

TECUMSEH

TECHNICIAN'S HANDBOOK

This manual covers engine models:

OHH50 - 65, OHHSK50 - 130, OHV11 - OHV17, OVM120,
OVRM40-675, OVRM120, OVXL/C120, OVXL120, OVXL125.

Other illustrated Tecumseh 2-Cycle Engine, 4-Cycle Engine and
Transmission manuals; booklets; and wall charts are available
through Tecumseh.

For complete listing write or call

CONTAINS SEARS CRAFTSMAN CROSS REFERENCE

4-CYCLE OVERHEAD VALVE ENGINES



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CHAPTER 1 GENERAL INFORMATION

ENGINE IDENTIFICATION

Tecumseh engine model, specification, and serial numbers or date of manufacture (D.O.M.) are stamped into the blower housing, or located on a decal on the engine in locations as illustrated (diag. 1 & 2). The engine identification decal also provides the applicable warranty code and oil recommendations (diag. 2).

Interpretation of Model Number

The letter designations in a model number indicate the basic type of engine.

- OHH - Overhead Valve Horizontal
- OHM - Overhead Valve Horizontal MediumFrame
- OHSK - Overhead Valve Horizontal Snow King
- OVM - Overhead Valve Vertical Medium Frame
- OVRM - Overhead Valve Vertical Rotary Mower
- OVXL - Overhead Valve Vertical Medium Frame Extra Life
- OHV - Overhead Valve Vertical

The number designations following the letters indicate the basic engine model.

The number following the model number is the specification number. The last three numbers of the specification number indicate a variation to the basic engine specification.

The serial number or D.O.M. indicates the production date of the engine.

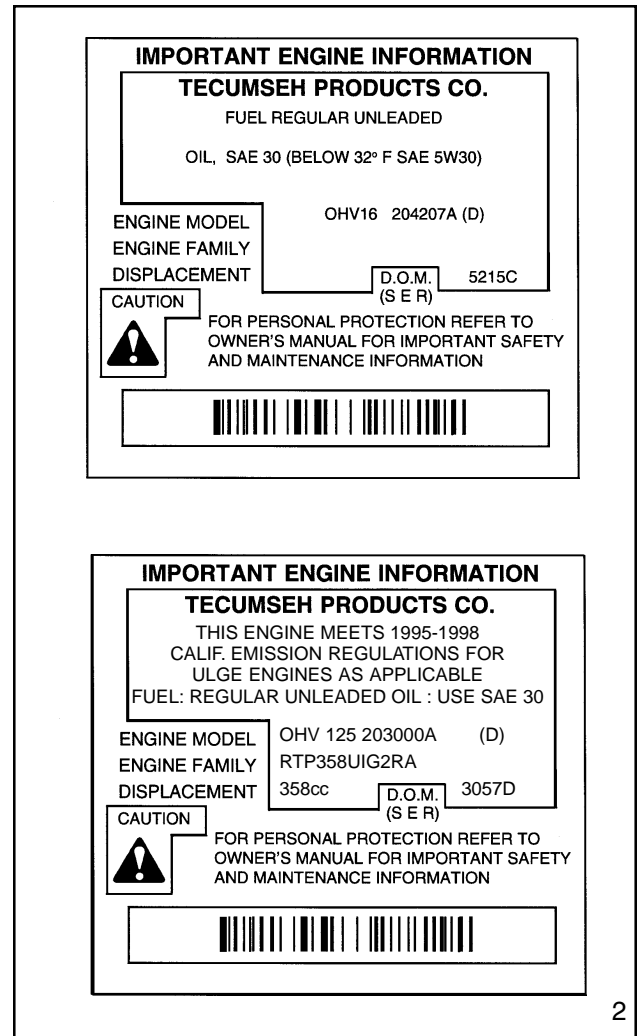
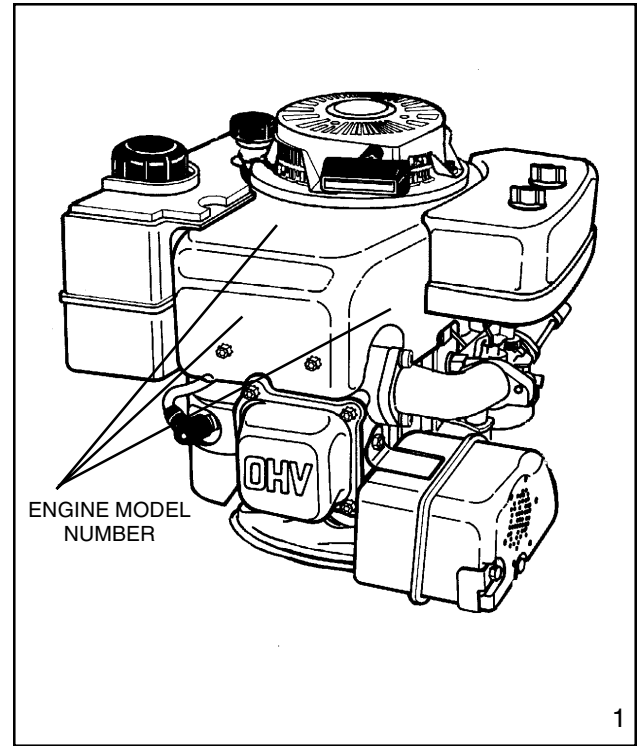
Using model **OHV16-204207A**, serial **5215C** as an example, interpretation is as follows:

OHV16-204207A is the model and specification number.

- OHV** Overhead Valve Vertical
- 16** Indicates the basic engine model.
- 204207A** is the specification number used for properly identifying the parts of the engine.
- 5215C** is the serial number or D.O.M. (Date of Manufacture)
- 5** is the last digit in the year of manufacture (1995).
- 215** indicates the calendar day of that year (215th day or August 3, 1995).
- C** represents the line and shift on which the engine was built at the factory.

Emissionized engines that meet the California Air Resource Board (C.A.R.B.) or the Environmental Protection Agency (E.P.A.) standards will include additional required engine information on the engine decal.

NOTE: To maintain best possible emission performance, use only Genuine Tecumseh Parts.

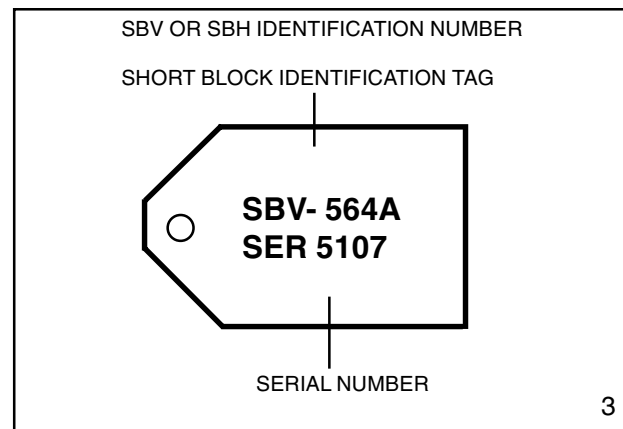


SHORT BLOCKS

New short blocks are identified by a tag marked S.B.H. (Short Block Horizontal) or S.B.V. (Short Block Vertical). Original model identification numbers of an engine should always be transferred to a new short block for correct parts identification (diag. 3).



THIS SYMBOL POINTS OUT IMPORTANT SAFETY INSTRUCTIONS WHICH IF NOT FOLLOWED COULD ENDANGER THE PERSONAL SAFETY OF YOURSELF AND OTHERS. FOLLOW ALL INSTRUCTIONS.



FUELS

Tecumseh Products Company strongly recommends the use of fresh, clean, unleaded regular gasoline in all Tecumseh Engines. Unleaded gasoline burns cleaner, extends engine life, and promotes good starting by reducing the build up of combustion chamber deposits. Unleaded regular, unleaded premium or reformulated gasoline containing no more than 10% Ethanol, or 15% MTBE, or 15% ETBE may also be used.

Leaded fuel is generally not available in the United States and should not be used if any of the above options are available.

Never use gasoline, fuel conditioners, additives or stabilizers containing methanol, white gas, or fuel blends which exceed the limits specified above for Ethanol, MTBE, or ETBE because engine/fuel system damage could result.

Regardless of which of the approved fuels are used, fuel quality is critical to engine performance. Fuel should not be stored in an engine or container more than 30 days prior to use. This time may be extended with the use of a fuel stabilizer like TECUMSEH'S, part number 730245.

See "STORAGE" instructions in the Technician's Manual, Operators Manual, or Bulletin 111.

ENGINE OIL

TECUMSEH FOUR CYCLE ENGINES REQUIRE THE USE OF A CLEAN, HIGH QUALITY DETERGENT OIL. Be sure original container is marked: A.P.I. service "SF" thru "SJ" or "CD".

TECUMSEH RECOMMENDS USING ONE OF THE FOLLOWING FOUR CYCLE OILS THAT ARE SPECIALLY FORMULATED TO TECUMSEH SPECIFICATIONS.

DO NOT USE SAE10W40 OIL.

FOR SUMMER (Above 32° F) (0°C) USE SAE30 OIL. PART #730225

Use SAE30 oil in high temperature, high load applications. Using multigrade oil may increase oil consumption.

FOR WINTER (Below 32°F) (0°C) USE SAE5W30 OIL. PART #730226

(SAE 10W is an acceptable substitute.)

(BELOW 0°F (-18°C) ONLY): SAE 0W30 is an acceptable substitute.

NOTE: For severe, prolonged winter operation of HH120 model, SAE10W oil is recommended.

Capacities

Engine Model	Oz.	ml.
OHH,OHSK 50-70	21	630
OVRM 40 - 6.75	21	630
OVRM105 & 120	21	630
OHSK80 - 100	26	720
OHM, OHSK 110* - 130	32	960
OVM 120, OVXL 120, 125	32	960
OHV 11 - 13 without oil filter	32	960
OHV 11 - 13 with filter	39	1170
OHV 13.5 - 17 without oil filter	55	1650
OHV 13.5 -17 2 1/4" filter (part # 36563)	62	1860
OHV 13.5 -17 2 5/8" filter (part # 36262)	64	1920

* NOTE: Model OHSK110 with a spec. of 221000 and up, have a capacity of 26 oz. (720 ml.)

Oil Change Intervals: Change the oil after the first two (2) hours of operation and every 25 hours thereafter (OHH & OHSK50-130, OHV13.5-17 every 50 hours), or more often if operated under dusty or dirty conditions. If the engine is run less than 25 hours per year, change the oil at least once per year.

NOTE: The oil filter (if equipped) requires changing every 100 hours or more often if operated under dusty or dirty conditions.

Oil Check: Check the oil each time the equipment is used or every five (5) hours of operation. Position the equipment so the engine is level when checking the oil.



CAUTION: Remove the spark plug wire before doing any service work on the engine.

Oil Change Procedure: Locate the oil drain plug. On some units this plug is located below the deck through the bottom of the mounting flange. Other units drain at the base of the engine above the deck or frame. On some rotary mower applications, where access to the drain plug is restricted by the equipment, it may be necessary to drain the oil by tipping the mower in a position that would allow the oil to drain out of the fill tube.

On units that the drain plug is accessible, remove the plug and allow the oil to drain into a proper receptacle. Always make sure that drain oil is disposed of properly. Contact your local governing authorities to find a waste oil disposal site.

Once the oil is drained, reinstall the drain plug and fill the engine with new oil to the proper capacity.

TUNE-UP PROCEDURE:

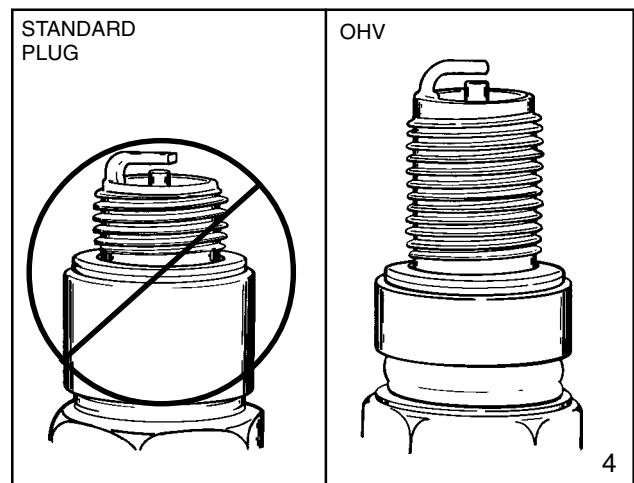
NOTE: Today's fuels can cause many problems in an engines performance due to the fuels quality and short shelf life. Always check fuel as a primary cause of poor engine performance.

The following is a minor tune-up procedure. When this procedure is completed, the engine should operate properly. Further repairs may be necessary if the engine's performance remains poor.



CAUTION: Remove the spark plug wire before doing any service work on the engine.

1. Service or replace the air cleaner. See Chapter 2 under "Service".
2. Inspect the level and condition of the oil and change or add oil as required.
3. Remove the blower housing and clean all dirt, grass or debris from the intake screen, head, cylinder cooling fins, carburetor, governor levers and linkage.
4. Make sure the fuel tank, fuel filter and fuel line are clean. Replace any worn or damaged governor springs or linkage. Make the proper governor adjustments and carburetor presets where required.
5. When replacing the spark plug, consult the proper parts breakdown for the spark plug to be used in the engine being serviced. Set the proper spark plug gap (.030") (.762 mm) and install the spark plug in the engine. Tighten the spark plug to 21 foot pounds (28 Nm) of torque. If a torque wrench isn't available, screw the spark plug in as far as possible by hand, and use a spark plug wrench to turn the spark plug 1/8 to 1/4 turn further if using the old spark plug, or 1/2 turn further if using a new spark plug.
6. Make sure all ignition wires are free of abrasions or breaks and are properly routed so they will not rub on the flywheel.
7. Properly reinstall the blower housing, gas tank, fuel line, and air cleaner assembly if removed.
8. Make sure all remote cables are properly adjusted for proper operation. See Chapter 4 under "Speed Controls and Linkage".
9. Reinstall the spark plug wire, add fuel and oil as necessary, start the engine.



STORAGE (IF THE ENGINE IS TO BE UNUSED FOR 30 DAYS OR MORE)



CAUTION: NEVER STORE THE ENGINE WITH FUEL IN THE TANK INDOORS OR IN ENCLOSED, POORLY VENTILATED AREAS, WHERE FUEL FUMES MAY REACH AN OPEN FLAME, SPARK OR PILOT LIGHT AS ON A FURNACE, WATER HEATER, CLOTHES DRYER OR OTHER GAS APPLIANCE.

Gasoline can become stale in less than 30 days and form deposits that can impede proper fuel flow and engine operation. To prevent deposits from forming, all gasoline must be removed from the fuel tank and the carburetor. An acceptable alternative to removing all gasoline, is by adding Tecumseh's fuel stabilizer, part number 730245, to the gasoline. Fuel stabilizer is added to the fuel tank or storage container. Always follow the mix ratio found on the stabilizer container. **Run the engine at least 10 minutes after adding the stabilizer to allow it to reach the carburetor.**

Draining the Fuel System



CAUTION: DRAIN THE FUEL INTO AN APPROVED CONTAINER OUTDOORS, AND AWAY FROM ANY OPEN FLAME OR COMBUSTION SOURCE. BE SURE THE ENGINE IS COOL.

1. Remove all gasoline from the fuel tank by running the engine until the engine stops, or by draining the fuel tank by removing the fuel line at the carburetor or fuel tank. Be careful not to damage the fuel line, fittings, or fuel tank.
2. Drain the carburetor by pressing upward on bowl drain (if equipped) which is located on the bottom of the carburetor bowl. On carburetors without a bowl drain, the carburetor may be drained by loosening the bowl nut on the bottom carburetor one full turn. Allow to completely drain and retighten the bowl nut being careful not to damage the bowl gasket when tightening.
3. If "Gasohol" has been used, complete the above procedure and then put one half pint of unleaded gasoline into the fuel tank and repeat the above procedure. If Gasohol is allowed to remain in the fuel system during storage, the alcohol content can cause rubber gaskets and seals to deteriorate.

Change Oil: If the oil has not been changed recently, this is a good time to do it. See "Oil Change Procedure" on page 3.

Oil Cylinder Bore

1. Disconnect the spark plug wire and ground the spark plug wire to the engine. Remove the spark plug and put a 1/2 ounce (15 ml.) of clean engine oil into spark plug hole.
2. Cover the spark plug hole with a shop towel.
3. Crank the engine over, slowly, several times.
4. Install the spark plug and connect the spark plug wire.

Clean Engine: Remove the blower housing and clean all dirt, grass or debris from the intake screen, head, cylinder cooling fins, carburetor, governor levers and linkage.

CHAPTER 2 AIR CLEANERS

GENERAL INFORMATION

The air cleaner is the device used to eliminate dust and dirt from the air supply. Filtered air is necessary to assure that abrasive particles are removed before entering the combustion chamber. Dirt allowed into the engine will quickly wear the internal components and shorten the life of the engine.

Tecumseh engines use either a polyurethane or a paper-type air filter system. A polyurethane pre-cleaner or a flocked screen may be used with the main filter. Snow King® engines do not use an air filter due to the clean operating environment and to prevent filter freeze-up.

Extremely dirty conditions may require more frequent filter cleaning or replacement.

OPERATION

The air cleaner cover allows access to the air filter element(s) and prevents large particles from entering the filter body. Air is filtered through the pre-cleaner or flocked screen if equipped, and the polyurethane or paper filter element. Pre-cleaners or flocked screens provide more air cleaning capacity.

In Tecumseh's Kleen Aire® system, air is drawn in through a rotating screen or recoil housing to be centrifugally cleaned by the flywheel before the air enters the air filter.

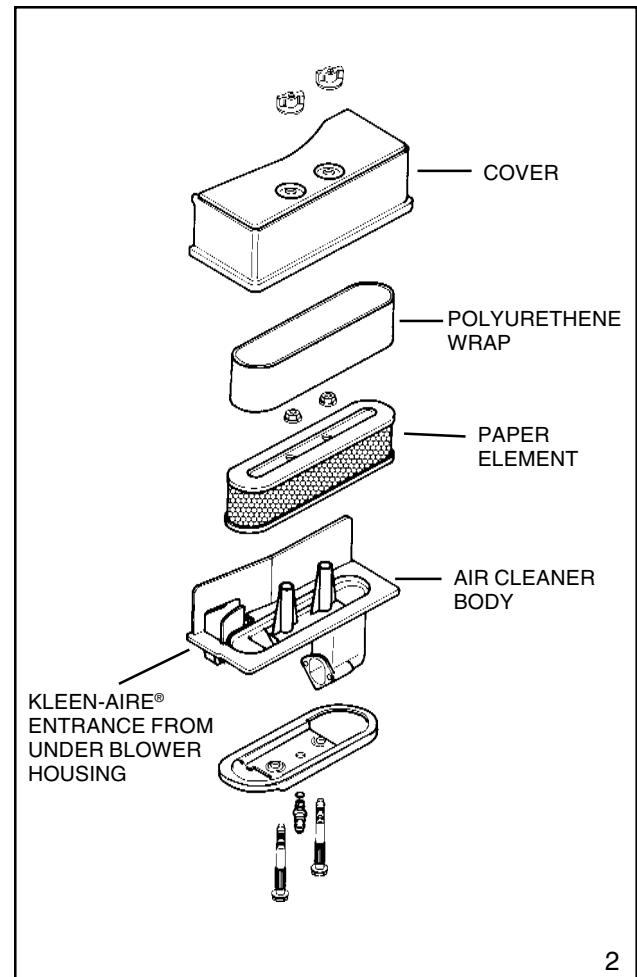
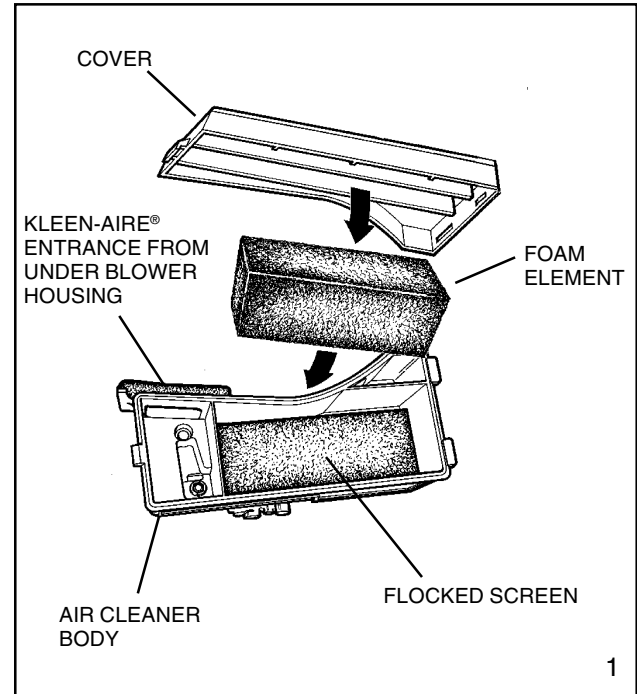
COMPONENTS

The **cover** holds the filter element and prevents large debris from entering the filter body.

The **polyurethane wrap pre-cleaner** is used on XL or XL/C engine models with paper filter elements.

The **paper** or **polyurethane filter element** is the main filter to trap dust and dirt. Dry-type paper elements are pleated paper for increased surface area and rubberized sealing edges. The polyurethane filter uses an oil film to trap fine particles found in dust.

The **flocked screen** is used as an additional filter on XL or XL/C engine models that use a polyurethane filter element.



TROUBLESHOOTING OR TESTING

If the engine's performance is unsatisfactory (needs excessive carburetor adjustments, starts smoking abnormally, loses power), the first engine component to be checked is the air filter. A dirt restricted or an oil soaked filter will cause noticeable performance problems. A polyurethane filter may be cleaned following the service procedure listed under "Service" in this chapter. A paper-type air filter should only be replaced. A paper-type filter cannot have an oil film present on the paper. Follow the procedure listed in the "Service" section of this chapter for filter replacement or cleaning.

SERVICE

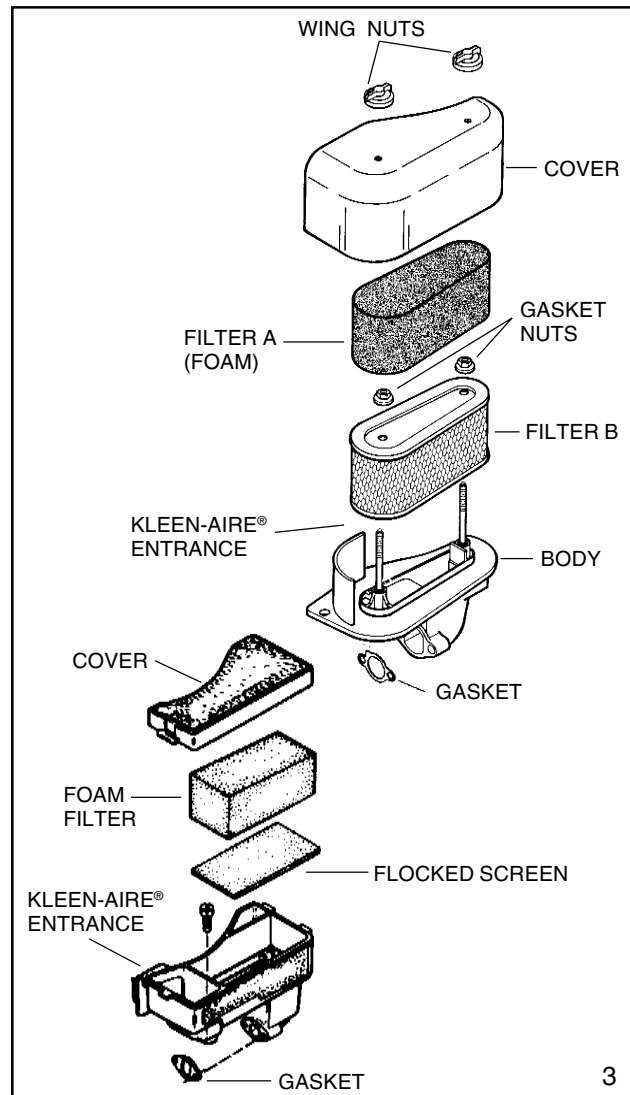
Service on the polyurethane filter element (cleaning and oiling) is recommended every three (3) months or every twenty five (25) operating hours, whichever comes first. Extremely dirty or dusty conditions may require daily cleanings.

The paper filter element should be replaced once a year or every 100 operating hours, more often if used in extremely dusty conditions.

NOTE: NEVER RUN THE ENGINE WITHOUT THE COMPLETE AIR CLEANER ASSEMBLY INSTALLED ON THE ENGINE. ALWAYS REPLACE THE FILTER ELEMENT WITH THE PROPER TECUMSEH ORIGINAL REPLACEMENT PART.

DISASSEMBLY PROCEDURE

1. Unlock the tabs or remove the screws or wing nuts holding the air cleaner cover in place.
2. Remove the hex nuts holding the element down if equipped. New nuts are supplied with a new filter and are to be used for proper sealing.
3. Clean the excess contaminants out of the air cleaner body before removing the old element.
4. Remove the old element and the polyurethane pre-cleaner if equipped.
5. On air cleaners that use a flocked screen under the polyurethane element, remove the air cleaner assembly from the carburetor before removing the flocked screen. This prevents dirt from entering the carburetor (diag 3).
6. Clean the inside of the cover and body, remove the old gasket between the carburetor and the air cleaner assembly.
7. Reinstall the air cleaner assembly using a new gasket.
8. Use reverse procedure for reassembly. When installing the polyurethane pre-cleaner, make sure the seam is installed to the outside to prevent gaps between the paper element and the pre-cleaner.



Polyurethane-Type Filter Element or pre-cleaner

This type of air filter or pre-cleaner can be serviced when restricted with dust or dirt. Wash the filter or pre-cleaner in a detergent and water solution until all the dirt is removed. Rinse in clear water to remove the detergent solution. Squeeze the filter or pre-cleaner (do not twist) to remove the excess water. Wrap the filter or pre-cleaner in a clean cloth and squeeze it (do not twist) until completely dry.

On the polyurethane filter only, re-oil the filter by applying engine oil and squeezing it vigorously to distribute the oil. Roll the filter in a cloth and squeeze it (do not twist) to remove the excess oil. The pre-cleaner must not be oiled.

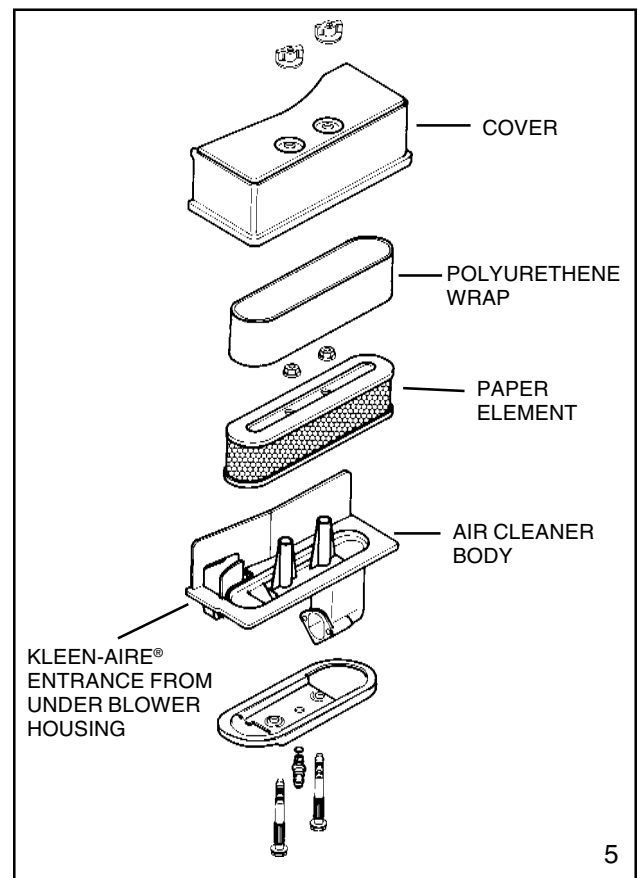
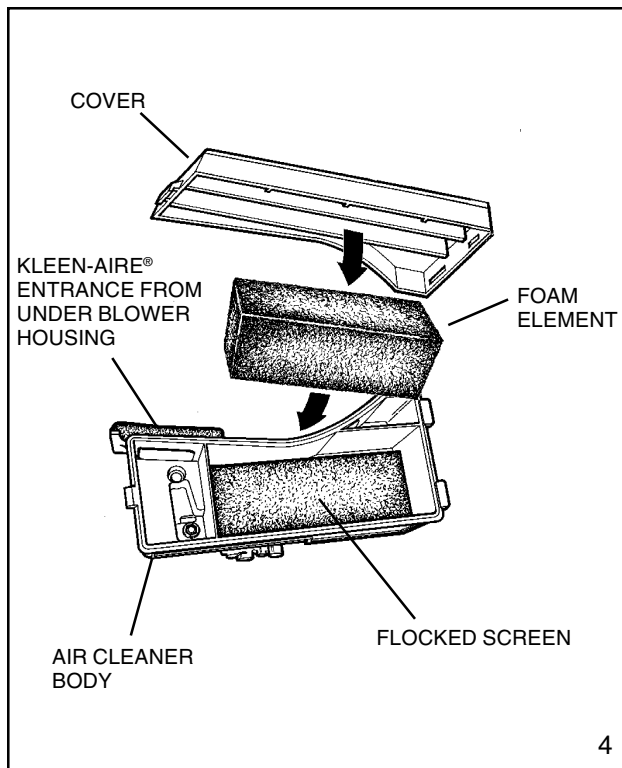
Clean the air cleaner housing and cover being careful not to allow dirt to fall into the carburetor or intake pipe.

Paper -type filter element

Paper type air filter elements can only be serviced by replacement. Do not attempt to clean a paper filter element. Replacement filters are available at any authorized Tecumseh Service Outlet. Be sure to use new filter nuts or seals for the air cleaner studs if supplied with the new filter (diag. 5).

Flocked Screen

A flocked screen may be cleaned by blowing compressed air through the screen from the backside. If the screen cannot be cleaned with this procedure, it should be replaced with a new screen.



CHAPTER 3 CARBURETORS AND FUEL SYSTEMS

GENERAL INFORMATION

Tecumseh overhead valve engines use float type carburetors. Float type carburetors use a hollow float to maintain the operating level of fuel in the carburetor.

The float type carburetor will have a fuel enrichment system of either a primer or a manual choke to provide easy cold engine starting. The carburetor fuel mixtures are either fully adjustable, partially adjustable, or nonadjustable. Carburetor adjustments, cleaning, and related fuel system service is covered in this chapter.

Some Tecumseh engines utilize Walbro carburetors. Basic operation is very similar to the Tecumseh float style carburetor.

Carburetors used by Tecumseh can be identified by a manufacturing number stamping on the carburetor as illustrated (diag. 1).

When servicing carburetors, use the engine model and specification number to obtain the correct carburetor part number. An alternate method to find the correct carburetor part number is to use the manufacturing number stamped on the carburetor and convert this number to a service part number. In the carburetor section of the Master Parts Manual or Microfiche Catalog, a cross reference chart will convert a carburetor manufacturing number to a Tecumseh Service part number.

Complete carburetor replacement may be accomplished by a standard service carburetor. A standard service carburetor is a basic carburetor that may require the use of original carburetor parts or additional new parts to adapt to the specification. An instruction sheet is provided with the new service carburetor or see "SERVICE" in this chapter.

