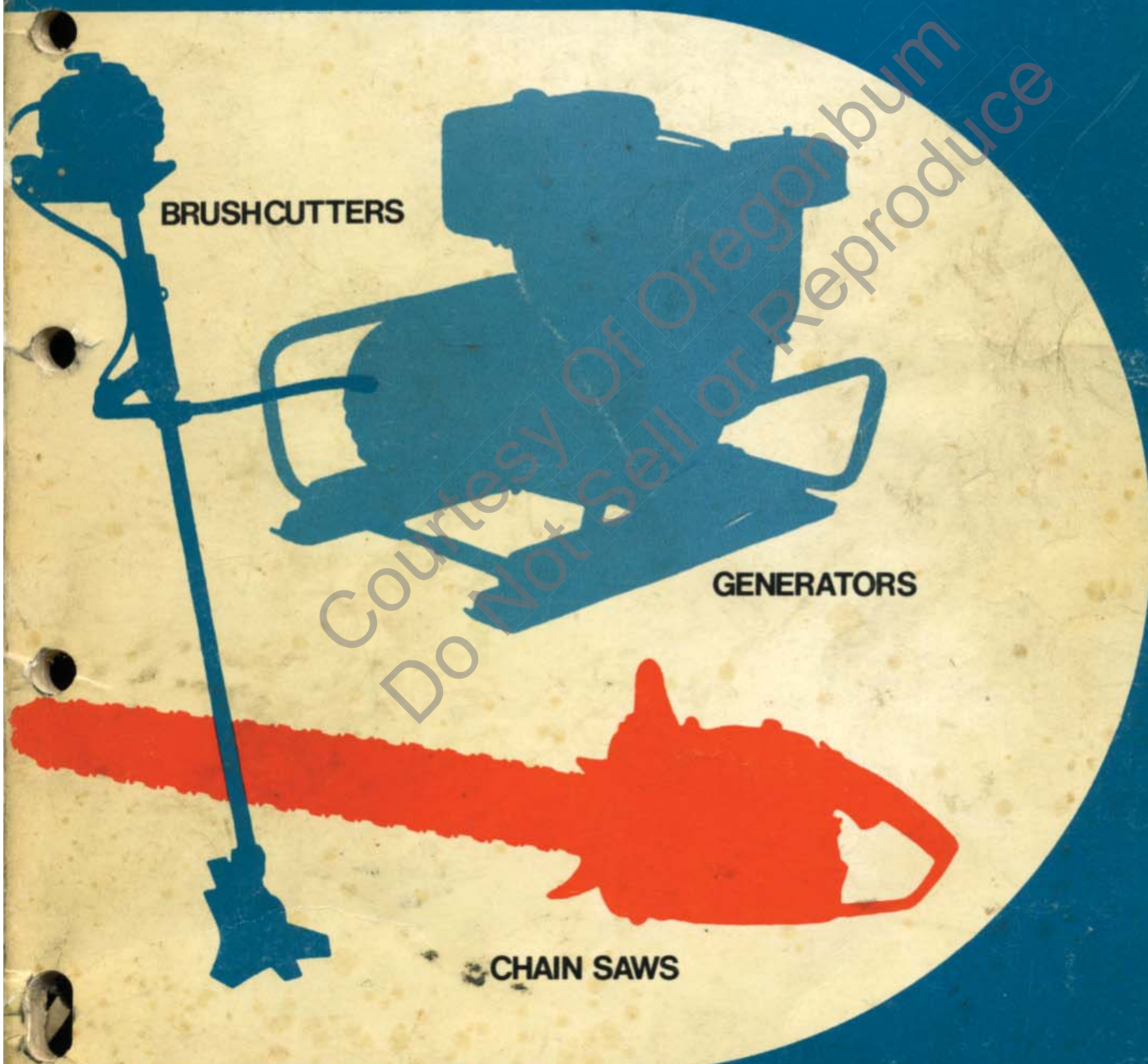
HOMELITE®

SHOP SERVICE MANUAL



FOURTH EDITION

HOMELITE®
SHOP SERVICE MANUAL
(FOURTH EDITION)
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HOMELITE®

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

FUNDAMENTAL SECTION

ENGINE DESIGN

OPERATING PRINCIPLES

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

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

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

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

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

1. The mixture of fuel and air is pushed or drawn into the cylinder, by reducing cylinder pressure to less than the outside pressure, or by applying an initial, higher pressure to the fuel charge.
2. The mixture is compressed, or reduced in volume.
3. The mixture is ignited by a timed electric spark.
4. The burning fuel-air mixture expands, forcing the piston down, thus converting the generated chemical energy into mechanical power.
5. The burned gases are exhausted from the cylinder so that a new cycle can begin.

The series of events comprising the work cycle are commonly referred to as INTAKE, COMPRESSION, IGNITION, EXPANSION (POWER), and EXHAUST.

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

Fig. CS1 shows a schematic view of the crankcase scavenged, reed valve type, two-stroke cycle engine commonly used. The general sequence of events required for operation is as follows: As the piston moves outward from the crankshaft as shown in view "B", the volume of the closed crankcase is enlarged and the pressure lowered, causing air to be drawn through the carburetor (C), where it is mixed with fuel. This mixture is then drawn through the reed valve (R) and into the crankcase. At the same time, a previous charge of fuel is being compressed between head of piston and closed end of cylinder as shown by the darkened area. As the piston approaches top center, a timed spark ignites the compressed fuel charge and the resultant expansion moves the piston downward on the power stroke. The reed valve (R) closes, and downward movement of piston compresses the next fuel charge in the crankcase as shown in view "A". When the piston nears the bottom of its stroke, the crown of piston uncovers the exhaust port (EX) in cylinder wall, allowing the combustion products and remaining pressure to escape as shown by the wavy arrow. Further downward movement of piston opens the transfer port (TP) leading from the crankcase to cylinder; and the then higher crankcase pressure forces the compressed fuel-air mixture through transfer port into the cylinder. The incoming fuel mixture from the transfer ports displaces exhaust gases in the cylinder, and most of the remaining exhaust gases are driven from the combustion chamber by this fresh charge. Two-stroke cycle, crankcase scavenged engines are sometimes produced with a fuel induction system other than the inlet reed valve. The two induction systems used in chain saw engines in addition to the reed valve are the three-port system illustrated in Fig. CS2 and the rotary valve system illustrated in Fig. CS3.

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

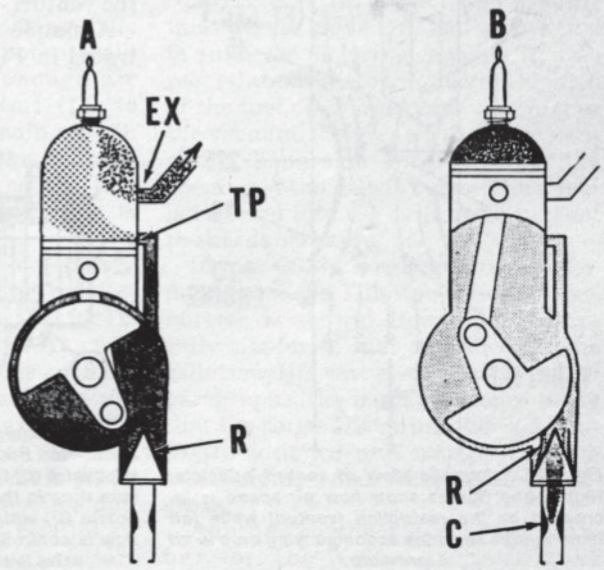


Fig. CS1–Schematic view of two-stroke cycle, crankcase scavenged engine used in most chain saws. The series of events comprising the Otto cycle takes place in one revolution of the crankshaft by using the crankcase as a scavenging pump.

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

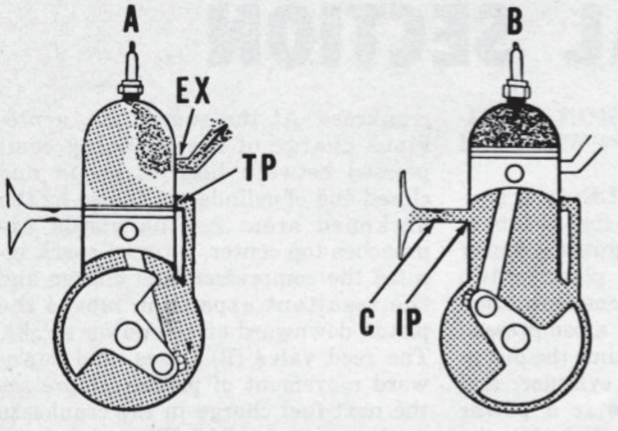


Fig. CS2–Two stroke, three port engine. Principles are similar to reed valve or rotary valve types except that a third, intake port is located in cylinder wall and opened and closed by the piston skirt.

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

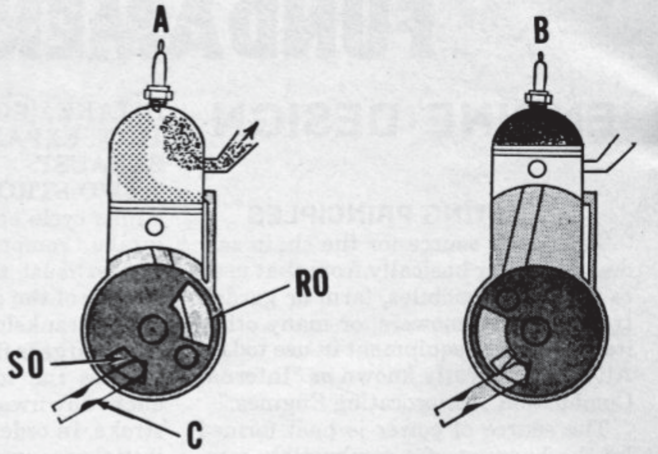


Fig. CS3–Two stroke, rotary valve engine. The incoming fuel charge is controlled by a rotary valve attached to the crankshaft. The opening in valve (RO) and crankcase (SO) align at the proper time to admit a fresh charge, then close to allow initial crankcase compression.

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

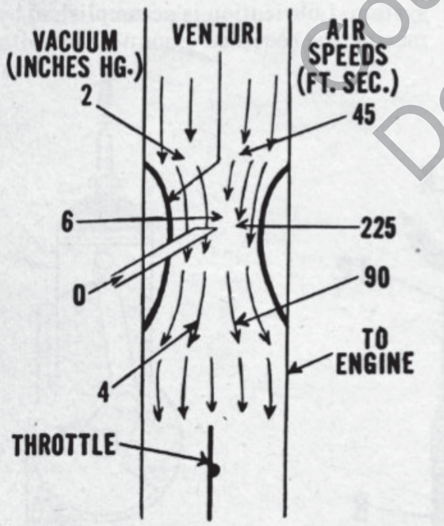


Fig. CS5–Schematic view of venturi principle. Right hand figures show how air speed is increased by the restriction (venturi) while left hand figures show the accompanying drop in air pressure.

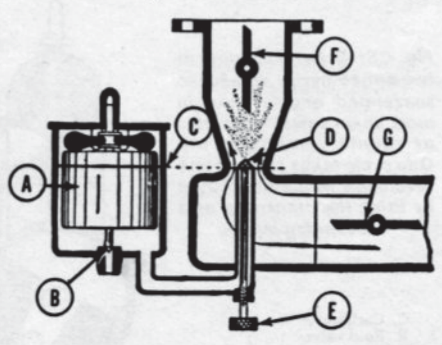


Fig. CS6–Schematic view of simple float-type carburetor. Buoyancy of float (A) closes the fuel inlet valve (B) to maintain fuel level at (C). Pressure drop in the venturi causes fuel to flow out nozzle (D) which is just above fuel level. Fuel flow is controlled by mixture valve (E). Throttle valve is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

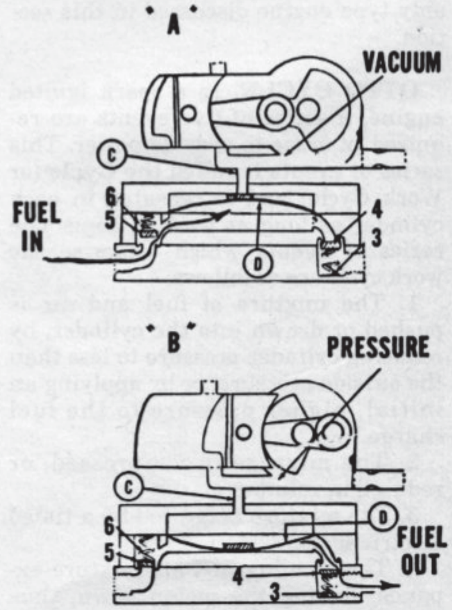


Fig. CS7–Schematic view of a typical, crankcase operated, diaphragm type fuel pump. Pressure and vacuum pulsations from crankcase pass through connection (C) to rear of diaphragm (D) which induces a pumping action on fuel line as shown.

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

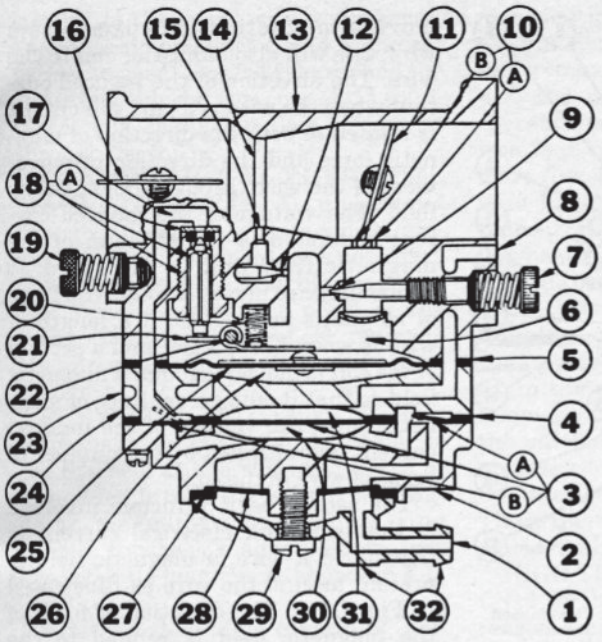


Fig. CS8–Cross-sectional schematic view of Tillotson series HL diaphragm carburetor. Some models of this type carburetor are equipped with an accelerator pump.

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

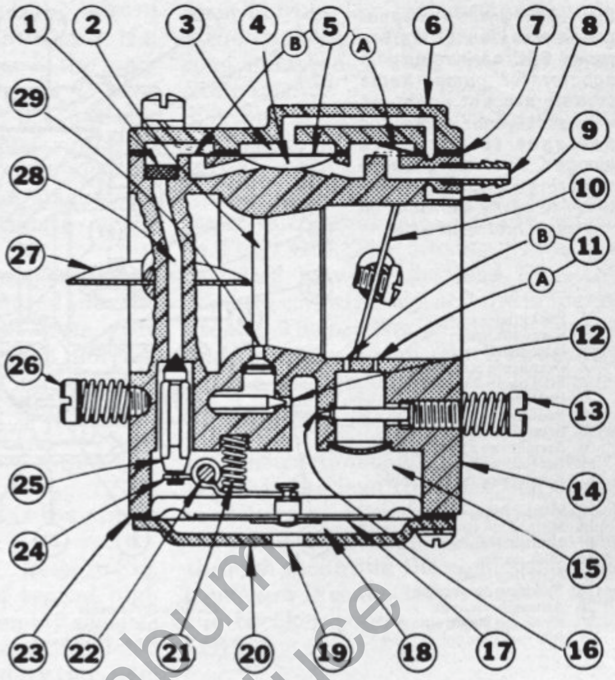


Fig. CS8A–Cross-sectional view of typical Series HS Tillotson diaphragm type carburetor.

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.

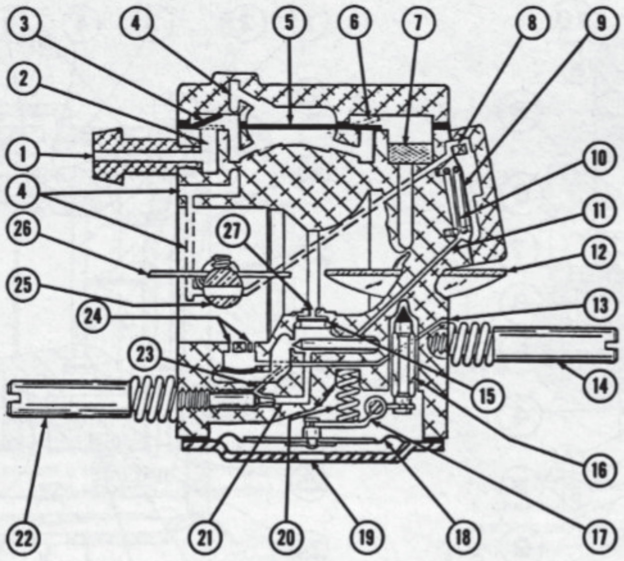
As the throttle disc is opened, enough vacuum is created on the secondary idle jet port (10B) so that fuel is drawn through that port also. At a certain point, the throttle disc is open far enough so that the velocity of air passing through the venturi is sufficient to lower the pressure at the main 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.

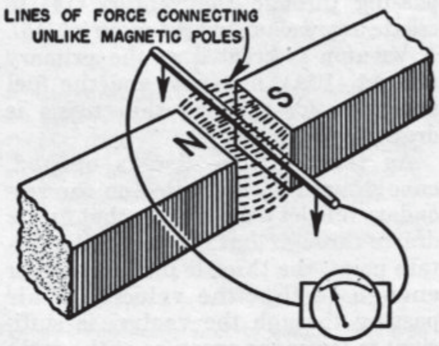


Fig. CS10–When a wire (conductor) is moved through a magnetic field across lines of magnetic force, an electro-motive force is induced into the wire. If the wire is a part of an electrical circuit, current will flow in the circuit as shown.

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.

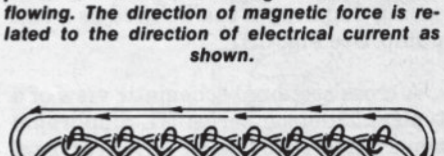


Fig. CS12–When a wire carrying an electrical current is wound in the shape of a coil or helix, the magnetic field surrounding loops of the wire tend to converge into a single electro-magnetic field as shown. If the loops of the coil are wound closely together, there is very little tendency for the electro-magnetic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

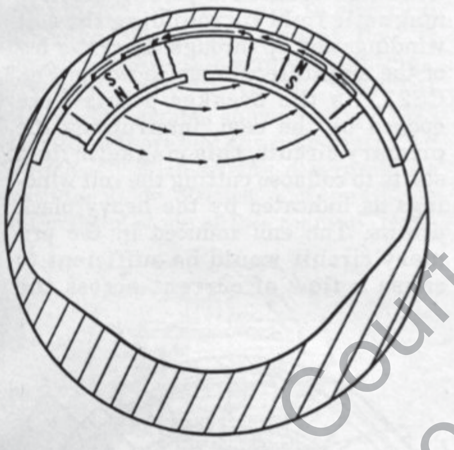


Fig. CS13–Cut-away of typical flywheel used for magneto rotor. The permanent magnets are usually cast into the flywheel. For flywheel magnetos having the ignition coil and core mounted to outside of flywheel, magnets would be flush with outer diameter of flywheel.

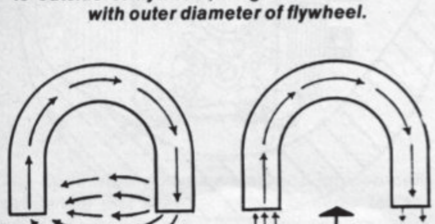


Fig. CS14–Drawing showing function of magneto armature core. At left, lines of force of permanent magnet are dispersed in the air. When a soft iron bar, which is an excellent conductor of magnetism, is moved close to the magnetic poles, the magnetic field becomes concentrated in the bar.

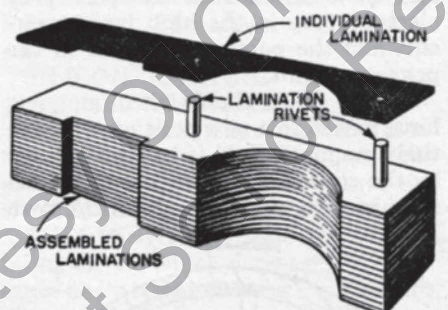


Fig. CS15–To prevent stray electrical currents (eddy currents) from building up within armature core and creating opposing magnetic fields that would decrease efficiency of magneto, armature core is constructed of thin plates (laminations) that are insulated from each other. (Oxide on surfaces of laminations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

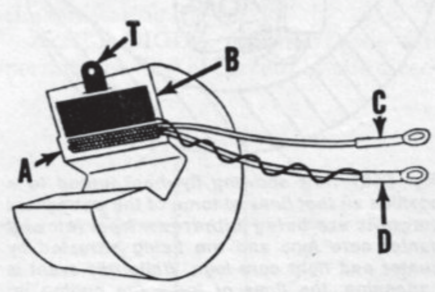


Fig. CS16–Cross-sectional view of a typical high tension coil. Primary windings (A) consist of 100-200 turns of copper wire. Secondary windings consist of about 10,000 turns of very fine wire. Lead (C) is to insulated terminal of breaker points. Lead (D) is to ground. Spark plug (high tension wire) attaches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

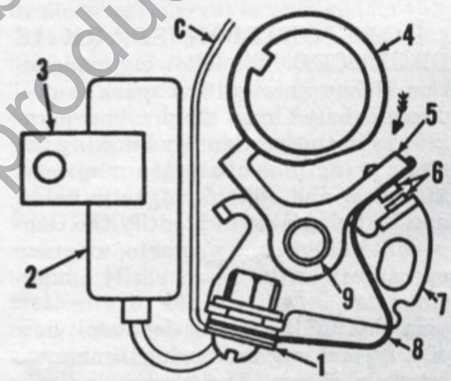


Fig. CS17–Typical flywheel magneto breaker point unit. Cam (4) is driven by engine crankshaft. Breaker arm spring (8) connects insulated contact point on breaker arm (5) to terminal (1).

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

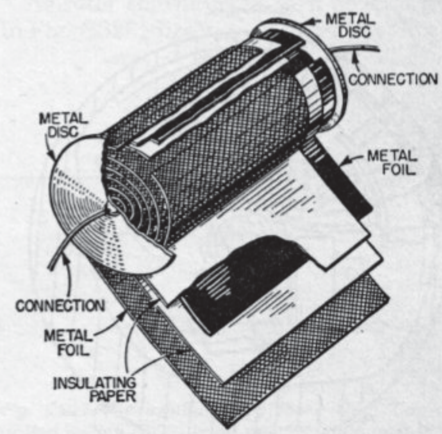


Fig. CS18–View showing construction of typical condenser. One connection is usually made to the metal housing of the condenser and is grounded to the magneto base plate through the condenser mounting strap (3–Fig. CS17).

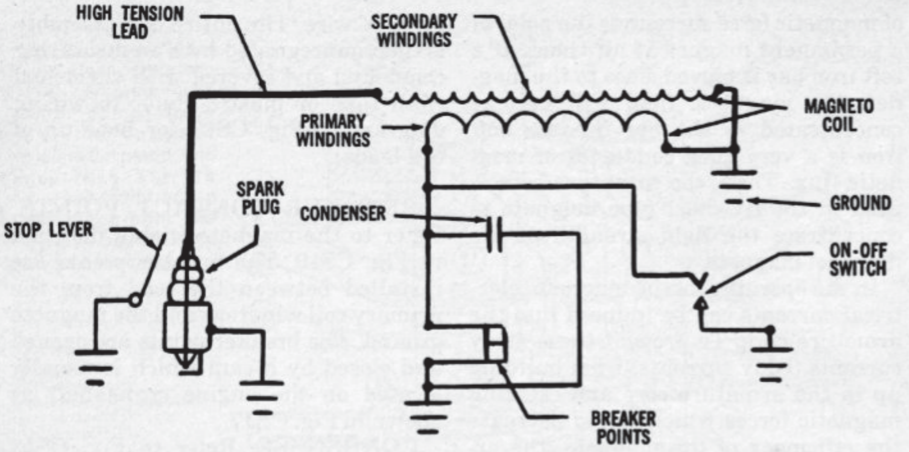


Fig. CS19–Typical wiring diagram for conventional flywheel type magneto. An on-off switch to stop the engine may be attached to the magneto primary circuit to ground out the system, or a stop lever may be used to ground out the center electrode of the spark plug.

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

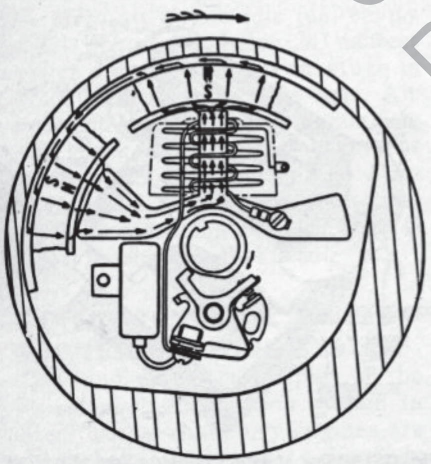


Fig. CS20–View showing flywheel turned to a position so that lines of force of the permanent magnets are concentrated in the left and center core legs and are interlocking the coil windings.

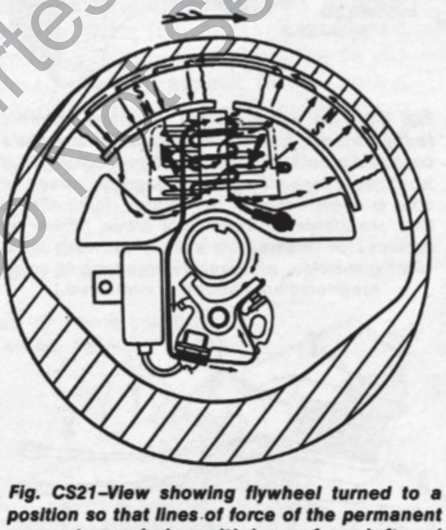


Fig. CS21–View showing flywheel turned to a position so that lines of force of the permanent magnets are being withdrawn from left and center core legs and are being attracted by center and right core legs. While this event is happening, the lines of force are cutting up through the coil windings section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

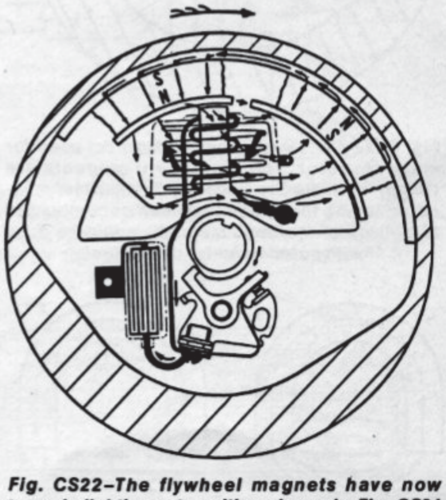


Fig. CS22–The flywheel magnets have now turned slightly past position shown in Fig. CS21 and rate of movement of lines of magnetic force cutting through coil windings is at maximum. At this instant, the breaker points are opened by the cam and flow of current in primary circuit is being absorbed by the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

Solid State (Breakerless) Magneto Ignition System

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

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

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

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

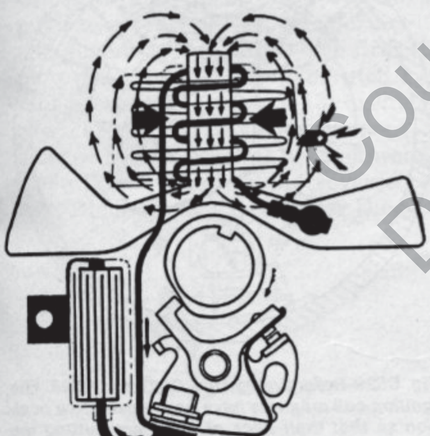


Fig. CS23–View showing magneto ignition coil, condenser and breaker points at same instant as illustrated in Fig. CS22; however, arrows shown above illustrate lines of force of the electro-magnetic field established by current in primary coil windings rather than the lines of force of the permanent magnets.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

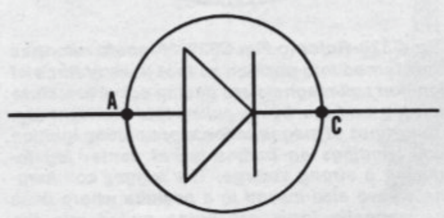


Fig. CS24–In a diagram of an electrical circuit, the diode is represented by the symbol shown above. The diode will allow current to flow in one direction only (from anode "A" to cathode "C" terminal of diode).

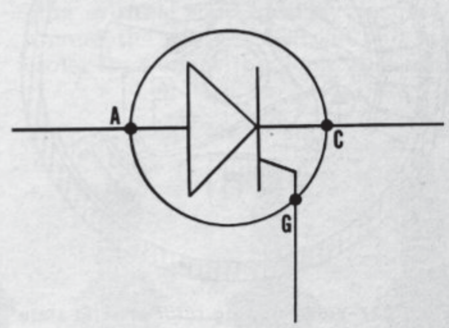


Fig. CS25–The symbol used for a Gate Controlled Switch (GCS) in an electrical diagram is shown above. The GCS will allow current to flow from anode (A) terminal to cathode (C) terminal when "turned on" by a positive electrical charge at gate (G) terminal. A negative electrical charge at gate (G) terminal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

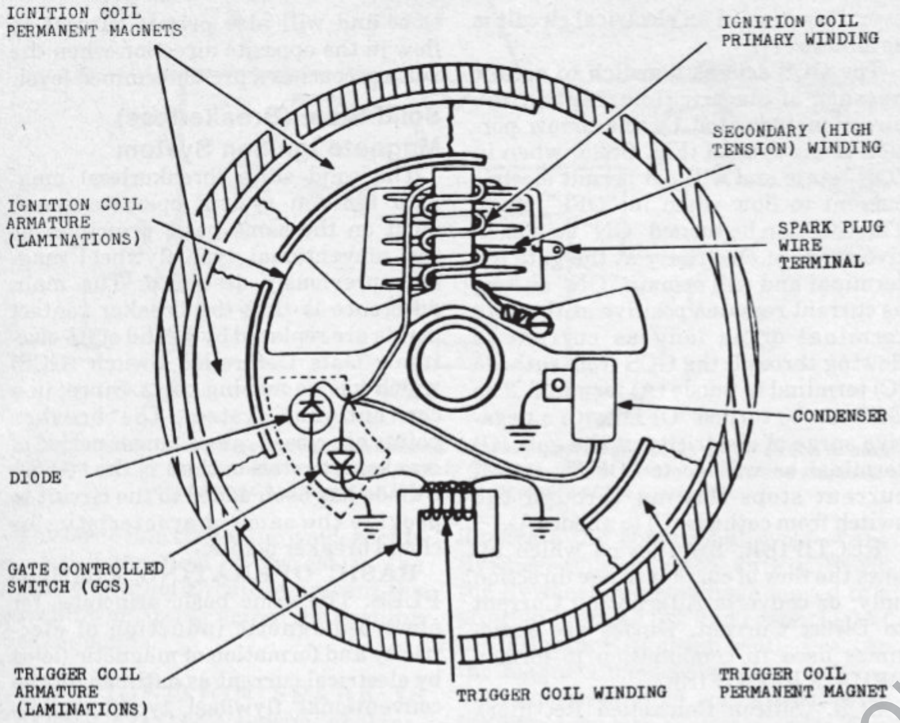


Fig. CS26–Schematic diagram of solid state (breakerless) flywheel magneto. The diagram is drawn to follow the schematic drawings of a conventional type magneto as shown in Figs. CS20, CS21, CS22 and CS23. Refer to Figs. CS24 and CS25 for diode and Gate Controlled Switch (GCS) symbols. Refer to Figs.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

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

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

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-

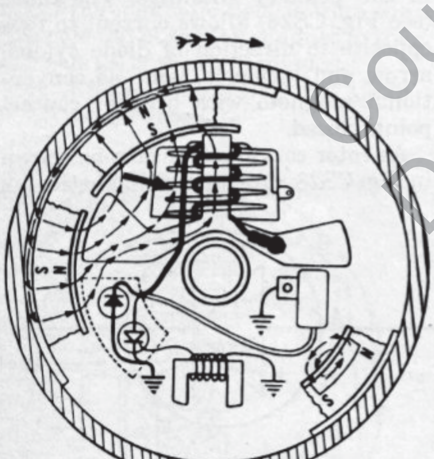


Fig. CS27–View showing rotor of solid state magneto at instant in rotation where lines of force of ignition coil magnets are being drawn into left and center legs of magneto armature. The diode (see Fig. CS24) acts as a closed set of breaker points in completing the primary ignition circuit at this time,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

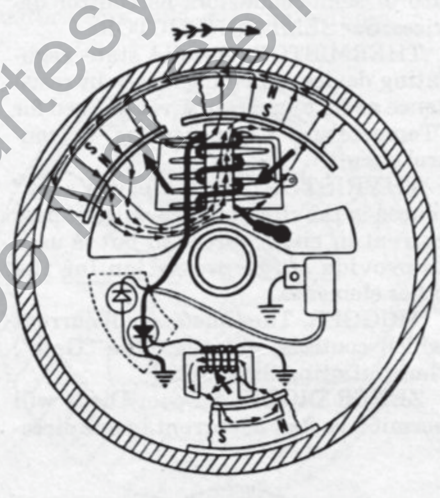


Fig. CS28–Refer to Fig. CS27. Magneto rotor has now turned into position so that lines of force of ignition coil magnets are pulling out of armature left leg and are being pulled into the right leg. Thus, lines of magnetic force are cutting ignition coil windings on both sides of center leg inducing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

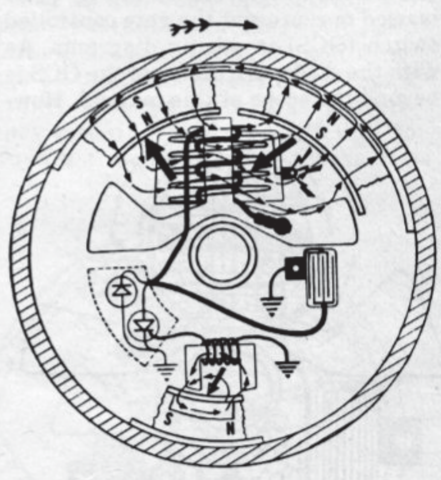


Fig. CS29–Refer first to Figs. CS27 and CS28. The ignition coil magnets have now moved to a position so that their lines of force are cutting the ignition coil windings at a maximum rate. At this same instant, movement of the trigger coil magnets is pulling lines of force away from the trigger coil armature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

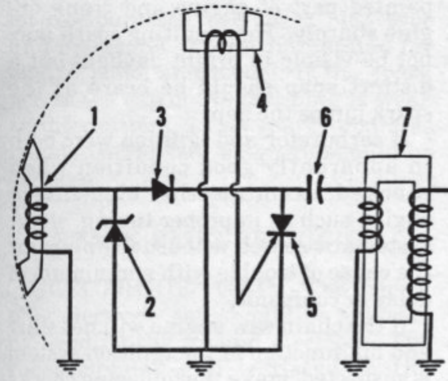


Fig. CS30–Schematic diagram of a simple Capacitor Discharge "Solid State" ignition system.

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-

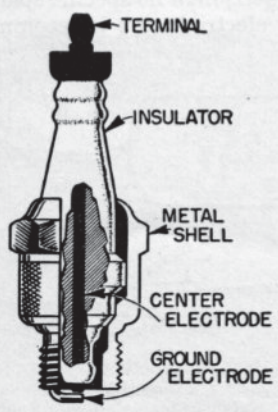


Fig. CS31–Cross sectional view of spark plug showing construction and nomenclature.

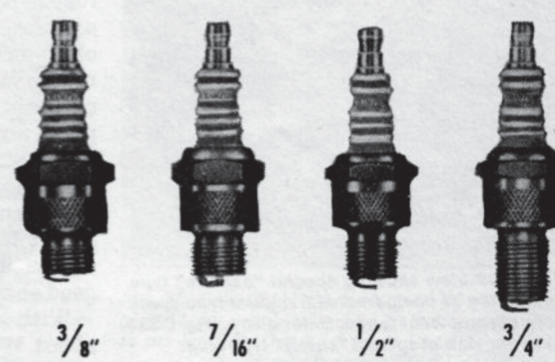


Fig. CS32–Various "reaches" of plugs available. Chain saw engines normally use a ⅜-inch reach spark plug. A ⅜-inch reach plug measures ⅜-inch from firing end of shell to gasket surface of shell.

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.

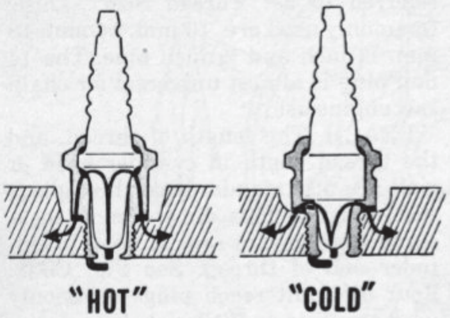


Fig. CS33–Spark plug tip temperature is controlled by the length of the path heat must travel to reach the cooling surface of the engine cylinder head.

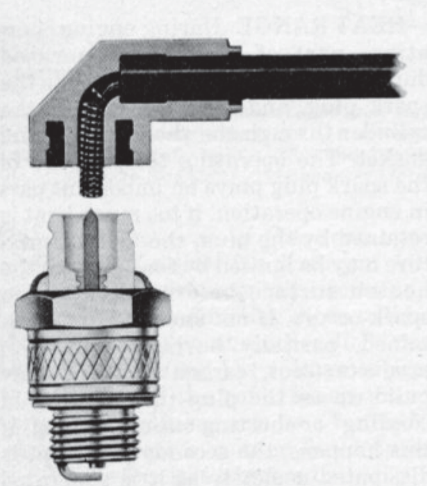


Fig. CS34–Cut-away view of special "shorty" type spark plug and terminal available for chain saw engines. Refer to Fig. CS35 for a second type special plug.

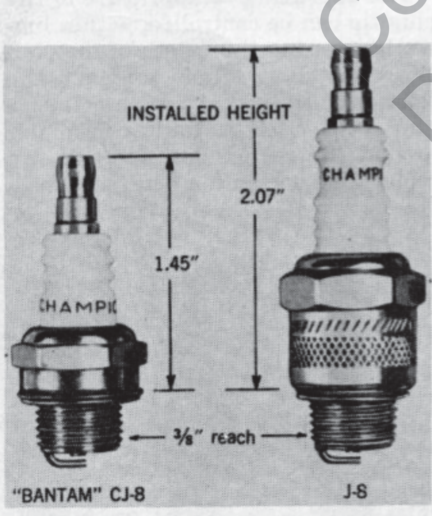


Fig. CS35–View showing special "bantam" type spark plug as compared with regular type spark plug of same heat range. Refer also to Fig. CS34 for view of special "shorty" type plug.

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.

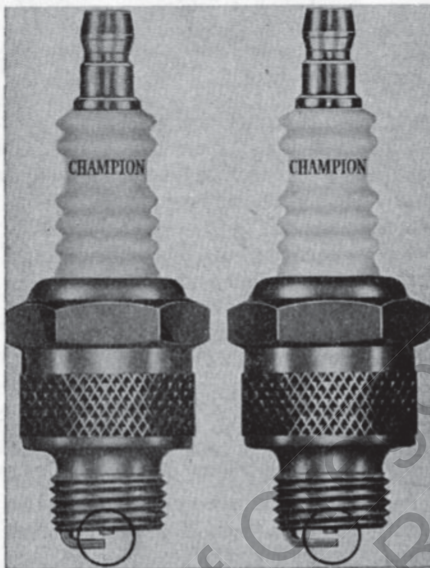


Fig. CS36–The two stroke (left) differs from conventional plug in that the grounded electrode is shortened to minimize carbon fouling.

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

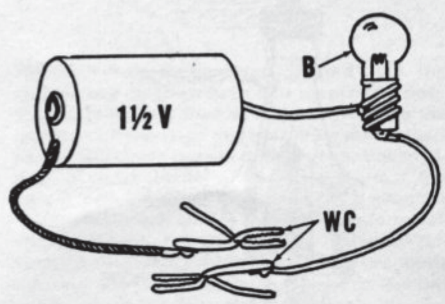


Fig. S1–A static timing light can be made from a flashlight battery, a bulb (B), two wire clips (WC) and short pieces of insulated wire. Bulb should light when clips are touched together. Refer to Fig. S2.

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.

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

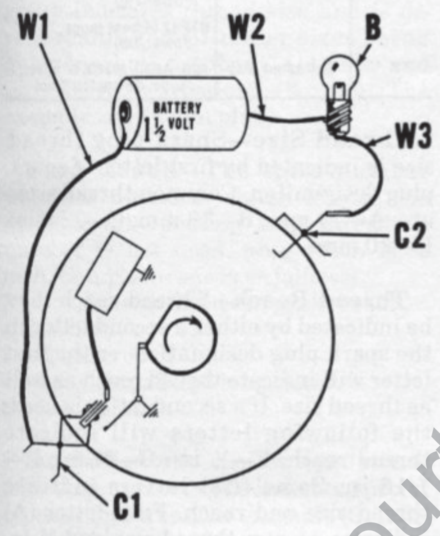


Fig. S2–When connecting timing light (see Fig. S1), first disconnect primary coil wire from breaker point terminal, then connect one wire clip (C1) to terminal and other clip (C2) to magneto back plate or engine. Bulb should be out when points are open and light when points close.

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

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

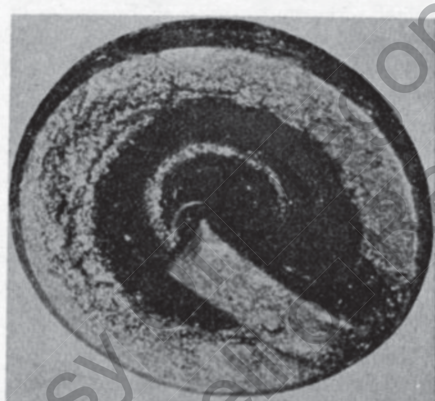


Fig S4–Damp or wet black carbon coating over entire firing end of plug. Could be caused by rich carburetor mixture, too much oil in fuel, or low ignition voltage. Could also be caused by incorrect heat range (too cold) for operating conditions. Correct the defects or install a hotter plug.

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

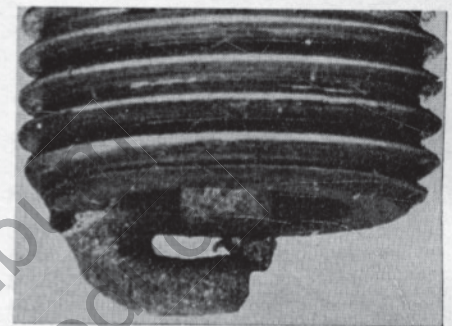


Fig. S6–Gap bridging. Usually results from the same causes outlined in Fig. S5.

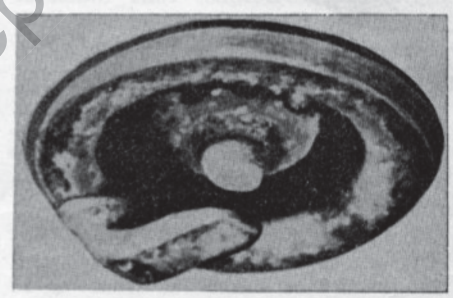


Fig. S7–Electrodes badly eroded, deposits white or light gray and gritty. Insulator has "blistered" appearance. Could be caused by lean carburetor mixture, fast timing, overloading, or air intake screen and engine cooling fins blocked with sawdust or other debris. Could also be caused by incorrect heat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

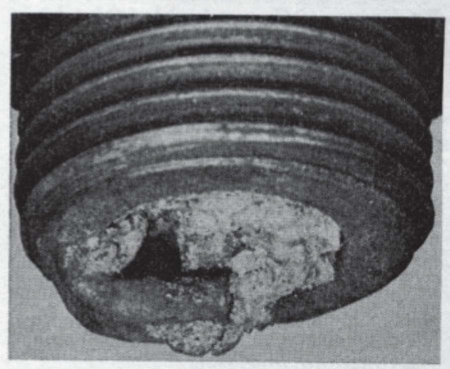
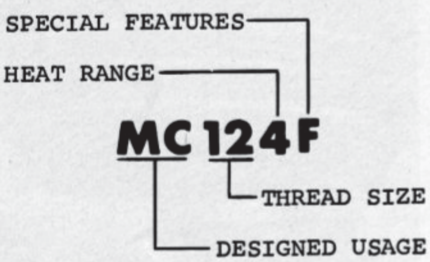


Fig. S8–Gray metallic aluminum deposits on plug. (Seldom encountered.) Piston damage due to pre-ignition. Overhaul engine and determine cause of pre-ignition.

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

AC SPARK PLUGS



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

2—½ inch thread
4—14mm thread
7—⅞ inch thread
8—18mm thread
10—10mm thread
12—12mm thread

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

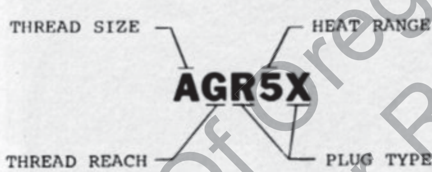
Suffix Letters—A letter (or letters) after the number indicates special features. The "F" in pictured example indicates that plug is "Special Reach for Foreign Applications".

