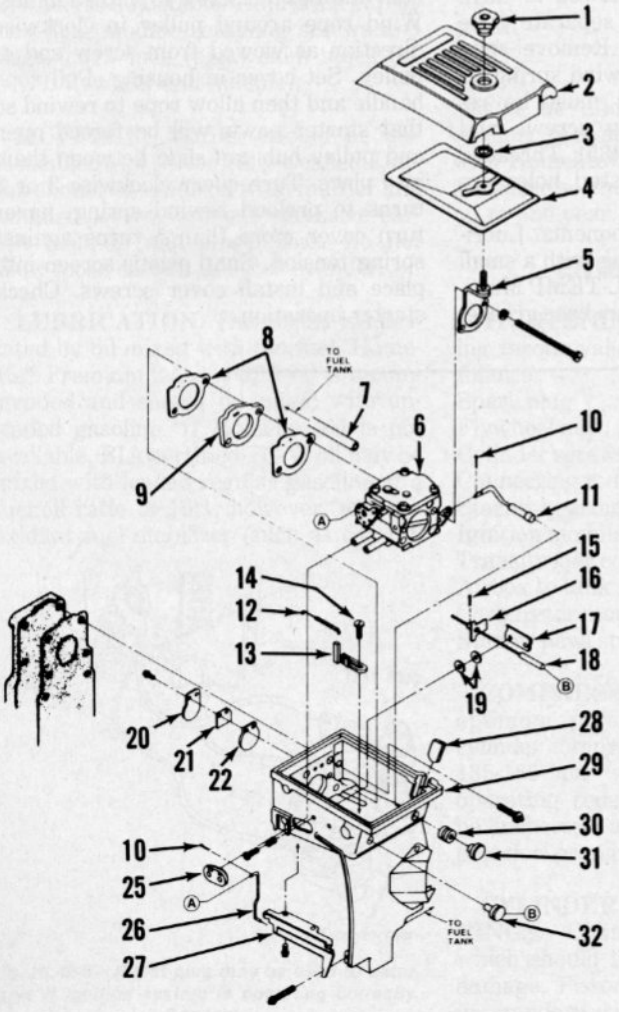


Fig. HL43-1 — Exploded view of air box assembly on Model XL-12 engine.

1. Nut
2. Air filter cover
3. Retaining ring
4. Air filter element
5. Mounting bracket
6. Carburetor
7. Fuel line
8. Gasket
9. Spacer
10. Cotter pin
11. Choke rod
12. Governor spring
13. Adjusting plate
14. Screw
15. Cotter pin
16. Collar
17. Clamp
18. Throttle cable
19. Washers
20. Reed stop
21. Reed backup
22. Reed valve
23. Throttle rod friction adjustment screws
24. Springs
25. Grommet
26. Governor link
27. Governor air vane
28. Felt plug
29. Air box
30. Grommet
31. Choke button
32. Throttle button

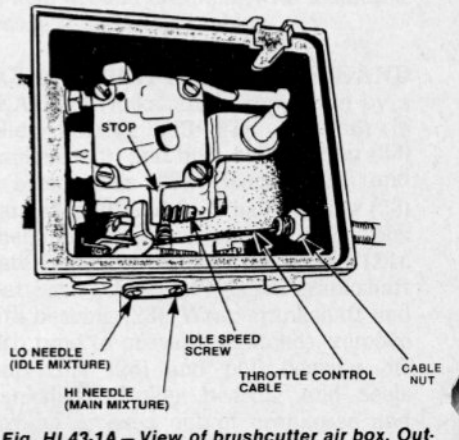


Fig. HL43-1A — View of brushcutter air box. Outside throttle cable nut is not shown.

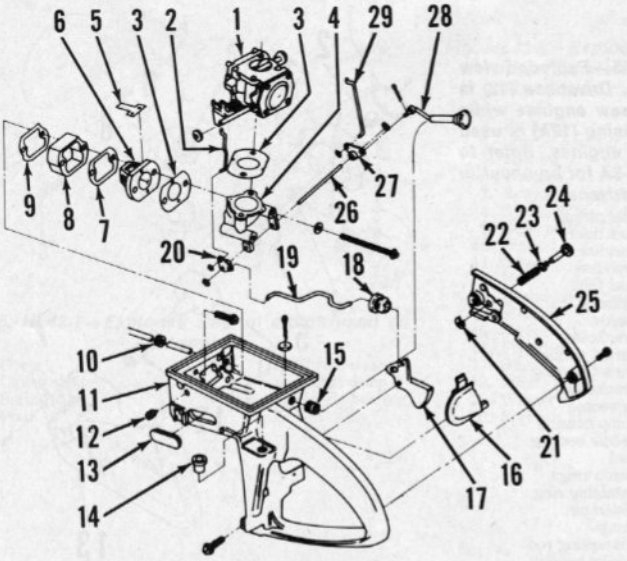


Fig. HL43-2—Exploded view of air box assembly on Super XL engine.

1. Carburetor
2. Throttle rod
3. Gasket
4. Intake manifold
5. Valve reeds
6. Reed valve seat
7. Gasket
8. Spacer
9. Gasket
10. Grommet
11. Air box
12. Idle adjusting screw
13. Grommet
14. Plug
15. Grommet
16. Spark plug shield
17. Throttle trigger
18. Boot
19. Throttle rod
20. Bellcrank
21. Retaining ring
22. Spring
23. Nylon bushing
24. Throttle lock
25. Handle cover
26. Shaft
27. Bellcrank
28. Choke rod
29. Choke link

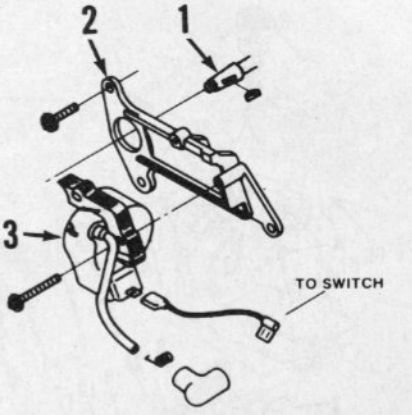


Fig. HL43-4—Exploded view of solid-state ignition.

1. Crankshaft
2. Stator plate
3. Ignition module

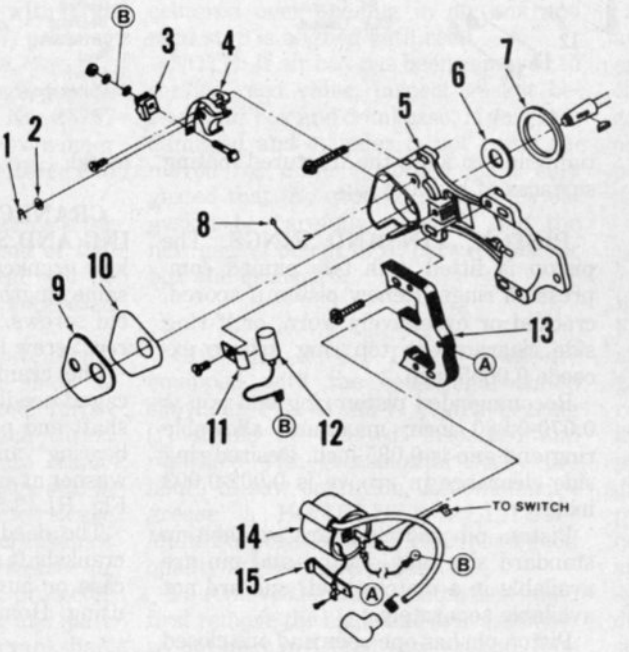


Fig. HL43-3—Exploded view of breaker-point type ignition used on early pump engines.

1. Pivot post clip
2. Washer
3. Terminal block
4. Breaker point set
5. Stator plate
6. Felt seal
7. Gasket
8. Clip
9. Cover
10. Gasket
11. Clamp
12. Condenser
13. Coil core
14. Coil
15. Coil retaining clip

filled with water), engine speed should be 6400 to 6600 rpm. If not, loosen screw (14) and move speed adjusting plate (13) 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. Be sure idle speed screw on carburetor is backed out so it will not interfere with full movements of throttle shaft lever and governor linkage moves smoothly throughout range of travel.

BRUSHCUTTER GOVERNOR. The engine used in brushcutter application is equipped with an air-vane type governor; refer to Fig. HL43-1.

To adjust governor using vibrating reed or electronic tachometer, proceed as follows: With engine warm and running and throttle trigger released, adjust position of cable nuts (see Fig. HL43-1A) on remote control cable so that engine slow idle speed is 2500 rpm, or just below clutch engagement speed. Then when throttle trigger is fully depressed, engine no-load speed should be 6300 rpm. To adjust maximum governed no-load speed, loosen screw (14—Fig. HL43-1) and move speed adjusting plate (13) as required to obtain no-load speed of 6300 rpm. When adjusting maximum no-load speed, be sure that governor link (26) is reconnected at hole "A" in carburetor throttle shaft lever. Governor spring (12) 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.

MAGNETO AND TIMING. Early pump engines are equipped with a conventional breaker-point, flywheel magneto (Fig. HL43-3). Breaker point gap should be 0.015 inch. Ignition timing is not adjustable.

Later pump engines and all brushcutter and saw engines are equipped with a solid-state ignition (Fig. HL43-4). Ignition service is accomplished by replacing ignition components until faulty part is located. Air gap between ignition module (3) and flywheel is adjustable and should be 0.015 inch. Loosen ignition module mounting screws and adjust module position to set air gap.

LUBRICATION. The engine is lubricated by mixing oil with regular gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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

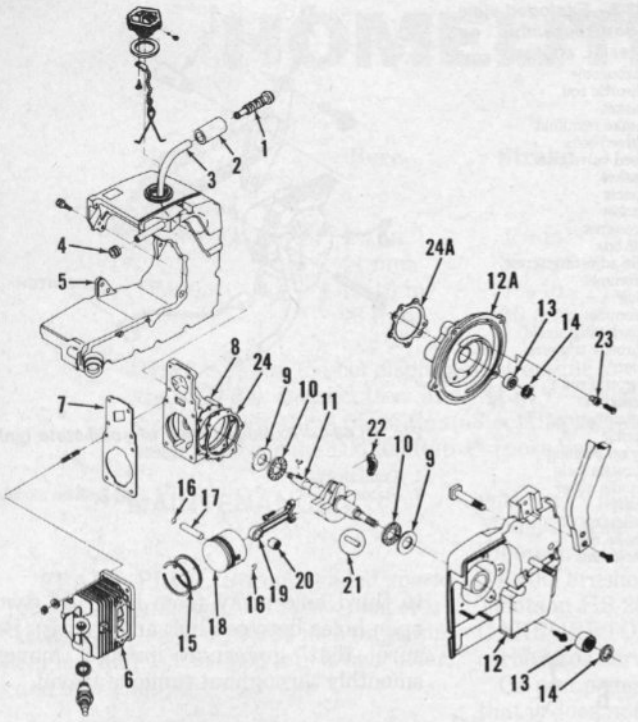


Fig. HL43-5—Exploded view of engine. Drivecase (12) is used on saw engines while pump housing (12A) is used on pump engines. Refer to Fig. HL43-5A for brushcutter drivecase.

1. Fuel pickup
2. Fuel filter
3. Fuel line
4. Grommet
5. Fuel tank
6. Cylinder
7. Gasket
8. Crankcase
9. Thrust washer
10. Thrust bearing
11. Crankshaft
12. Drivecase

12A. Pump housing

13. Needle bearing
14. Seal
15. Piston rings
16. Retaining ring
17. Piston pin
18. Piston
19. Connecting rod
20. Needle bearing
21. Crankpin rollers (31)
22. Rod cap
23. Sealing washer
24. Gasket

24A. Gasket

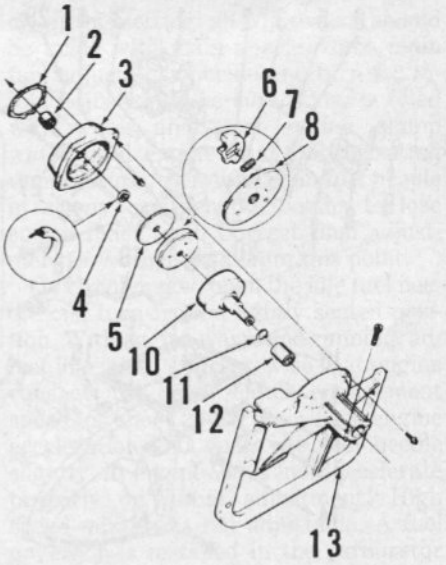


Fig. HL43-5A—Exploded view of ST-400 clutch assembly.

1. Gasket
2. Bearing
3. Drivecase
4. Seal
5. Cover
6. Clutch shoe
7. Spring
8. Clutch hub
10. Clutch drum
11. Snap ring
12. Bearing
13. Frame

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

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 130-155 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression pressure is 90 psi or below.

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Refer to Fig. HL43-5. Be careful not to lose any of the 31 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. 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. When assembling connecting rod on crankshaft, 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 inch.

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

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.

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

CRANKCASE, BEARING HOUSING AND SEALS. CAUTION: Do not lose 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 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. HL43-5.

The needle roller main bearings and crankshaft seals in crankcase and drivecase or pump housing can be renewed using Homelite tool Nos. 23757 and

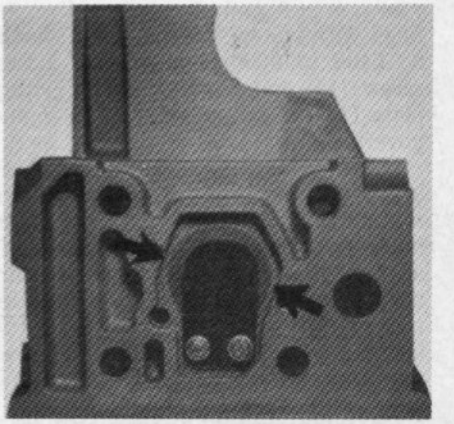


Fig. HL43-6—When installing flat reed valve, reed backup and reed stop, be sure reed is centered between two points indicated by black arrows.

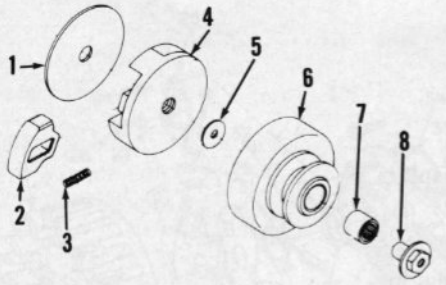


Fig. HL43-7—Exploded view of clutch used on saw engines.

1. Cover
2. Clutch shoe
3. Spring
4. Plate
5. Thrust washer
6. Clutch drum
7. Needle bearing
8. Nut

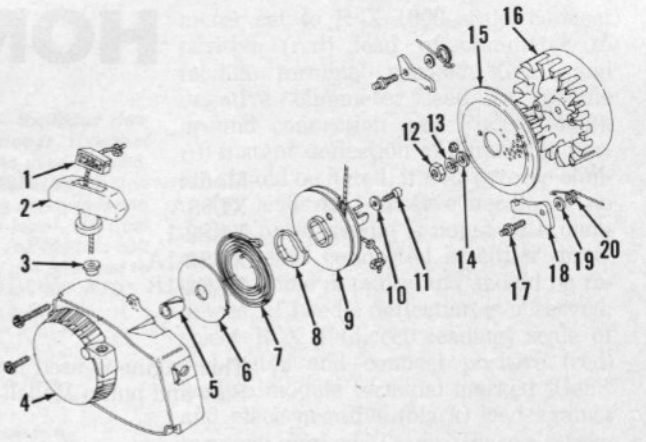


Fig. HL43-8—Exploded view of rewind starter.

1. Rope retainer
2. Handle
3. Bushing
4. Starter housing
5. Bushing
6. Washer
7. Rewind spring
8. Spring lock
9. Rope pulley
10. Washer
11. Screw
12. Nut
13. Lockwasher
14. Washer
15. Screen
16. Flywheel
17. Stud
18. Pawl
19. Washer
20. Spring

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 (10) 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 gasket on shoulder of drivecase or pump housing. Lubricate seal protector sleeve, seal and needle bearing and mate drivecase or pump housing to crankshaft and crankcase. Use **NEW** 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.

FLAT REED INTAKE VALVE. A flat reed intake valve is used on pump engines. The reed valve is attached to the carburetor air box as shown in Fig. HL43-6 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 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, 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.

CLUTCH. Model DM20 saws are equipped with the centrifugal clutch shown in Fig. HL43-7. Clutch bearing (7) should be cleaned, inspected and repacked with grease after every 100 hours of saw operation. Recommended grease is HOMELITE® ALL-TEMP Multi-Purpose Grease (#24551) or a good quality lithium base grease.

To remove the DM20 clutch assembly, first remove the blade and arm assembly as outlined in DM20 saw section. The clutch bearing inner race (8—Fig. HL43-7) unscrews clockwise (left-hand threads). Remove inner race with impact wrench, or if impact wrench is not available, use a ¾-inch socket wrench and strike wrench handle a sharp blow to loosen threads. Remove clutch drum, pulley and bearing assembly and remove thrust washer (5). Then, unscrew clutch plate (4) using a spanner wrench (Homelite tool No. A-23934 or equivalent) in clockwise direction. Remove clutch cover (1). Inspect clutch drum and pulley for excessive wear or scoring. Inspect all 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.

To service clutch on ST-400 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. Inspect clutch components and renew any which are damaged or excessively worn.

REWIND STARTER. To disassemble starter, refer to exploded view in Fig. HL43-8 and proceed as follows: Pull starter rope out fully, hold pulley (9) and place rope in notch of pulley. Let pulley rewind slowly. Hold pulley while removing screw (11) and washer (10). 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. HL43-8. Install pulley (9), 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 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.

HOMELITE

Model	Bore	Stroke	Displ.
XL98A, XLS2-1, XLS2-1A, XLS2-1B	2-1/16 in. 52.4 mm	1½ in. 38.1 mm	5.0 cu. in. 82 cc

This engine is used to power Model XL98A Multi-Purpose Saw and pump Models XLS2-1, XLS2-1A and XLS2-1B.

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion CJ6. Spark plug electrode gap should be 0.025 inch.

CARBURETOR. A Tillotson Model HS diaphragm carburetor is used. Refer to CARBURETOR SERVICE section for carburetor service. The carburetor used on Model XL98A saw has a fixed main jet and a governor valve which is designed to maintain a governed speed of about 5000 rpm. Neither main jet or governor valve is adjustable. The carburetor on Models XLS2-1A and XLS2-1B 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 1½ 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 ⅛ turn counterclockwise. Note: Governor is designed to limit maximum no-load speed to 6400 rpm. Adjust 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.

MAGNETO. Models XL-98A, XLS2-1B. Saw Model XL-98A and pump Model XLS2-1B are equipped with the capacitor discharge ignition system shown in Fig. HL44-1. 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 ⅜-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 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

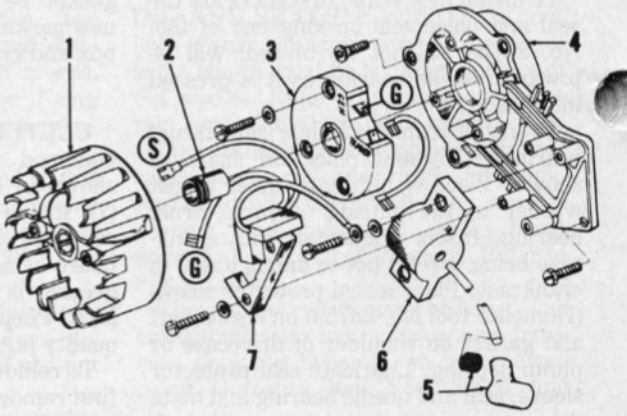


Fig. HL44-1—Exploded view of Phelon capacitor discharge type magneto used on Models XL-98A and XLS2-1B.

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

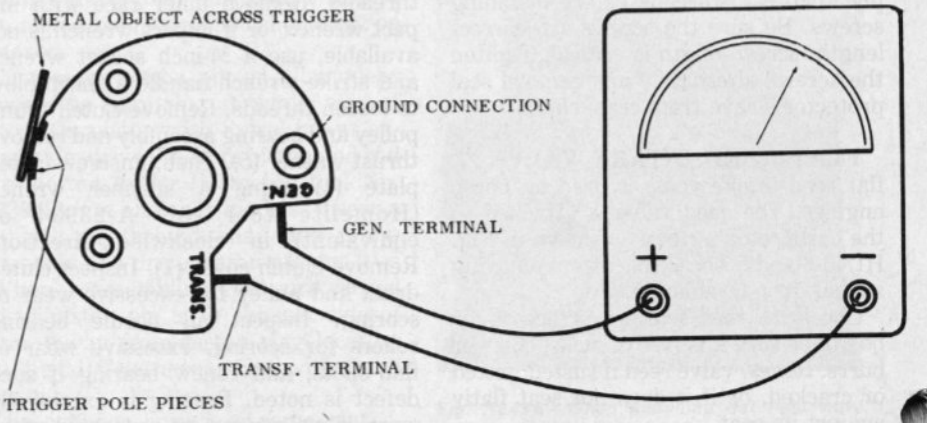


Fig. HL44-2—Drawing showing volt-ohmmeter connections to ignition module (3—Fig. HL44-1) for checking module. It should be noted that this is not a conclusive test and module should be renewed in event of spark failure when other magneto components test OK.

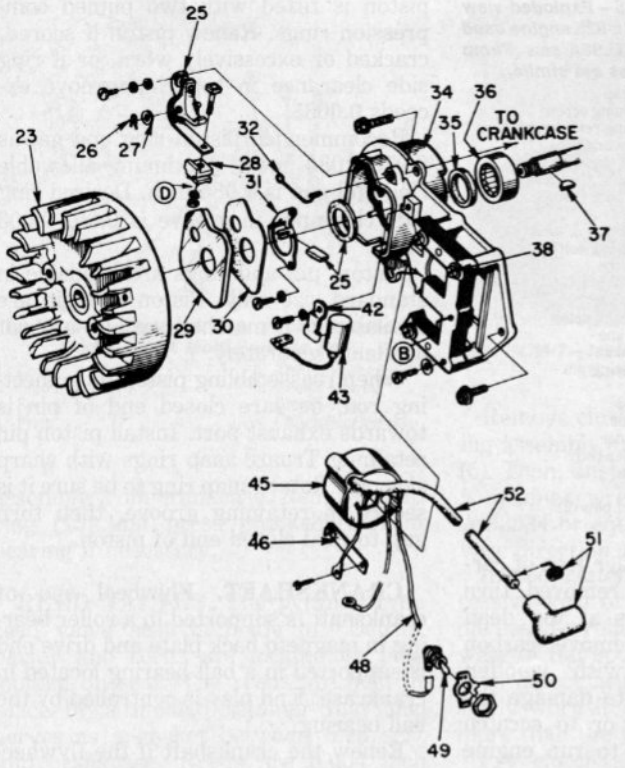


Fig. HL44-3—Exploded view of conventional flywheel type magneto used on models XLS2-1 and XLS2-1A. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D".

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

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. HL44-2). 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. HL44-2); 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. HL44-3. Breaker points and condenser are accessible after removal of starter housing, flywheel and breaker box cover. Adjust breaker point gap to 0.015 inch. Condenser capacity should test

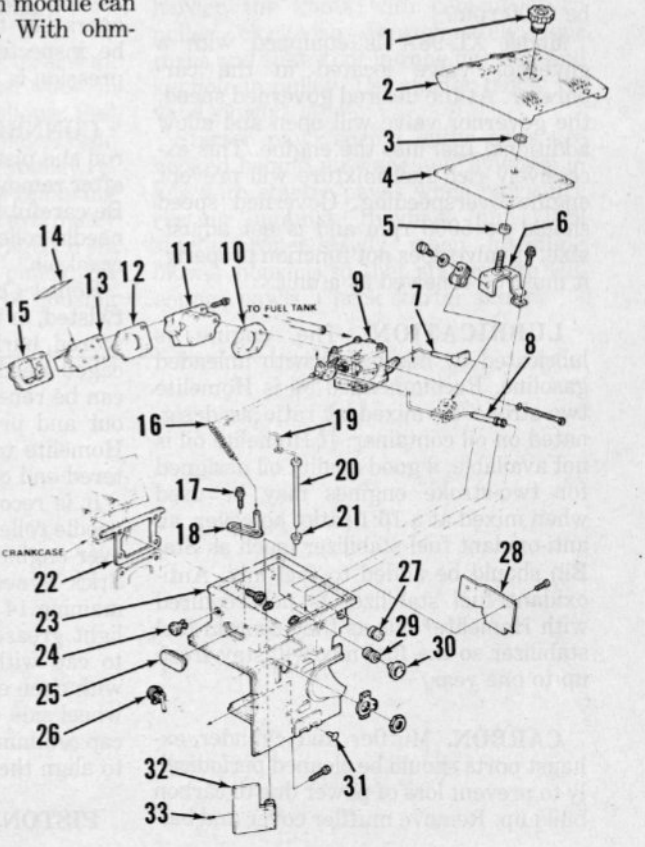


Fig. HL44-4—Exploded view of air box assembly used on Model XLS2-1B.