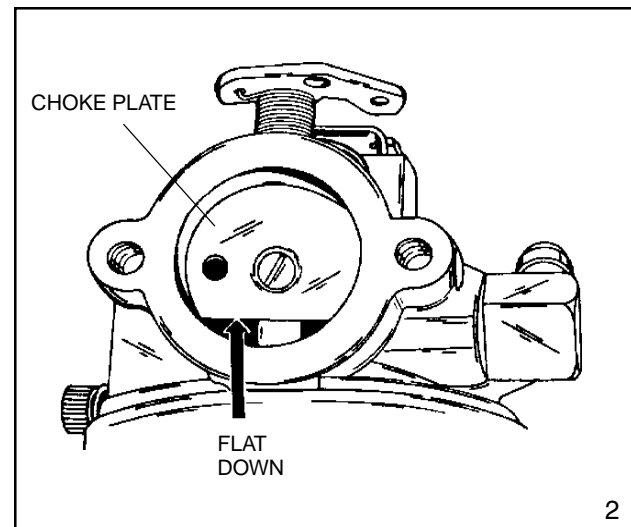
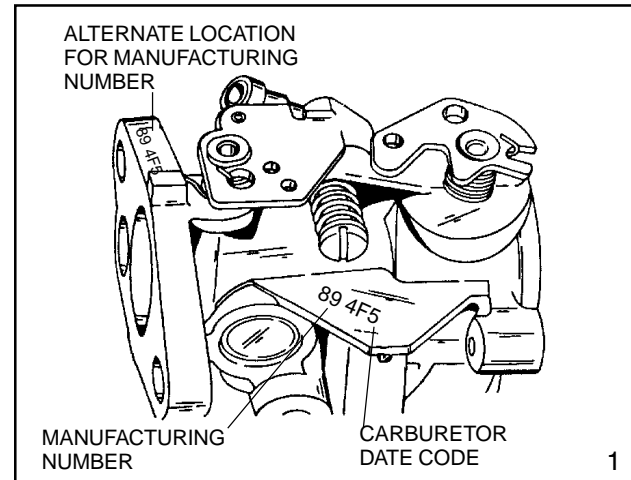
OPERATION

In the "CHOKE" or "START" position, the choke shutter is closed, and the only air entering the engine enters through openings around the shutter. As the starting device is operated to start the engine, downward piston travel creates a low air pressure area in the engine cylinder above the piston. Higher pressure (atmospheric air) rushes into the engine to fill the created low pressure area. Since the majority of the air passage is blocked by the choke shutter, a relatively small quantity of air enters the carburetor at increased speed. The main nozzle and both idle fuel discharge ports are supplying fuel due to the low air pressure in the intake of the engine. A maximum fuel flow through the carburetor orifices combined with the reduced quantity of air that passes through the carburetor, make a very rich fuel mixture which is needed to start a cold engine.

At engine IDLE speed, a relatively small amount of fuel is required to operate the engine. The throttle is almost completely closed. A fuel / air mixture is supplied through the primary idle-fuel discharge orifice during idle.

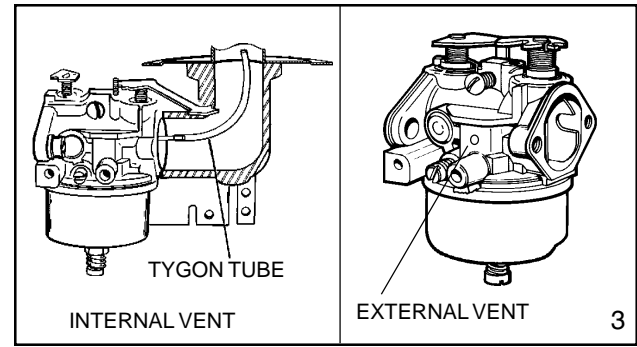
During INTERMEDIATE engine operation, a second orifice is uncovered as the throttle shutter opens, and more fuel mixture is allowed to atomize with the air flowing into the engine.

During HIGH SPEED engine operation, the throttle shutter is opened. Air flows through the carburetor at high speed. The venturi, which decreases the size of the air passage through the carburetor, further accelerates the air flow. This high speed movement of the air decreases the air pressure at the main nozzle opening. Fuel is forced out the main nozzle opening due the difference in the atmospheric air pressure on the fuel in the carburetor bowl and the reduced air pressure at the main nozzle opening.



For the fuel to flow, the carburetor bowl must be either vented externally or internally. Some internally vented float style carburetors use a tygon tube and a vent within the air intake. This tube must be present for the carburetor to operate properly (diag. 3).

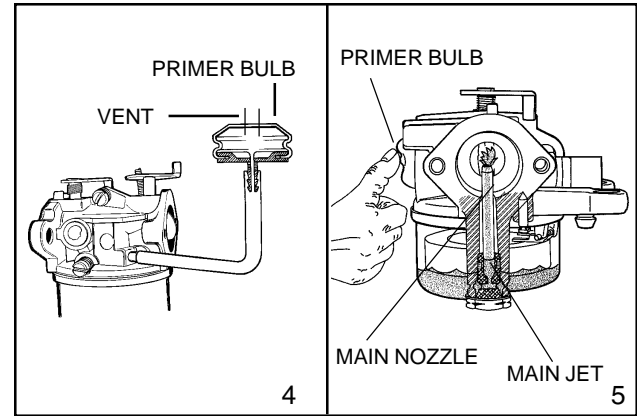
Air is bled into the main nozzle through the air bleed located in the air horn. This mixes fuel and air prior to the fuel leaving the main nozzle. Atomization occurs as the fuel mixture contacts the fast moving air stream and the mist flows into the intake of the engine.



FUEL PRIMERS

Primers may be mounted remotely or as an integral part of the carburetor. The basic function of the primer is to supply an air pressure charge to the carburetor main well or carburetor bowl to displace fuel directly into the carburetor venturi. This displaced fuel provides a rich mixture necessary for engines to start easily on the first or second attempt (diag. 4 & 5).

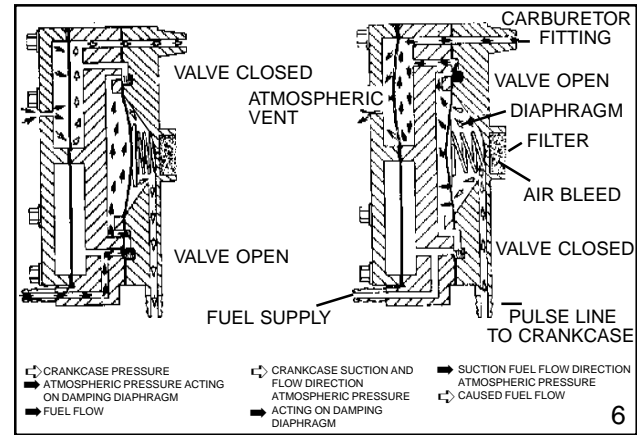
Primers must be vented either internally through a passage in the carburetor air horn prior to the venturi or externally through a hole in the primer bulb. The vent allows atmospheric air to enter the fuel bowl during operation and to fill the primer bulb after the primer bulb is released.



IMPULSE FUEL PUMPS

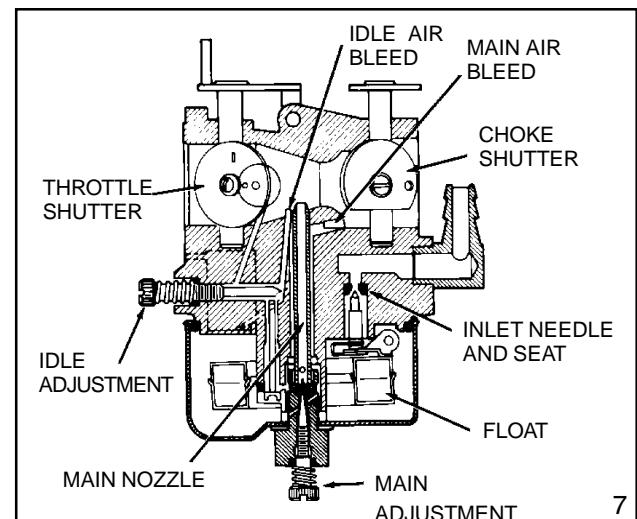
Impulse fuel pumps may either be mounted externally onto the carburetor fuel inlet or remotely mounted. This pump is connected in the fuel line between the fuel supply and the carburetor or directly to the fuel inlet.

Impulse fuel pumps are operated by crankcase impulses created by the up and down movement of the piston. A hose called a pulse line connects the fuel pump diaphragm chamber to the crankcase and transmits the impulses to the pump diaphragm. The impulses actuate the diaphragm and flap valves to lift the fuel from the fuel tank to the carburetor (diag. 6). A crankcase overfilled with engine oil can affect pump operation.



FLOAT STYLE CARBURETORS

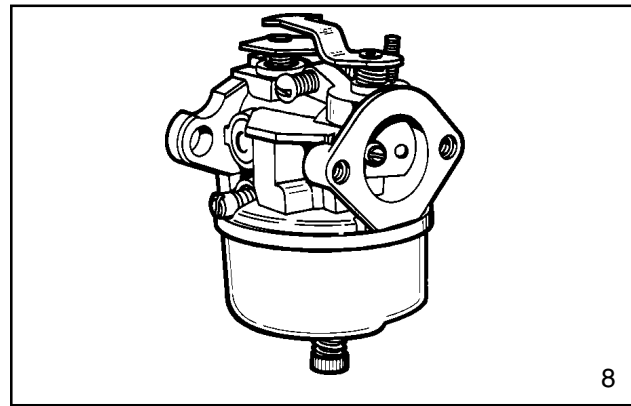
A float is used to maintain the operating level of fuel in the carburetor bowl. As the fuel is used by the engine, the fuel level in the carburetor bowl drops and the float moves downward. This allows the inlet needle valve to move off the sealing seat. Fuel flows by gravity or a pulse pump into the fuel bowl. As the fuel level in the bowl again rises, it raises the float. This upward float motion moves the inlet needle valve to the closed position. When the needle contacts the seat, the fuel flow is stopped. The tapered end of the inlet needle varies the fuel flow rate and the fuel level in the carburetor bowl remains constant (diag. 7). The float height is set according to the service procedure.



CARBURETOR VISUAL IDENTIFICATION

Series1 Carburetors

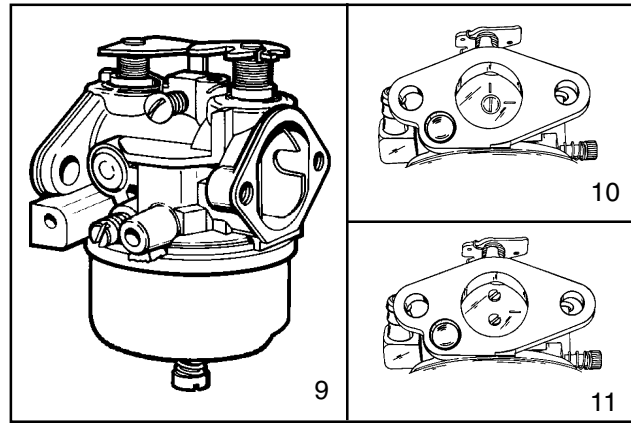
Series 1 carburetors are used on some 4 - 7 model overhead valve engines. This float style carburetor has a smaller venturi than the Series 3 or 4 carburetor and has no bosses on each side of the idle mixture screw. The main and idle mixture may be fixed or adjustable. A remote primer or choke may also be used with this carburetor (diag. 8).



Series 3 & Series 4 Carburetors

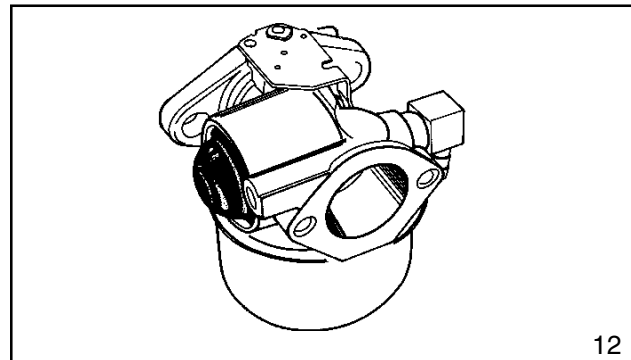
Series 3 or 4 carburetors are generally used on 8 through 14 model 4-cycle engines. The quickest way to identify these carburetors is by the presence of bosses on each side of the idle mixture screw (diag. 9).

To determine whether the carburetor is a Series 3 or Series 4, look at the throttle end of the carburetor. Series 3 will have one throttle plate screw (diag. 10). The Series 4 will have two throttle plate screws (diag. 11).



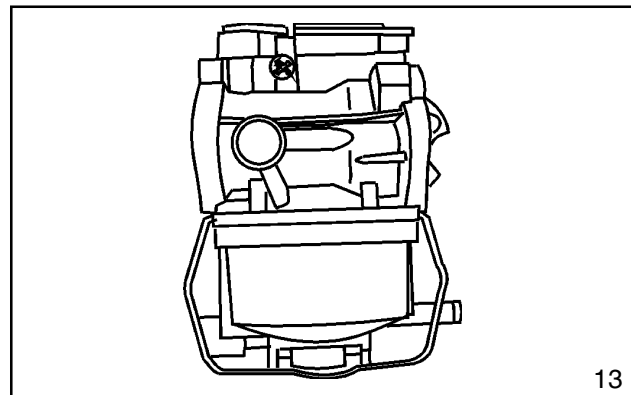
Series 6 Carburetors

Series 6 carburetors are used on 2 and 4-cycle engines in the 3 to 6 model range. Series 6 uses a simple fixed idle and fixed main fuel circuit. Series 6 carburetors are commonly used on rotary mower applications. Series 6 are nonadjustable, with a stepped primer bulb and a bowl prime system (diag. 12).



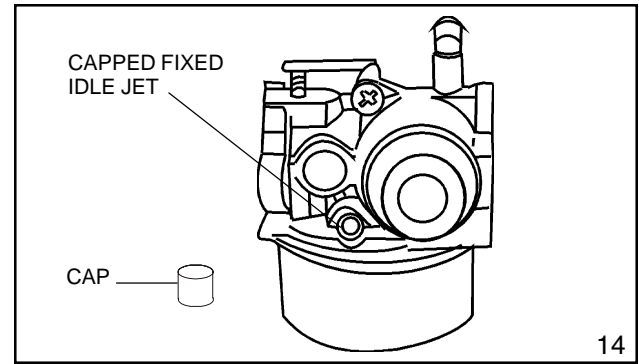
Series 7

Series 7 carburetors are totally nonadjustable. The die cast carburetor body is similar in appearance and slightly longer than the Walbro LMK body. The choke shaft is made of a plastic material with an internal slot to hold the choke shutter. The carburetor base is flat to accept a Vector style bowl that is held on with a wire bail. (diag. 13)



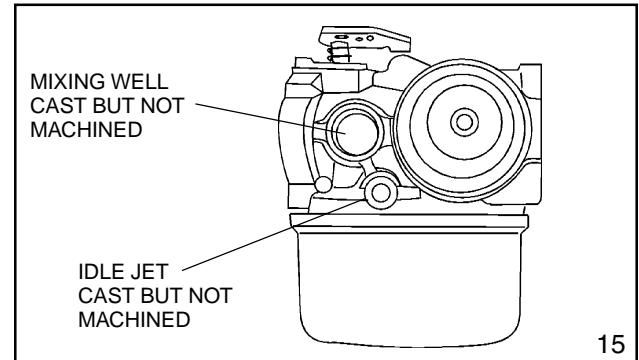
Series 8

Series 8 carburetors have both a fixed main and a fixed idle circuit. These carburetors are totally nonadjustable. This series of carburetor uses an integral primer system like the Series 6. Distinguish this carburetor from the Series 6 by the fixed idle jet that appears as a screw just above the bowl on the primer side. This fixed idle jet may also be capped. (diag. 14)



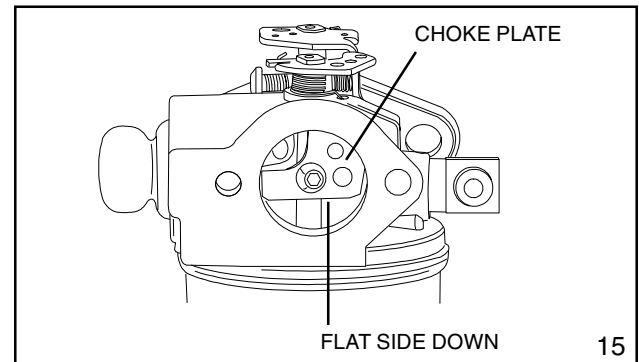
Series 9

Series 9 carburetors are hybrid versions of the Series 8. This carburetor uses a fixed idle jet and fixed main fuel circuit. This carburetor is totally nonadjustable. The bowl nut uses a ball plug on the bottom to cover the center drilling. Also visible is a plastic main fuel discharge nozzle in the venturi. The idle mixing well and jet will be visible but not machined. (diag. 15)



Series 10

This carburetor is for use on all season engine applications. It is the equivalent of the series "8" with the addition of a choke. It has a fixed main and idle with a serviceable main nozzle and a primer assist, with the added benefit of a choke for cold weather starting.

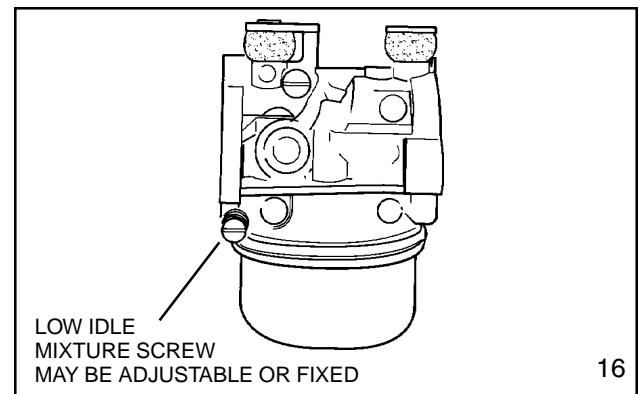


Walbro Model LMK

OHV 15-17 models use this float-feed carburetor. The carburetor is attached to the intake pipe using studs that also fasten the air filter body. Walbro model and manufacturing numbers are found on the throttle end of the carburetor. This carburetor has a fixed, nonadjustable main mixture jet.

Idle mixture screws were adjustable on early production OHV15. This has since changed to a fixed idle jet which may be capped for tamper resistance.

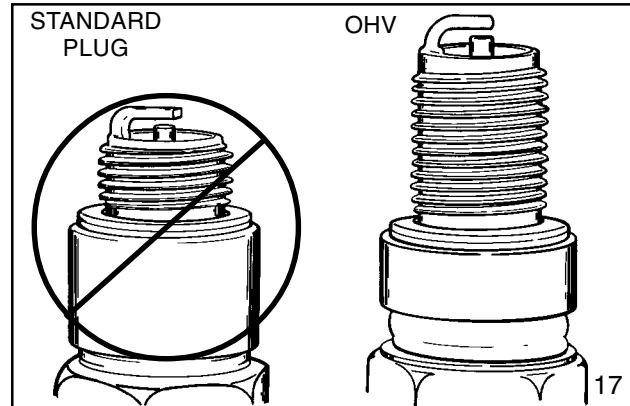
If no spring is visible, the jet is fixed. Servicing should be done by a Authorized Tecumseh Dealer.



1. After repeated efforts to start the engine using the procedure listed in the operator's manual fail, check for spark by removing the high tension lead and removing the spark plug. Install a commercially available spark tester and check for spark. If the spark is bright blue and consistent, proceed to step 2. If no or irregular spark see Chapter 8 under "Testing".
2. Visually inspect the removed spark plug for a wet condition indicating the presence of gasoline in the cylinder.

NOTE: Check plug for correct reach (diag. 17).

3. If the spark plug is dry, check for restrictions in the fuel system before the carburetor. If the spark plug is wet, continue with step # 7. **CHECK THE FUEL CAP FOR PROPER VENTING.** With a proper draining receptacle, remove the fuel line clamp on the carburetor fuel inlet and pull the fuel line off the fitting. Examine the fuel flow with the fuel cap both on and off the fuel tank.



CAUTION: DRAIN THE FUEL INTO AN



APPROVED CONTAINER OUTDOORS, AND AWAY FROM ANY OPEN FLAME OR COMBUSTION SOURCE. BE SURE THE ENGINE IS COOL.

NOTE: Today's fuels can cause many problems in an engine's performance, due to the fuel's quality and short shelf life. Always check fuel as a primary cause of engine performance.

4. Remove the air filter, heater box, or air cleaner assembly if applicable to visually check that the choke shutter completely closes or check to see if fuel comes out of the main nozzle during priming.
5. If the fuel flow from the tank is adequate and no fuel is evident during priming, the carburetor will need to be removed for service. See "Service" in this chapter or consult the "Carburetion Troubleshooting" chart to diagnose carburetor symptoms. Improper fuel flow indicates the fuel, fuel line, filter or tank require cleaning or replacement.
6. Check the engine compression using a commercially available compression tester and follow the tester's recommended procedure. Low compression, a dry spark plug, adequate fuel flow, and a known good functional carburetor indicates an internal engine problem exists. See Chapter 9 under "Troubleshooting."
7. A wet spark plug indicates fuel is being supplied by the carburetor. The engine may be flooded by a restricted air filter, carbon shorted or defective spark plug, excessive choking or over priming, improperly adjusted or defective carburetor. With the spark plug removed and a shop towel over the spark plug hole, turn the engine over slowly 3 or 4 times to remove excess gasoline from the engine cylinder.



CAUTION: KEEP ALL COMBUSTIVE SOURCES AWAY. AVOID THE SPRAY FROM THE SPARK PLUG HOLE WHEN CRANKING THE ENGINE OVER.

8. Replace the air filter if restricted or oil soaked. Replace the spark plug if questionable. Install the spark plug and high tension lead and try to start the engine.
9. If the engine floods and fails to start, the carburetor will require service. See the proceeding "Carburetion Troubleshooting" chart for additional causes. If the carburetor is functioning properly the problem may be ignition timing related. See Chapter 8 "Ignition" under "Troubleshooting."

SERVICE

Carburetor Pre-sets and Adjustments

Before adjusting any mixture screws the necessary carburetor presets should be made. Check for the proper governor adjustments as outlined in Chapter 4. Identify the correct carburetor model and manufacturer to find locations of the high and low speed adjustment screws. Check the throttle control bracket for proper adjustment allowing a full choke shutter position. See Chapter 4 under "Speed Controls and Linkage". Check to see if the normal maintenance procedures have been performed (oil changed, fresh fuel, air filter replaced or clean). Consult microfiche card #30 to find the correct R.P.M. settings for the engine. Start the engine and allow it to warm to operating temperature. The carburetor can now be adjusted.

NOTE: RPM SETTINGS CAN ALSO BE FOUND ON THE COMPUTERIZED PARTS LOOK UP SYSTEMS.

Pre-sets and Adjustments (Tecumseh and Walbro carburetors)

Turn both the main and idle mixture adjusting screws in (clockwise) until finger tight if applicable.

NOTE: OVERTIGHTENING WILL DAMAGE THE TAPERED PORTION OF THE NEEDLE.

Now back the mixture screws out (counterclockwise) to obtain the pre-set figure in the chart shown.

NOTE: SOME CARBURETORS HAVE FIXED IDLE AND MAIN JETS. IDENTIFY THE SERIES OF CARBURETOR USING THE VISUAL IDENTIFICATION IN THIS CHAPTER. IDLE MIXTURE FIXED JETS APPEAR AS ADJUSTING SCREWS WITHOUT TENSION SPRINGS AND ARE NOT ADJUSTABLE.

Final Adjustments

Start the engine and allow it to warm up to normal operating temperature (3 - 5 minutes). Set the speed control to the HIGH or FAST position, then turn the main mixture adjustment screw in (clockwise) slowly until the engine begins to run erratic. Note the position of the screw. Now, turn the screw out (counterclockwise) until the engine begins to run erratic. Turn the screw in (clockwise) midway between these two positions. This will be the best setting.

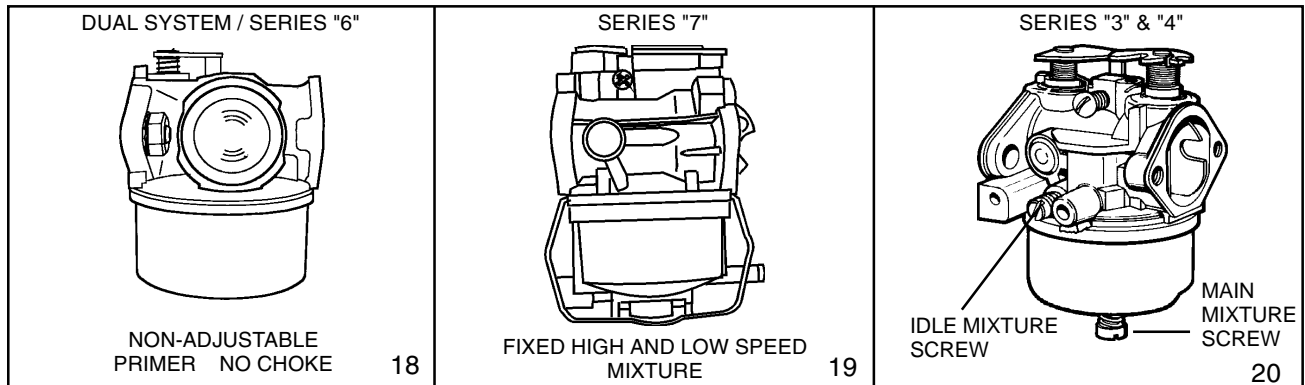
Set the speed control to the IDLE or SLOW position. Adjust the idle mixture screw following the same procedure used to adjust the main mixture adjustment screw.

Identify the location of both HIGH and LOW speed adjustments, then locate the recommended HIGH and LOW R.P.M. setting according to microfiche card # 30 and adjust the engine speed accordingly.

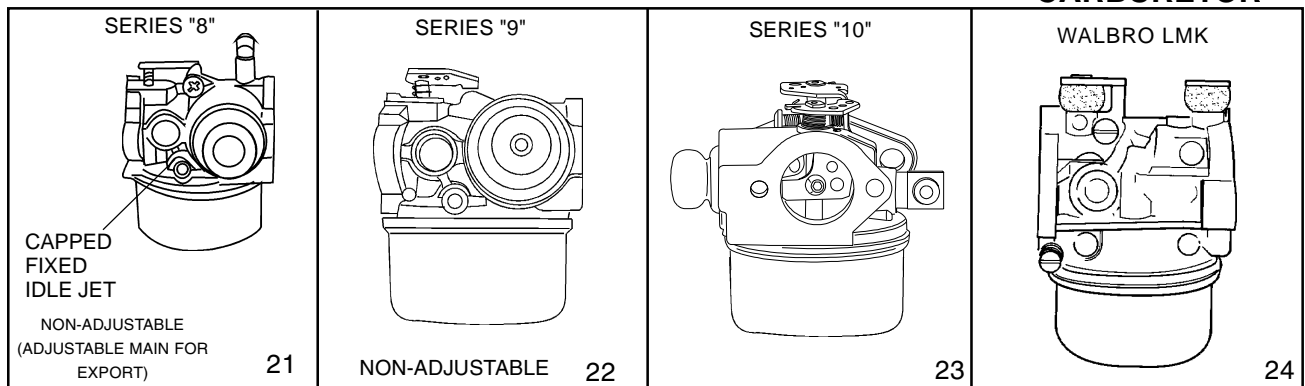
NOTE: RPM SETTINGS CAN ALSO BE FOUND ON THE COMPUTERIZED PARTS LOOK UP SYSTEMS.

Tecumseh Carburetors		
Engine Model	Main Pre-set	Idle Pre-set
All models with float-type carburetors	1-1/2 turn	1 turn
All models with diaphragm-type carburetors	1 turn	1 turn
Walbro Carburetors		
Carburetor Model		
LMK	Fixed	1 turn if adjustable or seated, if fixed

TECUMSEH CARBURETORS



WALBRO CARBURETOR



If further adjustment is required, the main adjustment should be made under a load condition.

If the engine stops or hesitates while engaging the load (lean), turn the main mixture adjusting screw out (counterclockwise) 1/8 turn at a time, testing each setting with the equipment under load, until this condition is corrected. A few Tecumseh carburetors were built as air adjust idle system. If you have one, the adjustments are reversed out for lean in for richer.

If the engine smokes excessively (rich), turn the main adjusting screw in (clockwise) 1/8 turn at a time, testing each setting with the equipment under load, until this condition is corrected.

After the main mixture screw is set, move the speed control to the IDLE or SLOW position. If the engine does not idle smoothly, turn the idle mixture screw 1/8 turn either in (clockwise) or out (counterclockwise) until engine idles smoothly.

Recheck the high and low R.P.M. setting and adjust as necessary.

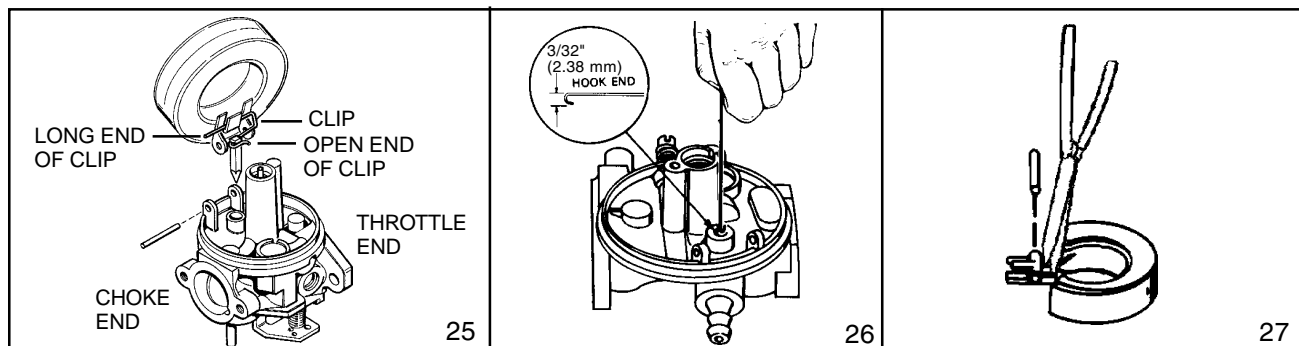
CARBURETOR DISASSEMBLY PROCEDURE

NOTE : CARBURETORS THAT ARE EMISSION COMPLIANT (MANUFACTURING NUMBERS 5000 OR GREATER) WITH FIXED IDLE OR MAIN JETS ARE TO BE REMOVED BY DEALERS ONLY FOR INSPECTION AND CLEANING.

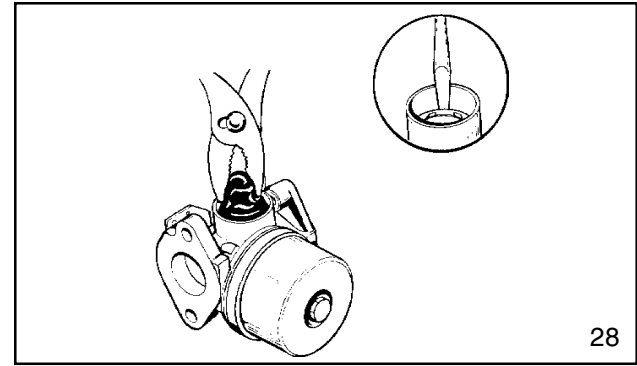
1. Note or mark the high and low mixture adjusting screws to aid in reassembly (if applicable). Remove the high speed mixture screw, bowl nut, and float bowl. Remove the idle mixture screw assembly. On Series 7 carburetors, release the wire retainer that retains the bowl and remove the bowl assembly. If a screwdriver or similar tool is used to release the retainer, carefully move the retainer to prevent bending of the wire.
2. Series 8 carburetors have a tamper resistant cap, over the fixed idle jet. (diag. 21). The cap is removed by piercing it with an ice pick or similar instrument, then remove the jet for service, always replace the cap.
3. Note the position of the spring clip on the inlet needle and float. Remove the float hinge pin with a needlenose pliers. Some carburetors use a float dampening spring to aid the inlet valve to maintain a steady position in rough service applications. Note the position of the hooks before removing the float hinge pin (diag. 25). On Series 7 carburetors, grasp the crossbrace on the float with a needlenose pliers and pull straight out to release the float hinge pin.
4. Remove the float, clip, and inlet needle.
5. Remove the inlet needle seat using a wire or a paper clip with a 3/32" (2.38 mm) hook end (Tecumseh carburetors only, Walbro model LMK uses a non-serviceable seat). Push the hook through the hole in the center of the seat and pull out to remove it.
6. On Series 7 only, remove the main nozzle tube, "O" ring, and spring located in the center leg of the carburetor bowl. Remove the bowl drain screw and gasket. Remove the spring, metering jet, and "O" ring.
7. Note or mark the action of the choke and throttle shutters and the hook points of the choke or throttle return spring or seal retainer springs located on the top of the choke or throttle shaft.