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

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

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

AUTOLITE SPARK PLUGS



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

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

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

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

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

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

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

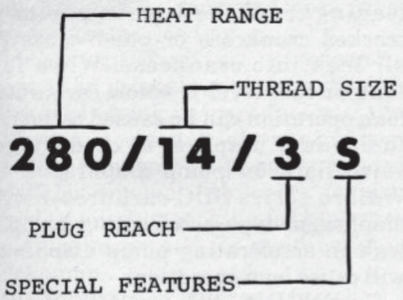
Thread Reach—Thread reach may be indicated by either a second letter in the spark plug designation, or the first letter will indicate thread reach as well as thread size. If a second letter is used, the following letters will indicate thread reach: E—½ in.; G—¾ in.; L—7/16 in. Some first letters indicate thread size and reach. First letter (A) indicates 14 mm thread size and ⅜ in. thread reach. First letter (B) indicates an 18 mm thread size and ½ in. thread reach.

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

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

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

BERU SPARK PLUGS



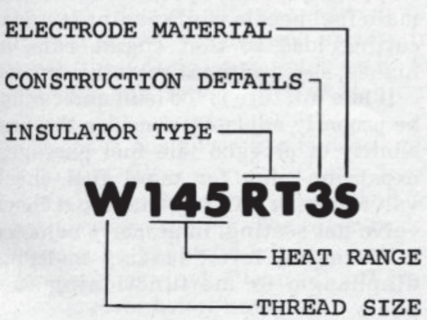
Heat Range—The first number group indicates heat range. The hottest available plug is coded "20" and the coldest available plug "400". Readily available (stocked) plugs are within the range "95" to "280", placing the example at the cold end of the commercial scale.

Thread Size—The second number group indicates thread size and is direct reading, millimeter sizes being given in whole number (14, 18 etc) and inch sizes in fractions (⅞, etc). The example is a 14 mm plug.

Plug Reach—The third number indicates thread or shank length, the example (3) denoting long thread. If number is not used, plug reach is ½ inch. Complete code is as follows:
2—Long shank (between gasket seat and hex)
3—¾ inch reach
4—Long thread and long shank
5—⅜ inch reach

Suffix Letters—Letter (or letters) following number code indicate special types or features. The example (S) indicates silver electrode.
A—Extended tip
AM—Short plug
HGF—Wide heat range
K—Tapered seat
P—Platinum electrode
S—Silver electrode
UK—Low profile (chainsaw type)

BOSCH SPARK PLUGS



Thread Size—The first letter (or letters) indicates thread size and general plug type. The example "W" is 14mm plug.
U—10mm plug
X—12mm plug
W—14mm plug
M—18mm plug
Z—⅞ inch plug

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

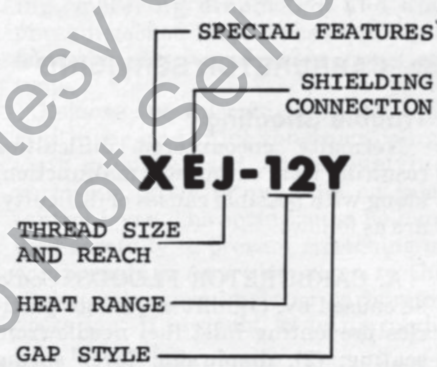
Heat Range—The number indicates plug heat range, 20 being the hottest readily available plug and 340 the coldest readily available. The example (145) is approximately midrange.

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

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

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

CHAMPION SPARK PLUGS



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

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

14mm / ⅜" Reach			14mm / .472" Reach	
—	—	HOT	—	—
J-8J	—		L-86	—
—	UJ-11G		—	—
J-7J	—		—	—
—	UJ-7G		L-81	L-6G
J-6J	—		—	—
—	—		—	—
J-4J	—		L-78	L-3G
—	—		—	—
J-57R	—	COLD	L-77J	L-2G

14mm / ¾" Reach			18mm / .445" Reach	
—	—	HOT	K-13	—
—	—		—	K-12G
N-5	—		K-9	—
—	—		—	K-8G
N-4	N-4G		K-8	—
—	—		—	K-5G
N-3	N-3G		K-7	—
—	—		—	—
N-2	N-2G		K-60R*	K-3G
—	—	COLD	K-57R*	K-2G

* .500" Reach

Thread Size and Reach—The code letter ("J" in example) indicates thread size and reach. The example is 14mm-⅜ inch reach.

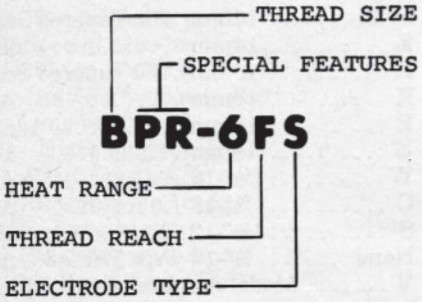
Letter	Thread Size	Thread Reach (Inch)
Y	10mm	¼
Z	10mm	.492
G	10mm	.700
P	12mm	.492
R	12mm	¾
J	14mm	⅜
J (preceded by C)	14mm	⅜
J (preceded by D)	14mm	.325 Tapered Seat
H	14mm	7/16
L	14mm	½ or .472
L (preceded by B)	14mm	.460 Tapered Seat
N	14mm	¾
N (preceded by B)	14mm	.708 Tapered Seat
E	14mm	.680
F	18mm	.460 Tapered Seat
K	18mm	All
B	18mm	13/16
U	18mm	1⅛
W	⅞"-18	All
C	⅞"-18	All
S	1⅛"-12	.600
None	½"-14 Pipe Thread	All
V	Model Airplane Engine Plug	

Type of Shielding Connection—In some cases, code indicates special short plugs. If this code is not used, plug is not shielded and is not a short plug. Example (E) indicates shielded plug with ⅝ inch-24 threaded connection.
B—See Thread Size Code L & N
C—(See Thread Size Code J) Short plug (bantam)
D—(See Thread Size Code J) Short plug
E—Shielded—⅝ inch-24 thread
H—Shielded—¾ inch-24 thread
M—Shielded—⅝ inch-24 thread Ordnance
P—Shielded—9/16 inch—27 thread
S—Shielded—11/16 inch—24 Whitworth
T—Low Profice Plug (shorty)
W—Shielded 13/16 inch—20 thread

Special Internal Features—Indicates resistor or auxiliary gap. If this code is not present, plug has no resistor or auxiliary gap.
R—Resistor (Less than 6000 ohms)
X—Resistor (more than 6000 ohms)
U—Auxiliary gap

Gap or Electrode Type—Suffix letters indicate type of material of electrodes and type of gap. Letter (Y) in example indicates projected core.
B—Two heavy duty ground electrodes
C—Protruding nose, round ground electrode, sawed gap
D—Protruding nose, round ground electrode
F—Three heavy duty ground electrodes
G—"Gold Palladium" center electrode
J—Cut back ground electrode
LM—Special Lawn Mower Plug
N—Four-prong Aircraft Type
P—Fine wire Platinum electrodes
R—Push wire ground electrode
S—Single ground electrode, side gap
T—Special Gap
V—Surface Gap
Y—Projected core
NOTE: "Gold Palladium" plugs are factory gapped at 0.015″ and a gap 0.003″-0.005″ narrower than standard plug is recommended.

NGK SPARK PLUGS



Thread Size—The first letter indicates thread size. Second and third letters (if used) denote variations. The letter "M" as second or third letter indicates low profile plug; "P" indicates projected nose and "R" indicates resistor plug.
A—18mm plug
AB—18mm plug
B—14mm plug
C—10mm plug
D—12mm plug
Heat Range—The number indicates heat range. Numbers are from 2 (hot) to 14 (cold). Number "6" in example is approximately mid-range.
Thread Reach—Three suffix letters (E, H & L) are used to indicate thread reach. If none of the above letters appear on 14mm plug, reach is ⅜ inch; if none appear on 18mm plug, reach is 12mm. Letter "F" suffix (example) indicates taper seat.
E—¾ inch reach
H—½ inch reach
L—7/16 inch reach
Electrode Type—Suffix letters are also used to indicate special electrode types; may be used in combination with thread suffix as in example, or alone if thread suffix is not used. If electrodes are conventional type, no suffix is used.
C—Competition type electrode
N—Racing (Nickel) electrode
P—Racing (Platinum) electrode
S—Super wide heat range
X—Surface gap electrode

CARBURETOR SERVICING

Trouble Shooting

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

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

B. ENGINE RUNS LEAN. Could be caused by: (1), fuel tank vent plugged; (2) leak in fuel line or fittings between fuel tank and carburetor; (3), filter screen in carburetor or filter element in fuel pick-up head plugged; (4), fuel orifice plugged; (5), hole in fuel metering diaphragm; (6), metering lever not properly set; (7), dirt in carburetor fuel channels or pulse channel to engine crankcase plugged; or (8), leaky gaskets between carburetor and crankcase intake port. Also, check for leaking crankshaft seals, porous or cracked crankcase or other cause for air leak into crankcase. When fuel tank or fuel level is below carburetor, lean operation can be caused by hole in fuel pump diaphragm or damaged valve flaps on pump diaphragm. On Walbro series SDC carburetor with diaphragm type accelerating pump, a leak in accelerating pump diaphragm will cause lean operation.

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

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

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

Adjusting

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

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

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

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

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

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

Tillotson Models HC, HJ and HL

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

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

Some HL carburetors are equipped with a governor valve (25—Fig. S10) which 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.

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

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

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

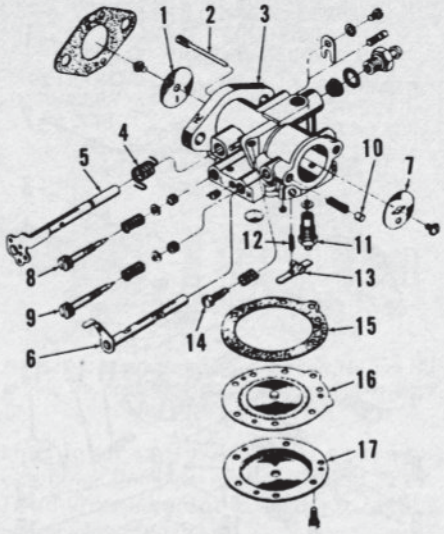


Fig. S9–Exploded view of Tillotson model HC carburetor. Model HJ is similar.

1. Throttle plate
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

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

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

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

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

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

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

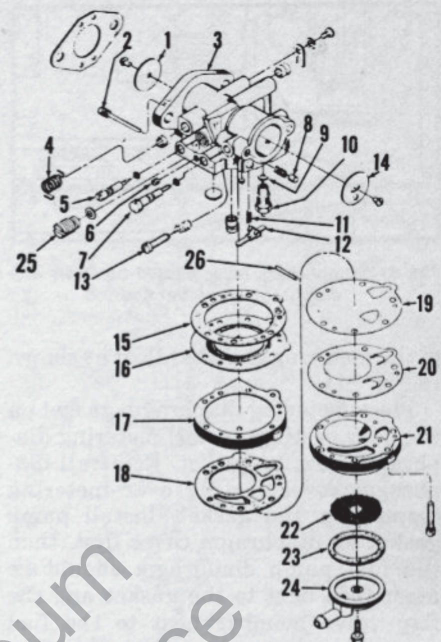


Fig. S10–Exploded view of Tillotson model HL carburetor. On some HL carburetors, pump diaphragm (19) and valves (20) are one-piece. Governor valve (25) is not used on all carburetors.

1. Throttle plate
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

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 counter bore with convex side up and flatten it to a tight fit using a 5/16 inch flat end punch. If the installed welch plug is concave, it may be loose and cause an uncontrolled fuel leak. The correctly installed welch plug is flat.

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

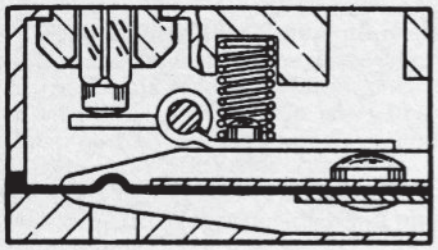


Fig. S11–Diaphragm lever should be flush with diaphragm chamber floor.

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

Place metering diaphragm gasket on the body casting. Install metering diaphragm next to gasket. Reinstall diaphragm cover casting over metering diaphragm and gasket. Install pump gasket on diaphragm cover first, then the fuel pump diaphragm should be assembled next to the gasket and the flap valve member next to the fuel pump 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 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 into the metering holes. This may damage the flow characteristics of the holes and damage carburetor performance. Blow out plugged holes with compressed air. Remove main nozzle ball check assembly with a screwdriver of correct blade width. If ball check is defective, engine idling will be hampered unless high speed mixture screw is shut off or there will be poor high speed performance with the high speed mixture screw adjusted

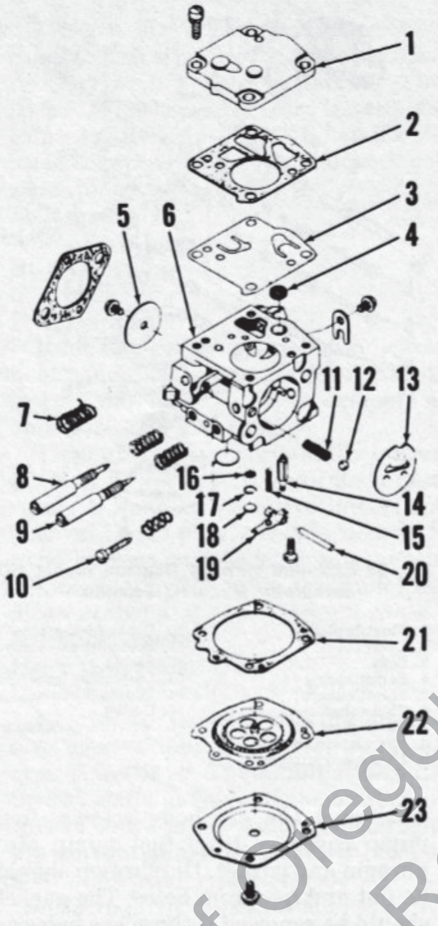


Fig. S12–Exploded view of Tillotson model HS carburetor.

1. Pump cover
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

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 reassembly. The plates are tapered for exact fit in the carburetor bore. Remove two screws and pull the plate out of the carburetor body. Remove the throttle shaft clip and pull the shaft out of the casting. Examine both the shaft and body bearing areas for wear. Should either part show wear then either the shaft or the body or both will have to be replaced. Remove the choke shaft from the body carefully so that the friction ball and spring will not fly

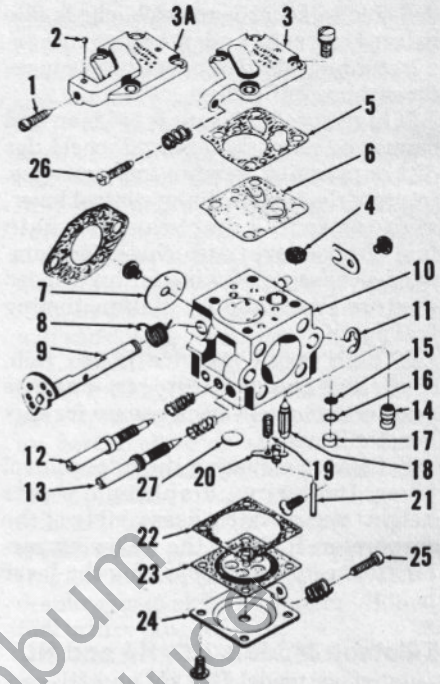


Fig. S13–Exploded view of Tillotson model HU carburetor. Note difference in idle speed screw location used on fuel pump covers (3 & 3A) of some carburetors. Idle speed screw (25) may be located in cover (24).

1. Idle speed screw
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

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

Tillotson Models HS And HU

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

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

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

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

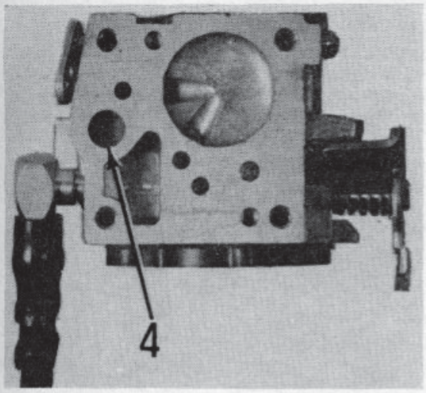


Fig. S14–Be sure to clean filter screen (4–Fig. S12 or S13) when servicing carburetor.

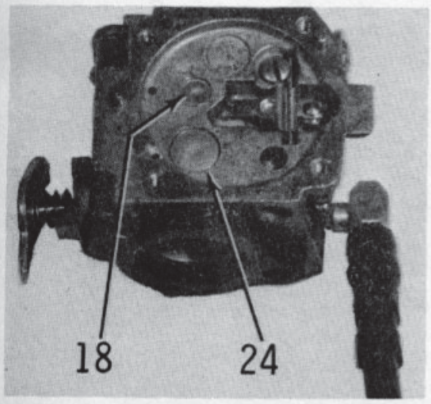


Fig. S15–View showing location of welch plugs (18 & 24–Fig. S12).

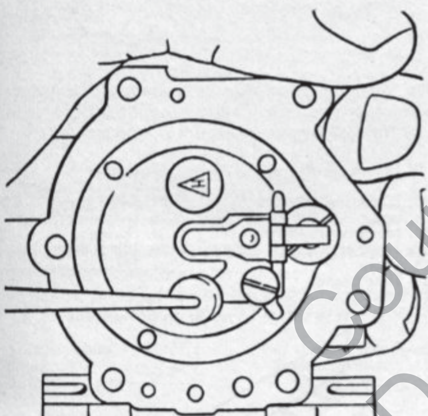


Fig. S16–A punch can be used to remove welch plugs as shown after carefully drilling a small hole in plug.

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

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

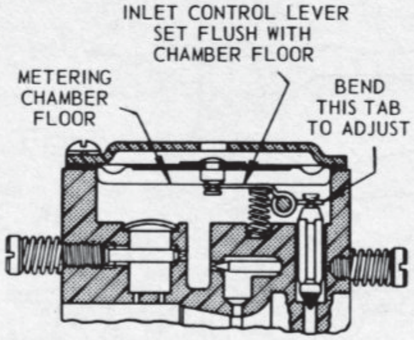


Fig. S17–Diaphragm lever on models HS and HU should be flush with diaphragm chamber floor as shown above.

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

Walbro Models HDC And SDC

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

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

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

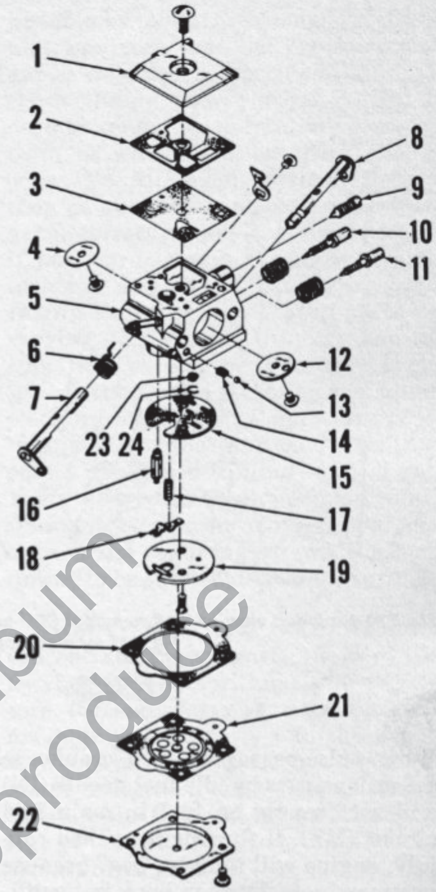
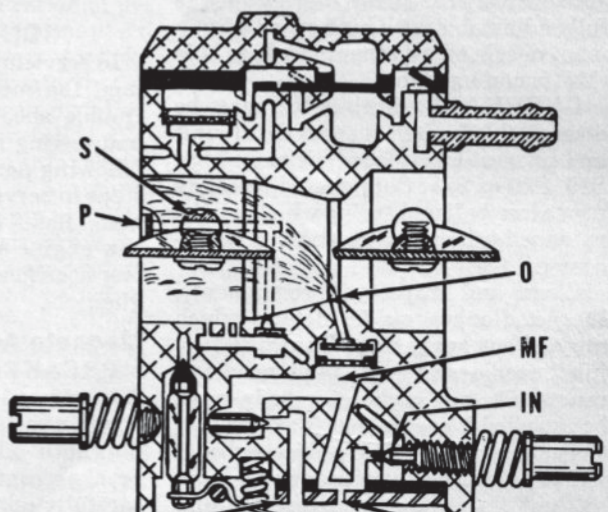


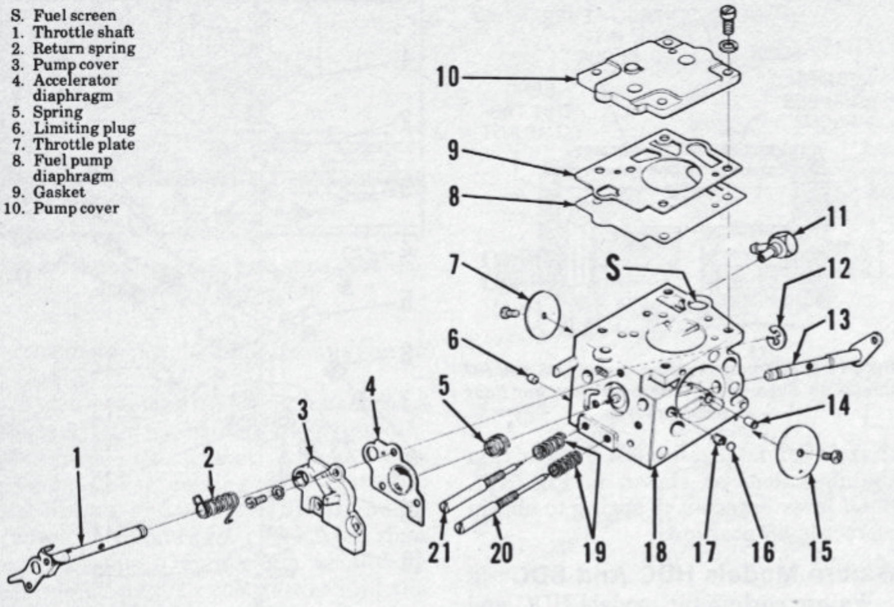
Fig. S19–Exploded view of Walbro model HDC carburetor.

1. Pump cover
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

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

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





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

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

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

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

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

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

Clean and inspect all components. Inspect diaphragms for defects which may affect operation. Examine fuel inlet needle and seat. Inlet needle is renewable, but carburetor body must be renewed if needle seat is excessively worn or damaged. Sharp objects should not be used to clean orifices or passages as fuel flow may be altered. Compressed air should not be used to clean main nozzle as check valve may be damaged. A check valve repair kit is available to renew a damaged valve. Fuel mixture needles must be renewed if grooved or broken. Inspect mixture needle seats in carburetor body and renew body if seats are damaged or excessively worn. Screens should be clean.

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

IGNITION SYSTEM

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

Magneto Adjustments

BREAKER CONTACT POINTS. Adjustment of the breaker contact points affects both ignition timing and magneto edge gap. Therefore, the breaker contact point gap should be carefully adjusted according to engine manufacturer's specifications. Before adjusting the breaker contact gap, inspect contact points and renew if condition of contact surfaces is questionable. It is sometimes desirable to check the

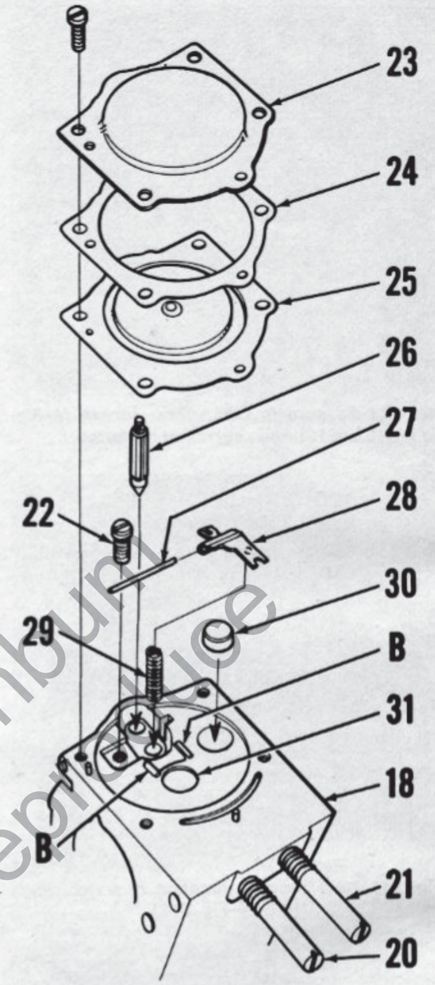


Fig. S21–Exploded view of metering diaphragm assembly used on Walbro model SDC. Refer to Fig. S20 for other carburetor components.

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

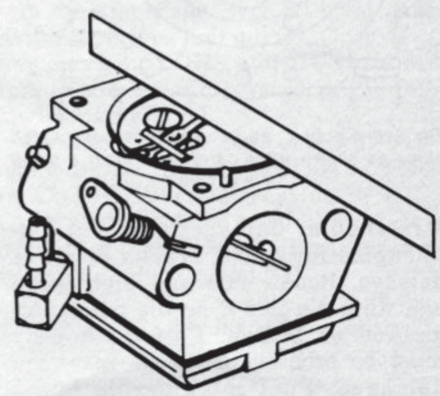


Fig. S22–Diaphragm lever on model HDC should just touch a straight edge laid on carburetor body as shown.

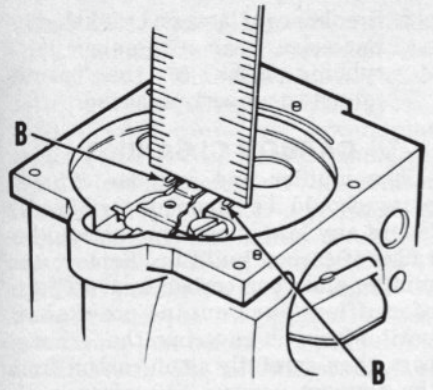


Fig. S23–Diaphragm lever on model SDC should just touch straight edge placed on bosses (B) adjacent to lever.

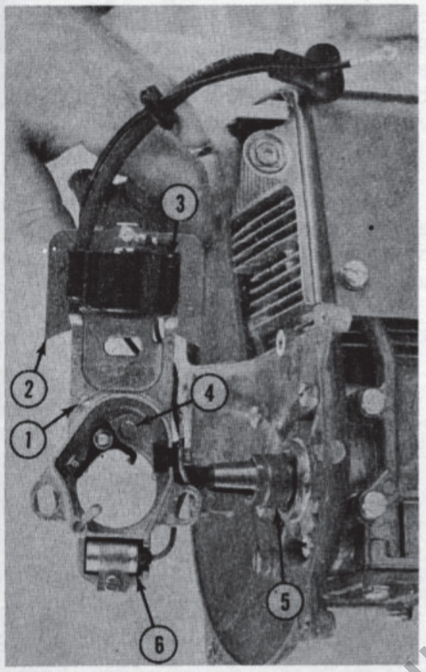


Fig. S24–On some chain saw engines, the magneto stator plate mounting holes are slotted as shown so that ignition timing can be adjusted by relocating position of stator plate.

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

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

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

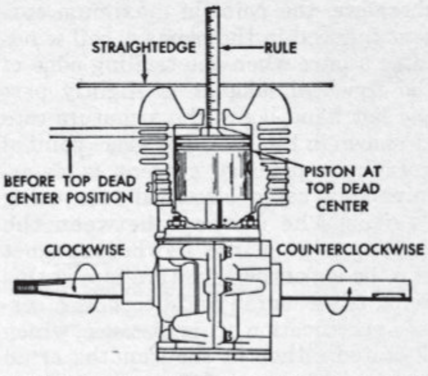


Fig. S25–Where timing is specified as measurement of piston travel, measurement can be made as illustrated. Use of a dial indicator instead of ruler will give more exact measurement. Some manufacturers provide a timing gage that can be screwed into spark plug hole or a gage that can be attached to crankshaft.

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

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

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

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

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

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

Where the armature core is located under or behind the flywheel, the following methods may be used to check and adjust armature air gap. On some engines, slots or openings are provided in the flywheel through which the armature air gap can be checked. Some engine manufacturers provide a 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. S27), 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.

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

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

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

a. Flywheel drive key sheared
b. Flywheel drive key worn (loose)
c. Keyway in flywheel or crankshaft worn (oversized)
d. Loose flywheel retaining nut which can also cause any above listed difficulty
e. Excessive wear on breaker cam
f. Breaker cam loose on crankshaft
g. Excessive wear on breaker point rubbing block so that points cannot be properly adjusted.

CARBON CLEANING

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

LUBRICATION

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

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

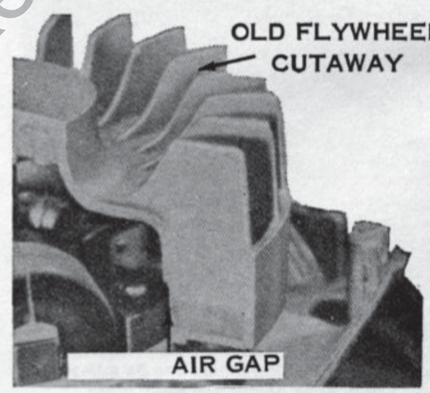


Fig. S27–Where armature core and ignition coil are located inside of flywheel, and old discarded flywheel can be cut away as shown to provide air gap adjustment fixture.

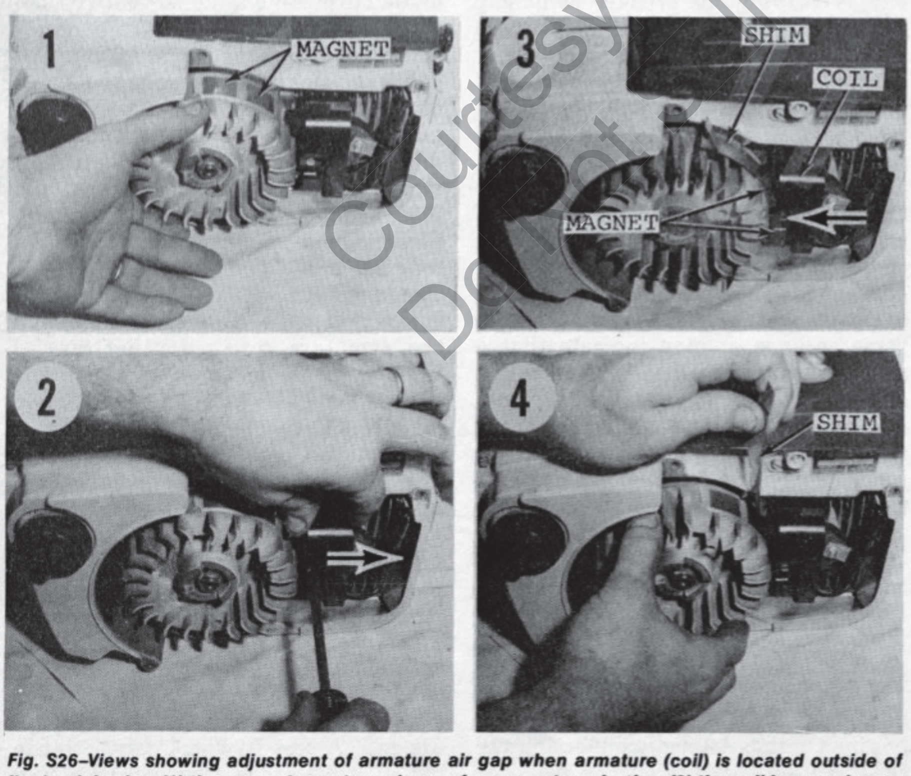


Fig. S26–Views showing adjustment of armature air gap when armature (coil) is located outside of flywheel. In view (1) the magnets are turned away from armature. In view (2) the coil is moved away from the flywheel. View (3) shows shims positioned between magnets and armature legs for setting correct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

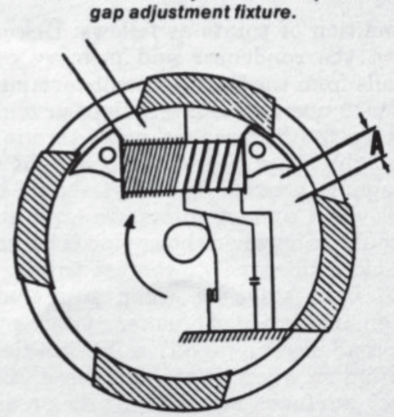


Fig. S28–The distance (A) between trailing edge of magnet and leading edge of pole shoe when primary voltage is highest is known as EDGE GAP.

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

RATIO	Gasoline	Oil
10:1	.63 Gallons	½ Pint
12:1	.75 Gallons	½ Pint
14:1	.88 Gallons	½ Pint
15:1	.94 Gallons	½ Pint
16:1	1.00 Gallons	½ Pint
20:1	1.25 Gallons	½ Pint
22:1	1.38 Gallons	½ Pint
24:1	1.50 Gallons	½ Pint
25:1	1.56 Gallons	½ Pint
32:1	2.00 Gallons	½ Pint
50:1	3.13 Gallons	½ Pint
100:1	6.25 Gallons	½ Pint
10:1	5 U.S. Gallons	4 Pints 64 Fl. Oz.
12:1	3 U.S. Gallons	2 Pints 32 Fl. Oz.
14:1	5 U.S. Gallons	3 Pints 45¾ Fl. Oz.
15:1	5 U.S. Gallons	2¾ Pints 42½ Fl. Oz.
16:1	5 U.S. Gallons	2½ Pints 40 Fl. Oz.
20:1	5 U.S. Gallons	2 Pints 32 Fl. Oz.
22:1	5 U.S. Gallons	1¾ Pints 29 Fl. Oz.
24:1	3 U.S. Gallons	1 Pint 16 Fl. Oz.
25:1	4 U.S. Gallons	1¼ Pints 20½ Fl. Oz.
32:1	4 U.S. Gallons	1 Pint 16 Fl. Oz.
50:1	3 U.S. Gallons	½ Pint 8 Fl. Oz.
100:1	3 U.S. Gallons	¼ Pint 4 Fl. Oz.

REPAIRS

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

A given amount of heat applied to aluminum or magnesium will cause it to expand a greater amount than will steel under similar conditions. Because of the different expansion characteristics, heat is usually recommended for easy installation of bearings, pins, etc., in aluminum or magnesium castings. Sometimes, heat can be used to free parts that are seized or where an interference fit is used. Heat, therefore, becomes a service tool and the application of heat, one of the required service techniques. An open flame is not usually advised because it destroys the paint and other protective coatings and because a uniform and controlled temperature with open flame is difficult to obtain. Methods commonly used for heating are: 1. In oil or water. 2. With a heat oven or kiln. 3. With hot air gun. The hot air gun has the advantages of being portable and having a directional control of heat to a small or large area depending upon the type of gun. Two types of hot air guns are shown in Figs. S30 and S31. Thermal crayons are available which can be used to deter-

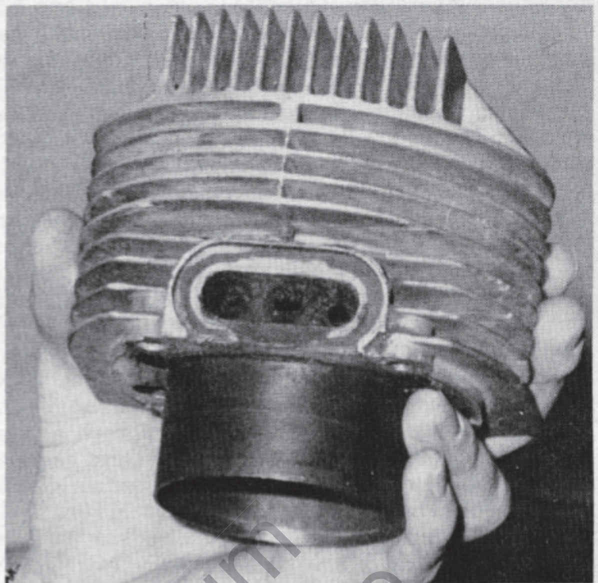


Fig. S29–Example of severe case of port carbon. Carbon must be removed to restore performance.

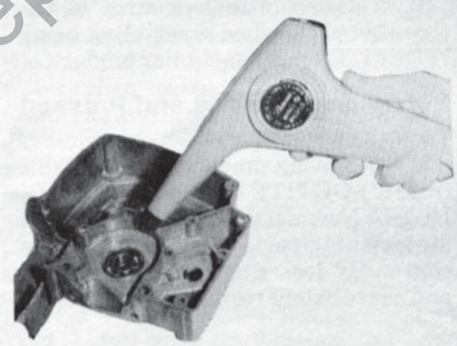


Fig. S30–Heat can be used efficiently as a service tool. Shown is an Electric Heat Gun available from UNGAR, 233 East Manville, Compton, California 90220.

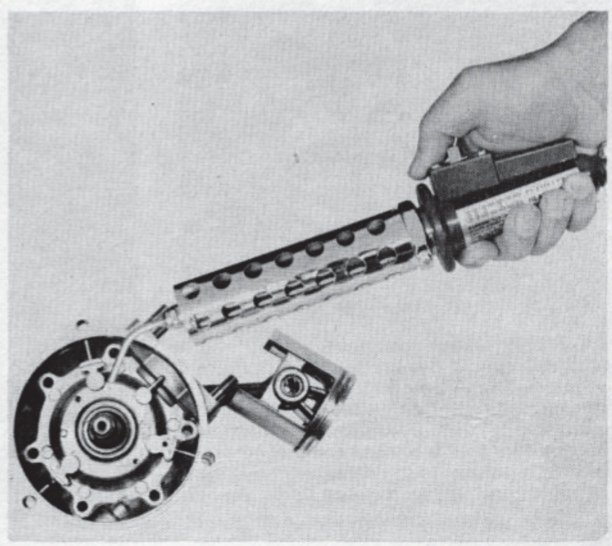


Fig. S31–Heat Torch delivers hot air to a smaller area than Heat Gun shown in Fig. S30. Dry compressed air is electrically heated and temperature (up to 1000° F.) is varied by controlling air pressure. The torch shown is available from Master Appliance Corp., 1745 Flett Ave., Racine, Wis. 53403.

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

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

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

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

Retaining Threaded and Pressed Together Parts

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

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

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

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

"Klean N' Prime" is used to clean parts and to provide the best curing of the locking resins. Loctite resins will not work properly on dirty, oily parts. Some primers ("Locquic") are available to speed up or slow down the curing time of the resins. The "Locquic" primers are most often used for production assembly and are not often available for service.

REPAIRING DAMAGED THREADS

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

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

PISTON, PIN, RINGS AND CYLINDER

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

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

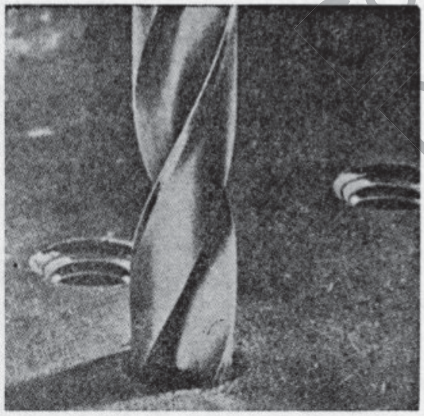


Fig. S32–First step in repairing damaged threads is to drill out old threads using exact size drill recommended in instructions provided with thread repair kit. Drill all the way through an open hole or all the way to bottom of blind hole, making sure hole is straight and that centerline of hole is not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

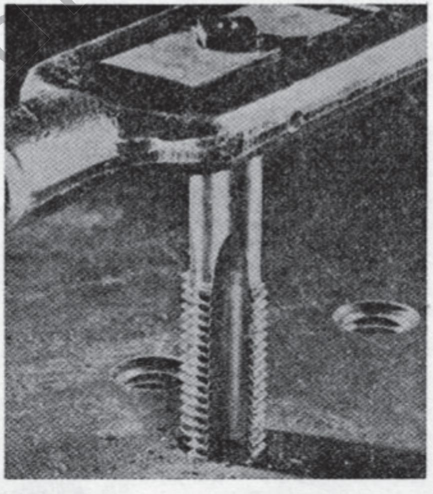


Fig. S33–Special drill taps are provided in thread repair kit for threading drilled hole to correct size for outside of thread insert. A standard tap cannot be used.

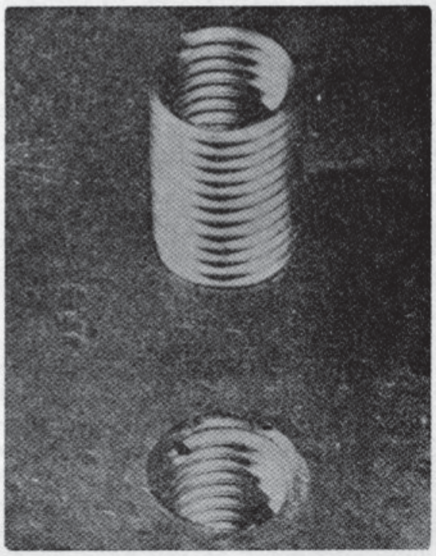


Fig. S34–A thread insert and a complete repair are shown above. Special tools are provided in thread repair kit for installation of thread insert.

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

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

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

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

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

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

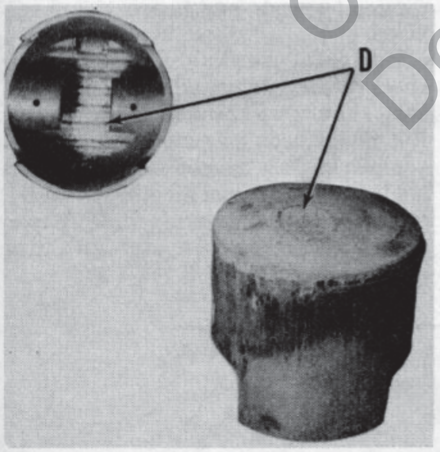


Fig. S35–Top and bottom view of piston severely damaged by detonation. Spot (D) on top and bottom of crown show where metal has started to melt. Absence of scoring on skirt rule out seizure, overheating or lack of lubrication as a contributing cause.

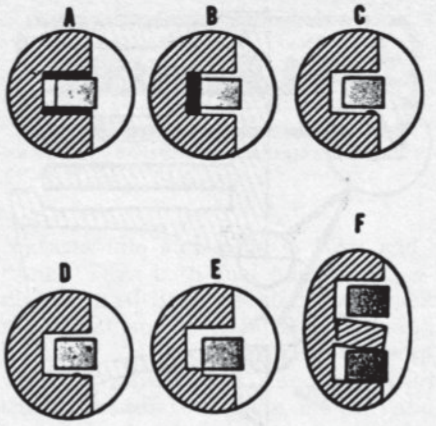


Fig. S36–Examine piston for damage before removing old rings. Shown are some common faults.

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

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

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

A rule of thumb says scuffing or scoring of piston above the piston pin is due to overheating. Damage below the pin is more likely due to insufficient lubrication or improper fit. 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. S36). The finished cylinder should have a light cross-hatch pattern. After honing, wash cylinder assembly with soap and water, then swab with new oil on a clean rag until all tendency of rag to discolor is gone. Washing in solvent will not remove the abrasive from finished cylinder walls.

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

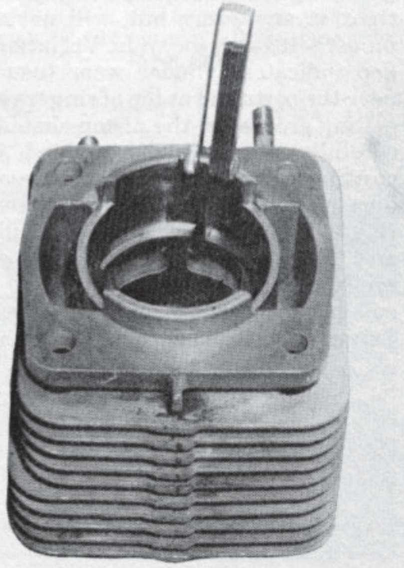


Fig. S37–Clearance between ends of ring (ring end gap) should be measured with feeler gage as shown. Make sure ring is straight in cylinder.

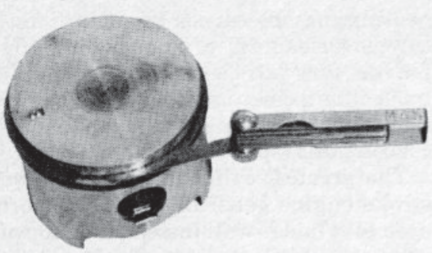


Fig. S38–Ring side clearance in groove should be measured with feeler gage as shown. Clearance should be within recommended limits and the same all the way around piston.