1. Nut
2. Air filter cover
3. Retaining ring
4. Air filter element
5. Gasket
6. Bracket
7. Choke rod
8. Throttle rod
9. Carburetor
10. Gasket
11. Intake manifold
12. Gasket
13. Reed valve seat
14. Valve reeds
15. Reed valve retainer
16. Governor spring
17. Adjusting plate screw
18. Adjusting plate
19. Link
20. Vane shaft
21. Bushing
22. Gasket
23. Air box
24. Plug
25. Grommet
26. Ignition switch
27. Grommet
28. Air deflector
29. Grommet
30. Choke knob
31. Rivet
32. Set screw
33. Air vane

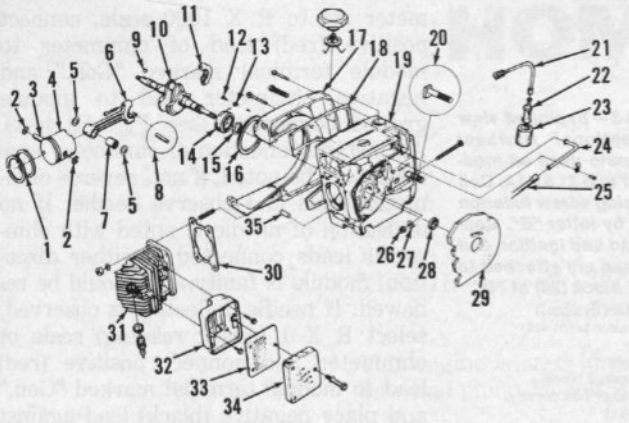


Fig. HL44-5 – Exploded view of Model XL-925 engine used on Model XL98A saw. Pump engines are similar.

1. Piston rings
2. Pin retaining rings
3. Piston pin
4. Piston
5. Thrust washer
6. Connecting rod
7. Needle bearing
8. Needle rollers (28)
9. Key
10. Crankshaft
11. Rod cap
12. Retaining screw
13. Bearing retainer washers
14. Ball bearing
15. Snap ring
16. Gasket
17. Fuel tank cover
18. Gasket
19. Crankcase & tank
20. Guide bar bolt
21. Fuel line
22. Fuel pickup
23. Fuel filter
24. Fuel connector
25. Fuel line
26. Locknut
27. Adjusting pin
28. Seal
29. Shield
30. Gasket
31. Cylinder
32. Muffler body
33. Baffle
34. Cap
35. Dowel pins (2)

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 inch. 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 XLS2-1, XLS2-1A and XLS2-1B as shown in Fig. HL44-4. Governed speed is adjusted by loosening screws (17) and moving plate (18). Maximum governed speed should be 6400 rpm.

Model XL-98A is equipped with a governor valve 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 does not function properly, it must be renewed as a unit.

LUBRICATION. The engine is lubricated by mixing oil with unleaded gasoline. Recommended oil is Homelite two-stroke oil mixed at ratio as designated on oil container. If Homelite oil is not available, a good quality oil designed for two-stroke engines may be used when mixed at a 16:1 ratio, however, an anti-oxidant fuel stabilizer (such as Sta-Bil) should be added to fuel mix. Anti-oxidant fuel stabilizer is not required with Homelite® oils as they contain fuel stabilizer so the fuel mix will stay fresh up to one year.

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

COMPRESSION PRESSURE. For optimum performance of all models, cylinder compression pressure should be 155-185 psi with engine at normal operating temperature. Engine should be inspected and repaired when compression is 90 psi or below.

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 inch, maximum allowable ring end gap is 0.085 inch. Desired ring side clearance in groove is 0.002-0.003 inch.

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

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 (29 – Fig. HL44-5) on saws and pump assembly on Models XLS2-1, XLS2-1A and XLS2-1B. Then, remove the two ball bearing retaining screws (12) from inside of crankcase and remove crankshaft and ball bearing

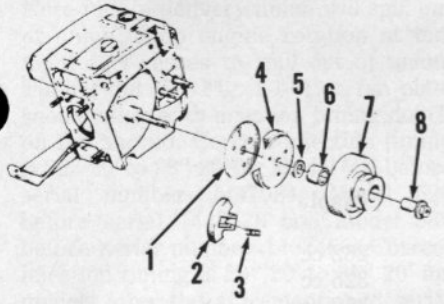


Fig. HL44-6—Exploded view of clutch used on Model XL98A Multi-Purpose Saw.

1. Cover
2. Clutch shoe
3. Spring
4. Plate
5. Thrust washer
6. Needle bearing
7. Clutch drum
8. Clutch bearing race

assembly from crankcase. Remove snap ring (15) 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 inch 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. Model XL98A is equipped with a centrifugal clutch. To remove the clutch assembly, first remove the blade and arm assembly as noted in XL98A saw section. The clutch bearing inner race (8—Fig. HL44-6) unscrews counterclockwise (left-hand threads). Remove inner race with impact wrench, or if impact wrench is not available, use a ¾-inch socket wrench and strike wrench handle a sharp blow to loosen threads.

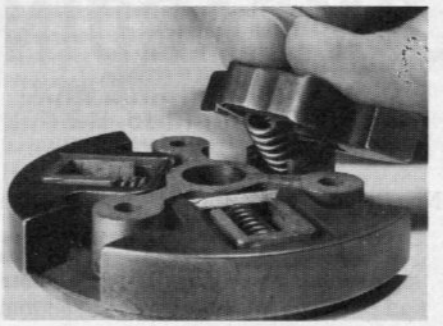


Fig. HL44-7—Installing shoes and springs on clutch spider plate.

Remove clutch drum, pulley and bearing assembly and remove thrust washer (5). Then, unscrew clutch plate (4) using a spanner wrench (Homelite tool No. A-23934 or equivalent) in counterclockwise direction. Remove clutch cover (1).

Inspect clutch drum and pulley for excessive wear or scoring. Inspect all 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. HL44-7. Reinstall clutch by reversing removal procedure. Lubricate needle roller bearing in clutch drum with a small amount of Homelite® ALL-TEMP Multi-Purpose Grease (#24551). Note: The bearing should be cleaned and repacked after each 45 to 50 hours of operation.

REWIND STARTER. To disassemble starter, refer to exploded view in Fig. HL44-8 and proceed as follows: Pull starter rope out fully, hold pulley (7) and pry rope knot from pulley. Let pulley rewind slowly. Hold pulley while removing screw (11) and washer (10). Turn pulley counterclockwise until disengaged from spring, then carefully lift pulley off starter post. Turn open side of housing

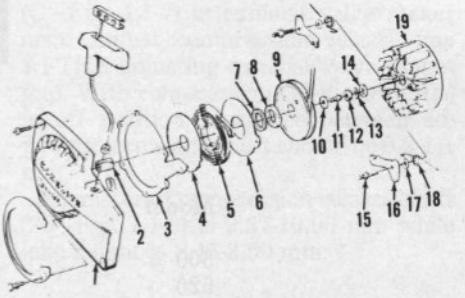


Fig. HL44-8—Exploded view of rewind starter.

1. Starter housing
2. Bushing
3. Air flow ring
4. Shield
5. Rewind spring
6. Shield
7. Bushing
8. Spring lock
9. Rope pulley
10. Washer
11. Screw
12. Locknut
13. Lockwasher
14. Washer
15. Stud
16. Pawl
17. Washer
18. Spring
19. Flywheel

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 ring (3) and shield (4) in starter housing (1). Install new spring with loop in outer end over pin in blower housing and be sure spring is coiled in direction shown in Fig. HL44-8. Install shield (6) and pulley (9), 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 cement. Turn pulley clockwise approximately four 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. Check starter action.

LOMBARDINI

LOMBARDINI ENGINE, INC.
3402 Oakcliff Road, B-2
Doraville, Georgia 30340

Model	No. Cyls.	Bore	Stroke	Displ.
500	1	70 mm	68 mm	262 cc
520	1	78 mm	68 mm	325 cc
530	1	82 mm	68 mm	359 cc

Lombardini Model 530 engine is used on Homelite® DTP3-1 Pump.

Lombardini Model 500, 520 and 530 engines are four-stroke, air-cooled diesel engines. The cylinder head and cylinder block are aluminum. Crankshaft rotation is counter-clockwise at pto end.

Metric fasteners are used throughout engine.

MAINTENANCE

LUBRICATION

Recommended engine oil is SAE 10W for temperatures below 0° C (32° F), SAE20W for temperatures between 0° C (32° F) and 20° C (68° F), and SAE 40 for temperatures above 20° C (68° F). API classification for oil should be CD. Oil sump capacity is one liter.

A renewable oil filter is located in side of engine block. Manufacturer recommends removing filter (22–Fig. L1-1) and installing a new filter after every 300 hours of operation.

ENGINE SPEED ADJUSTMENT

Idle speed is adjusted by turning idle speed screw (I–Fig. L1-2). Idle speed should be 1000-1050 rpm. Maximum governed speed is adjusted by turning high speed screw (H). Maximum governed speed under load should be 3600 rpm.

FUEL SYSTEM

FUEL FILTER. The fuel filter may be located inside the fuel tank as shown in Fig. L1-3 or a cartridge type filter as shown in Fig. L1-4 may be used. Renew fuel filter after every 300 hours of operation or sooner if required.

BLEED FUEL SYSTEM. If equipped with cartridge filter (F–Fig. L1-4), unscrew bleed screw and allow fuel to flow until air-free, then retighten screw.

On gravity flow fuel systems (Fig. L1-3), loosen fuel line fitting on injection pump and allow fuel to flow until air-free, then retighten fitting.

On models equipped with a fuel pump (L–Fig. L1-4), loosen fuel line fitting on injection pump and operate fuel pump primer lever until air-free fuel flows from fitting, then retighten fitting.

On all models, loosen high pressure injection line at injector. Rotate engine crankshaft to operate injection pump until air-free fuel flows from injection line. Retighten injection line.

INJECTION PUMP TIMING

Injection pump timing is adjusted using shim gaskets (G–Fig. L1-3 and L1-4) between pump body and mounting surface on crankcase. To check injection pump timing, unscrew delivery line (D) fitting from delivery union (1–Fig. L1-5). Unscrew delivery union and remove spring (3), washer (4) and valve (5), then screw delivery union (1) into pump body. Move throttle control lever to full speed position. Rotate engine in normal direction (clockwise at flywheel end) so piston is on compression stroke.

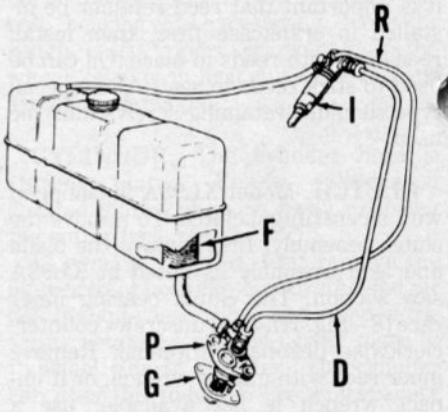


Fig. L1-3—Diagram of fuel system.

D. Delivery line
F. Fuel filter
G. Shim gasket
I. Injector
P. Injection pump
R. Return line

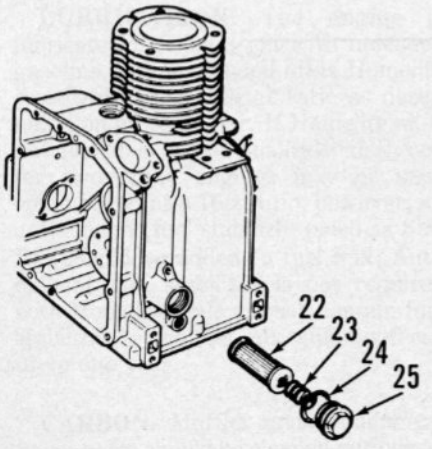


Fig. L1-1—Exploded view of oil filter.

22. Oil filter
23. Spring
24. "O" ring
25. Plug

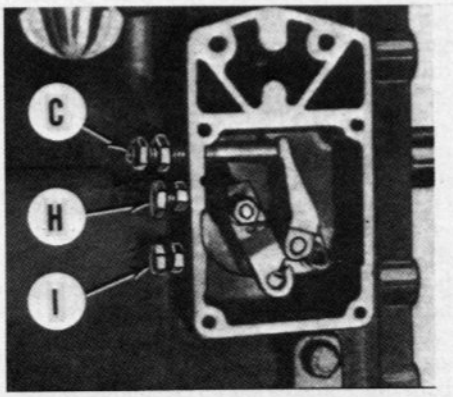


Fig. L1-2—Turn screw (I) to adjust low idle speed and screw (H) to adjust high idle speed. Torque control screw (C) must be adjusted as outlined in text.

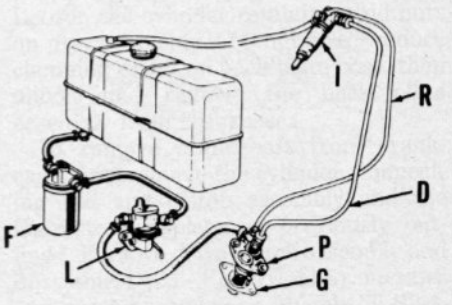


Fig. L1-4—Diagram of fuel system used on some models.

D. Delivery line
F. Fuel filter
G. Shim gasket
I. Injector
L. Fuel pump
P. Injection pump
R. Return line

Note fuel in delivery union will spill out of union. Stop engine rotation at moment fuel ceases to spill out of union. Timing dot (R – Fig. L1-6) on fan plate should align with injection timing dot (I) on fan shroud. Correct injection timing is 26° 20' to 28° 20' for Model 500 before serial number 1447084, Model 520 before serial 1448128 and Model 530 before serial number 1457466. Correct injection timing is 29° 20' to 31° 20' for models after the aforementioned serial numbers. To advance injection timing, remove shim gaskets (G – Fig. L1-3 and L1-4); install shim gaskets to retard injection timing. Shim gaskets are available in thicknesses of 0.1, 0.3 and 0.5 mm. Reinstall removed pump components after checking injection timing. Tighten injection pump retaining screws to 29 N·m.

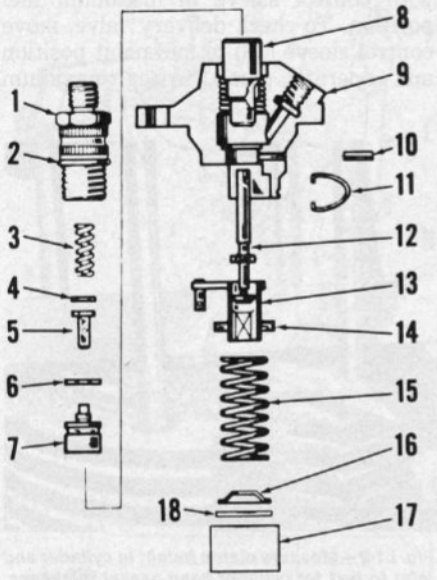


Fig. L1-5 – View of injection pump.

1. Delivery union
2. "O" ring
3. Spring
4. Washer
5. Delivery valve
6. Gasket
7. Delivery valve seat
8. Barrel
9. Pump body
10. Pin
11. Clip
12. Plunger
13. Control sleeve
14. Spring seat
15. Spring
16. Spring retainer
17. Tappet
18. Spacer

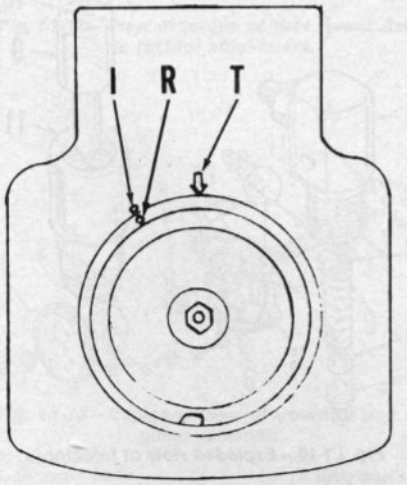


Fig. L1-6 – Injection should occur when timing dot (R) of fan plate is aligned with injection timing dot (I) on fan shroud. Piston is at TDC when timing dot (R) and arrow (T) are aligned.

REPAIRS

TIGHTENING TORQUES

Refer to following table for tightening torques. All values are in newton meters.

Connecting rod	33.3
Crankcase cover	29
Cylinder head	39.2
Flywheel	147
Injection pump	29
Injector nozzle nut	60-90
Injector retainer plate	12
Oil pump	11.8

VALVE TAPPET GAP

Valve tappet gap may be adjusted after removing rocker arm cover. Valve tappet gap should be 0.15 mm for both valves with engine cold. Note that there are two adjusting screws (Fig. L1-7) in exhaust rocker arm on some models. Adjusting screw (V) nearer rocker arm shaft is used to adjust valve clearance while outer screw (C) adjusts compression release gap on models so equipped.

COMPRESSION RELEASE

Some models are equipped with a manual compression release so the exhaust valve may be held open to aid starting. Compression release components (24 through 29 – Fig. L1-8) are mounted in the cylinder head. Rotating shaft (26) will force the exhaust rocker arm (10) to slightly open the exhaust valve.

The compression release is adjusted by turning outer adjusting screw (C – Fig. L1-7) in exhaust valve rocker arm. Adjust compression release gap AFTER adjusting exhaust valve tappet gap. With compression release lever (L) in off position, clearance between adjusting screw and shaft should be 0.9-1.1 mm.

Diameter of compression release shaft (26 – Fig. L1-8) is 9.37-10.00 mm while lobe height is 8.45-8.50 mm.

CYLINDER HEAD AND VALVE SYSTEM

Manufacturer does not recommend removing a hot cylinder head as deformation may result.

Valve face angle is 45 degrees and minimum valve head margin is 0.5 mm. Valve seat angle is 45 degrees with a seat width of 1.4-1.6 mm. Valve seats are renewable and must be installed with head heated to 160°-180° C (320°-356° F). Valve seals are used on intake valves. Valve stem diameter is 6.98-7.00 mm while valve guide diameter is 7.03-7.05 mm. Desired valve stem clearance is 0.03-0.07 mm. Valve guides are renewable and oversize valve guides are available. Exhaust valve guide is bronze. Note locating ring (15 – Fig. L1-8) around top of each guide. The cylinder head should be heated to 160°-180° C (320°-356° F) when installing valve guides.

Valve spring free length should be 42 mm. Valve spring pressure should be 225.4 newtons at 32 mm.

The rocker arms are supported by rocker arm shaft (6). Desired clearance between shaft and rocker arms is 0.03-0.06 mm. Renew shaft and rocker arms if clearance exceeds 0.1 mm.

The cylinder head gasket is available in varying thicknesses. Gasket thickness is determined by measuring piston height at top dead center (TDC) as shown in Fig. L1-9. Measure from piston crown to gasket seating surface of cylinder. Subtract measurement from 0.6-0.7 mm to obtain required gasket

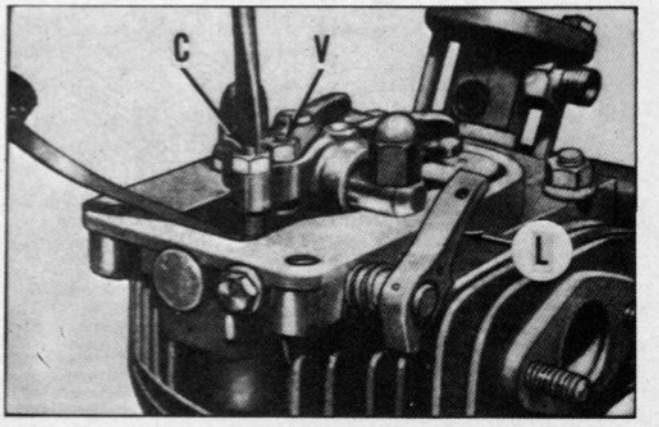


Fig. L1-7 – With compression lever (L) in off position, turn adjusting screw (C) so clearance is 0.9-1.1 mm (0.035-0.043 in.) between screw and shaft. Adjusting screw (V) determines valve clearance.

thickness. Cylinder head gaskets are available in thicknesses of 0.5 mm, 0.6 mm, 0.7 mm and 0.8 mm.

Tighten cylinder head nuts in a crossing pattern to 39.2 N·m.

INJECTOR

REMOVE AND REINSTALL. To remove injector, first clean dirt from injector, injection line, return line and cylinder head. Disconnect return line and injection line and immediately cap or plug all openings. Unscrew retainer plate nuts and lift off retainer plate (1–Fig. L1-10) being careful not to lose dowel pin (2). Injector may now be carefully removed from cylinder head. Do not lose shims between injector and cylinder head.

Tighten injector retaining plate nuts to 12 N·m. If accessible, measure protrusion of nozzle into combustion chamber. Nozzle tip should extend 2.5-3.0 mm above adjacent combustion chamber surface. Adjust position of nozzle by installing shims between injector and cylinder head. Shims are available in thicknesses of 0.5 mm and 1.0 mm.

TESTING. WARNING: Fuel leaves the injection nozzle with sufficient force to penetrate the skin. When testing, keep yourself clear of nozzle spray.

If a suitable test stand is available, injector operation may be checked. Only clean, approved testing oil should be used to test injector. When operating properly during test, injector nozzle will emit a buzzing sound and cut off quickly with no fluid leakage at seat.

Opening pressure with a new spring (4–Fig. L1-10) should be 20.5-22.5 MPa while opening pressure with a used spring should be 19.6-21.5 MPa. Opening pressure is adjusted by varying number and thickness of shims (5). Valve should not show leakage at orifice spray holes for 10 seconds at 17.6 MPa.

OVERHAUL. Clamp nozzle body (3–Fig. L1-10) in a vise with nozzle tip pointing upward. Remove nozzle holder nut (11). Remove nozzle tip (9) with valve (10) and spacer (8). Invert nozzle body (3) and remove spring seat (6), shim (5) and spring (4). Thoroughly clean all parts in a suitable solvent. Clean inside orifice end of nozzle tip with a wooden cleaning stick. The 0.20 mm diameter orifice spray holes may be cleaned by inserting a cleaning wire slightly smaller than spray hole. When reassembling injector, make certain all components are clean and wet with clean diesel fuel oil. Tighten nozzle holder nut (11) to 60-90 N·m.

INJECTION PUMP

Refer to Fig. L1-5 for view of injection pump. Disassembly and reassembly is evident after inspection of pump and referral to Fig. L1-5. Note that slot in barrel (8) must align with pin (10) and helix in plunger (12) must face pin (10).

The following tests may be used to check injection pump if necessary test equipment is available. With a suitable pressure gage connected to delivery union (1), operate pump. With control sleeve (13) at mid-point, pump pressure should be at least 29.4 MPa. Pump pressure should be at least 39.2 MPa with control sleeve in maximum fuel position. To check delivery valve, move control sleeve (13) to mid-point position and operate pump. After maximum

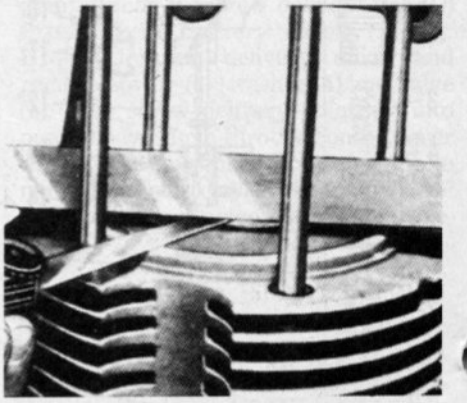


Fig. L1-9—Measure piston height in cylinder and refer to text for cylinder head gasket thickness.

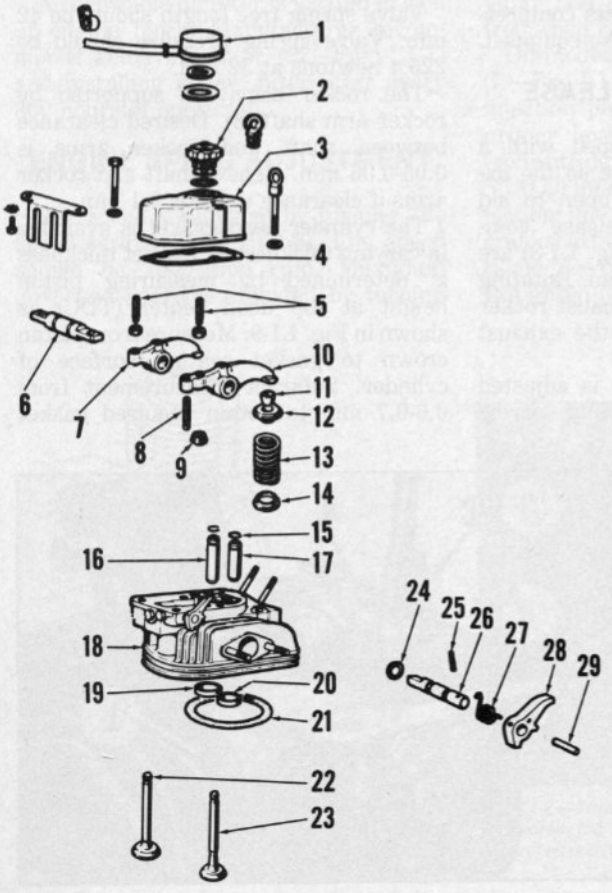


Fig. L1-8—Exploded view of cylinder head assembly.