NOTE: MARK THE EDGES OF THE THROTTLE AND CHOKE SHUTTERS PRIOR TO DISASSEMBLY. THE SHUTTERS HAVE BEVELED EDGES AND MUST BE INSTALLED IN THE ORIGINAL POSITION.

Remove the throttle shutter, throttle shaft, choke shutter, springs and choke shaft by removing the screw or screws that attach the throttle or choke shutter to the shaft inside the air horn. To remove the choke shaft assembly on Series 7 or Walbro LMK carburetors, grasp the choke shutter with a pliers and pull it through the slot in the choke shaft. Slide the choke shaft out of the carburetor body.

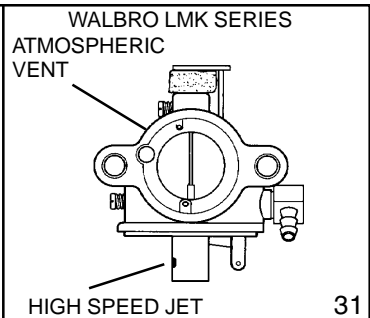
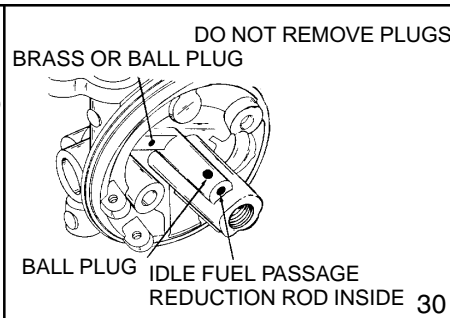
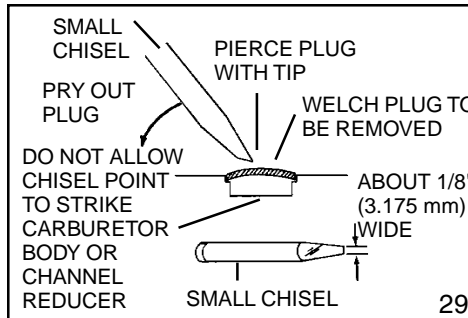


8. Remove the primer bulb (if equipped) by grasping with a pliers and pulling and twisting out of the body. Remove the retainer by prying and lifting out with a screwdriver. Do not re-use old bulb or retainer (diag. 28).
9. Remove all welch plugs if cleaning the carburetor. Secure the carburetor in a vise equipped with protective jaws. Use a small chisel sharpened to a 1/8" (3.175 mm) wide wedge point. Drive the chisel into the plug to pierce the metal and push down on the chisel to pry the plug out of the hole (diag. 29).



NOTE: DO NOT REMOVE ANY BALL OR CUP PLUGS (diag. 29).

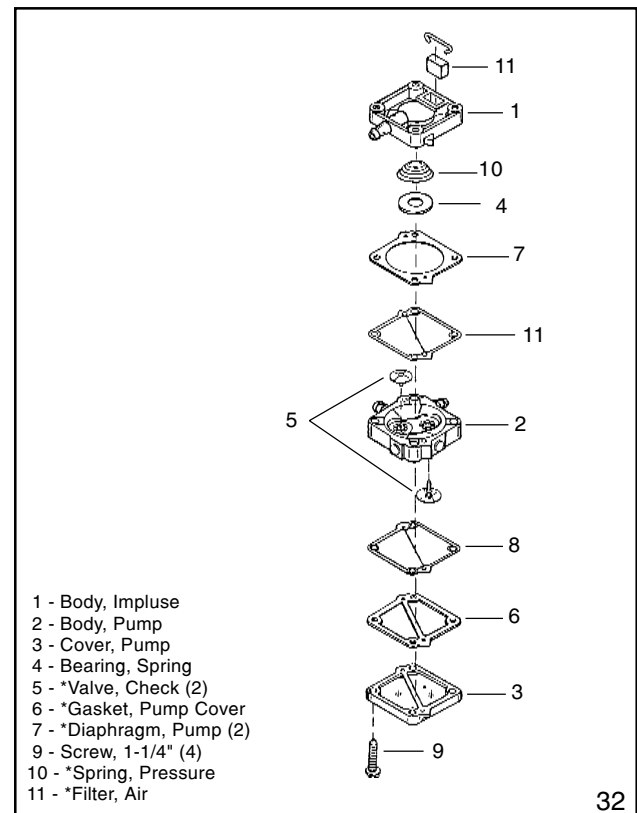
10. Note the direction of the inlet fitting. If necessary the inlet fitting can be removed by pulling with a pliers or vise, do not twist. The fitting must be replaced. Tap a 1/4"-20 thread inside the metal shank, use 1/4"-20 bolt and nut inserted into a 1/4" (6.350 mm) flat washer and 1/2" (12.700 mm) nut, thread the bolt into the shank, and thread the nut down to pull out the shank.
11. The Walbro LMK carburetor main fuel jet can be removed only if the jet is damaged or if a high altitude jet is needed to be installed. To remove place the carburetor firmly in a soft jawed vice. Using a punch the same size or slightly smaller than the jet, drive the jet through and into the center leg. Insert the high altitude jet in the same hole. Using a punch slightly larger than the diameter of the new jet, tap it into place flush with the outside of the center leg casting (diag. 31).



Impulse Fuel Pump

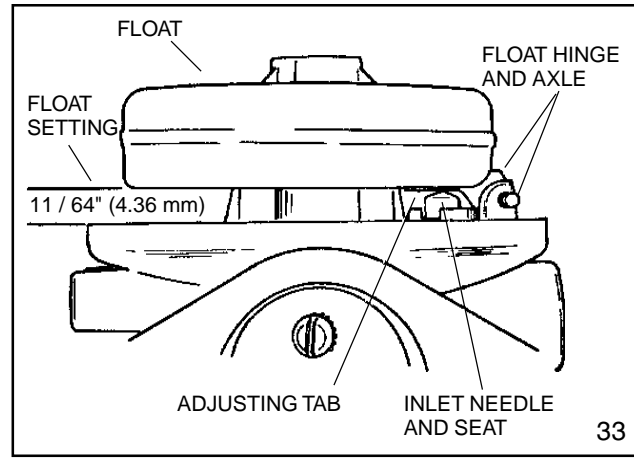
The valve type impulse pump can be serviced using the following procedure.

1. Remove the old filter on the back of the pump body if applicable.
2. Note or mark the pump body alignment, remove the four screws and disassemble the pump.
3. Remove the gaskets, diaphragms, old valves and spring bearing from the spring.
4. Clean the body parts with solvent.
5. Install new valves with the face of the valve facing the raised portion of the passage. After installation, cut off the extended portion of the valves.
6. Install the diaphragms against the center portion of the body with the gaskets against the outside covers. The parts can only be assembled one way without damage.
7. Install the spring bearing on the new spring and place into position.
8. Assemble the body sections, install the retaining screws, and torque the screws to 12 - 16 inch pounds (1.36 - 1.81 Nm).
9. Install new filter in pump cavity if applicable.



FLOAT ADJUSTING PROCEDURE

All Tecumseh carburetors with an adjustable float require the correct float height to achieve the proper operation and easy engine starts. To check the float setting, hold the carburetor in an upside down position. Remove the bowl nut, float bowl, and "O" ring. Place an 11/64" (4.36mm) diameter drill bit across the top of the carburetor casting on the opposite side and parallel to the float hinge pin. The float must just touch the drill bit when the bit is flush with the edge of the float. If the float is too high or too low, adjust the height by bending the tab accordingly. If the required adjustment is minor, the tab adjustment may be made without removing the float and carefully inserting a small bladed screwdriver to bend the tab.



If float sticking occurs due to deposits, or when the fuel tank is filled for the first time, this condition can be quickly corrected by loosening the carburetor bowl nut one full turn. Turn the bowl 1/4 inch in either direction, then return the bowl to its original position and tighten the bowl nut.

THE TECUMSEH SERIES 7 AND THE WALBRO MODEL LMK CARBURETOR HAVE A FIXED AND NONADJUSTABLE FLOAT HEIGHT.

Inspection

After careful disassembly of the carburetor and the removal of all non metallic parts, all metallic parts should be cleaned with solvent, or commercial carburetor cleaner, no longer than 30 minutes. Wearing eye protection, use compressed air and soft tag wire or monofilament fishing line to clean internal carburetor passages. To perform a proper carburetor rebuild, the welch plugs must be removed to expose the drilled passages.

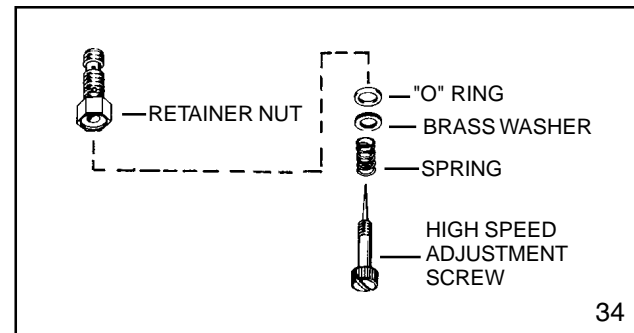
Throttle and Choke

Examine the throttle and choke shaft, and carburetor body at the bearing points and holes into which the linkage is fastened, and replace if worn or damaged. Any excessive wear in these areas can cause dirt to enter the engine and cause premature wear. If dust seals are present, check the seal condition and the correct placement next to the carburetor body.

Idle and High Speed Mixture Adjusting Screw

Examine the idle mixture needle tip and tapered surface for damage. The tip and tapered surface of the needle must not show any wear or damage. If either is worn or damaged, replace the adjusting needle. Tension is maintained on the screw with a coil spring. Replace the "O" ring seal if removed (diag. 34).

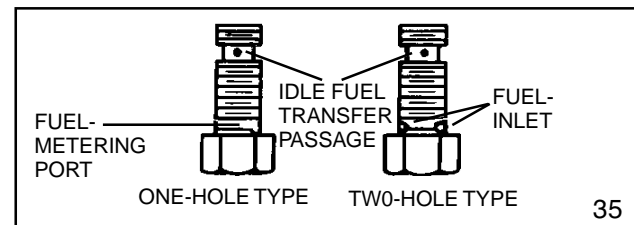
Examine the tapered surface of the high speed mixture needle. If the tapered surface is damaged or shows wear, replace the needle.



Fuel Bowl Retaining Nut

The bowl nut contains the passage through which fuel is delivered to the high speed and idle fuel system of the carburetor. If a problem occurs with the idle system of the carburetor, examine the small fuel passage in the annular groove in the bowl nut. This passage must be clean for the proper transfer of fuel into the idle metering system.

Bowl nuts that are used on adjustable main, float style carburetors may use either one or two metering ports. This difference relates to calibration changes of the carburetor, depending on the application (diag. 35).



NOTE: DO NOT INTERCHANGE BOWL NUTS.

The fuel inlet ports must be free of any debris to allow proper fuel flow.

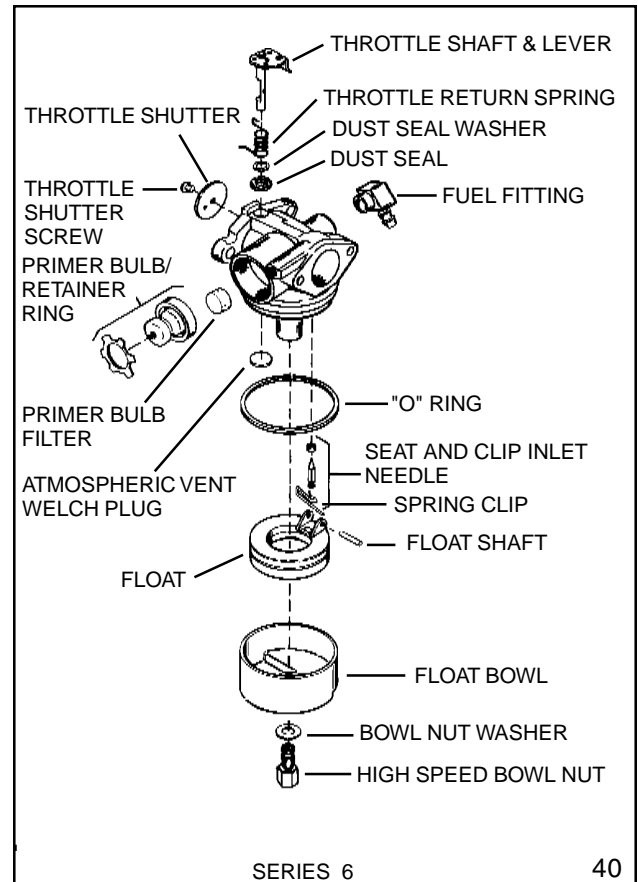
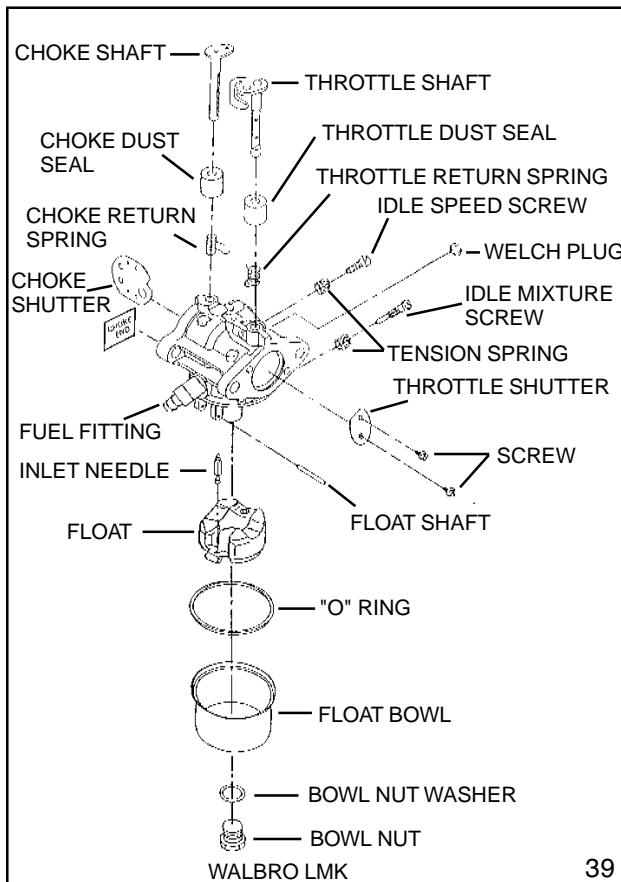
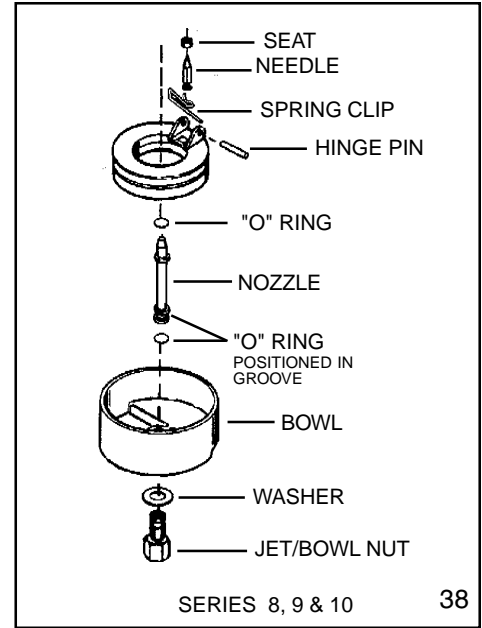
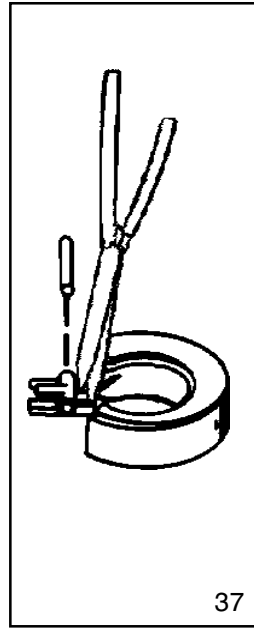
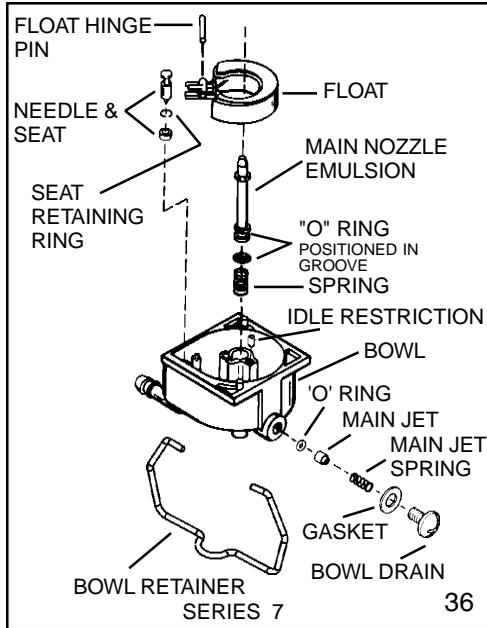
Fuel Bowl, Float, Needle and Seat

NOTE: To prevent damage to the float bowl on Series 7 carburetor, pull straight up with a needle nose pliers in the pocket closest to the main fuel well (diag. 37).

The float bowl must be free of dirt and corrosion. Clean the bowl with solvent or carburetor cleaner (soak 30 minutes or less).

Examine the float for cracks or leaks. Check the float hinge bearing surfaces for wear, as well as the tab that contacts the inlet needle. Replace any damaged or worn parts.

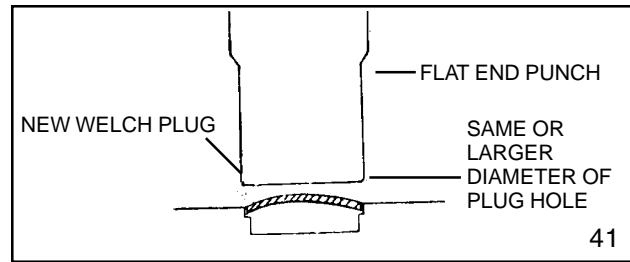
The needle and seat should be replaced if any fuel delivery problems are experienced (flooding or starvation). Sealing problems with the inlet needle seat may not be visible and replacement is recommended. Only the inlet needle is serviceable on the Walbro model LMK carburetor.



ASSEMBLY PROCEDURE

Welch Plugs

To install a new welch plug after cleaning the carburetor, secure the carburetor in a vise equipped with protective jaws. Place the welch plug into the receptacle with the raised portion up. With a punch equal to the size of the plug hole, merely flatten the plug. Do not dent or drive the center of the plug below the top surface of the carburetor. After installation of the welch plug, seal the outer diameter with fingernail polish (diag. 41).



Throttle Shaft and Plate

When reassembling Tecumseh or Walbro carburetors, it is important that the lines, lettering, or numbers on the throttle plate are facing out when in the closed position. If the throttle plate has only one line, this line should be positioned in the 3 o'clock position on Series 3, 4, and 7 carburetors, and at the 12 o'clock position on Series 1, 6, 8, 9 carburetors. (diag. 42 & 43).

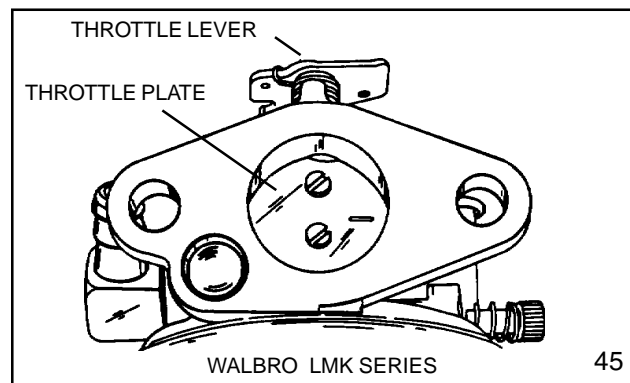
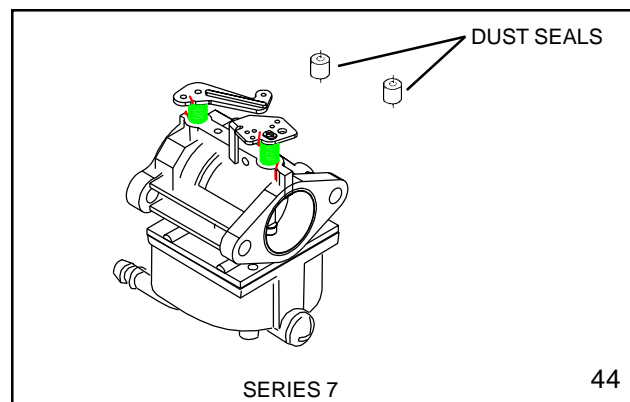
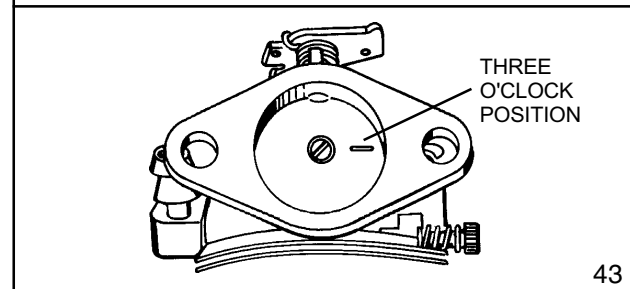
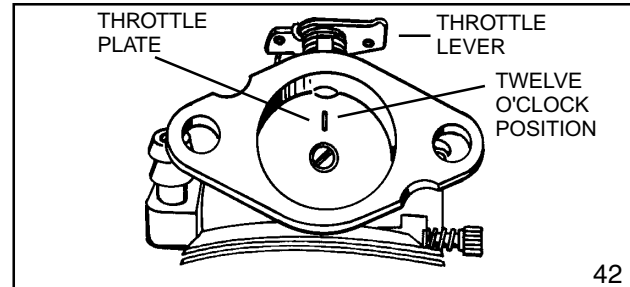
Test the operation of the throttle and return spring if equipped. If binding occurs, correct by loosening the screws and repositioning throttle plate.

Always use a new screw(s) when reinstalling the throttle shutter to prevent the screws from loosening and being drawn into the engine. New Tecumseh screws are treated with dry-type adhesive to secure them in place.

NOTE: NEVER REUSE OLD SCREWS.

On Walbro LMK and Series 7 carburetors, install the throttle return spring on the throttle shaft with the squared end up. Slide the foam dust seal over the spring. Insert the throttle lever assembly into the carburetor body with both tangs of the return spring on the left side of the center boss (viewed from throttle end) and the flat side of the shaft toward the carburetor mounting flange. Install the throttle shutter to the throttle shaft using notes or marks to place the shutter as originally found (Series 7 must have the line on the shutter at the 3 o'clock position) (diag. 44).

Always use new throttle shutter screws when reinstalling. Install the screws so they are slightly loose. Apply light downward pressure on the throttle shaft and rotate it clockwise to seat the throttle shutter in the bore, then tighten the throttle shutter screws. Check for binding by rotating the throttle shaft. If necessary, adjust the throttle shutter by loosening and repositioning the shutter, then retighten the screws (diag. 45).



Choke Shaft and Plate

The choke plate is inserted into the air horn of the carburetor in such a position that the flat surface (if applicable) of the choke is down. Choke plates will operate in either direction. Make sure it is assembled properly for the engine. Test the operation of the choke and return spring function if equipped (diag. 46).

Always use a new screw(s) when reinstalling the choke shutter as the screws are treated with dry-type adhesive to secure them in place.

NOTE: NEVER REUSE OLD SCREWS.

The choke shaft and plate must be in the closed position prior to tightening the screws. Hard starting may be due to insufficient choking action because of a misaligned choke plate. Correct by readjusting the choke plate to close completely. Note the cutout position of choke shutter if applicable.

On Walbro LMK and Series 7 carburetors, install the choke return spring on the choke shaft with the squared end up and hooked into the notch in the plate. Work the dust shield up around the spring and insert the choke shaft into the carburetor body. Rotate the shaft counterclockwise until the tang on the spring rests against the left side of the center boss on the carburetor body (viewed from choke end). Rotate the choke shaft approximately 1/4 turn counterclockwise and insert the choke shutter into the slot in the choke shaft. Make sure the tabs on the shutter lock the choke shaft between them. Rotate the shaft and check for binding, the choke must return to the open position when released (diag. 47).

Fuel Inlet Fitting

When installing the fitting, insert the tip into the carburetor body. Support the carburetor body with a wood block to avoid damage to other parts. Use a bench vise or press to install the fitting squarely. Press it in until it bottoms out (diag. 48).

High and Low Speed Adjusting Screw, Main Nozzle

When reassembling, position the coil spring on the adjusting screws, followed by the small brass washer and the "O" ring seal. Turn the high speed adjustment screw into the bowl nut and the low speed mixture screw into the carburetor body (diag. 49).

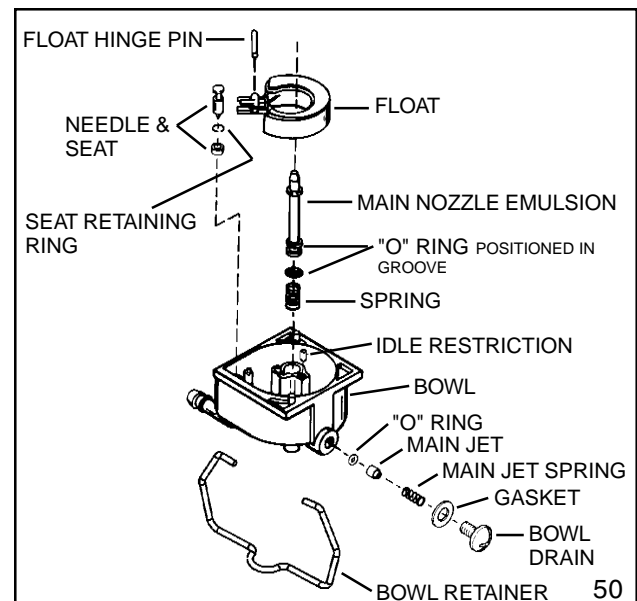
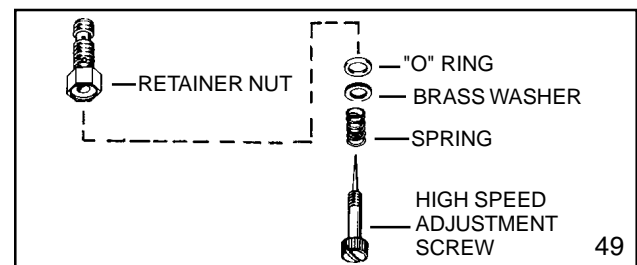
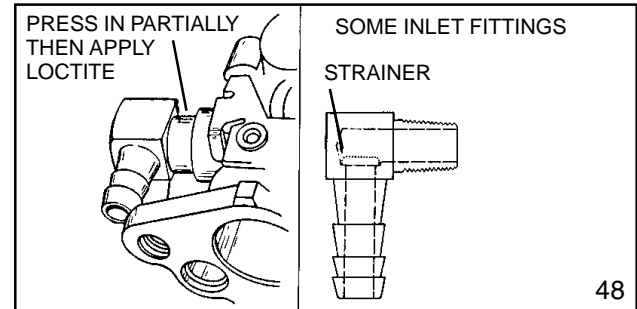
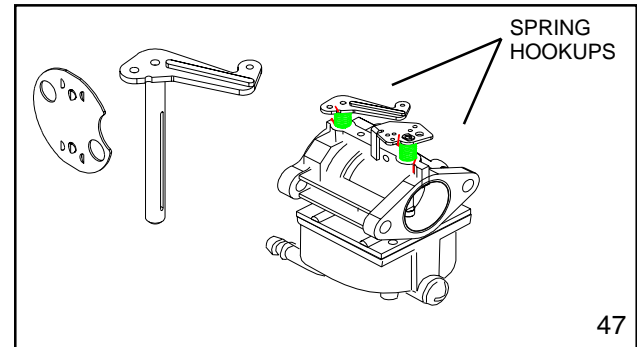
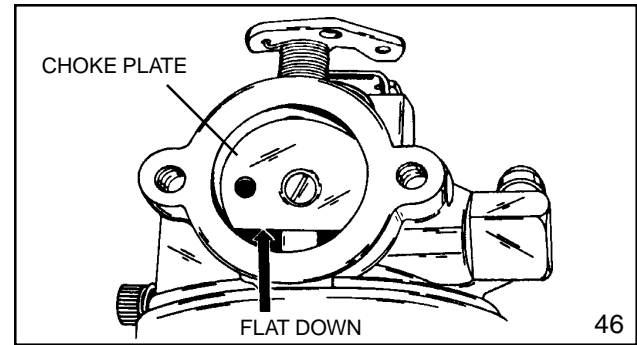
Some carburetors may have a fixed main mixture or both a fixed idle mixture and main mixture, and are not adjustable.

On Series 7 carburetors, place the main nozzle spring into the main nozzle cavity. Apply oil to the main nozzle "O" ring and push the main nozzle into the cavity with the "O" ring end in first.

Next install the "O" ring in the main jet cavity. Place the spring over the shoulder on the main jet and push the jet into the cavity with the main jet toward the "O" ring. Place a new gasket on the drain screw and tighten in position (diag. 50).

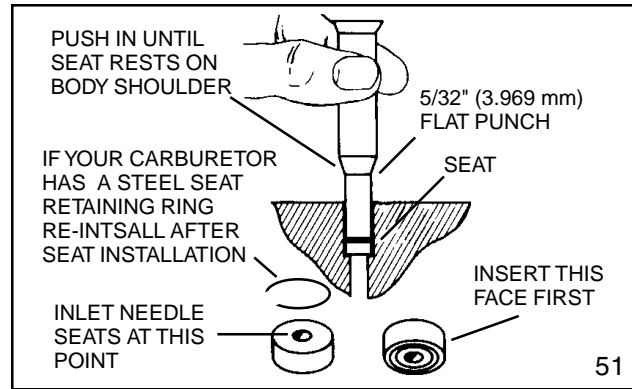
On Walbro LMK carburetors, the main jet can be replaced by pressing it into the center leg of the carburetor until flush. (diag. 31 page 15).

NOTE: FOR HIGH ALTITUDE JETTING, CONSULT BULLETIN 110.

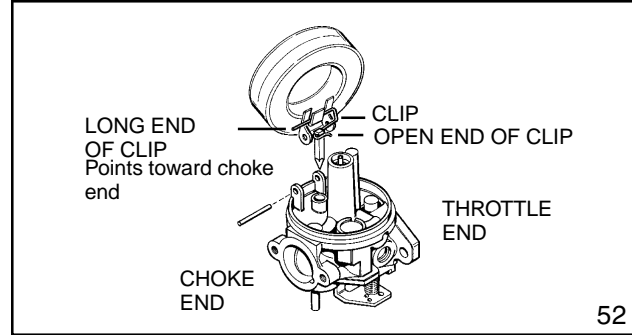


Inlet Needle and Seat

Make sure the seat cavity is clean. Moisten the seat with oil and insert the seat with the grooved side down and away from the inlet needle. Press the seat into the cavity using a 5/32" (3.969 mm) flat punch, making sure it is firmly seated (diag. 51). On Series "7" carburetors, install the seat retainer into the cavity and push it down using the flat punch until it contacts the seat.