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

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

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

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

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

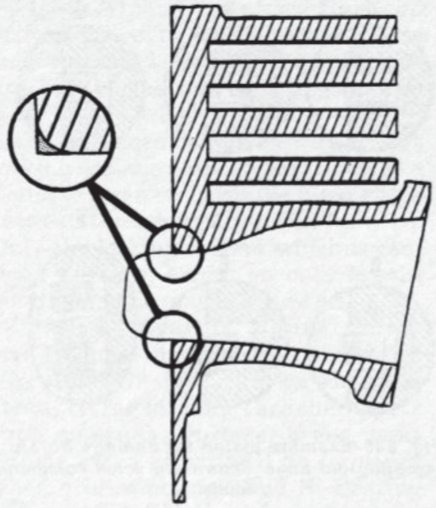


Fig. S39–Some manufacturers recommend that edges of ports be chamfered as shown in insert, after reboring.

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

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

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

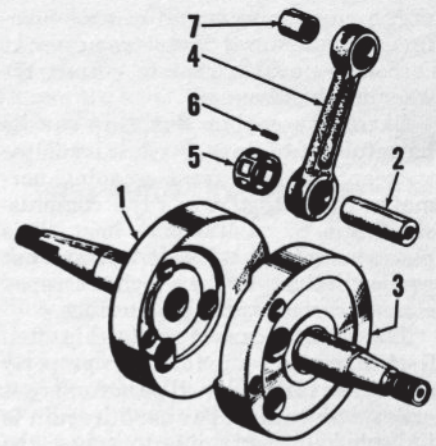


Fig. S40–Exploded view of typical built-up crankshaft.

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

CONNECTING ROD, CRANKSHAFT AND BEARINGS

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

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

HOMELITE®

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

MODEL COVERAGE

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

DESIGN FEATURES CODE

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

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

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

To adjust starting speed (speed at which engine will run with throttle latch engaged), stop engine and remove chain, guide bar, air filter cover and air filter. Open trigger adjusting screw ⅛-turn clockwise. With trigger latched, start engine and run at half throttle (not at high speed) for 30-50 seconds to warm it up. Release throttle trigger, then latch it while engine is running. If engine stops, restart it. With throttle trigger latched, gently hold trigger down and slowly back trigger adjusting screw out counter-clockwise until engine falters, then turn screw back in 1/16-turn clockwise. Squeeze and release trigger to idle engine, then shut engine off with stop switch. Try to restart engine; if hard to start, open screw another 1/16-turn at a time until enough for consistent starting. When starting speed is satisfactorily adjusted, stop engine and reinstall guide bar, chain, air filter and filter cover. If engine will start readily and saw chain does not turn or only turns slowly, adjustment is correct. If chain turns rap-

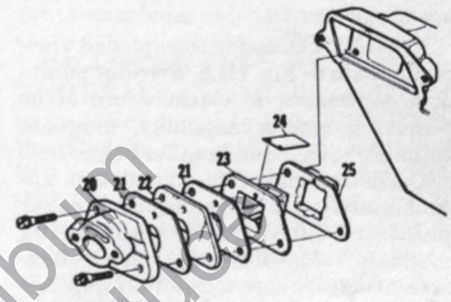


Fig. HL2–View showing earliest production reed valve and spacer installation.

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

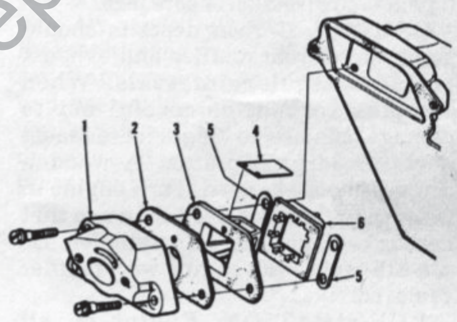


Fig. HL3–View showing reed valve and spacer installation used later in production than parts shown in Fig. HL2, but prior to installation shown in Fig. HL1.

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

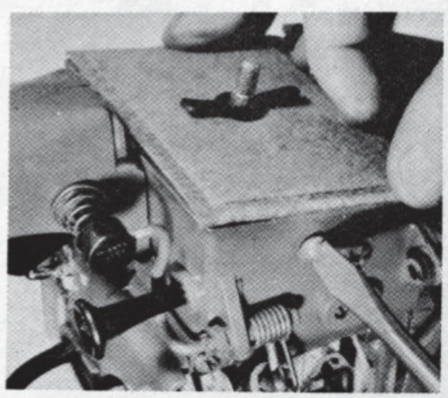


Fig. HL4–Before tightening screws retaining air filter bracket in throttle handle, place air filter element on bracket stud and align filter with edges of air box.

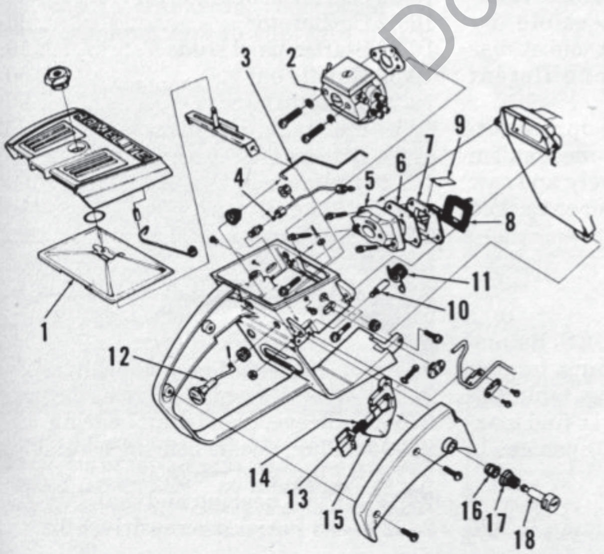


Fig. HL1–Exploded view of handle assembly and related assemblies.

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

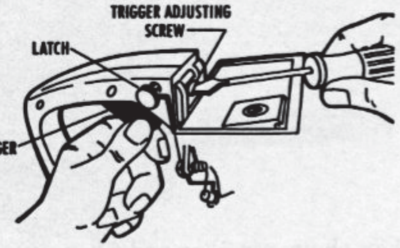


Fig. HL5–Adjusting starting speed for models EZ and XL-Mini. Refer to text for procedure.

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

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

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

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

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

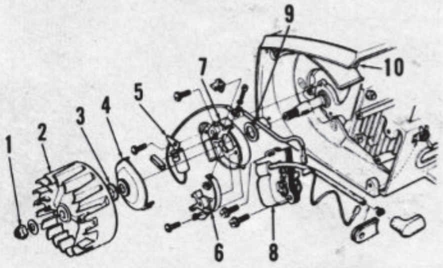


Fig. HL6–Exploded view of ignition assembly. Felt seal (3) is cemented to breaker box cover (4).

1. Nut
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

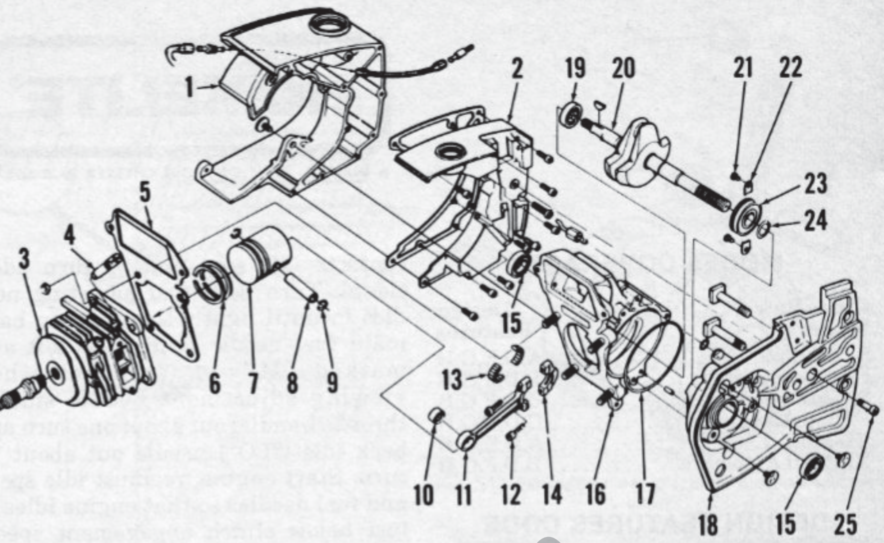


Fig. HL7–Exploded view of typical engine assembly. A head land piston ring is used on EZ Automatic model in place of rings (6) shown.

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

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

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

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

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

REPAIRS

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

4/40 Flange bearing	5
6/32 Compression release clamp	20
6/32 Compression release post nut	20
6/32 Breaker box	20
6/32 Breaker point adjustable arm	20
6/32 Condenser	20
8/32 Air filter bracket	25
8/32 Connecting rod	55
8/32 Throttle handle cover	35
8/32 Rewind spring cover	35
8/32 Intake manifold (reed spacer)	20
8/32 Coil assembly	20
8/32 Automatic oiler pump	35
8/32 Fuel tank	35
10/32 Main bearing retainer screws	50
10/32 Stack muffler	50
10/32 Muffler body	50
10/32 Muffler cap	35
10/32 Starter housing	50
10/32 Carburetor	20
10/32 Starter pawl studs	50
10/32 Handle bar	50
12/24 Throttle handle	80
12/24 Fuel tank to crankcase	75
12/24 Drivecase	75
1/4-28 Cylinder nuts	100
5/16-24 Rotor (flywheel) nut	150
14mm Spark plug	120
Clutch	180

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

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

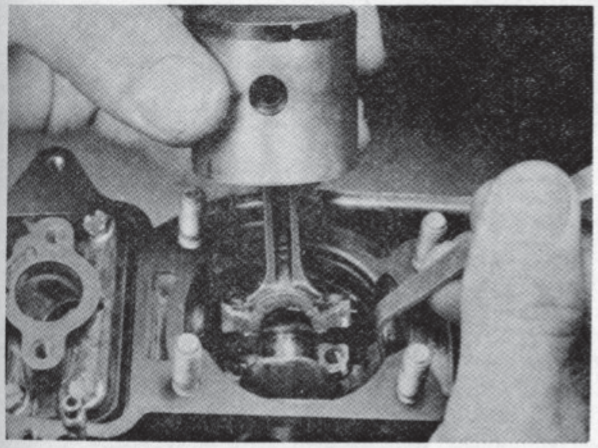


Fig. HL8–Installing piston and connecting rod assembly using locally made tool to hold rod cap in position. Tool can be made from flat strip of metal. Using grease, stick 14 rollers in cap and 14 rollers in rod; make sure that match marks on rod and cap are aligned.

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

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

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

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

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

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

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

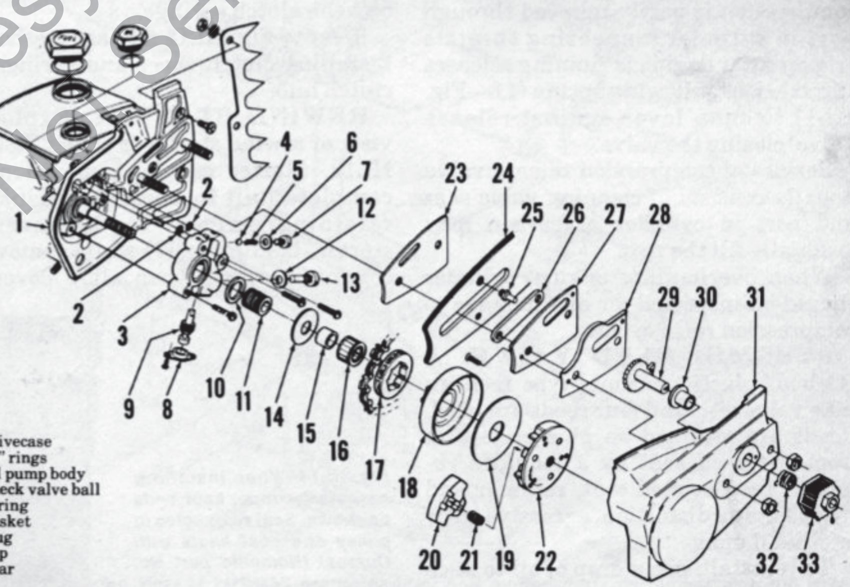
Assemble piston to connecting rod so that piston ring locating pin is towards intake side (away from exhaust port).

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

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

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

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



1. Drivecase
2. "O" rings
3. Oil pump body
4. Check valve ball
5. Spring
6. Gasket
7. Plug
8. Cap
9. Gear
10. Seal
11. Worm gear
12. Gasket
13. Cam screw
14. Thrust washer
15. Inner race
16. Bearing
17. Sprocket
18. Clutch drum
19. Thrust washer
20. Clutch shoe
21. Spring
22. Clutch hub
23. Inner guide plate
24. Bar
25. Pin
26. Block
27. Outer guide plate
28. Cam cover
29. Adjusting cam
30. Bushing
31. Cover
32. Spring
33. Knob

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

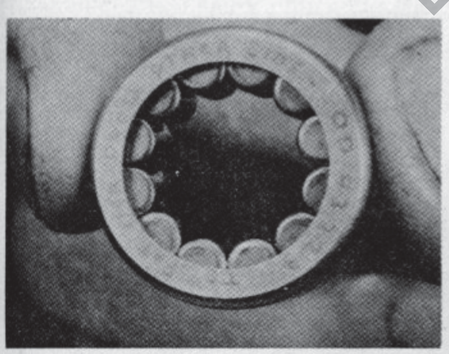


Fig. HL9–Roller type main bearing used at flywheel end of crankshaft is marked on one side, "PRESS OTHER SIDE". Be sure to observe this precaution when installing bearing in crankcase.

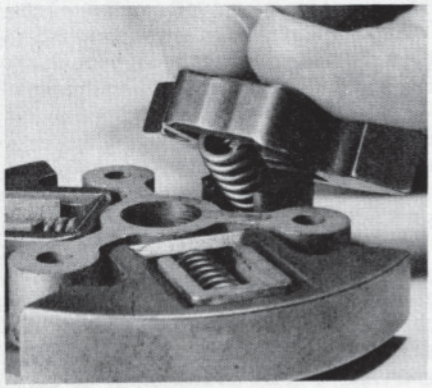
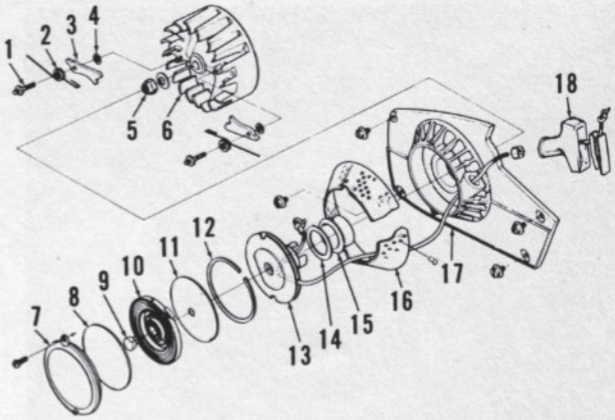


Fig. HL11–View showing easy method of installing clutch shoes and springs. Model EZ clutch is not shown; however, method is same.

Fig. HL12–Exploded view of recoil starter.

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



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

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

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

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

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

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

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

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

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

REWIND STARTER. Exploded view of rewind starter is shown in Fig. HL12. Starter can be removed as a complete unit by removing housing retaining screws. To disassemble starter, hold cover (7) while removing retaining screws, then allow cover to turn slowly until spring tension is released. Remainder of disassembly is evident from inspection of unit and with reference to exploded view.

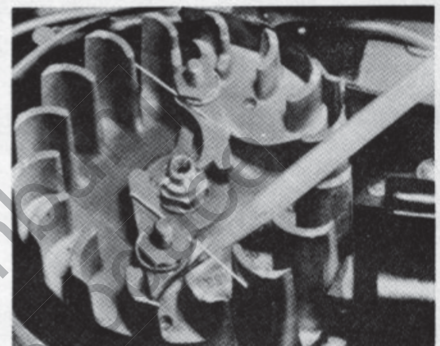
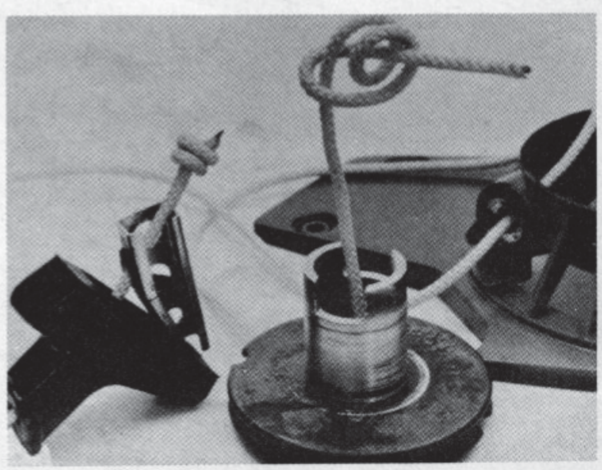


Fig. HL13–View showing proper installation of pawl springs.

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

Fig. HL14–When installing new starter rope, knot ends as shown. Seal rope holes in pulley and coat knots with Duxseal (Homelite part No. 24382)



HOMELITE®

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

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

DESIGN FEATURES CODE

A—Displacement, 3.3 cu. in.; bore, 1¾ in.; stroke, 1⅜ in.
B—Displacement, 3.55 cu. in.; bore, 1 13/16 in.; stroke, 1⅜ in.
C—Displacement, 4.0 cu. in.; bore, 1⅞ in.; stroke, 1 7/16 in.
D—Displacement, 4.5 cu. in.; bore, 2 in.; stroke, 1 7/16 in.
E—Flat reed type intake valve.
F—Pyramid type reed intake valve, 4 reeds.
G—Conventional flywheel type magneto.
H—Direct drive.
J—Planetary gear drive transmission.
K—Manual chain oiler only.
L—Automatic chain oiler only; manual chain oiler pump available as optional accessory.

MAINTENANCE

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

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

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

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

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

CARBURETOR. A Tillotson model HS diaphragm carburetor or a Walbro model SDC diaphragm carburetor may be used. Refer to Tillotson or Walbro section of SERVICE FUNDAMENTALS section for overhaul and exploded views.

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

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

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

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

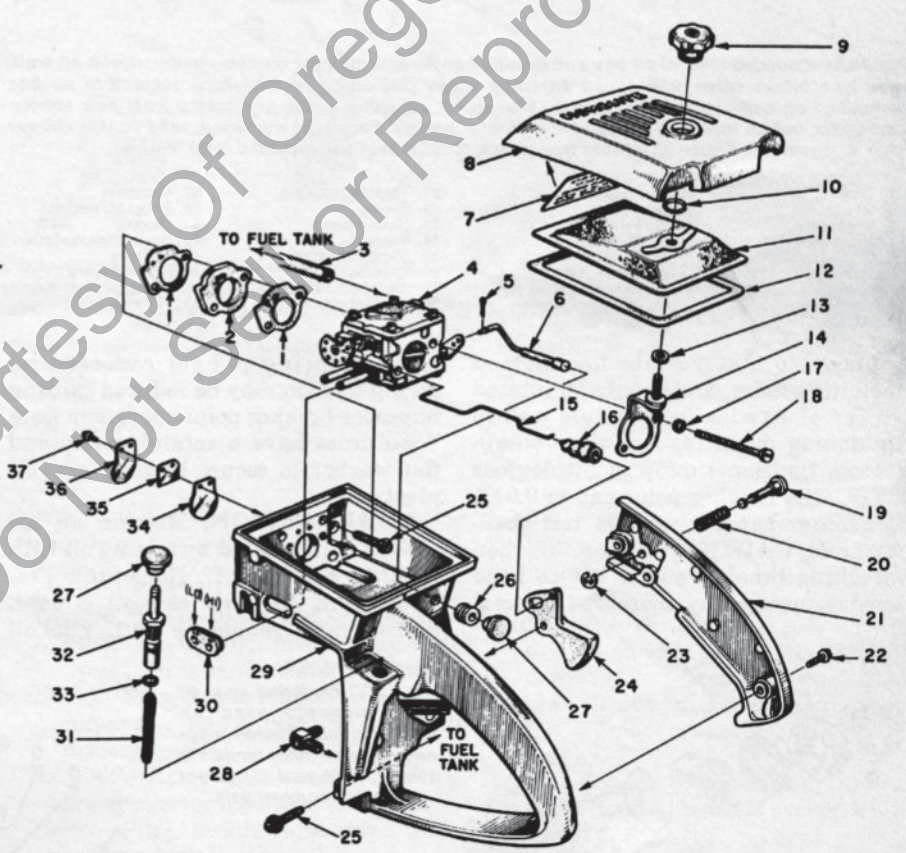


Fig. HL30–Exploded view of air box (throttle handle) and related parts on models with flat reed intake valve (34). Refer to Fig. HL31 for models equipped with pyramid reed valve.

1. Gasket
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

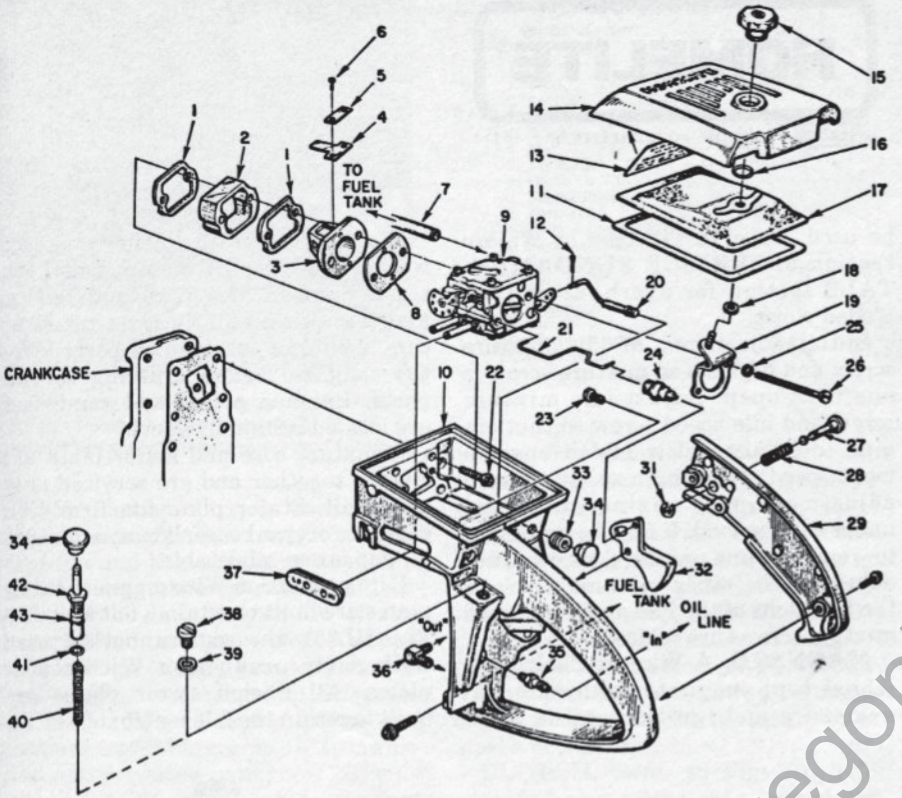


Fig. HL31–Exploded view of air box and throttle handle assembly for models equipped with pyramid reed type intake valve. Idle speed adjusting screw (23) on some models, is located in air box instead of on carburetor body; remove idle speed adjusting screw and spring from new service carburetor before 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

Magneto stator plate has slotted mounting holes, and should be rotated as far clockwise as possible before tightening mounting screws to obtain correct ignition timing of 30 degrees BTDC. Set breaker point gap to 0.015. Condenser capacity should test 0.16-0.20 mfd. CAUTION: Be careful when installing breaker points not to bend tension spring any more than 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. Engine on all models is lubricated by mixing oil with regular gasoline. If Homelite® Premium SAE 40 chain saw oil is used, fuel:oil ratio should be 32:1. Fuel:oil ratio should be 16:1 if Homelite® 2-Cycle SAE 30 oil or other SAE 30 oil designed for air-cooled two stroke engines is used.

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

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

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

REPAIRS

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

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

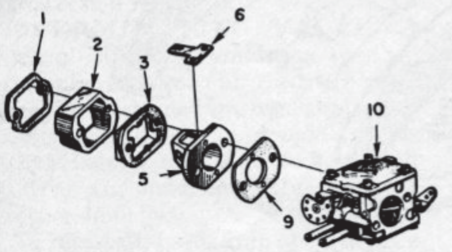
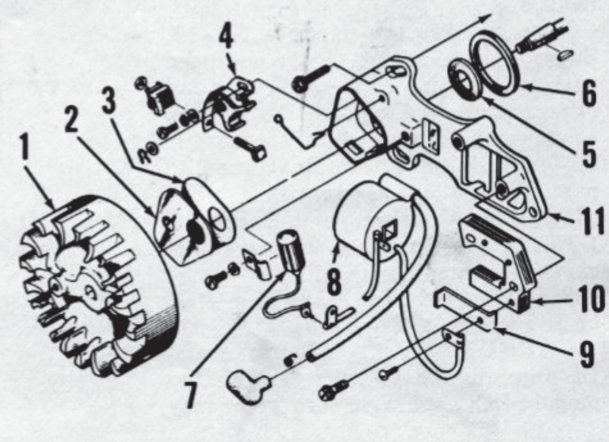


Fig. HL32–View showing late type Delrin plastic reed seat (5) and moulded reed retainer (3). Reeds (6) are held on pins protruding from seat by the retainer. Refer to text for assembly instructions.

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

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

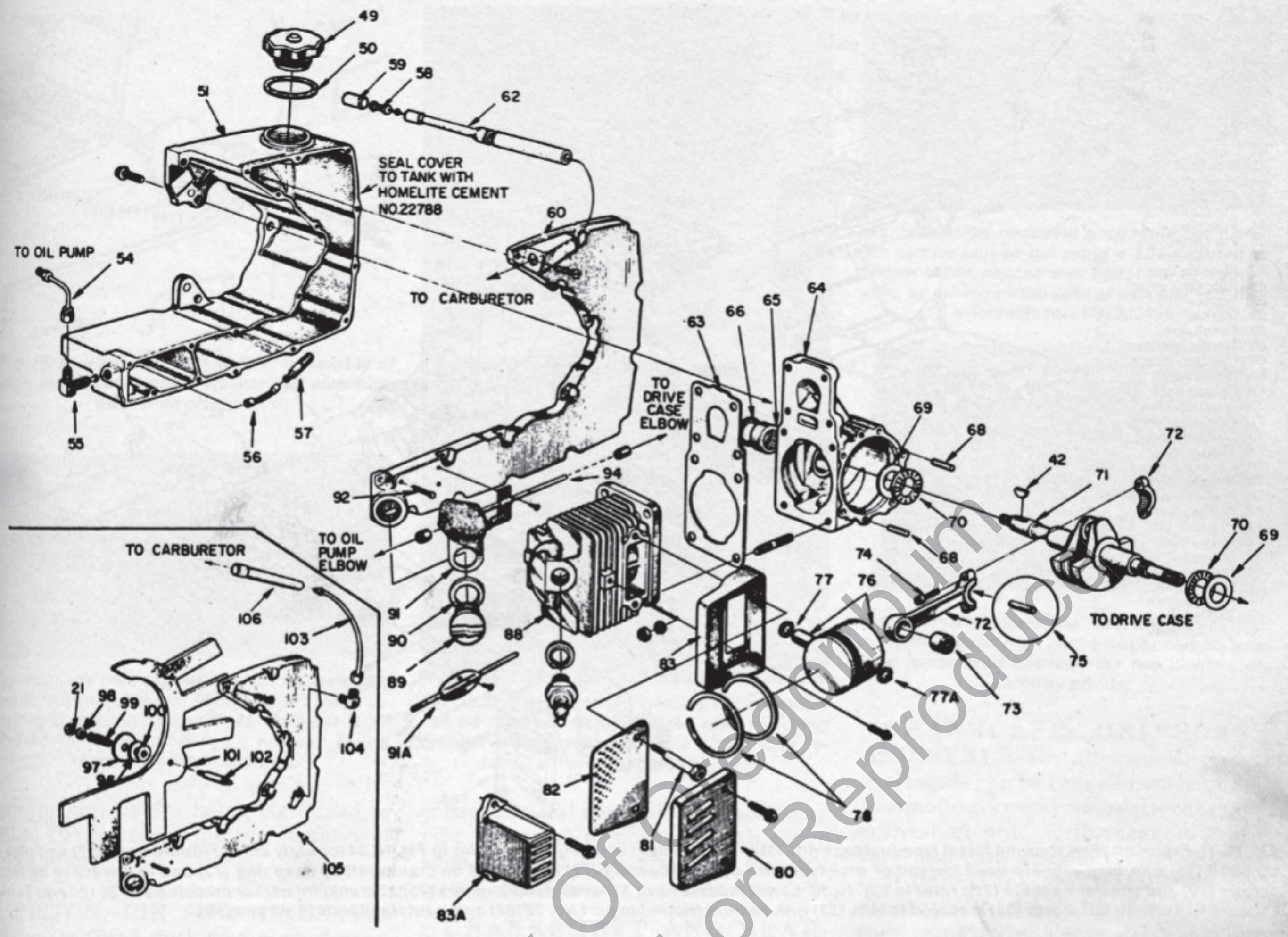


Fig. HL34–Exploded view showing powerhead and fuel tank construction of models XL-12, Super XL-12 and XL-15, refer to Fig. HL35 for other models. Early wick type fuel pickup and tank cover are shown in inset; beginning with serial No. 2188611, flexible hose (62) type pickup is used. Dowel pins (68) are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

21. Lock nut
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
73. Needle bearing
74. Rod cap screws
75. Needle rollers
76. Piston & pin
77. Snap ring
77A. Snap ring
78. Piston rings
80. Muffler cap (XL-15)
81. Special studs
82. Baffle (XL-15)
83. Muffler body (XL-15)
83A. Muffler (XL-12 & S/XL-12)
88. Cylinder
89. Oil cap
90. Gasket
91. Shield (XL-15)
91A. Plate (XL-12 & S/XL-12)
92. Cotter pin (breather)
94. Oil line
96. Washer (aluminum)
97. Washer (rubber)
98. Flat washer
99. Spring
100. Washer (felt)
101. Wick
102. Stud
103. Fuel line
104. Elbow
105. Tank cover (early)
106. Fuel line

12/24 Bracket to drivecase	80
12/24 Stator to crankcase and cylinder	80
12/24 Drivecase to crankcase	80
12/24 Carburetor chamber to fuel tank	80
12/24 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
14mm Spark plug	250
Clutch spider	180

HOMELITE SERVICE TOOLS. Listed below are Homelite tool numbers, tool description and model application of tools for servicing XL-12 through XL-500 series chain saws.

Tool No. Description & Model Usage

A-23949—Remover, piston pin with Spirol pin at exhaust side of piston.

23756—Plug, connecting rod bearing removal and installation, all models.

A-23960—Remover and locking bracket, rotor (flywheel), all models.

23757—Plug, needle roller type main bearing installation, all models.

23758—Plug, crankcase seal installation, all models; drivecase seal installation, models XL-12, XL-15 & S/XL-12.

23759—Sleeve, crankcase seal protector, all models; drivecase seal protector, models XL-12, XL-15 & S/XL-12.

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

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

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

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

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

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

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

42. Woodruff key
49. Fuel tank cap
50. Gasket
53. Fuel tank
54. Pipe plug
55. Fuel filter
56. Pick-up head
57. Flexible hose
58. Fuel tank cover
59. Screws (16)
63. Gasket
64. Crankcase
65. Needle bearing
66. Crankshaft seal
68. Dowel pins
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

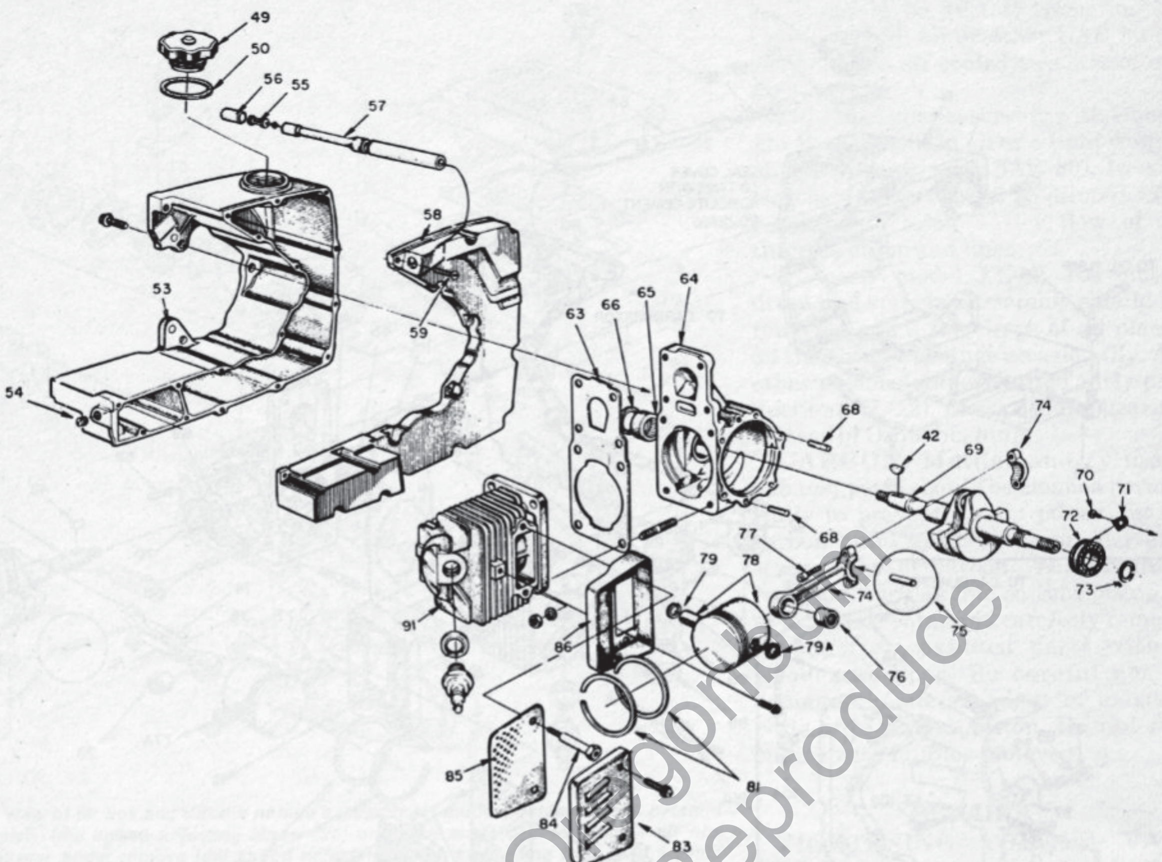


Fig. HL35–Exploded view showing latest type fuel tank and later construction of power head; refer to Fig. HL34 for early units. Flexible hose (57) and pick-up head (55) with filter (56) are used instead of wick type pick-up. Ball bearing (72) is retained on crankshaft by snap ring (73) and in drivecase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

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

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

22820-1—Bearing collar for A-23137.

23136—Body for A-23137.

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

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

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

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

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

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

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

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

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

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

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

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. On early models with 28 needle rollers, stick 14 needle rollers in the rod and remaining 14 needle rollers in rod cap with light grease or beeswax. On late models with 31 needle rollers, stick 16 rollers in rod and 15 rollers in rod cap. Assemble rod to cap with match marks aligned, and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap re-

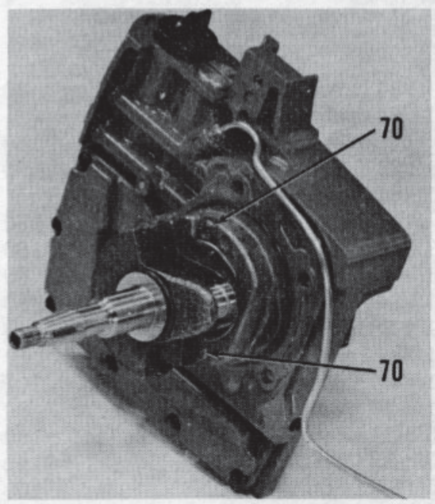


Fig. HL36–View showing crankcase removed from drive case and crankshaft on models equipped with ball bearing at drive end of crankshaft. To remove crankshaft from drive case, bearing retaining screws (70) must first be removed.

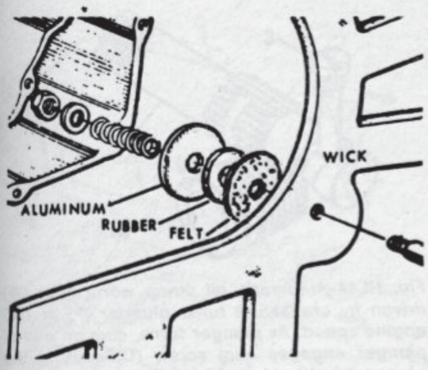


Fig. HL37–View showing proper assembly of wick, felt washer, rubber washer and aluminum washer on pickup stud.

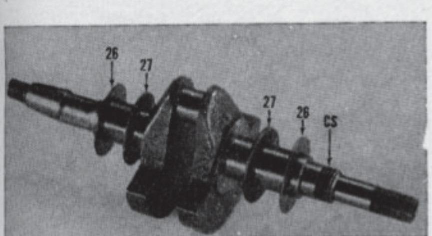


Fig. HL38–Be sure the steel thrust washers (26) are to outside of thrust bearings (27) when installing crankshaft on models XL-12, Super XL-12 and XL-15. Other models do not use thrust washers or thrust bearings.

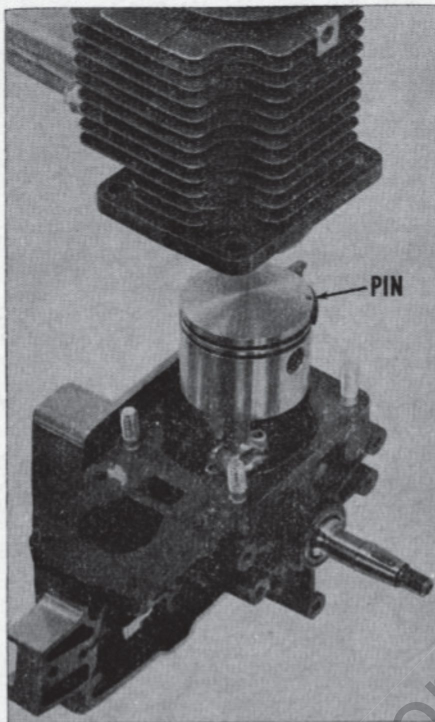


Fig. HL39–Piston and connecting rod assembly can be removed from crankpin after removing cylinder from crankcase. Note piston ring locating pin on intake side of piston.

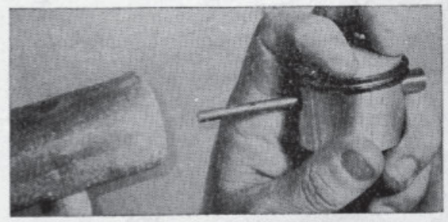


Fig. HL40–After removing snap rings, the piston pin can be tapped out using a 3/16-inch rod as shown or, on pistons with Spirol pin at exhaust side, by driving piston pin out with slotted driver (Homelite tool No. 23949).

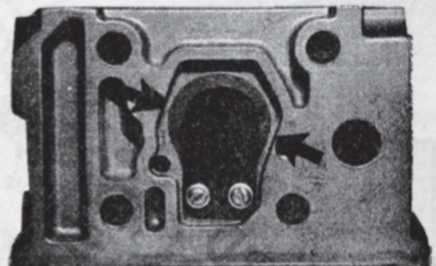


Fig. HL41–When installing reed valve on air box (models with flat reed intake valve only), be sure reed is centered between the two points indicated by arrows.

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

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

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

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

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

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

When reassembling piston to connecting rod, be sure to install closed end of piston pin towards exhaust side of piston (away from piston ring 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 models XL-12, Super XL-12 and XL-15, the crankshaft is supported in two caged needle roller bearings and crankshaft end play is controlled by a roller bearing and hardened steel thrust washer on each end of the shaft. Refer to Fig. HL38. On all other models, flywheel end of crankshaft is supported in a needle bearing in crankcase and drive end is supported in a ball bearing located in drive case; end play is controlled by the ball bearing.

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

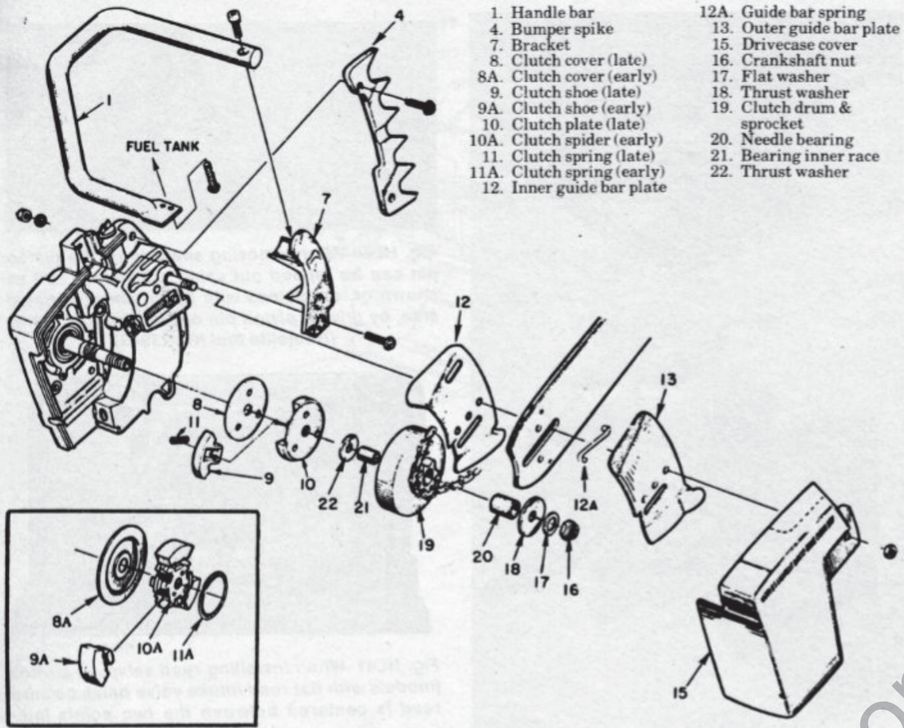
Renew the crankshaft if any of the main bearing, crankpin bearing or thrust bearing surfaces or sealing surfaces are scored, burned or excessively worn. Renew the drivecase ball bearing if excessively loose or rough. Also, reject crankshaft if flywheel keyway is beat out or if threads are badly damaged.

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

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

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

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



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

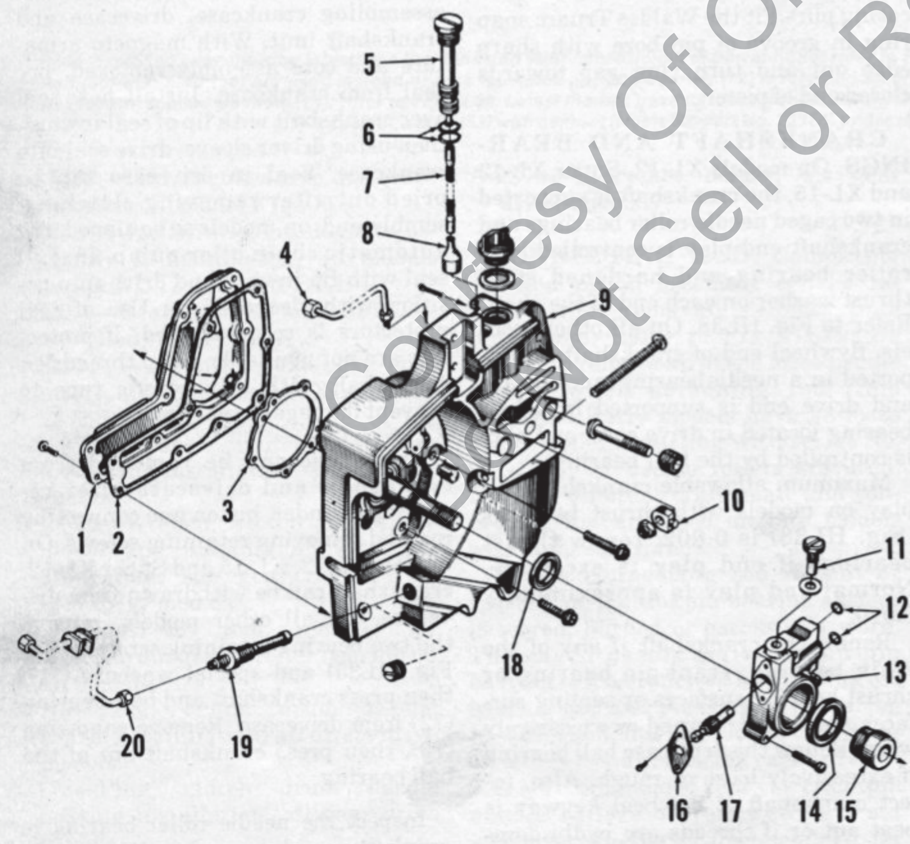


Fig. HL43–Exploded view of automatic chain oil pump on models so equipped.