1. Breather
2. Fill cap
3. Rocker cover
4. Gasket
5. Valve adjusting screws
6. Rocker arm shaft
7. Intake rocker arm
8. Compression release adjusting screw
9. Valve seal
10. Exhaust rocker arm
11. Valve keepers
12. Spring retainer
13. Spring
14. Spring seat
15. Locating rings
16. Intake valve guide
17. Exhaust valve guide
18. Cylinder head
19. Intake valve seat
20. Exhaust valve seat
21. Head gasket
22. Intake valve
23. Exhaust valve
24. "O" ring
25. Pin
26. Compression release shaft
27. Spring
28. Compression release lever
29. Pin

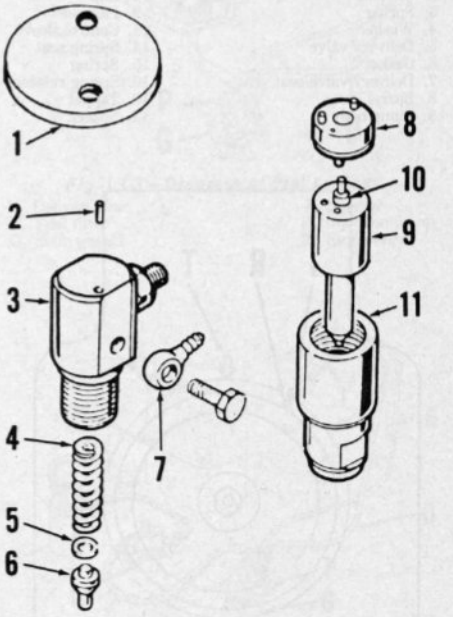


Fig. L1-10—Exploded view of injector.

1. Clamp plate
2. Dowel pin
3. Nozzle body
4. Spring
5. Shim
6. Spring seat
7. Return line fitting
8. Spacer
9. Nozzle tip
10. Valve
11. Nozzle holder nut

pressure is reached, pressure should drop sharply to a pressure 2940-4900 kPa less than maximum pressure if delivery valve is operating properly. Maximum delivery rate of pump is 44-46 cc at 1800 rpm for 1000 pump strokes.

Outside diameter of tappet (17) is 27.96-27.98 mm while maximum allowable clearance in tappet guide bore is 0.10 mm. Thickness of spacer (18) should be 3.45-3.55 mm.

When installing injection pump, place shim gaskets (G–Fig. L1-3 or L1-4) under pump then engage control sleeve (13–Fig. L1-5) pin with governor arm (F–Fig. L1-11). Tighten pump retaining screws to 29 N·m. Loosen clamp nut (N) then move throttle lever (T) to full throttle. Push governor lever (L) in until it stops thus moving injection pump control sleeve to maximum delivery. Tighten clamp nut (N).

Torque control screw (C–Fig. L1-2 and L1-12) allows additional fuel usage under high torque load. The tip (T–Fig. L1-12) is backed by spring (S). Tip (T) must travel 0.2-0.3 mm when 400-430 grams is forced against tip. To adjust torque control screw, run engine at high idle with no load and turn screw so there is 2.1-2.3 mm gap (G) between tip (T) and lever (L). Tighten locknut.

Refer to INJECTION PUMP TIMING section to time injection pump.

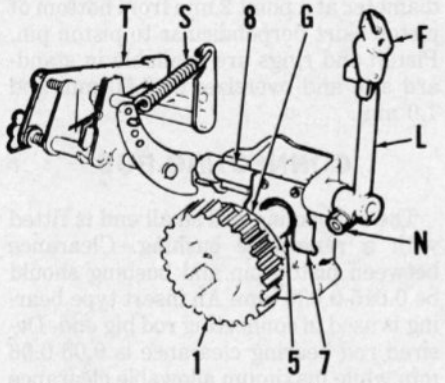


Fig. L1-11–View of governor mechanism. Refer to text for operation.

GOVERNOR

All models are equipped with a flyweight centrifugal type governor which is attached to the back of oil pump drive gear as shown in Fig. L1-11. The oil pump drive gear (1) is driven by the crankshaft and rotates governor flyweight assembly (G). The flyweights are interlocked with sleeve (5) to move fork (7) and rotate attached shaft. As the fork shaft rotates, governor lever (L) forces arm (F) against a pin in the fuel injection pump control sleeve thereby changing fuel flow to cylinder. Throttle lever (T) operates through governor spring (S) to control engine speed.

Governor components must move freely for proper governor operation. Governor spring (S–Fig. L1-11) free length should be 56.9-57.0 mm. At a spring length of 71.9-72.0 mm, spring tension should be 13.7-15.7 newtons.

Spindle (8–Fig. L1-13) diameter is 7.95 mm. Desired clearance between spindle and bores in oil pump body (13) is 0.06-0.10 mm with a maximum allowable clearance of 0.15 mm.

On most 3600 rpm models, hook governor spring end in second hole from governor lever end.

OIL PUMP

Refer to Fig. L1-13 for an exploded view of oil pump. The oil pump is accessible after removing crankcase cover (3–Fig. L1-14). Clearance between gears and pump body walls must not exceed 0.15 mm. Renew oil pump if components are excessively worn or damaged. Tighten pump mounting screws evenly to 11.8 N·m.

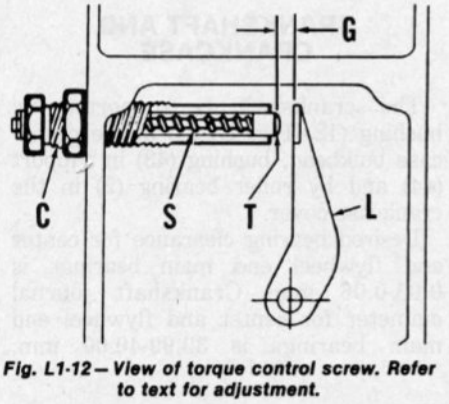


Fig. L1-12–View of torque control screw. Refer to text for adjustment.

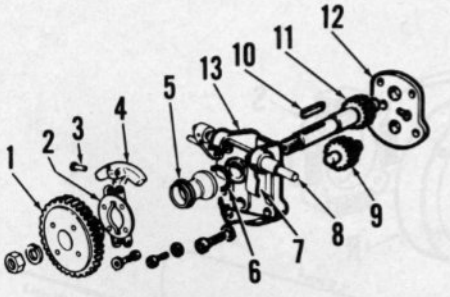


Fig. L1-13–Exploded view of governor and oil pump assembly.

1. Drive gear
2. Governor frame
3. Pins
4. Weights
5. Sleeve
6. Stop
7. Fork
8. Spindle
9. Gear
10. Key
11. Gear & shaft
12. Cover
13. Oil pump body

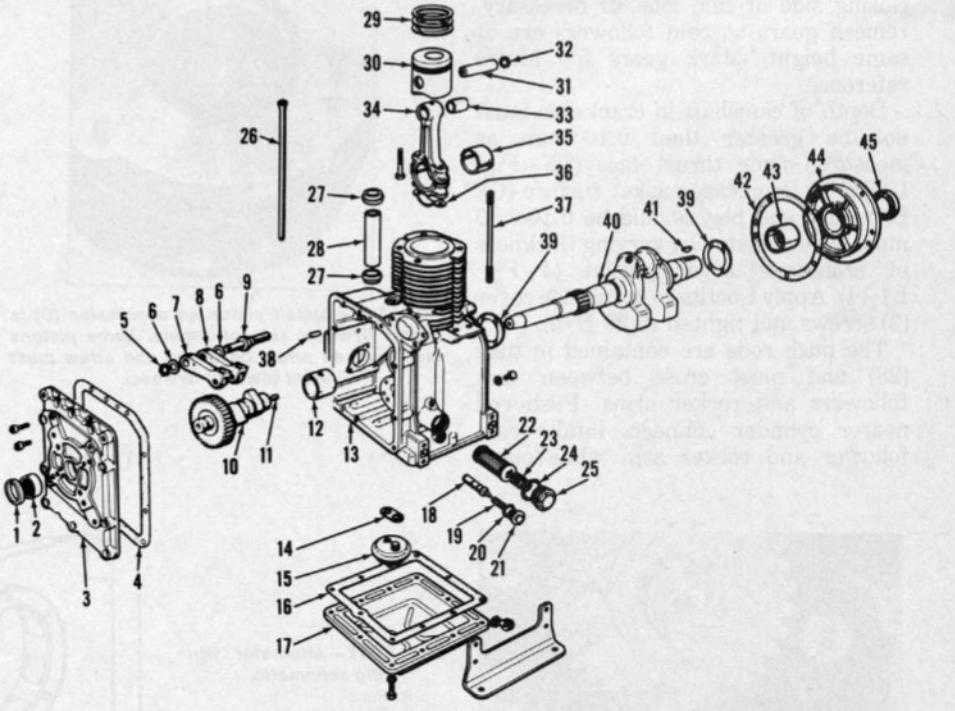


Fig. L1-14–Exploded view of engine.

1. Seal
2. Roller bearing
3. Crankcase cover
4. Gasket
5. Snap ring
6. Washer
7. Exhaust cam follower
8. Intake cam follower
9. Stud
10. Camshaft
11. Plug
12. Bushing
13. Engine block
14. Gasket
15. Oil pickup
16. Gasket
17. Oil pan
18. Oil pressure relief valve
19. Spring
20. Gasket
21. Plug
22. Oil filter
23. Spring
24. "O" ring
25. Plug
26. Push rods
27. Seal
28. Push rod tube
29. Piston rings
30. Piston
31. Piston pin
32. Snap ring
33. Bushing
34. Connecting rod
35. Rod bearing
36. Lock plate
37. Studs
38. Dowel pins
39. Thrust washers
40. Crankshaft
41. Key
42. Gasket
43. Bushing
44. Support
45. Seal

CAMSHAFT, CAM FOLLOWERS AND PUSH RODS

The camshaft rides directly in crankcase cover and crankcase bulkhead and is accessible after removing crankcase cover (3–Fig. L1-14). Cam followers (7 and 8) pivot on stud (9) and transfer motion to push rods (26) which pass through tube (28) to rocker arms. In addition to valve actuating lobes, a lobe is ground on the camshaft to operate the fuel injection pump.

Oil passages in the camshaft may be cleaned after removing plug (11). Be sure plug is securely reinstalled. Lobe height for intake and exhaust valves should be 33.14-33.15 mm while lobe height for injection pump should be 33.99-34.00 mm. Camshaft bearing journal diameters are 19.937-19.950 mm and 25.937-25.950 mm.

Desired clearance between cam followers and pivot stud (9) is 0.03-0.06 mm with a maximum clearance of 0.1 mm.

Install camshaft so timing marks (M–Fig. L1-15) are aligned. If timing marks are absent from gears, proceed as follows: Position piston at top dead center (TDC) then install camshaft so intake cam follower is on opening side of cam lobe and exhaust cam follower is on closing side of cam lobe. If necessary, remesh gears so cam followers are at same height. Mark gears for future reference.

Depth of camshaft in crankcase must not be greater than 0.10 mm as measured from thrust face (TF–Fig. L1-15) to crankcase gasket surface (G). Camshaft end play should be 0.10-0.30 mm and is adjusted by varying thickness of crankcase cover gasket (4–Fig. L1-14). Apply Loctite to crankcase cover (3) screws and tighten to 29 N·m.

The push rods are contained in tube (28) and must cross between cam followers and rocker arms. Push rod nearer cylinder connects intake cam follower and rocker arm while outer push rod connects exhaust cam follower and rocker arm.

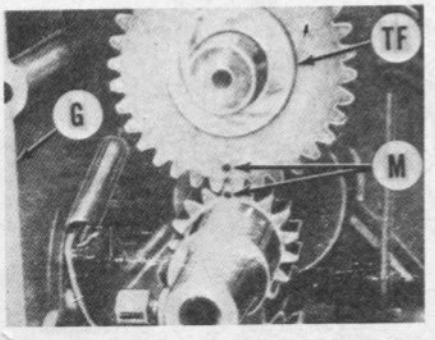


Fig. L1-15—View of camshaft and crankshaft timing marks (M). Measure depth of camshaft thrust face (TF) from crankcase gasket surface (G) as outlined in text.

PISTON AND ROD UNIT

REMOVE AND REINSTALL. Piston and connecting rod may be removed after removing cylinder head and oil pan.

When installing piston and rod, note that depression (D–Fig. L1-16) in piston crown is closer to one side of piston. Install piston so depression side of piston is nearer flywheel. Some pistons also have an arrow embossed in piston crown as shown in Fig. L1-16. Properly installed, arrow on piston crown will point towards flywheel.

The connecting rod and cap have machined serrations which must mate during assembly. Match marks on rod and cap must be on same side. Tighten connecting rod screws to 33.3 N·m.

PISTON, PIN AND RINGS

The piston may be equipped with two or three compression rings and an oil control ring. Piston ring end gap is 0.25-0.40 mm for all compression rings and 0.20-0.35 mm for the oil ring. Maximum side clearance is 0.22 mm for top compression ring, 0.17 mm for second, and if used, third compression ring and 0.12 mm for oil control ring.

Clearance between piston pin and bushing should be 0.015-0.030 mm. Renew pin if excessively worn or damaged.

Piston to cylinder wall clearance should be 0.11-0.14 mm with a maximum allowable clearance of 0.28 mm. When determining clearance, measure piston diameter at a point 2 mm from bottom of piston skirt perpendicular to piston pin. Piston and rings are available in standard size and oversizes of 0.50 mm and 1.0 mm.

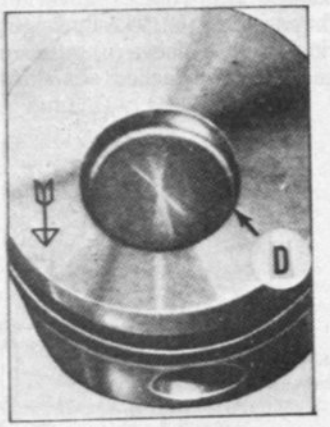


Fig. L1-16—Install piston so depression (D) is nearer flywheel side of engine. Some pistons may have an arrow on crown and arrow must point towards flywheel.

CONNECTING ROD

The connecting rod small end is fitted with a renewable bushing. Clearance between piston pin and bushing should be 0.015-0.030 mm. An insert type bearing is used in connecting rod big end. Desired rod bearing clearance is 0.03-0.06 mm while maximum allowable clearance is 0.10 mm. Big end bearings are available in undersizes of 0.25 mm and 0.50 mm.

CRANKSHAFT AND CRANKCASE

The crankshaft is supported by bushing (12–Fig. L1-14) in the crankcase bulkhead, bushing (43) in support (44) and by roller bearing (2) in the crankcase cover.

Desired bearing clearance for center and flywheel end main bearings is 0.03-0.06 mm. Crankshaft journal diameter for center and flywheel end main bearings is 39.99-40.00 mm.

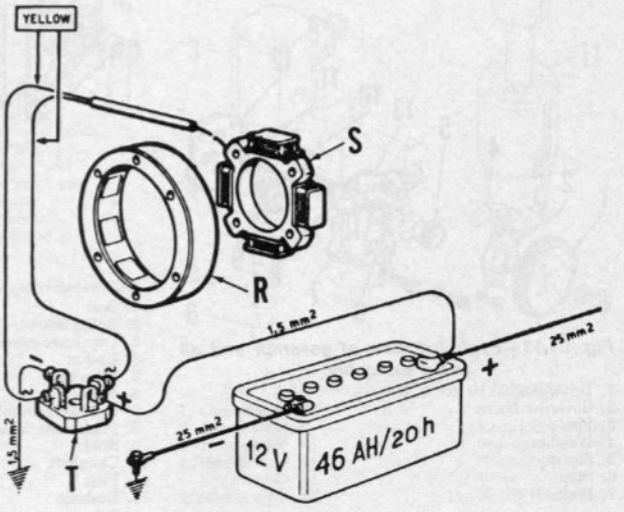


Fig. L1-17—Alternator wiring schematic.
R. Rotor
S. Stator
T. Rectifier

Center and flywheel end main bearings are available in standard size and undersizes of 0.5 mm and 1.0 mm. Crankshaft journal diameter at pto end is 27.94-28.00 mm. Crankshaft must be renewed if pto end journal is worn more than 0.10 mm.

The crankshaft has drilled oil passages to circulate oil. Expansion plugs located adjacent to crankpin may be removed to clean oil passages, however, new plugs must be installed securely.

ELECTRIC STARTER

Early models are equipped with a Prestolite MGL-4002A electric starter while later models are equipped with Bosch starter B.001.214.002.

The Prestolite starter is secured by clamps to the cylinder block and a rubber spacer ring between starter pinion housing and steel stamped backplate is used to properly locate starter. Rubber spacer ring thickness should be 14.5-15.5 mm. The Bosch starter is bolted to a cast aluminum backplate.

ALTERNATOR

An alternator is mounted on the flywheel end of engine to recharge the battery. The stator is secured to the engine crankcase while a ring of magnets is carried by the flywheel. Note wiring schematic in Fig. L1-17. The magnet ring may be removed from the flywheel if faulty. Stator and rotor are available only as an assembly.

LOMBARDINI

Model	No. Cyls.	Bore	Stroke	Displ.
832	2	100 mm	105 mm	1648 cc
833	3	100 mm	105 mm	2472 cc
834	4	100 mm	105 mm	3296 cc
L27	2	100 mm	105 mm	1648 cc
L40	3	100 mm	105 mm	2472 cc
L54	4	100 mm	105 mm	3296 cc

Lombardini Model L27 engine is used on Homelite® GD12000-1 and GD12300-2 Generators.

Engines covered in this section are four-stroke, air-cooled diesel engines. Crankcase, cylinders and cylinder head are cast iron. Crankshaft rotation is counterclockwise at pto end. Number 1 cylinder is cylinder nearest flywheel. Firing order is 1-3-2 on Models 833 and L40, and 1-3-4-2 on Models 834 and L54.

Metric fasteners are used throughout engine.

MAINTENANCE

LUBRICATION

Recommended engine oil is SAE 10W for temperatures below 0° C (32° F), SAE 20W for temperatures between 0° C (32° F) and 20° C (68° F), and SAE 40 for temperatures above 20° C (68° F). API classification for oil should be CD. Oil sump capacity is 3.5 liters on Models 832 and L27, 5.5 liters on Models 833 and L40, and 8 liters on Models 834 and L54. Manufacturer recommends renewing oil after every 100 hours of operation.

A renewable oil filter is mounted on side of crankcase. Manufacturer recommends renewing filter after every 400 hours of operation.

All models are equipped with a pressurized oil system. Refer to Fig. L3-1 for a diagram of the oil circuit.

ENGINE SPEED ADJUSTMENT

Models 834 and L54

Engine application will determine engine speed settings. Manufacturer recommends that personnel experienced with Bosch fuel injection pumps should adjust engine speed settings.

All Other Models

Idle speed is adjusted by turning idle speed screw (I – Fig. L3-3). Idle speed should be 900-950 rpm. Maximum governed speed is adjusted by turning high speed screw (H). Maximum governed speed under load is 2200 rpm for Models L27 and L40, and 2600 rpm for Models 832 and 833.

FUEL SYSTEM

FUEL FILTER. Models 834 and L54 are equipped with two renewable fuel filters while all other models are equipped with a single renewable fuel filter. Renew the fuel filter after every 300 hours of operation or sooner if required.

BLEED FUEL SYSTEM. To bleed the fuel system on Models 834 and L54, open the bleed screw on fuel filter housing then operate primer (M – Fig. L3-4) on fuel transfer pump until air-free fuel flows. Retighten bleed screw. Open the fuel injection pump bleed screw (B), then operate primer (M) until air-free fuel flows and retighten bleed screw. Loosen high pressure line fittings at injectors. Rotate engine to operate fuel injection pump until air-free fuel flows from fittings, then retighten fittings.

To bleed fuel system on all other models, loosen bleed screw on fuel filter housing then operate primer (M – Fig. L3-5) on fuel transfer pump until air-free fuel flows. Retighten bleed screw. Open injection pump bleed screw, on models so equipped, or loosen inlet fuel line fitting at injection pump. Operate primer (M) until air-free fuel flows, then tighten bleed screw or fuel fitting. Loosen high pressure line fittings at injectors. Rotate engine to operate fuel injection pump until air-free fuel flows then retighten fittings.

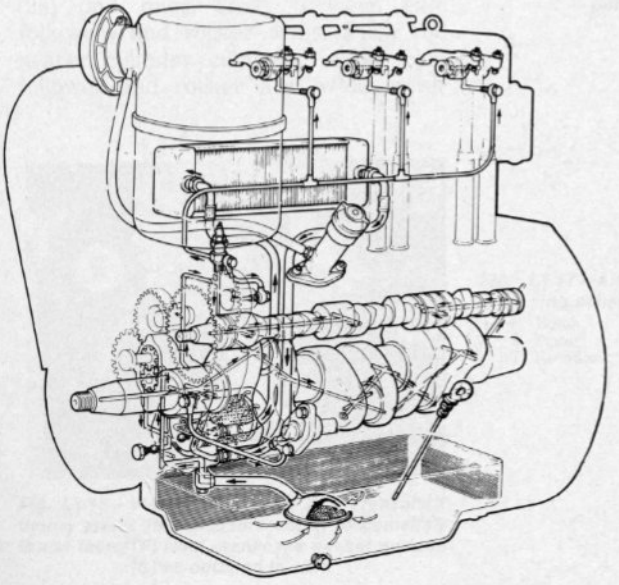


Fig. L3-1 – Drawing of lubrication system.

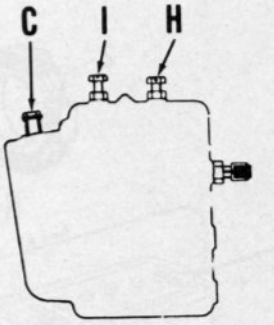


Fig. L3-3 – Drawing showing location of low idle speed screw (I), high idle speed screw (H) and torque control screw (C) on all models except 834 and L54.

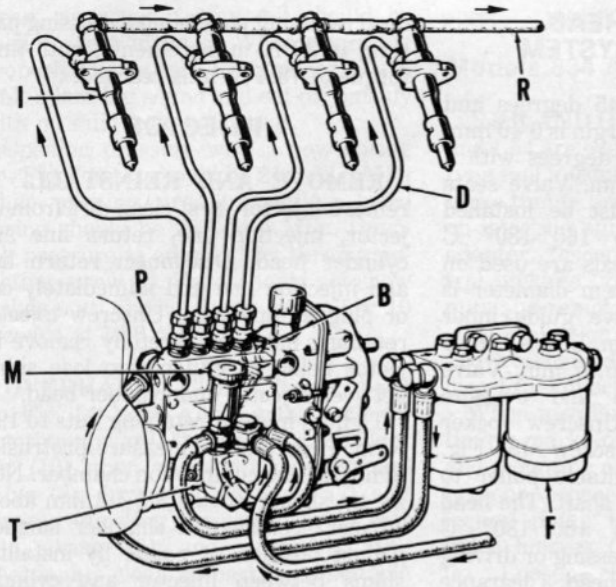


Fig. L3-4 – Fuel circuit diagram for Models 834 and L54.

B. Pump bleed screw
D. High pressure delivery line
F. Fuel filters
I. Injector
M. Primer
R. Fuel return line
T. Fuel transfer pump

INJECTION PUMP TIMING

Models 834 and L54

Injection occurs between 28°30' and 30°. To check injection pump timing on Models 834 and L54, rotate crankshaft so injection timing mark (I – Fig. L3-6 or L3-7) is aligned with reference mark (M). Disconnect number 1 injection line from fuel injection pump. Loosen clamp (C – Fig. L3-8) and remove delivery valve holder (H). Remove spring (S) and delivery valve (D) then reinstall delivery valve holder (H). If available, attach a spill pipe to holder. Loosen injection pump retaining nuts. Operate primer pump (M – Fig. L3-4) and rotate injection pump so fuel flows from delivery valve holder or spill pipe. Rotate injection pump until fuel just stops flowing and tighten injection pump retaining nuts to 29.4 N·m. Reinstall delivery valve and spring and connect injection line.