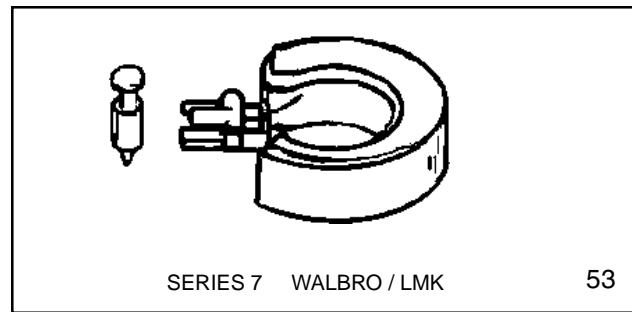
The inlet needle hooks onto the float tab by means of a spring clip. To prevent binding, the long, straight end of the clip should face the choke or air filter end of the carburetor as shown (diag. 52).



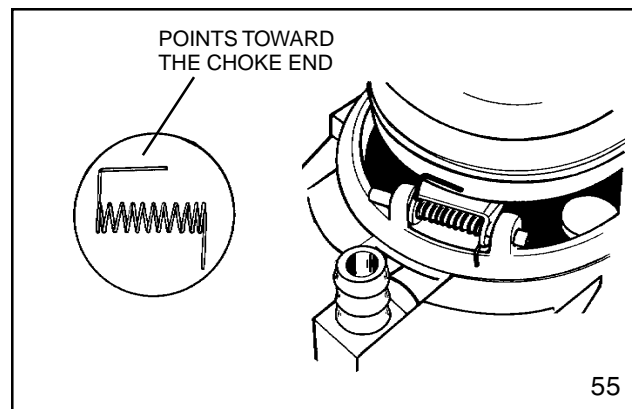
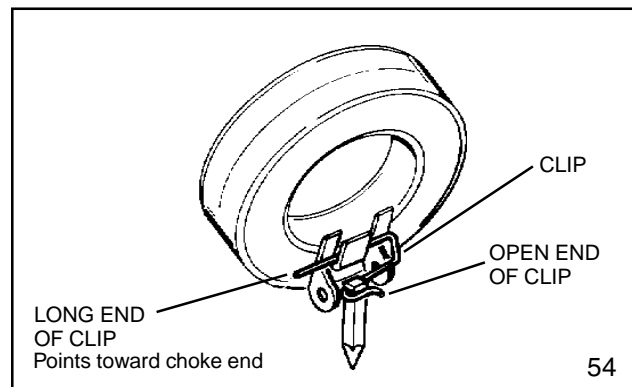
Float Installation

On Series 7 carburetors, slide the hinge pin into the hinge on the float. Position the needle into the fuel inlet and snap the float pin into the tabs on the float bowl. Float height is not adjustable.

On Series 7 carburetors and the Walbro LMK, reinstall the inlet needle on to the float and place it into the carburetor (diag. 53).



1. When rebuilding a carburetor with a clip on the needle, position carburetor float side up for assembly.
2. Place the inlet needle and spring clip onto the float as shown. The long end of the spring clip must point towards the choke end of the carburetor. This will ensure that the inlet needle will move up and down in a straight line (diag. 53).
3. To set the proper float height on carburetors except Series 7 and Walbro LMK, see adjusting procedure.
4. Some Tecumseh float style carburetors have a damper spring which is installed as shown in diag. 55.

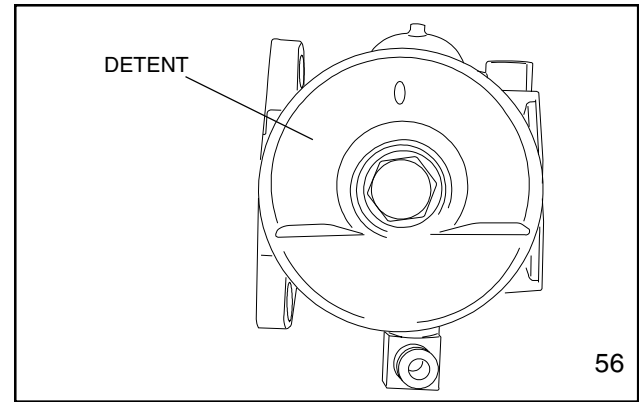


Fuel Bowl And Bowl Nut

Whenever a carburetor bowl is removed for service, the fuel bowl "O" ring (or gasket on Series "7") and the bowl nut washer must be replaced. For easier installation, lubricate the "O" ring with a small amount oil.

Installing the Float Bowl

Install the float bowl by placing the detent portion opposite of the hinge pin. Make sure the deepest end of the bowl is opposite of the inlet needle. The bowl has a small dimple located in the deepest part. The purpose of this dimple is to minimize the chances of the float sticking to the bottom of the bowl caused by stale fuel.

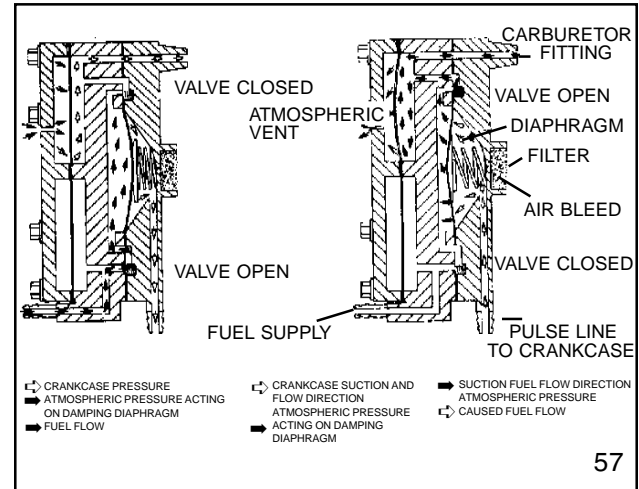


Impulse Fuel Pump

The diaphragms must be installed against the center body with the gaskets against the outside covers. The parts are designed so they cannot be misassembled without damage (diag. 57).

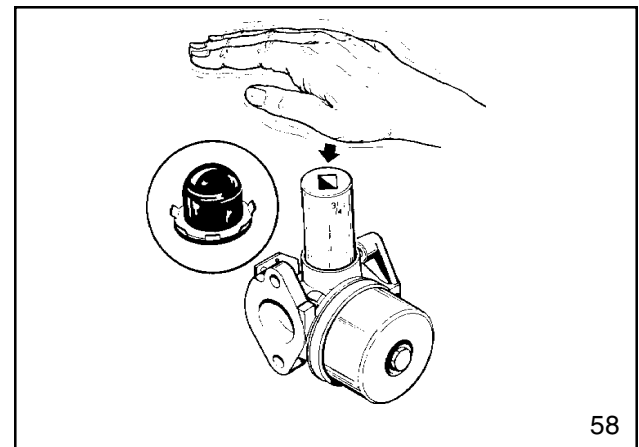
To test the unit, assemble the carburetor to the engine, leaving the fuel line from the pump off. Use a different fuel tank remotely placed above the carburetor to provide gravity fuel flow to the carburetor inlet to run the engine while testing the pump. Make sure fuel is available in both fuel tanks and the original fuel tank's fuel line is connected to the fuel pump inlet. Place the pump outlet line in a proper draining receptacle. With the pulse line connected from the engine crankcase to the pump and the engine running, a definite fuel flow should result at the pump outlet.

If the flow is erratic or intermittent, the pump needs repair or replacement.



Primer Bulb

To install, start the retainer and bulb into the casting with the retainer tabs pointed out. Firmly push the bulb and retainer into position using a 3/4" (19.05 mm) deep well socket (diag. 58).



Final Checks

Before reinstalling a newly overhauled carburetor, pre-set the main mixture adjustment screw, the idle mixture adjustment screw and the idle speed adjustment screw. See "Pre-sets and Adjustments" in this chapter.

CHAPTER 4 GOVERNORS AND LINKAGE

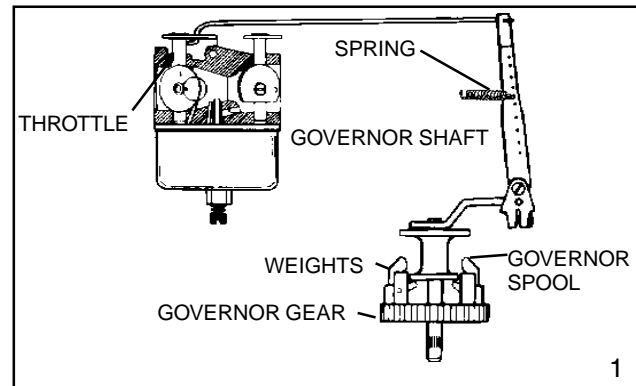
GENERAL INFORMATION

Tecumseh 4 cycle engines are equipped with mechanical type governors. The governor's function is to maintain a R.P.M. setting when engine loads are added or taken away. Mechanical type governors are driven off the engine's camshaft gear. The governor follower arm rests on the center of the governor spool on center force governors, and off to one side on other governor systems. Changes in engine R.P.M. cause the governor lever to move the solid link that is connected from the governor lever to the throttle in the carburetor. The throttle is opened when the engine R.P.M. drops and is closed as an engine load is removed.

This chapter includes governor assembly linkage illustrations to aid in governor or speed control assembly.

OPERATION

As the speed of an engine increases, the governor weights on the governor gear move outward by centrifugal force. The shape of the governor weights force the governor spool to lift. The governor rod maintains contact with the governor spool due to the governor spring tension. The governor rod rotates causing the attached outer governor lever to push the solid link and close the throttle opening. When the engine speed decreases, the lower centrifugal force allows the governor weights to be pulled in by the governor spring. The governor rod rotates and the solid link moves the throttle to a more open position (diag. 1).



TROUBLESHOOTING

Engine operation problems where the governor is suspected to be the cause may actually be the result of other engine system failures. Hunting (engine R.P.M. surging up and down) indicates that the engine is incapable of maintaining a constant R.P.M. with or without an engine load. Engine overspeeding must be corrected immediately before serious engine damage occurs. Use the applicable following procedure to diagnose a suspected governor failure.

ENGINE OVERSPEEDING

1. If the engine runs wide open (faster than normal), shut the engine off or slow it down **immediately**.
2. Check the condition of the external governor shaft, linkage, governor spring, and speed control assembly for breakage or binding. Correct or replace binding or damaged parts.
3. Follow the governor adjustment procedure and reset the governor - see "Service" in this chapter.
4. Run the engine. Be ready to shut the engine off if an overspeed problem still exists. If the problem persists, the engine will require disassembly to inspect the governor gear assembly for damage, binding, or wear.
5. See Chapter 9 under "Disassembly Procedure" to disassemble the engine.
6. Remove the governor gear assembly. Repair or replace as necessary.

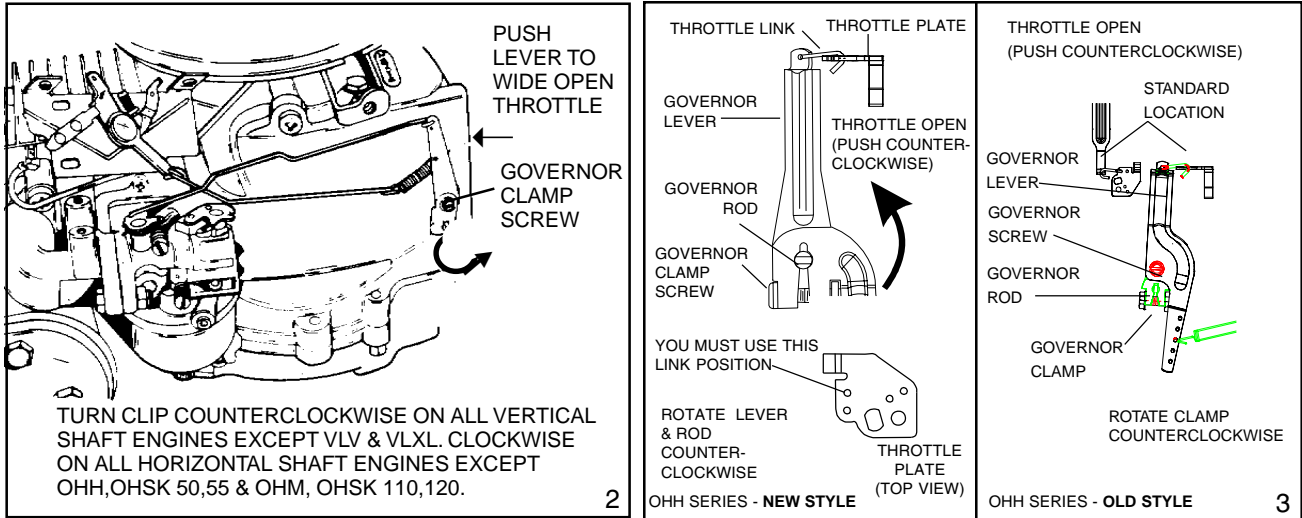
ENGINE SURGING

1. Try to stabilize the engine R.P.M. by holding in one position the solid link between the governor arm and the carburetor throttle, using a pliers or fingers.
2. If the engine R.P.M. stabilizes, the governor or governor adjustment should be checked. See "Service" governor adjustment procedure in this chapter. If the engine R.P.M. does not stabilize, the engine will require additional checks see Chapter 9 under "Troubleshooting".
3. If the problem persists after the governor adjustment, check the engine R.P.M. found on microfiche card # 30. The R.P.M. settings are critical. If the R.P.M. setting for high and low speed are within specification and a slight surge is experienced, increasing the engine idle R.P.M. setting slightly may eliminate this condition.
4. Check the governor shaft or linkages for binding, wear, or improper hookup. Check the governor spring for adequate tension or damaged condition. Repair or replace as necessary.

SERVICE

GOVERNOR ADJUSTMENT

With the engine stopped, loosen the screw holding the governor lever to the governor shaft clamp. Push the governor lever to move the carburetor throttle plate to the wide open position. Rotate the governor clamp counterclockwise on all overhead valve engines covered in this manual. Hold the lever and clamp in this position while tightening the screw (diag. 2).



GOVERNOR GEAR AND SHAFT SERVICE

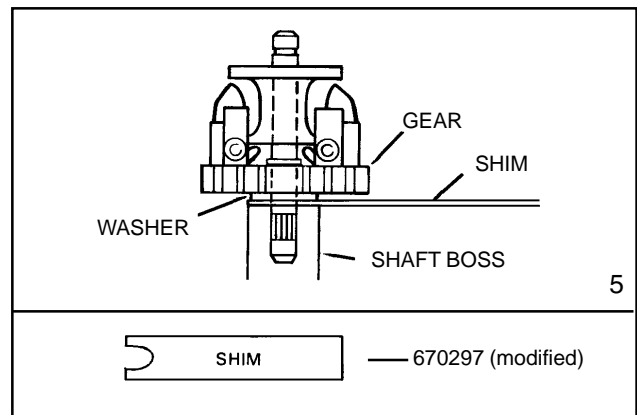
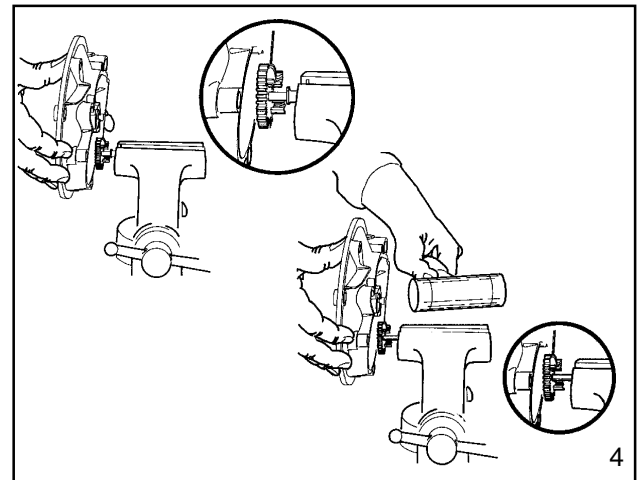
After the cylinder cover is removed from the engine, the governor spool, gear, or governor shaft can be removed. On some governor assemblies, the retaining ring must be removed to allow the spool or gear to slide off the shaft. Other governor shafts use an upset to hold the governor spool on. If the gear requires replacement, the governor shaft will have to be removed.

Governor Gear or Shaft Replacement, Upset Style Governor Shaft

1. Grip the original spool in a vise and use a twisting and pulling motion on the flange until the spool is free.
2. Clamp the shaft in a vise and pound gently on the flange with a wooden or plastic mallet to remove the shaft (diag. 4).

NOTE: DO NOT TWIST THE SHAFT WHEN REMOVING. THE SHAFT BOSS MAY BECOME ENLARGED AND THE PRESS FIT WILL NOT SECURE THE NEW GOVERNOR SHAFT.

3. To install a new shaft, first assemble the gear and washer on the shaft. Start the shaft into the hole with a few taps from a soft faced hammer.
4. Place the flange in a press with a solid piece supporting the area below the shaft boss. Press the shaft in until a part # 670297 (.0125" / .3175 mm) shim just becomes snug (.010" - .020" / .254-.508 mm clearance) (diag. 5).



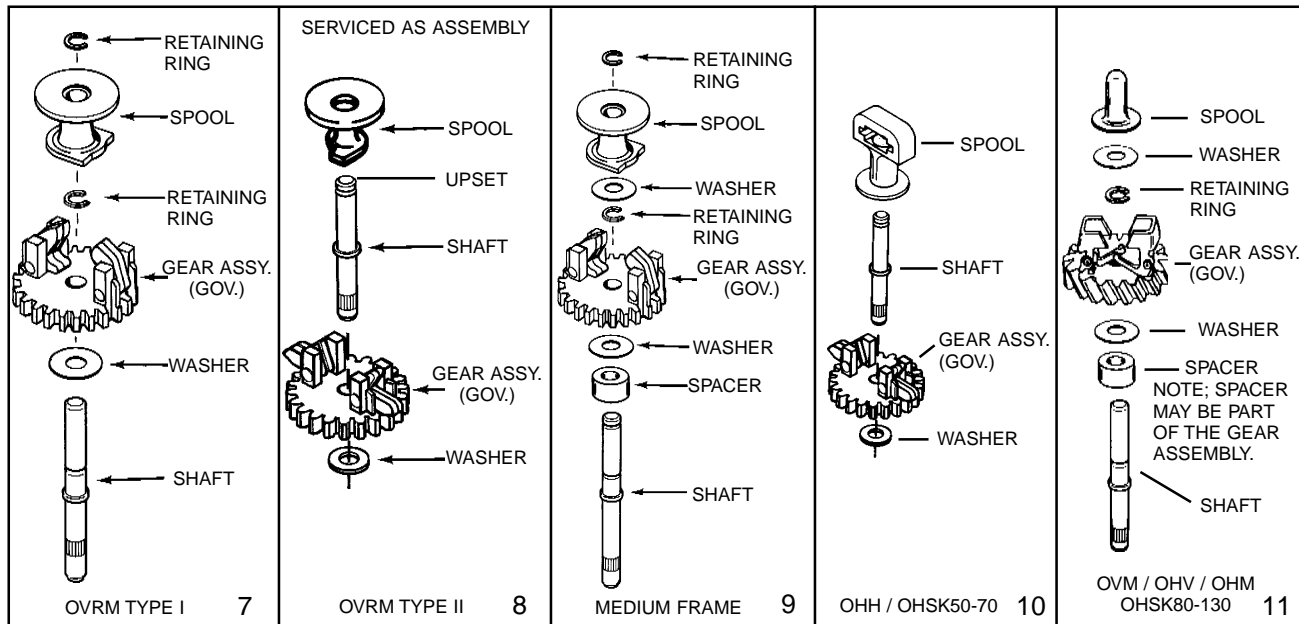
Governor Shaft Replacement, Retaining Ring Style

1. Remove the retaining ring, spool, gear assembly, and washer(s).
2. Clamp the shaft in a vise and pound gently on the flange with a wooden or plastic mallet to remove the shaft.

NOTE: DO NOT TWIST THE GOVERNOR SHAFT WHEN REMOVING. THE SHAFT BOSS MAY BECOME ENLARGED AND THE PRESS FIT WILL NOT SECURE THE NEW GOVERNOR SHAFT.

3. Start the new shaft into the shaft boss by tapping with a soft faced hammer.
4. Refer to the chart at right for the proper shaft exposed length from the mounting surface. Add a drop of red Loctite 271 and press the governor shaft to the proper depth using a press or a vise. Wipe the extra Loctite off after installation.
5. Reassemble the washer (s), governor gear, and spool followed by the retaining ring.

ENGINE MODEL	EXPOSED SHAFT LENGTH
OHH/OHSK50-70	1.319" - 1.334"
OVRM	(33.502 - 33.883 mm)
OHM OHSK80-130	1.085" - 1.100"
	(27.559 - 27.940 mm)
OVM OVXL OHV	1.350" - 1.365"
	(34.290-34.671 mm) 6



Speed Controls And Linkage

Many different types of speed controls and linkage are used for O.E.M. applications. Linkage attachment points are best recorded or marked prior to disassembly. This assures the correct placement during reassembly. The solid link is always connected from the outermost hole in the governor lever to the throttle in the carburetor. The governor spring is connected between the speed control lever and the governor lever. Vertical shaft engines may use an adjustable intake pipe mounted speed control bracket located above the carburetor, or a vertical or horizontal control mounted on the side of the engine. The ignition ground out terminal, idle R.P.M. and high speed R.P.M. adjustment screws may be located on the speed control bracket.

The adjustable speed control bracket which is mounted on the intake pipe must be aligned properly when installing. To align the control bracket, use the following steps.

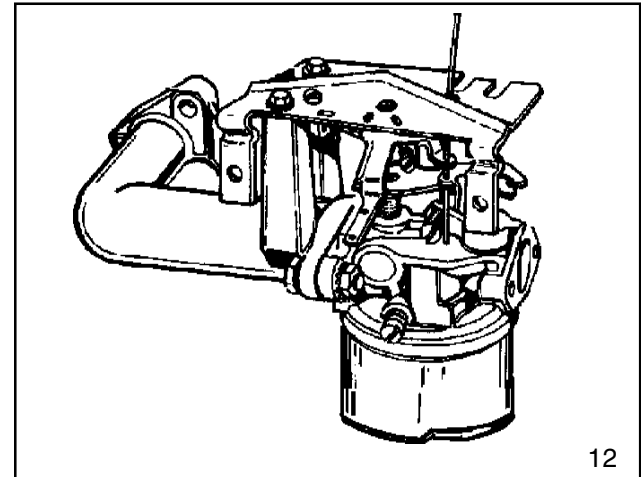
1. Loosen the two screws on the top of the panel.
2. Move the control lever to full wide open throttle position and install a wire or aligning pin through the hole in the top of the panel, the hole in the choke actuating lever, and the hole in the choke (diag. 12).
3. With the components aligned, tighten the two screws on the control panel.

The following pages show common linkage hookup arrangements. Whenever the carburetor or the governor linkage is removed or replaced, the engine R.P.M.'s should also be checked. Use microfiche card #30 or contact a local Tecumseh dealer for the correct R.P.M. settings for the engine model and specification.

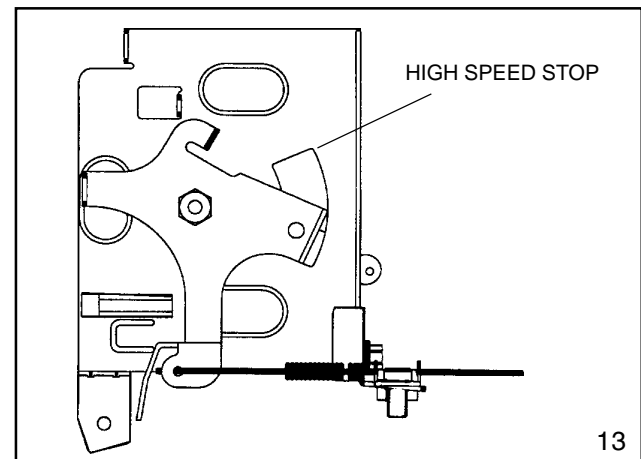
NOTE: RPM SETTINGS CAN ALSO BE FOUND ON THE COMPUTERIZED PARTS LOOK UP SYSTEMS.

OHH REMOTE SPEED CONTROL

The engine and equipment control must be adjusted to allow the engine control lever to touch the high speed stop when the equipment control is set in the "highspeed" or "fast" position. Loosen the bowden wire clamp, place the equipment control to the "fast" position, move the engine control lever to contact the high speed stop, and hold the lever in this position while tightening the bowden wire clamp.



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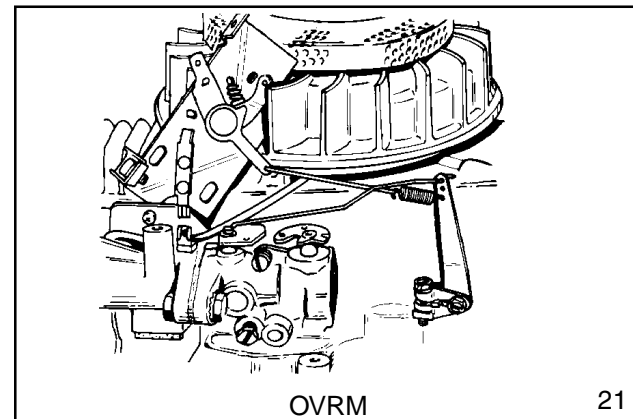
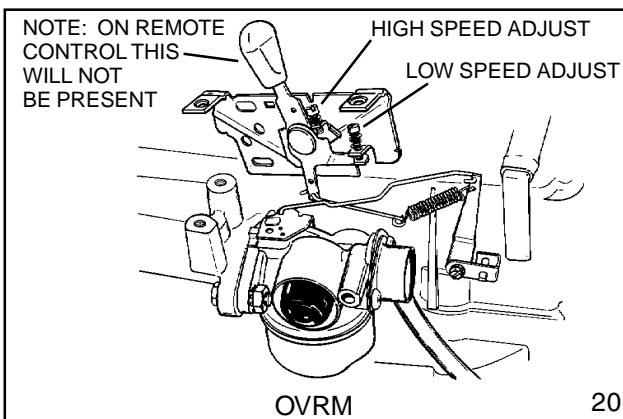
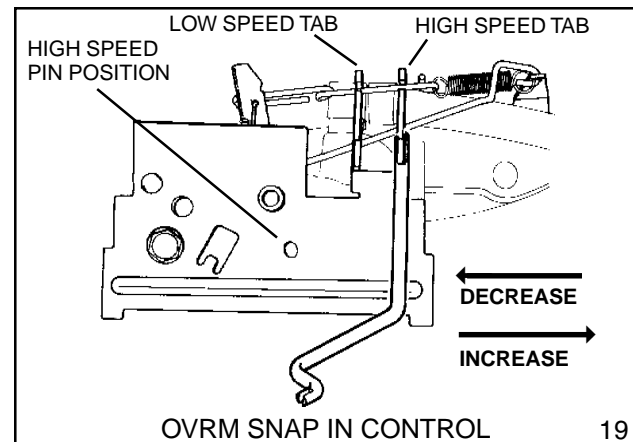
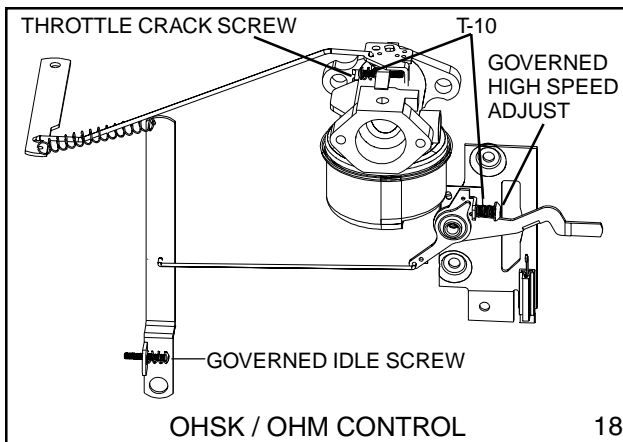
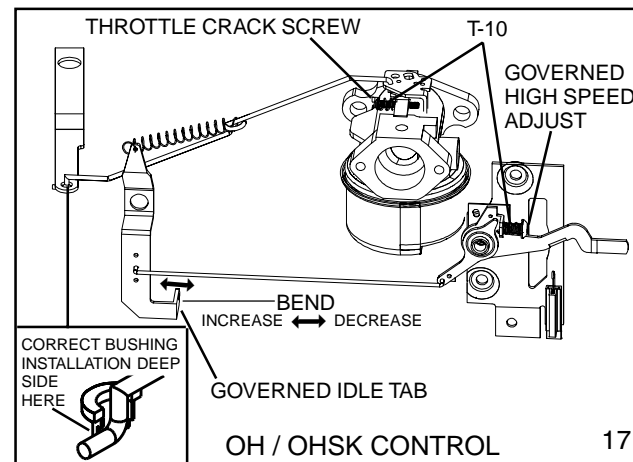
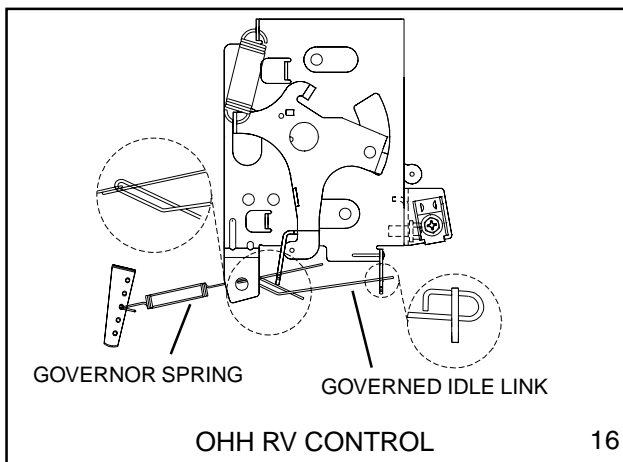
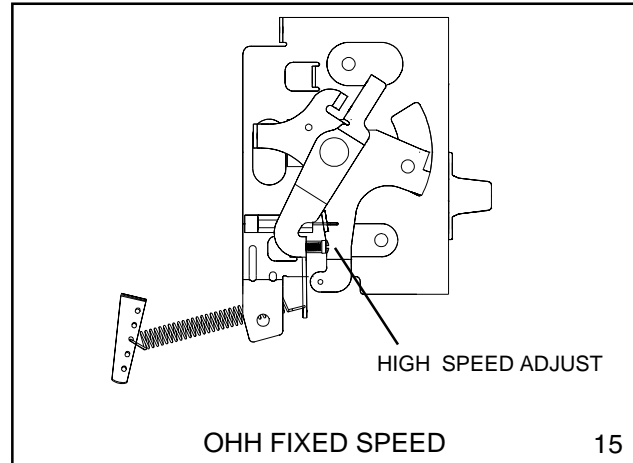
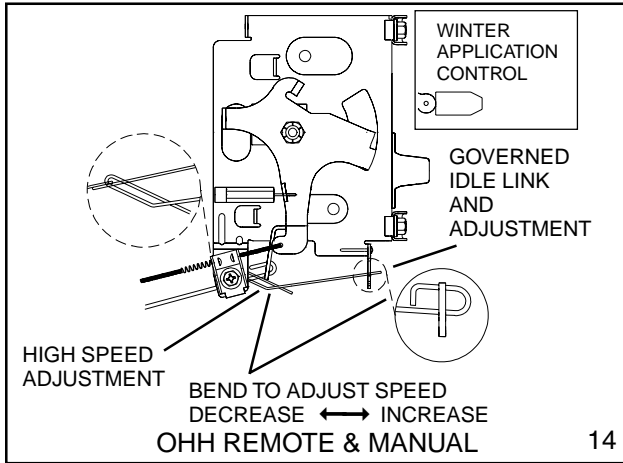
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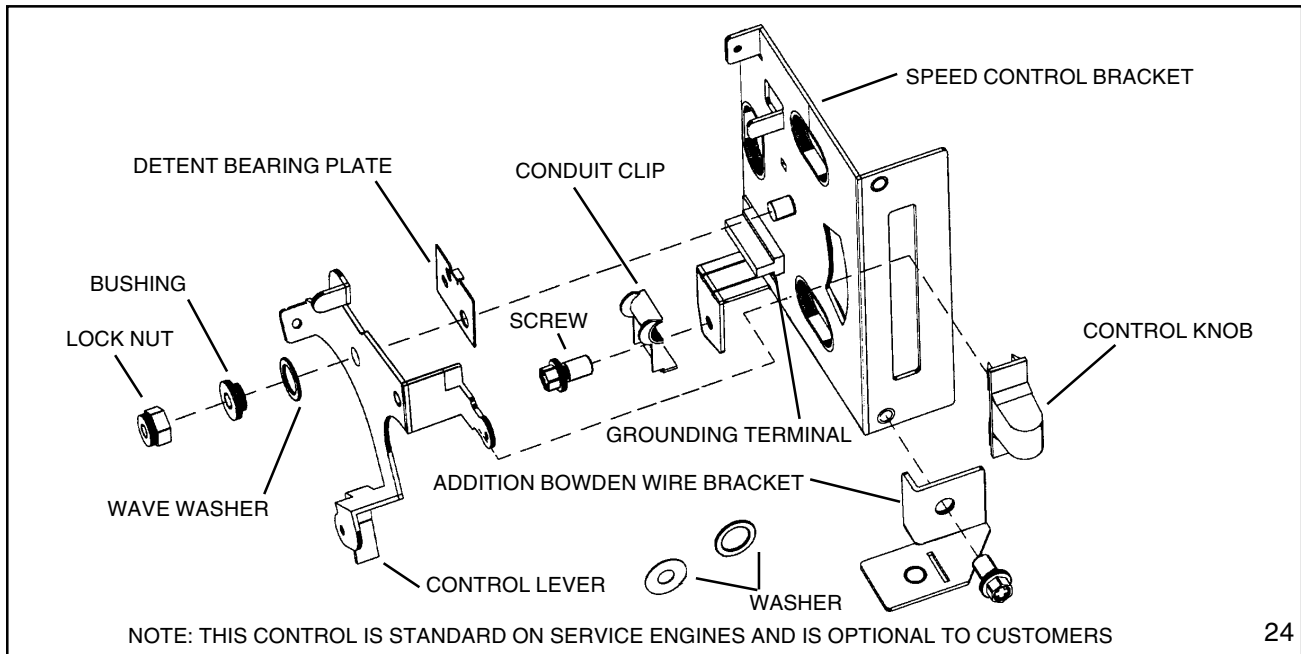
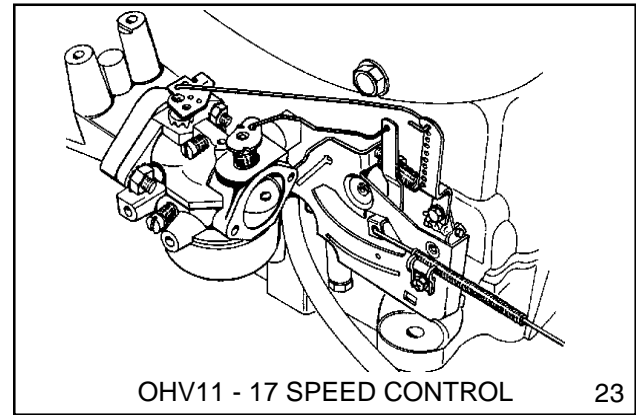
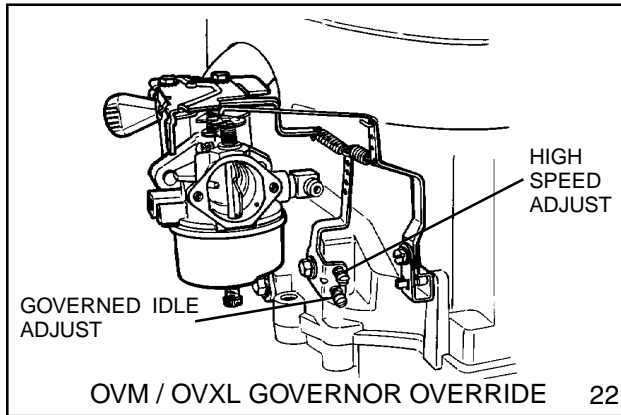
OHH GOVERNED IDLE SPEED CONTROL