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

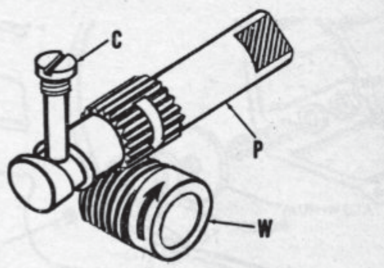


Fig. HL44–Automatic oil pump worm gear (W) driven by crankshaft turns plunger (P) at 1/20 engine speed. As plunger turns, cam on end of plunger engages cam screw (C) causing the plunger to go back and forth. Flat end of plunger acts as inlet and outlet valve.

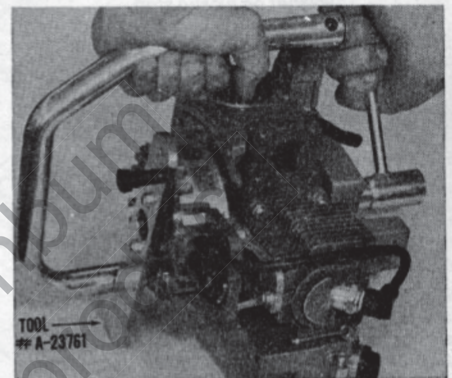
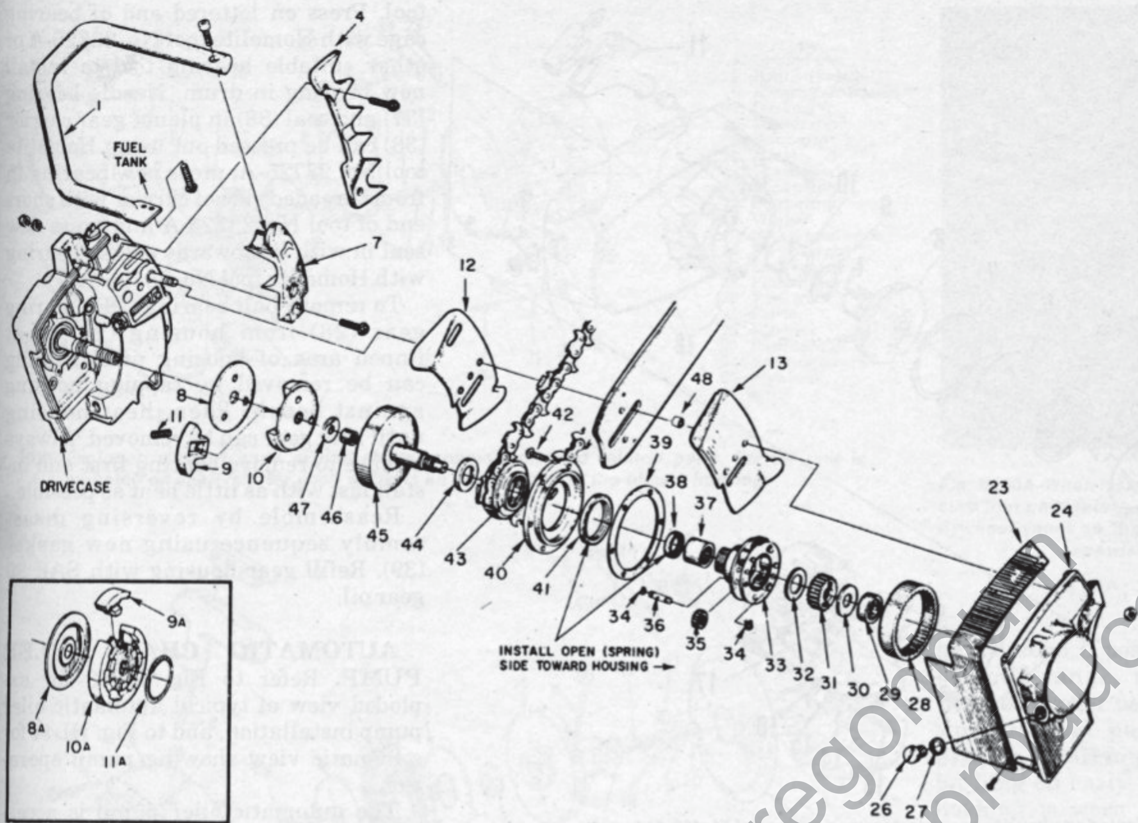


Fig. HL45–Using Homelite tool No. A-23761 to keep crankshaft from turning while removing clutch retaining nut and clutch rotor. Homelite tool No. A-23696 is used to remove or install clutch rotor.

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

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

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



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
13. Outer guide bar plate
23. Chain guard
24. Gear housing
26. Filler cap
27. Gasket
28. Ring gear
29. Ball bearing
30. Thrust washer
31. Sun gear
32. Thrust washer
33. Planetary carrier
34. Snap rings
35. Planet gears & bearings
36. Gear shaft
37. Needle bearing
38. Oil seal
39. Gasket
40. Housing cover
41. Oil seal
42. Cover screws
43. Chain sprocket
44. Thrust washer
45. Clutch drum & shaft
46. Needle bearing
47. Phenolic thrust washer
48. Guide bar bushing

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

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

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

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

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

The reed stop is curved so that measurement of reed lift distance is not practical. However, be sure that reed is centered over opening in air box and reed stop is aligned with reed as shown in Fig. HL41. Clean the screw threads and apply Loctite to threads before installing screws.

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

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

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

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

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

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

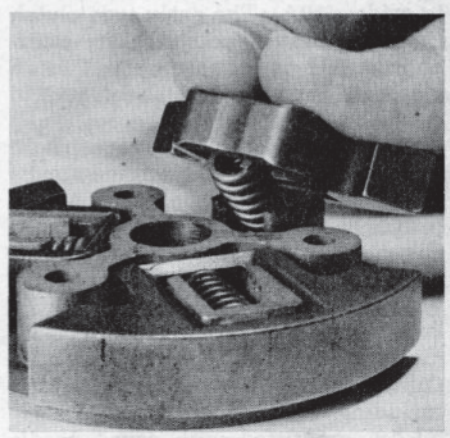


Fig. HL47–View showing easy method for installing late type clutch shoes and springs on clutch plate.

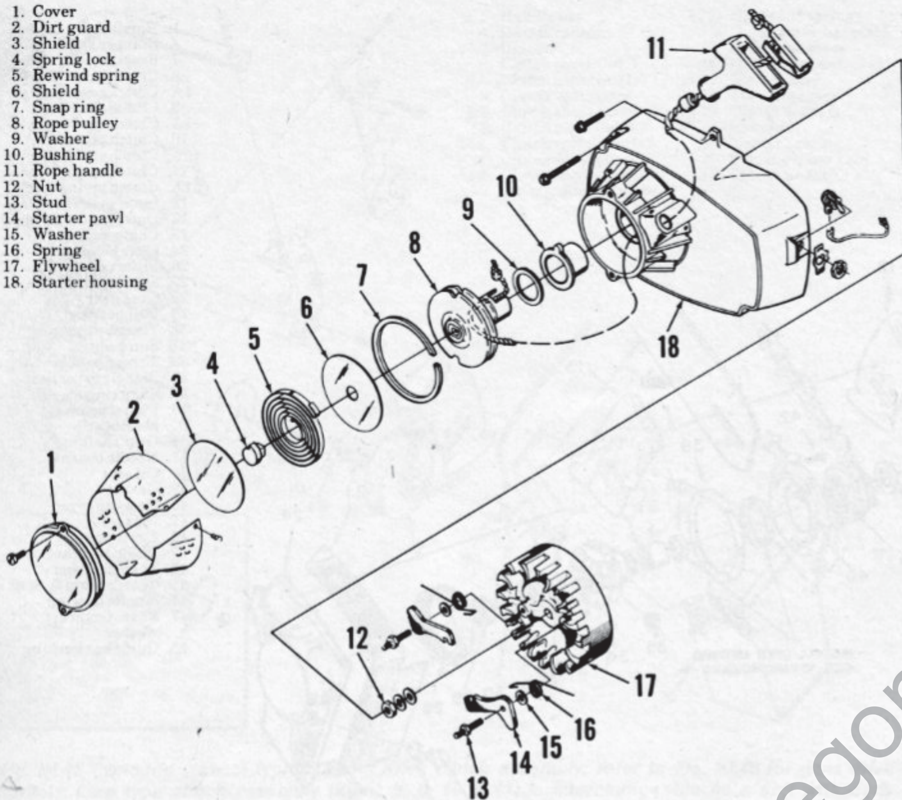


Fig. HL48–Exploded view of recoil starter used on model XL-400 Automatic.

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

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

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

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

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

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

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

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

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

Needle bearing (46) can be removed from blind hole in clutch drum with Snap-On puller A-78 or equivalent tool. Press on lettered end of bearing cage with Homelite tool No. 23726-A or other suitable bearing tool to install new bearing in drum. Needle bearing (37) and seal (38) in planet gear carrier (33) can be pressed out using Homelite tool No. 23725-A; press new bearing in from threaded side of carrier with short end of tool No. 23725-A and press new seal in with lip towards needle bearing with Homelite tool No. 23726-A.

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

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

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

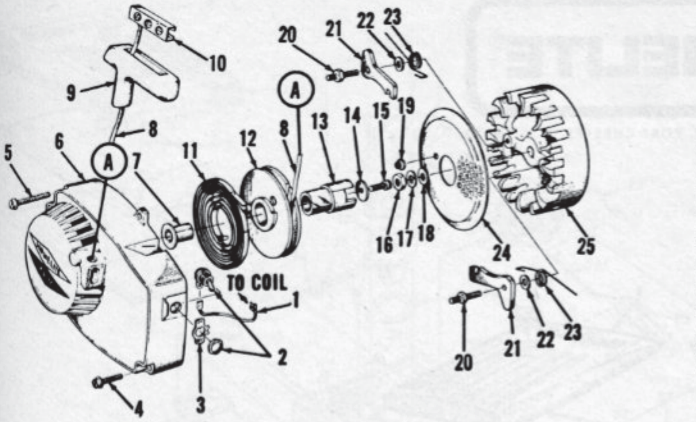
The automatic oiler pump is accessible after removing the clutch assembly from crankshaft and disconnecting oil lines. Pump plunger (67) and body (72) are available as a complete assembly only which includes flange (66), cam screw (68), gasket (69), "O" rings (70), sealing felt (71) and flange retaining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

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

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

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

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



1. Ground wire
2. Ignition switch
6. Blower (fan) housin
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 relatcd parts. Starter unit is mounted on shaft (starter post) which is an integral part of the blower housing.

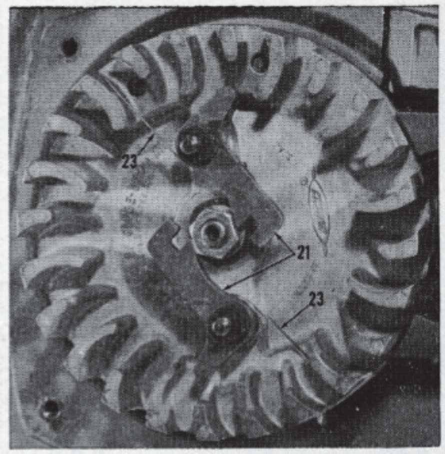


Fig. HL50A–When installing starter pawls (21), be sure that pawl return springs (23) are located in flywheel vanes so that they are parallel to the pawls as shown.

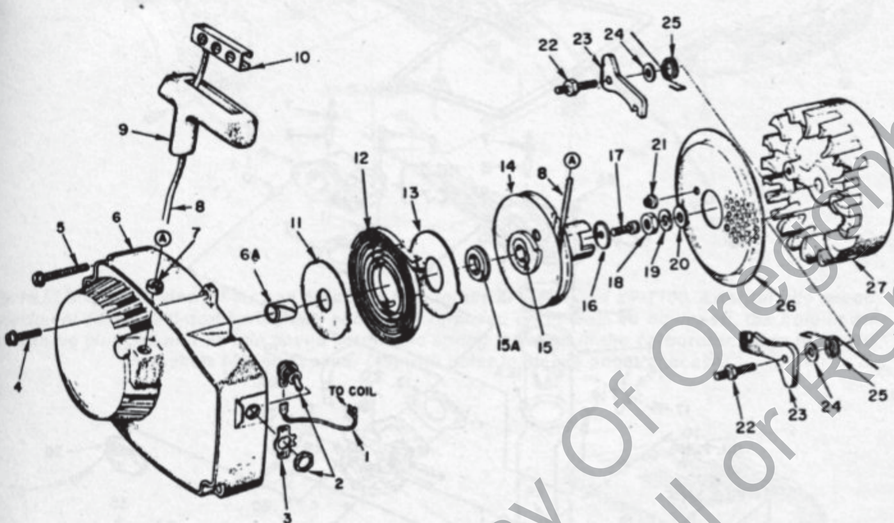


Fig. HL50–Exploded view of later production rewind starter except XL-400 Automatic.

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)

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

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

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

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

HOMELITE®

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

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

DESIGN FEATURES CODE

A—Displacement, 4.7 cu. in.; bore, 2 in.; stroke, 1½ in.

B—Displacement, 4.9 cu. in.; bore, 2 in.; stroke, 1 9/16 in.

C—Displacement, 5.22 cu. in.; bore, 2 1/16 in.; stroke, 1½ in.

D—Displacement, 6.1 cu. in.; bore, 2 3/16 in.; stroke, 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.

J—Pyramid reed type intake valve, 4 reeds, prior to Serial No. 1854403, flat reed type intake valve on all later production.

K—Conventional flywheel type magneto.

L—Direct drive.

M—Direct drive, convertible to planetary gear drive.

N—Planetary gear drive transmission.

O—Three gear transmission with optional ratios of 2:1 and 3:1.

P—Manual chain oiler only.

Q—Manual chain oiler, automatic oiler kit available for models with drilled oil channel in drive case.

R—Automatic and manual chain oiler.

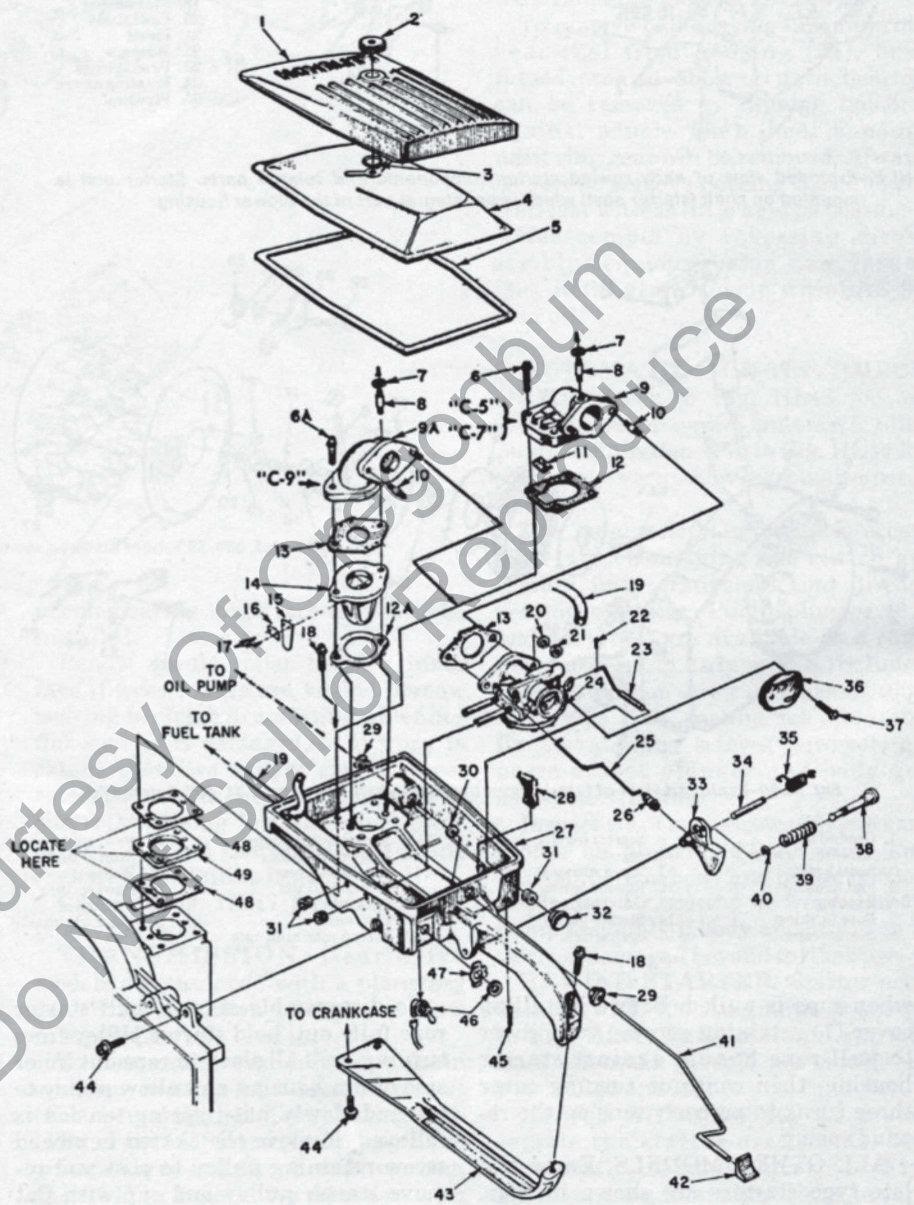


Fig. HL51–Exploded view of C-Series air box assembly (throttle handle) and related parts. Models C-5, C-51, C-51G, C-71 and C-71G have integral elbow (9) and reed valve unit. Models C-9, C-91 and C-91G are equipped with pyramid type reed valve assembly (14, 15, 16 & 17). Air deflector (36) is used on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

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

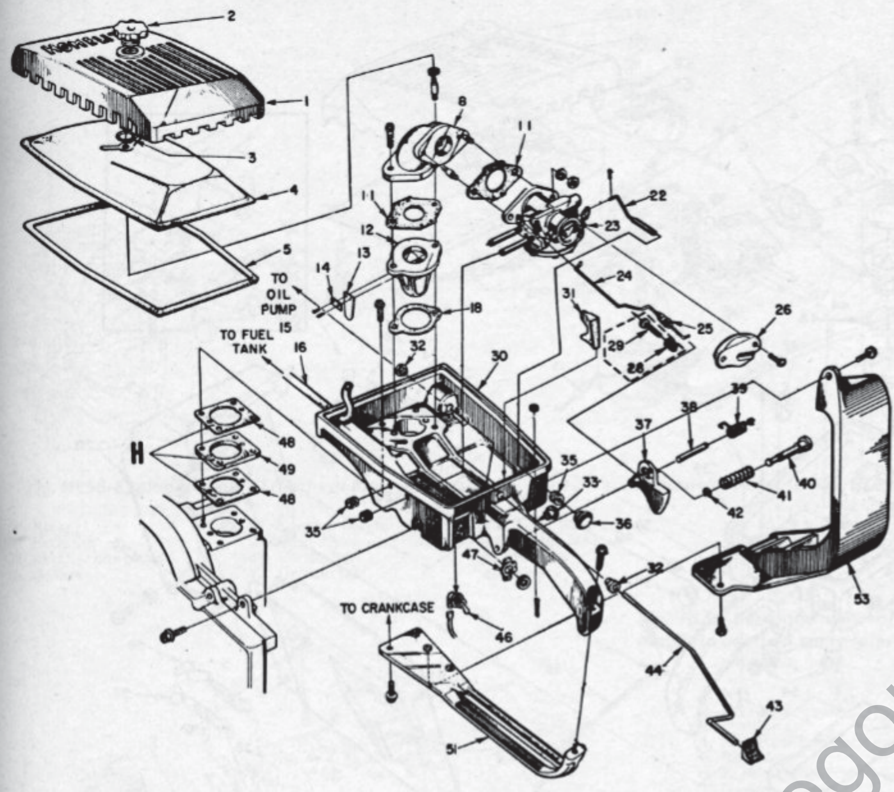


Fig. HL52–Exploded view of air box assembly for models XP-1000 and XP-1100. External idle speed adjustment screw (29) and spring (28) should be removed on models so equipped, the hole in air box can be plugged and an idle speed screw and spring installed in the carburetor. Align holes (H) in gaskets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

1. Cover
2. Knob
3. Retainer
4. Filter
5. Gasket
8. Elbow
11. Gaskets
12. Reed valve seat
13. Reed valves
14. Retainer
16. Fuel tube
18. Gasket
22. Choke rod
23. Carburetor
24. Throttle rod
25. Grommet
26. Air deflector
28. Spring
29. Idle speed screw
30. Air box
31. Stop
32. Grommet
33. Bushing
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 (XP-1100)

MAINTENANCE

SPARK PLUG. Recommended Champion spark plug is as follows:

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

Recommended spark plug electrode gap is 0.025.

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

Initial carburetor adjustment for all C series saws is 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. Note that idle speed on models XP-1020, XP-1020 Automatic, XP-1130, 1050 Automatic, and 1130G is adjusted by turning air screw (5—Fig. HL53) in intake manifold. Turning screw clockwise will increase idle speed while turning screw counterclockwise will decrease idle speed. Initial setting is ⅜ turn open. Make final adjustments with engine at running temperature. Adjust high speed screw to obtain optimum performance with engine under cutting load.

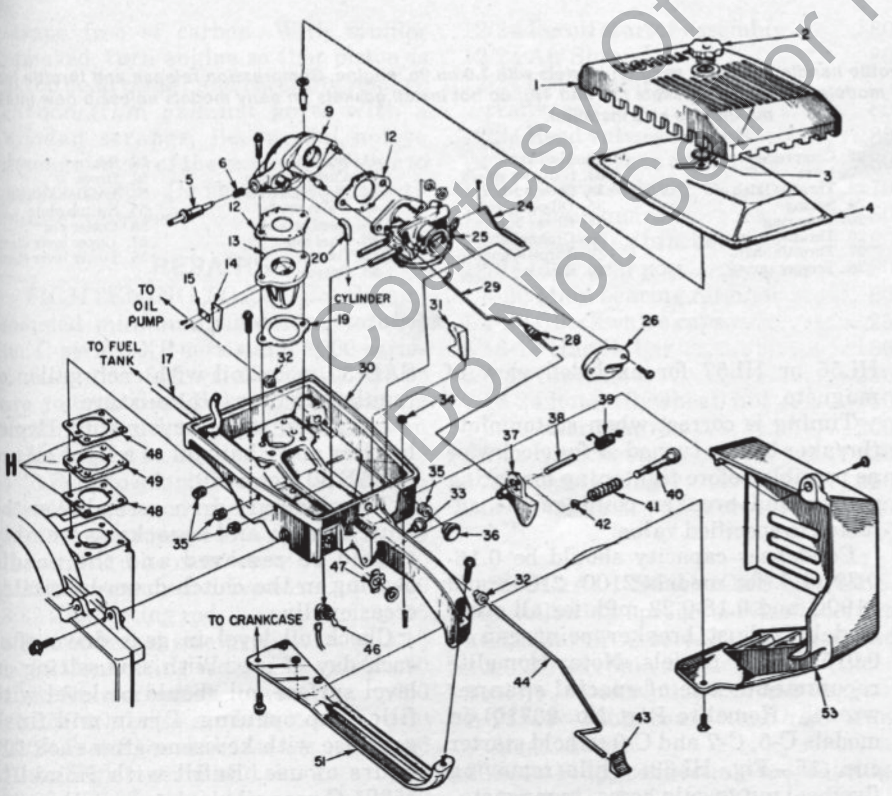


Fig. HL53–Exploded view of air box assembly for models with 6.1 cu. in. engine except XP-1000 and XP-1100. Note idle air (speed) adjusting screw (5) in elbow (intake manifold) (9). Tube (20) is connected between intake manifold and cylinder transfer port. Align holes (H) in gaskets (48) and spacer (49)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

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

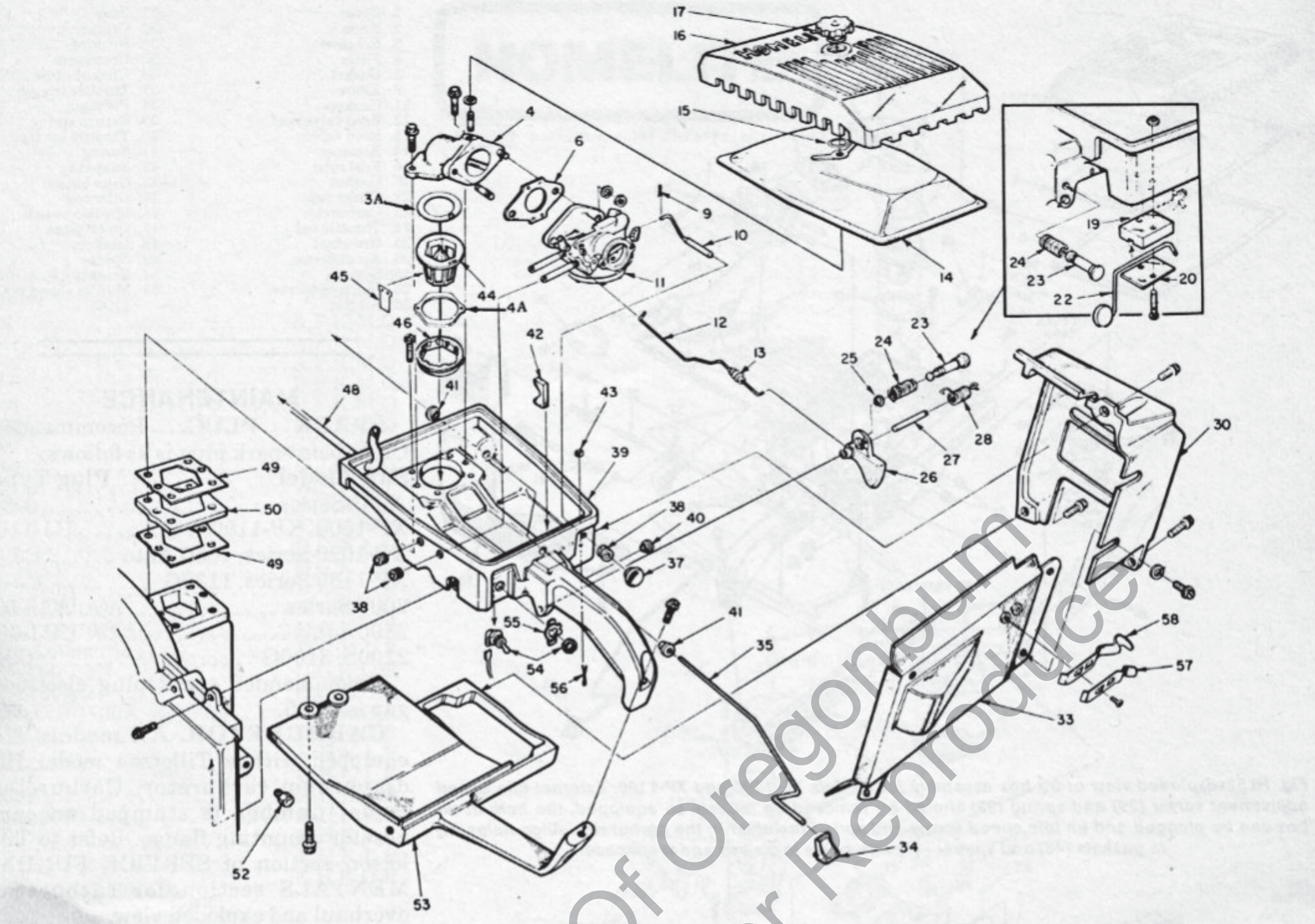


Fig. HL54–Exploded view of typical air box and throttle handle assembly used on models with 7.0 cu. in. engine. Compression release and throttle lock mechanism is shown in inset at upper right. Early models did not use gaskets (3A and 4A); do not install gaskets on early models unless a new intake manifold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

3A. Gasket
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

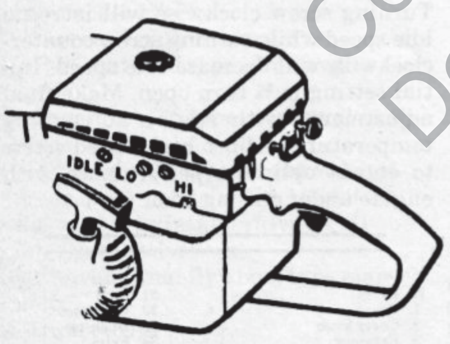


Fig. HL55–View showing carburetor adjustment points for models XP-1020, XP-1020 Automatic, 1050 Automatic, XP-1130 and 1130G. Refer to exploded view in Fig. HL53 for view showing idle adjusting screw (5), spring (6) and intake manifold (9).

MAGNETO AND TIMING. All saws are equipped with a conventional flywheel type magneto. Refer to Fig. HL56 or HL57 for exploded view of magneto.

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

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

LUBRICATION. Engine is lubricated by mixing oil with fuel. Mix thoroughly in a separate container ½-pint of Homelite motor oil or good grade SAE 30 motor oil with each gallon of regular gasoline (16:1 mixture).

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

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

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

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

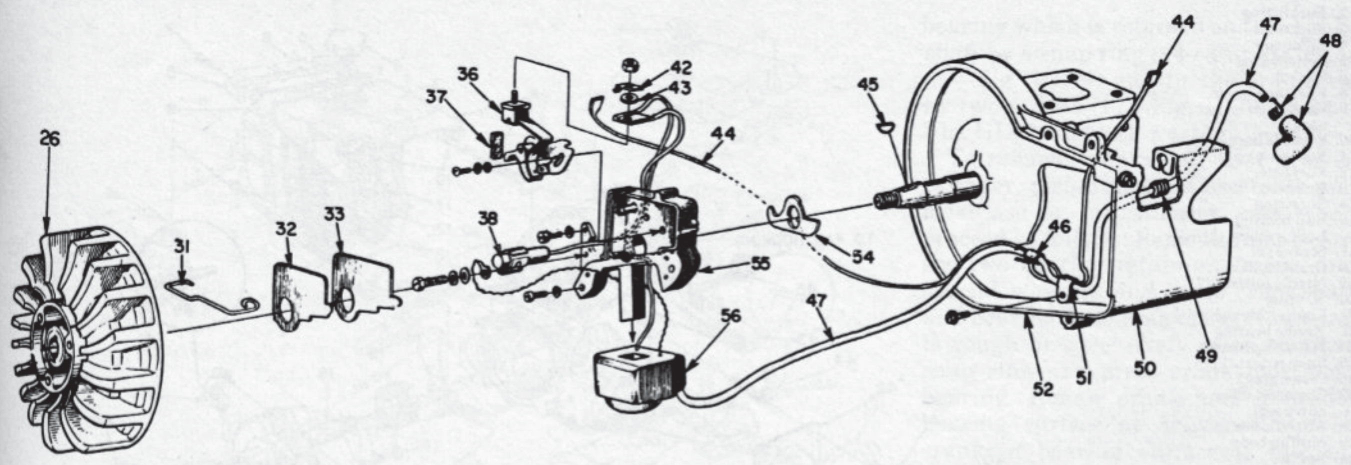


Fig. HL56–Exploded view of flywheel magneto assembly used on some models. Refer to Fig. HL57 for magneto which is also used on some models.

26. Rotor
31. Retainer
32. Breaker box cover
33. Gasket
36. Breaker points
37. Cam wiper
38. Condenser
42. Ground tab
43. Terminal washer
44. Switch lead
45. Rotor key
46. Sleeve
47. Spark plug wire
48. Terminal
49. Grommet
50. Cylinder shield
51. Clamp
52. Crankcase
54. Seal
55. Breaker box & core
56. Ignition coil

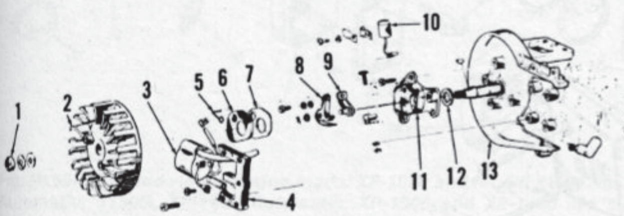


Fig. HL57–Exploded view of magneto used on some later models.

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

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

REPAIRS

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

4/40 Reed to adapter	5
4/40 Flange bearing, oil pump	5
#6 Oil reservoir cover	25
Automatic oiler cam screw	70
8/32 Oiler pump to drive-case	40
8/32 Connecting rod	55
8/32 Condenser screw	15
10/32 Connecting rod	70
10/32 Starter pulley	50
10/32 Carburetor air deflector	50
10/24 Stator to crankcase	40
10/24 High tension lead clamp	25
10/24 Cylinder shield	50
12/24 Fuel tank	80
12/24 Muffler cap	50
12/24 Muffler to cylinder	60
12/24 Pistol grip bracket	80
12/24 Recoil starter assembly	80
12/24 Air Shroud	80
12/24 Carburetor chamber to crankcase	80
12/24 Reed valve assembly	80
12/24 Drivecase to crankcase	80
12/24 Gearcase cover	70
12/24 Chain guard	80
12/24 Mounting bracket	80
12/24 Idler gear post	80
1/4-20 Main bearing retainer	80
1/4-28 Check valve caps	25
5/16-18 Handle bar	180
3/8-24 Clutch nut	250
7/16-24 Rotor (flywheel) nut	250
1/2-20 Idler gear nut	200
1/2-20 Sprocket nut	250
14mm Spark plug	250
Clutch spider	180

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

Tool No. Description & Model Usage

A-23809—Plug connecting rod bearing, C-series.
23874—Plug, connecting rod bearing, XP-series, 1050, 1130G.
24206-1—Plug, connecting rod bearing, 2000, 2100, 2100S.
22828—Pliers, piston pin snap ring, all models.
23234—Remover, piston pin, early C-series.
A-23950—Remover, piston pin W/Spirol pin, XP-series.
A-23951—Remover, piston pin W/Spirol pin, early C-series.
AA-22560—Remover, rotor, C-series, early XP.
A-24028—Remover, rotor, late XP-series, 1050, 1130G, 2000.
A-23762—Jackscrew, ball main bearing, all models.
23136—Body for A-23762.
22820-2—Bearing collar for A-23762.
23670—Aligning plate, crankshaft, C series, XP series, 1050, 1130G.
24207-1—Aligning plate, crankshaft, 2000, 2100, 2100S, 3100G.
A-23858—Fixture, drivecase, 2000, 2100, 2100S.
23373-4—Bearing collar, 2000, 2100, 2100S, 3100G.
23382—Crankshaft spacer, 2000, 2100, 2100S, 3100G.
24210-1—Collar, 2000, 2100, 2100S.
23233-1—Plug, crankcase seal, all models.
23671—Plug, drivecase seal, all models.
23693—Sleeve, drivecase seal, C & XP-series, 1050, 1130G, 3100G.
23876—Plug, drivecase bearing, C-series & XP-1020, 1050.
23391-2—Plug, drivecase bearing, C-series.
23391-3—Plug, drivecase bearing, XP-1130, 1130G.
23384—Plug, drivecase seal, 2000, 2100, 2100S, 3100G.
23390—Sleeve, crankshaft assembling, 2000, 2100, 2100S.
A-24138—Reamer, compression release valve seat 2000, 2100, 2100S, 3100G.
23420—Plug, clutch drum bearing, XP-1020 Automatic, XP-1130, 1050.

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

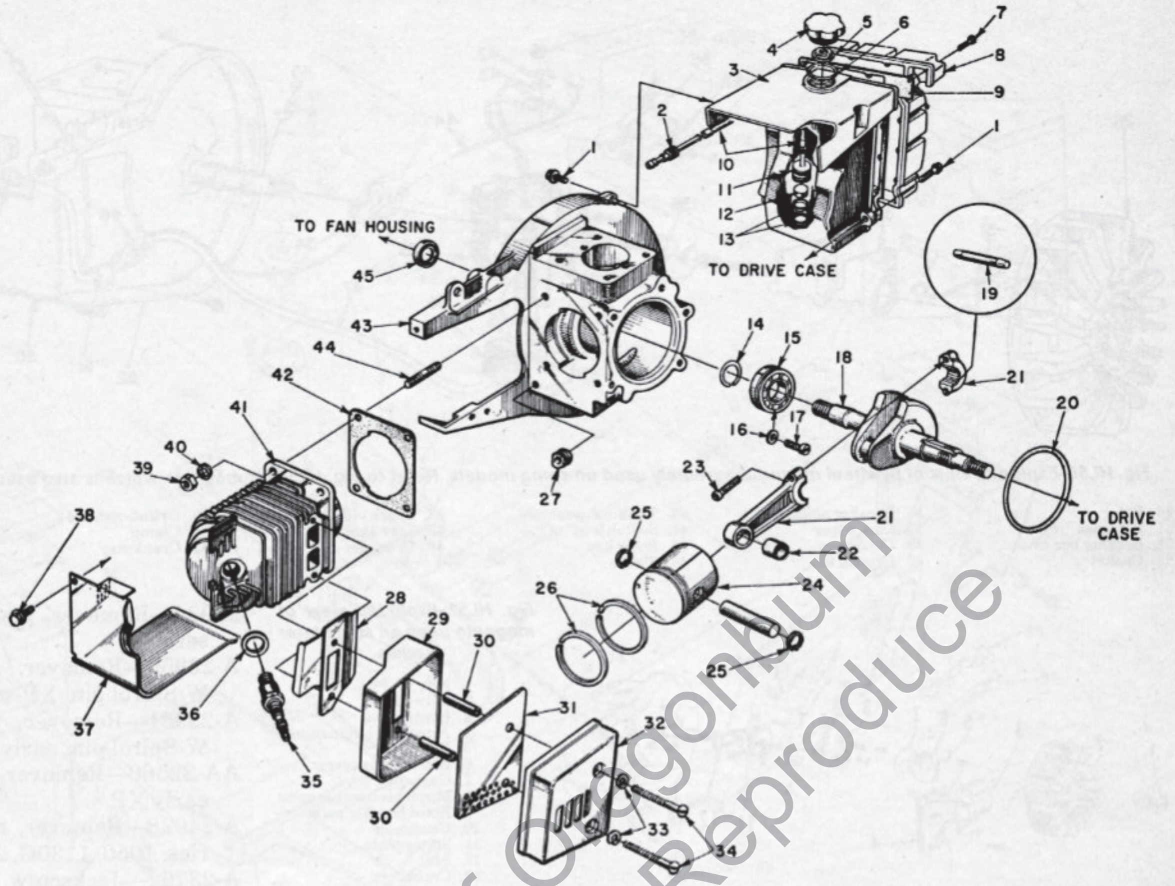


Fig. HL58–Exploded view of model C-7 powerhead and fuel tank. Other C series saws are similar. Gasket (9) is no longer used. Homelite cement No. 22788 is used in place of gasket to seal between tank and cover.

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

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

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

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. Latest connecting rods are 1/16-inch wider than early rods (at piston pin end). The caged needle roller piston 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 Super 2000 and model 2100, piston is fitted with a pinned head land type piston ring; on all other models, piston is fitted with two pinned compression rings. Renew piston if scored, cracked or excessively worn, or if ring side clearance in top ring groove exceeds 0.004.

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

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

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

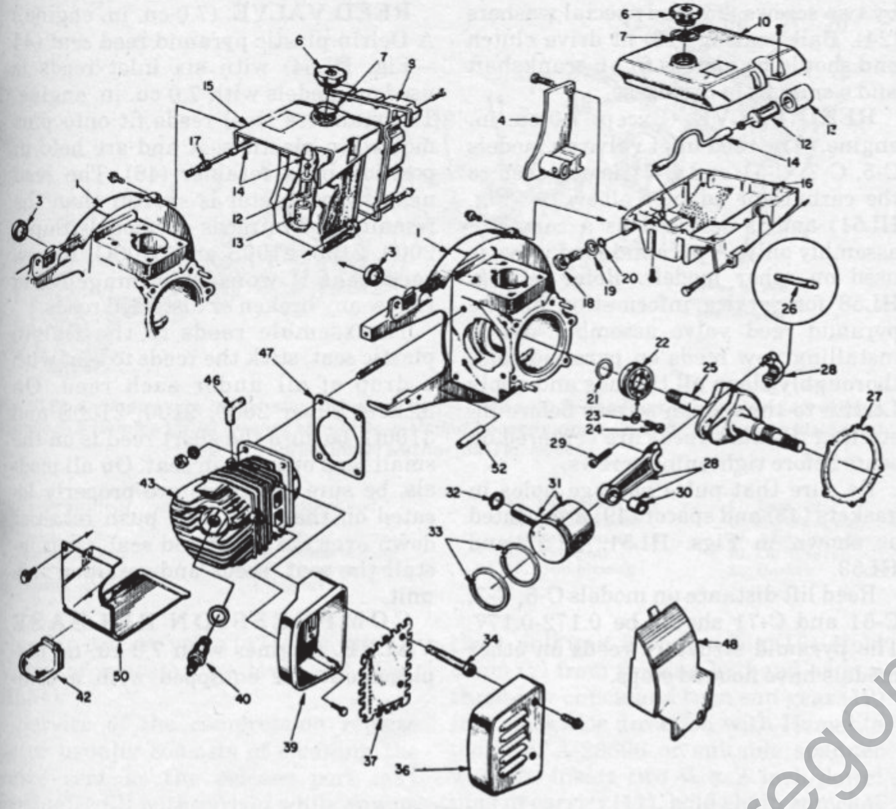


Fig. HL59–Exploded view showing model XP-1020 and model XP-1130 engine assembly. Models 1050 Automatic, 1130G, XP-1020 Automatic, XP-1000 and XP-1100 are similar. View shows fuel tank construction for both the direct and gear drive models.

1. Crankcase
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 (see 20—Fig. HL51D)
47. Gasket
48. Heat exchanger (optional)
50. Cylinder shield

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

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

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

CRANKSHAFT, MAIN BEARINGS AND SEALS. Except on 7.0 cu. in. engines, the crankshaft is supported in a caged needle roller bearing at drivecase end of shaft and a ball bearing at flywheel end. End play of the crankshaft is controlled by the ball bearing which is retained on the crankshaft by a snap ring (14—Fig. HL58, or 21—Fig. HL59) and in the crankcase by two screws (17—Fig. HL58 or 24—Fig. HL59) and lock washers.

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

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

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

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

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
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

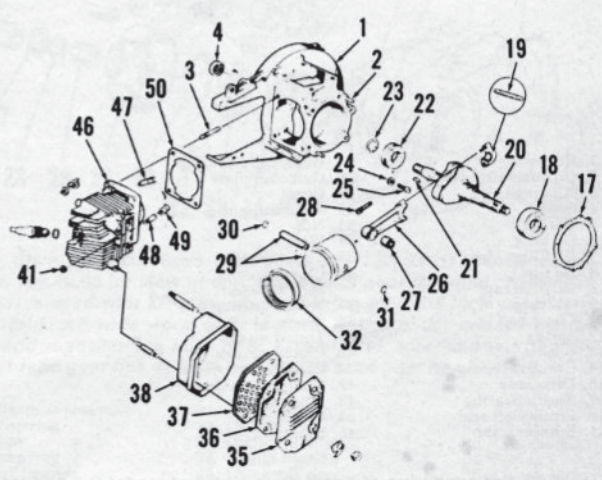


Fig. HL60–Exploded view of powerhead used on Super 2000 saw. Other 2000, 2100 and 3100 series models are similar. Some models use two conventional piston rings instead of head land type ring shown. Be sure piston and rings are of same type.

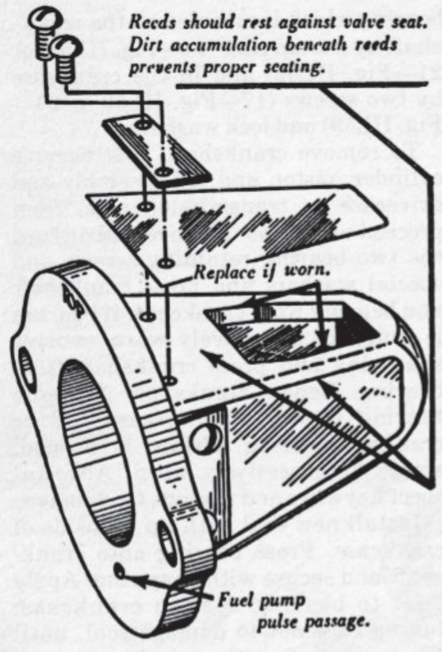


Fig. HL61–Pyramid type reed valve, showing proper installation for models with metal reed seat.