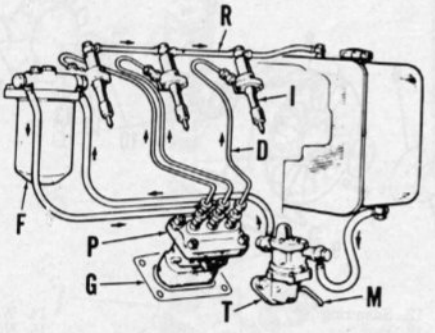


Fig. L3-5 – Fuel circuit diagram for Models 833 and L40. Models 832 and L27 are similar.

D. High pressure delivery line
F. Fuel filter
G. Shim gasket
I. Injector
M. Primer lever
P. Fuel injection pump
R. Fuel return line
T. Fuel pump

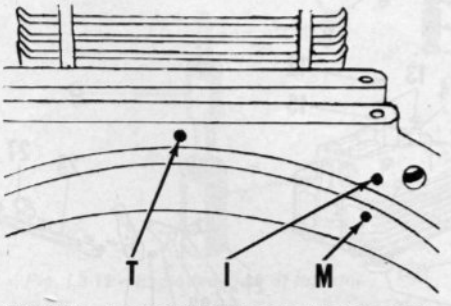


Fig. L3-6 – View of timing marks located on flywheel of some models.

I. Injection
M. Reference mark
T. Top dead center

All Other Models

Fuel injection occurs between 25° and 26° 5'. Injection timing is adjusted using shim gaskets (G – Fig. L3-5) between pump body and mounting surface on crankcase. To check injection timing, unscrew number 1 cylinder delivery injection line (D) fitting from delivery valve holder (25 – Fig. L3-9). Unscrew delivery valve holder (25) and remove spring (23) and delivery valve (22) and then screw delivery valve holder (25) into pump. Move throttle to full speed position. Rotate engine in normal direction (counter-clockwise at pto) so number 1 piston is on compression stroke. Note fuel in delivery valve holder will spill out of holder. Stop rotation at moment fuel ceases to flow out of holder. Timing marks (I and M – Fig. L3-6 and L3-7) should be aligned. To advance injection timing, remove shim

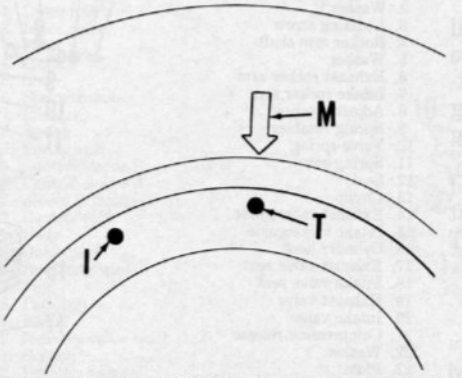


Fig. L3-7 – View of timing marks on crankshaft pulley used on some models.

I. Injection
M. Reference mark
T. Top dead center

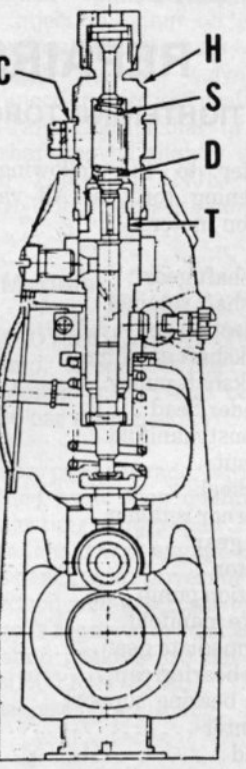


Fig. L3-8 – Cross-sectional view of Bosch PES fuel injection pump.

C. Clamp
D. Delivery valve
H. Delivery valve holder
S. Spring
T. Delivery valve seat

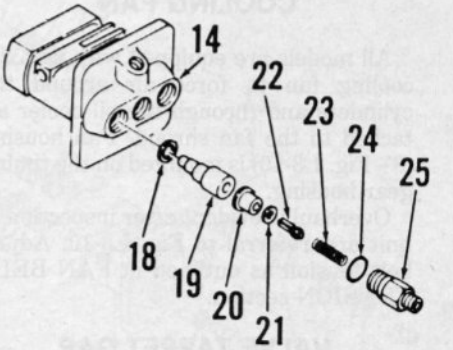


Fig. L3-9 – Partial exploded view of fuel injection pump used on all models except 834 and L54.

14. Pump body
18. Packing
19. Barrel
20. Delivery valve seat
21. Gasket
22. Delivery valve
23. Spring
24. "O" ring
25. Delivery valve holder

gaskets (G–Fig. L3-5); install shim gaskets to retard injection timing. Reinstall removed pump parts after checking timing. Tighten injection pump retaining screws to 29.4 N·m.

FAN BELT TENSION

All models are equipped with a belt-driven, cooling fan. Belt tension is adjusted by varying the number of shims between fan pulley halves. Belt tension is correct when thumb pressure applied midway between pulleys deflects belt approximately 1 cm.

REPAIRS

TIGHTENING TORQUES

Refer to the following table for tightening torques. All values are in newton meters.

Camshaft gear	196
Camshaft retainer	19.6
Connecting rod	49
Crankshaft drive gear	490
Crankshaft pulley	441
Cylinder head	78.4
Exhaust manifold	19.6
Fan nut	34.3
Flywheel	343
Governor retainer	19.6
Idler gear	137
Injector	19.6
Injection pump	29.4
Intake manifold	19.6
Intermediate gear	137.2
Main bearing cap	49
Main bearing support	
Center	49
End	39.2
Oil pan	29.4
Oil pump	34.3
Rocker arm shaft	12.7
Timing gear cover	19.6
Timing gear housing	19.6

COOLING FAN

All models are equipped with an axial cooling fan to force air around the cylinders and through the oil cooler attached to the fan shroud. Fan housing (8–Fig. L3-10) is mounted on the timing gear housing.

Overhaul is evident after inspection of unit and referral to Fig. L3-10. Adjust belt tension as outlined in FAN BELT TENSION section.

VALVE TAPPET GAP

Valve tappet gap may be adjusted after removing rocker arm cover. Valve tappet gap should be 0.3 mm for both valves with the engine cold.

CYLINDER HEAD AND VALVE SYSTEM

Valve face angle is 45 degrees and minimum valve head margin is 0.40 mm. Valve seat angle is 45 degrees with a seat width of 1.4-1.6 mm. Valve seats are renewable and must be installed with head heated to 160°-180° C (320°-356° F). Valve seals are used on intake valves. Valve stem diameter is 8.98-9.00 mm and valve guide inner diameter is 9.03-9.05 mm. Desired valve stem clearance is 0.03-0.07 mm. Valve guides are renewable and oversize guides are available. Unscrew rocker arm shaft locating screw (3–Fig. L3-11), then use a suitable puller to remove the rocker arm shaft. The head should be heated to 160°-180° C (320°-356° F) before pressing or driving rocker arm shaft into head. Clearance between rocker arms and shaft should be 0.03-0.06 mm with a maximum allowable clearance of 0.1 mm.

Valve spring free length should be 54.56 mm. Valve spring pressure should be 412.6-420.4 newtons at a length of 26.3-26.5 mm.

Before tightening cylinder head nuts, install manifolds so heads are properly mated with manifolds. Tighten cylinder head retaining nuts using a crossing pattern, in 20 N·m increments, until final torque of 78.4 N·m is reached.

INJECTOR

REMOVE AND REINSTALL. To remove injector, first clean dirt from injector, injection line, return line and cylinder head. Disconnect return line and injection line and immediately cap or plug all openings. Unscrew injector retaining nuts and carefully remove injector being careful not to lose shims between injector and cylinder head.

Tighten injector retaining nuts to 19.6 N·m. If accessible, measure protrusion of nozzle into combustion chamber. Nozzle tip should extend 3.5-4.2 mm above adjacent combustion chamber surface. Adjust position of nozzle by installing shims between injector and cylinder head. Shims are available in thicknesses of 0.5, 1.0 and 1.5 mm.

TESTING. WARNING: Fuel leaves the injection nozzle with sufficient force to penetrate the skin. When testing, keep yourself clear of nozzle spray.

If a suitable test stand is available, injector operation may be checked. Only

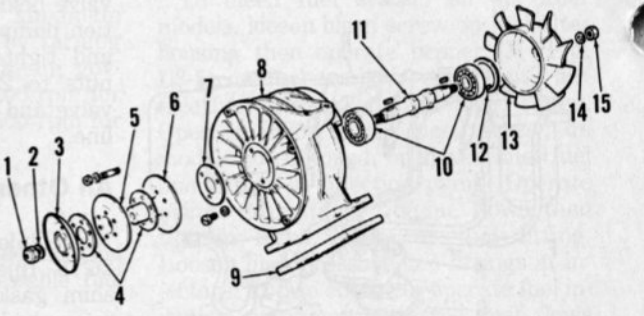


Fig. L3-10—Exploded view of cooling fan. Models 834 and L54 are equipped with two drive belts while one belt is used on all other models.

1. Nut
2. Washer
3. Pulley half
4. Shims
5. Center pulley half
6. Drive pulley half
7. Washer
8. Fan housing
9. Spacer
10. Bearings
11. Shaft
12. Snap ring
13. Fan
14. Washer
15. Nut

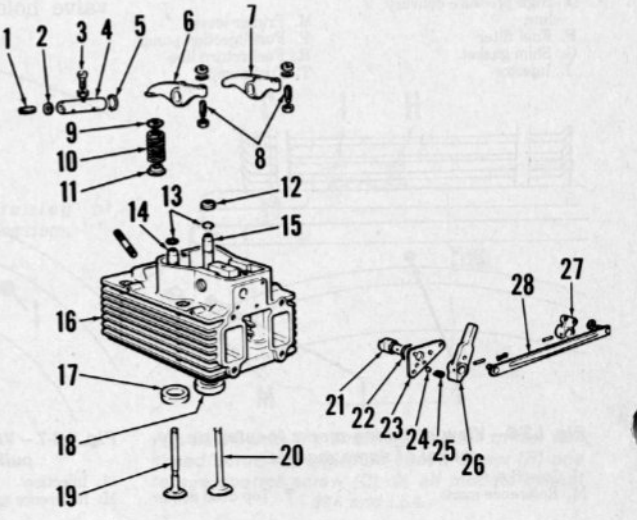


Fig. L3-11—Exploded view of cylinder head assembly.

1. Plug
2. Washer
3. Locating screw
4. Rocker arm shaft
5. Washer
6. Exhaust rocker arm
7. Intake rocker arm
8. Adjuster screw
9. Spring retainer
10. Valve spring
11. Spring seat
12. Seal
13. Circlip
14. Exhaust valve guide
15. Intake valve guide
16. Cylinder head
17. Exhaust valve seat
18. Intake valve seat
19. Exhaust valve
20. Intake valve
21. Compression release
22. Washer
23. Plate
24. Ball
25. Spring
26. Lever
27. Arm
28. Link

clean, approved testing oil should be used to test injector. When operating properly during test, injector nozzle will emit a buzzing sound and cut off quickly with no fluid leakage at seat.

Opening pressure with a new spring (5–Fig. L3-12) should be 21.6-22.5 MPa while opening pressure with a used spring should be 20.6-21.6 MPa. Opening pressure is adjusted by turning adjusting screw (2). Valve should not show leakage at orifice spray holes for 10 seconds at 17.6 MPa.

OVERHAUL. Clamp nozzle body (7–Fig. L3-12) in a vise with nozzle tip pointing upward. Unscrew nozzle holder nut (10), then remove nozzle (9) and valve (8). Invert nozzle body (7) and remove adjusting screw (2), spring seat (4), spring (5) and push rod (6). Thoroughly clean all parts in a suitable solvent. Clean inside orifice end of nozzle with a wooden cleaning stick. The orifice spray holes may be cleaned by inserting a 0.20 mm cleaning wire. When reassembling injector, make certain all components are clean and wet with clean diesel fuel oil. Tighten nozzle holder nut (10) to 49 N·m.

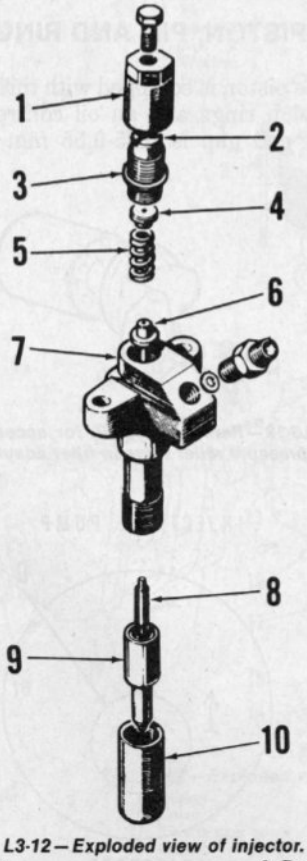


Fig. L3-12–Exploded view of injector.

1. Cap nut
2. Adjusting screw
3. Gasket
4. Spring seat
5. Spring
6. Push rod
7. Body
8. Valve
9. Nozzle
10. Nozzle nut

INJECTION PUMP

Models 834 And L54

R&R AND OVERHAUL. Models 834 and L54 are equipped with a Bosch PES type fuel injection pump. If not present, make timing marks for future reference on injection pump flange and mounting adapter. Disconnect fuel lines and control linkage, then unscrew retaining nuts and remove fuel injection pump.

The injection pump should be tested and overhauled by a shop qualified in diesel fuel injection pump repair.

When installing injection pump, align timing marks on injection pump flange and mounting adapter. If marks are not present, proceed as follows: Mount injection pump in a vise with delivery valve holders (H–Fig. L3-8) pointing up. Loosen clamp (C) and remove delivery valve holder (H) for number 1 cylinder (farthest from mounting flange). Remove spring (S) and delivery valve (D) then reinstall delivery valve holder (H). If available, attach a spill pipe to holder. Connect an external fuel supply to injection pump fuel inlet so pump is gravity fed with fuel. Turn injection pump shaft in a counter-clockwise direction, as viewed at shaft end. Then, stop shaft rotation at moment fuel stops flowing from delivery valve holder or spill pipe. Remove plug (P–Fig. L3-12A) and install a suitable screw that will bear lightly against pump shaft to prevent shaft rotation. If available, Mercedes tool number 700-589-86-73 may be used. Rotate engine crankshaft so injection timing mark (I–Fig. L3-6 or L3-7) is aligned with reference mark (M). Install injection pump on engine and tighten pump retaining nuts to 29.4 N·m. Reinstall delivery valve and spring, fuel injection lines and drain plug (P–Fig. L3-12A). If crankshaft or injection pump shaft moved slightly during installation, refer to INJECTION PUMP TIMING and recheck pump timing.

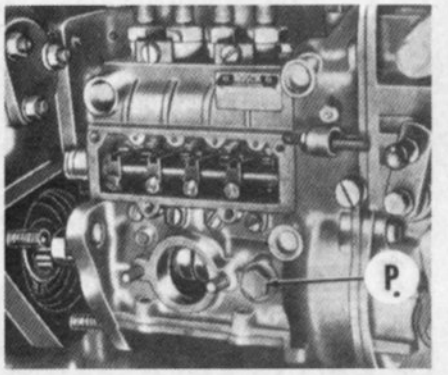


Fig. L3-12A–View of Bosch injection pump used on Models 834 and L54 showing location of drain plug (P).

All Other Models

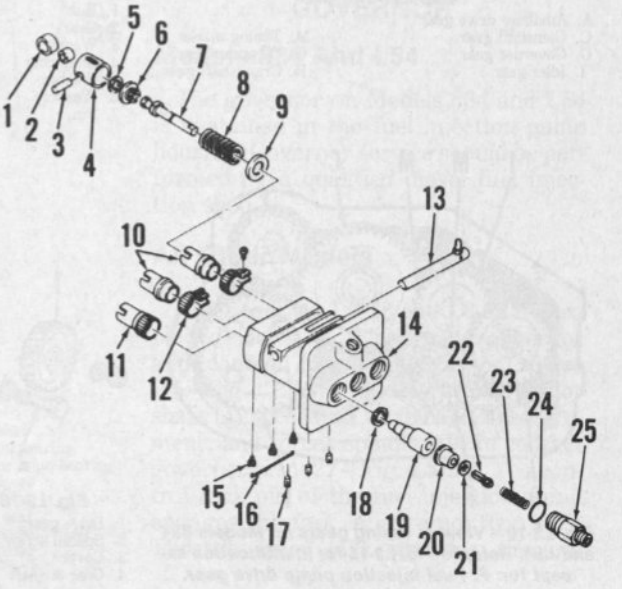
R&R AND OVERHAUL. To remove injection pump, disconnect fuel lines, unscrew retaining screws and remove pump. Do not lose shim gaskets (G–Fig. L3-5).

The injection pump should be tested and overhauled by a shop qualified in diesel fuel injection pump repair.

When installing pump, engage pin on pump control rack with governor fork. Tighten injection pump screws to 29.4 N·m. If pump is renewed or overhauled, or original shim gaskets are not used, refer to INJECTION PUMP TIMING section and adjust pump timing.

Fig. L3-13–Exploded view of fuel injection pump used on Models 833 and L40. Models 832 and L27 are similar.

1. Outer roller
2. Inner roller
3. Pin
4. Guide
5. Shim
6. Spring retainer
7. Plunger
8. Spring
9. Spring seat
10. Control sleeve B
11. Control sleeve A
12. Sleeve B pinion
13. Control rack
14. Body
15. Guide pins
16. Retaining wire
17. Pins
18. Packing
19. Barrel
20. Delivery valve seat
21. Gasket
22. Delivery valve
23. Spring
24. "O" ring
25. Delivery valve holder



TIMING GEARS

To remove timing gear cover, remove fan belt guard, fan belt and crankshaft pulley. Unscrew and remove timing gear cover. Gears may be removed after unscrewing retaining nut or screw and by using a suitable puller. Refer to Fig. L3-15 or L3-16 for view of timing gears.

To remove the fuel injection pump drive gear (2 – Fig. L3-17) on Models 834 and L54, the fuel injection pump must be removed as previously outlined. Detach snap ring (4) and remove gear and hub. Unscrew gear retaining screws and separate the gear from the hub. Bushings (10) in adapter (9) are renewable.

Timing marks on crankshaft, idler and camshaft gears must be aligned as shown in Fig. L3-15 and L3-16. If timing gears do not have marks, proceed as follows: If not previously removed, remove cylinder head and push rod tubes on number 1 cylinder. Install crankshaft and camshaft gears, but do not install idler gear. Rotate crankshaft so number 1 piston is at top dead center. Rotate camshaft so number 1 cylinder intake valve tappet is opening (rising) and exhaust valve tappet is closing (going down) then stop rotation when tappets are at same height above crankcase surface. Install idler gear and mark crankshaft, idler and camshaft gears for future reference.

Tighten timing gear cover screws to 19.6 N·m. Adjust fan belt tension as outlined in FAN BELT TENSION section.

OIL PUMP

R&R AND OVERHAUL. The oil pump is mounted on the front of the engine and is accessible after removing the timing gear cover. Unscrew pump gear retaining nut then using a suitable puller, remove pump gear (1 – Fig. L3-18). Remove pump cover (3) and gears. Pump housing (6) surrounds the crankshaft and the crankshaft gear must be removed before pump housing can be removed. Note that screw (2) is drilled to allow oil flow through screw.

Oil clearance between oil pump housing and crankshaft should be 0.04-0.08 mm. Renew pump housing if clearance exceeds 0.13 mm. Maximum allowable backlash between gears is 0.15 mm. Maximum allowable clearance between gears and pump housing bore is 0.15 mm.

Assembly is reverse of disassembly procedure.

Normal oil pressure with engine running at 3000 rpm and oil hot is 303.8-352.8 kPa. Oil pressure is adjusted by removing plug (P – Fig. L3-19) and turning adjusting screw.

PISTON AND ROD UNITS

REMOVE AND REINSTALL. Piston and connecting rod may be removed after removing cylinder head and oil pan.

When installing piston and rod, note that depression (D – Fig. L3-20) in piston crown is closer to one side of piston. Install piston so depression side of piston is nearer injectors. Some pistons also have an arrow embossed on piston. Properly installed, arrow on piston crown will point towards injection pump.

Tighten connecting rod screws to 49 N·m. Refer to CYLINDER section and measure piston height in cylinder.

PISTON, PIN AND RINGS

The piston is equipped with three compression rings and an oil control ring. Ring end gap is 0.35-0.55 mm for all

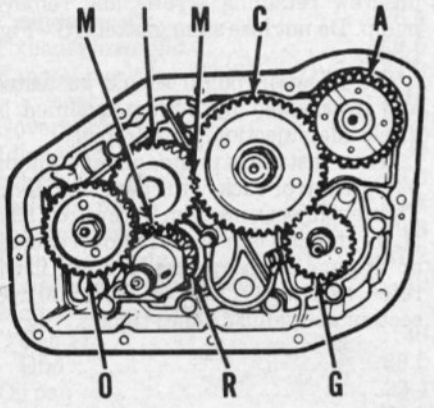


Fig. L3-15 – View of timing gears on Models 832, 833, L27 and L40.

A. Auxiliary drive gear
C. Camshaft gear
G. Governor gear
I. Idler gear
M. Timing marks
O. Oil pump gear
R. Crankshaft gear

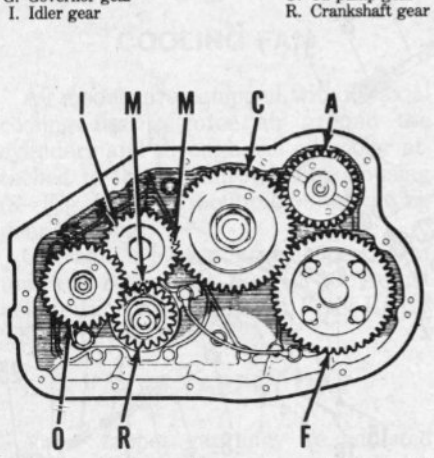


Fig. L3-16 – View of timing gears on Models 834 and L54. Refer to Fig. L3-15 for identification except for: F. Fuel injection pump drive gear.

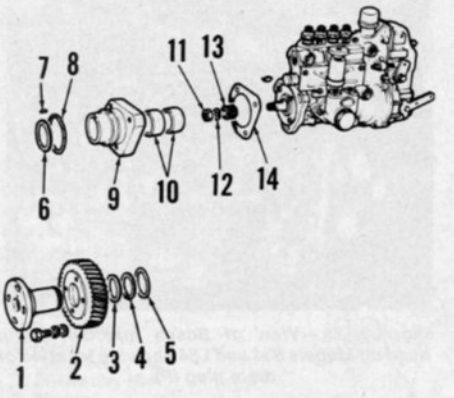


Fig. L3-17 – Exploded view of fuel injection pump drive assembly on Models 834 and L54.

1. Hub
2. Gear
3. Washer
4. Snap ring
5. Washer
6. Washer
7. Pin
8. "O" ring
9. Adapter
10. Bushings
11. Nut
12. Washer
13. Gear
14. Gasket

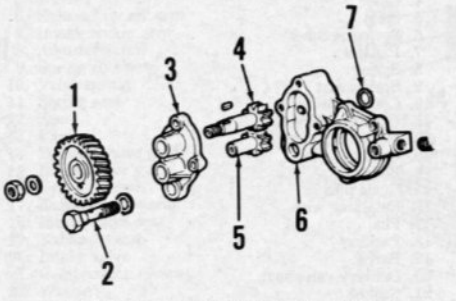


Fig. L3-18 – Exploded view of oil pump.

1. Drive gear
2. Special screw
3. Cover
4. Gear & shaft
5. Gear
6. Pump body
7. "O" ring

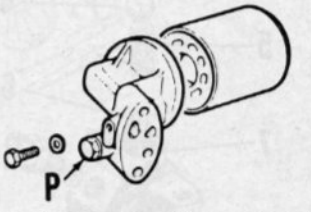


Fig. L3-19 – Remove plug (P) for access to oil pressure relief valve in filter adapter.

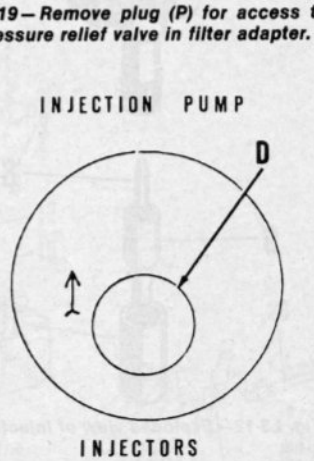


Fig. L3-20 – Arrow on piston crown should point towards injection pump and depression (D) should be near injectors.