This control is adjusted by bending the tabs on the control bracket to achieve the correct idle speed and high speed. When the engine is running, the governor controls both the idle and the high engine speed. In order for the governor to respond properly to a crankshaft load at engine idle, the idle speed screw on the top of the carburetor must be set 600 RPM lower than the governed idle speed. Use the following procedure to set the engine speeds (diag. 14 & 16).

1. Check to find the correct engine speeds found on microfiche card # 30 or using the Computer Parts Look-up System.
2. Start and allow the engine to run (3-5 minutes) before beginning adjustments. Place the control knob in the lowest engine speed position. Use a Vibra-Tach or other tachometer to set the non-governed idle speed (600 RPM lower than the governed idle speed) by pushing the bottom of the governor lever away from the control bracket so the throttle lever contacts the idle speed screw and hold the lever in this position. Turn the idle speed screw clockwise to increase or counterclockwise to decrease engine idle speed.
3. Allow the governor to control the throttle. Use a Vibra-Tach or other tachometer and bend the tab as shown to achieve the specified governed idle speed.
4. Slide the control knob to the high speed position and bend the tab as shown to achieve the specified governed high engine speed.

NOTE: Early production OHH engines did not have governed idle, set only the idle crack screw and high speed governor stop.





CONVERSION TO REMOTE CONTROL

Remove the manual control knob by squeezing together with a pliers or prying with a screw driver. Remove the air cleaner cover and air cleaner element to gain easier access to the speed control lock nut that holds the control levers together.

Remove the 3/8" (9.525 mm) locknut, bushing, wave washer, control lever, and the detent bearing plate.

Reassembly of **REMOTE** control.

Discard the detent bearing plate and in its place install the washer with the smaller I.D. from the new parts bag.

Install the lever over the post making sure that the end of the lever is in the slot of the control.

Place the other washer with the large I.D. from the parts bag next to lever, then the bushing. The smaller side of the bushing goes towards the lever and fits inside of the lever and the washer.

Discard the wave washer.

Install the lock nut.

Check the alignment of the lever, bushing and washers to ensure that everything is aligned properly and torque the lock nut to 20 in. lbs. (2 Nm).

The control lever should move freely.

This engine speed control is set up with the "stop in the control". If a remote stop is desired remove and discard the short green wire that runs from the speed control grounding terminal (to the remote grommet stop blade). Reinstall the blade and screw. It will now be necessary to run a grounding wire to a remote grounding switch in order to stop the engine.

A remote grounding switch can be added to the engine at this terminal as well, thus allowing the engine to be stopped at either the stop in the control or the remote grounding switch.

OVM, OVXL, OHV VERTICAL SPEED CONTROL

This remote speed control may have governed idle, a choke override, and the option of an ignition remote stop terminal block.

The speed control is adjusted to the equipment throttle control by aligning the slot in the speed control lever with the alignment hole on the mounting bracket. Place a pin through the two holes, place the equipment throttle control to the wide open position, hook the bowden cable end in the control as shown, and tighten the cable housing clamp. In this position, the gap of .040" - .070" (1.02 - 1.778 mm) should exist at the gap location as illustrated. This will assure that the carburetor will go into full choke when the control is placed in the start position.

The idle speed is adjusted by turning the idle speed screw clockwise to increase engine R.P.M. and counterclockwise to decrease R.P.M. Use tool part # 670326 to adjust the high speed engine R.P.M. Place the slotted end of the tool onto the adjustment tab and bend the tab to the left (away from the control) to increase engine R.P.M.

Throttle plate alignment on all models with speed controls mounted on intake manifold. This adjusts choke in control as well (diag. 12 on page 25).

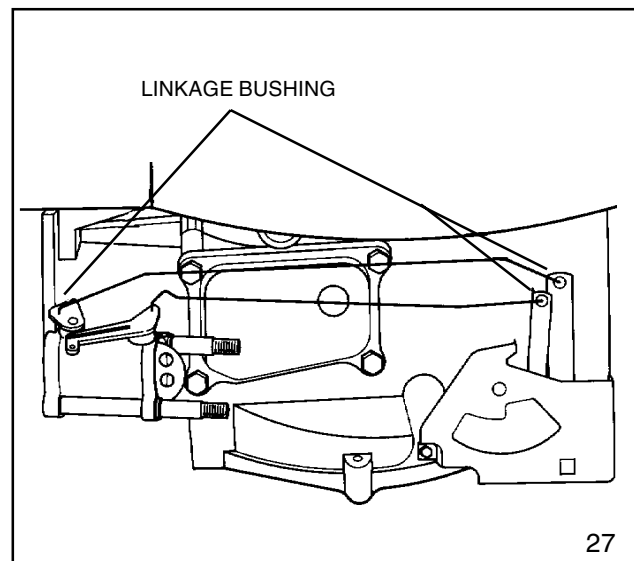
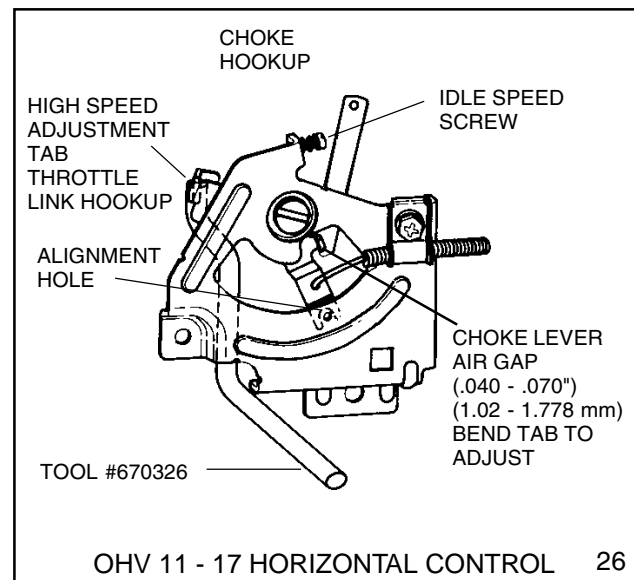
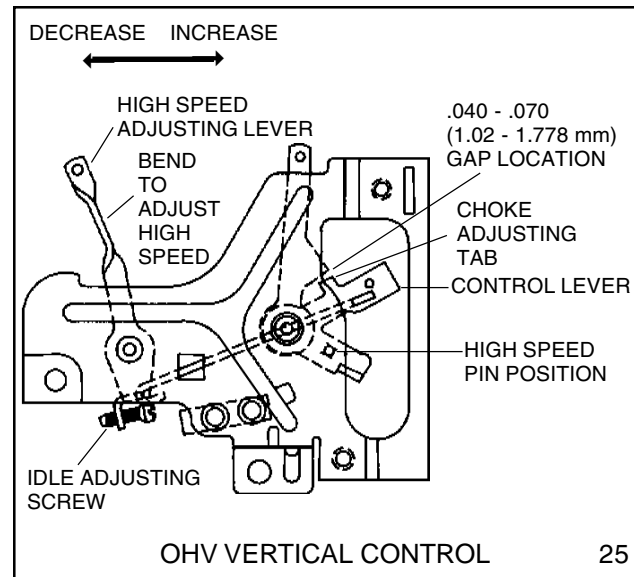
OHV 11-17 HORIZONTAL SPEED CONTROL

This speed control is adjusted to the equipment throttle control by aligning the slot in the speed control lever with the alignment hole on the mounting bracket. Place a pin through the two holes, place the equipment throttle control to the wide open position, hook the bowden cable end in the control as shown, and tighten the cable housing clamp. In this position, the gap of .040" - .070" (1.02 - 1.778 mm) should exist at the gap location as illustrated. This will assure that the carburetor will go into full choke when the control is placed in the start position.

NOTE: Assure that the throttle cable has full travel from wide open throttle to full choke. **Hard starting** could result if the cable is not properly adjusted to allow for full choke.

The idle speed is adjusted by turning the idle speed screw clockwise to increase engine R.P.M. and counterclockwise to decrease R.P.M. Use tool part # 670326 to adjust the high speed engine R.P.M. Place the slotted end of the tool onto the adjustment tab and bend the tab to the left (toward the spark plug end) to increase engine R.P.M.

OHV 11 -17 engines use nylon bushings on the throttle and choke linkage hook-up points to extend the life of the linkage and to enhance the stability of the governor system. Make sure they are in good condition and in place (diag. 27).



CHAPTER 5 RECOIL STARTERS

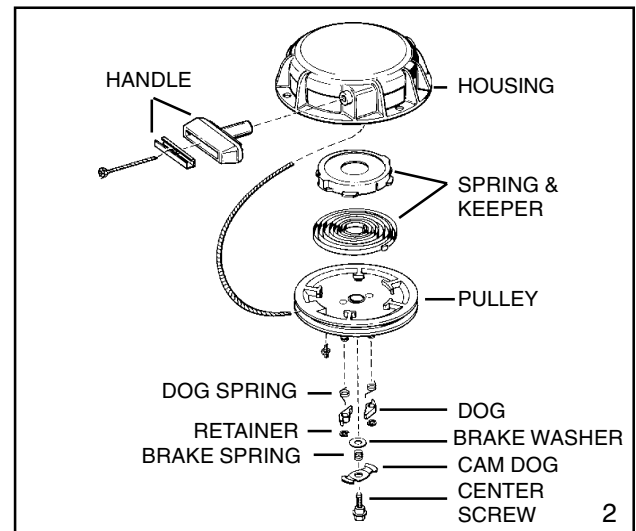
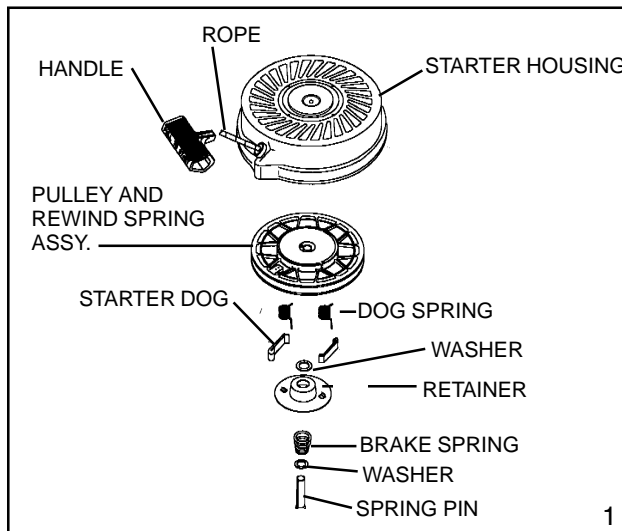
GENERAL INFORMATION

Recoil starters used on vertical shaft Tecumseh engines are top mount horizontal pull style. Horizontal shaft engines use recoil starters which can be mounted to pull either vertically or horizontally. All recoil starters turn the engine over by engaging a dog(s) into the starter cup attached to the engine flywheel. All starters are spring loaded to retract the dog(s) when the engine speed exceeds the turning speed of the starter.

OPERATION

As the starter rope is pulled, the starter pulley rotates on the center pin. The starter dog(s) is pinned or pocketed in the pulley hub and extend outward when the pulley rotation forces the starter dog(s) to contact the ears on the retainer. The retainer ears act as a ramp to fully extend the starter dog(s). The fully extended starter dog(s) locks in contact with notches in the starter cup. When the engine fires and the rotational speed of the starter cup exceeds the starter pulley, the starter dog(s) disengages from the starter cup. The starter dog spring(s) returns the starter dog(s) to the disengaged position. When the starter handle is released, the recoil spring turns the starter pulley in the opposite direction to retract the starter rope.

COMPONENTS



SERVICE

Starter related problems will require the starter to be removed from the engine to diagnose the cause. Visually inspect the starter dog(s), starter cup, retainer, springs, rope, washers, and the starter pulley for wear or breakage. Use one of the following procedures that apply to the application to disassemble, repair, and assemble the starter. Always consult the Tecumseh Master Parts Manual for the correct replacement parts.

ROPE SERVICE

Rope replacement should be done using the correct part number replacement rope or braided rope of the correct diameter and length. Consult the Tecumseh Master Parts Manual to obtain the correct part number, length, and size required. Use the following rope chart to convert a numbered rope to a fractional diameter for bulk rope use. The rope ends should be cauterized by burning with a match and wiping the rope end with a cloth while hot.

CAUTION: HANDLE MATCHES SAFELY TO AVOID BURNS, AND EXTINGUISH COMPLETELY BEFORE DISCARDING.

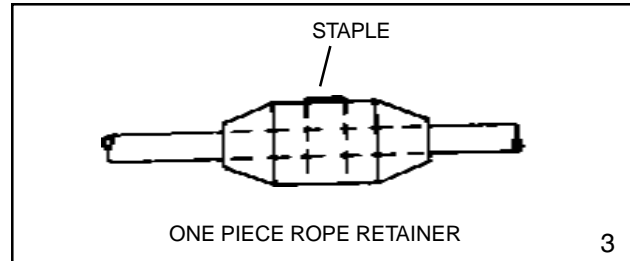
4 1/2 rope = 9/64" diameter (3.572 mm)

5 rope = 5/32" diameter (3.969 mm)

6 rope = 3/16" diameter (4.762mm)

ROPE RETAINER REPLACEMENT

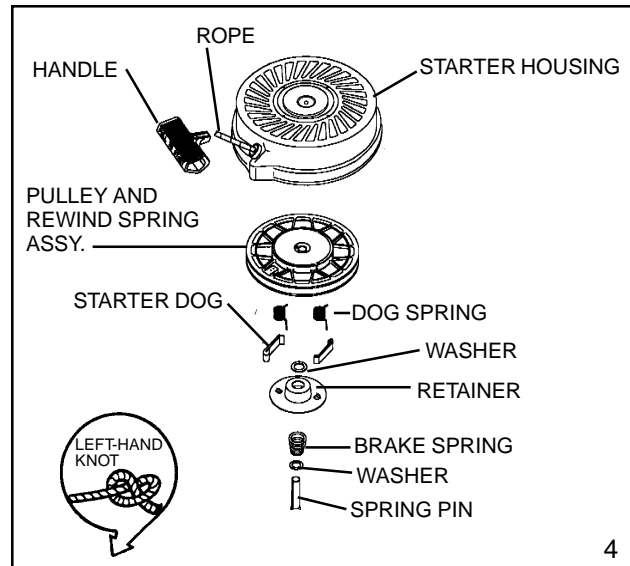
1. Remove the starter handle if the retainer is a complete circle design. Remove the staple and old retainer.
2. Slide the rope retainer into the proper position and insert the staple using a pliers.
3. Install the starter handle and tie a left hand knot to secure the handle.



STYLIZED REWIND STARTER (OHH, OVRM, OHM, OHSK, OVM, OVXL, OHV), and STAMPED STEEL STARTER

Disassembly Procedure

1. After removing the rewind assembly from the engine blower housing, release the tension on the rewind spring. Remove the starter handle and carefully allow the rope to unwind into the starter housing (diag. 4).
2. Remove the decal or plastic disc in the center of the rewind.
3. Place a 1" (25.4 mm) deep well socket under the retainer. Set the rewind on a bench, supported on the socket.
4. Use a 5/16" (7.937 mm) or a [1/4" (6.35 mm) punch for stamped steel] roll pin punch to drive out the center pin. The stamped steel center pin is driven out from the outside, the punch tip must be angled inside the center hole. Move the punch around while driving the pin to help keep the pin straight.

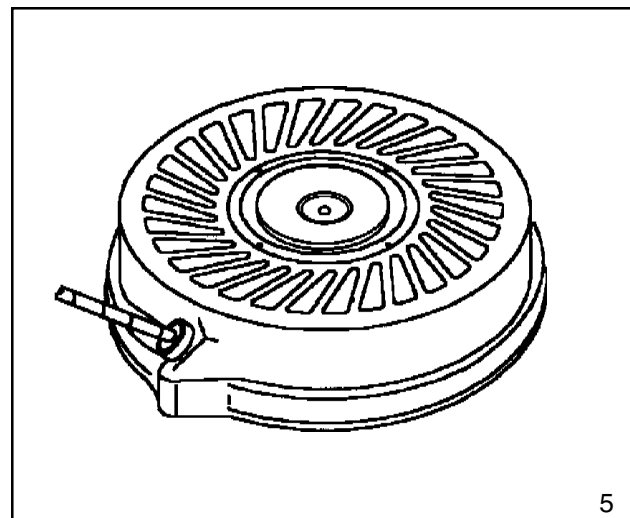


CAUTION: THIS REWIND SPRING IS NOT SECURED IN A CANISTER. PULLEY BOSSES HOLD THE REWIND SPRING AND COVER, AND CAN BE EASILY DISLODGED DURING HANDLING.

5. Remove the brake spring, retainer, washers, and pulley assembly (diag. 4).

Note: The starter dogs face out on the stamped steel starter and the dogs face in on the stylized rewind starter.

6. All components in need of service should be replaced.



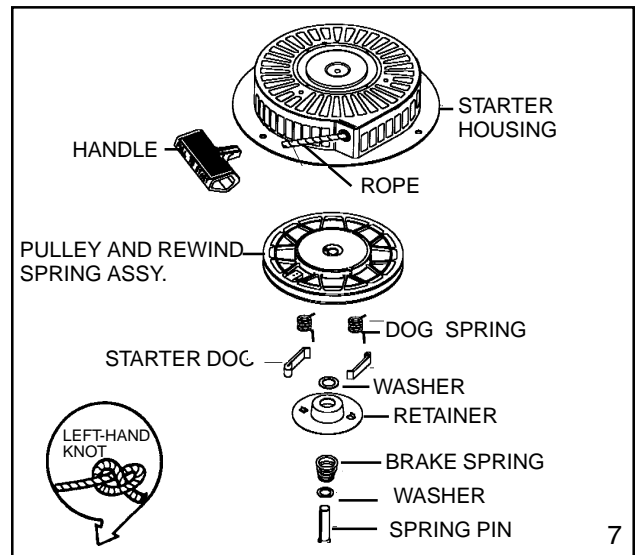
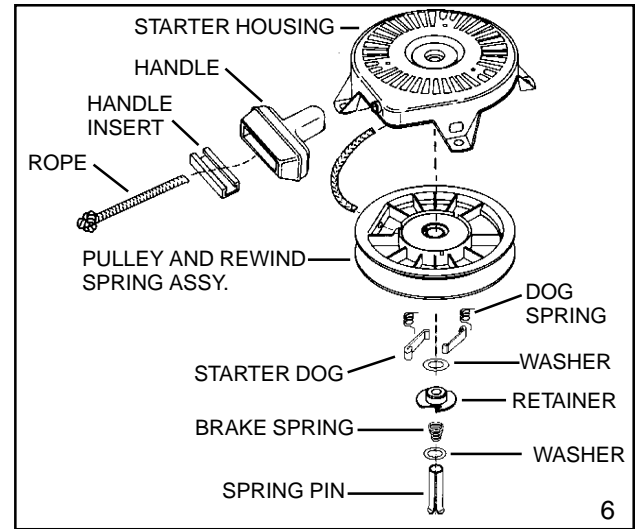
Assembly Procedure

1. Reverse the disassembly procedure. The starter dogs with the dog springs must snap back to the center of the pulley (disengaged position). When the rope is pulled, the tabs on the retainer must be positioned so that they will force the starter dogs to engage the starter cup. (diag. 6 & 7)
2. Install a new recoil spring if necessary by pushing the new spring out of the holder into the pulley cavity while aligning the outside spring hook into the deep notch in the pulley. Push the spring cover in until seated.
3. Always replace the center spring pin with a new one upon reassembly. Place the two new plastic washers between the center leg of the starter and the retainer. New plastic washers are provided with a new center spring pin. Discard the old plastic washer.
4. Place the rewind on a flat surface and drive the new center pin in until it is within 1/8" (3.175 mm) of the top of the starter.

NOTE: DO NOT DRIVE THE CENTER PIN IN TOO FAR.

The retainer will bend and the starter dogs will not engage the starter cup. On the stamped steel starter the center pin should be driven in until it contacts the shoulder in the starter housing.

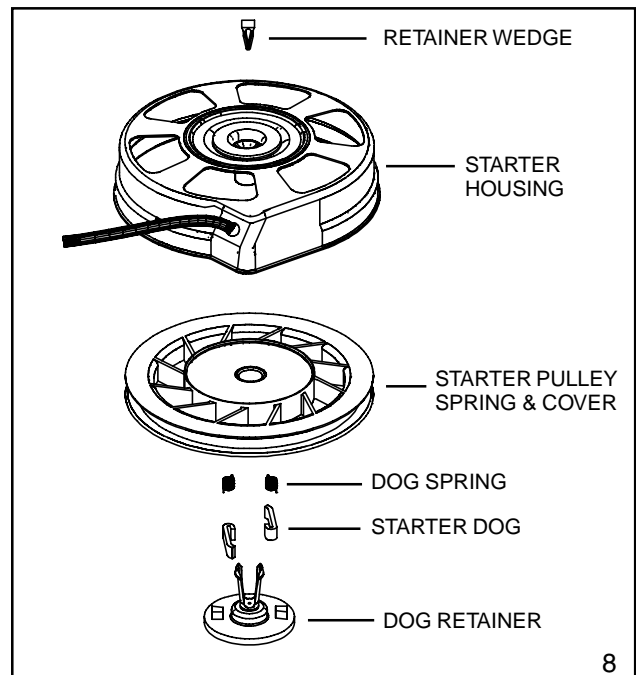
5. Replacing rope wind the starter pulley counterclockwise four or five turns to pre-load the recoil spring and thread the rope through the starter housing eyelet. Pull enough rope through to tie a temporary knot in the rope. Reattach the starter handle to the rope using a left-hand knot. Untie the temporary knot and allow the rope to recoil.



STYLIZED REWIND STARTER WITH PLASTIC RETAINER

Disassembly Procedure

1. After removing the rewind assembly from the engine blower housing, remove the starter handle by first pulling a length of rope out using the handle, tying a temporary knot in the exposed rope, and either untying the knot in handle or prying out the staple.
2. Untie the temporary knot and slowly allow the rope to fully retract into the starter housing and the recoil spring to fully unwind.
3. Remove the decal from the center of the starter housing.



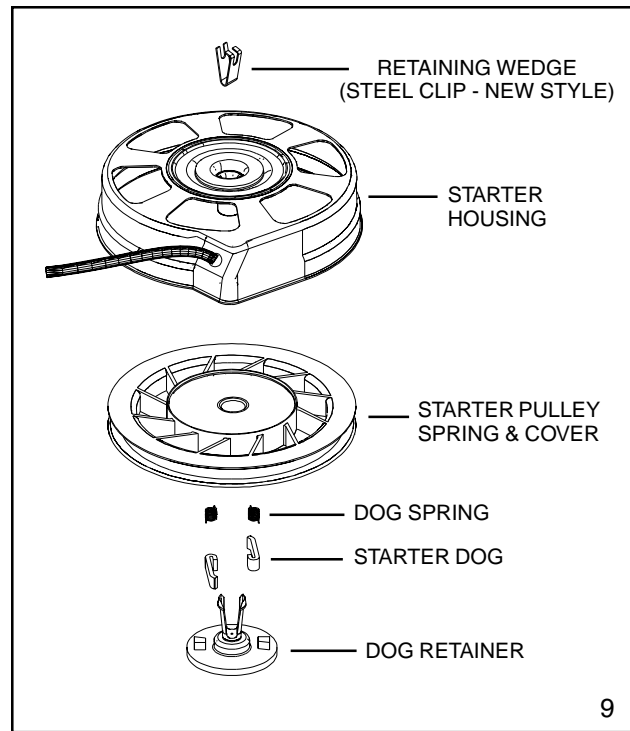
4. Use a small Phillips screwdriver or similar tool to pry the retainer legs apart and lift out the retaining wedge.
5. Pinch the legs of the retainer together and pull on the head of the retainer to remove it from the housing.
6. Remove the pulley assembly from the recoil housing.
7. Repair or replace as necessary.

Assembly

1. If replacing the starter rope, see Step 8.
2. Install a new recoil spring if necessary by pushing the new spring out of the holder into the pulley cavity while aligning the outside spring hook into the deep notch in the pulley. Push the spring cover in until seated.
3. Apply a small amount of lithium grease to the inner bore of the center shaft.
4. Replace or check that both starter dogs are in the pulley pockets and that the dog springs are hooked on the outer surface of the dog.
5. Pinch the two legs of the plastic retainer together and start into the center shaft hole.
6. Rotate the retainer so the two tabs on the bottom of the part fit between the dog and pulley hub (left side of the dog). Push the retainer in until the leg prongs pop out of the center shaft.
7. Turn the starter over and snap the locking tab between the retainer legs, replace the top decal.

NOTE: Refer to Service Bulletin 122 for metal locking tab.

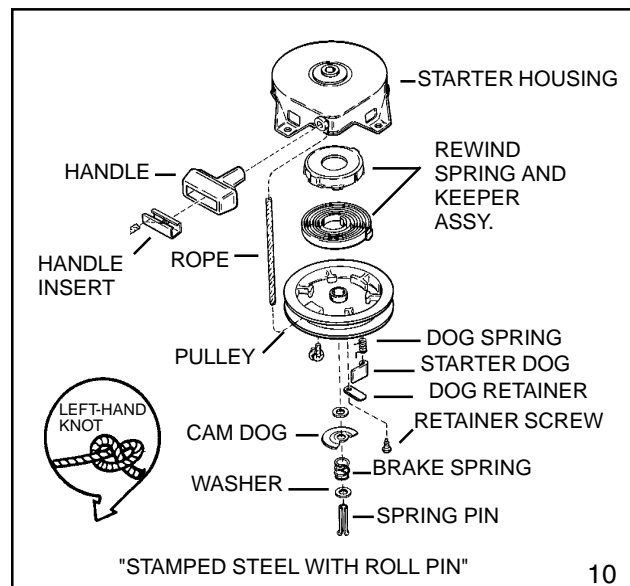
8. Wind the starter pulley counterclockwise four or five turns to pre-load the recoil spring and thread the rope through the starter housing eyelet. Pull enough rope through to tie a temporary knot in the rope. Reattach the starter handle to the rope using a left-hand knot. Untie the temporary knot and allow the rope to recoil.