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

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

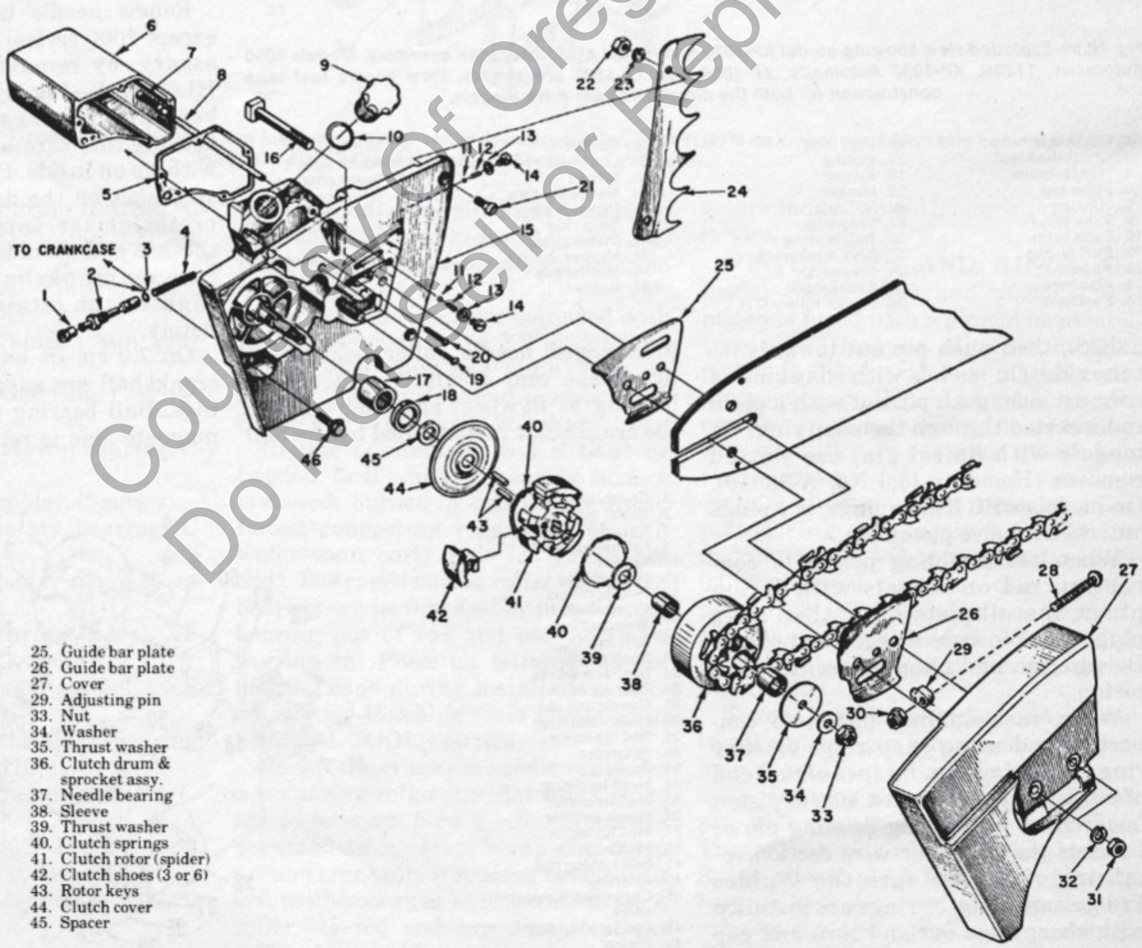
Be sure that pulse passage holes in gaskets (48) and spacer (49) are located as shown in Figs. HL51, HL52 and HL53.

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

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

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

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



1. Connector
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. Drive case
17. Needle bearing
18. Crankshaft seal
24. Bumper spike
25. Guide bar plate
26. Guide bar plate
27. Cover
29. Adjusting pin
33. Nut
34. Washer
35. Thrust washer
36. Clutch drum & sprocket assy.
37. Needle bearing
38. Sleeve
39. Thrust washer
40. Clutch springs
41. Clutch rotor (spider)
42. Clutch shoes (3 or 6)
43. Rotor keys
44. Clutch cover
45. Spacer

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

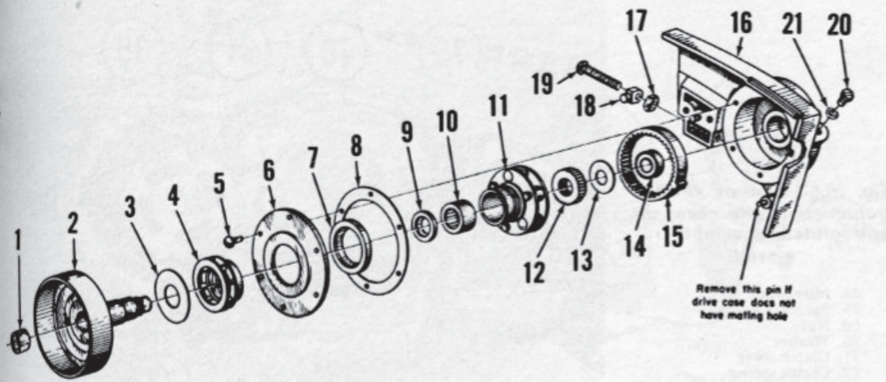


Fig. HL63–Exploded view of planetary drive unit that is used on C Series saws. When planetary drive is installed, a formica thrust washer should be installed between drum (2) and clutch rotor instead of steel thrust washer (39–Fig. HL62).

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

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

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

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

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

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

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

To disassemble gear drive unit, drain oil from housing and remove screws (5); then, pull unit from housing (16). Hold drum (2) from turning by hand or in a three-jaw chuck and turn sun gear (12) in a clockwise direction with Homelite tool No. A-23696 or suitable spanner wrench. Insert two ¼ x 2 inch dowel pins in carrier (11), hold chain sprocket from turning (use of Homelite sprocket locking fixture No. A-23713 is suggested) and turn planet carrier in a counter-clockwise direction with pry-bar against the dowel pins.

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

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

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

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

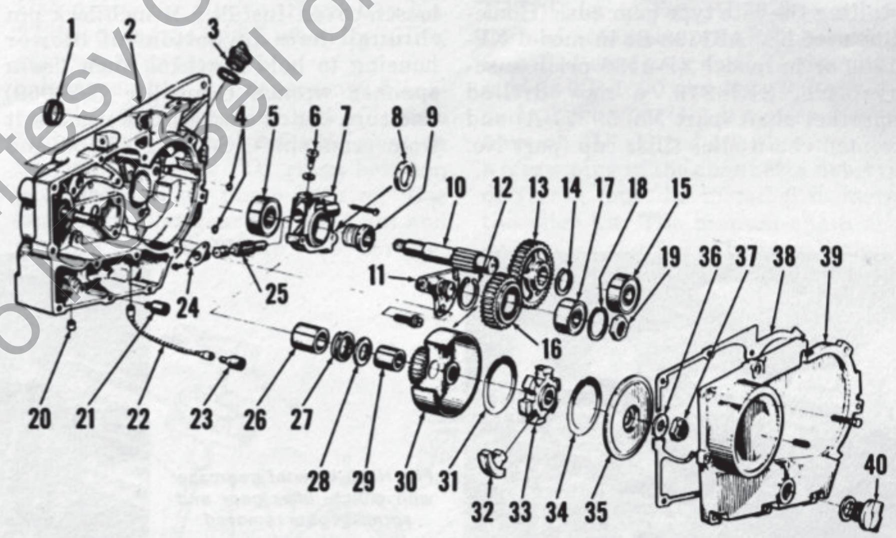


Fig. HL64–Exploded view of gear drive assembly used on models XP-1100, XP-1130A, Super XP-1130A, 1130G and 3100G. Refer to Fig. HL65 for view of opposite side of gearcase and chain drive sprocket. A ⅛-inch thick spacer (8) is used with XP-1100 models having an 11/16-inch wide worm gear (9); do not use spacer if a 13/16-inch wide worm gear is used. Ratios of 2:1 and 3:1 can be obtained by changing gear (13) and repositioning idler gear assembly to accommodate the different gear diameter. The 2:1 ratio gear has 42 teeth and the 3:1 ratio gear has 64 teeth.

1. Oil seal
2. Gearcase
3. Filler cap
4. "O" rings
5. Ball bearing
6. Cam screw
7. Oil pump housing
8. Spacer
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

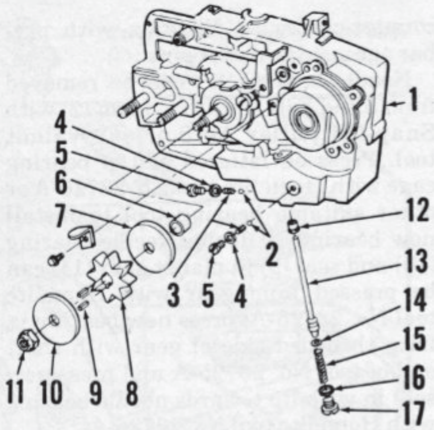


Fig. HL65–View showing chain drive sprocket and manual oiler pump components removed on models shown in Fig. HL64.

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

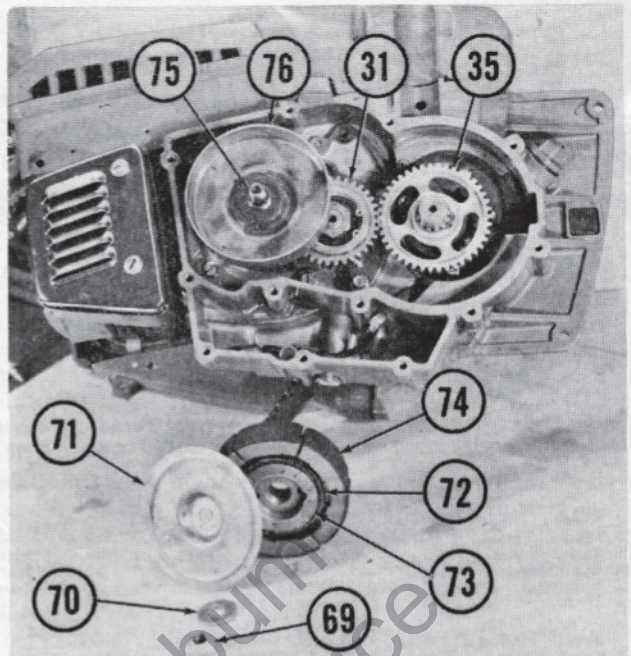


Fig. HL67–View of XP-1100 transmission with cover off and clutch assembly removed.

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

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

NOTE: Effective with model XP-1130 serial No. 2188219, gear case is vented through drilled sprocket shaft instead of through hole in gear case. Also, the chain oiler reservoir is vented through the filler cap instead of through hole in reservoir. When installing the late type gear case (Homelite part No. A63398-B) in model XP-1100 or in model XP-1130 prior to serial No. 2188219, a new drilled sprocket shaft (part No. 59277-A) and vented chain oiler filler cap (part No. A63717) must also be installed. When installing drilled sprocket shaft in early type vented gear case, it is recommended that the transmission vent hole in gear case be plugged.

To service transmission, drain oil from chain oil tank and transmission case, then remove handlebar and cover (39). Tap cover lightly, if necessary, to loosen cover. Install a 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 bearing (29—Fig. HL64) can be removed if necessary. Turn nut (19) clockwise to remove and lift idler gear assembly (16) off idler post (11). Bearing (17) can be removed from idler gear after removing snap ring (30). Remove retaining ring (14) and pull sprocket gear (13) from sprocket shaft (10). See Fig. HL68.

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

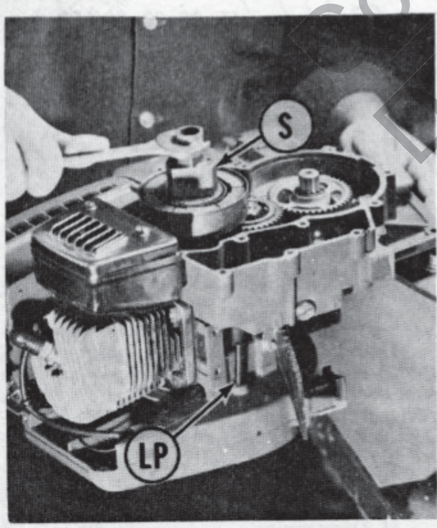
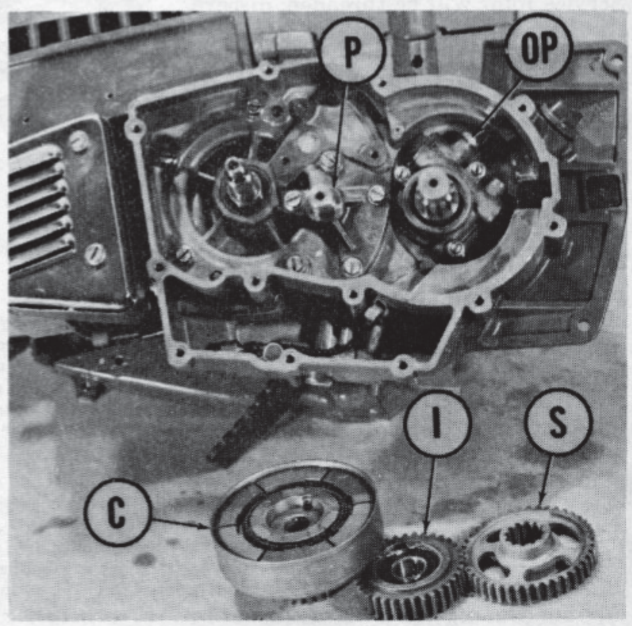


Fig. HL66–When removing clutch spider, use lock pin (LP) inserted as shown and turn clutch spider clockwise using a spanner wrench (S). Homelite number for spanner is A-23969.

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

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



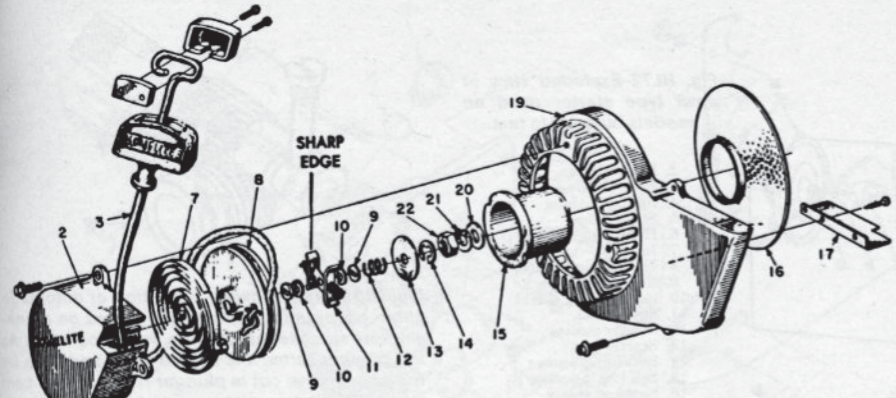


Fig. HL69–Exploded view of C Series Fairbanks-Morse starter. Friction shoe (11) components are not available separately; however, if unit has been disassembled, refer to Fig. HL70 for reassembly. Baffle (17) is integral with housing on late production units.

2. Starter housing
3. Starter rope
7. Rewind spring
8. Starter pulley
9. Brake washer
10. Fiber washer
11. Friction shoe
12. Spring
13. Washer
14. Snap ring
15. Starter cup
16. Rotating screen
17. Baffle
19. Fan housing
20. Flat washer
21. Lock washer
22. Flywheel nut

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

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

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

If sprocket shaft outer (pilot) bearing requires renewal, heat cover (39) until bearing will drop out. To remove sprocket shaft inner bearing, remove oil seal and press bearing out toward clutch side of gearcase using Homelite tool No. 23228, or equivalent.

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

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

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

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

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

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

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

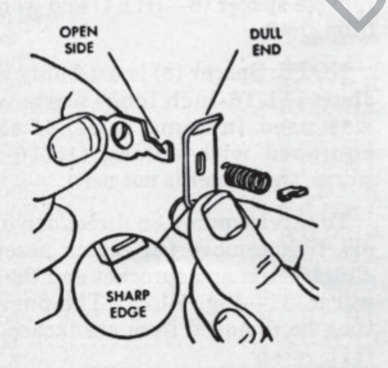


Fig. HL70–Fairbanks-Morse friction shoe unit is serviced as complete assembly only. However, if unit has been disassembled, it must be reassembled as shown. Refer to Fig. HL69 for complete view of Fairbanks-Morse starter.

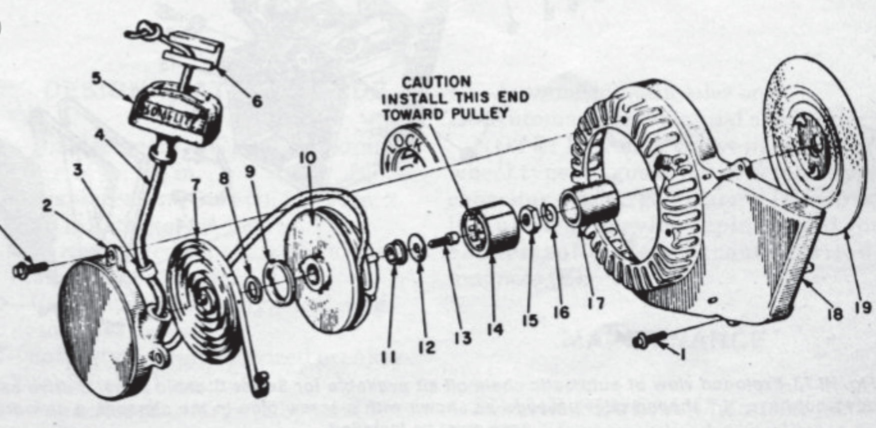


Fig. HL71–Exploded view of overrunning bearing starter used on models listed in text.

2. Starter cover
3. Rope bushing
4. Starter rope
7. Rewind spring
8. Thrust washer
9. Rewind spring lock
10. Starter pulley
11. Pulley bushing
12. Thrust washer
13. Socket head screw
14. Overrunning bearing
15. Flywheel nut
16. Lock washer
17. Inner race for (14)
18. Blower housing
19. Rotary screen

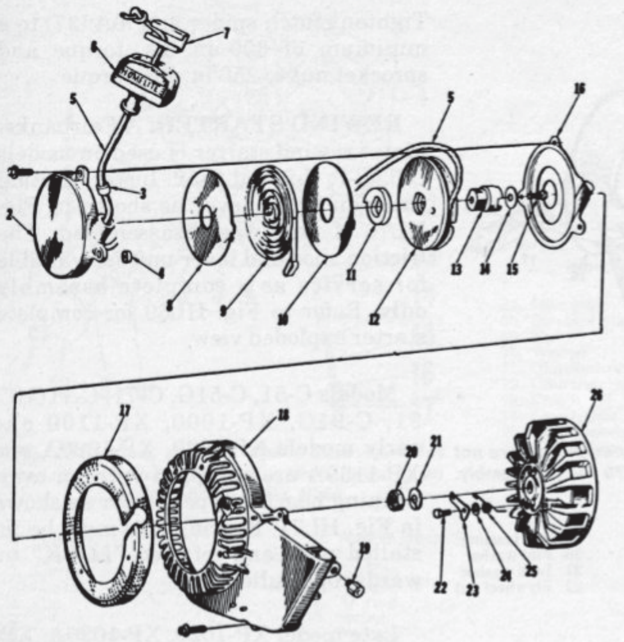


Fig. HL72–Exploded view of pawl type starter used on models outlined in text.

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

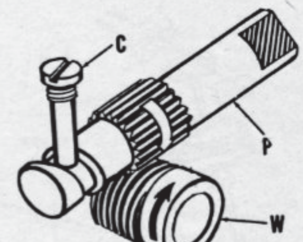


Fig. HL74–View showing operation of automatic chain oiler pump. Worm (W) mounted on crankshaft or sprocket shaft turns the plunger (P). As the plunger turns, it is moved back and forth by the cam groove cut in plunger riding on the cam screw (C). Flat on piston end of plunger acts as inlet and outlet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

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

The drive pin (7) must extend 25/64 to 13/32-inch, and must engage the drive slot in clutch drum (1). Under normal conditions, use Homelite Bar and Chain oil or SAE 30 motor oil in reservoir. In cold weather, dilute oil with kerosene as necessary to keep it flowing through pump. Oil filter (24) can be cleaned after removing cover (26).

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

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

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

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

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

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

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

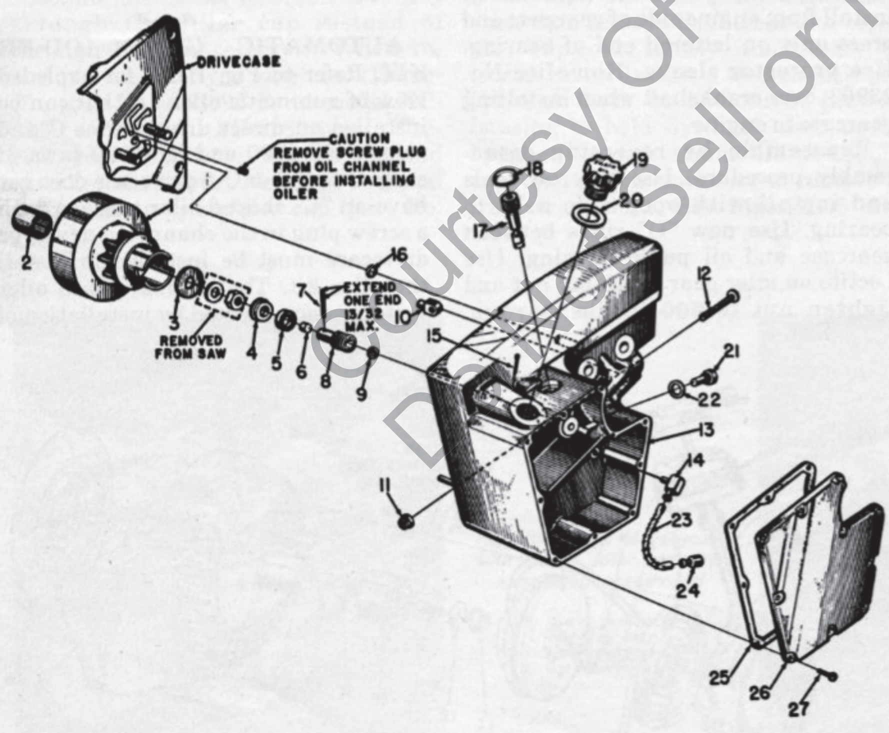
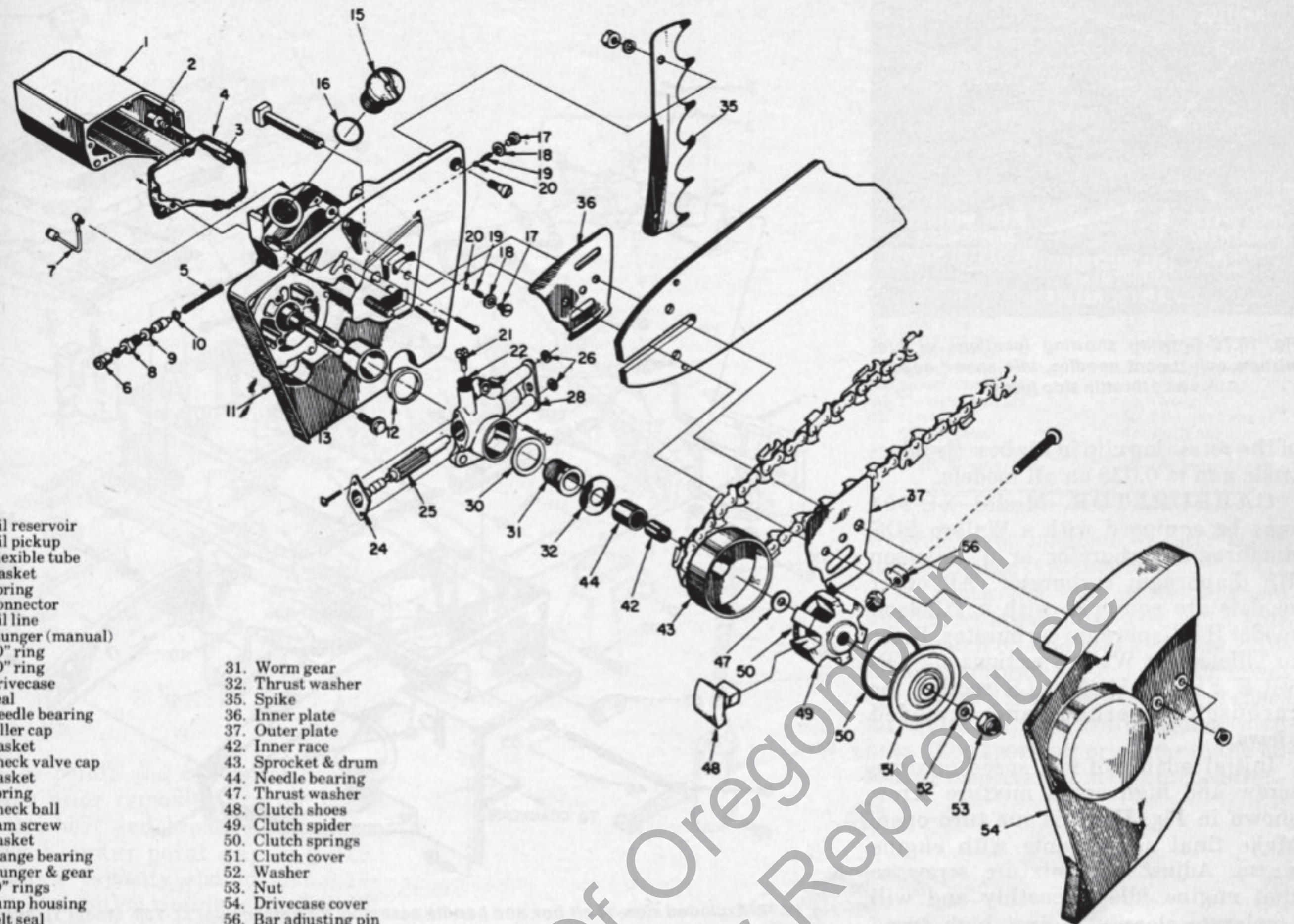


Fig. HL73–Exploded view of automatic chain oil kit available for Series C chain saws. If drive case does not have "L" shaped oiler passage as shown with a screw plug in the channel, a new drive case must be installed.

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



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
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
35. Spike
36. Inner plate
37. Outer plate
42. Inner race
43. Sprocket & drum
44. Needle bearing
47. Thrust washer
48. Clutch shoes
49. Clutch spider
50. Clutch springs
51. Clutch cover
52. Washer
53. Nut
54. Drivecase cover
56. Bar adjusting pin

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

HOMELITE®
A textron DIVISION, PORT CHESTER, N.Y. 10573

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

DESIGN FEATURES CODE

A—Displacement, 4.71 cu. in.; bore, 2 in.; stroke, 1½ in.

B—Displacement, 5.01 cu. in.; bore, 2 1/16 in.; stroke, 1½ in.

C—Pyramid reed type intake valves, 4 stainless steel reeds.

D—Conventional type flywheel magneto.

E—Solid state (transistorized breakerless) flywheel magneto.

F—Capacitor discharge (CD) solid state magneto.

G—Decompression valve (Simplex starting).

H—Direct drive.

J—Manual chain oiler only.

K—Automatic chain oiler only.

L—Automatic and manual chain oiler.

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

MAINTENANCE

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

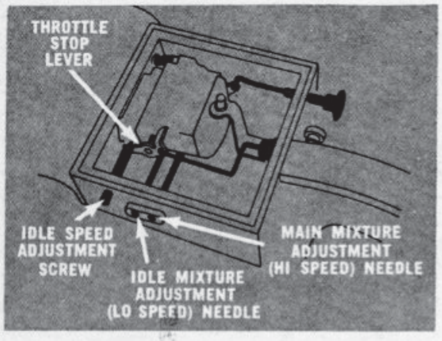


Fig. HL76–Drawing showing locations of fuel mixture adjustment needles, idle speed needle and throttle stop lever.

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

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

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

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

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

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

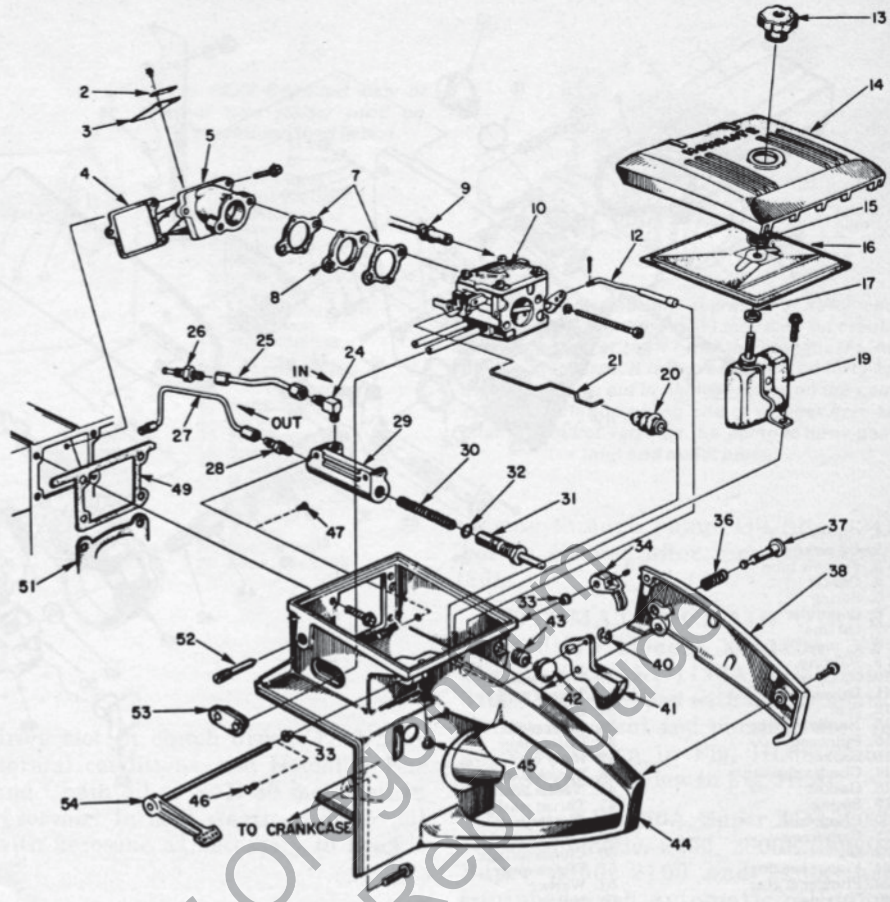
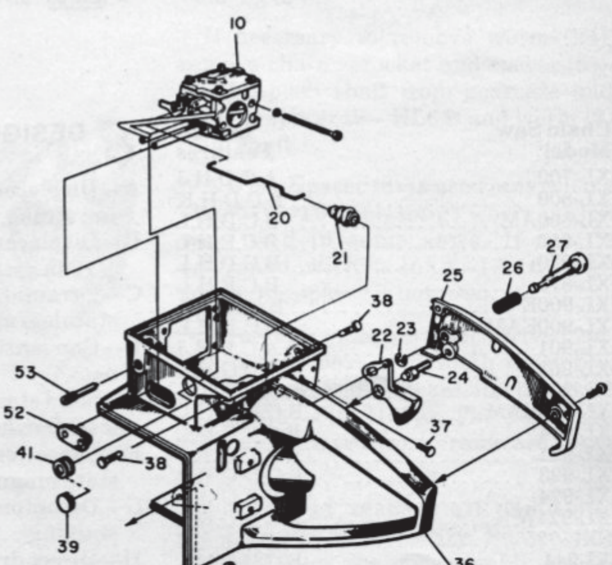


Fig. HL78–Exploded view of air box and handle assembly for early model XL-700. Model XL-800 is not equipped with manual oiler pump (items 24 through 31) and operating lever (34 and 54) although late model XL-800 has provisions for installing same. Model XL-850 and late models XL-700 and XL-800 have "Delrin"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

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

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

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



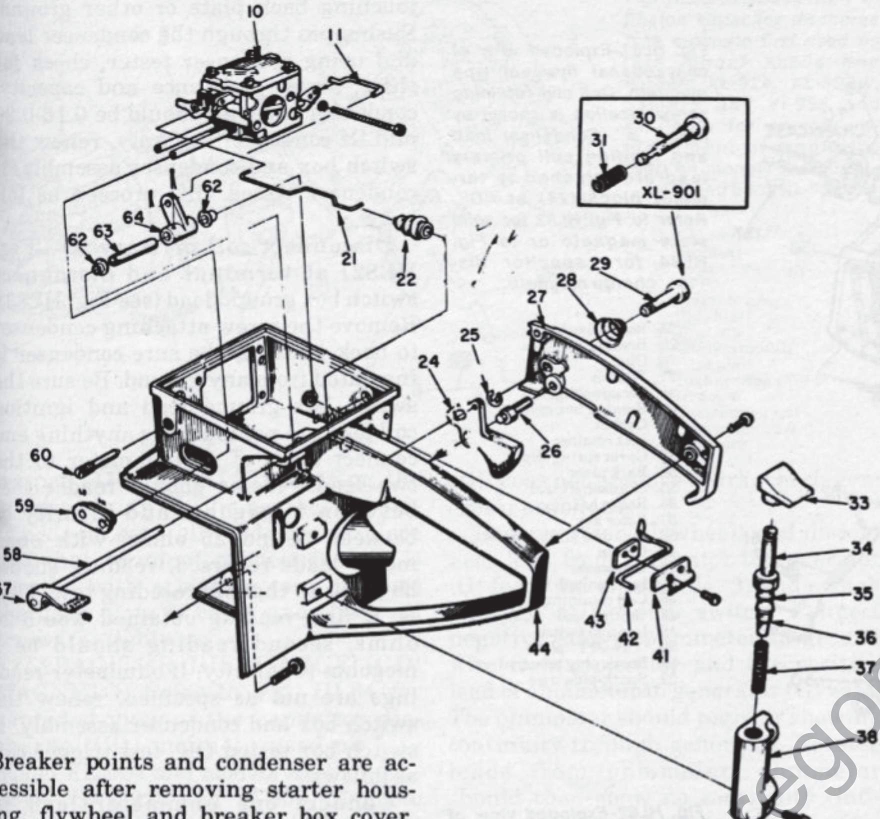


Fig. HL79A–On models XL-901, XL-903 and XL-904, choke is actuated by bellcrank (64) mounted on shaft (58) and manual chain oiler pump body (38) is mounted on air box near handle. Manual oil pump is also used on models XL-921, XL-923, XL-924, XL-924W and SXL-925. Compression release lever (42), on models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

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

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

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

To check the solid state magneto, disconnect spark plug wire, turn ignition switch on and crank engine while holding terminal about ¼-inch away from ground (engine casting) and check for spark as with conventional magneto. If no spark occurs, refer to the following inspection and test procedure:

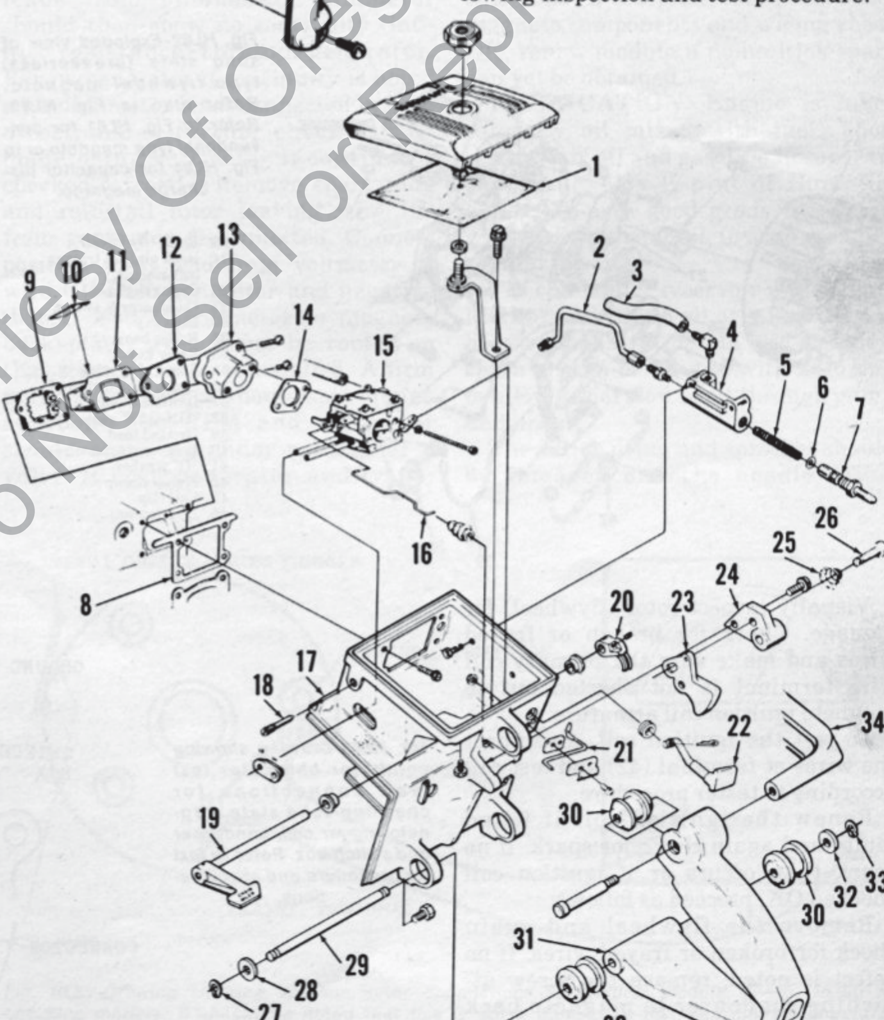


Fig. HL80–Exploded view of models VI-944 and VI-955. Note vibration isolating bushings (30). Choke rod (22) is also used on models XL-1, XL-923, XL-924, XL-924W and SXL-925.

1. Air filter
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

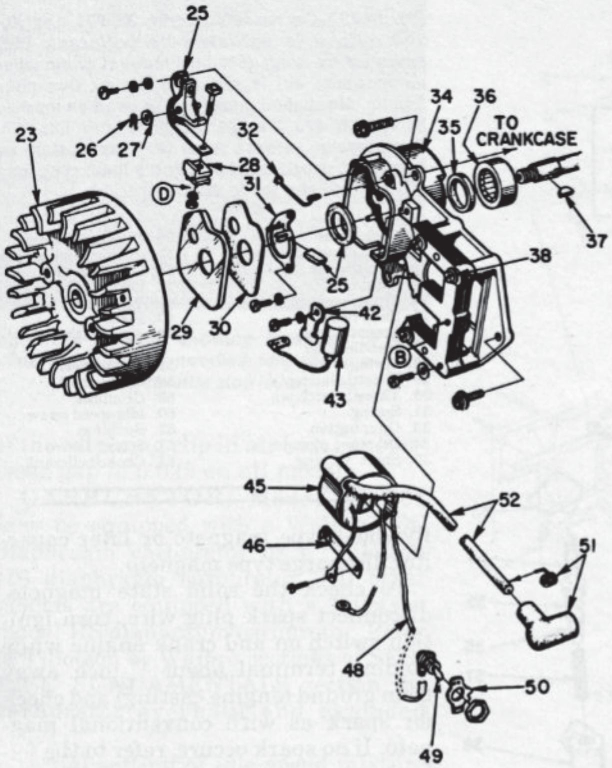


Fig. HL81–Exploded view of conventional flywheel type magneto. Coil clip retaining screw location is shown by letter "B". Condenser lead and ignition coil primary lead are attached to terminal block (28) at "D". Refer to Fig. HL82 for solid state magneto or to Fig. HL84 for capacitor discharge magneto.

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

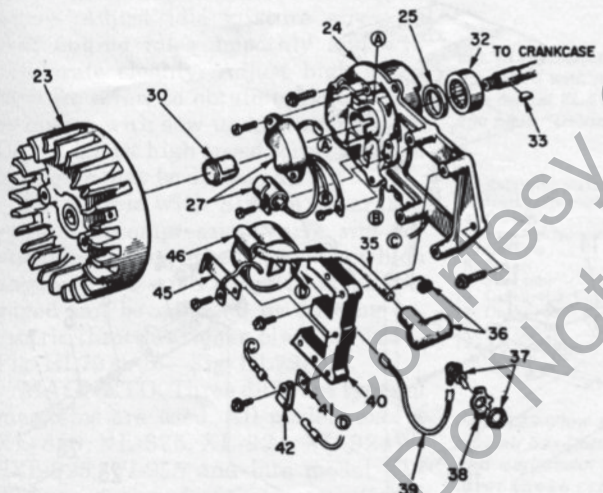


Fig. HL82–Exploded view of solid state (breakerless) type flywheel magneto. Refer also to Fig. HL83. Refer to Fig. HL81 for conventional type magneto or to Fig. HL84 for capacitor discharge magneto.

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

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

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

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

Remove the flywheel and again check for broken or frayed wires. If no defect is noted, remove the screw attaching condenser to magneto back plate and be sure condenser is not touching back plate or other ground. Push a pin through the condenser lead and using condenser tester, check for short, series resistance and capacity; condenser capacity should be 0.16-0.20 mfd. If condenser is faulty, renew the switch box and condenser assembly. If condenser tested OK, proceed as follows:

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

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

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

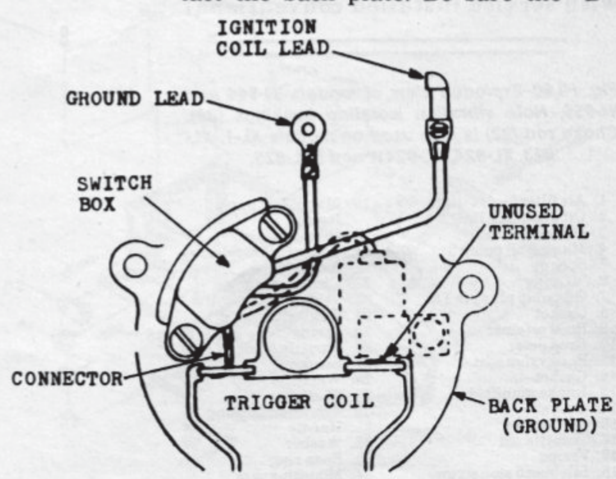


Fig. HL83–Drawing showing points for ohmmeter test lead connections for checking solid state magneto trigger coil, condenser and switch box. Refer to text for procedure and specifications.

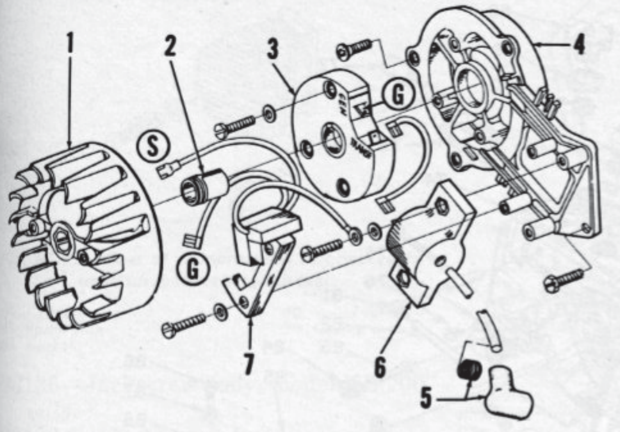


Fig. HL84–Exploded view of Phelon capacitor discharge type magneto first used on late model XL904 and models XL-924, XL-924W, SXL-925 and VI-955 and available for service replacement of magnetos used on models XL-850, XL-875 and early XL-904.

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

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

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

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

The capacitor discharge magneto can be considered OK if spark will jump a ⅜-inch gap when turning engine at cranking speed. If magneto fails to produce spark, service consists of locating and renewing inoperative unit; no maintenance is necessary.

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

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

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

LUBRICATION. Engine is lubricated by oil mixed with fuel. Thoroughly mix oil and gasoline in separate container. Mix ½-pint of Homelite motor oil, or a good grade non-detergent SAE 30 motor oil, in each gallon of regular gasoline.

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

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

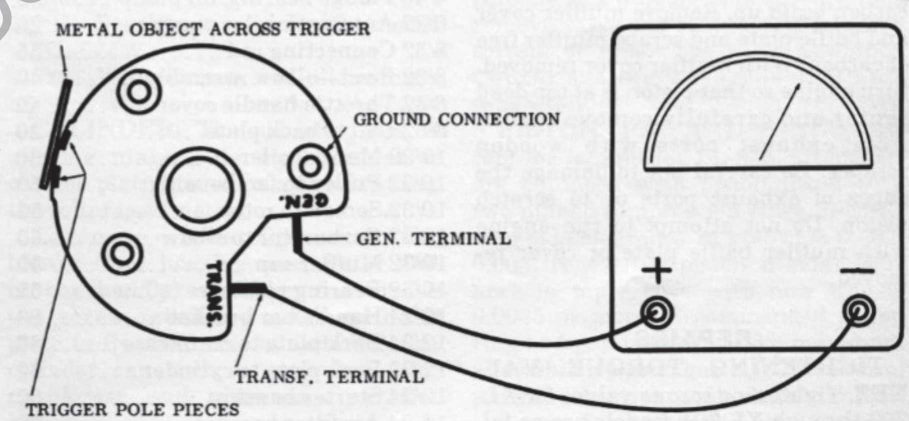


Fig. HL85–Drawing showing volt-ohmmeter connections to ignition module (3–Fig. HL84) for checking module. It should be noted that this is not a conclusive test and module should be renewed in event of spark failure when other magneto components test OK.