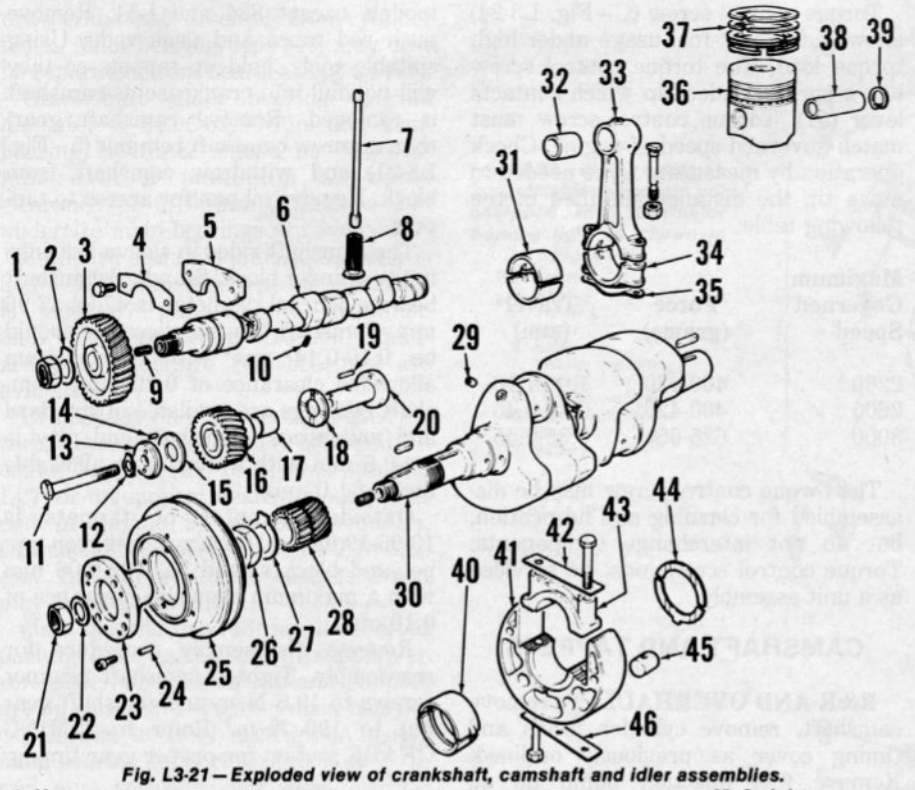


Fig. L3-21 – Exploded view of crankshaft, camshaft and idler assemblies.

1. Nut
2. Tab washer
3. Camshaft gear
4. Lockplate
5. Retainer
6. Camshaft
7. Push rod
8. Tappet
9. Plug
10. Plug
11. Screw
12. Tab washer
13. Spacer
14. Pin
15. Washer
16. Idler gear
17. Bushing
18. Thrust washer
19. Pin
20. Idler shaft
21. Nut
22. Washer
23. Hub
24. Pin
25. Pulley
26. Nut
27. Tab washer
28. Gear
29. Plug
30. Crankshaft
31. Bearing
32. Bushing
33. Connecting rod
34. Rod cap
35. Lockplate
36. Piston
37. Piston rings
38. Piston pin
39. Snap ring
40. Bearing
41. Main bearing support
42. Lockplate
43. Main bearing cap
44. Thrust washer
45. Nut
46. Lockplate

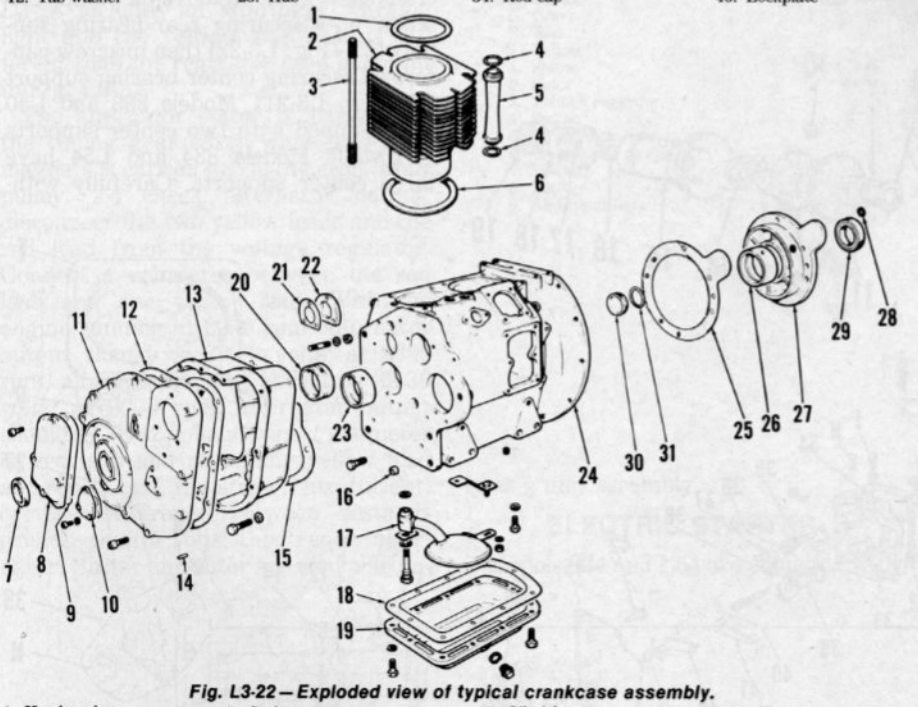


Fig. L3-22 – Exploded view of typical crankcase assembly.

1. Head gasket
2. Cylinder
3. Stud
4. Seal
5. Push rod tube
6. Shim gasket
7. Seal
8. Cover
9. Gasket
10. Cover
11. Timing gear cover
12. Gasket
13. Gear housing
14. Pin
15. Gasket
16. Dowel
17. Oil pickup
18. Gasket
19. Oil pan
20. Camshaft bearing
21. Gasket
22. Cover
23. Main bearing
24. Crankcase
25. Gasket
26. Main bearing
27. Rear main bearing support
28. "O" ring
29. Oil seal
30. Camshaft cover
31. "O" ring

compression rings and 0.25-0.40 mm for the oil control ring. Piston ring side clearance should be 0.30 mm for top compression ring, 0.20 mm for second compression ring, 0.15 mm for third compression ring and 0.10 mm for oil control ring.

Standard piston diameter measured 2 mm from bottom of skirt, perpendicular to piston pin, is 99.800-99.810 mm. Piston to cylinder clearance should be 0.19-0.22 mm. Piston and rings are available in standard size and oversizes of 0.5 and 1.0 mm.

Clearance between piston pin and connecting rod should be 0.02-0.03 mm. Maximum allowable clearance is 0.07 mm.

CONNECTING ROD

The connecting rod small end is fitted with a renewable bushing. Clearance between piston pin and rod bushing should be 0.02-0.03 mm with a maximum allowable clearance of 0.07 mm.

An insert type bearing is used in connecting rod big end. Desired rod bearing clearance is 0.04-0.07 mm with a maximum allowable clearance of 0.10 mm. Big end bearings are available in standard and undersizes.

CYLINDERS

All models are equipped with removable cylinders. Standard cylinder diameter is 100.00-100.02 mm. Cylinders may be bored to accept oversize pistons. Maximum allowable taper or out-of-round is 0.1 mm.

Piston height in cylinder is adjusted using shim gaskets (6 – Fig. L3-22). With piston at top dead center, piston crown should be 0.0-0.1 mm below top of cylinder. Install shims (6) to obtain desired piston height.

GOVERNOR

Models 834 And L54

The governor on Models 834 and L54 is contained in the fuel injection pump housing. Governor service should be performed by a qualified diesel fuel injection shop.

All Other Models

Refer to Figs. L3-23 and L3-24 for exploded views of flyball type governor and control linkage. Governor sleeve (15 – Fig. L3-23) slides on governor shaft (4) according to flyball (10) movement, and forces spindle (19) to contact governor arm (27 – Fig. L3-24). The control rack pin of the fuel injection pump engages the fork in governor arm (27). Throttle lever (47) operates through

governor spring (31) to control engine speed.

The governor shaft assembly (Fig. L3-23) may be removed after removing timing gear cover. Unscrew retainer (6) screws and withdraw governor shaft. Inspect components for excessive wear or damage. Components must move easily without binding. When installing governor shaft, tighten retainer (6) screws to 19.6 N·m.

To synchronize governor linkage with fuel injection pump, remove cover (45–Fig. L3-24) and loosen nuts (N–Fig. L3-25) securing eccentric (39). Fully rotate eccentric in counter-clockwise direction. With fuel injection pump removed, install tool (T) number 7276-2003-04 on Model 832 or number 7277-2003-05 on Model 833 so tool roller (R) engages fork on governor arm (27). Rotate eccentric (39) until all play is removed from governor but tool roller (R) is still free in fork. Tighten nuts (N), remove tool and install fuel injection pump.

Start spring (25–Fig. L3-24) allows maximum fuel delivery when starting engine. Spring free length should be 42 mm.

Torque control screw (C–Fig. L3-24) allows additional fuel usage under high torque load. The torque control screw has a spring loaded tip which contacts lever (41). Torque control screw must match governed speed of engine. Check operation by measuring force needed to move tip the distance specified in the following table:

Maximum Governed Speed	Force (grams)	Travel (mm)
2200	400-420	1.00-1.10
2600	400-420	0.35-0.45
3000	625-650	0.35-0.45

The torque control screw may be disassembled for cleaning and lubrication, but do not interchange components. Torque control screw must be serviced as a unit assembly.

CAMSHAFT AND TAPPETS

R&R AND OVERHAUL. To remove camshaft, remove cylinder heads and timing cover as previously outlined. Remove fuel injection pump on all models except 834 and L54. Remove push rod tubes and push rods. Using suitable tools, hold up tappets so they will not fall into crankcase as camshaft is removed. Remove camshaft gear, then unscrew camshaft retainer (5–Fig. L3-21) and withdraw camshaft from block. Remove oil pan for access to tappets.

The camshaft rides in sleeve bearings in the cylinder block. Standard camshaft bearing journal diameter is 47.94-47.96 mm. Camshaft bearing clearance should be 0.10-0.14 mm with a maximum allowable clearance of 0.20 mm. Camshaft bearings are available in standard and undersizes. Camshaft end play is 0.4-0.6 mm with a maximum allowable limit of 1.0 mm.

Outside diameter of tappets is 19.96-19.98 mm. Clearance between tappet and block should be 0.02-0.06 mm with a maximum allowable clearance of 0.10 mm.

Reverse disassembly procedure for reassembly. Tighten camshaft retainer screws to 19.6 N·m and camshaft gear nut to 196 N·m. Refer to TIMING GEARS section for proper gear timing.

CRANKSHAFT AND BEARINGS

R&R AND OVERHAUL. To remove crankshaft, remove pistons and timing gear cover as previously outlined. Remove idler gear, oil pump gear and crankshaft gear. Remove oil pump. Unscrew nuts securing rear bearing support (27–Fig. L3-22) then unscrew capscrews securing center bearing support (41–Fig. L3-21). Models 833 and L40 are equipped with two center supports (41) while Models 834 and L54 have three center supports. Carefully with-

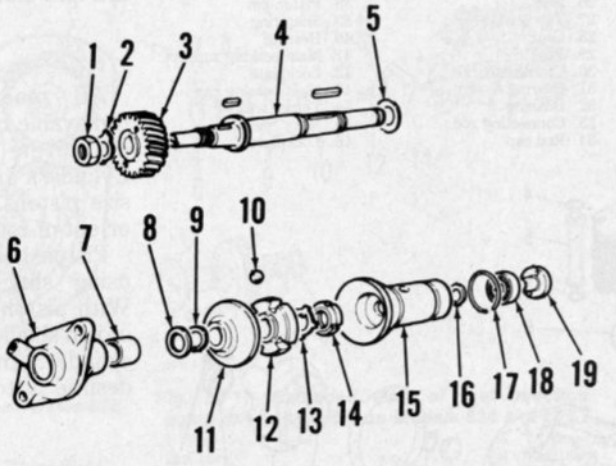


Fig. L3-23–Exploded view of governor shaft.

1. Nut
2. Tab washer
3. Governor gear
4. Shaft
5. Washer
6. Retainer
7. Bushing
8. Washer
9. Snap ring
10. Balls (4)
11. Ball retainer
12. Ball carrier
13. Tab washer
14. Nut
15. Governor sleeve
16. Snap ring
17. Circlip
18. Bearing
19. Spindle

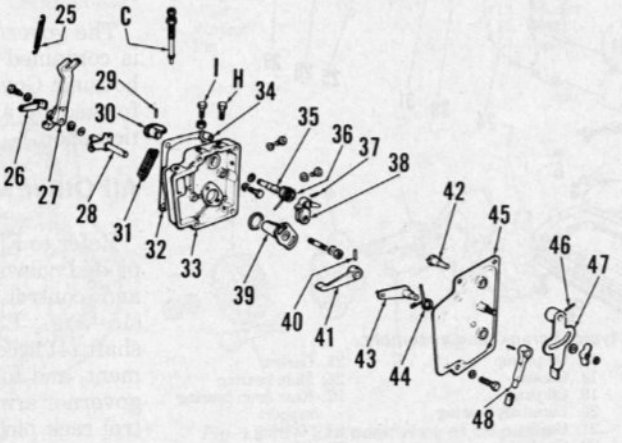


Fig. L3-24–Exploded view of governor and throttle linkage.

C. Torque control screw
H. High idle speed screw
I. Low idle speed screw
25. Start spring
26. Lever
27. Arm
28. Spindle
29. Pin
30. Lever
31. Governor spring
32. Gasket
33. Control housing
34. Dowel
35. Shaft
36. Spring
37. Pin
38. Arm
39. Eccentric
40. Pin
41. Lever
42. Shaft
43. Lever
44. Spring
45. Cover
46. Pin
47. Throttle lever
48. Stop lever

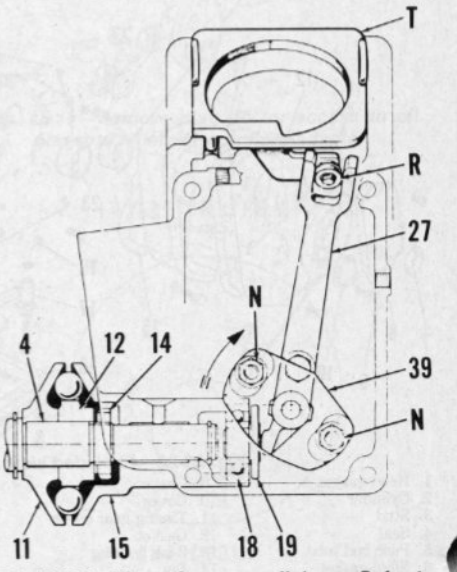


Fig. L3-25–View of governor linkage. Refer to text and Fig. L3-24.

draw crankshaft assembly from cylinder block. Main bearing caps (43) may now be separated from bearing support (41).

Crankshaft main bearing journal diameter is 64.96-64.98 mm and main bearing clearance should be 0.05-0.08 mm with a maximum allowable clearance of 0.10 mm. Standard and undersize main bearings are available.

Standard crankpin journal diameter is 55.34-55.35 mm. Rod bearing clearance is 0.04-0.07 mm with a maximum allowable clearance of 0.10 mm. Standard and undersize rod bearings are available.

Crankshaft end play is controlled by thrust washer halves (44) mounted on center support (41) of Models 832 and L27, or on support nearest timing gear end of engine on all other models. Crankshaft end play should be 0.15-0.25 mm. Install new thrust washers if end play exceeds 0.5 mm.

Main bearing cap (43) has a serrated parting face. Install cap in support so reference numbers on cap and support are on same side. Tighten main bearing cap screws to 49 N·m. Tighten center main bearing support screws to 49 N·m and nuts securing rear main bearing support (27–Fig. L3-22) to 39.2 N·m.

ALTERNATOR AND VOLTAGE REGULATOR

Refer to Fig. L3-27 or L3-28 for wiring schematic. Note that circuit in Fig. L3-28 includes an alternator warning light and the voltage regulator is different than the regulator used in circuit in Fig. L3-27.

The alternator stator is attached to the timing gear cover while a ring of magnets is carried inside the crankshaft pulley. To check alternator output, disconnect the two yellow leads and the red lead from the voltage regulator. Connect a voltmeter between the red lead and one yellow lead. With the engine running at 2200 rpm, alternator output should be 28-30 volts; at 2600 rpm, alternator output should be 32-36 volts; at 3000 rpm, alternator output should be 38-42 volts. Connect voltmeter to red lead and remaining yellow lead and repeat test. If voltage is insufficient, or the difference between tests is greater than 5 volts, then renew alternator. Stator and rotor are available only as a unit assembly.

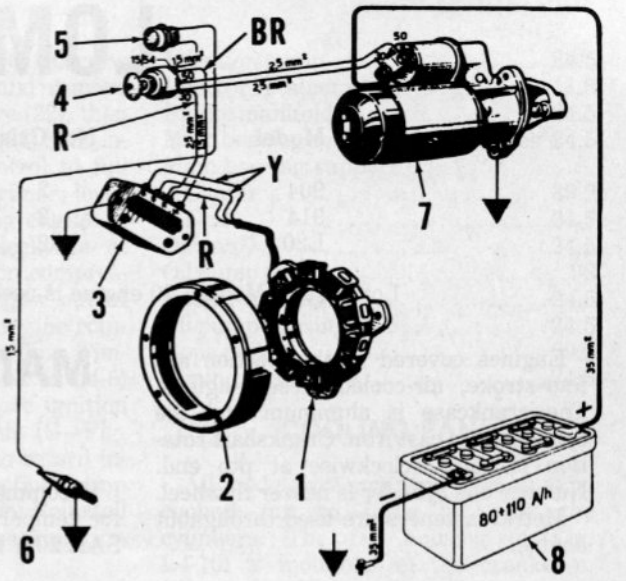


Fig. L3-27 – Wiring schematic applicable to models not equipped with alternator warning light as shown in Fig. L3-28.

BR. Brown
R. Red
Y. Yellow
1. Stator
2. Rotor
3. Voltage regulator
4. Switch
5. Oil pressure light
6. Oil pressure sender
7. Starter
8. Battery

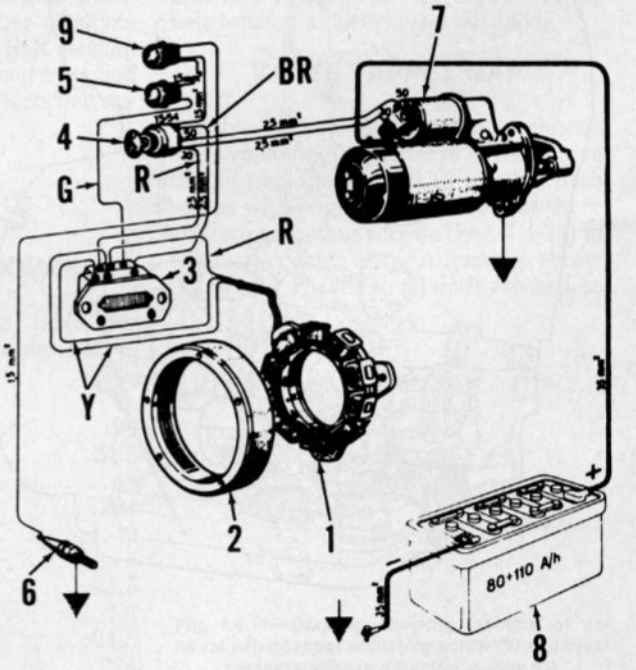


Fig. L3-28 – Wiring schematic of models equipped with an alternator warning light.

BR. Brown
G. Green
R. Red
Y. Yellow
1. Stator
2. Rotor
3. Voltage regulator
4. Switch
5. Oil pressure light
6. Oil pressure sender
7. Starter
8. Battery
9. Alternator light

ELECTRIC STARTER

Models 834 and L54 are equipped with a Bosch JD 12V-4PS electric starter. All other models may be equipped with either a Bosch JD 12V-1.8PS or Femsa MTL 12-6 electric starter.

LOMBARDINI

Model	No. Cyls.	Bore	Stroke	Displ.
904	2	90 mm	94 mm	1196 cc
914	2	95 mm	94 mm	1332 cc
L20	2	95 mm	94 mm	1332 cc

Lombardini Model L20 engine is used on Homelite® Model GD7200-1 and GD7400-2 Generators.

Engines covered in this section are four-stroke, air-cooled diesel engines. The crankcase is aluminum and the cylinders are cast iron. Crankshaft rotation is counterclockwise at pto end. Number one cylinder is nearer flywheel.

Metric fasteners are used throughout engine.

MAINTENANCE

LUBRICATION

Recommended engine oil is SAE 10W for temperatures below 0° C (32° F), SAE 20W for temperatures between 0° C (32° F) and 20° C (68° F), and SAE 40 for temperatures above 20° C (68° F). API classification for oil should be CD. Oil sump capacity is 2.8 liters. Manufacturer recommends renewing oil after every 100 hours of operation.

A renewable oil filter is mounted on side of engine crankcase. Manufacturer recommends renewing filter after every 400 hours of operation.

All models are equipped with a pressurized oil system. Refer to Fig. L4-1 for a diagram of the oil circuit.

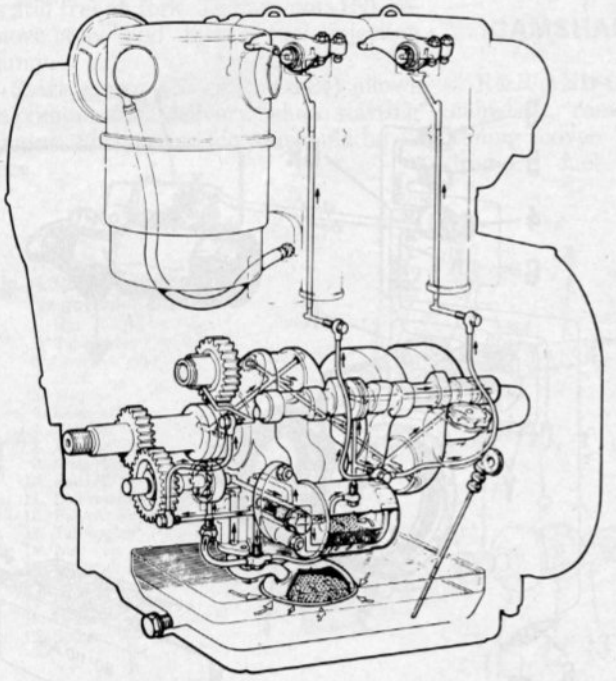


Fig. L4-1—Drawing of lubrication system.

ENGINE SPEED ADJUSTMENT

Idle speed is adjusted by turning idle speed screw (I–Fig. L4-2). Idle speed should be 900-950 rpm. Maximum governed speed is adjusted by turning high speed screw (H). Maximum governed speed under load is 3000 rpm for Models 904 and 914 and 2200 rpm for Model L20.

FUEL SYSTEM

FUEL FILTER. A renewable fuel filter is located in the fuel tank. Renew filter after every 300 hours of operation or sooner if required.

BLEED FUEL SYSTEM. To bleed fuel system, remove fuel injection pump bleed screw (B–Fig. L4-3), then operate fuel pump primer lever (P) until air-free

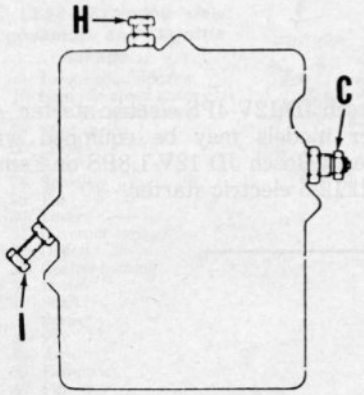


Fig. L4-2—Drawing showing location of low idle speed screw (I), high idle speed screw (H) and torque control screw (C).

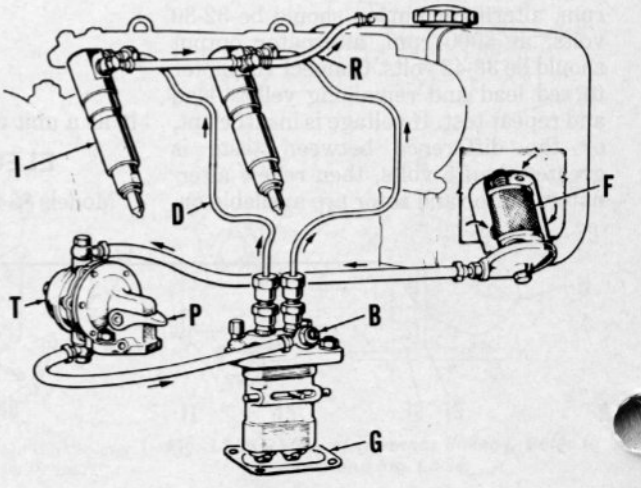


Fig. L4-3—Fuel circuit diagram.