KEEPER SPRING STYLE STARTERS

Disassembly Procedure

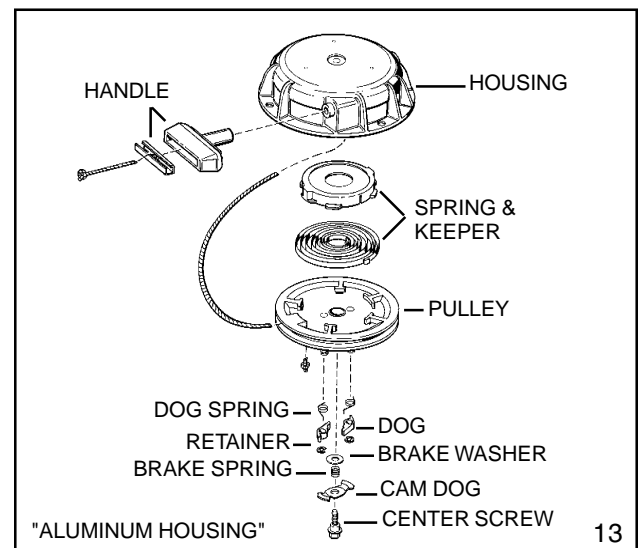
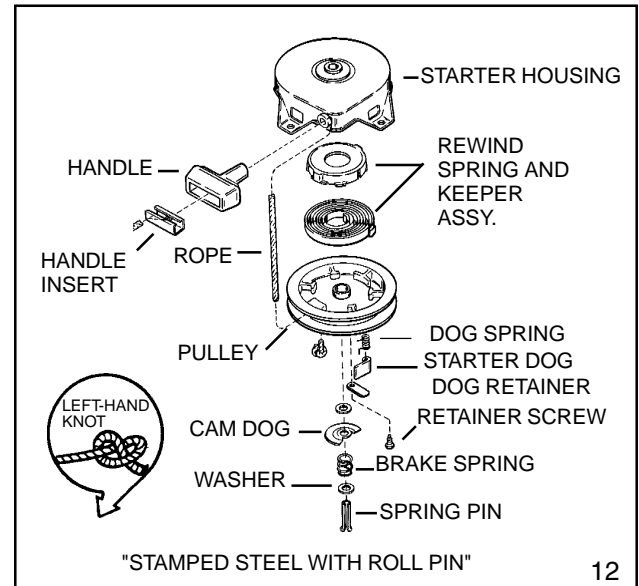
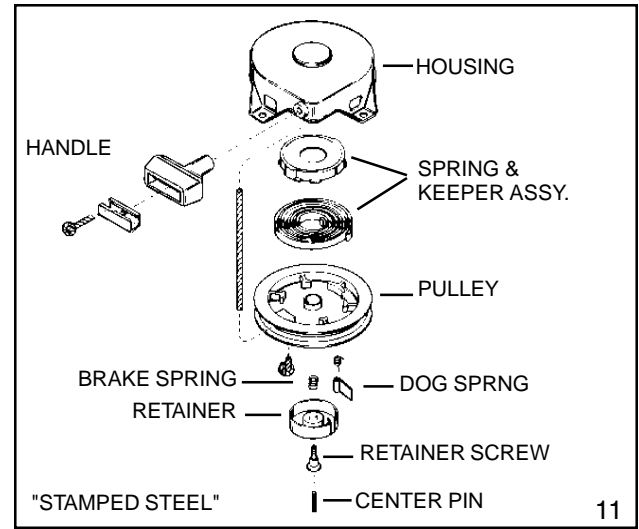
1. Untie the knot in the rope and slowly release the spring tension.
2. Remove the center screw, retainer (cam dog on snow proof type), starter dog(s) and dog spring(s), and brake spring (diag. 10).
3. Turn the spring and keeper assembly to remove the pulley. Lift the pulley out of the starter housing. Replace all worn or damaged parts.



Assembly Procedure

NOTE: This procedure covers three starters. Follow illustration of your starter type as shown.

1. Place the rewind spring and keeper assembly into the pulley. Turn the pulley to lock into position. A light coating of grease should be on the spring.
2. Place the pulley assembly into the starter housing.
3. Install the brake spring, starter dog(s), and starter dog return spring(s). The starter dog spring(s) must hold the dog(s) in against the pulley.
4. Replace the retainer cup (cam dog on snow proof starter) and retainer screw. Tighten to 65 - 75 in. lbs. (7-8.5 Nm) Older models that use a 10 - 32 retainer screw can be replaced with a larger 12 - 28 screw (part # 590409A). Re-drill the screw hole using a 13/64" (5.159 mm) drill bit. The center screw torque on cast aluminum starters is 115 to 135 in. lbs. (13-15 Nm) (diag. 11).
5. Tension the recoil spring by winding the pulley counterclockwise until it becomes tight, then allow the pulley to unwind until the hole in the pulley lines up with the rope eyelet in the starter housing. Install a knotted rope through the pulley and the eyelet and install the handle. A left-hand knot should be tied on the end of the rope to secure the handle.



Stylized Starter (OHV 13.5 -17)

1. Remove the starter handle by first pulling a length of rope out using the handle, tying a temporary knot in the exposed rope, and untying the knot in the handle.
2. Untie the temporary knot and slowly allow the rope to fully retract into the starter housing and the recoil spring to fully unwind.
3. Remove the nut (using a 10 mm socket) and washers from the center leg of the recoil housing. Slowly unwind the dog spring by allowing the starter dog retainer to rotate.
4. Remove the starter dog retainer, starter dog spring, brake spring, and starter dogs.
5. Remove the starter pulley.



CAUTION: THE REWIND SPRING IS NOT SECURED IN PLACE. HOUSING BOSSES HOLD THE REWIND SPRING, AND THE SPRING CAN BE EASILY DISLODGED DURING HANDLING.

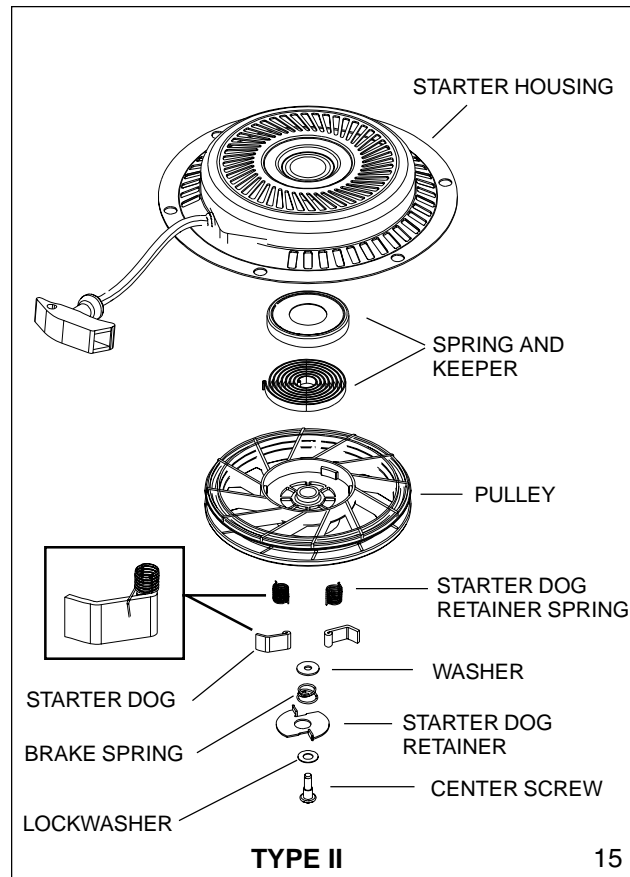
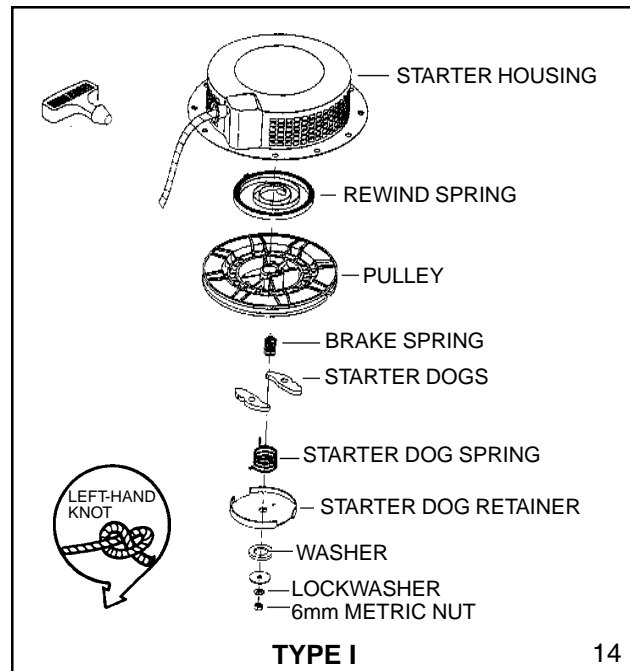
6. Remove the starter rope from the pulley if necessary.

Assembly

1. Replace the starter rope if removed by inserting one end through the hole in the side of the pulley and tying a left hand knot near the rope end. Pull the knot into the squared area and wind the rope counterclockwise (viewed from the pulley bottom) on the starter pulley.
2. Place the pulley on the housing center leg, align the end of recoil spring and the notch in the pulley and push down until seated.
3. Insert the starter dogs on the pulley pegs with the flat side away from the pulley, place the brake spring and starter dog spring on the pulley. The starter dogs must be free to retract into the pulley pocket.
4. Place the starter dog retainer on the center leg, hook the end of the dog spring into the hole in the retainer, press down and turn 1/2 a turn clockwise to line up the notches to the starter dogs, add the nylon washer, metal washer, lock washer, and hex nut. Tighten the hex nut to 40 inch pounds (4.5 Nm) torque.

NOTE: Type II - Apply blue Loctite to the center screw and torque to 70 in pounds (8 Nm).

5. Wind the pulley counterclockwise 4-5 turns, thread the rope through the starter housing hole, and place a temporary knot in the rope leaving at least one foot of rope length.
6. Slide the starter handle on the end of the rope and secure using a left hand knot. Remove the temporary knot and allow the rope to retract.



CHAPTER 6 ELECTRICAL SYSTEMS

GENERAL INFORMATION

The electrical system consists of three main elements: a battery, a starting circuit, and a charging circuit. The battery is part of both the starting and charging circuit. The battery should be checked before going into any extensive starter or charging system checks. If a battery has a shorted cell, overcharging can result, and the regulator or rectifier may appear to be at fault. If a cell has an open or high resistance connection, the electric starter operation will be affected.

The power source used to provide the energy to turn an electric starter motor on Tecumseh engines is either 120 volt A.C. current or 12 volt D.C. A 120 volt A.C. starter circuit utilizes a 120 volt power source instead of a battery. The 12 volt battery models require a charging system to maintain proper battery charge.

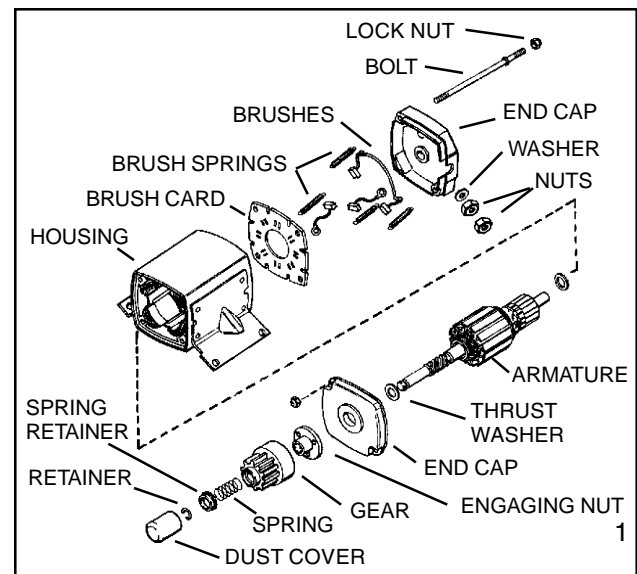
The starting circuit includes the battery, battery cables, starter or ignition switch, safety switches, starter solenoid, and an electric starter motor.

The charging system consists of alternator charge coils, rectifiers or diodes, regulator, ignition switch, flywheel magnets, and a battery. All engines that have a charging system will use a combination of some or all of these features.

OPERATION

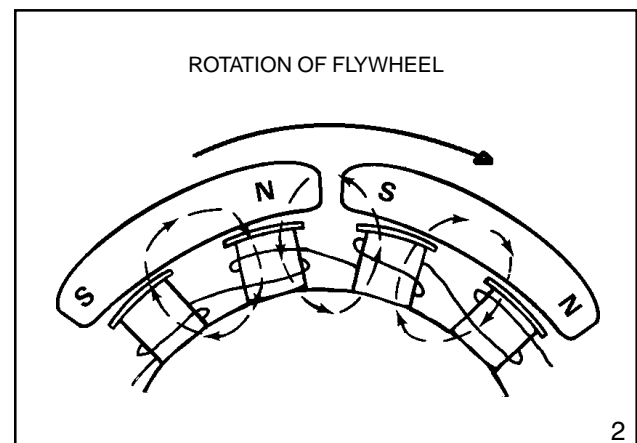
STARTING CIRCUIT AND ELECTRIC STARTERS

After all of the safety interlock switches have been activated, the starter switch closes the starting circuit. A strong magnetic force is produced by the electrical current running through the armature windings. The armature magnetism repels the magnetism produced by the permanent field magnets of the electric starter. The repelling magnetic forces cause the armature to rotate, moving the drive pinion laterally on the splined armature shaft, meshing the starter pinion gear with the flywheel ring gear. When the drive pinion contacts the stop at the end of the armature shaft, the pinion rotates along with the armature shaft to crank the engine. The armature and pinion remain positively engaged until the engine fires and the flywheel rotates faster than the armature. The greater momentum of the flywheel throws the starter pinion gear out of mesh and forces the starter pinion back to the disengaged position. After the switch is released, the starting circuit is opened and the armature coasts to a stop. A small anti-drift spring holds the pinion in the disengaged position (diag. 1).



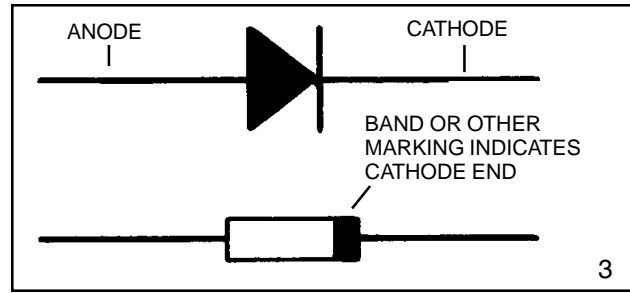
CHARGING CIRCUIT

The charging system works independently of any manual controls. The engine needs to be running to produce an electric current flow. When a conductor (alternating coils) cuts the magnetic field generated by the magnets in the flywheel, a current is induced in the alternator coil. The permanent magnets in the flywheel have a magnetic field in which the lines of magnetic force run from the North Pole to the South Pole. As the flywheel rotates and the position of the magnets change, the direction of the magnetic field changes or alternates. The alternating coils are wound in different directions to allow current to flow as an A.C. waveform (diag. 2).



CONVERTING ALTERNATING CURRENT TO DIRECT CURRENT

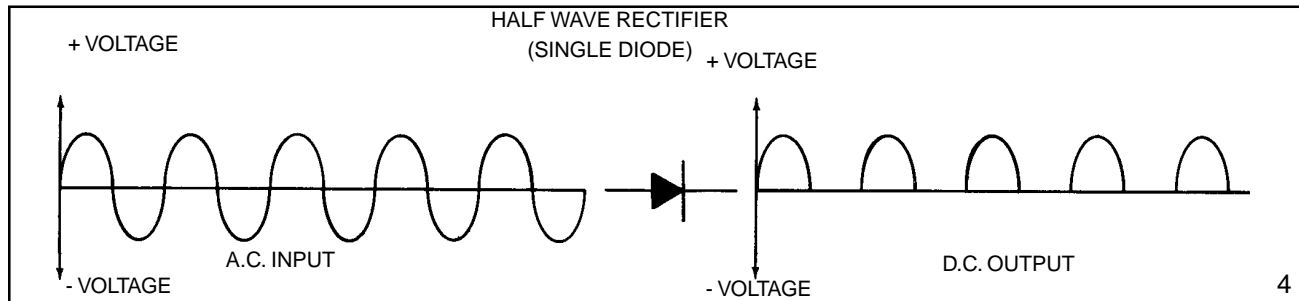
In order to charge a battery, it is necessary to convert alternating current (A.C.) to direct current (D.C.). This is accomplished by using a diode or rectifier (diag. 3). A single diode makes use of only one half of the A.C. signal and is known as HALF WAVE RECTIFICATION (diag. 4). This is acceptable in certain applications. In certain situations it is necessary to make use of the entire A.C. signal. To accomplish this, multiple diodes in a bridge configuration are used to produce FULL WAVE RECTIFICATION (diag. 5).



Current flows through a diode when the anode is more positive than the cathode. The cathode end of the diode should point toward the battery when diode is used between a charging system and a battery.

Half Wave Rectifier Single Diode

The single diode allows only the positive half of the A.C. signal through. It does not allow the negative portion through.



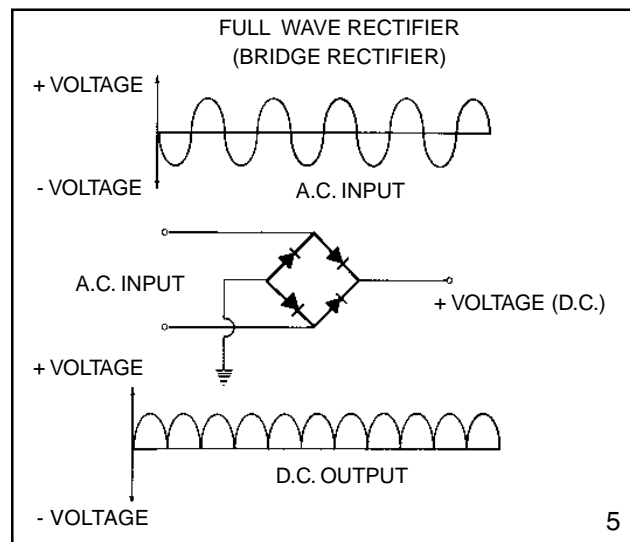
Full Wave Rectifier Bridge Rectifier

The full wave rectifier makes use of the entire A.C. signal, converting it to D.C.

COMPONENTS

BATTERY

The batteries used in conjunction with Tecumseh engines are 12 volt lead acid or "maintenance free" style. The chemical energy produced by the dissimilar metals of the battery plates provides a electrical potential that is used to power the electric starter or unit accessories. Consult the original equipment manufacturer's service manual for battery size, capacities, and testing procedure.



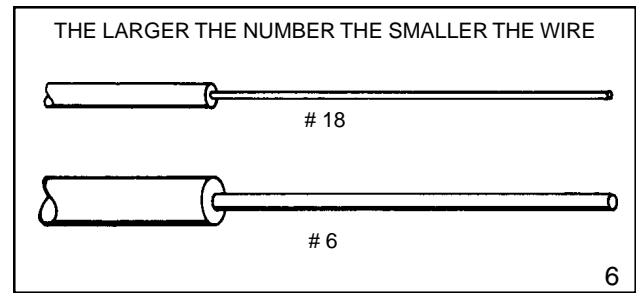
WIRING

The wires used in Tecumseh electrical systems are copper stranded with an insulated coating around the copper strands.

CONDITION: All wiring must be fully insulated between connection points, securely fastened and free of foreign material (such as rust and corrosion) at the connection points. This is especially important in the use of batteries where much of the potential may be lost due to loose connections or corrosion. Remember to check the insulation on the wire. All it takes is a pin hole for leakage to "ground out" on the engine or frame. This is of special concern when moisture or water is present.

WIRE GAUGE: The proper thickness of wire is necessary in all electrical circuits. Wire diameter is measured in increments of gauge numbers. As the gauge number of the wire increases, the wire diameter decreases in size (diag. 6).

1. The starter circuit wiring must be rated at #6 or lower gauge number.
2. The charging circuit wiring must be rated at #16 or lower gauge number (20 amp system requires #14 or lower gauge number).
3. The magneto circuit wiring (ground circuit) must be rated at #18 or lower gauge number.



Tecumseh Products Company's standard wiring color codes effective August, 1992 are as follows:

Code	-	Product
Yellow	-	Alternator A.C. Leads
Red	-	Alternator D.C. + Leads
Brown	-	Alternator D.C. - Leads
Black	-	Alternator Ground Leads, Battery Ground Leads
Orange	-	12 Volt Starter B + Leads
Dark Green	-	Ignition Shut-Off Leads

NOTE: PRIOR TO AUGUST 1992, WIRE CODES CHANGED ACCORDING TO MODEL AND SPECIFICATION NUMBERS.

ELECTRICAL TERMS

ALTERNATOR - An alternator consists of coils of wire wound around a metal lamination stack. When a magnet is moved past the coils, a current is induced in the coils. In general, the greater the number of coils, the greater the output of the alternator.

RECTIFIERS and DIODES - Charging a battery requires that the alternating current produced by the alternator be changed to direct current. This is accomplished by using a diode or rectifier.

REGULATOR/RECTIFIERS - This combines a regulator with a rectifier. The regulator prevents overcharging of the battery and the rectifier changes the alternating current to direct current.

CONDUCTORS - A conductor is a material that allows an electric current to pass through it. All metals are conductors of electricity, but some are better conductors than others. Silver, copper and gold are some of the better known conductors.

INSULATORS - An insulator is a material that will not allow an electric current to pass through it. Some of the more common materials that are insulators are glass, plastic, rubber, ceramics and porcelain.

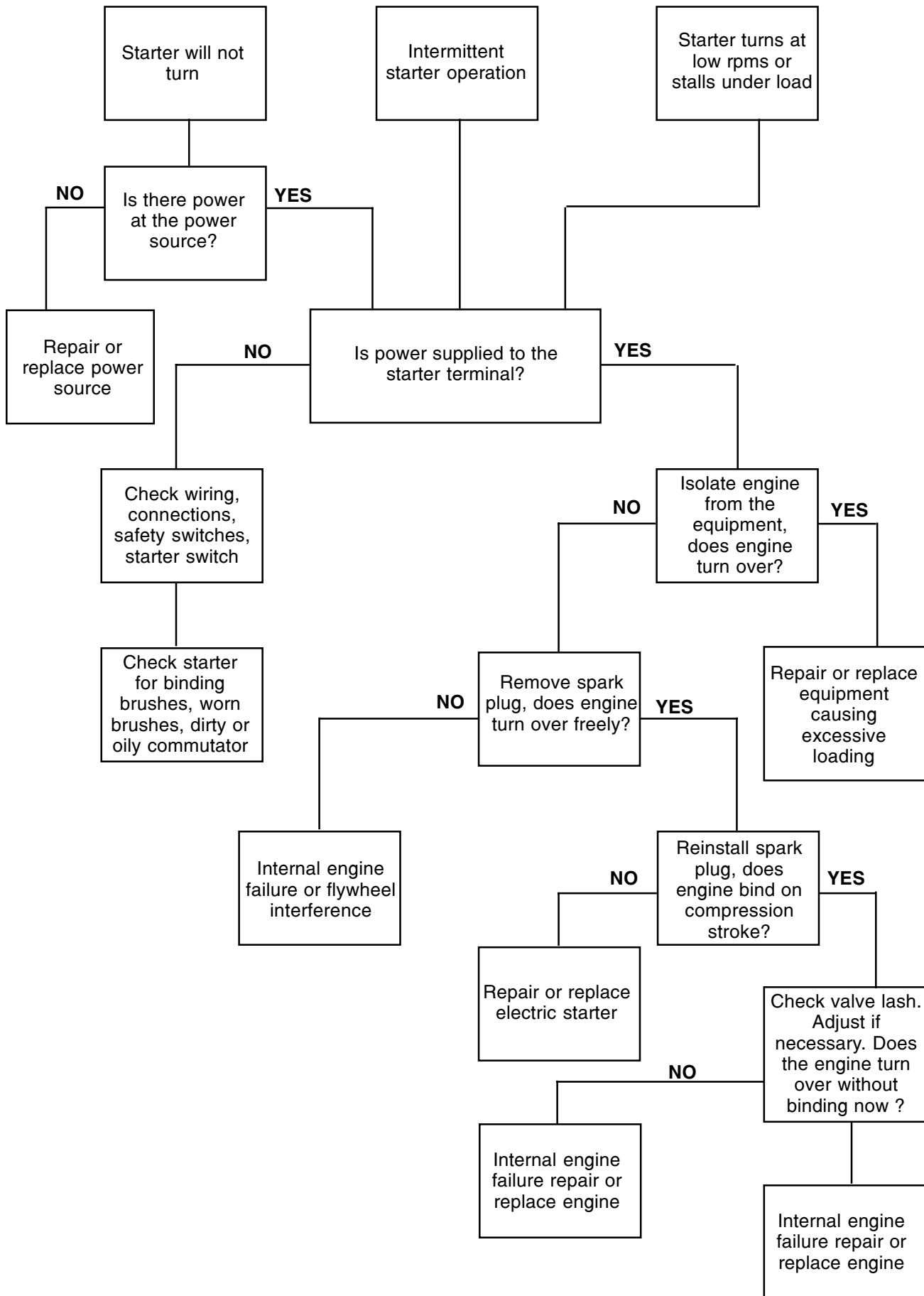
BASIC CHECKS

Before going into extensive checks, be sure to perform the more basic checks first, such as:

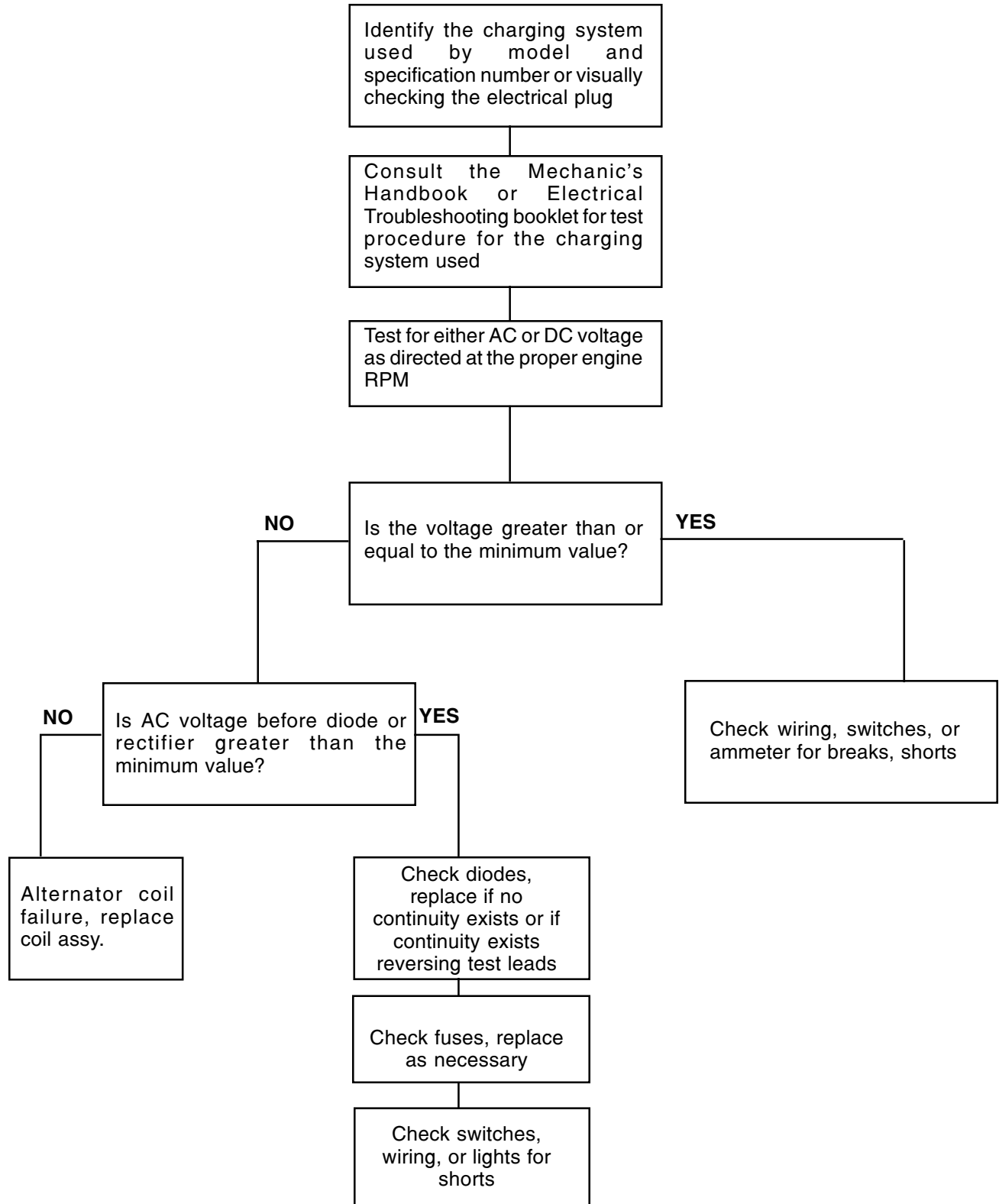
1. Battery defective or not charged.
2. Corroded or loose terminals or connections, or wrong connections.
3. Cracked insulation or broken wires.
4. A wire "grounding out" in the system.
5. Defective switch.
6. Operator presence system functioning properly.*

***NOTE:** ALL LAWN AND GARDEN TRACTORS BUILT AFTER JULY OF 1987 ARE REQUIRED TO HAVE AN OPERATOR PRESENCE SYSTEM AND MANY CAME EQUIPPED WITH SUCH A SYSTEM PRIOR TO THIS DATE. IF THE TRACTOR IS "CUTTING OUT" OR WILL NOT START, THIS IS AN AREA THAT SHOULD BE CHECKED OUT.

TROUBLESHOOTING ELECTRICAL STARTER CIRCUIT FLOW CHART



TROUBLESHOOTING ELECTRICAL CHARGING CIRCUIT FLOW CHART



TESTING PROCEDURE

STARTING CIRCUIT

1. Check the power source using an electrical tester and following the tester's recommended procedure. Make sure the battery meets the minimum battery voltage requirements found in the original equipment manufacturer's service manual.
2. Check the electric starter terminal for the required voltage (12v D.C. or 120v A.C.) using a voltmeter.



CAUTION: FOLLOW ALL SAFETY PRECAUTIONS WHEN TESTING FOR A.C. VOLTAGE, ELECTRIC SHOCK CAN KILL.

3. Check wiring, connections, fuses, ignition or starter switch, safety switches, or solenoid for continuity using an ohmmeter or a continuity light. Repair or replace as necessary.
4. Remove all equipment loads from the engine. Take off all drive belts, chains, and couplers to isolate the engine from the equipment it is powering.
5. Try to turn the engine over using the recoil assembly if equipped. If the engine doesn't turn over, a mechanical binding may be the cause. Check for proper lubrication (oil level and viscosity) and check for electric starter gear and flywheel ring gear interference. If no problem is discovered, the problem is an internal failure.
6. If the engine binds only on the compression stroke, check the engine valve clearance per the specification table in Chapter 10. If the valve clearance is within the specifications, the camshaft (compression release failure) may require replacement. Valve clearance not within the listed specifications will require resetting the rocker arms to obtain the proper clearance.
7. If the engine turns over freely, the electric starter should be replaced or disassembled and checked. See "Service" in this chapter. 120 volt starters labeled UL Listed/CSA Approved can be serviced; however, starters labeled CSA must only be replaced. If the preceding steps fail to correct the problem, the engine will require to be disassembled to find the mechanical failure. See Chapter 9 under "Disassembly Procedure".