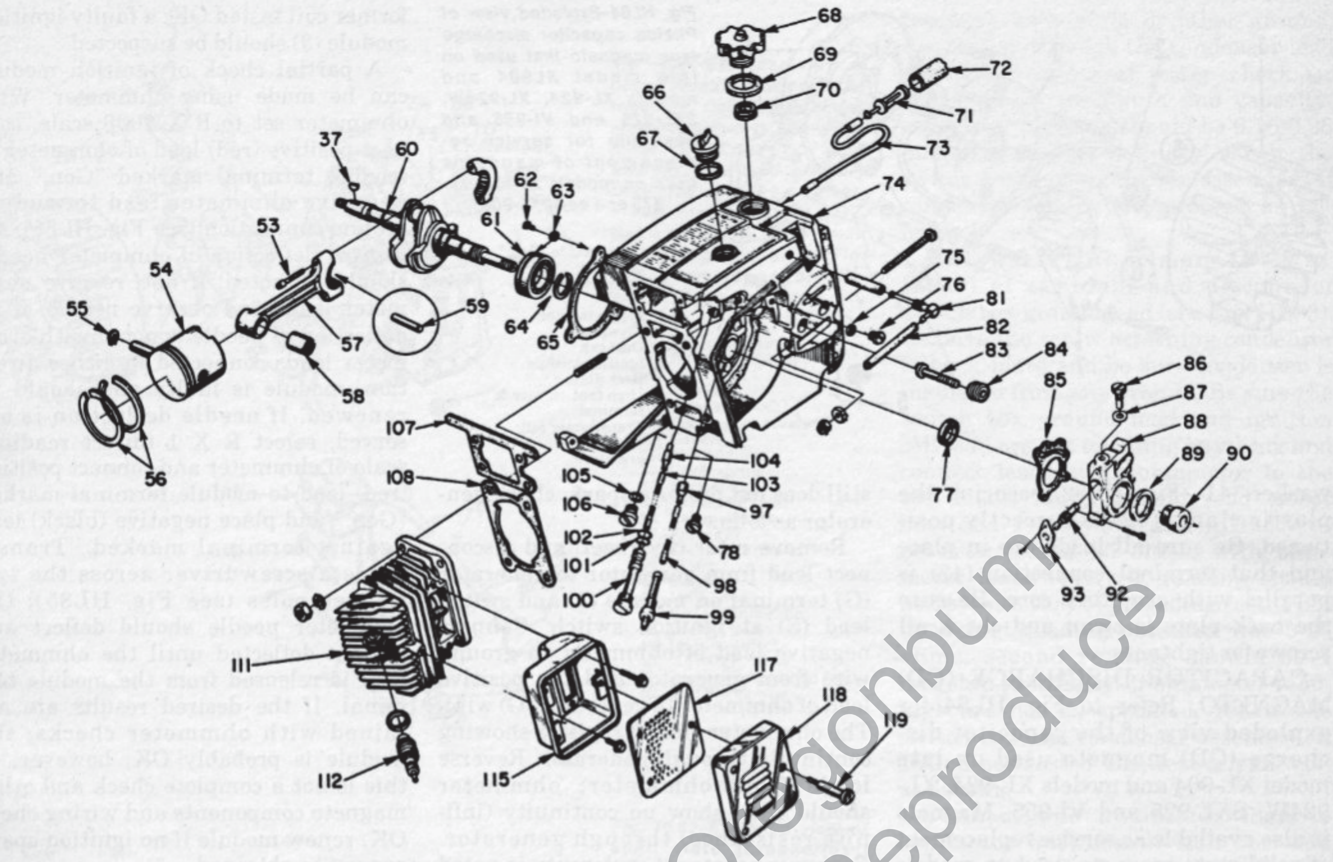


Fig. HL86–Exploded view of typical engine assembly. Some models are not equipped with automatic chain oiler pump assembly (items 85 through 93). Note that to remove the guide bar studs (83), the stud retainers (84) must be unscrewed from crankcase and tank assembly (74); do not attempt to unscrew the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

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

bearing and inner race be cleaned and greased occasionally.

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

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values for XL-700 through XL-904 models are as follows: Most of the torque values will also apply to other models. Note: All values are in inch-pounds; minimum torque value is given. To find maximum torque value, add 20% to value given.

4/40 Outer spring shield	5
4/40 Reeds to seat	5
4/40 Flange bearing, oil pump	5
6/32 Automatic oiler pump	20
8/32 Connecting rod	55
8/32 Reed—elbow assembly	40
8/32 Throttle handle cover	40
8/32 Coil to back plate	20
10/32 Manual oiler	30
10/32 Pulley to fan housing	50
10/32 Screen to rotor	50
10/32 Carburetor to elbow	50
10/32 Muffler cap	30
10/32 Bearing retainer	55
12/24 Handle bar bracket	80
12/24 Back plate to crankcase	80
12/24 Back plate to cylinder	80
12/24 Starter housing	80
12/24 Air filter bracket	80
12/24 Muffler body	80
12/24 Carburetor chamber	80
12/24 Pawl studs to rotor	80
1/4-20 Handle bar to bracket	100
1/4-20 Handle bar to crankcase	100
3/8-24 Clutch nut	150
3/8-24 Rotor nut	150
1/4-28 Cylinder nuts	100
14MM Spark plug	150
Clutch spider or plate	180

RECOMMENDED SERVICE TOOLS. Special tools for servicing models XL-700 through VI-955 are as follows:

Tool No. Description & Model Usage

23987—Shim, magneto air gap, all models except with capacitor discharge magneto.

24306—Shim, capacitor discharge magneto air gap.

23955 or 23955-I—Plug, connecting rod bearing installation, all models.

A-23137—Jackscrew, crankshaft and bearing, XL-700, XL-901 and XL-921.

A-23965—Jackscrew, crankshaft and bearing, all models, except XL-700, XL-901 and XL-921.

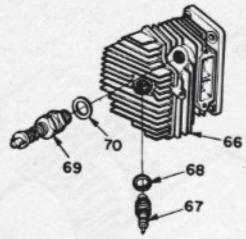


Fig. HL86A–View of compression release valve used on models listed in text.

66. Cylinder
67. Spark plug
68. Gasket
69. Relief valve
70. Copper washer

23136—Jackscrew body, model XL-700 only.
23136-1—Jackscrew body, all models except XL-700, XL-901 and XL-921.
23136-2—Jackscrew body, models XL-901 and XL-921.
22820-3—Collar, main bearing installation, models XL-700, XL-901 and XL-921.
22820-4—Collar, main bearing installation, all models except XL-700, XL-921.
23759—Sleeve, crankcase seal protector, models XL-700, XL-901 and XL-921.
23971—Sleeve, crankcase seal protector, all models except XL-700, XL-901 and XL-921.
23972—Sleeve, crankcase seal installation, all models.
23957—Plug, crankcase seal installation, all models.
A-23696—Wrench, clutch spider, all models with garter spring type clutch.
A-23934—Wrench, clutch plate, all models with compression spring type clutch.
A-23841—Wrench, bar stud retainer remover, models XL-700-800-850-900.
A-23841-A—Wrench, bar stud retainer remover, models XL-870-875-901-903-904.
A-23960—Puller, flywheel (magneto rotor), all models.
23819—Plug, sprocket bearing, models XL-700 and others with small diameter bearing.
23420—Plug, sprocket bearing, models with large diameter bearing.
23956—Plug, back plate bearing and seal, all models except XL-924, XL-924W, SXL-925, VI-944 and VI-955.
A-23962—Jackscrew, back plate bearing, all models.
23846-2—Anvil, back plate bearing, all models.
A-23951—Remover, piston pin, piston with Spirol pin.
22828—Pliers, piston pin snap ring, all models except with Rulon plastic pin retaining plugs.
23846-1—Anvil, crankshaft installation, all models.

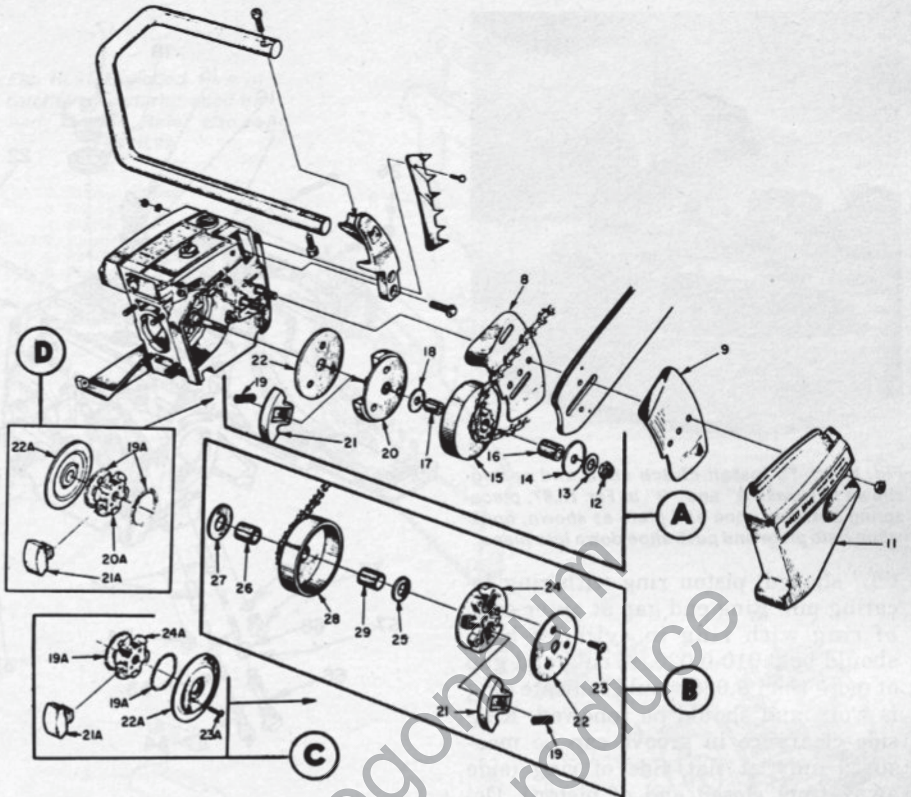


Fig. HL87–View showing different clutches which have been used. Refer to Fig. HL88 for assembly of clutch shoes (21) and springs (19) to clutch plate (20 or 24). Clutch shoes should be renewed in complete sets only to maintain balance of clutch assembly. On models XL-901, XL-921 and late XL-700, clutch construction is as shown in View "A". Early model XL-700 clutch is shown in View "D". Models XL-870, XL-875, XL-923, XL-924, XL-924W, SXL-925, VI-944, VI-955 and early XL-800 use clutch shown in View "C". All other models have clutch as shown in View "B".

8. Inner guide plate
9. Outer guide plate
11. Clutch cover
12. Crankshaft nut
13. Flat washer
14. Outer thrust washer
15. Clutch drum & sprocket
16. Needle roller bearing
17. Inner race
18. Inner thrust washer
19. Clutch spring (late)
19A. Clutch spring (early)
20. Clutch plate (late)
20A. Clutch spider (early)
21. Clutch shoe (late)
21A. Clutch shoe (early)
22. Clutch cover (late)
22A. Clutch cover (early)
23. Socket head screws
23A. Button head screws
24. Clutch plate (late)
25. Outer thrust washer
26. Inner race
27. Inner thrust washer
28. Clutch drum & sprocket
29. Needle roller bearing

23846-2—Anvil, back plate bearing, all models.
24006-1—Aligning plate, crankshaft installation, all models.
24304—"Pozidriv" screwdriver bit.
24230—"Pozidriv" hand screwdriver.
24302—Plug, backplate seal, models XL-924, XL-924W, SXL-925, VI-944 and VI-955.
24094—Spark plug removal, model XL-924W.
23528—Wrench, conn. rod, all models.

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

To remove cylinder, first remove the blower (fan) housing, carburetor and air box (handle) assemblies and remove the screw retaining magneto back plate to flywheel side of cylinder. The cylinder can then be unbolted from crankcase and removed from the piston.

COMPRESSION RELIEF VALVE. Models XL-903, XL-903E, XL-903EAM, XL-904, XL-923, XL-924, early XL-924W and VI-944 are equipped with a compression relief (decompression) valve. The poppet type relief valve is mounted in a port adjacent to exhaust port as shown in Fig. HL86A. The valve is opened as throttle lock plunger is depressed to lock position. If valve fails to close when throttle lock plunger is released, either remove valve and clean using a carbon solvent or renew the valve assembly. Copper sealing washer is available separately.

PISTON, PIN AND RINGS. Except for late model XL-875, all models are equipped with piston fitted with two pinned compression rings. Desired ring side clearance in groove is 0.002-0.003; renew the piston if side clearance in top groove with new ring is 0.0035 or more. Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Piston, pin and rings are available in standard size only. Pin and piston are available, fitted set only.

Late model XL-875 is equipped with piston having a single head-land type

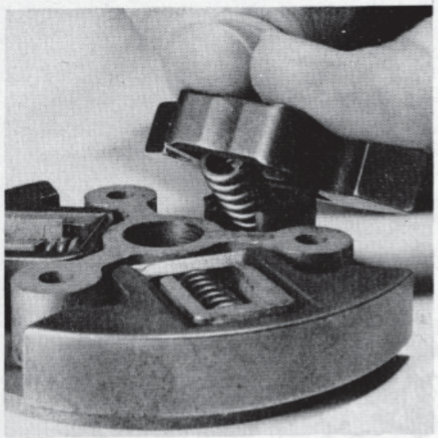


Fig. HL88–To install clutch shoe and spring shown in views "A" and "B" in Fig. HL87, place spring between shoe and plate as shown, hook shoe onto plate and push shoe down into place.

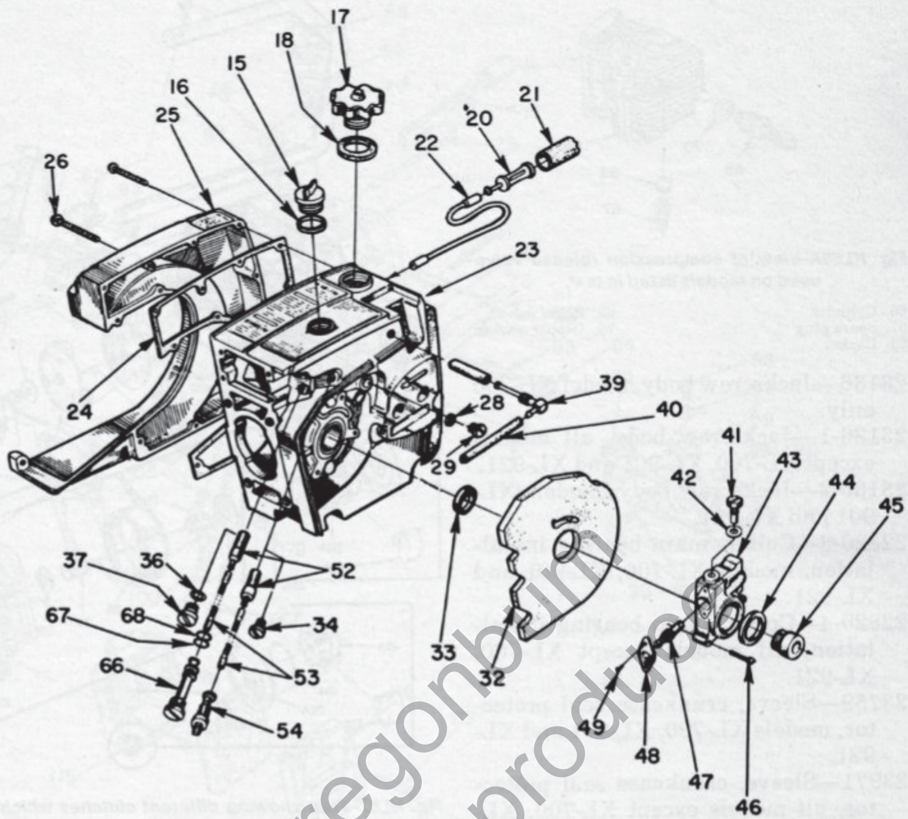


Fig. HL89–Exploded view showing automatic chain oiler pump, manual and automatic oiler pick-ups, crankcase and oil reservoir and fuel tank. Automatic oil pump plunger (47) and pump body (43) are available as a matched set only. Plug (34) is used to seal opening when saw is not equipped with manual chain oiler; plug (37) and washer (36) are used on models not equipped with automatic chain oiler. On late models, fuel tank cover (25) is sealed to crankcase and chain oil reservoir with gasket (24); early units were equipped with integral epoxied unit.

15. Chain oil cap
16. Gasket
17. Fuel tank cap
18. Gasket
20. Pick-up head
21. Fuel filter
22. Flexible line
23. Crankcase
24. Gasket
25. Fuel tank
26. Tank cover screws
28. Gasket
29. Cap
32. Saw dust shield
33. Crankshaft seal
34. Plug
36. Sealing washer
37. Plug
39. Elbow
40. Fuel line
41. Oil pump cam
42. Gasket
43. Oil pump body
44. Felt seal
45. Worm gear
46. Pump retaining screws
47. Pump gear/plunger
48. Flanged bearing
49. Screws
52. Oil pick-ups
53. Flexible oil lines
54. Connector
66. Oil line tube
67. Gasket
68. "O" ring

("L" shaped) piston ring with ring locating pin. Ring end gap at outer edge of ring with ring in cylinder bore should be 0.010-0.020. A ring end gap of more than 0.020 would indicate ring is worn and should be renewed. Ring side clearance in groove can be measured only at flat side of ring (side away from closed end of piston). Desired side clearance in ring groove is 0.001-0.004. NOTE: Piston with head land ring should not be used to renew early model XL-875 piston with two pinned rings unless a new unworn cylinder is also installed.

Different methods of retaining piston pin have been used. Early models were equipped with piston fitted with non-removable Spirol pin through pin boss at exhaust side of piston and a Waldes Truarc snap ring at intake side. Later models and service replacement piston for early models utilize a non-removable snap ring at exhaust side of piston instead of the Spirol pin. A third method of retaining piston pin is using "Rulon" (thermal plastic) plugs that snap into pin bore of piston at end of piston pin.

To remove piston pin retained with snap ring at intake side of piston, remove the snap ring using special pliers (Homelite tool No. 22828). On early type piston with Spirol pin at exhaust side, push piston pin out towards intake side using slotted remover (Homelite tool No. A-23951). On models with snap ring at exhaust side of piston, insert a 3/16-inch diameter rod through snap ring and push pin from piston. On models with "Rulon" retaining plugs, pry the plugs from piston, then push piston pin out.

When installing piston pin, be sure closed end is towards exhaust side of piston (away from piston ring locating pin). On models with snap ring at intake side of piston (all models except those with "Rulon" plugs), insert snap ring using special pliers; sharp edge of snap ring must be out and locate end gap towards closed end of piston. On models with "Rulon" plugs, use new plugs when reassembling piston to connecting rod.

CONNECTING ROD. Connecting rod and piston assembly can be removed after removing cylinder from crankcase. Be careful to remove all of the 28 loose needle rollers when detaching rod from crankpin.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The caged needle roller piston pin bearing can be renewed by pressing old bearing out and pressing new bearing in with Homelite tool No. 23955 or 23955-1. Press on lettered end of bearing cage only.

It is recommended that the crankpin needle rollers be renewed as a set whenever engine is disassembled for service. Stick 14 needle rollers in rod and the remaining 14 needle rollers in rod cap with light grease or beeswax. Assemble rod to cap with match marks aligned and with open end of piston pin towards flywheel side of engine. Wiggle the rod as cap retaining screws are being tightened to align the fractured surfaces of rod and cap.

CRANKSHAFT. Flywheel end of crankshaft is supported in a roller bearing in magneto back plate and drive end is supported in a ball bearing located in crankcase. End play is controlled by the ball bearing.

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

CRANKCASE, MAGNETO BACK PLATE AND SEALS. To remove the magneto back plate, first remove the blower (fan) housing, flywheel and (ex-

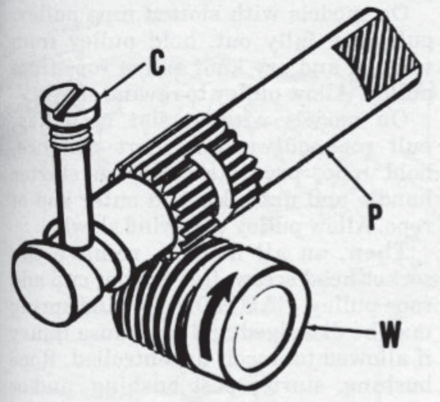
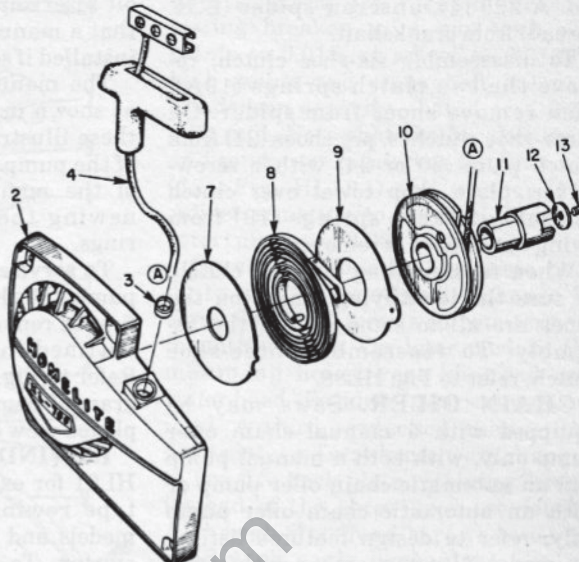


Fig. HL90–Schematic diagram of automatic chain oiler pump operation. Worm gear (W) on crankshaft drives (rotates) pump plunger (P). Cam cut in plunger rides against cam screw (C) causing plunger to move back and forth as it rotates. Flat on plunger acts as a valve as it opens intake port on downward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

Fig. HL91–Exploded view of ratchet type starter used on early models. Refer also to Fig. HL92.

2. Starter housing
3. Rope guide
4. Starter rope
7. Plastic disc
8. Rewind spring
9. Plastic disc
10. Rope pulley
11. Starter cup
12. Flat washer
13. Screw



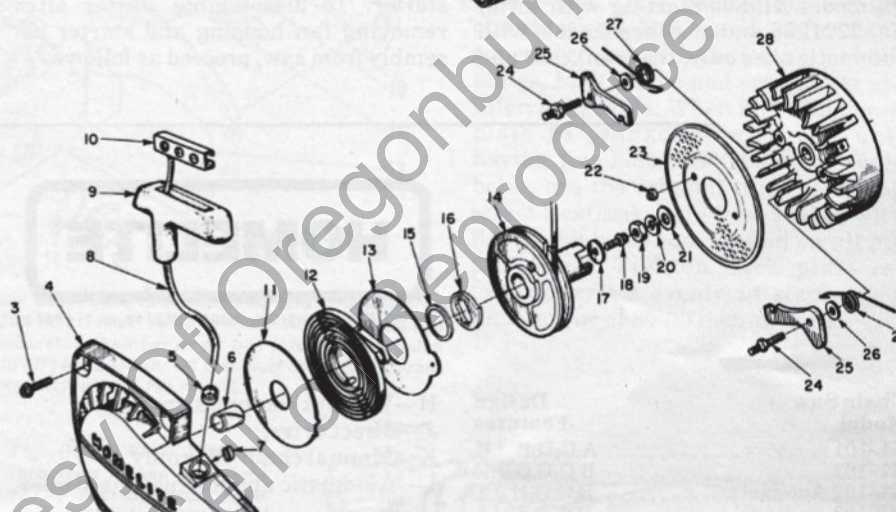
cept on model XL-850) breaker point assemblies. Loosen the cylinder retaining stud nuts on flywheel side of engine to reduce clamping effect on back plate boss, then unbolt and remove the back plate assembly from crankcase.

To remove crankshaft from crankcase, first remove the cylinder, connecting rod and piston assembly and the magneto backplate as previously outlined. Remove the drive clutch assembly and, on models so equipped, the automatic chain oiler drive worm and pump from drive end of crankcase and shaft. Then, remove the two ball bearing retaining screws (62—Fig. HL86) from inside of crankcase and remove the crankshaft and ball bearing assembly from crankcase. Remove snap ring (64) and press crankshaft from bearing if necessary.

REED VALVES. All models are equipped with pyramid reed valves. On early models XL-700 and XL-800, the four 0.005 thick reeds are retained to the metal pyramid seat by retaining plates and screws.

On later models the pyramid seat is of "Delrin" plastic and the 0.004 thick reeds are located by pins molded in the seat. The reeds are held in place by a molded retainer that also serves as a gasket between reed seat and crankcase. Reeds for the previous diecast metal seat are 0.005 thick whereas reeds for the late type "Delrin" seat are 0.004 thick. Do not attempt to interchange reeds between metal and "Delrin" type seats.

When installing latest type intake elbow and "Delrin" seat assembly, insert reed retainer into crankcase first. Stick reeds to seat with oil, then insert seat with reeds. Also, it is important



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)

Fig. HL92–Exploded view of late type starter. Note that fan housing (4) has renewable starter post bushing (6) and rewind spring bushing (7). Also, pulley and starter cup are an integral unit (14). Separate spring lock (16) and spring lock bushing (15) are used. Screen (1) and attaching clips (2) are optional equipment. An air flow ring is used in place of screen (23) on some later models.

that the special shoulder type retaining screws be installed.

CLUTCH. Early models XL-700 and XL-800 were equipped with a six-shoe clutch as shown in the exploded views (C & D—Fig. HL87). All later models may be equipped with a three-shoe clutch as shown in views A & B or six-shoe clutch.

To remove either type clutch, proceed as follows: On models with clutch outside of chain first remove screws retaining clutch cover (22 or 22A) to clutch spider (24 or 24A) and remove cover. Unscrew the clutch spider (L.H. thread) from crankshaft using a spanner wrench (Homelite tool No. A-23696 or No. A-23934). The clutch drum, bearing and inner race can then be removed from crankshaft.

On models with clutch inside chain, remove nut from drive end of crankshaft and slide clutch drum and inner race from shaft. Then, using spanner wrench (Homelite tool No. A-23696 or

No. A-23934), unscrew spider (L.H. thread) from crankshaft.

To disassemble six-shoe clutch, remove the two clutch springs (19A), then remove shoes from spider. On three-shoe clutches, pry shoes (21) from clutch plate (20 or 24) with a screwdriver; place shop towel over clutch assembly to keep springs (19) from flying out as shoe is removed.

When reassembling six-shoe clutch, be sure the identifying marks on the shoes are all to same side of the assembly. To reassemble three-shoe clutch, refer to Fig. HL88.

CHAIN OILER. Saws may be equipped with a manual chain oiler pump only, with both a manual pump and an automatic chain oiler pump or with an automatic chain oiler pump only; refer to design features listing. On model XL-800 starting with serial No. 2201258 and on other models with automatic oiler only, the crankcase and oil reservoir are drilled and tapped so that a manual chain oiler pump can be installed if so desired.

The manual oiler pump is installed as shown in Fig. HL78 or Fig. HL79A; these illustrations show exploded view of the pump assembly. Usually, service of the manual pump consists of renewing the plunger and shaft "O" rings.

To service the automatic chain oiler pump, the clutch drum and spider must first be removed from the crankshaft as outlined in a preceding paragraph. Refer to Fig. HL90 for operational diagram of pump and to Fig. HL89 for exploded view of pump assembly.

REWIND STARTER. Refer to Fig. HL91 for exploded view of the ratchet type rewind starter used on early models and to Fig. HL92 for late type starter. To disassemble starter after removing fan housing and starter assembly from saw, proceed as follows:

On models with slotted rope pulley, pull rope fully out, hold pulley from turning and pry knot end of rope from pulley. Allow pulley to rewind slowly.

On models without slot in pulley, pull rope outward a short distance, hold rope, pry retainer from starter handle and untie knot in outer end of rope. Allow pulley to rewind slowly.

Then, on all models, remove the socket head screw, flat washer cup and rope pulley. CAUTION: Rewind spring may be dislodged and can cause injury if allowed to uncoil uncontrolled. Rope bushing, starter post bushing, and/or rewind spring bushing in housing should be renewed if worn.

When reassembling starter, lubricate starter port lightly and install spring dry except for a small amount of lithium base grease on edges of spring.

Reassemble starter using exploded view in Fig. HL91 or Fig. HL92 as a guide. Prewind spring about 2-4 turns.

HOMELITE®

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

Chain Saw Model	Design Features
XL-101	A,C,D,H,J,K
XL-102	B,C,D,G,J,K
XL-102 Automatic	B,C,D,H,J,L
XL-103	B,C,D,G,J,L
XL-103E	B,C,D,G,J,L
XL-104	B,C,E,G,J,L*
XL-104E	B,C,E,G,J,L
XL-113	B,C,D,G,J,L
XL-114	B,C,F,G,J,L
XL-123	B,C,D,G,J,L
VI-123	B,C,D,G,J,L

*Later models are equipped with capacitor discharge ignition system.

DESIGN FEATURES CODE

A—Displacement, 3.3 cu. in.; bore, 1¾ in.; stroke, 1⅜ in.

B—Displacement, 3.5 cu. in.; bore, 1 13/16 in.; stroke, 1⅜ in.

C—Pyramid reed type intake valve, 4 reeds.

D—Equipped with conventional flywheel type magneto.

E—Equipped with solid state (transistorized breakerless) flywheel magneto.

F—Equipped with capacitor discharge ignition system.

G—Equipped with compression release.

H—Without compression release.

J—Direct drive.

K—Manual chain oiler only.

L—Automatic and manual chain oiler.

MAINTENANCE

SPARK PLUG. A Champion CJ-6 "bantam" spark plug is used in all models. Set electrode gap to 0.025. Tighten plug to torque of 150 inch-pounds.

CARBURETOR. All models are equipped with a Walbro model SDC diaphragm carburetor. Refer to Walbro section of SERVICE FUNDAMENTALS section for overhaul and exploded views.

Initial adjustment of idle mixture screw is ¾-1 turn open. Initial adjustment of high speed mixture screw is 1-1¼ turns open. Adjust idle speed screw and idle mixture screw so that engine idles smoothly just below clutch engagement speed. Make final adjustments with engine warm. Adjust high speed mixture screw to obtain optimum performance with engine under cutting load. Do not adjust carburetor too lean as engine may be damaged.

When reinstalling carburetor on early models, stick gaskets to spacer and stick spacer and gasket assembly to carburetor with tacky grease to aid in reinstalling unit to adapter. Tighten retaining screws evenly to a torque of 50 inch-pounds. On late models without spacer, install carburetor with new gasket and tighten screws evenly

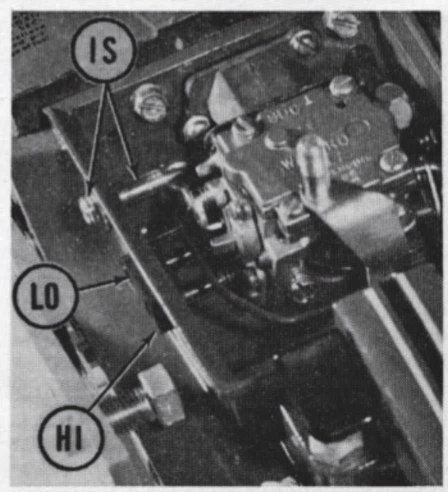


Fig. HL100–View with air filter removed showing carburetor adjusting points. Early model air box and idle speed screw have 5/16-18 thread; late models have 5/16-24 thread for more accurate idle speed adjustment.

HI. High speed needle
IS. Idle speed screw
LO. Idle fuel needle

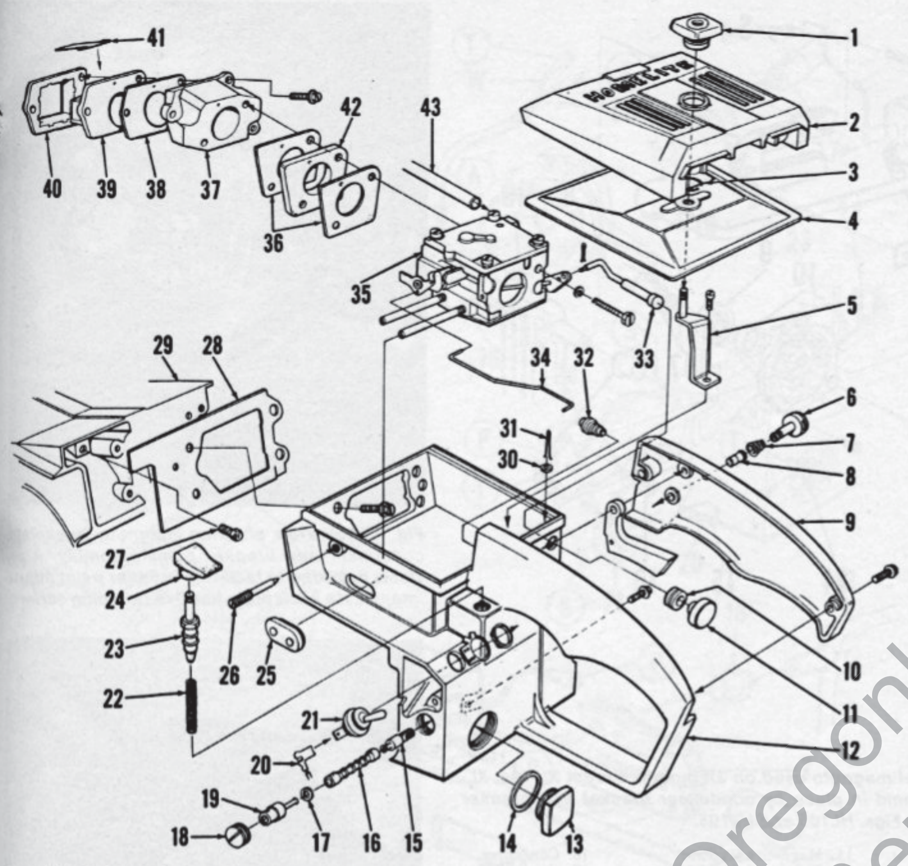


Fig. HL101–Exploded view of throttle handle, air box chain oiler tank assembly and related parts. When cementing new gasket (28) to crankcase (29), insert reed valve retainer (40) in crankcase opening to align gasket. Fuel tank is vented to carburetor chamber in air box through vent valve (27). Refer to Fig. HL102 for late type intake manifold (37) installation. Oil reservoir cover is separate from throttle handle on late models; refer to Fig. HL103.

1. Knob
2. Air filter cover
3. Snap ring
4. Filter element
5. Bracket
6. Throttle latch
7. Spring
8. Bushing
9. Handle cover
10. Grommet
11. Choke knob
12. Throttle handle
13. Oil tank cap
14. Gasket
15. Oil filter
16. Flexible tube
17. Gasket
18. Plug
19. Check valve
20. Ground lead
21. Ignition switch
22. Spring
23. Pump plunger
24. Oil pump button
25. Grommet
26. Idle speed stop screw
27. Fuel tank vent
28. Gasket
29. Crankcase
30. Felt washer
31. Cotter pin
32. Boot
33. Choke rod
34. Throttle rod
35. Carburetor
36. Gaskets
37. Intake manifold
38. Gasket
39. Reed valve seat
40. Reed retainer
41. Valve reeds
42. Heat insulator
43. Fuel tube

to a torque of 25 inch-pounds. Note: A kit is available to install late type manifold on early model saws.

MAGNETO (Except XL-104, XL-104E and XL-114). Refer to Fig. HL104 for exploded view of the conventional flywheel type Wico magneto used on all models except XL-104, XL-104E and XL-114.

Breaker points and condenser are accessible after removing the fan housing and starter assembly, flywheel and breaker cover. A pry slot is provided to facilitate breaker point gap adjustment using screwdriver as shown in Fig. HL105. Adjust breaker point gap to 0.015 if not renewing points. Homelite recommends adjusting breaker point gap with new points to 0.016, or adjust to 0.0165 if both points and crankshaft are new. Condenser capacity should test 0.16-0.20 mfd. Note that the breaker point and condenser retain the felt dust seal (12—Fig. HL104) and washer (13). Adjust armature to flywheel (magneto rotor) air gap to 0.004-0.008.

On early production, magneto back plate was retained to crankcase by three flat head screws in countersunk mounting holes. On later models, the mounting holes were changed and wafer head "Pozidriv" type screws were used. A third production change, the back plate and crankcase were changed to use five back plate retaining screws instead of the three used previously. Although flat head screws must be used with early back plate having countersunk holes and wafer head screws be used with the later type back plates, back plates and crankcases are interchangeable. When installing back plate to crankcase with one unit having five holes and the other three holes, use the original three retaining screw locations. Late type gasket with five screw holes can be used on all applications. Tighten back plate retaining screws evenly in stages to a final torque of 80-90 inch-pounds.

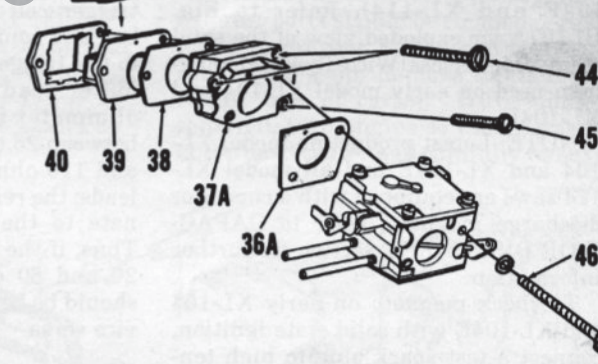


Fig. HL102–View showing late type intake manifold (37A) installation. One gasket (36A) is used instead of two gaskets (36–Fig. HL101) and spacer (42–Fig. HL101) previously used. Late type manifold is available with installation kit for earlier models.

36A. Gasket
37A. Intake manifold
38. Gasket
39. Reed valve seat
40. Reed retainer
44. Manifold screws
45. Manifold screw
46. Carburetor screw

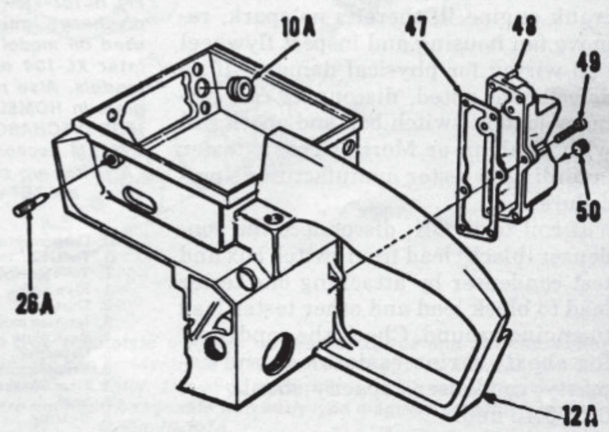


Fig. HL103–Oil tank cover (48) is sealed to throttle handle (12A) with gasket (47) on later models. An oil tank repair (gasket) kit is available for resealing epoxied cover on earlier models. Idle speed adjusting screw (26A) on late throttle handle has 5/16"-24 thread for more accurate idle speed adjustment. Grommet (10A) is used to seal fuel line air box entry. "Pozidriv" screws (49) retain cover to throttle handle. Plug (50) is used on models XL-101 and XL-102 to seal automatic oiler opening

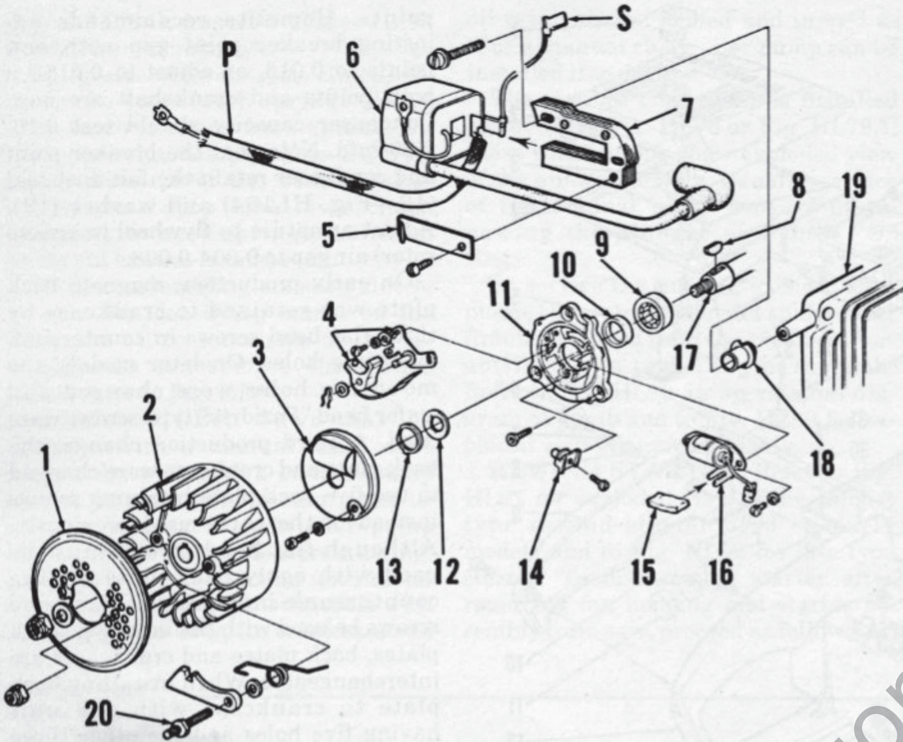


Fig. HL104–Exploded view of conventional flywheel magneto used on all models except XL-104, XL-104E and XL-114. Felt dust seal retainer (13) is held in place by condenser bracket and breaker point base. Refer also to Figs. HL105 and HL106.

P. Primary lead
S. Switch (ground) lead
1. Rotating screen
2. Rotor (flywheel)
3. Breaker cover
4. Breaker points
5. Coil retainer
6. Ignition coil
7. Armature core
8. Flywheel key
9. Roller bearing
10. Crankshaft seal
11. Magneto backplate
12. Felt dust seal
13. Retainer
14. Insulated terminal
15. Felt cam wiper
16. Condenser
17. Crankshaft
18. Lead retainer
19. Cylinder
20. Pawl studs

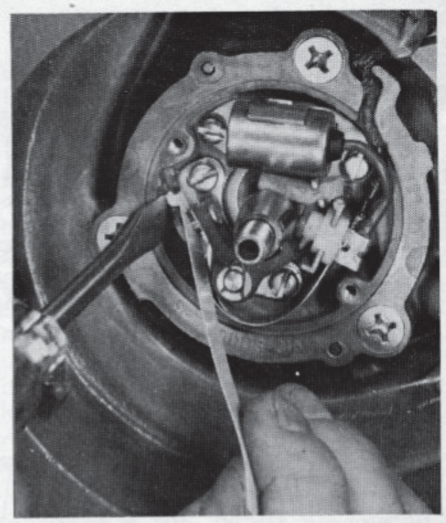


Fig. HL105–View showing magneto backplate, condenser and breaker point assembly. A pry slot is provided to facilitate breaker point adjustment. Late back plate has five retaining screws.

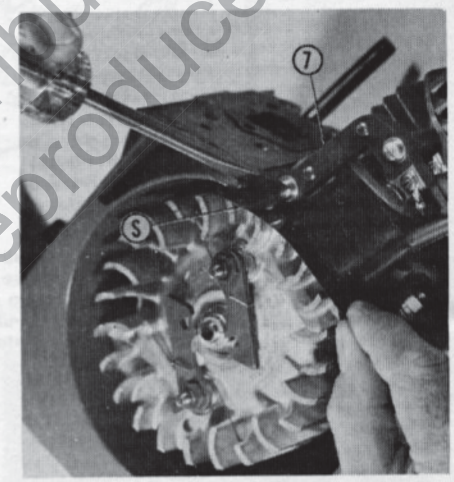


Fig. HL106–Adjusting air gap between flywheel and armature (7) using plastic shim (S). Air gap should be 0.004-0.008.

MAGNETO (Models XL-104, XL-104E and XL-114). Refer to Fig. HL107A for exploded view of the solid state breakerless Wico flywheel magneto used on early model XL-104 and XL-104E.

NOTE: Latest production model XL-104 and XL-104E and all model XL-114 saws are equipped with a capacitor discharge magneto; refer to CAPACITOR DISCHARGE section for further information.

To check magneto on early XL-104 and XL-104E with solid state ignition, connect a test spark plug to high tension lead, turn ignition switch on and crank engine. If there is no spark, remove fan housing and inspect flywheel and wiring for physical damage. If no defects are noted, disconnect coil primary lead at switch box and check coil with Graham or Merc-O-Tronic tester according to tester manufacturer's procedure.

If coil tests OK, disconnect the condenser (black) lead from switch box and test condenser by attaching one tester lead to black lead and other tester lead to engine ground. Check the condenser for short, series resistance and capacity; condenser capacity should test 0.13-0.15 mfd.