B. Pump bleed screw
D. High pressure delivery line
F. Fuel filter
G. Shim gasket
I. Injector
P. Primer lever
R. Fuel return line
T. Fuel transfer pump

fuel flows from injection pump. Reinstall bleed screw (B). Loosen high pressure injection lines at injectors, then rotate engine crankshaft to operate fuel injection pump until air-free fuel flows from injection lines. Retighten injection lines.

INJECTION PUMP TIMING

Injection pump timing is adjusted using shim gaskets (G – Fig. L4-3) between pump body and mounting surface on crankcase. Injection should occur at 26° 45' – 28° 30' before top dead center. To check injection pump timing, unscrew high pressure injection line of number 1 cylinder from injection pump delivery valve holder (25 – Fig. L4-4). Unscrew delivery valve holder (25) and remove spring (23) and delivery valve (22), then screw delivery valve holder (25) back into pump. Move throttle control to full speed position. Operate primer lever (P – Fig. L4-3) while rotating engine in normal direction (counterclockwise at pto) so number 1 piston is on compression stroke. Note fuel will flow out of delivery valve holder. Stop engine rotation at moment fuel ceases to flow. Timing marks (I and M – Fig. L4-5 or L4-6) should be aligned. To advance ignition timing, remove shim gaskets (G – Fig. L4-3); install shim gaskets to retard injection timing. Tighten injection pump retaining screws to 24.5 N·m. Reinstall removed pump parts after checking timing.

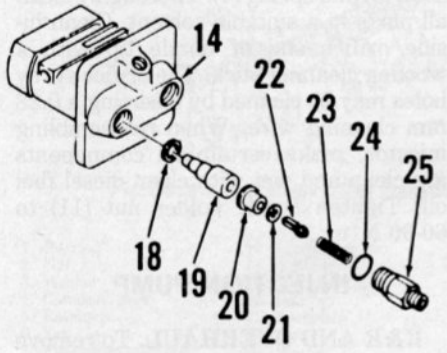


Fig. L4-4 – Partial exploded view of fuel injection pump.

14. Pump body
18. Packing
19. Barrel
20. Delivery valve seat
21. Gasket
22. Delivery valve
23. Spring
24. "O" ring
25. Delivery valve holder

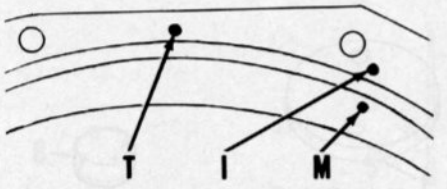


Fig. L4-5 – Drawing of flywheel timing marks used on some models.

I. Injection
M. Reference mark
T. Top dead center

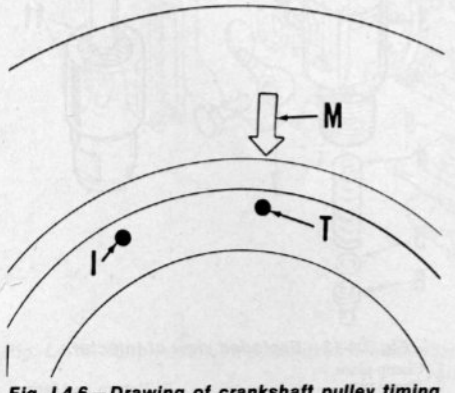


Fig. L4-6 – Drawing of crankshaft pulley timing marks used on some models.

I. Injection
M. Reference mark
T. Top dead center

FAN BELT TENSION

All models are equipped with a belt-driven cooling fan. Belt tension is adjusted by varying the number of shims between fan pulley halves. Belt tension is correct when thumb pressure applied midway between pulleys deflects belt approximately 1 cm.

REPAIRS

TIGHTENING TORQUES

Refer to the following table for tightening torques. All values are in newton meters.

Camshaft gear	196
Camshaft retainer	24.5
Connecting rod	49
Crankshaft pulley	294
Cylinder head	49
Exhaust manifold	24.5
Fan nut	24.5
Fan pulley	7.8
Fan pulley hub	24.5
Flywheel	294
Injection pump	24.5
Injector retainer plate	11.8
Intake manifold	24.5
Main bearing center support halves	24.5
Main bearing support	
Center	39.2
End	24.5
Oil pan	24.5
Oil pump gear	98
Rocker arm stand	24.5
Oil pump housing	24.5
Rope pulley	39.2
Timing gear cover	24.5

COOLING FAN

All models are equipped with an axial cooling fan to force air past the cylinders. The fan housing (4 – Fig. L4-10) is mounted on the crankcase. Alternator (7) is contained in the fan housing with the alternator rotor mounted on shaft (6).

Overhaul is evident after inspection of unit and referral to Fig. L4-10. Adjust belt tension as previously outlined.

VALVE TAPPET GAP

Valve tappet gap may be adjusted after removing rocker arm cover. Valve tappet gap should be 0.15 mm for both valves with engine cold. Note that there are two adjusting screws (Fig. L4-11) in exhaust rocker arm. Adjusting screw (V) nearer rocker arm shaft is used to

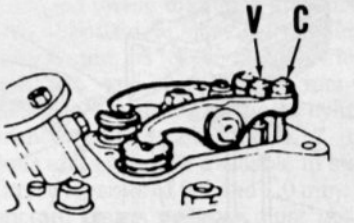


Fig. L4-11 – Drawing showing location of exhaust valve tappet adjusting screw (V) and compression release adjusting screw (C).

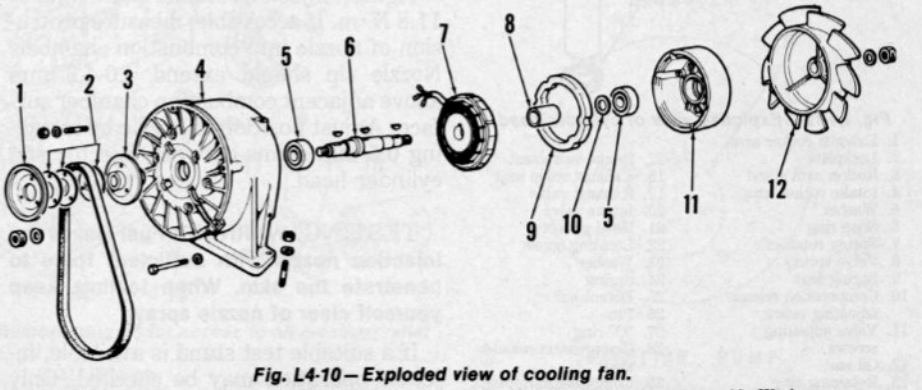


Fig. L4-10 – Exploded view of cooling fan.

1. Pulley half
2. Shims
3. Pulley hub
4. Fan housing
5. Bearing
6. Shaft
7. Alternator
8. Spacer
9. Spacer
10. Washer
11. Alternator housing
12. Fan

adjust valve clearance while outer screw (C) adjusts compression release gap.

COMPRESSION RELEASE

A manual compression release is located on each cylinder head so the exhaust valve can be held open to aid starting. Rotating shaft (28–Fig. L4-12) forces the exhaust rocker arm to slightly open the exhaust valve.

The compression release is adjusted by turning outer adjusting screw (C–Fig. L4-11) in exhaust valve rocker arm. Adjust compression release gap AFTER adjusting exhaust valve tappet gap. With compression release lever in off position, clearance between adjusting screw and shaft should be 0.9-1.1 mm.

Diameter of compression release shaft (28–Fig. L4-12) is 11.95-11.97 mm while lobe height is 10.4-10.5 mm.

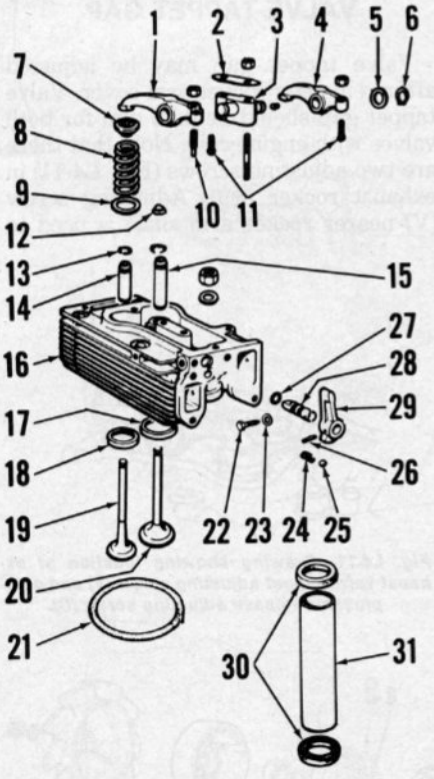


Fig. L4-12–Exploded view of cylinder head.

1. Exhaust rocker arm
2. Lockplate
3. Rocker arm stand
4. Intake rocker arm
5. Washer
6. Snap ring
7. Spring retainer
8. Valve spring
9. Spring seat
10. Compression release adjusting screw
11. Valve adjusting screws
12. Oil seal
13. Retaining ring
14. Exhaust valve guide
15. Intake valve guide
16. Cylinder head
17. Intake valve seat
18. Exhaust valve seat
19. Exhaust valve
20. Intake valve
21. Head gasket
22. Locating screw
23. Washer
24. Spring
25. Detent ball
26. Pin
27. "O" ring
28. Compression release shaft
29. Compression release lever
30. Seals
31. Push rod tube

CYLINDER HEAD AND VALVE SYSTEM

Do not remove cylinder head while hot as head may deform.

Valve face angle is 45 degrees and minimum valve head margin is 0.4 mm. Valve seat angle is 45 degrees with a seat width of 1.4-1.6 mm. Valve seats are renewable and must be installed with head heated to 160°-180° C (320°-356° F). Valve seals are used on intake valves. Valve stem diameter is 7.98-8.00 mm while valve guide diameter is 8.03-8.05 mm. Desired valve stem clearance is 0.03-0.07 mm. Valve guides are renewable and oversize valve guides are available. Note locating ring (13–Fig. L4-12) around top of each valve guide. Outside of oversize valve guide must be machined so outer diameter is 0.05-0.06 mm greater than hole in head. The cylinder head should be heated to 160°-180° C (320°-356° F) when installing valve guide.

Desired clearance between rocker arms and shafts is 0.03-0.06 mm. Maximum clearance is 0.1 mm.

Before tightening cylinder head nuts, install exhaust manifold, then tighten cylinder head nuts to 49 N·m.

When installing cylinder head, be sure oil tubes to head are properly connected as shown in Fig. L4-1. Before tightening cylinder head nuts, install exhaust and intake manifolds to correctly position head, then tighten cylinder head nuts to 49 N·m.

INJECTOR

REMOVE AND REINSTALL. To remove injector, first clean dirt from injector, injection line, return line and cylinder head. Disconnect return line and injection line and immediately cap or plug all openings. Unscrew retainer plate (1–Fig. L4-13) being careful not to lose dowel pin (2). Injector may now be carefully removed from cylinder head. Do not lose shims between injector and cylinder head.

Tighten injector retainer plate nuts to 11.8 N·m. If accessible, measure protrusion of nozzle into combustion chamber. Nozzle tip should extend 4.0-4.5 mm above adjacent combustion chamber surface. Adjust position of nozzle by installing 0.5 mm shims between injector and cylinder head.

TESTING. WARNING: Fuel leaves the injection nozzle with sufficient force to penetrate the skin. When testing, keep yourself clear of nozzle spray.

If a suitable test stand is available, injector operation may be checked. Only clean, approved testing oil should be used to test injector. When operating properly during test, injector nozzle will emit a buzzing sound and cut off quickly with no fluid leakage at seat.

Opening pressure with a new spring (4–Fig. L4-13) should be 21.6-22.5 MPa while opening pressure with a used spring should be 20.6-21.6 MPa. Opening pressure is adjusted by varying number and thickness of shims (5). Valve should not show leakage at orifice spray holes for 10 seconds at 19.1 MPa.

OVERHAUL. Clamp nozzle body (3–Fig. L4-13) in a vise with nozzle tip pointing upward. Remove nozzle holder nut (11). Remove nozzle tip (9) with valve (10) and spacer (8). Invert nozzle body (3) and remove spring seat (6), shim (5) and spring (4). Thoroughly clean all parts in a suitable solvent. Clean inside orifice end of nozzle tip with a wooden cleaning stick. The orifice spray holes may be cleaned by inserting a 0.28 mm cleaning wire. When reassembling injector, make certain all components are clean and wet with clean diesel fuel oil. Tighten nozzle holder nut (11) to 60-90 N·m.

INJECTION PUMP

R&R AND OVERHAUL. To remove injection pump, disconnect fuel lines, unscrew retaining screws and remove pump. Do not lose shim gaskets (G–Fig. L4-3).

The injection pump should be tested and overhauled by a shop qualified in diesel fuel injection pump repair.

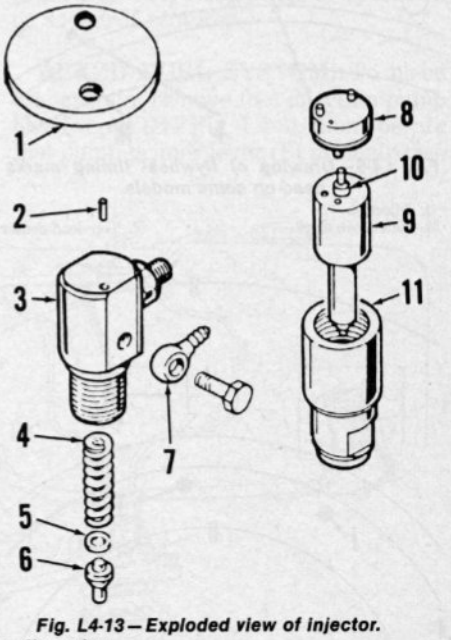


Fig. L4-13–Exploded view of injector.

1. Clamp plate
2. Dowel pin
3. Nozzle body
4. Spring
5. Shim
6. Pressure pin
7. Return line fitting
8. Spacer
9. Nozzle
10. Valve
11. Nozzle holder nut

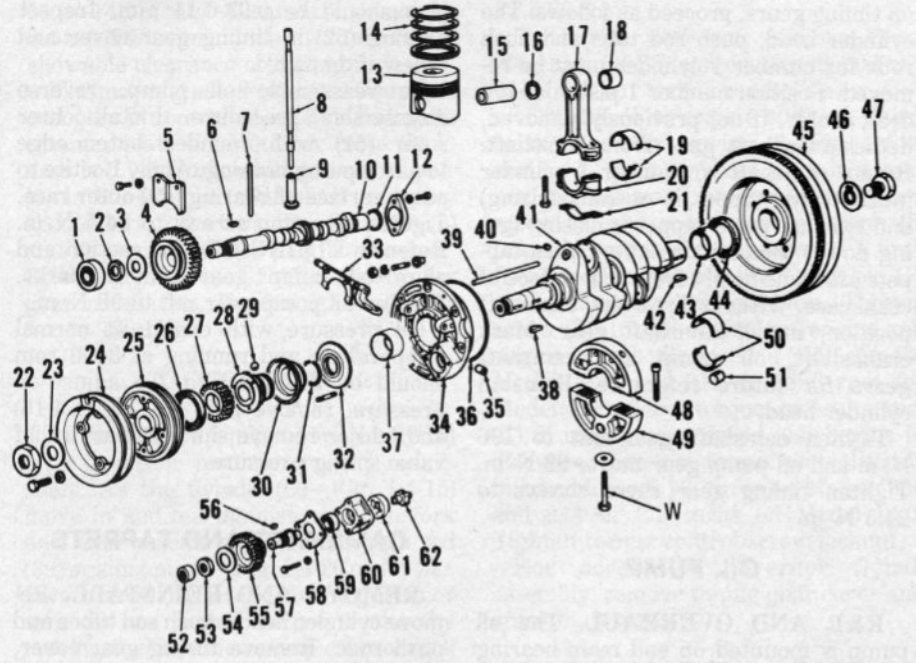


Fig. L4-15—Exploded view of crankshaft, camshaft and oil pump assemblies.

1. Bearing
2. Nut
3. Washer
4. Camshaft gear
5. Retainer
6. Key
7. Fuel pump push rod
8. Push rod
9. Tappet
10. Camshaft
11. "O" ring
12. Cover plate
13. Piston
14. Piston rings
15. Piston pin
16. Snap ring
17. Connecting rod
18. Bushing
19. Rod bearing
20. Rod cap
21. Lockplate
22. Nut
23. Washer
24. Rope pulley
25. Fan pulley
26. Seal
27. Gear
28. Governor hub
29. Balls
30. Governor cup
31. Snap ring
32. Seal
33. Governor arm & shaft
34. End bearing support
35. Bushing
36. "O" ring
37. Main bearing
38. Key
39. Governor rod
40. Plug
41. Crankshaft
42. Key
43. Main bearing
44. Seal
45. Flywheel
46. Lockwasher
47. Cap screw
48. Upper center bearing support
49. Lower center bearing support
50. Center main bearing
51. Round nut
52. Bearing
53. Nut
54. Washer
55. Gear
56. Key
57. Drive shaft
58. Bearing retainer
59. Bearing
60. Oil pump cover
61. Outer rotor
62. Inner rotor
W. Support screw

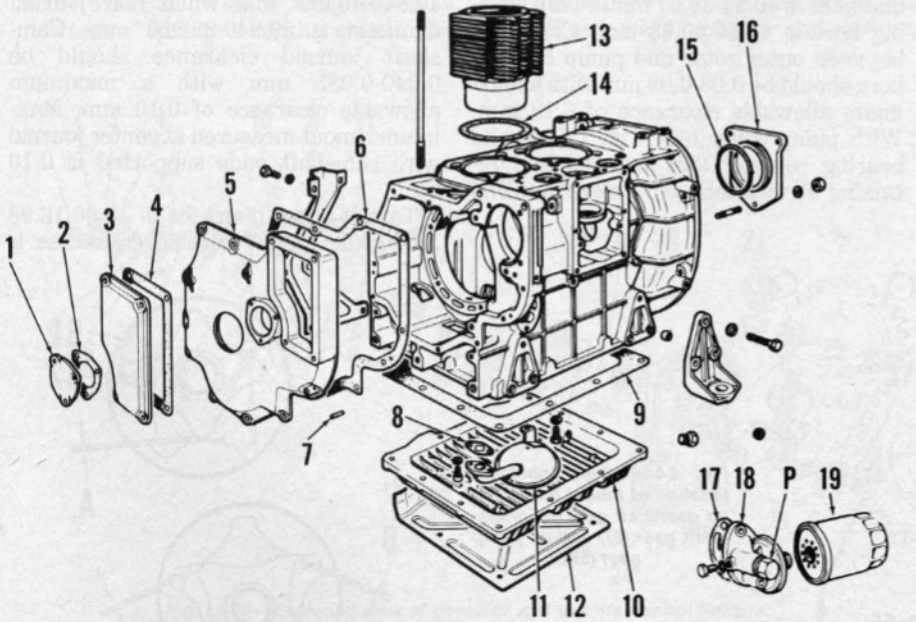


Fig. L4-16—Exploded view of crankcase assembly. Remove plug (P) for access to oil pressure relief valve.

1. Cover
2. Gasket
3. Cover
4. Gasket
5. Timing gear cover
6. Gasket
7. Pin
8. Gasket
9. Gasket
10. Oil pan
11. Oil pickup
12. Air shroud
13. Cylinder
14. Shim gasket
15. "O" ring
16. Cover
17. Gasket
18. Filter adapter
19. Oil filter

When installing pump, engage pin on pump control rack with governor fork. Tighten injection pump screws to 24.5 N·m. If pump is renewed or overhauled, or original shim gaskets are not used, refer to INJECTION PUMP TIMING section and adjust pump timing.

PISTON AND ROD UNITS

REMOVE AND REINSTALL. Piston and connecting rod may be removed after removing cylinder head, oil pan and oil pickup.

When installing piston and rod, note that depression (D–Fig. L4-17) in piston crown is closer to one side of piston. Install piston so depression side of piston is nearer injector. Some pistons also have an arrow embossed on piston. Properly installed, arrow on piston crown will point towards injection pump. Match alignment marks on rod and cap and tighten rod screws to 49 N·m.

Refer to CYLINDER section and measure piston height in cylinder.

PISTON, PIN AND RINGS

The piston is equipped with three compression rings and an oil control ring. Ring end gap is 0.35-0.55 mm for all compression rings and 0.25-0.40 mm for the oil control ring. Piston ring side clearance should be 0.15 mm for top compression ring and 0.10 mm for all other piston rings.

Standard piston diameter measured 2 mm from bottom of skirt, perpendicular to piston pin, is 89.85-89.86 mm for Model 904 and 94.85-94.86 mm for Models 914 and L20. Piston to cylinder clearance should be 0.14-0.17 mm. Pistons and rings are available in standard and oversizes of 0.5 and 1.0 mm. Difference in piston weights must not exceed 6 grams.

Piston pin diameter is 27.995-28.005 mm. Piston pin clearance in rod should

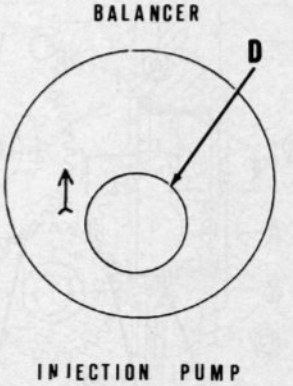


Fig. L4-17—Arrow on piston crown should point towards injection pump and depression (D) should be near injectors.

be 0.015-0.035 mm with a maximum allowable clearance of 0.05 mm.

CONNECTING ROD

The connecting rod small end is fitted with a renewable bushing. Clearance between piston pin and rod bushing should be 0.015-0.035 mm with a maximum allowable clearance of 0.05 mm. Bushing inner diameter is 28.020-28.030 mm.

An insert type bearing is used in connecting rod big end. Desired rod bearing clearance is 0.03-0.07 mm with a maximum allowable clearance of 0.10 mm. Big end bearings are available in standard and undersizes.

CYLINDERS

All models are equipped with removable cylinders. Standard cylinder diameter is 90.00-90.02 mm for Model 904 and 95.00-95.02 mm for Models 914 and L20. Maximum allowable taper or out-of-round is 0.1 mm.

With piston at top dead center, top of piston must be even with cylinder top edge. Cylinder height is adjusted using shim gaskets (14 – Fig. L4-16) which are available in thicknesses of 0.1 and 0.3 mm.

TIMING GEARS

REMOVE AND REINSTALL. Remove belt guard and fan belt. Unscrew nut, then using a suitable puller, pull pulley off crankshaft. Remove timing gear cover.

Use a suitable puller to remove gears. Note that retainer (5 – Fig. L4-15) must be removed before pulling off camshaft gear (4). When installing camshaft gear, place gear on shaft so retainer groove is out. Align timing marks (M – Fig. L4-18) on models so equipped, when installing gears. If timing marks are not present on timing gears, proceed as follows: The cylinder head, push rod tube and push rods for number 1 cylinder must be removed. Position number 1 piston at top dead center. If not previously removed, detach camshaft gear from camshaft. Rotate camshaft so number 1 cylinder intake valve tappet is opening (rising) and exhaust valve tappet is closing (going down) then stop rotation when tappets are same height from top surface of crankcase. Without disturbing camshaft position, install camshaft gear. Mark crankshaft, oil pump and camshaft gears for future reference. Reinstall cylinder head.

Tighten camshaft gear nut to 196 N·m and oil pump gear nut to 98 N·m. Tighten timing gear cover screws to 24.5 N·m.

OIL PUMP

R&R AND OVERHAUL. The oil pump is mounted on end main bearing support (34 – Fig. L4-15). To remove pump, remove timing gear cover and oil pump gear (55). Unscrew pump housing screws and disassemble pump.

Refer to Fig. L4-19 and measure clearance between inner and outer rotors (61 and 62). Clearance (A) should be 0.01-0.06 mm with a maximum allowable clearance of 0.10 mm, and clearance (B) should be 0.02-0.10 mm with a maximum allowable clearance of 0.20 mm. Width of inner and outer rotors should be 14.95-14.97 mm and difference in rotor widths must not be greater than 0.02 mm. Outer rotor outer diameter is 40.54-40.57 mm. Pump housing bore is 40.60-40.63 mm. Clearance between outer rotor and pump housing bore should be 0.03-0.09 mm with a maximum allowable clearance of 0.13 mm. With pump cover (60 – Fig. L4-15) and bearing retainer (58) installed and retaining screws torqued, inner rotor end play should be 0.03-0.11 mm. Inspect bearing (52) in timing gear cover and renew if damaged.

To reassemble oil pump, reverse disassembly procedure. Install outer rotor (61) with rounded outer edge towards pump housing. Apply Loctite to outer surface of bearing (59) outer race. Tighten oil pump screws to 24.5 N·m. Refer to TIMING GEARS section and align oil pump gear timing marks. Tighten oil pump gear nut to 98 N·m.