CHARGING CIRCUIT

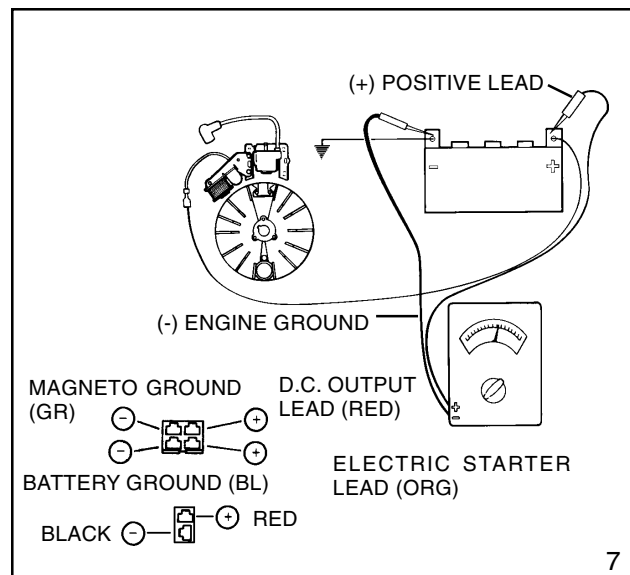
The following pages will show wiring diagrams of several Tecumseh charging systems. The charging system used on the engine is best identified by obtaining the engine model number and the specification number on the engine. Consult a Tecumseh dealer or a parts manual to identify the charging system. To make many of the tests it is necessary to run the engine and measure alternator output with a voltmeter. When making voltage tests with the engine running, it is not necessary to take readings at all the listed R.P.M.s. Checking at one of the speeds is sufficient.

In some cases an open circuit D.C. check cannot be made. A SCR (Silicon Controlled Rectifier) is located in the circuit which requires a minimum "turn on" voltage to allow it to conduct. Without the battery in the circuit this "turn on" voltage is not present. The SCR "senses" this and there will be no D.C. output from the regulator / rectifier.

Each charging system has its own testing procedure. Test the charging system using the applicable procedure found on the following pages.

350 Milliamp Charging System

CHECKING THE SYSTEM: The battery must be in the circuit to perform the test properly. Set the voltmeter to the 0 - 20 D.C. volt scale. Connect a voltmeter across the battery. The voltmeter should read the battery voltage. Start the engine. With the engine running, there should be an increase in the voltage reading. If there is no change in the voltage reading, the alternator is defective and should be replaced. See Chapter 9 for "Disassembly Procedure" (diag. 7).



18 Watt A.C. Lighting Alternator

CHECKING THE SYSTEM: To check the system, disconnect the plug from the rest of the lighting system. Connect a wire lead from the single pin connector coming out of the engine to one terminal of a No. 4414, 18 watt bulb. Connect another wire lead to the other terminal of the bulb and run to a good ground on the engine. Start the engine and test the circuit using the A.C. voltmeter as shown (diag. 8).

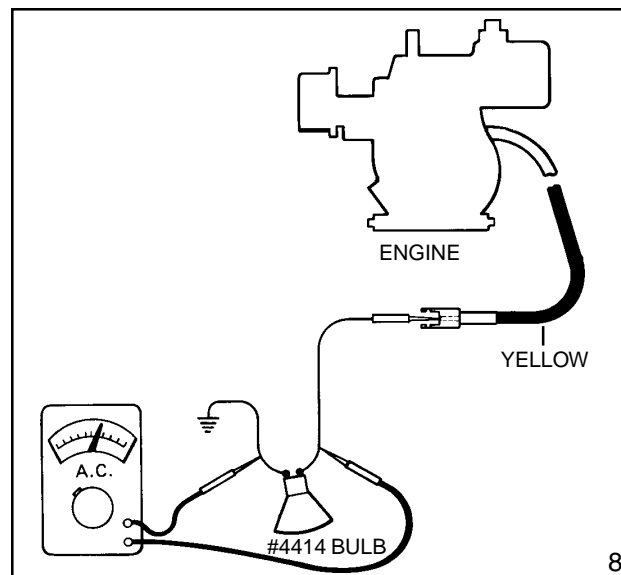
With the engine running, minimum A.C. voltage across the bulb should be:

2000 R.P.M. - 6.0 Volts A.C.

3000 R.P.M. - 8.5 Volts A.C.

3600 R.P.M. - 10.0 Volts A.C.

If minimum values are noted, the alternator is okay. If less than the minimum values, the alternator is defective. See Chapter 9 for "Disassembly Procedure".



3 AMP

Before making any exterior tests, check for inoperative switch, shorted wires and burned out headlight and/or stop tail light. To check out the alternator, check the A.C. lead to ground at each yellow wire (diag. 9).

With engine running, minimum values should read:

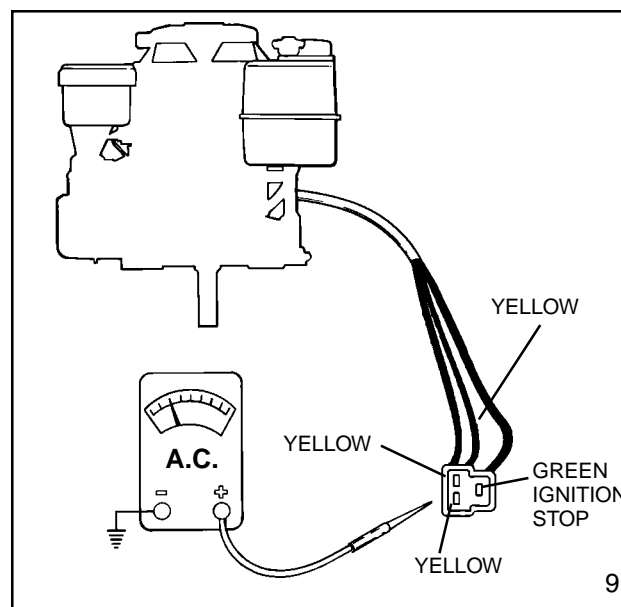
2500 R.P.M. - 8.0 Volts A.C.

3000 R.P.M. - 9.5 Volts A.C.

3300 R.P.M. - 10.5 Volts A.C.

3600 R.P.M. - 11.5 Volts A.C.

If the above minimum readings are noted, the alternator is okay. Check for defective lights, wiring or switches, if less than the above readings, the alternator is defective. See Chapter 9 for "Disassembly Procedure".



NOTE: ON OLDER POINT IGNITION SYSTEMS, THE A.C. OUTPUT LEADS ARE BLACK AND RED.

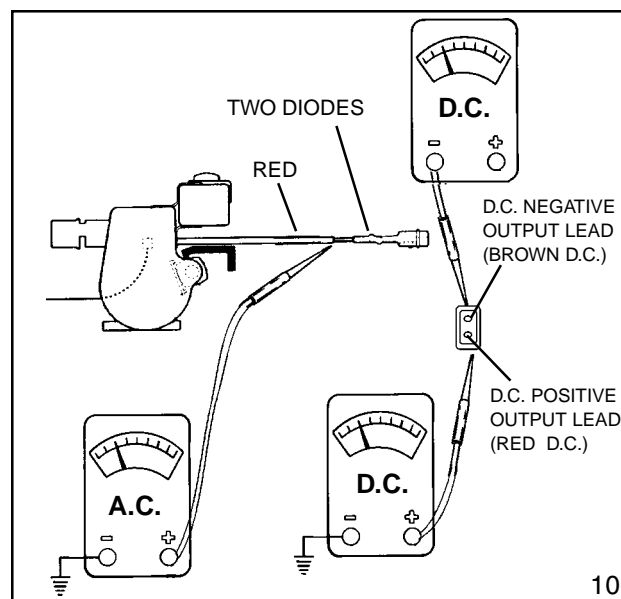
2.5 Amp D.C., 35 Watt Lighting

To check this system follow the meter hook ups at the right, checking the D.C. neg and D.C. positive first. If output is below standard listed pull back protective coating in front of the diode and check A.C. output. If A.C. is good check each diode it services as requested see parts list.

D.C. valve (+) or (-) check A.C. outputs both sides.

R.P.M.	D.C. Volts	R.P.M.	Volts A.C.
2500	- 8.0 Volts D.C.	2500	- 18 Volts A.C.
3000	- 9.5 Volts D.C.	3000	- 22 Volts A.C.
3300	- 10.5 Volts D.C.	3600	- 26 Volts A.C.
3600	- 11.5 Volts D.C.		

NOTE: These minimum numbers should be obtained by your meter and will often be higher.



3 AMP DC ALTERNATOR SYSTEM - DIODE IN HARNESS SLEEVE

This system has a diode included in the red wire which converts the alternating current (A.C.) to direct current. The direct current (D.C.) is used to provide a trickle charge for the battery. The leads from the alternator and the type of connector may vary, but the output readings will be the same.

CHECKING THE SYSTEM: Remove the fuse from fuse holder and check the fuse to make certain it is good. If faulty, replace with a six (6) AMP fuse.

To check D.C. output, separate the connectors at the engine. Place the probe (+) in the red wire lead connector. Ground the other probe to the engine (diag. 11).

With the engine running minimum values should read:

2500 R.P.M. - 8.0 Volts D.C.

3000 R.P.M. - 9.5 Volts D.C.

3300 R.P.M. - 10.5 Volts D.C.

3600 R.P.M. - 11.5 Volts D.C.

If one of these minimum readings are noted, the system is okay. Check for bad battery, ammeter, wiring, etc.

If no reading or less than the above reading, proceed to make an A.C. output check by pulling back the protective coating from the wire on the alternator side of the diode. Test the A.C. voltage before the diode using an A.C. voltmeter.

With the engine running minimum values should read:

2500 R.P.M. - 18.0 Volts A.C.

3000 R.P.M. - 22.0 Volts A.C.

3300 R.P.M. - 24.0 Volts A.C.

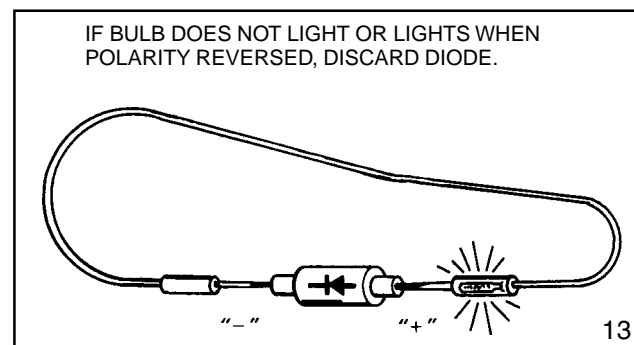
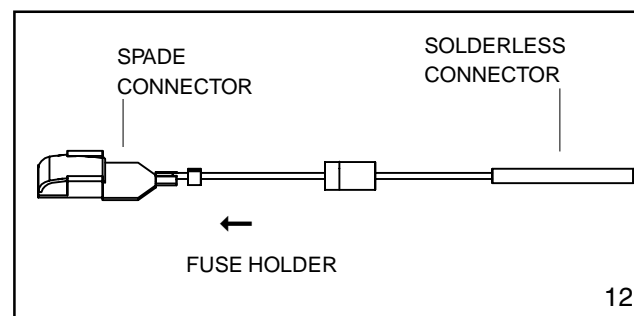
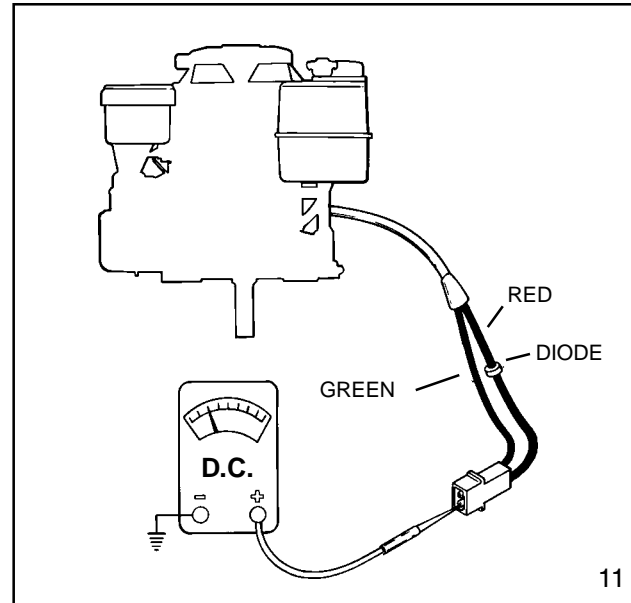
3600 R.P.M. - 26.0 Volts A.C.

If low or no voltage is experienced, replace the alternator. If the alternator puts out the minimum A.C. voltage, replace the diode.

To replace the diode, disconnect at plug (spade terminal) and cut the wire on the opposite end of the diode at the solderless (crimped) connector. Remove 1/4" (6.35 mm) of insulation from the cut end of the wire and twist the strands together. Place the solderless connector from the new diode onto the exposed 1/4" (6.35 mm) wire and crimp the connector with a standard electricians pliers. Reconnect plug end (or spade connector (diag. 12).

NOTE: DO NOT USE ACID CORE SOLDER. BE CAREFUL NOT TO APPLY HEAT DIRECTLY TO THE DIODE - USE A HEAT SINK.

New heat shrink tubing can be installed by slipping over the wires and heating with a hot air gun. If this is not available, tape the diode and connections with electrical tape.



5 AMP D.C. ALTERNATOR SYSTEM REGULATOR-RECTIFIER UNDER BLOWER HOUSING

CHECKING THE SYSTEM: An open circuit D.C. voltage check cannot be made with this system. If a known good battery fails to maintain a charge, proceed to make an A.C. voltage test.

To do this, the blower housing must be removed, and the regulator-rectifier must be brought outside of the blower housing. Reinstall the blower housing. Disconnect the red D.C. output connector at the wiring harness and connect the probes from an A.C. voltmeter to the wire terminals at the regulator-rectifier (diag. 14).

CAUTION: AT NO TIME SHOULD THE ENGINE BE STARTED WITH THE BLOWER HOUSING REMOVED.

With the engine running, the minimum values should read:

2500 R.P.M. - 19.0 Volts A.C.

3000 R.P.M. - 23.0 Volts A.C.

3300 R.P.M. - 26.0 Volts A.C.

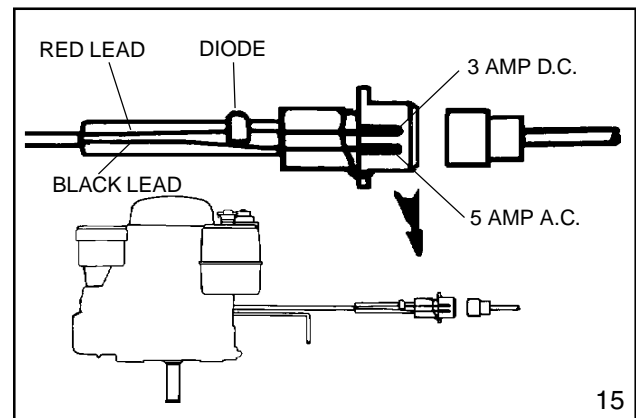
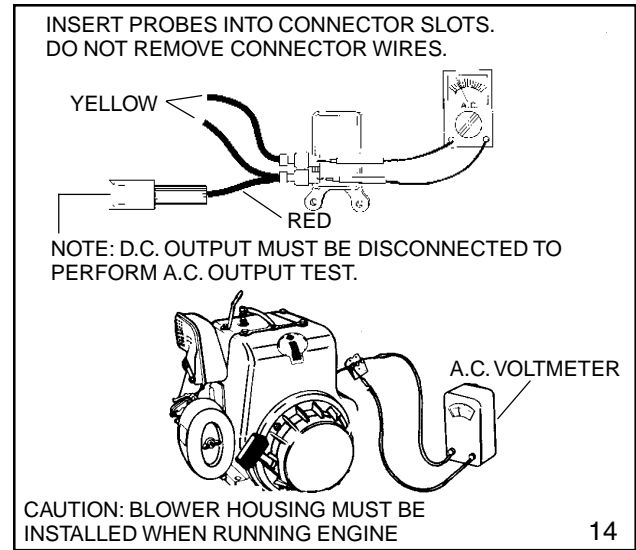
3600 R.P.M. - 28.0 Volts A.C.

If the minimum values are noted, the alternator is ok and the regulator-rectifier is defective. If less than above readings, the alternator is defective. See Chapter 9 for "Disassembly Procedure".

3 Amp D.C. 5 Amp A.C. Alternator

This unit combines a 3 Amp D.C. system used to charge a battery with a 5 Amp A.C. system used for lighting. Located in the red wire of the harness is a diode which converts the alternating current to direct current for charging the battery. The yellow wire provides the A.C. voltage for the lighting circuit.

A wire harness (part # 36588) may be added to the 3 Amp D.C. / 5 Amp A.C. charging system to power an electric clutch without the use of a battery. Test the charging system using the applicable "Checking the System" procedure listed in this section. Test the diode in the harness by using a continuity test (diag. 15) Continuity should exist in one direction only. Replace the diode if continuity exists after reversing tester leads or no continuity is found. Use the procedure for diode replacement found in the 3 AMP alternator test (diag. 12).



CHECKING THE SYSTEM: To check the system, disconnect the plug and measure the D.C. voltage at the red wire terminal (diag. 16). Measure the A.C. voltage at the yellow wire terminal. With the engine running, the minimum values should be:

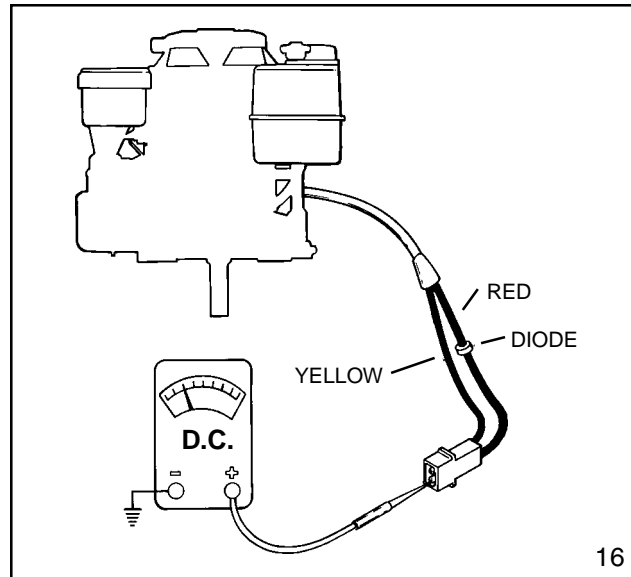
MODELS OVM/OVXL/OHV12.5

3 Amp D.C. (Red wire)

- 2500 R.P.M. - 8.0 Volts D.C.
- 3000 R.P.M. - 11.0 Volts D.C
- 3600 R.P.M. - 13.0 Volts D.C.

5 Amp A.C. (Yellow wire)

- 2500 R.P.M. - 8.5 Volts A.C.
- 3000 R.P.M. - 11.0 Volts A.C.
- 3600 R.P.M. - 13.0 Volts A.C.



MODELS OHV 13.5 - 17.0 (3/5 amp split)

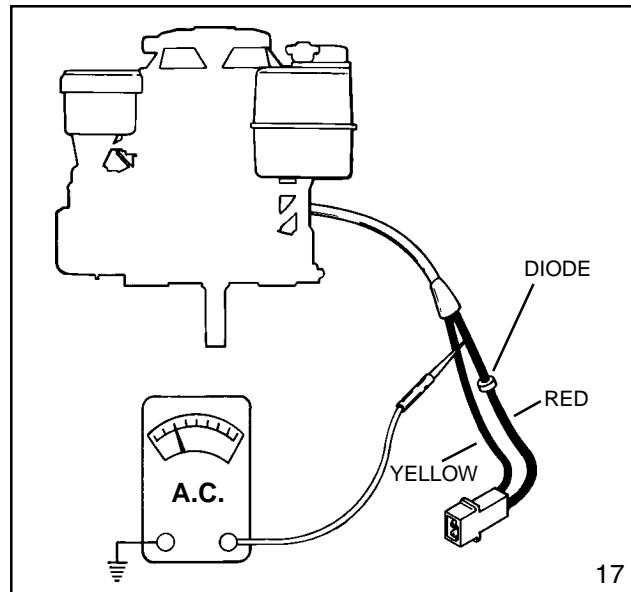
3 Amp D. C. (Red wire)

- 2500 R.P.M. - 6.5 Volts D. C.
- 3000 R.P.M. - 9.0 Volts D. C.
- 3600 R. P.M. - 11.0 Volts D. C.

5 Amp A.C. (Yellow wire)

- 2500 R.P.M. - 15.0 Volts A.C.
- 3000 R.P.M. - 18.0 Volts A.C.
- 3600 R.P.M. - 22.0 Volts A.C.

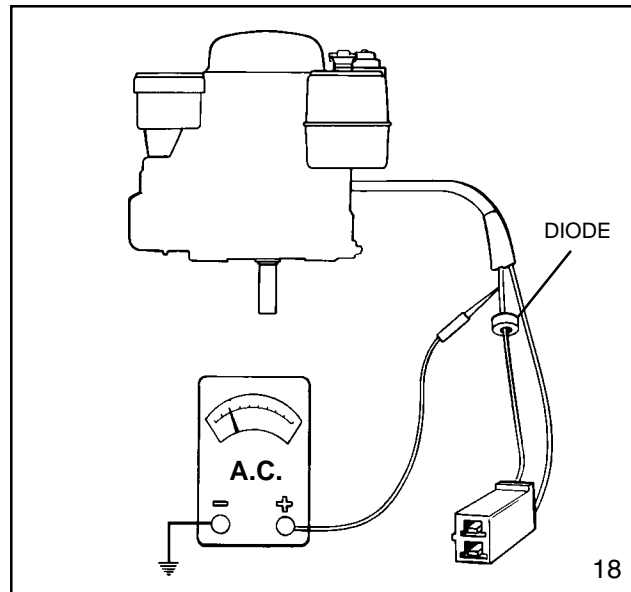
If the above minimum values are noted, the system is okay. Check for defective lights, wiring or switches. If less than above values are noted, pull back the protective shrink tubing from the diode. Using an A.C. voltmeter, check the voltage going into the diode from alternator, at the lead on the alternator side of the diode (diag.17). If low or no voltage is experienced, replace the alternator.



Models OVM/OVXL/OHV12.5 (Red between Engine and Diode)

With the engine running, the minimum values should read:

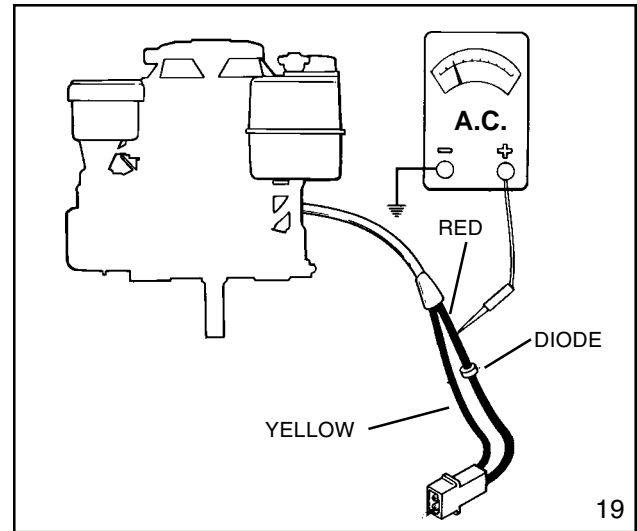
- 2500 R.P.M. - 20.0 Volts A.C.
- 3000 R.P.M. - 25.0 Volts A.C.
- 3300 R.P.M. - 26.5 Volts A.C.
- 3600 R.P.M. - 29.0 Volts A.C.



**Models OHV 13.5 - 17
(Read between Engine and Diode)**

- 2500 R.P.M. - 17.0 Volts A.C.
- 3000 R.P.M. - 21.0 Volts A.C.
- 3600 R.P.M. - 24.5 Volts A.C.

If low or no voltage is experienced, replace the alternator. If the alternator puts out the minimum A.C. voltage, replace the diode.



7 Amp D.C. Alternator System Regulator-Rectifier Under Engine Housing

In this system, the regulator and rectifier are combined in one solid state unit mounted under the blower housing of the engine.

Various types of regulator-rectifiers have been used on different applications. Test procedures for all types are the same. However, regulator styles are not interchangeable (diag. 20).

CHECKING THE SYSTEM: An open circuit D.C. voltage check cannot be made with this system. If a known good battery fails to maintain a charge, proceed to make an A.C. voltage test.

To do this, the blower housing must be removed, and the regulator-rectifier must be brought outside of the blower housing.

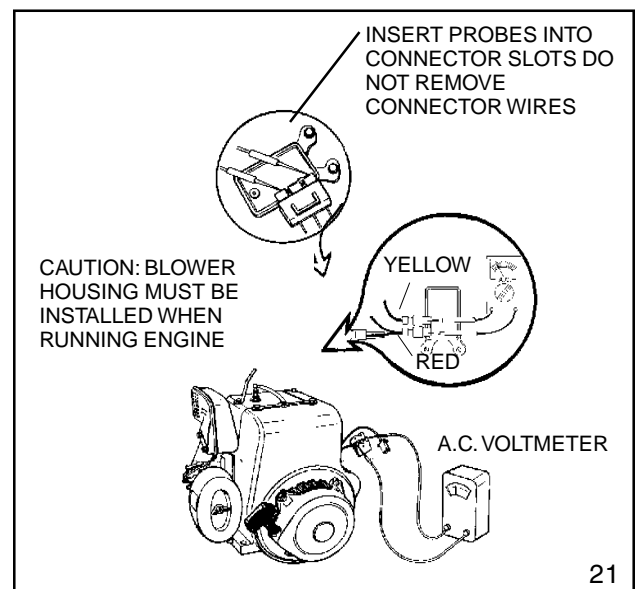
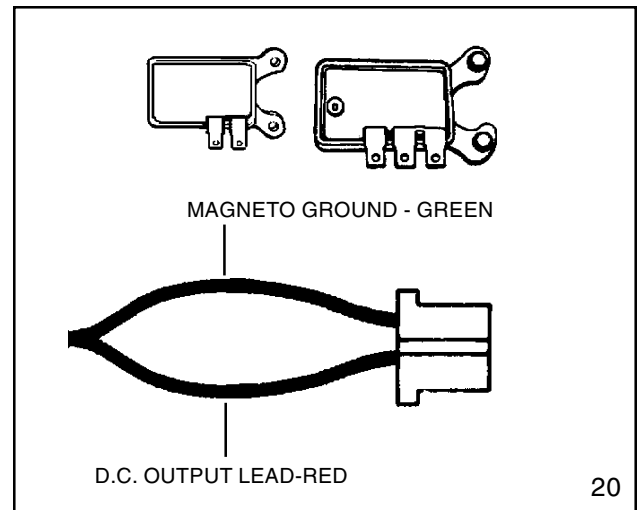
Keep the A.C. leads attached to the regulator-rectifier. Install the blower housing with the regulator-rectifier outside the housing. With an A.C. voltmeter probe the regulator as shown (diag. 21)

CAUTION: AT NO TIME SHOULD THE ENGINE BE STARTED WITH THE BLOWER HOUSING REMOVED.

With engine running, minimum A.C. voltage from lead to lead should be:

- 2500 R.P.M. - 16.0 Volts A.C.
- 3000 R.P.M. - 19.0 Volts A.C.
- 3300 R.P.M. - 21.0 Volts A.C.
- 3600 R.P.M. - 23.0 Volts A.C.

If the minimum readings are noted, the alternator is okay. If the system fails to charge a known good battery, the regulator-rectifier is defective.



10 Amp A.C. Alternator

CHECKING THE SYSTEM: Unplug the connector at the wiring harness supplied by the OEM. Proceed to make an A.C. output check. Place one lead of the A.C. voltmeter on the center plug of the connector. Place the other lead to engine ground (diag. 22).

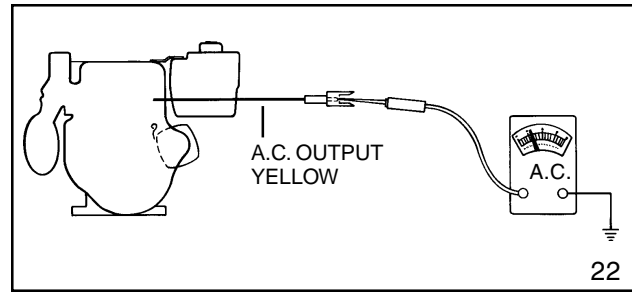
With the engine running, minimum values should read:

2500 R.P.M. - 16.0 Volts A.C.

3000 R.P.M. - 20.0 Volts A.C.

3300 R.P.M. - 22.0 Volts A.C.

If less than above output, the alternator assembly is defective. See Chapter 9 for "Disassembly Procedure".



16 Amp Alternator System with External Regulator

CHECKING THE SYSTEM: An open circuit D.C. voltage check cannot be made with this system. If a known good battery fails to maintain a charge, proceed to make an A.C. voltage test.

Disconnect the red D.C. output connector at the wiring harness and connect the probes from an A.C. voltmeter to the wire terminals at the regulator-rectifier.

With the engine running, minimum values should read:

2500 R.P.M. - 21 Volts A.C.

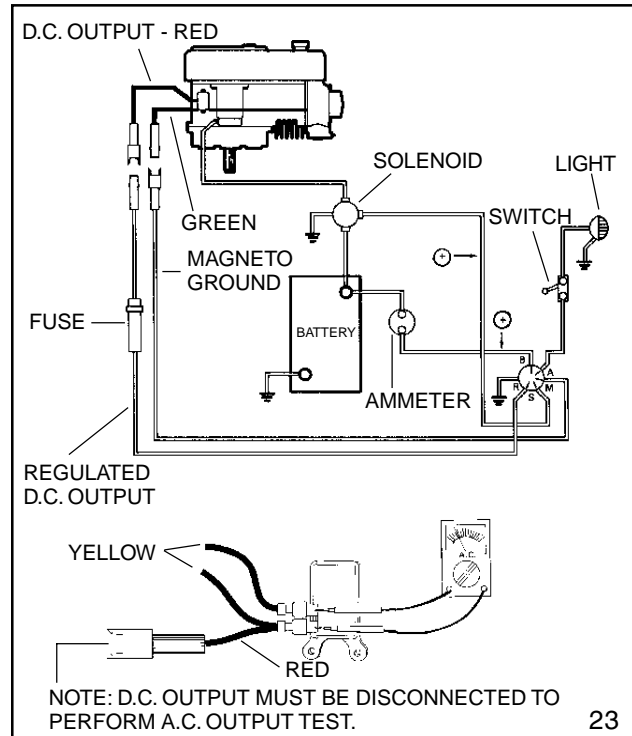
3000 R.P.M. - 26.5 Volts A.C.

3600 R.P.M. - 31.0 Volts A.C.

If the minimum values are noted, the alternator is operating properly. If less than the above values are noted, the alternator is defective.

VOLTAGE REGULATORS

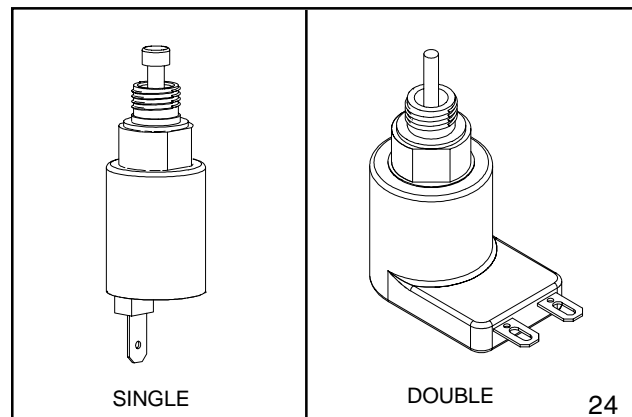
If a known good or load tested battery fails to maintain a charge, the charging system and the regulator can be checked using a voltmeter. Set the voltmeter on the 0-20 Volt D.C. scale and connect the probes across the battery terminals. Note the battery voltage. Start the engine, the voltage reading should increase from the noted battery voltage but not exceed 15 Volts D.C. If no voltage increase is noted, proceed to make an A.C. voltage check using the applicable procedure. If the battery voltage exceeds 15 Volts D.C., or the proper minimum A.C. voltage is noted during the check, replace the regulator (diag. 23).