To check trigger coil, disconnect trigger coil (white) lead from switch box and connect one lead of ohmmeter to the trigger coil lead and other ohmmeter lead to engine ground. The ohmmeter reading should be either between 25 and 80 ohms or between 80 and 110 ohms. Reverse the ohmmeter leads; the reading should then be alternate to the first ohmmeter reading. Thus, if the first reading was between 20 and 80 ohms, the second reading should be between 80 and 110 ohms, or vice versa.

To check trigger switch, disconnect all wires from the switch. Then, connect one lead of ohmmeter to switch box "P" terminal (see Fig. HL107A) and other ohmmeter lead to switch box

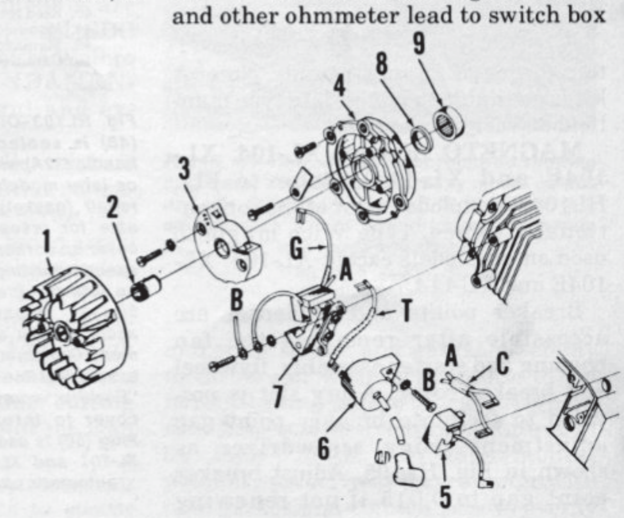


Fig. HL107–View of capacitor discharge ignition system used on model XL-114 and later XL-104 and XL-104E models. Also refer to diagram in HOMELITE CAPACITOR DISCHARGE IGNITION SYSTEM section. Note that "A" wires are connected as are "B" wires.

C. Condenser wires
G. To "GEN" terminal
T. To "TRANSF" terminal
1. Flywheel
2. Dust cap
3. Ignition module
4. Back plate
5. Capacitor
6. Transformer
7. Generator coil & armature
8. Seal
9. Bearing

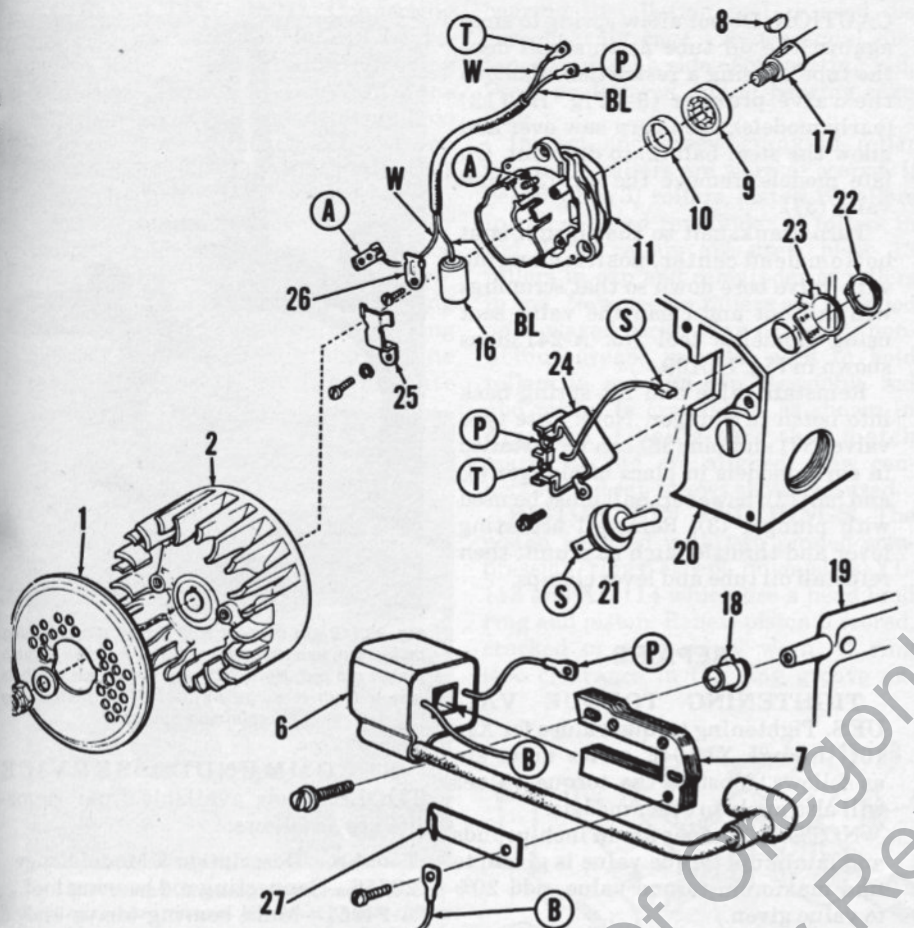


Fig. HL107A–Exploded view of the breakerless solid state Wico magneto used on early models XL-104 and XL-104E. Wiring connections are identified by circled letter; thus, connect wire clip (A) to connection (A) on trigger coil, etc. White wire (W) connects trigger coil to terminal (T) on trigger switch (24). Refer to Fig. HL107B for wiring diagram on model XL-104 above serial No. 2805889.

A. Trigger coil connection
B. Coil ground lead
BL. Black (condenser) lead
P. Trigger switch connection
S. Switch connection
T. Trigger switch connection
W. White lead
1. Rotating screen
2. Magneto rotor (flywheel)
6. Ignition coil
7. Armature
8. Flywheel key
9. Roller main bearing
10. Crankshaft seal
11. Magneto backplate (trigger coil)
16. Condenser
17. Crankshaft
18. Condenser lead retainer
19. Cylinder
20. Throttle handle
21. Ignition switch
22. Nut
23. "ON-OFF" plate
24. Trigger switch
25. Condenser clamp
26. Lead retainer
27. Coil retainer

ground terminal (retaining strap screw eye). Ohmmeter reading should be either between 5 to 25 ohms or between 1 megohm to infinity. Reverse the ohmmeter leads and alternate reading should be obtained. Thus, if first reading was between 5 to 25 ohms, second reading should be between 1 megohm to infinity, or vice versa.

Renew any component not checking within specified test values and reconnect wiring according to connection code shown in Fig. HL107A. Note: Although not necessary to remove flywheel to check or test magneto components, the flywheel must be removed to renew trigger coil and/or condenser. Adjust armature air gap of model XL104 breakerless Wico and Phelon CD ignition systems to 0.008-0.012 using 0.0125 plastic shim stock, Homelite #24306. Adjust armature air gap as outlined in preceding paragraph for conventional magneto used on other models.

On early models, trigger coil (magneto back plate) was retained to crankcase with three screws. Later production models have five back plate retaining screws. When installing late type back plate or crankcase with five screw holes to crankcase or back plate with three screw holes, use only the original three mounting screw positions. Tighten the wafer head screws evenly in stages to a final torque of 80-90 inch-pounds. Use only a #2 "Pozidriv" screwdriver bit (Homelite tool No. 24304) to remove or tighten back plate screws.

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

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

The clutch needle roller bearing should be cleaned and relubricated after each 100 hours of operation. Homelite® ALL-TEMP Multi-Purpose Grease or an equivalent grease is recommended.

CARBON. Muffler and cylinder exhaust ports should be cleaned periodically to prevent loss of power due to carbon build up. Remove muffler and scrape free of carbon. With muffler removed, turn engine so that piston is at top dead center and carefully remove

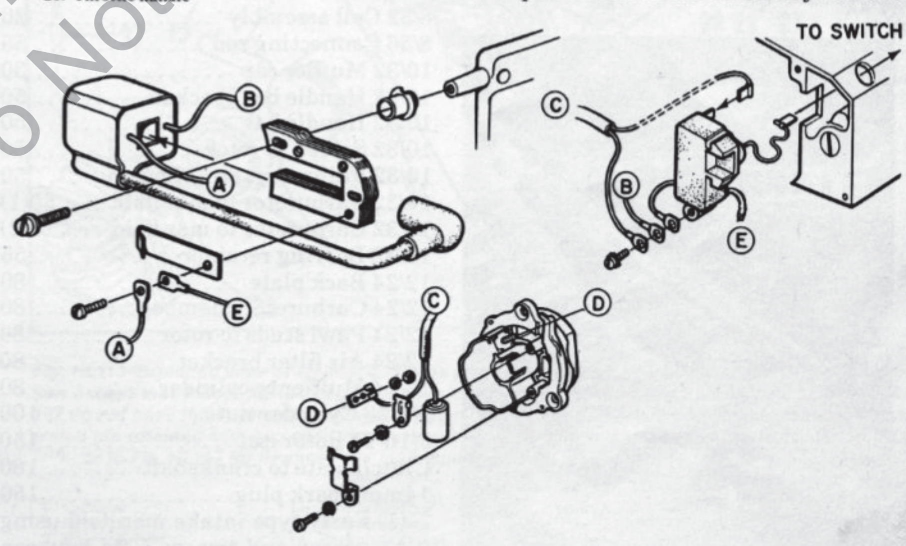


Fig. HL107B–View showing late type solid state magneto on models XL-104 and XL-104E. Letters indicate wiring connections. Magneto can be identified by red colored trigger switch whereas early trigger switch (24–Fig. HL107A) is natural color. The back plate (trigger coil), rotor, trigger switch, condenser and throttle handle are not interchangeable with early type magneto components shown in Fig. HL107A.

carbon from exhaust ports with a wooden scraper. Be careful not to damage chamfered edges of exhaust ports or to scratch piston. **Do not** run engine with muffler removed.

CLEAN COMPRESSION RELIEF VALVE. While muffler is removed to clean carbon from the muffler and exhaust ports, proceed as follows to clean the compression relief valve:

Remove the two bolts retaining compression relief lever bracket (51—Fig. HL108) and oil tube clamp (55) to air box and remove the compression relief lever (50) and throttle latch (6). Using pliers, carefully lift end of spring (52) from notch in end of valve plunger (2) and ease spring down against oil tube.

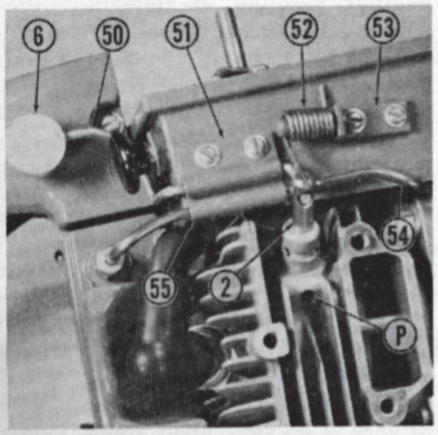


Fig. HL108–View with muffler assembly removed to show compression relief mechanism. Depressing throttle latch button (6) actuates lever (50) lifting compression relief plunger (2). Engine compression is then relieved through port (P).

P. Compression relief port
2. Relief valve plunger
6. Throttle latch button
50. Release lever
51. Lever bracket
52. Valve spring
53. Spring bracket
54. Chain oiler tube
55. Tube clamp

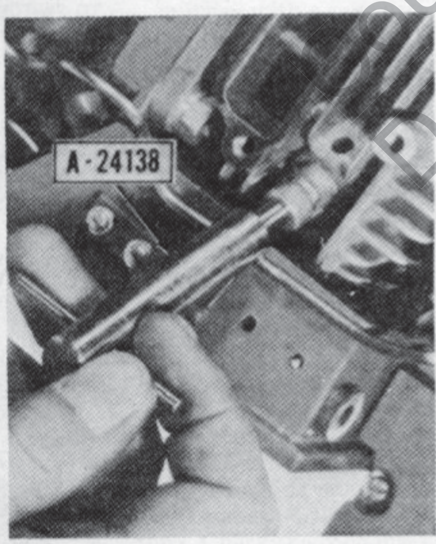


Fig. HL109–Cleaning compression relief valve seat using Homelite tool No. A-24138. Hold the engine in inverted position so that carbon scraped from seat will fall out.

CAUTION: Do not allow spring to snap against the oil tube as this will dent the tube causing a restriction. Remove the valve plunger (3—Fig. HL113) (early models), then turn saw over and allow the steel ball (2) to drop out. On late models, remove the pin (38) and valve (37).

Turn crankshaft so that piston is at bottom dead center, position engine with valve bore down so that scrapings will fall out and clean the valve seat using Homelite tool No. A-24138 as shown in Fig. HL109.

Reinstall valve and lift spring back into notch in plunger. Note: Late type valve (37) and pin (38) can be installed in early models in place of plunger (3) and ball (2); however, ball must be used with plunger (3). Reinstall actuating lever and throttle latch as a unit, then reinstall oil tube and lever clamps.

REPAIRS

TIGHTENING TORQUE VALUES. Tightening torque values for XL-101 through XL104E series units are as follows. Most of the torque values will also apply to other models.

NOTE: All values are in inch-pounds and minimum torque value is given; to find maximum torque value, add 20% to value given.

6/32 Compression release lever	20
6/32 Compression release spring	20
6/32 Point dust cover	15
8/32 Automatic chain oiler	40
8/32 Intake manifold	40(1)
8/32 Intake manifold	20(2)
8/32 Throttle handle cover	40
8/32 Starter (fan) housing	40
8/32 Coil assembly	20
8/36 Connecting rod	55
10/32 Muffler cap	30
10/32 Handle bar bracket	50
10/32 Handle bar	50
10/32 Screen to rotor	50
10/32 Pulley to starter housing	50
10/32 Carburetor to manifold	50(1)
10/32 Carburetor to manifold	25(2)
10/32 Bearing retainer	55
12/24 Back plate	80
12/24 Carburetor chamber	80
12/24 Pawl studs to rotor	80
12/24 Air filter bracket	80
12/24 Muffler to cylinder	80
1/4-28 Cylinder nuts	100
5/16-24 Rotor nut	150
Clutch plate to crankshaft	180
14mm Spark plug	150

(1) Early type intake manifold using spacer and two gaskets between manifold and carburetor.

(2) Late type intake manifold using single gasket (no spacer) between manifold and carburetor.

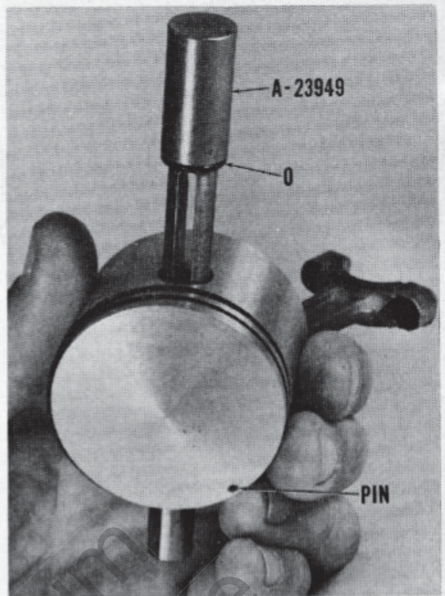


Fig. HL110–On models with Spirol pin retaining piston pin, use Homelite tool No. A-23949 to push piston pin out. Note "O" ring (O) which protects piston from damage by tool. Note piston ring retaining pin.

RECOMMENDED SERVICE TOOLS. Tools available from Homelite are as follows:

Tool No.	Description & Model Usage
23756	Connecting rod bearing tool
A-24051	Main bearing (drive end) & crankshaft jackscrew; also requires:
23136-1	Sleeve
22820-5	Collar
24076	Seal protector
24006-1	Alignment plate
23972	Crankshaft seal installer (drive end w/crankshaft installed)
24054	Crankshaft seal installer (drive end w/crankshaft removed)
A-24057	Main bearing remover (backplate end)
23846-2	Anvil (for use w/A-24057)
24055	Main bearing installer (backplate end); seal remover & installer (backplate)
24053	Seal protector sleeve (XL-101)
24076	Seal protector sleeve (Except XL-101)
23759	Seal protector (backplate)
22828	Piston pin snap ring pliers
A-23949	Piston pin remover
A-23960	Rotor (flywheel) holder & remover
A-24060	Clutch spanner wrench (Early)
A-23934	Clutch spanner wrench (Late)
A-24138	Compression relief valve seat reamer
24304	#2 "Pozidriv" bit
24230	#3 "Pozidriv" bit
A-23841-A	Bar stud insert wrench
24173	Carburetor check valve installer

CONNECTING ROD. Connecting rod and piston assembly can be removed from crankshaft after removing cylinder. Be careful to remove all of the loose needle rollers when detaching rod from crankshaft. Models XL-123 and VI-123 have 25 rollers while all other models have 31 rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn. The needle roller piston pin bearing can be renewed by pressing old bearing out and new bearing in using Homelite tool No. 23756. Note: If substitute bearing installation tool is used, be sure bearing cage extends equal distance from each side of connecting rod. Press on lettered end of bearing cage only.

Inspect and renew crankpin roller bearing if rollers are worn or scored. If bearing has 31 rollers, install 16 rollers in rod cap and remainder of rollers in rod. If 25 rollers are used, place 13 rollers in cap and remainder of rollers in rod. New needle rollers are supplied on a waxed strip. Wax or heavy non-fibrous grease may be used to hold rollers in rod and cap. Assemble rod and piston to crankshaft as shown in Fig. HL111 being sure that match marks on rod are aligned. New connecting rod cap screws should be used.

PISTON, PIN AND RINGS. The piston is fitted with two pinned compression rings except on models XL-113 and XL-114 which use a head land ring and piston. Renew piston if scored, cracked or excessively worn. If ring side clearance in top ring groove exceeds 0.004 when measured with new ring, piston should be renewed.

Recommended piston ring end gap is 0.070-0.080; maximum allowable ring end gap is 0.085. Desired ring side clearance in groove is 0.002-0.003. No piston ring specifications for head land ring used on models XL-113 and XL-114 were available before publication.

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

Early type pin is retained in piston by a Waldes Truarc snap ring at intake side of piston and by a Spirol pin at exhaust side. Closed end of piston pin must be towards Spirol pin. To remove piston from connecting rod, remove snap ring using Truarc snap ring pliers (Homelite tool No. 22828 or equivalent) and push pin out using Homelite tool No. A-23949 as shown in Fig. HL110.

On late production pistons, pin is retained by a plain square end snap ring at exhaust side and by a Waldes

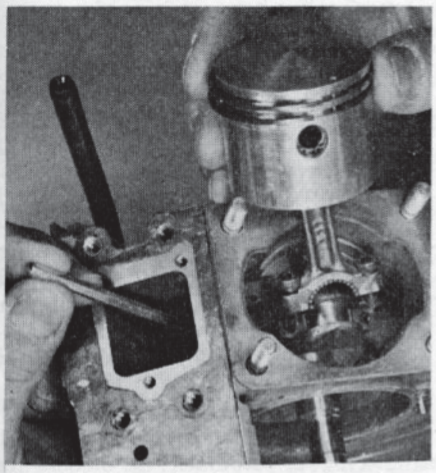


Fig. HL111–View showing reassembly of connecting rod to crankpin. Note that needle rollers are stuck to rod and cap with grease. Rod cap is held in position with Allen wrench. Be sure that match marks on rod and cap are aligned, and that intake side of piston is towards flywheel end of crankshaft as shown.

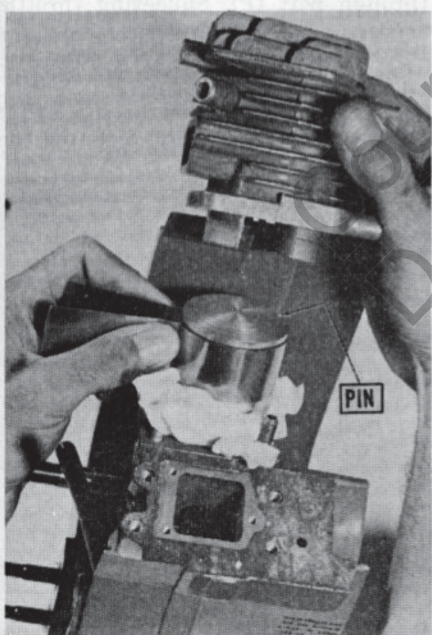


Fig. HL112–View showing cylinder being installed over piston. Piston is held upright by rags stuffed around rod. Make final check to be sure piston ring pin is towards intake side of cylinder as shown.

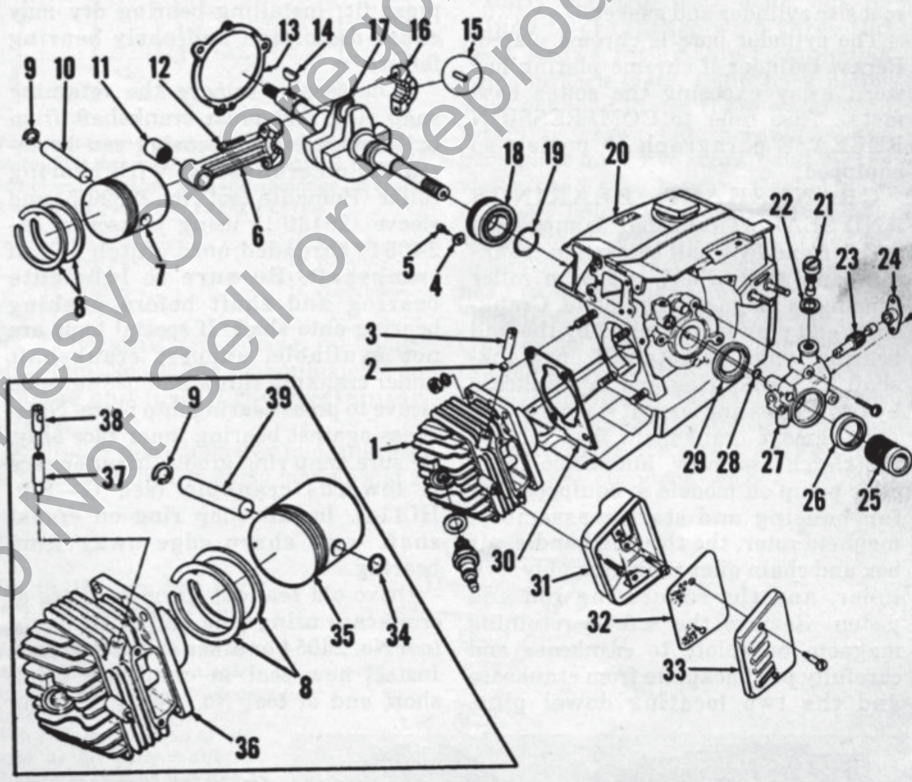


Fig. HL113–Exploded view of typical XL-Series engine assembly; all models are of similar construction except that Model XL-101 does not have compression relief valve and Models XL-101 and XL-102 do not have the automatic chain oiler pump. Inset shows late type compression relief valve and piston pin retained with two snap rings instead of Spirol pin and one snap ring. Refer to Fig. HL104 or to Fig. HL107 for flywheel end main bearing which is supported in magneto backplate.

1. Cylinder
2. Relief valve
3. Valve plunger
4. Special washers (2)
5. Retaining screws (2)
6. Connecting rod
7. Piston
8. Rings
9. Snap ring
10. Piston pin
11. Needle bearing
12. Rod cap screws
13. Backplate gasket
14. Flywheel key
15. Needle rollers
16. Rod cap
17. Crankshaft
18. Ball bearing
19. Snap ring
20. Crankcase & fuel tank assy.
21. Cam screw
22. Gasket
23. Pump plunger & gear
24. Flange bearing
25. Worm gear
26. Felt seal
27. Pump body
28. "O" ring
29. Crankshaft seal
30. Gasket
31. Muffler body
32. Baffle
33. Muffler cover
34. Snap ring
35. Piston
36. Cylinder
37. Relief valve
38. Valve plunger
39. Piston pin

Truarc snap ring at intake side. Do not remove the plain square end snap ring. To remove piston pin, remove the Waldes Truarc snap ring, then insert a 3/16-inch dia. rod through the plain snap ring and drive pin from piston.

When reassembling piston to connecting rod, push piston pin in with a 3/16-inch diameter rod inserted in open end of pin. Install snap ring at open end of pin with sharp edge of ring out. Rotate snap ring to be sure it is seated in groove, then turn snap ring gap towards closed end of piston.

CYLINDER. The cylinder can be unbolted and removed from crankcase and piston after removing fan housing and starter assembly and the throttle handle, air box and chain oil tank assembly. Be careful not to let piston hit against crankcase as cylinder is removed.

NOTE: If renewing cylinder, measure pilot diameter in crankcase. Pilot diameter of early models is 1-15/16 inch, whereas late models have 2 inch pilot diameter. Be sure to obtain correct size cylinder and gasket.

The cylinder bore is chrome plated. Renew cylinder if chrome plating has worn away exposing the softer base metal. Also refer to COMPRESSION RELEASE paragraph on models so equipped.

CRANKSHAFT, BEARINGS AND SEALS. Crankshaft is supported at drive end by a ball bearing in crankcase and at flywheel end by a roller bearing in magneto back plate. Crankshaft end play is controlled by the ball bearing which is retained on crankshaft by a snap ring and in crankcase by two screws and special washers.

To remove crankshaft, first remove the clutch assembly, automatic chain oiler pump on models so equipped, the fan housing and starter assembly, magneto rotor, the throttle handle, air box and chain oiler tank assembly, cylinder, and the connecting rod and piston. Remove the screws retaining magneto backplate to crankcase and carefully pry backplate from crankcase and the two locating dowel pins. Working through magneto backplate opening, remove the two screws and special washers retaining ball bearing in crankcase, then press crankshaft and bearing assembly from crankcase.

An expandable type bearing remover (Homelite tool No. A-24507) is available for removing roller bearing from backplate. Insert tool through bearing from inner side of backplate taking care to push tool through bearing only far enough that collets will engage outer side of rollers. Tighten the expander screw of tool, then place backplate on suitable support such as Homelite tool No. 23846-2 and drive bearing from backplate. Remove old crankshaft seal, lubricate new seal and install with lip to inner side of backplate; large stepped end of Homelite tool No. 24055 may be used to install seal. **Lubricate** outer race of new bearing and bore in backplate, then place bearing on small stepped end of Homelite tool No. 24055 or use other suitable tool and press bearing into backplate. CAUTION: Due to tight press fit, installing bearing dry may cause distortion and early bearing failure.

If necessary, remove the retaining snap ring and press crankshaft from ball bearing. New bearing can be installed on crankshaft with bearing collar (Homelite tool No. 22820-5) and sleeve (23136-1) using jackscrew (A-24051) threaded onto clutch end of crankshaft. **Be sure to lubricate** bearing and shaft before pushing bearing onto shaft. If special tools are not available, support crankshaft under crankpin throw and use suitable sleeve to press bearing into place. Note: Press against bearing inner race only. Be sure snap ring groove in outer race is towards crankpin (see G—Fig. HL114). Install snap ring on crankshaft with sharp edge away from bearing.

Drive old seal out towards inside of crankcase using long end of Homelite tool No. 24054 or other suitable driver. Install new seal in crankcase using short end of tool No. 24054; if using substitute seal installation tool, outer face of seal should be 1/16-inch below flush with crankcase. Note: Be sure lip of seal is towards inside of crankcase. If desired, new seal can be installed after installing crankshaft and bearing assembly; Homelite tool No. 23972 can be used to install seal with crankshaft installed.

Refer to Fig. HL114 for recommended crankshaft installation procedure. **Be sure to lubricate** both bearing and bore in crankcase before installing crankshaft and bearing assembly. Due to tight press fit, installing bearing dry may cause distortion and early bearing failure. Alignment plate (P) (Homelite tool No. 24006-1) fits onto magneto backplate dowels to guide shaft and bearing as the bearing is being pressed into crankcase. Insert shows removing seal protector (SP) (Homelite tool No. 24076) after crankshaft is installed. Note position of retaining groove (G) in bearing outer race. Use two new screws and special washers to secure bearing in crankcase. Refer to appropriate MAGNETO paragraph for installation of back plate to crankcase.

COMPRESSION RELIEF VALVE. Except for models XL-101 and XL-102 Automatic, all models are equipped with compression relief valve for easier cranking. When throttle lock (6—Fig. HL115) is pushed in, lever (50) lifts plunger (2) against spring (52) pressure. Then, when engine is cranked, compression is partly relieved through port (P). Squeezing throttle trigger after engine starts releases throttle lock allowing spring to close valve.

Service of the compression relief valve usually consists of cleaning the

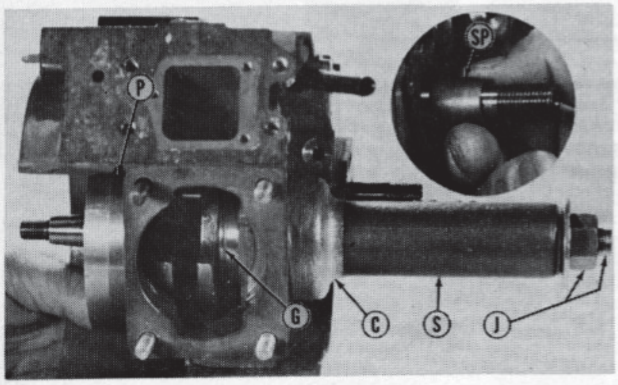


Fig. HL114–Alignment plate (P) fits onto magneto backplate dowel pins to guide crankshaft as it is being pulled into position with collar (C), sleeve (S) and jackscrew (J). Note that groove (G) in main bearing outer race is next to crankpin throw. Inset shows seal protector (SP) being removed after crankshaft is in position.

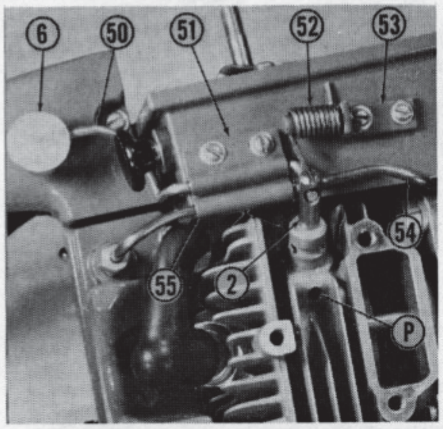


Fig. HL115–View showing compression relief mechanism; all models except XL-101 and XL-102 Automatic are so equipped.

P. Relief port
2. Valve plunger
6. Throttle trigger latch
50. Valve lever
51. Lever bracket
52. Valve spring
53. Spring bracket
54. Oiler tube
55. Tube clamp

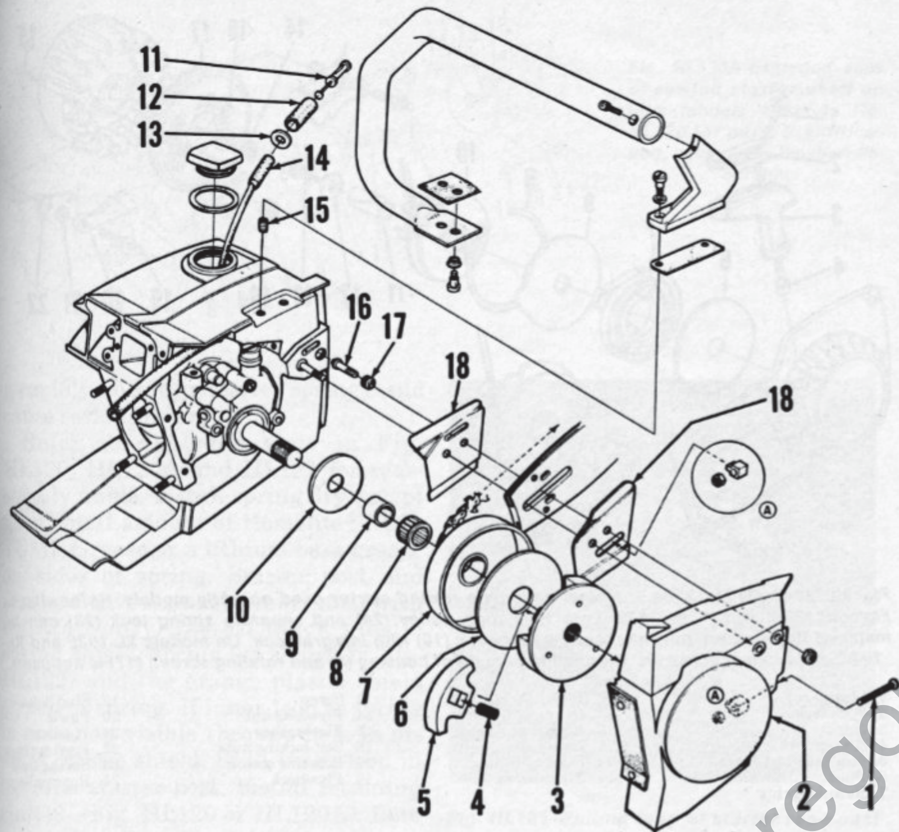


Fig. HL116–Exploded view showing clutch cover and chain tension adjustment, clutch and fuel tank (engine crankcase and fuel tank assembly). Clutch plate (3) is threaded to crankshaft (L.H. threads). On model XL-102 only, a spacer (not shown) is used between washer (10) and shoulder on crankshaft. On late models, fuel tank cover is a separate part; refer to Fig. HL116A.

1. Adjusting screw
2. Clutch cover
3. Clutch plate
4. Springs
5. Shoes
6. Large washer
7. Clutch drum & sprocket
8. Needle bearing
9. Bearing race
10. Small washer
11. Fuel pickup
12. Filter
13. Washer
14. Flexible tube
15. Thread insert
16. Bar studs
17. Stud retainers
18. Guide plates

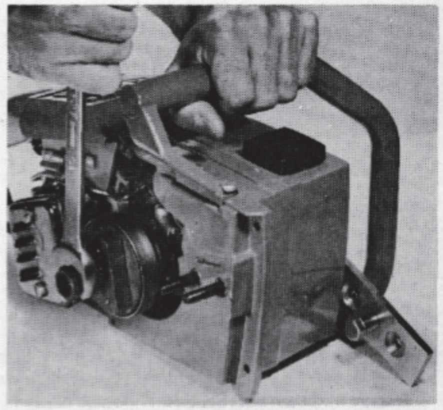


Fig. HL117–Turn clutch rotor clockwise to unscrew from crankshaft (L.H. threads). Spanner wrench is Homelite tool No. A-24060 for early 2-¾ inch clutch or A-23934 for late 3-1/16 inch clutch. Flywheel (rotor) holder is Homelite tool No. A-23960.

valve seat as the port may gradually fill with carbon while the engine is running with compression relief valve open. Refer to MAINTENANCE paragraph for seat cleaning procedure. Early models used steel ball (2—Fig. HL113) and plunger (3) to hold ball on seat. Late valve (37) and pin (38) are available as assembly only and may be used to renew early type plunger and steel ball.

When overhauling engine, the cylinder should be inspected for any damage to the compression relief valve port and valve seat. Renew cylinder if there is damage to port or seat that cannot be remedied by cleaning with Homelite tool No. A24138 as shown in Fig. HL109.

CRANKCASE, FUEL TANK AND BACK PLATE. On early models, crankcase and fuel tank were an integral epoxied unit. On later models, fuel tank cover is sealed to crankcase with a gasket and is retained with screws. Several different types of screws have been used, the latest type being "Pozidriv" screws which are used as service replacement for all earlier types. Use a No. 2 "Pozidriv" screwdriver bit (Homelite tool No. 24304 or equivalent) to remove and install cover retaining screws.

Cylinder pilot diameter in crankcase is 1-15/16 inches on early models and 2 inches on late models. A new crankcase with 2 inch pilot diameter can be installed with early type cylinder having a 1-15/16 inch pilot diameter; use correct gasket with cylinder.

Early magneto back plate was retained to crankcase with three flat head screws fitting into countersunk holes in back plate. Later back plates were changed to use three wafer head retaining screws. Latest crankcase and back plate have five screw holes for the wafer head type screws. Gasket with five bolt holes is used for all models. Use a No. 3 "Phillips" screwdriver bit to remove and install early type flat head (countersunk) screws, or a No. 2 "Pozidriv" screwdriver bit for the later type wafer head screws. Tighten retaining screws evenly and in stages to a final torque of 80-90 inch-pounds when installing magneto back plate.

PYRAMID REED VALVE. All models are equipped with a "Delrin"

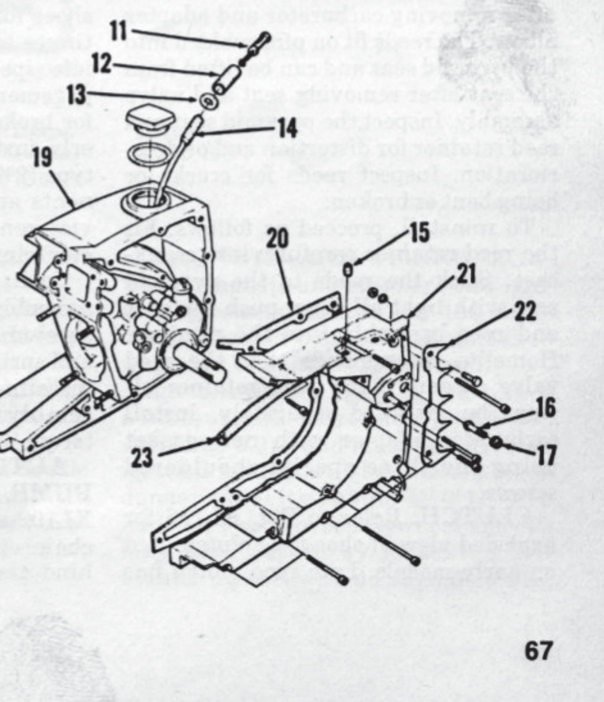


Fig. HL116A–Late type fuel tank (19) and cover (21) are separate parts sealed with a gasket (20) whereas early tank and cover was a single epoxied unit. Note flexible hose (14), pickup (11) and filter (12) used instead of felt wick as on early models. Guide bar studs (16) are retained by threaded retainers (17).

11. Pickup
12. Filter
13. Washer
14. Flexible hose
15. Threaded insert
16. Guide bar studs
17. Stud retainers
19. Fuel tank & crankcase
20. Gasket
21. Fuel tank cover
22. Bumper spike
23. Fuel line

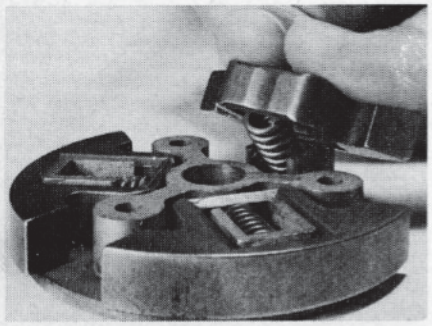


Fig. HL118–To install clutch shoes on early type clutch, hook shoe and spring on clutch plate as shown, then push shoe down into place.

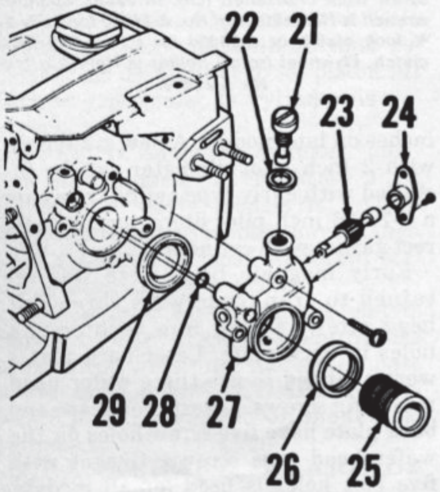


Fig. HL119–Exploded view of automatic chain oiler pump assembly used on models so equipped. Worm gear (25) is driven by engine crankshaft.

21. Cam screw
22. Gasket
23. Plunger & gear
24. Flange bearing
25. Worm
26. Felt seal
27. Pump body
28. "O" ring
29. Crankshaft seal

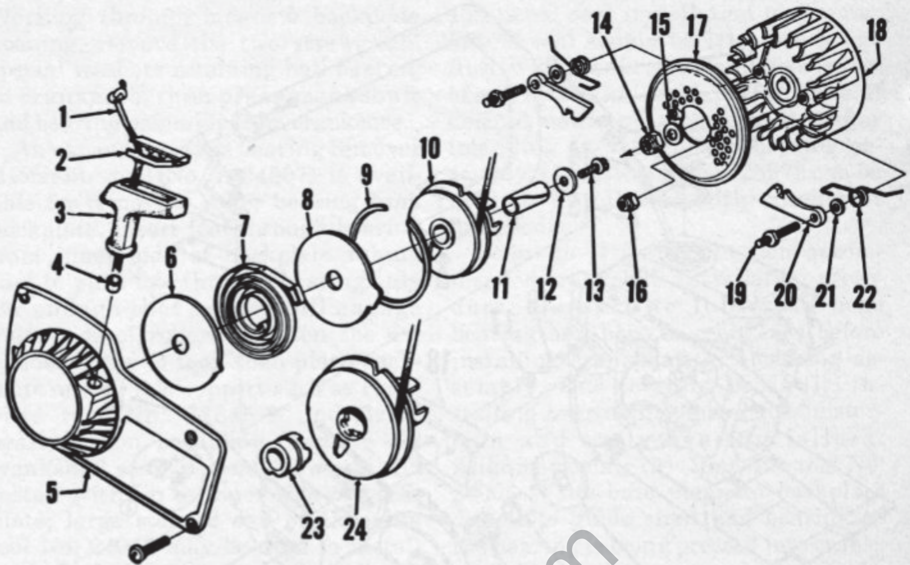


Fig. HL120–Exploded view of typical pawl type rewind starter used on early models. Refer also to Figs. HL120A, HL121 and 122. Late type rope pulley (24) and separate spring lock (23) can be installed if necessary to renew early type pulley (10) with integral lock. On models XL-103E and XL-104E, a stationary screen is attached to outside of housing (5) and rotating screen (17) is not used.

1. Starter rope
2. Rope lock
3. Handle
4. Rope insert
5. Fan housing
6. Plastic shield (black)
7. Rewind spring
8. Plastic shield (orange)
9. Retaining ring
10. Rope pulley
11. Plastic bushing
12. Flat washer
13. Screw
14. Flywheel nut
15. Flat washer
16. Self-locking nuts
17. Rotating screen
18. Flywheel
19. Stud bolts
20. Pawls
21. Washers
22. Pawl springs
23. Spring lock
24. Rope pulley

plastic pyramid valve seat and stainless steel valve reeds. Pyramid seat, reeds and retainer can be removed after removing carburetor and adapter elbow. The reeds fit on pins molded into the pyramid seat and can be lifted from the seat after removing seat and valve assembly. Inspect the pyramid seat and reed retainer for distortion and/or deterioration. Inspect reeds for cracks or being bent or broken.

To reinstall, proceed as follows: Fit the reed retainer carefully into crankcase. Stick the reeds to the pyramid seat with light oil, then push the seat and reed assembly into the retainer. Homelite recommends that the reed valve assembly and reed retainer always be installed separately. Install carburetor adapter with new gasket using the three special shouldered screws.

CLUTCH. Refer to Fig. HL116 for exploded view of shoe type clutch used on early models. Late type clutch has "full radius" shoes and is 3-1/16 diameter whereas early clutch is 2¾ inch diameter. The clutch rotor (plate) (3) is threaded to the crankshaft and can be removed as shown in Fig. HL117; note that L.H. threads are used.

The needle roller bearing (8—Fig. HL116) should be removed, cleaned and lubricated after each 100 hours of operation. A high temperature grease such as Aero Shell #L-14, Aero Shell #5, Texaco Unitemp #500 or Humble (Esso) Nebula EP1 should be used.

If clutch slips with engine running at high speed under load, check the clutch shoes for excessive wear. If chain continues to turn with engine running at idle speed (below normal clutch engagement speed of 3000 RPM), check for broken, weak, distorted or improperly installed clutch springs. If early type (2¾ inch diameter) clutch components are not suitable for further service, renew with late type (3-1/16 diameter) clutch unit.

To disassemble clutch plate and shoe assembly, pry shoes from plate with screwdriver. To install clutch shoes and springs, refer to Fig. HL118. When installing clutch plate and shoe assembly on crankshaft, tighten to a torque of 180 inch-pounds.

AUTOMATIC CHAIN OILER PUMP. All models except XL-101 and XL102 are equipped with an automatic chain oiler pump which is located behind the clutch and chain sprocket. Refer to exploded view in Fig. HL119. Pump body (27) is attached to crankcase and worm gear (25) is driven by crankshaft.

To service pump, unscrew the clutch plate assembly as shown in Fig. HL117 and remove clutch drum and bearing. The automatic chain oiler pump can then be removed from engine crankcase after disconnecting the oil lines.

Worm gear (25—Fig. HL119) can be removed from pump body. To remove pump plunger (23) for inspection, first remove flange bearing (24) and cam screw (21). Pump body and plunger are serviced as a matched assembly only. Flange bearing retaining screws are available separately. Pry felt dust seal (26) from pump body and install new seal using suitable driver. Install new gasket (22) on cam screw and use new "O" ring (28) when reassembling and reinstalling pump. Tighten pump retaining screws evenly to a minimum torque of 40 inch-pounds.