Oil pressure with engine at normal temperature and running at 3000 rpm should be 343-392 kPa. To adjust oil pressure, remove plug (P – Fig. L4-16) and add or remove shims to vary relief valve spring pressure.

CAMSHAFT AND TAPPETS

REMOVE AND REINSTALL. Remove cylinder heads, push rod tubes and push rods. Remove timing gear cover, gear retainer (5 – Fig. L4-15) and camshaft gear (4). Remove fuel injection pump. Using suitable tools, pull valve tappets away from camshaft and secure tappets so they will not fall into crankcase when camshaft is removed. If tappets fall into crankcase, then crankshaft must be removed so tappets can be reinstalled. Withdraw camshaft from crankcase. Remove oil pan for access to tappets.

Inspect bearing (1) in timing gear cover and renew if damaged. Inspect camshaft lobes and bearing journals. Center journal diameter is 40.940-40.960 mm while rear journal diameter is 29.940-29.960 mm. Camshaft journal clearance should be 0.040-0.085 mm with a maximum allowable clearance of 0.10 mm. Maximum runout measured at center journal with camshaft ends supported is 0.10 mm.

Tappet outer diameter is 13.96-13.98 mm while tappet bore in crankcase is

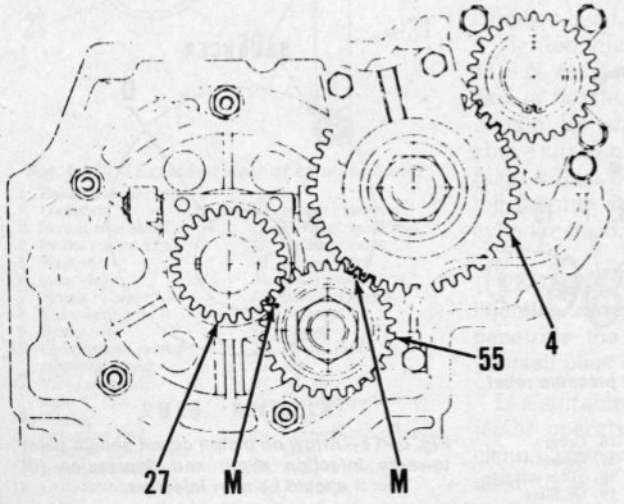


Fig. L4-18 – View showing location of timing marks (M) on camshaft gear (4), crankshaft gear (27) and oil pump gear (55).

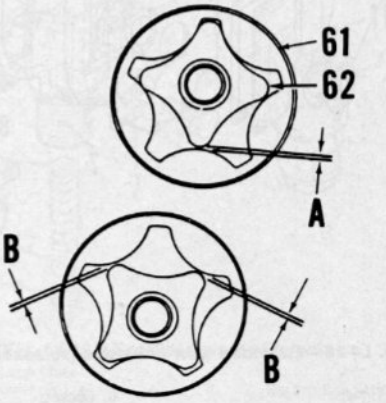


Fig. L4-19 – Refer to text for clearances (A&B) between oil pump outer rotor (61) and inner rotor (62).

14.00-14.02 mm. Clearance should be 0.02-0.06 mm with a maximum allowable clearance of 0.10 mm.

If removed, install tappets. Camshaft end play is controlled by camshaft gear retainer plate (5). Retainer plate thickness is 5.7-5.8 mm while groove in gear (4) is 6.0-6.1 mm. Camshaft end play should be 0.2-0.4 mm. Renew plate (5) and/or gear (4) if end play is incorrect. Refer to TIMING GEARS section for gear installation. Tighten camshaft gear nut to 196 N·m.

GOVERNOR

All models are equipped with a flyball type governor mounted on the crankshaft. As the flyballs (29–Fig. L4-15) move in and out against cup (30), fork and lever assembly (33) forces push rod (39) against pin (1–Fig. L4-20 or L4-21). Pivot flange (4), lever (16) and governor arm (5) are forced to rotate thereby moving fuel injection pump control rack pin (P). Throttle lever (25) operates through pivot arm (12) and governor spring (13) to control engine speed.

Torque control screw (C) on Models 904 and 914 allows additional fuel usage under high torque load. The tip is spring loaded. The tip should recede 0.5-0.6 mm when 470-500 grams force is applied to tip. Torque control screw is available only as an assembly.

Start spring (6) returns the fuel injection pump control rack to maximum fuel position to aid in starting. Spring free length is 29.5-30.5 mm.

Governor spring (13) free length is 69.5-70.5 mm. With a force of 56.84 newtons, spring length should be 82.5-83.5 mm.

To adjust governor, remove cover (24–Fig. L4-20) and on Models 904 and 914, back out torque control screw (C) 5 or 6 turns. With engine stopped, check to be sure start spring (6–Fig. L4-20 and L4-21) has removed slack in governor mechanism. Loosen governor arm screw (8) and move governor arm (5) towards torque control screw (C) until fuel injection pump control rack pin (P) is in maximum fuel position. Tighten screw (8). Install control cover and run engine at high idle speed of 3150 rpm for Models 904 and 914 or 2350 rpm for Model L20. Turn torque control screw (C) in until engine speed just begins to decrease, then turn torque control screw in an additional 1½ turns on Models 904 and 914 or 2.2 turns on Model L20. Tighten torque control screw locknut.

For access to governor flyball assembly, remove timing gear cover and crankshaft gear.

CRANKSHAFT AND BEARINGS

R&R AND OVERHAUL. The crankshaft rides in sleeve bearings in the crankcase bulkhead and end bearing support (34–Fig. L4-15), and in insert bearings in center support halves (48 and 49).

To remove the crankshaft, remove flywheel, pistons and rods, and governor as previously outlined. Unscrew center support retaining screw (W). Unscrew end support (34) retaining nuts and remove end support. Carefully extract crankshaft and center bearing support from crankcase. Do not lose round nut (51). If necessary, unscrew and separate center support halves (48 and 49).

Standard diameter of center main bearing journal is 55.34-55.35 mm. Standard diameter of outer main bearing journals is 54.94-54.95 mm. Bearing clearance should be 0.05-0.09 mm for center main bearing and 0.05-0.07 mm for outer main bearings with a maximum allowable clearance of 0.12 mm. End main bearings (37 and 43) must be reamed to size. Standard and undersize main bearings are available.

Standard crankpin journal diameter is 49.989-50.000 mm and rod bearing clearance should be 0.03-0.07 mm with a maximum allowable clearance of 0.10 mm. Standard and undersize rod bearings are available.

Serrated parting surfaces of center support halves (48 and 49) must be aligned during assembly. With support screws tightened to 24.5 N·m, center support outside diameter should be 154.980-154.990 mm and inside diameter should be 59.074-59.093 mm. Maximum out-of-round for either diameter is 0.01 mm.

When installing main bearing (37) in end support (34–Fig. L4-22), distance

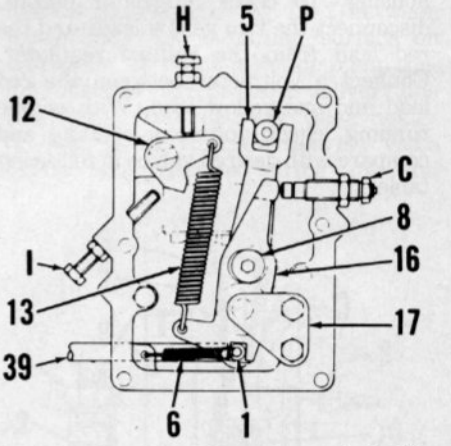


Fig. L4-21–Drawing of governor and throttle control linkage. Refer to Fig. L4-20 for parts identification.

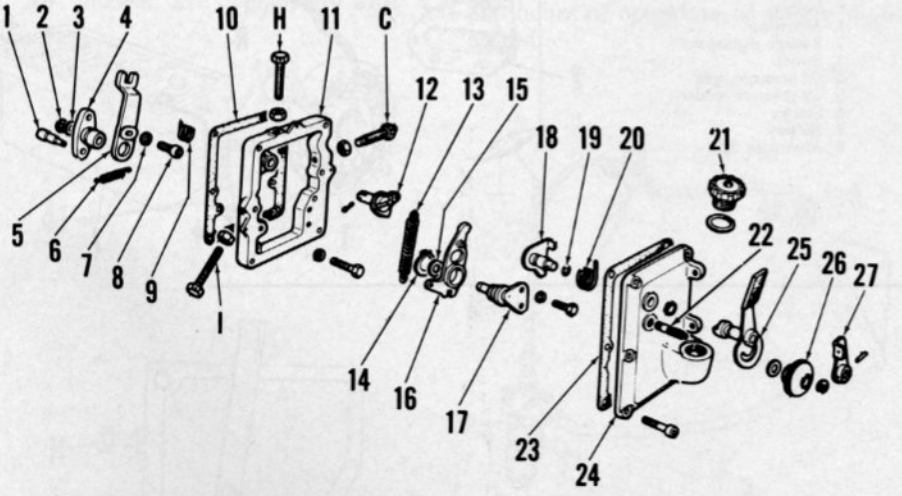


Fig. L4-20–Exploded view of governor and throttle control linkage.

1. Pin
2. Snap ring
3. Washer
4. Pivot flange
5. Governor arm
6. Start spring
7. Washer
8. Allen screw
9. Spring
10. Gasket
11. Plate
12. Pivot arm
13. Governor spring
14. Snap ring
15. Washer
16. Lever
17. Pivot
18. Arm
19. Washer
20. Spring
21. Oil fill cap
22. Stud
23. Gasket
24. Cover
25. Throttle lever
26. Knob
27. Stop lever
C. Torque control screw
H. High idle speed screw
I. Low idle speed screw

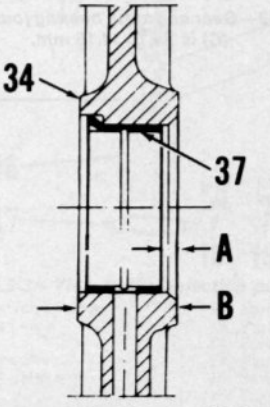


Fig. L4-22–Depth (A) of bearing (37) in end support (34) should be 5 mm. Support width measured at (B) is 33.90-33.95 mm.

(A) from bearing (37) to inside surface of support should be 5 mm.

Crankshaft end play should be 0.15-0.25 mm and is not adjustable. End support (34 – Fig. L4-15) width measured at (B) should be 33.90-33.95 mm. Width of gear end main bearing journal measured from shoulder to thrust face as shown at (C – Fig. L4-23) should be 34.10-34.15 mm. A worn end support or crankshaft will cause excessive end play.

Reassembly is reverse of disassembly. Tighten screws securing center support halves to 24.5 N·m. Tighten end support retaining nuts to 24.5 N·m. Tighten center support retaining screw to 39.2 N·m.

ALTERNATOR AND REGULATOR

Refer to Fig. L4-25 or L4-26 for wiring schematic. Note that circuit in Fig. L4-26 includes an alternator warning light and the voltage regulator is different than the regulator used in circuit in Fig. L4-25. Alternator output may be 14 or 21 amperes as noted on voltage regulator.

The alternator is contained in the fan housing. To check alternator output, disconnect the two yellow leads and the red lead from the voltage regulator. Connect a voltmeter between the red lead and one yellow lead. With engine running, check voltmeter reading and compare with desired values in following table:

Engine RPM	14 Amp Alternator	21 Amp Alternator
1500	18.5-20 Volts	30-32 Volts
2000	24-25 Volts	45-47 Volts
2500	31-32 Volts	57-58 Volts
3000	37-38 Volts	68-69 Volts

Connect voltmeter to red lead and remaining yellow lead and repeat test. If voltage is insufficient, or the difference between tests is greater than 5 volts, then renew alternator. Stator and rotor are available only as a unit assembly.

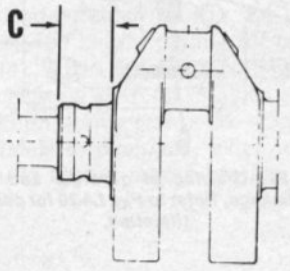


Fig. L4-23 – Gear end main bearing journal width (C) is 34.10-34.15 mm.

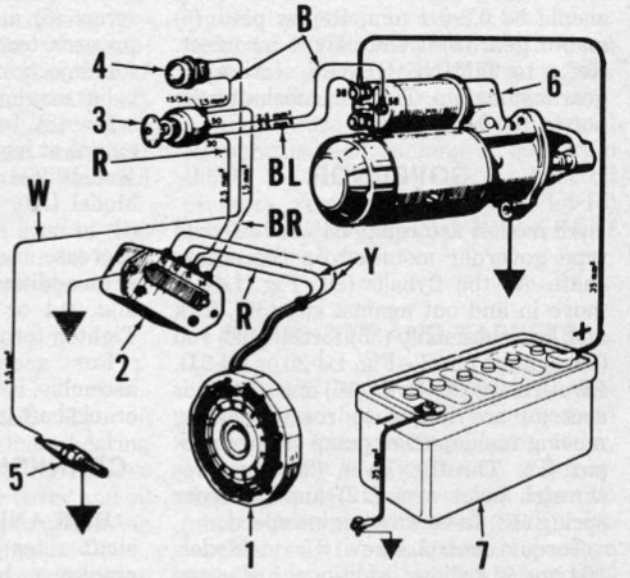


Fig. L4-25 – Wiring schematic of models not equipped with an alternator warning light.

B. Black
BL. Blue
BR. Brown
R. Red
W. White
Y. Yellow
1. Alternator
2. Voltage regulator
3. Switch
4. Oil pressure light
5. Oil pressure sender
6. Starter
7. Battery

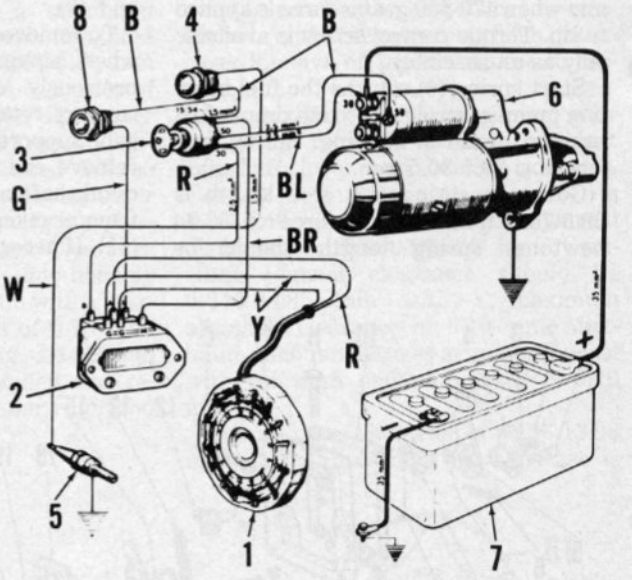


Fig. L4-26 – Wiring schematic of models equipped with an alternator warning light.

B. Black
BL. Blue
BR. Brown
G. Green
R. Red
W. White
Y. Yellow
1. Alternator
2. Voltage regulator
3. Switch
4. Oil pressure light
5. Oil pressure sender
6. Starter
7. Battery
8. Alternator light

LOMBARDINI

Model	No. Cyls.	Bore	Stroke	Displ.
L8	1	85 mm	90 mm	510 cc
L10	1	95 mm	90 mm	638 cc
L14	1	102 mm	100 mm	817 cc
LDA96	1	95 mm	90 mm	638 cc
LDA100	1	100 mm	90 mm	707 cc
LDA450	1	85 mm	80 mm	454 cc
LDA510	1	85 mm	90 mm	510 cc
LDA820	1	102 mm	100 mm	817 cc

Lombardini Model LDA510 Engine is used on Homelite® Model DPT4-1 Pump.

All models are four-stroke, single-cylinder, air-cooled diesel engines. Crankshaft rotation is counterclockwise at pto end.

Metric fasteners are used throughout engine.

MAINTENANCE

LUBRICATION

Recommended engine oil is SAE 10W for temperatures below 0° C (32° F), SAE 20W for temperatures between 0° C (32° F) and 20° C (68° F), and SAE 40 for temperatures above 20° C (68° F). API classification for oil should be CD. Oil sump capacity is 1.65 liters on Models L8, LDA450 and LDA510 or 2.6 liters on all other models. Manufacturer recommends renewing oil after every 100 hours of operation.

A renewable oil filter is mounted on side of engine crankcase. Manufacturer recommends renewing filter after every 300 hours of operation.

All models are equipped with a pressurized oil system. Refer to OIL PUMP section for service.

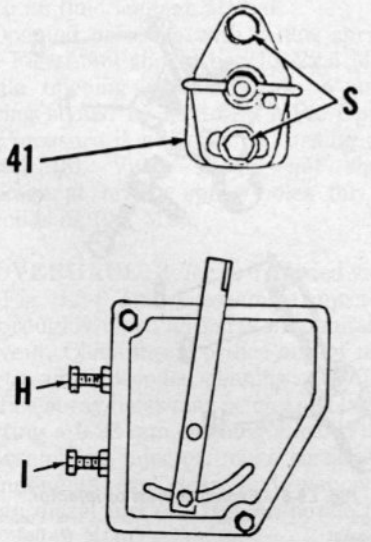


Fig. L5-1 – Refer to text for engine speed adjustment.

ENGINE SPEED ADJUSTMENT

Idle speed is adjusted by turning idle speed screw (I – Fig. L5-1). Idle speed should be 1000-1100 rpm. Maximum governed speed is adjusted by turning high speed screw (H). Maximum governed speed under load should be 2200 rpm for Models L8, L10 and L14, 2600 rpm for Models LDA100 and LDA820, and 3000 rpm for Models LDA96, LDA450 and LDA510.

Maximum fuel delivery is adjusted by loosening screws (S) and moving plate (41). Set plate so satisfactory engine pickup is obtained without excessive smoke. Moving plate to left increases fuel delivery.

FUEL SYSTEM

FUEL FILTER. The fuel filter is located inside the fuel tank as shown in Fig. L5-2. Renew fuel filter after every 300 hours of operation or sooner if required.

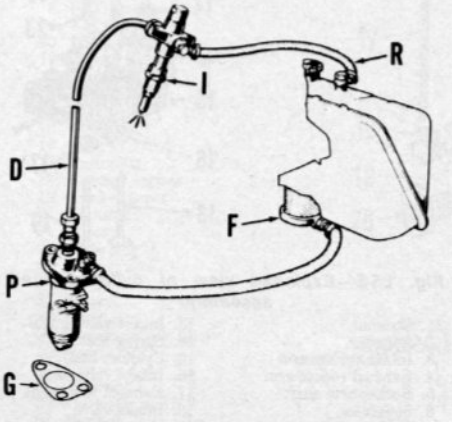


Fig. L5-2 – Diagram of fuel system.

D. High pressure delivery line
F. Fuel filter
G. Shim gasket
I. Injector
P. Injection pump
R. Return line

BLEED FUEL SYSTEM. To bleed fuel system, loosen fuel line fitting on fuel pump and allow fuel to flow until air-free, then retighten fitting. Loosen high pressure injection line at injector, then rotate engine crankshaft to operate injection pump until air-free fuel flows from injection line. Retighten injection line.

INJECTION PUMP TIMING

Injection pump timing is adjusted using shim gaskets (G – Fig. L5-2) between pump body and mounting surface on crankcase. To check injection pump timing, unscrew high pressure delivery line (D) fitting from delivery valve holder (1 – Fig. L5-3). Unscrew delivery valve holder and remove spring (3) and

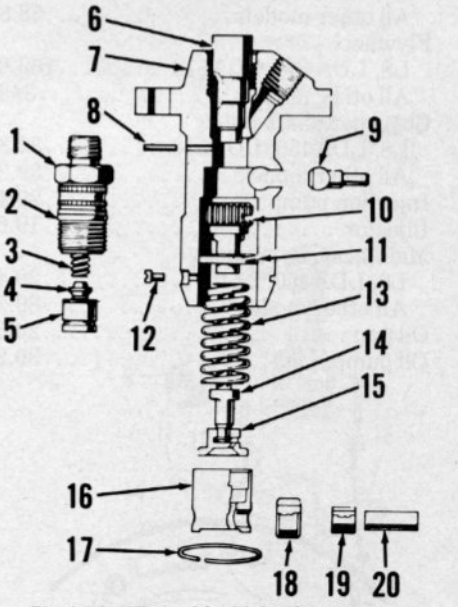


Fig. L5-3 – View of fuel injection pump.

1. Delivery valve holder
2. "O" ring
3. Spring
4. Delivery valve
5. Delivery valve seat
6. Barrel
7. Pump body
8. Pin
9. Control rack
10. Pinion
11. Spring seat
12. Pin
13. Spring
14. Plunger
15. Spring retainer
16. Tappet
17. Circlip
18. Outer roller
19. Inner roller
20. Pin

delivery valve (4) then screw delivery valve holder (1) into pump body. Move throttle control to full speed position. Rotate engine in normal direction (counterclockwise at pto) so piston is on compression stroke. Note fuel in delivery valve holder will spill out. Stop engine rotation at moment fuel ceases to flow out. Timing dot (R–Fig. L5-4) on fan plate should align with injection timing dot (I) on fan shroud. Ignition timing should occur at 22°-23° BTDC on Model L8, 23°45'-25°30' on Models LDA450 and LDA510, and 25°15'-26°45' on all other models.

To advance injection timing, remove shim gaskets (G–Fig. L5-2); install shim gaskets to retard injection timing. Reinstall removed pump components and tighten delivery valve holder to 34.3-39.2 N·m. Tighten injection pump retaining screws to 29.4 N·m.

REPAIRS

TIGHTENING TORQUES

Refer to following table for tightening torques. All values are in newton meters.

Balancer case	49
Balancer cover	49
Connecting rod	
L8, LDA450, LDA510	29.4
All other models	44.1
Cylinder head	
L8, LDA450, LDA510	49
All other models	58.8
Flywheel	
L8, LDA450, LDA510	166.6
All other models	343
Governor shaft nut	
L8, LDA450, LDA510	34.3
All other models	39.2
Injection pump	29.4
Injector	19.6
Main bearing support	
L8, LDA450, L510	29.4
All other models	39.2
Oil pan	24.5
Oil pump	39.2
Oil pump gear	19.6
Pto bearing support	
L8, LDA450, LDA510	24.5
All other models	39.2
Pto flange	225.4
Rope pulley	
L8, LDA450, LDA510	34.3
All other models	39.2

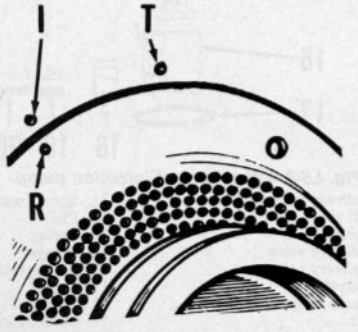


Fig. L5-4—View of timing marks located on air shroud. Refer to text for injection timing.

VALVE TAPPET GAP

Valve tappet gap may be adjusted after removing rocker arm cover. Valve tappet should be 0.20 mm for both valves with engine cold.

COMPRESSION RELEASE

A manual compression release is located in the rocker arm cover so the exhaust valve can be held open to aid starting. Exhaust valve should be lowered approximately 1 mm from valve seat when compression release is operated. Compression release may be adjusted by varying thickness of rocker arm cover.

CYLINDER HEAD AND VALVE SYSTEM

Do not remove a hot cylinder head as head may deform. To remove rocker arms, unscrew rocker shaft locating pin (21–Fig. L5-5) on Models L8, LDA450 and LDA510 or shaft locating screw (6) on all other models, then use a suitable puller and withdraw rocker shaft.

Valve face angle is 45 degrees and minimum valve head margin is 0.4 mm. Valve seat angle is 45 degrees with a seat width of 1.4-1.6 mm. Valve seats are renewable and must be installed with head heated to 160°-180° C (320°-356° F). A valve seal is used on the intake valve. Valve stem diameter is 6.98-7.00 mm on Models L8, LDA450 and LDA510 or 7.98-8.00 mm on all other models. Valve guide inside diameter is 7.03-7.05 mm on Models L8, LDA450 and LDA510 or 8.03-8.05 mm on all other models. Desired valve stem clearance for all models is 0.03-0.07 mm. Valve guides are renewable and oversize valve guides are available. Note locating ring (12) around top of each guide. Outside of oversize valve guide must be machined so outer diameter is 0.05-0.06 mm greater than hole in head. The cylinder head should be heated to 160°-180° C (320°-356° F) when installing valve guides.

Valve spring pressure should be 294 newtons at valve spring length of 25.2 mm on Models L8, LDA450 and LDA510 or 25.8 mm on all other models.

The rocker arm shaft on Models L8, L10 and L14 is drilled to allow passage of pressurized oil to rocker arms. Desired clearance on all models between rocker arms and rocker shaft is 0.03-0.06 mm with a maximum clearance of 0.1 mm.