REWIND STARTER. For exploded view of starter, refer to Fig. HL120 or HL120A. To disassemble starter, refer to Fig. HL121 and proceed as follows: If starter spring remains under tension, pull the starter rope out about two turns of pulley, hold pulley from turning and pull loop of rope out past notch in pulley. Allow the starter spring to completely unwind, then remove screw (13) and disassemble unit. Be careful when removing spring;

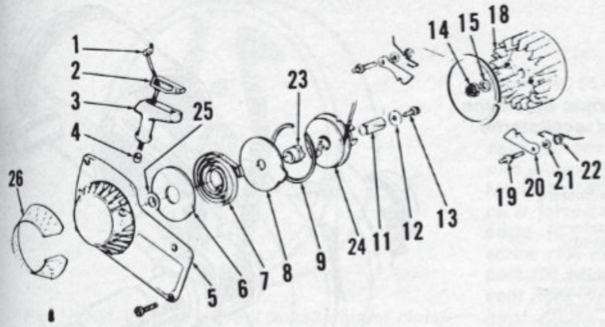


Fig. HL120A–Exploded view of rewind starter used on later models. Refer to Fig. HL120 for parts identification, except: 25. Washer; 26. Screen.

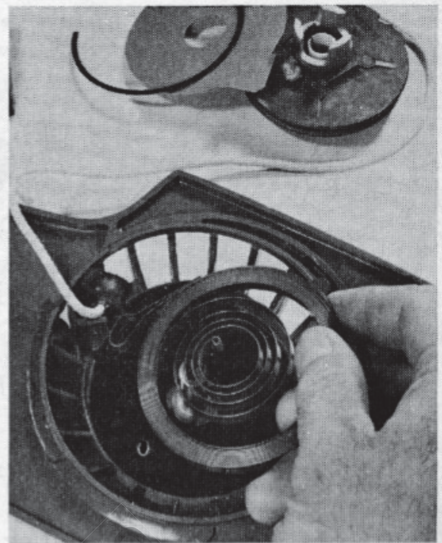


Fig. HL122–Installing rewind spring. Outer (black plastic) spring shield is already installed.

a rapidly uncoiling starter spring could cause serious injury.

Refer to exploded view in Fig. HL120, HL120A and HL122 for reassembly guide. Install spring dry except for a small amount of Homelite® ALL-TEMP Grease or a lithium base grease on sides of spring. Starter post and plastic sleeve should be lubricated with light oil only. Install black plastic spring shield, spring (as shown in Fig. HL122) and the orange plastic shield on top of spring. If inner loop of spring is not then visible through hole in orange plastic shield, bend inner loop in towards starter post. Install retaining ring (9—Fig. HL120 or HL120A). Late type pulley (24—Fig. HL120) and separate spring lock (23) are used to renew early type pulley (10) with integral spring lock.

If necessary to install new rope, insert end through pulley and tie knot as shown at (K—Fig. HL121). Heat end of rope to secure knot, then insert other end through rope guide in fan housing

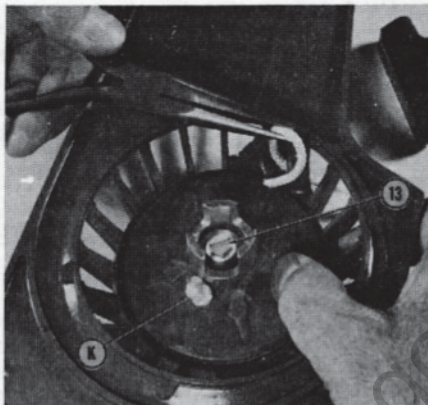


Fig. HL121–Pulling loop of starter rope past notch in rope pulley. Rope is retained by knot (K). Rope pulley retaining screw is (13).

and secure in handle. Wind cord all the way onto pulley, then fit pulley and plastic sleeve onto starter post. Pull rope out far enough to be sure pulley engages spring, then allow spring to rewind. Install pulley retaining washer and screw and tighten screw to minimum torque of 50 inch-pounds. Pull cord out about two feet so that notch in pulley is at rope insert in housing and hold pulley from turning (Fig. HL121). Pull up a loop of rope between notch and fan housing, then holding loop, turn pulley and rope three turns clockwise (winding spring). Pull out the rope so that it runs straight from pulley through insert in fan housing, then allow pulley to rewind slowly.

HOMELITE®

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

Model	Bore Inches	Stroke Inches	Displ. Cu. In.	Drive Type
150 Automatic	1 9/16	1 3/8	2.64	Direct

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion DJ-7J or AC CS45T. Spark plug electrode gap should be 0.025. Note that spark plug has a tapered seat and does not require a gasket.

CARBURETOR. Model 150 Automatic is equipped with a Walbro model HDC-3 diaphragm carburetor. Refer to Walbro section of SERVICE FUNDAMENTALS section for carburetor overhaul and an exploded view.

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 flywheel magneto and breaker point ignition system is used on the 150 Automatic. Breaker points are contained in a breaker box under the flywheel.

Ignition timing is 28° BTDC and is nonadjustable. Breaker point gap should be 0.015 and must be correct or ignition timing will be affected. Condenser capacity should be 0.15-0.19 mfd. Air gap between flywheel and coil may be adjusted by loosening coil mounting screws and repositioning

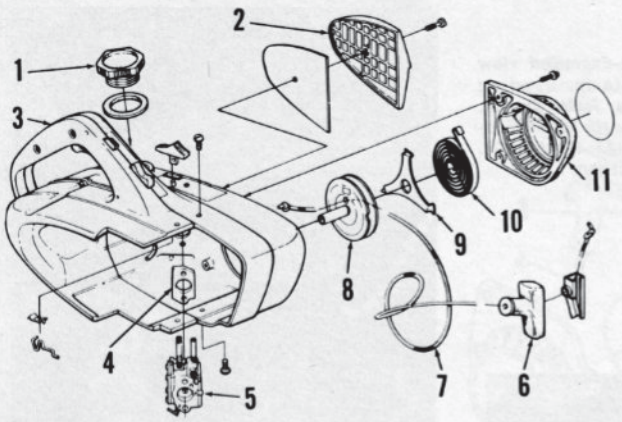


Fig. HL150–View of engine housing and recoil starter.

1. Gas cap
2. Air filter
3. Engine housing
4. Gasket
5. Carburetor
6. Rope handle
7. Rope
8. Rope pulley
9. Spring retainer
10. Rewind spring
11. Starter housing

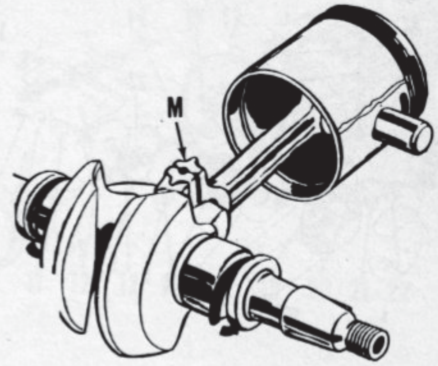


Fig. HL152–View of connecting rod match marks (M).

coil. Place 0.0125 in. (black) shim stock between flywheel and coil legs and apply pressure against flywheel in direction of coil to take up bearing play. Tighten coil screws and remove shim stock.

LUBRICATION. The engine is lubricated by mixing oil with the fuel. Fuel:oil ratio should be 16:1 when using Homelite SAE 30 oil or another good quality SAE 30 oil designed for use in chain saw or air-cooled two-stroke engines. Premium Homelite SAE 40 oil may be used and mixed with the fuel at a ratio of 32:1. Recommended fuel is regular or low lead.

Chain oil tank should be filled with Homelite Bar and Chain Oil or a good quality SAE 30 oil. It may be necessary to use SAE 10 oil or oil mixed with kerosene if temperature is below 40° F.

Clutch needle bearing should be removed, cleaned and lubricated periodically with Homelite All-Temp Multi-Purpose Grease.

CARBON. Carbon deposits should be removed from muffler and exhaust ports at regular intervals. Be careful not to damage ports or piston or to allow loose carbon to enter cylinder.

REPAIRS

TIGHTENING TORQUES. Recommended tightening torques are listed in the following table; all values are in inch-pounds.

Flywheel nut	200
Spark plug	150
Clutch hub	100
Connecting rod screws	60
10-24 Engine housing	45
10-24 Front handle	45
8-32 Socket Head, Cylinder-to-crankcase	40
8-32 Muffler	36
8-32 Intake manifold	36
8-32 Oil pump mounting screws	36
8-32 Cylinder-to-crankcase	36
8-32 Oil pump spring screw	36
8-32 Starter housing	36

CYLINDER, PISTON, PIN AND RINGS. Refer to Fig. HL151 for exploded view of engine. To remove cylinder, remove chain, bar, starter, carburetor, engine housing, clutch, flywheel and ignition assembly. Remove chain and dirt guards. Remove oil tank and unscrew cylinder-to-crankcase screws. Note that there are four socket head screws in bottom of crankcase. Be careful when removing cylinder as crankshaft assembly will be loose in crankcase. Care should be taken not to scratch or nick mating surfaces of cylinder and crankcase.

Cylinder bore is chromed and should be inspected for excessive wear which may expose soft base metal underneath. Also inspect bore for scoring, flaking, or chipping of chrome surface.

Piston pin retaining ring on exhaust side of piston does not have a removal notch and opposite retaining ring must be removed to push pin out of piston. Piston pin is a snug fit in piston and has a closed end which must be installed on exhaust side of piston. Piston rings are retained in position by locating pins. Install piston on connecting rod so that piston ring locating pins will be towards flywheel side of engine when cylinder is installed.

Be sure piston rings are correctly positioned around ring locating pins while installing cylinder. Refer to CRANKSHAFT AND CRANKCASE section to install cylinder on crankcase.

CONNECTING ROD. Connecting rod may be removed after removing cylinder as previously outlined. Connecting rod has a needle roller bearing in small end and 18 loose bearing rollers in big end. Big end is fractured and rod and cap must have serrations correctly mated. Rod and cap have aligning marks as shown in Fig. HL152 which must be aligned to correctly assemble connecting rod.

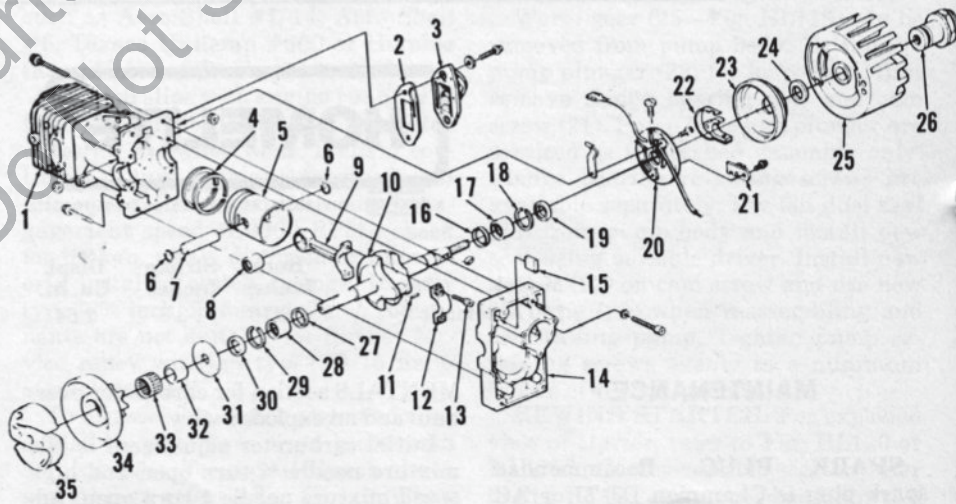
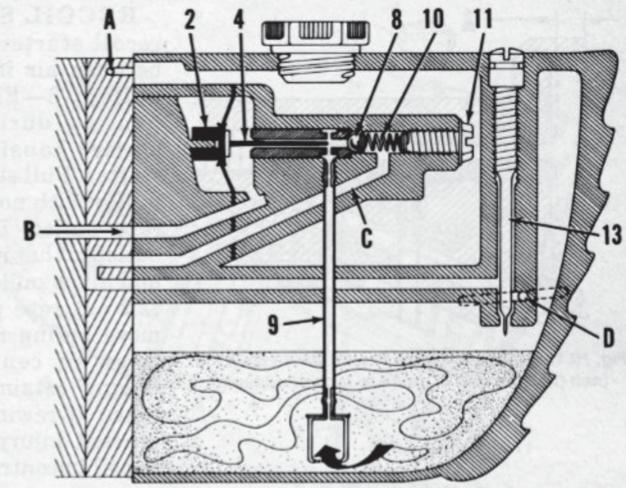


Fig. HL151–Exploded view of 150 Automatic engine, clutch and flywheel assemblies.

1. Cylinder
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. HL153–View of correct installation of clutch hub in drum.

Fig. HL155–Oil is drawn through pick-up (9) by action of crankcase pulses in passage (B) against diaphragm and plunger (4). Plunger (4) forces ball (8) off its seat and oil is forced into outlet passage (C), past adjusting screw (13) and out exhaust port (D) to the chain. Note vent hole (A) which must be kept clear. Refer to Fig. HL154 for parts identification.



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 wear or damage caused by clutch bearing. Lubricate clutch bearing with Homelite ALL-TEMP Multi-Purpose Grease.

AUTOMATIC CHAIN OILER. Model 150 Automatic is equipped with a crankcase pulse actuated automatic chain oiler pump. Crankcase pulses move diaphragm and plunger (4—Fig. HL155) to force oil out oil outlet. Refer to Fig. HL155 for operation of pump.

Output of early models is adjusted by turning adjusting screw. (13—Fig. HL154). Later models are not equipped with adjusting screw.

To remove oil pump, remove recoil starter, engine housing and drain oil tank. Disconnect high tension lead from spark plug and clamp. Unscrew four screws and separate oil tank from crankcase. Remove oil pump from crankcase and disassemble pump. Clean and inspect pump components and passages. Note that there is a bleed hole (A—Fig. HL155) on clutch side of crankcase which must be clear to vent pump. Air vent seal (15—Fig. HL151) has been changed from packing felt to foam rubber.

Bumper (2—Fig. HL154) must have a minimum clearance of 0.100 between flange face of crankcase (1) and bumper as shown in Fig. HL156. Grind bumper and stud until minimum clearance is obtained. Plunger (4—Fig. HL154) length should be 0.620-0.630 measured from collar to end of plunger as shown in Fig. HL157. Plunger guide in pump body (7—Fig. HL154) should be 0.125-0.155 from face of pump body as shown in Fig. HL158. Plunger guide is not available separately from housing.

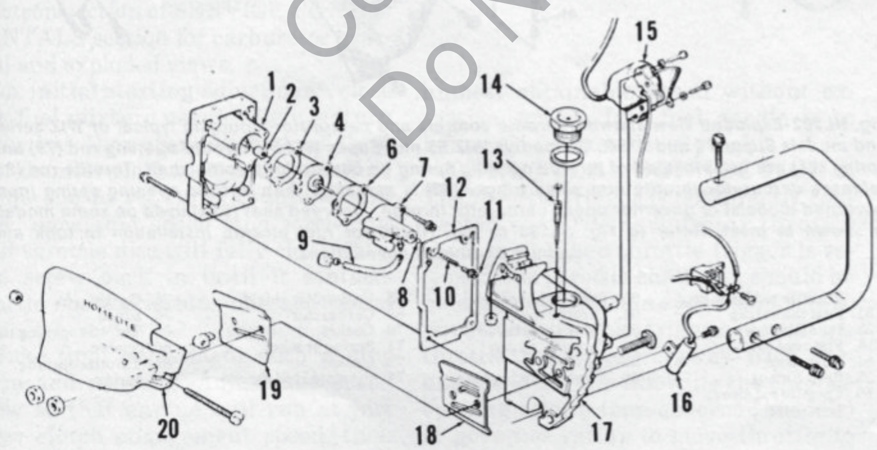


Fig. HL154–Exploded view of oil tank and related assemblies.

1. Crankcase
2. Bumper
3. Gasket
4. Diaphragm & plunger
6. Gasket
7. Oil pump body
8. Ball
9. Oil intake
10. Spring
11. Screw
12. Gasket
13. Oil pump adjusting screw
14. Oil tank cap
15. Ignition coil
16. Condenser
17. Oil tank
18. Inner bar plate
19. Outer bar plate
20. Chain guard

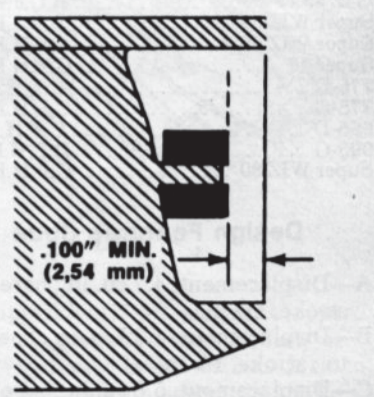


Fig. HL156–Bumper (2–Fig. HL154) and stud must be at least 0.100 inch from edge of crankcase.

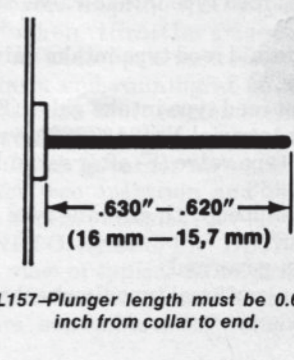


Fig. HL157–Plunger length must be 0.620-0.630 inch from collar to end.

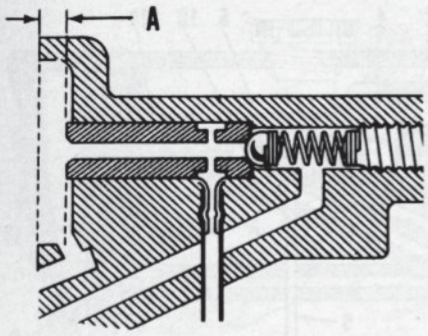


Fig. HL158–Plunger guide should be 0.125-0.155 inch (A) from end of guide to face of oil tank.

RECOIL STARTER. To remove recoil starter, insert a screwdriver between air intake slots to hold rope pulley (8—Fig. HL150) in starter housing during removal. Unscrew starter housing screws and remove starter. Pull starter rope and hold rope pulley with notch in pulley adjacent to rope outlet. Pull rope back through outlet so that it engages notch in pulley and allow pulley to completely rewind. Lift out rope pulley and carefully remove spring retainer (9) by pressing down in center of retainer while freeing retainer legs. Care must be taken if rewind spring is removed to prevent injury if spring is allowed to uncoil uncontrolled.

Rewind spring is wound in clockwise direction in starter housing. Rope is wound on rope pulley in clockwise direction as viewed with pulley in housing. To place tension on rewind spring, pass rope through rope outlet in housing and install rope handle. Pull rope out and hold rope pulley so notch on pulley is adjacent to rope outlet. Pull rope back through outlet between notch in pulley and housing. Turn rope pulley clockwise to place tension on spring. Release pulley and check starter action. Do not place more tension on rewind spring than is necessary to draw rope handle up against housing.

HOMELITE®

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

Chain Saw Model	Design Features
ZIP	A,E,J,K,L,O
WIZ	B,E,J,K,M,O
Super WIZ	A,F,H,K,M,O
WIZ 55	B,G,J,K,M,O
Super WIZ 55	B,F,J,K,M,O
Super WIZ 66	A,F,H,K,M,O
Super 77	C,F,H,K,M,O
775-D	C,F,H,K,L,O
775-G	C,F,H,K,M,O
995-D	C,F,H,K,L,O
995-G	D,F,H,K,N,O
Super WIZ 80	C,F,H,K,M,O

Design Features Code

A—Displacement, 4.7 cu. in.; bore 2 in.; stroke, 1½ in.
B—Displacement, 4.32 cu. in.; bore, 2 in.; stroke, 1⅜ in.
C—Displacement, 5.8 cu. in.; bore, 2 3/16 in.; stroke, 1 35/64 in.
D—Displacement, 6.83 cu. in.; bore, 2 5/16 in.; stroke, 1 35/64 in.
E—Flat reed type intake valve, single reed.
F—Pyramid reed type intake valve, 4 reeds.
G—Flat reed type intake valve (E) prior to serial No. 2537289; pyramid reed type valve (F) after serial No. 2537288.
H—Equipped with air-vane type governor.
J—Non-governed.
K—Conventional type flywheel magneto.
L—Direct drive.
M—Reduction drive, 2-gear transmission.
N—Reduction drive, 3-gear transmission.
O—Manual chain oiler only.

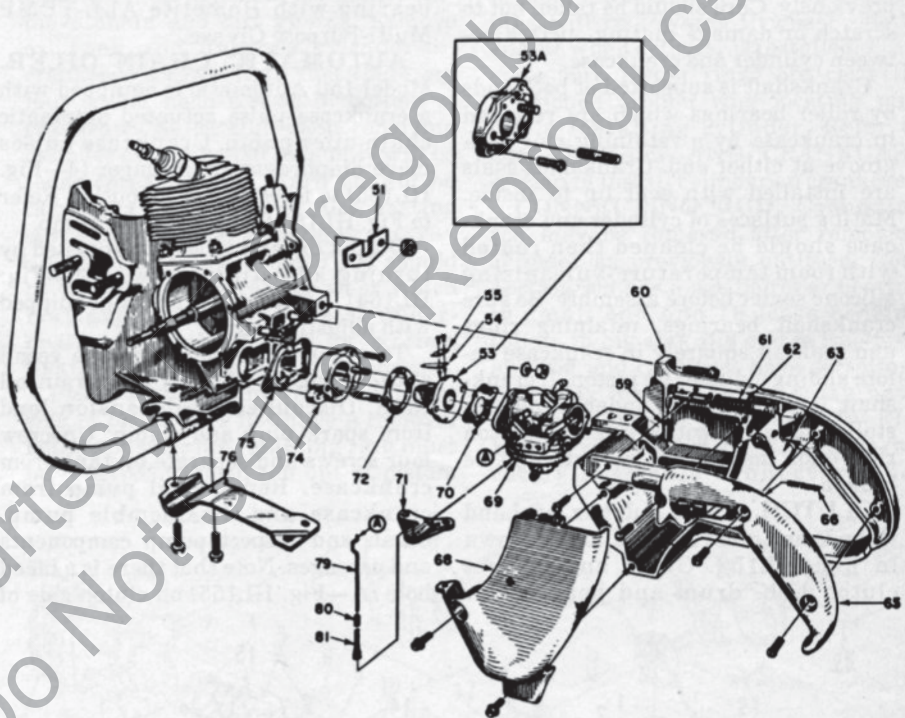


Fig. HL202–Exploded view showing throttle controls and carburetor mounting typical of WIZ series and models Super 77 and 775G. On models WIZ 55 and Super WIZ 55, throttle opening rod (79) and spring (81) are used instead of throttle opening spring on carburetor throttle shaft. Throttle rod (61) releases carburetor throttle arm when trigger (63) is actuated, then throttle opening spring (non-governed models) or governor opens carburetor throttle. Flat reed seat (53A) used on some models is shown in inset. Refer to Fig. HL203 or Fig. HL204 for fuel pick-up installation in tank and carburetor air inlet connections.

A. Throttle rod hook-up
51. Fuel tank strap
53. Pyramid reed seat
53A. Flat 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
79. Throttle opening rod
80. Spacer
81. Throttle opening spring

MAINTENANCE

SPARK PLUG. Recommended Champion spark plug is type UJ-7G for models 995D and 995G, type UJ-11G for models Super 77, 775D, 775G and

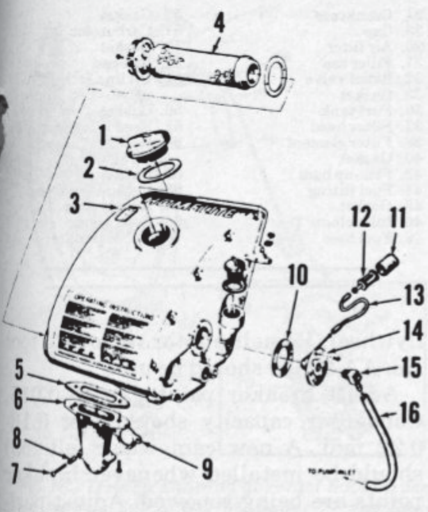


Fig. HL203–Exploded view showing fuel pick-up installation in tank and carburetor air inlet for models WIZ, Super WIZ, WIZ 55 and Super WIZ 55. Note springs (8) on air inlet elbow to carburetor screws.(7).

1. Fuel cap
2. Gasket
3. Fuel tank
4. Air filter
5. Gasket
6. Intake elbow
7. Screw
8. Spring
9. Gasket
10. Gasket
11. Filter
12. Filter head
13. Fuel hose
14. Fuel fitting
15. Elbow
16. Fuel hose

Super WIZ 80 and type J-6J for all other models listed.

Set electrode gap to 0.025. Champion J-6J plug may be substituted for type UJ-11G, but will be more susceptible to electrode erosion. In high temperatures or for heavy duty operation, use UJ-7G plug in place of J-6J or UJ-11G. In extremely cold weather, a UJ-12 plug may be used to avoid cold fouling and improve starting.

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

For initial starting adjustment, close both fuel mixture needles lightly (turn clockwise), then open idle fuel needle ¾ turn counter-clockwise and main fuel needle one to 1¼ turns counter-clockwise. Back idle speed stop screw out until throttle disc will fully close, then turn screw back in until it contacts throttle shaft arm plus one additional turn.

Make final adjustment with engine warm and running. Adjust idle speed screw so that engine will run at just below clutch engagement speed, then adjust idle fuel mixture needle so that engine runs smoothly. Readjust idle speed stop screw if necessary. With engine running at full throttle under load (stall chain in cut), adjust main fuel needle so that engine runs at highest obtainable speed without excessive smoke. Idle fuel needle is to left, main fuel needle is to right.

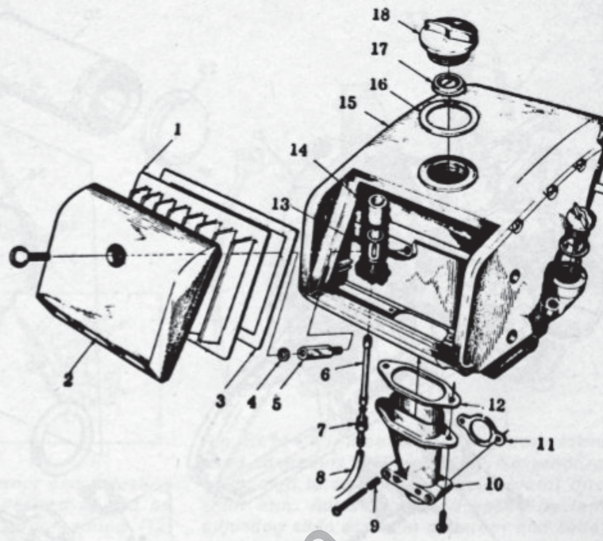


Fig. HL204–Exploded view showing fuel pick-up, air cleaner and carburetor inlet elbow and fuel tank typical of models Super WIZ 66, Super 77, 775G and Super WIZ 80. Model 775D is similar except chain oil tank is separate from fuel tank. Springs (9) are used on inlet to carburetor screws.

1. Air filter element
2. Cover
3. Gasket
4. Gasket
5. Stud
6. Pick-up hose
7. Fuel fitting
8. Fuel line
9. Springs
10. Air inlet elbow
11. Gasket
12. Gasket
13. Filter head
14. Filter element
15. Fuel tank
16. Gasket
17. Valve (integral W/cap on late models)
18. Filler cap

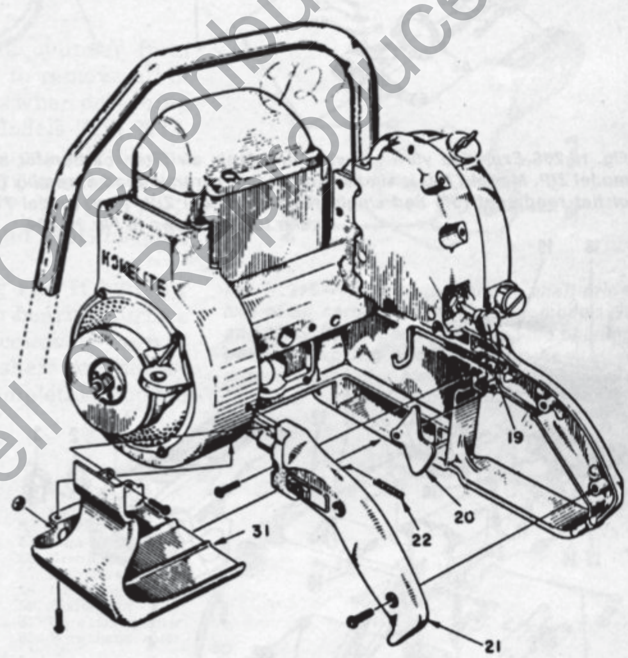


Fig. HL205–View showing throttle trigger and throttle rod installation on models ZIP and 775D; refer to Fig. HL206 for carburetor and reed valves.

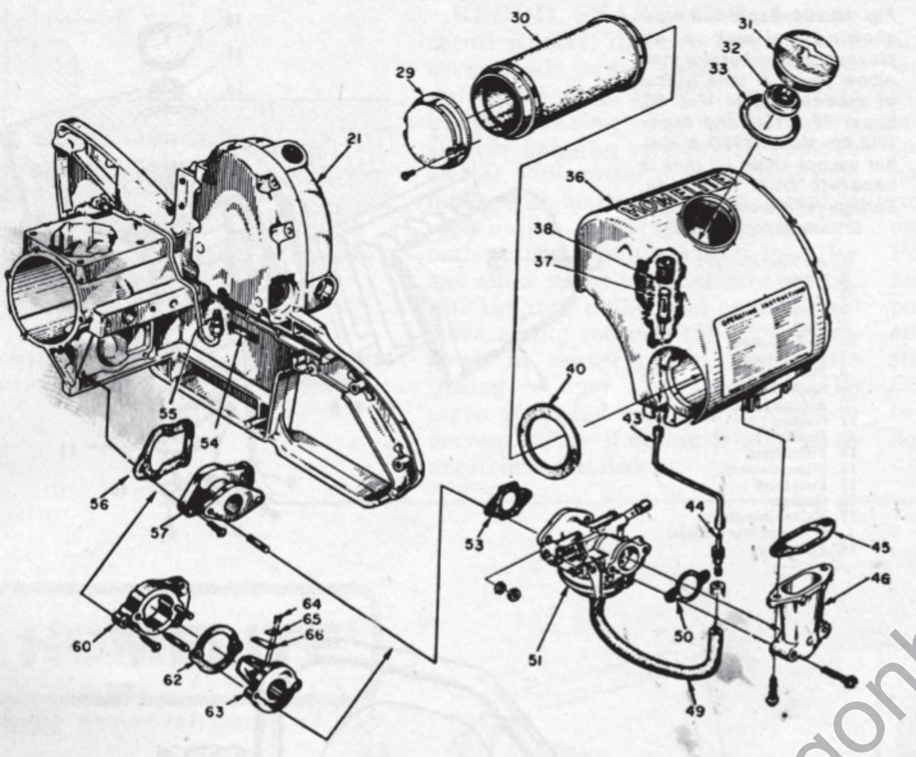
19. Throttle rod & return spring
20. Throttle trigger
21. Handle cover
22. Throttle lock spring
31. Carburetor cover

THROTTLE CONNECTIONS. The throttle trigger is not directly connected with the carburetor throttle shaft arm. When throttle trigger is released, the throttle shaft arm should be held against the idle speed stop screw. Squeezing throttle trigger moves the throttle rod or lever away from carburetor shaft arm allowing the throttle opening spring (non-governed models) or governor spring to move throttle to wide open position. Check action of throttle linkage, carburetor throttle shaft and throttle opening or governor spring with engine stopped.

GOVERNOR. All models except ZIP, WIZ, WIZ 55 and Super WIZ 55 are equipped with an air vane type governor to prevent over-speeding of engine when saw is out of cut. Maximum no-load engine speed should be 7500 RPM; engine peak horsepower is obtained at about 6000 RPM.

With engine not running, check to see that governor spring will fully open throttle when throttle trigger is squeezed to wide open position. With engine warm and running at no load, governor should limit engine speed to about 7500 RPM by closing carburetor throttle. Check governor air vane and linkage for free operation and renew governor if worn or damaged.

MAGNETO. Refer to Fig. HL217 for exploded view of typical REPCO magneto. Breaker points, coil and condenser are accessible after removing



21. Crankcase
29. Cap
30. Air filter
31. Filler cap
32. Relief valve
33. Gasket
36. Fuel tank
37. Filter head
38. Filter element
40. Gasket
43. Pick-up hose
44. Fuel fitting
45. Gasket
46. Inlet elbow
49. Fuel hose
50. Gasket
51. Carburetor
53. Gasket
54. Felt pad
55. Oil line & check valve
56. Gasket
57. Reed valve seat (ZIP)
60. Reed seat adapter (775D)
62. Gasket
63. Pyramid reed seat
64. Reed screws
65. Reed plates
66. Valve reeds (4)

Fig. HL206–Exploded view showing fuel tank, air filter, carburetor and reed valve installation on model ZIP. Model 775D is similar except that pyramid reed assembly (items 60 to 66) is used instead of flat reed seat (57) and single reed on model ZIP. Also, model 775D fuel tank and air filter is similar to that shown in Fig. HL204.

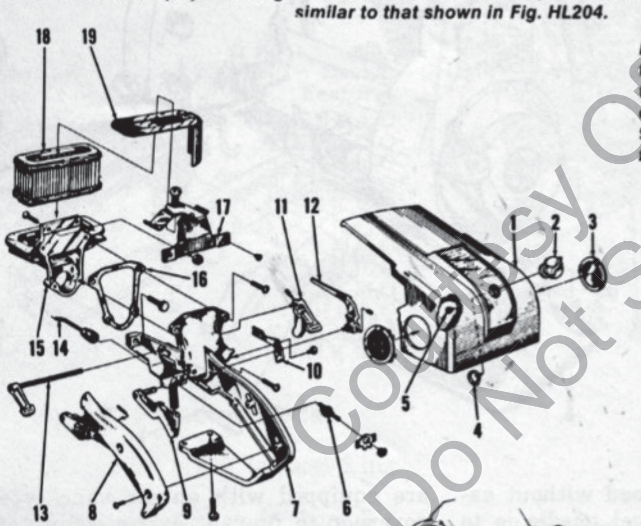
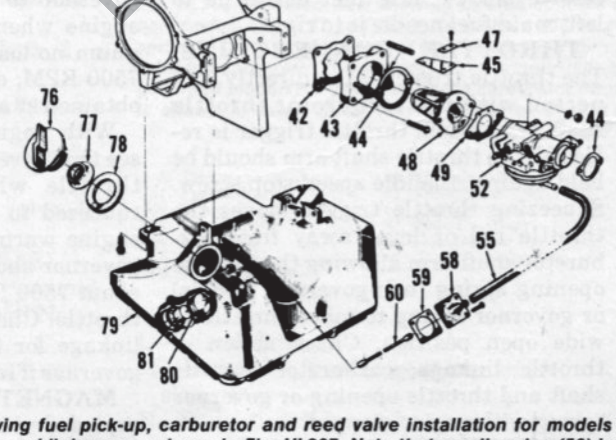


Fig. HL207–Exploded view of throttle handle, air inlet filter, throttle linkage and cover for models 995D and 995G. Refer to Fig. HL208 for fuel pick-up, carburetor and reed valve installation.

1. Cover
2. Retaining nut
3. Plugs
4. Snap ring
5. Rubber bumper
6. "ON-OFF" switch
7. Throttle handle
8. Handle cover
9. Throttle trigger
10. Choke lever
11. Oiler lever
12. Throttle lever
13. Oiler shaft & lever
14. Switch ground lead
15. Air filter holder
16. Gasket
17. Bracket
18. Air filter element
19. Filter cap



42. Gasket
43. Reed seat adapter
44. Gasket
45. Valve reeds
47. Reed plates
48. Pyramid reed seat
49. Gasket
52. Carburetor
53. "O" ring
55. Fuel line
56. Spring insert
58. Fuel fitting
59. Gasket
60. Pick-up hose
76. Filler cap
77. Relief valve
78. Gasket
79. Fuel & oil tank
80. Filter head
81. Filter element

Fig. HL208–Exploded view showing fuel pick-up, carburetor and reed valve installation for models 995D and 995G. Throttle handle and linkage are shown in Fig. HL207. Note that a coil spring (56) is inserted in fuel line (55).

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

Adjust breaker point gap to 0.015. Condenser capacity should test 0.18-0.22 mfd. A new cam wiper felt (53) should be installed whenever breaker points are being renewed. Adjust position of felt so that it lightly contacts cam surface of engine crankshaft.

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

The clutch drum and sprocket assembly on direct drive models should be removed occasionally and the needle roller bearing be cleaned and lubricated.

On gear drive models, maintain oil level in gear case to arrow on inspection window using Homelite Gear Oil or SAE 90 gear lubricant. Check oil level with saw setting on level surface. Do not overfill.

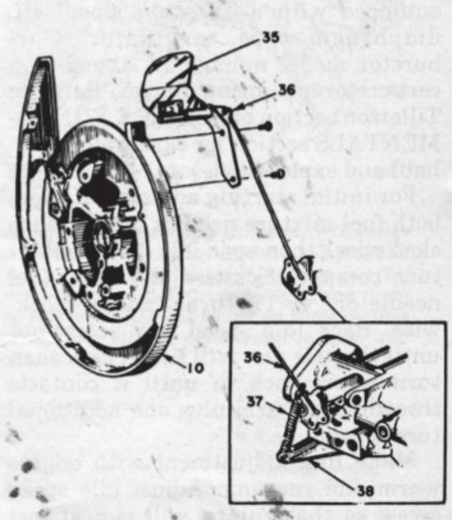
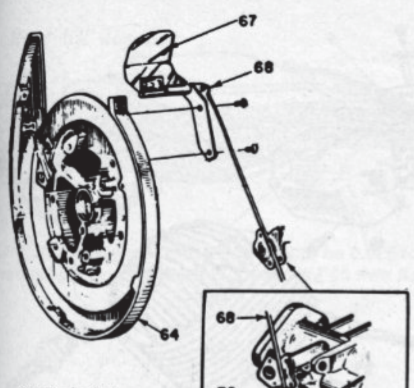


Fig. HL210–View showing Super WIZ governor installation. Refer to Fig. HL215; governor spring attaches to carburetor throttle arm hole numbered (1) and governor link attaches at hole numbered (3).

10. Back plate
35. Governor assy.
36. Governor rod
37. Governor spring
38. Spring bracket



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

Fig. HL211–View showing governor hookup used on models Super WIZ 66, Super 77 and Super WIZ 80. Refer to Fig. HL215; throttle rod is connected at hole numbered (3). Governor spring (70) is compressed between bracket (71) and shoulder on governor rod.

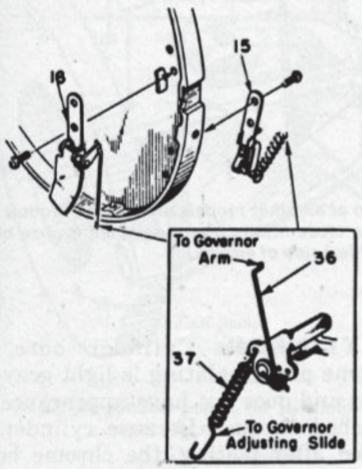


Fig. HL212–Model 775D governor spring (37) is connected to adjustable slide (15) making it possible to adjust engine governed speed by turning adjusting screw on slide. Refer to Fig. HL215; spring is hooked in throttle arm hole numbered (1) and governor rod is hooked in hole numbered (2).

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 ZIP, WIZ, Super WIZ, WIZ 55, Super WIZ 55 and Super WIZ 66 have 27 needle rollers and models Super 77, 775D, 775G, Super WIZ 80, 995D and 995G have 31 loose needle rollers.

Renew connecting rod if bent or twisted, or if crankpin bearing surface is scored, burned or excessively worn or if Formica thrust washers are deeply grooved or are not completely bonded

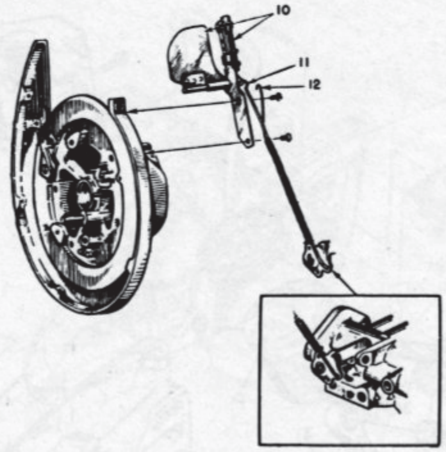


Fig. HL213–Model 775G governor and adjusting slide assembly; adjust governed speed by turning screw on slide. Governor spring (12) connects to adjusting slide and lower end of spring is threaded onto burr washer on rod (11). Hook rod to throttle arm hole numbered (4) (Fig. HL215).

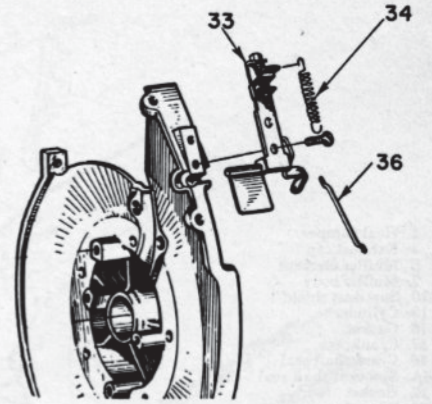


Fig. HL214–View showing governor assembly used on models 995D and 995G. Governor rod is connected to single hole in carburetor throttle shaft arm. Adjust governed speed by turning adjusting slide screw in governor and slide assembly (33). Governor spring (34) is connected between adjustable slide and arm on governor shaft.

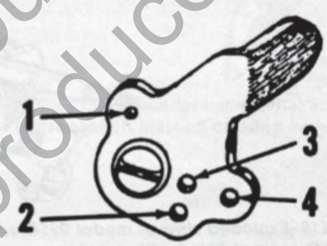


Fig. HL215–View showing throttle shaft arm typical of all carburetors except for models 995D and 995G. It is important that throttle opening or governor spring and/or link be hooked into proper hole. Refer also to Fig. HL202 and Figs. HL210 through HL213.

35. Plug terminal
36. High tension wire
37. Grommet
38. "ON-OFF" switch
39. Switch plate
40. Ground wire
41. Sleeve
42. Rotor
43. Ignition coil
47. Condenser
49. Breaker cover
50. Gasket
52. Breaker points
53. Cam wiper felt
56. Ground wire tab
57. Armature core
58. Cover clip
59. Sealing felt
61. Wire clamp, inner
63. Wire clamp, outer

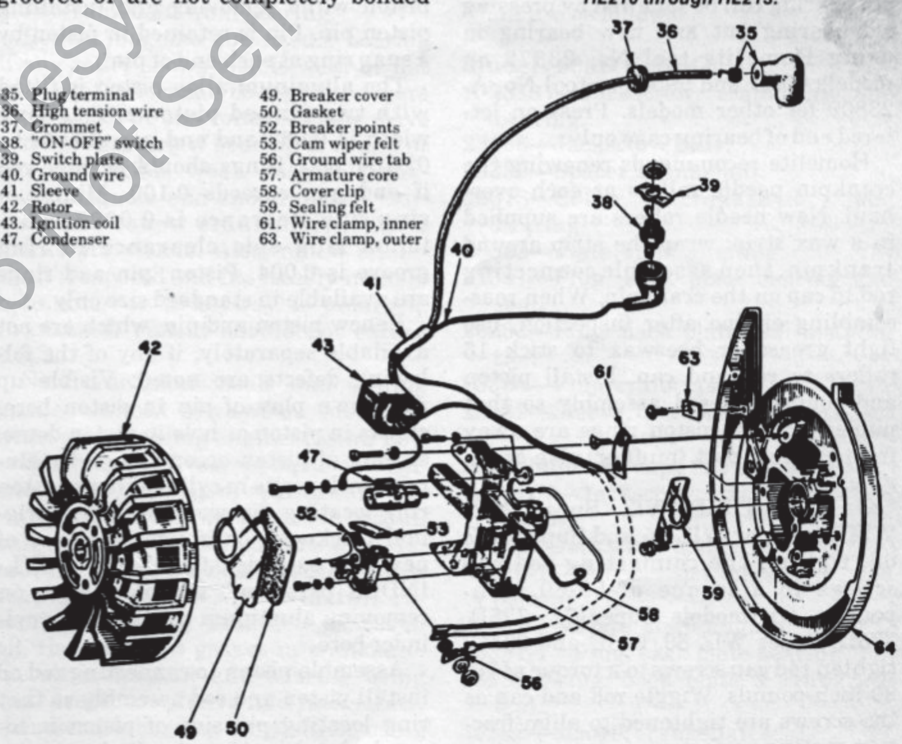


Fig. HL217–Exploded view of typical REPCO magneto used on all models. Rotor (flywheel) has three tapped holes for installation of remover (Homelite tool No. AA-22560). Magneto back plate (64) supports crankshaft seal and needle bearing.