No cylinder head gasket is used.

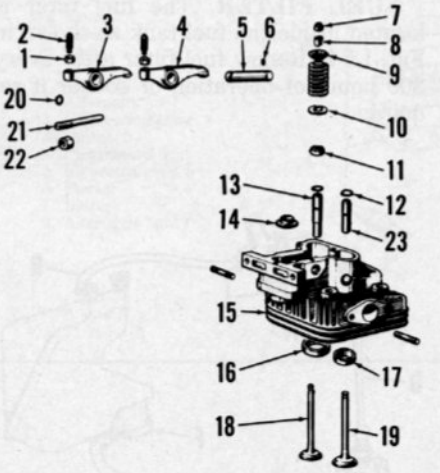


Fig. L5-5—Exploded view of cylinder head assembly.

1. Locknut
2. Adjuster
3. Intake rocker arm
4. Exhaust rocker arm
5. Rocker arm shaft
6. Set screw
7. Cap
8. Keys
9. Spring retainer
10. Washer
11. Oil seal
12. Circlip
13. Intake valve guide
14. Spring seat
15. Cylinder head
16. Intake valve seat
17. Exhaust valve seat
18. Intake valve
19. Exhaust valve
20. "O" ring
21. Rocker shaft locating pin
22. Locknut
23. Exhaust valve guide

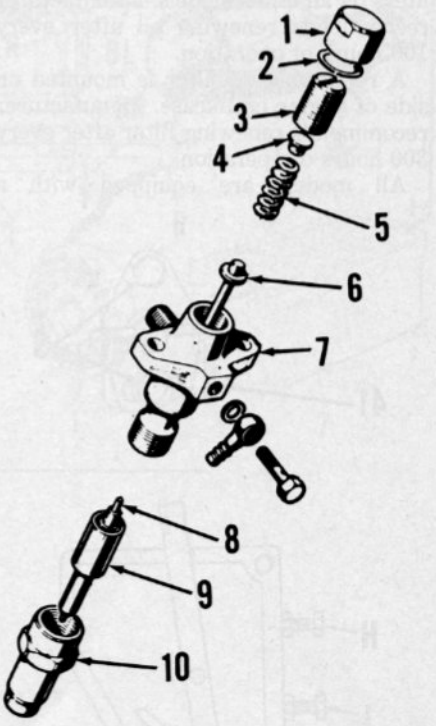


Fig. L5-6—Exploded view of injector.

1. Nut
2. Gasket
3. Adjuster
4. Spring seat
5. Spring
6. Push rod
7. Body
8. Valve
9. Nozzle
10. Nozzle nut

Cylinder head surface must not be deformed more than 0.30 mm. The cylinder head and cylinder may be lapped together to improve mating surface.

Push rod tube seals should be inspected and discarded if damaged. Push rod nearer cylinder connects to intake rocker arm while outer push rod connects to exhaust rocker arm.

Tighten cylinder head nuts to 49 N·m on Models L8, LDA450 and LDA510 or to 58.8 N·m on all other models.

INJECTOR

REMOVE AND REINSTALL. To remove injector, first clean dirt from injector, injection line, return line and cylinder head. Disconnect return and injection lines from injector and immediately cap or plug all openings. Unscrew injector retaining nuts and carefully remove injector from head being careful not to lose shims between injector and head.

Tighten injector retaining nuts to 19.6 N·m. If accessible, measure protrusion of nozzle into combustion chamber. Nozzle tip should extend 2.5-3.0 mm on Model LDA450, 3.0-3.5 mm on Models L8 and LDA510 or 3.5-4.0 mm on all other models. Adjust position of nozzle by installing 0.5 mm shims between injector and cylinder head.

TESTING. WARNING: Fuel leaves the injection nozzle with sufficient force to penetrate the skin. When testing, keep yourself clear of nozzle spray.

If a suitable test stand is available, injector operation may be checked. Only clean, approved testing oil should be used to test injector. When operating properly during test, injector nozzle will emit a buzzing sound and cut off quickly with no fluid leakage at seat.

Opening pressure with a new spring (5–Fig. L5-6) should be 21.6-22.5 MPa while opening pressure with a used spring should be 20.6-21.6 MPa. Opening pressure is adjusted by turning adjuster (3). Valve should not show leakage at orifice spray holes for 10 seconds at 19.1 MPa.

OVERHAUL. Refer to exploded view in Fig. L5-6 and disassemble injector. Thoroughly clean all parts in a suitable solvent. Clean inside orifice end of nozzle tip with a wooden cleaning stick. The orifice spray holes may be cleaned by inserting a 0.28 mm cleaning wire. When reassembling injector, make certain all components are clean and wet with clean diesel fuel oil. Tighten nozzle nut (10) to 49 N·m.

INJECTION PUMP

Refer to Fig. L5-3 for view of injection pump. Disassembly and reassembly is evident after inspection of pump and referral to Fig. L5-3. Note that slot in barrel (6) must align with pin (8). Align marks on pinion (10) and rack (9).

The following tests may be used to check injection pump if necessary test equipment is available. With a suitable pressure gage connected to delivery valve holder (1), operate pump. With control rack (18) at mid-point, pump pressure should be at least 29.4 MPa. Pump pressure should be at least 39.2 MPa with control rack in maximum fuel position. To check delivery valve, move control rack (9) to mid-point position and operate pump. After maximum pressure is reached, pressure should drop sharply to a pressure 2940-4900 kPa less than maximum pressure if delivery valve is operating properly. Maximum pump volume at a rate of 1000 pump strokes at 1500 rpm is 27 cc for Model LDA450, 31 cc for Models L8 and LDA510, 36-37 cc for Models L10 and LDA 96, and 51-53 cc for Models L14, LDA100 and LDA820.

Place shim gaskets (G–Fig. L5-2) on pump and engage control rack pin with governor arm during installation. Tighten pump retaining screws to 29.4 N·m. Refer to INJECTION PUMP TIMING section to time injection pump.

PISTON AND ROD UNIT

REMOVE AND REINSTALL. Piston and connecting rod may be removed after removing cylinder head and oil pan.

When installing piston and rod, note that depression in piston crown is closer to one side of piston. Install piston so depression side of piston is nearer exhaust. Some pistons also have an arrow embossed in piston. Install piston so arrow points toward injection pump.

Install cap on connecting rod so bearing tangs are on same side and tighten rod screws to 29.4 N·m on Models L8, LDA450 and LDA510 or 44.1 N·m on all other models.

PISTON, PIN AND RINGS

The piston is equipped with three compression rings and an oil control ring. The top compression ring is chrome plated. Compression ring end gap is 0.35-0.55 mm on Models L14, LDA100 and LDA820 or 0.30-0.45 mm for all other models. Oil control ring end gap is 0.25-0.40 mm for all models.

Refer to following table for standard piston diameter and desired piston clearance. Piston diameter is measured at bottom of skirt perpendicular to piston pin.

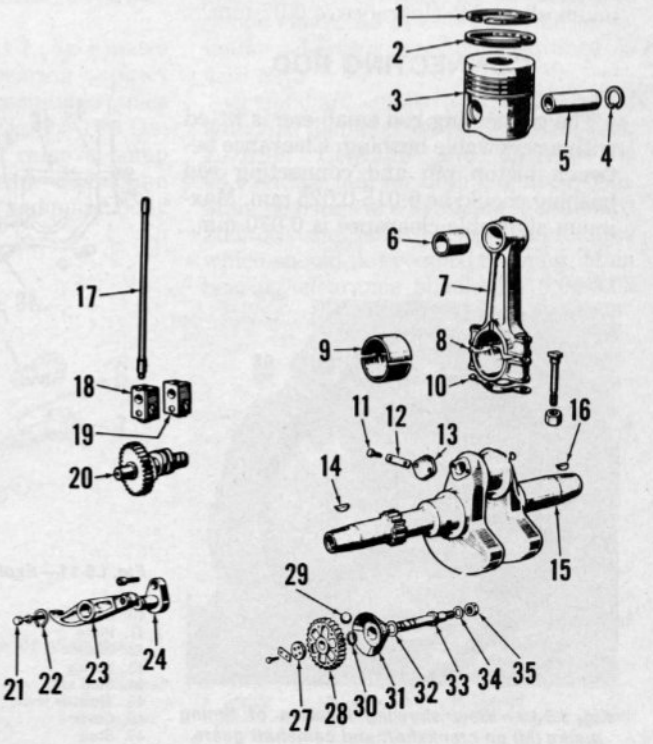


Fig. L5-7—Exploded view of crankshaft, governor and camshaft assemblies. Some models use flyweights instead of flyballs shown.

1. Compression piston rings (3)
2. Oil control ring
3. Piston
4. Snap rings
5. Piston pin
6. Bushing
7. Connecting rod
8. Rod cap
9. Rod bearing
10. Lockplate
11. Screw
12. Lockplate
13. Plate
14. Key
15. Crankshaft
16. Key
17. Push rods
18. Exhaust tappet
19. Intake tappet
20. Camshaft
21. Screw
22. Snap ring
23. Rocker arm
24. Stud
27. Plate
28. Gear
29. Governor balls (6)
30. Snap ring
31. Cup
32. Washer
33. Governor shaft
34. Washer
35. Nut

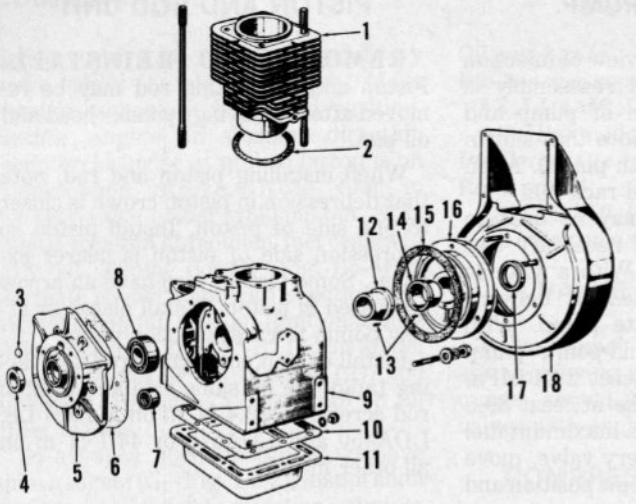


Fig. L5-8—Exploded view of crankcase.

1. Cylinder
2. Shim gasket
3. Plug
4. Seal
5. Pto bearing support
6. Gasket
7. Bearing
8. Bearing
9. Crankcase
10. Gasket
11. Oil pan
12. Main bearing
13. Dowel pins
14. Main bearing
15. Shim gasket
16. Main bearing support
17. Seal
18. Air shroud

Model	Standard Piston Dia. (mm)	Piston Clearance (mm)
L8	84.88-84.90	0.10-0.14
L10	94.85-94.87	0.13-0.17
L14	101.84-101.86	0.14-0.18
LDA96	94.85-94.87	0.13-0.17
LDA100	99.82-99.83	0.17-0.20
LDA450	84.88-84.90	0.10-0.14
LDA510	84.88-84.90	0.10-0.14
LDA820	101.84-101.86	0.14-0.18

Pistons and rings are available in standard size and oversizes of 0.5 mm and 1.0 mm.

Piston pin diameter is 22.995-23.000 mm on Models L8, LDA450 and LDA510 or 27.995-28.000 mm on all other models. Piston pin clearance in rod bushing should be 0.020-0.035 mm. Maximum allowable clearance is 0.07 mm.

CONNECTING ROD

The connecting rod small end is fitted with a renewable bushing. Clearance between piston pin and connecting rod bushing should be 0.015-0.025 mm. Maximum allowable clearance is 0.070 mm.

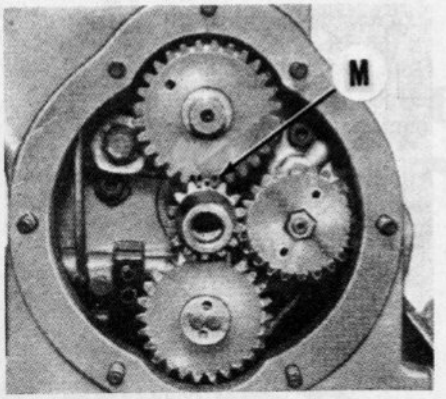


Fig. L5-10—View showing location of timing marks (M) on crankshaft and camshaft gears.

An insert type bearing is used in connecting rod big end. Desired rod bearing clearance is 0.03-0.06 mm for Models L8, LDA450 and LDA510 or 0.05-0.06 mm for all other models. Maximum allowable clearance for all models is 0.1 mm. Big end bearings are available in standard and undersizes.

CYLINDER

All models are equipped with a removable cylinder. Standard cylinder diameter is 85.00-85.02 mm for Models L8, LDA450 and LDA510, 95.00-95.02 mm for Models L10 and LDA96, 100.00-100.02 mm for Model LDA100, and 102.00-102.02 mm for Models L14 and LDA820. Maximum allowable taper or out-of-round is 0.1 mm.

With piston at top dead center, top of piston should be 0.9-1.0 mm below cylinder top edge. Cylinder height is adjusted by varying shim gaskets (2–Fig. L5-8).

TIMING GEARS

Gears are accessible after removing pto bearing support (5–Fig. L5-8). Crankshaft and camshaft gears are embossed with marks (M–Fig. L5-10) which should be aligned as shown. If crankshaft and camshaft gears are not marked, proceed as follows: If not previously removed, remove cylinder head, push rod tube and push rods. Position crankshaft so piston is at top dead center. Intake valve tappet (nearer cylinder) should be opening (rising) and exhaust valve tappet should be closing (going down). Valve tappets should be same height above crankcase when piston is at top dead center. If not, refer to CAMSHAFT section and remove camshaft, then install camshaft so it is correctly timed with crankshaft. Mark crankshaft and camshaft gears for future reference.

CAMSHAFT, TAPPETS AND PUSH RODS

REMOVE AND REINSTALL. To remove camshaft, remove cylinder head, push rod tube, push rods, valve tappets and fuel injection pump. Remove pto bearing support (5–Fig. L5-8) and withdraw camshaft.

Inspect camshaft for excessive wear

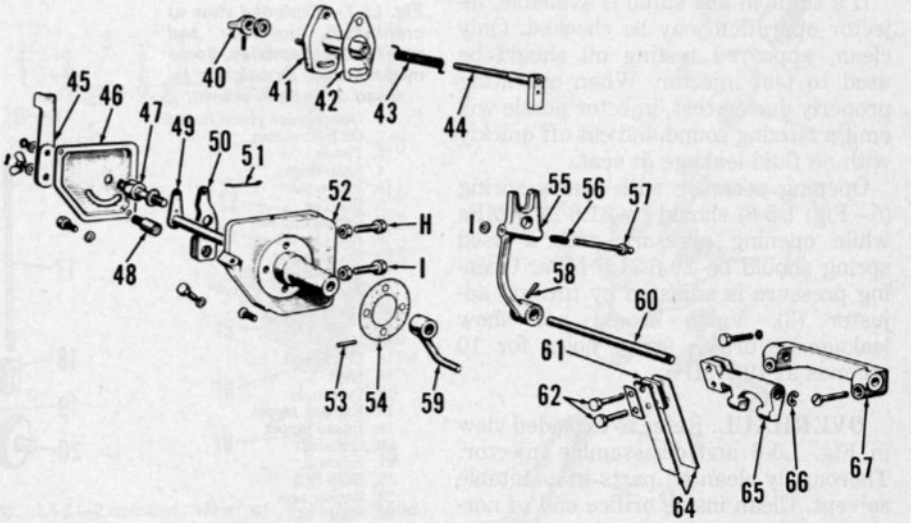


Fig. L5-11—Exploded view of governor and control linkage. Governor fork (65) contacts governor cup (31—Fig. L5-7).

40. Stop knob
41. Plate
42. Gasket
43. Spring
44. Stop arm
45. Throttle lever
46. Cover
47. Stud
48. Pivot screw
49. Arm
50. Lever
51. Link
52. Housing
53. Pin
54. Gasket
55. Arm
56. Spring
57. Torque control rod
58. Pin
59. Arm
60. Shaft
61. Spacer
62. Screws
64. Spring plates
65. Fork
66. "E" ring
67. Bracket
I. Low idle speed screw
H. High speed screw

and damage. Diameter of both camshaft bearing journals is 17.96-17.98 mm. Height of injection pump lobe (lobe nearest gear) should be 33.45-33.55 mm while lobe height for intake and exhaust should be 33.95-34.05 mm.

Reassembly is reverse of disassembly. Refer to TIMING GEARS section to time camshaft and crankshaft. Note that tappets have roller offset to one side and a notched sliding surface on the opposite side. Install tappets so sliding surfaces are together and rollers are on opposite sides. The push rods are contained in a tube and must cross between tappets and rocker arms. Push rod nearer cylinder connects intake tappet and rocker arm while outer push rod connects exhaust cam follower and rocker arm.

GOVERNOR

Most models are equipped with a flyball type governor while some models may be equipped with flyweights. The governor shaft is shown in Fig. L5-7 while governor linkage is shown in Fig. L5-11. The flyball assembly (G–Fig. L5-12) is rotated by the crankshaft. The crankshaft rotates flyball assembly (G–Fig. L5-12) which bears against fork (65–Fig. L5-11). As the flyballs move, the shaft attached to the fork is rotated thereby moving governor arm (55). Arm (55) mates with fuel injection control rack pin to regulate fuel flow. Throttle lever (45) operates through governor spring plates (64) to control engine speed. One spring plate is used on Models L8, L10 and L14, two spring plates are used on Models LDA96, LDA100 and LDA820, and three spring plates are used on Models LDA450 and LDA510.

To stop engine, stop knob (40) is turned counterclockwise which forces governor arm to move fuel injection pump control rack to no-fuel position. All models except L8, L10 and L14 are equipped with a torque control rod (57) and spring (56) which allows the governor arm (59) additional movement for additional fuel usage under high torque load. By pulling stop knob (40) away from engine, stop arm (44) will slide off tip of torque control rod (57) and allow governor arm to move forward so maximum fuel is delivered during starting.

Governor mechanism is accessible after removing pto bearing support (5–Fig. L5-8), however, the oil pan must be removed for access to nut (35–Fig. L5-7) so governor shaft can be withdrawn from crankcase. Inspect governor components and renew any which are damaged or excessively worn. Mechanism must move freely for proper governor operation.

To adjust governor, pto bearing support (5–Fig. L5-8) and gasket must be removed. Move throttle lever (45–Fig. L5-11) to full throttle position. Loosen spring plate screws (62) then move governor arm (55) towards crankcase opening and measure distance from pto bearing support mating surface of crankcase to upper part of governor arm. Distance between crankcase surface and governor arm should be 22 mm on Models L8, LDA450 and LDA510 or 28 mm on all other models. Retighten spring plate screws (62).

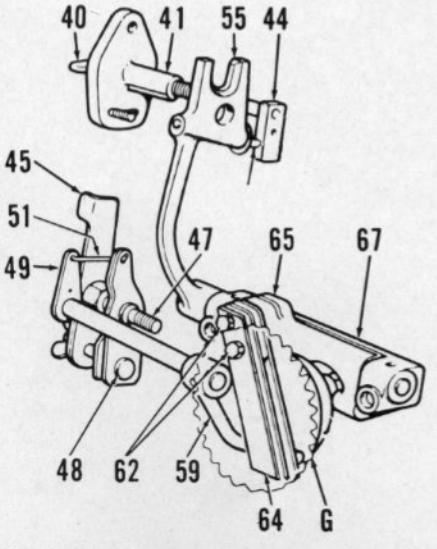


Fig. L5-12–Diagram of governor mechanism. Refer to text and Fig. L5-11 for parts identification.

OIL PUMP AND RELIEF VALVE

R&R AND OVERHAUL. To remove oil pump, remove pto bearing support (5–Fig. L5-8) and using a suitable puller remove pump gear (3–Fig. L5-13). Unscrew pump screws and remove pump from crankcase bulkhead. Maximum clearance between gears and pump body should not exceed 0.15 mm. Maximum clearance between ends of gears and mounting surface of pump body is 0.15 mm.

Apply a thin coating of sealer to mounting surface of pump body. Install pump and tighten mounting screws to 39.2 N·m. Tighten oil pump gear nut to 19.6 N·m. Install timing gear cover.

The oil pressure relief valve is located on inner face of main bearing support (16–Fig. L5-14). To remove main bearing support, remove crankshaft pulley or crank starter, flywheel and shroud. Unscrew retaining nuts and remove main bearing support. Inspect pressure relief valve components and renew if damaged or excessively worn. Reinstall relief valve by reversing disassembly procedure.

Normal oil pressure with warm oil is 49-98 kPa at idle and 245-392 kPa at full throttle.

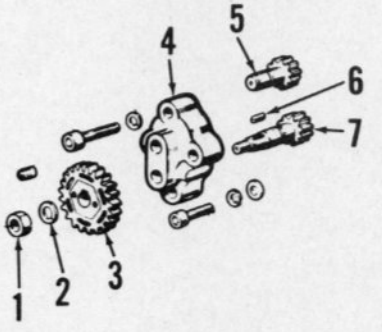


Fig. L5-13–Exploded view of oil pump.

1. Nut
2. Lockwasher
3. Gear
4. Pump body
5. Driven gear
6. Key
7. Drive gear

CRANKSHAFT AND BEARINGS

R&R AND OVERHAUL. Remove crankshaft pulley or crank starter then remove flywheel. Remove piston and connecting rod as previously outlined. Remove pto bearing support (5–Fig. L5-8) and air shroud (18). Remove main bearing support (16) and withdraw crankshaft from crankcase.

Crankshaft main bearing journal standard diameter on Models L8, LDA450 and LDA510 is 41.99-42.00 mm for pto end and 39.99-40.00 mm for flywheel end. Main bearings (12 and 14) on Models L8, LDA450 and LDA510 are available in standard and 1.0 mm undersizes. Main bearings must be reamed to obtain clearance of 0.04-0.06 mm. Maximum allowable bearing clearance is 0.10 mm.

Crankshaft main bearing journal standard diameter on Models L10, L14, LDA96, LDA100 and LDA820 is 44.99-45.00 mm for both main bearings. Main bearings are available in standard and 0.5 mm and 1.0 mm undersizes which should not require reaming. Main bearing clearance should be 0.06-0.08

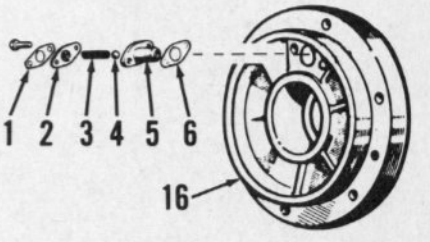


Fig. L5-14–Exploded view of oil pressure relief valve.

1. Lockplate
2. Cover
3. Spring
4. Ball
5. Body
6. Gasket
16. Main bearing support

mm with a maximum allowable clearance of 0.10 mm.

Reverse disassembly procedure to install crankshaft. Crankshaft end play should be 0.10-0.30 mm and is adjusted by varying thickness of gasket (15 – Fig. L5-8). Tighten main bearing support nuts to 29.4 N·m on Models L8, LDA450 and LDA510 or to 39.2 N·m on all other models.

MANUAL CRANK STARTER

Models L8, L10 and L14 are equipped with a crank type manual starter as shown in Fig. L5-15. Starter repair is evident after inspection of unit.

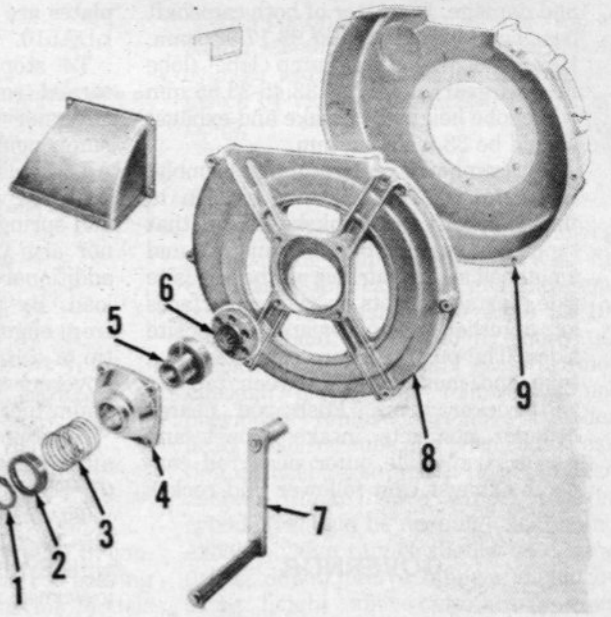


Fig. L5-15 – Exploded view of manual crank starter used on Models L8, L10 and L14.

1. Snap ring
2. Cap
3. Spring
4. Flange
5. Ring gear
6. Pinion
7. Crank
8. Cover
9. Case

HOMELITE TEXTRON

Homelite Division of Textron Inc.