FUEL SHUT-DOWN SOLENOIDS

If the engine is running, the solenoid can be checked by removing the electrical plug-in at the base of the solenoid. Almost immediately the engine should shut down, if not replace the solenoid.

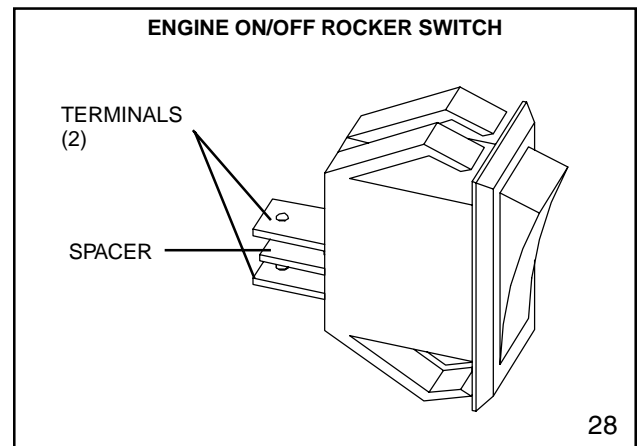
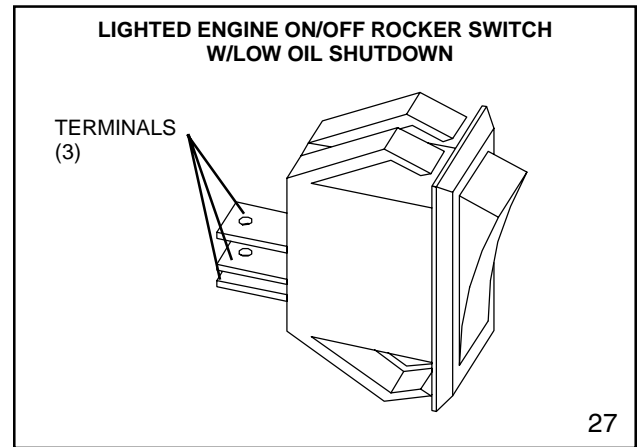
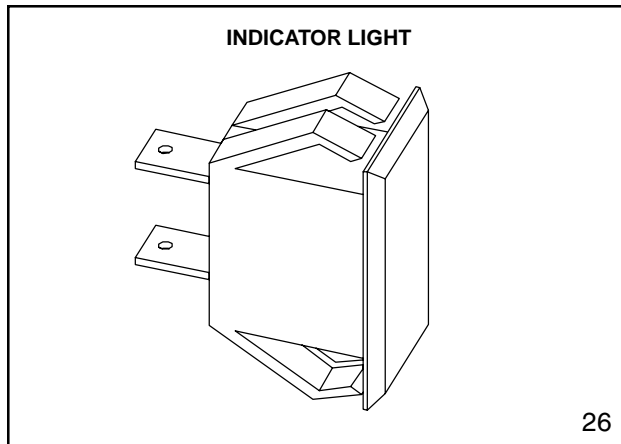
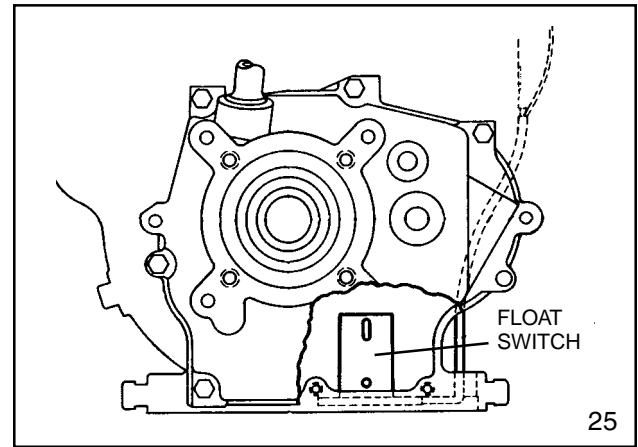
Test the solenoid off the carburetor by applying 12 volt D.C. from the battery positive terminal to the (or one) solenoid terminal. Connect a jumper wire from the metal housing (or other terminal) to a negative battery terminal. The plunger should retract the full travel distance. Disconnect the negative jumper lead and the plunger should return to the extended position. Replace if necessary (diag. 24).



LOW OIL SHUTDOWN SWITCHES

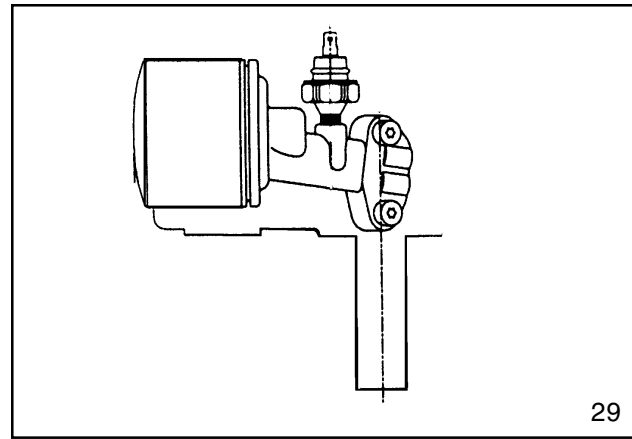
Check the LOS switch while it is in the engine. The engine must be level, and the oil level at the full mark. Place the speed control in the run position. Remove the spark plug wire from the spark plug. Install a gap type tester connected to the spark plug wire and a good engine ground. Spin the engine over using the electric or recoil starter. A bright blue spark should be seen at the tester. If not, remove the blower housing and disconnect the LOS lead from the ignition module. Reinstall the blower housing and spin the engine over. If spark occurs now, replace the LOS switch. If no spark is seen, replace the ignition module.

If equipped, the indicator light will flash if the oil level is at or below the add mark and the engine is turned over while attempting to start. Test by turning the engine over with the oil level below the add mark. If the indicator light does not flash, replace the indicator light.



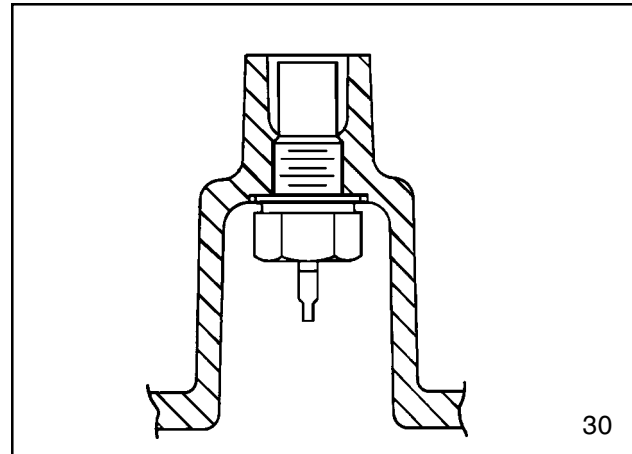
LOW OIL PRESSURE SENSOR

Test the sensor on a running engine using an ohmmeter or continuity tester with one tester lead connected the sensor terminal (with lead wire removed) and the other to an engine ground. An open circuit should be found with the engine running and continuity should exist when the engine is shut off. If continuity is found or the tractor oil pressure indicator light is on or comes on at low engine RPM's, remove the sensor and check engine oil pressure with a master oil pressure gauge. The oil pressure of a running engine should be above 10 p.s.i. (.700 bar). If lower than 10 p.s.i. (.700 bar), an internal engine problem exists (diag. 29).



LOW OIL SENSOR

This sensor must use a # 194 bulb in series with the sensor for proper operation and to prevent sensor damage. Remove the sensor from the engine and attach the electrical plug. Attach a jumper lead from an engine ground to the threaded portion of the sensor. Place the keyswitch in the run position. The indicator light should come on with the tip of the sensor in air and go off when oil covers the sensor tip. The response time of the sensor is between 5 and 15 seconds with 13 volts D.C. at the battery. Lower battery voltage will result in a longer response time. Use teflon-type pipe sealant on the sensor threads to prevent oil leakage when reinstalling (diag. 30).

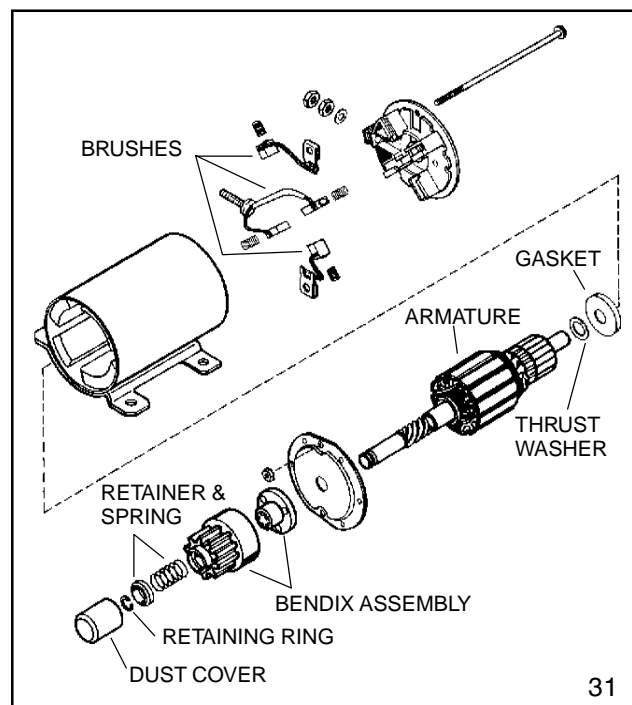


ELECTRIC STARTER SERVICE

This section covers the service procedures for the 12 and 120 volt electric starters. For diagnosis of the starting circuit see "Electrical Starter Troubleshooting" in this chapter. Illustrations may not be identical in configuration to the starter being serviced, but procedures and tests apply unless otherwise stated. Starters labeled UL listed/ CSA approved are serviceable. Starters labeled CSA cannot be serviced, only replaced. If a starter is serviced, the "O" rings on each end of the housing must be replaced.

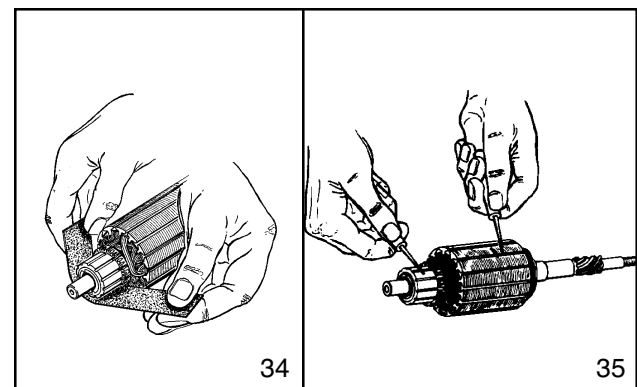
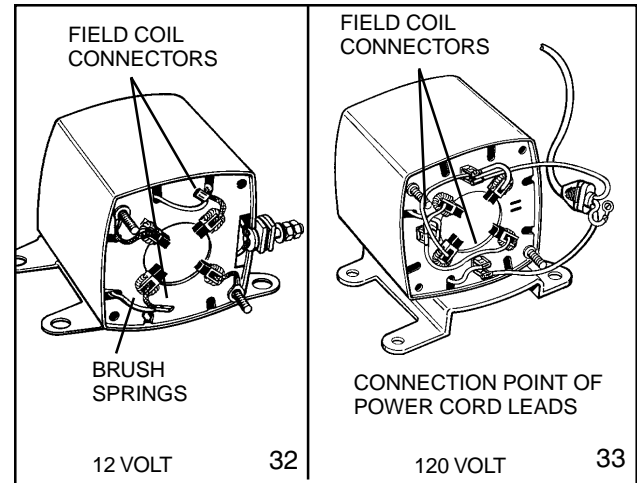
12 VOLT or 120 VOLT ELECTRIC STARTERS

1. Remove the plastic dust cover on the bendix end (diag. 31).
2. Push down the spring retainer and remove the retainer ring.
3. Slide off the spring retainer, anti-drift spring, gear, and drive nut.
4. If internal service is necessary (non-CSA) starters only, scribe a line across the cap assemblies and armature housing to aid in reassembly.
5. Remove the two or four retaining nuts from the through bolts holding the cap assembly.
6. Slide off the cap assembly. The terminal insulator slides out of the commutator cap (some models).
7. Remove the armature.
8. Inspect and replace as necessary, see the section "Inspection and Repair" later in this chapter. Use the reverse procedure for assembly. (For ease of assembly, place the armature into the brush end of the frame first.)



Inspection And Repair

1. The pinion gear parts should be checked for damage or wear. If the gear does not engage or slips, it should be washed in solvent (rubber parts cleaned in soap and water) to remove dirt and grease, and dried before reassembly. Also check the armature and drive nut splines for wear or damage. Replace parts as necessary.
2. The brushes and brush card holder should be checked for wear. With the armature in place and the brushes engaging the commutator surface, check the brushes for wear. Brushes should be replaced if the brush wire approaches the bottom of the brush holder slot. Brush springs must exhibit enough strength to keep tension on the brushes and hold them on the commutator.
3. The field windings can be checked using a continuity light or ohmmeter. Attach one lead to each field coil connection. Continuity should exist between each field coil connection, and no continuity should exist between the field coil connections and the starter housing (diag. 32 & 33).
4. The armature should be checked for glazing or wear. If necessary the armature can be turned down in a lathe. While rotating, polish the commutator bars using a piece of 00 sandpaper (diag. 34). Light pressure and back and forth movement should be used. Recut the commutator bars to a depth equal to the width of the insulators between the bars. Check for continuity between the copper commutator bars and the iron of the armature, none should exist (diag. 35).



Brush Card Replacement

1. Loosen but do not remove the two nuts on the starter terminal post.
2. Remove the nuts holding the end cap in place. Remove the end cap and the thrust washer.
3. Grasp the thru bolts using a vise grip positioned as close to the flanged end as possible to prevent thread damage. Remove the two nuts holding the driving end cap in place. Remove the armature and driving cap assembly, followed by the two thru bolts. Notice the position of the brush ground eyelet under the thru bolt flange.
4. Note or mark the position of the connectors of the brush wires. Use a wire cutter to clip the solid field wires as close to the connectors as possible.
5. Note or mark the brush card in the starter housing, and remove the brush card assembly. Clean the accumulated dirt off all starter parts. Scrape the insulating varnish off the last 1/2" (12.7 mm) of the solid field wires.
6. Insert the new brush card into position while guiding the solid field wires through the proper slots in the brush card.
7. Crimp and solder the brush leads to the solid field wires. Use a needle nose pliers or vise grip to hold the woven brush lead close to the connector while soldering. This prevents solder and heat from flowing up the brush lead. Insulate the crimped connection nearest the starter terminal post using electrical tape or heat shrink tubing. Route the wires to prevent damage during assembly.
8. Install the armature into the housing while spreading the brushes. Install the thru bolts while checking to make sure the bolts go thru the ground brush eyelet terminals. Install and tighten the drive end thru bolt nuts, but do not overtighten.
9. Install the thrust washer on the end of the armature and the install the starter end cap. Secure the cap with the locking nuts and tighten the nut on the starter terminal post. Rotate the armature by hand to check for binding before installation on the engine.

CHAPTER 7 FLYWHEEL BRAKE SYSTEMS

GENERAL INFORMATION

Tecumseh's brake systems are required to meet compliance standards which has become a federal law as of June 30, 1982. Listed below are two methods used by original equipment manufacturers to meet compliance standards.

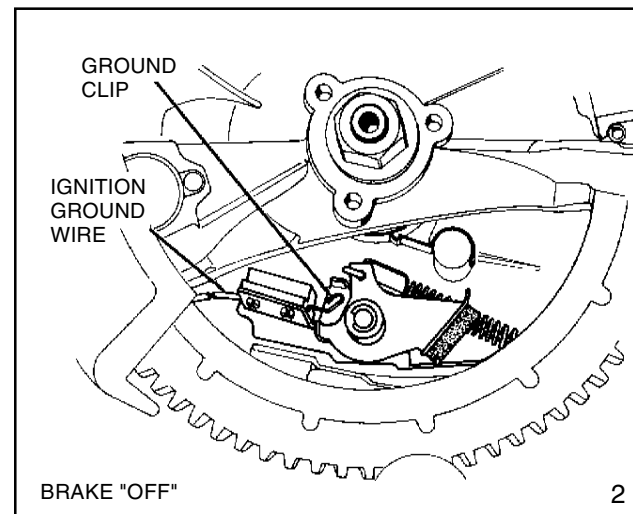
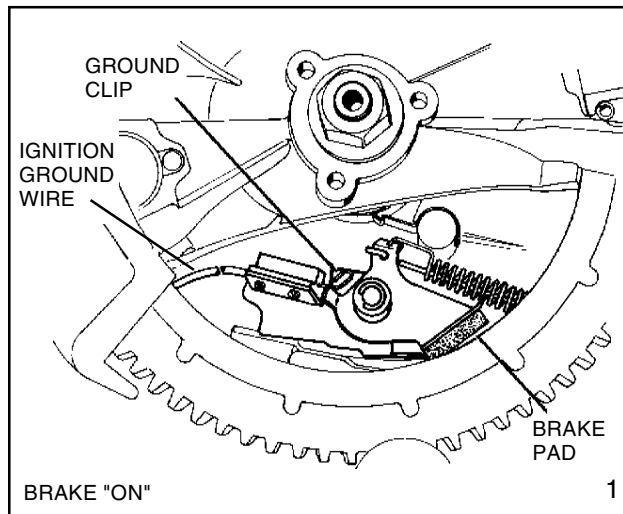
1. Use of the blade brake clutch in conjunction with a top mounted recoil starter or 12 volt electric starter. The blade must stop within three seconds after the operator lets go of the blade control bail at the operator position and the engine continues to run. Starter rope handle is either on the engine or on the equipment handle.
2. Use of a recoil starter with the rope handle on the engine as opposed to within 24 inches (61 cm) of the operator position. This method is acceptable if the mower deck passes the 360 degree foot probe test. A specified foot probe must not contact the blade when applied completely around the entire blade housing. This alternative can be used with engine mounted brake systems and typical bail controls. The blade must stop within three seconds after the operator lets go of the engine/blade control bail at the operator position and the engine is stopped.

Tecumseh's flywheel brake system provides consumer safety by killing the engine and stopping the lawnmower blade within three seconds after the operator releases the engine/blade control bail at the handle of the lawnmower. This system is available on recoil and electric start models. The engine stopping time is affected by the engine R.P.M. Consult microfiche card # 30, the Plus 1 or Parts Smart Look-up system, or Service Bulletin # 107 to determine the correct engine speed or blade tip speed.

OPERATION

In the stop position the brake pad is applied to the inside edge of the flywheel, at the same time the ignition system is grounded out (diag. 1).

In order to restart the engine, the engine/blade control bail must be applied. This action pulls the brake pad away from the inside edge of the flywheel and opens the circuit to the ignition ground out terminal. On electric start systems the starter is energized by an ignition/start switch or a two motion control. On nonelectric start systems, the recoil starter rope must be pulled to start the engine (diag. 2).



COMPONENTS

The brake bracket assembly consists of a replaceable brake lever and pad, an ignition kill switch, and a tension spring (diag. 3). Late production brake brackets are serviced as a complete assembly.

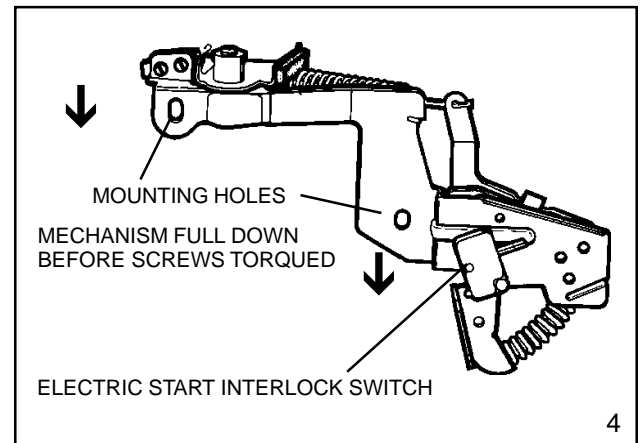
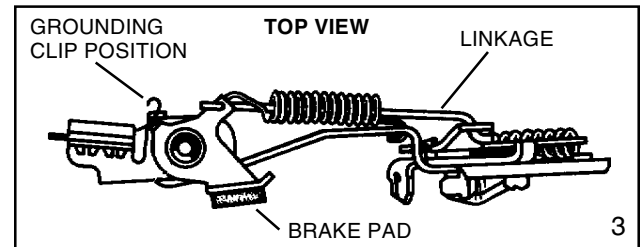
The **ignition ground terminal** is a plastic block with a wire extending out of it. The wire is connected to the ignition ground out spade on the solid state module. The brake lever contacts the wire of the ignition ground terminal when the engine/blade control bail is released, and the ignition module is grounded. This stops the solid state module from firing the spark plug (diag. 3).

The **interlock switch** is a push button switch that is activated by the brake lever when the engine/blade control is actuated. If there is a electric starter switch used to start the engine, the interlock switch acts as a safety switch and will not allow the starter to crank unless the engine/blade control bail is depressed.

Where a two motion control is used the interlock switch is utilized as the starter switch.

The **brake spring** supplies the pressure to the brake lever and brake pad to stop the flywheel.

The **control cable** transfers the motion of the engine/blade control bail to the brake system.



SERVICE

Service on part or all of the flywheel brake assembly will require a partial disassembly of the engine to allow the flywheel and brake bracket to be removed.

Remove the necessary components using steps 1-8 as outlined in Chapter 9 under "Disassembly".

BRAKE BRACKET ASSEMBLY

Late production brake brackets are serviceable only by installing a complete brake bracket assembly.

On serviceable brake brackets, continue by removing the alignment tool. Release the spring tension by unhooking the short end of the spring from bracket with a pliers. Remove the "E" clip from the brake pad shaft. Slide the pad lever from the shaft and unhook the link. Inspect the brake pad for dirt, oil or grease contamination. If the pad is contaminated, or if there is less than .060" (1.524 mm) thickness of brake pad material at the pad's thinnest point, replacement is necessary. The brake pad is bonded to the brake lever and must be replaced as an assembly. Rehook the link, install the brake lever and pad assembly, install the "E" clip, rehook the short end of the spring and continue to reassemble the brake system in the reverse order of disassembly.

IGNITION GROUNDOUT TERMINAL

Inspect the terminal grounding wire for proper alignment and contact with the brake arm. Insure that all electrical connections are clean and secure (diag. 5).

STARTER INTERLOCK SWITCH

The engine/blade control must close the interlock switch before the starter can be engaged. To check the interlock switch, use an ohmmeter or continuity light to perform a continuity check. Disconnect the wires off the switch before performing a continuity check. Continuity should exist between the two terminals when the interlock switch button is completely depressed. No continuity should exist when the button is released. If the switch fails replace the switch (diag. 6).

To replace the interlock switch, carefully grind the heads off of the rivets that fasten the interlock switch to the brake bracket. Remove the rivets from the back side of brake bracket. Use the self-tapping screws supplied with the new switch to make threads in the bracket. Install the interlock switch onto the brake bracket in the proper position and secure the switch to the brake bracket with the machine screws supplied. Be careful not to overtighten the screws as switch breakage can occur (diag. 6).

CONTROL CABLE

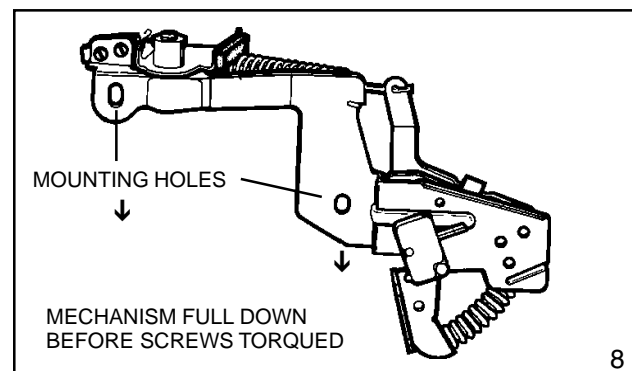
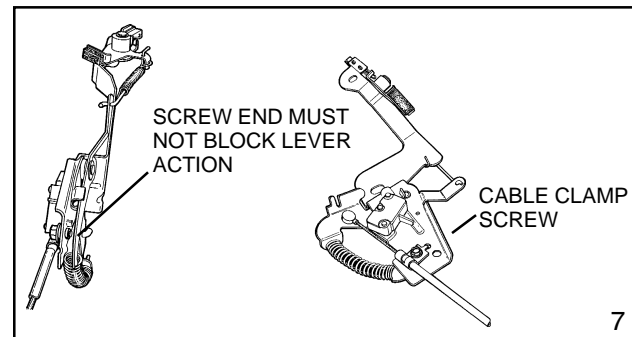
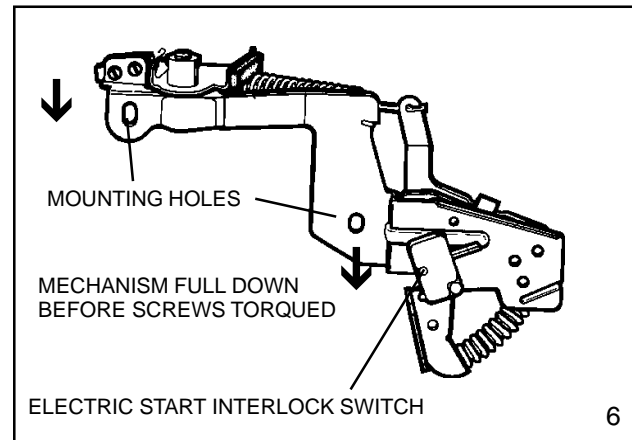
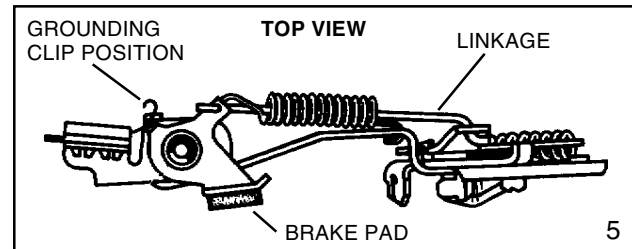
If replacing the cable conduit screw with a screw other than a service part replacement, be certain that the screw length is not too long as to prevent free travel of the lever.

Make sure the button on the starter interlock switch is completely depressed when the control is fully applied. The cable must provide enough travel so the brake will contact the flywheel. Some slack should exist in the cable adjustment to compensate for brake pad wear (diag. 7).

BRAKE BRACKET REPLACEMENT

When installing a inside edge brake bracket assembly, be sure the slotted holes in the brake bracket are all the way down on the fasteners. This will properly align the brake bracket to the flywheel brake surface (diag. 8).

When completed, check for less than 3 second stop time.



CHAPTER 8 IGNITION

GENERAL INFORMATION

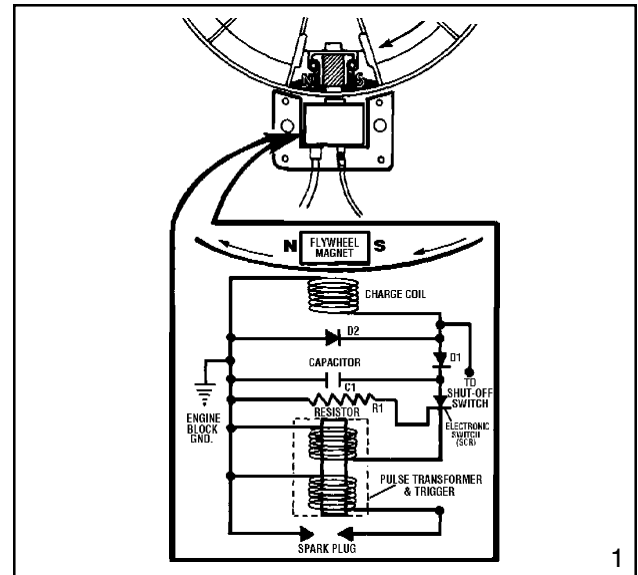
Overhead valve four cycle Tecumseh engines use solid state capacitor discharge modules to provide high voltage to fire the spark plug. This is an all electronic ignition system with all the components located outside the flywheel. The modules look similar but are not interchangeable. If necessary, the correct replacement module should be found using the Master Technician's Parts Manual.

The solid state ignition system consists of flywheel magnets and a flywheel key, charge coil, capacitor, a silicon controlled rectifier, pulse transformer, trigger coil, high tension lead, and a spark plug. Everything except the flywheel magnets, key and the spark plug are located in a encapsulated ignition module. This solid state (CDI) module is protected by epoxy filler from exposure to dirt and moisture. This system requires no maintenance other than checks of the high tension lead and spark plug.

OPERATION

SOLID STATE IGNITION SYSTEM (CDI)

As the magnets in the flywheel rotate past the charge coil, electrical energy is produced in the module. The energy is stored in the capacitor (approx. 200 volts) until it is released by an electrical switch (SCR). As the magnet continues to rotate, it passes past a trigger coil where a low voltage signal is produced. This low voltage signal closes the SCR switch, allowing the energy stored in the capacitor to flow to a transformer where the voltage is increased from 200 volts to 25,000 volts. This voltage follows along the high tension lead to the spark plug where it arcs across the electrodes and ignites the air-fuel mixture (diag. 1).

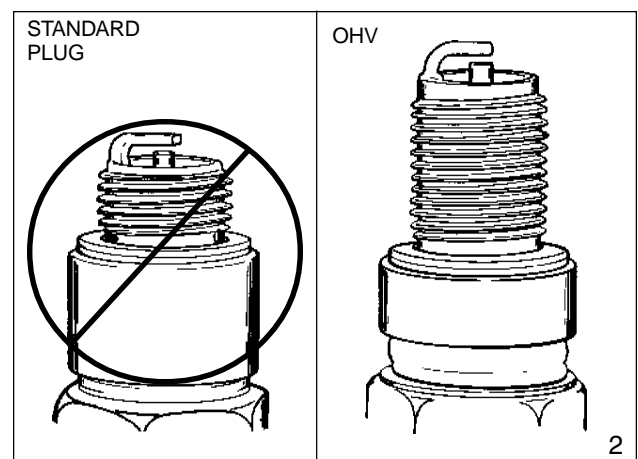


COMPONENTS

The **solid state module** is a complete unit that includes the laminations and spark plug wire.

The **spark plug** is made up of two electrodes. The outside electrode is grounded and secured to the threaded sleeve. The center electrode is insulated with porcelain. The two are separated by an air gap which creates a resistance. A large voltage from the module arcs the air gap which causes a spark and ignites the air-fuel mixture in the cylinder (diag.2).

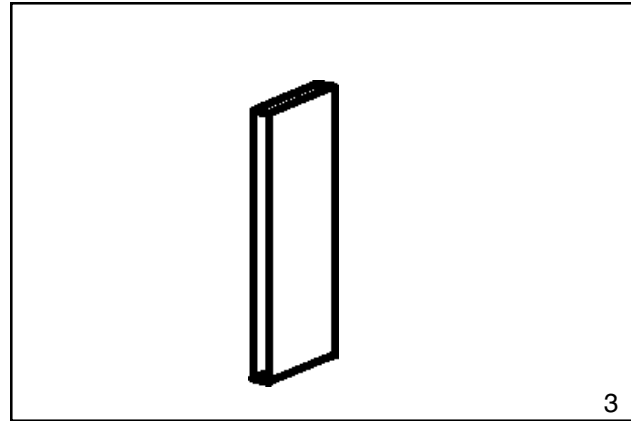
NOTE: Always consult parts manual for correct plug and reach.



The **flywheel** with magnets provide the magnetic flux (or field) which is necessary to induce voltage and trigger the module to provide spark.

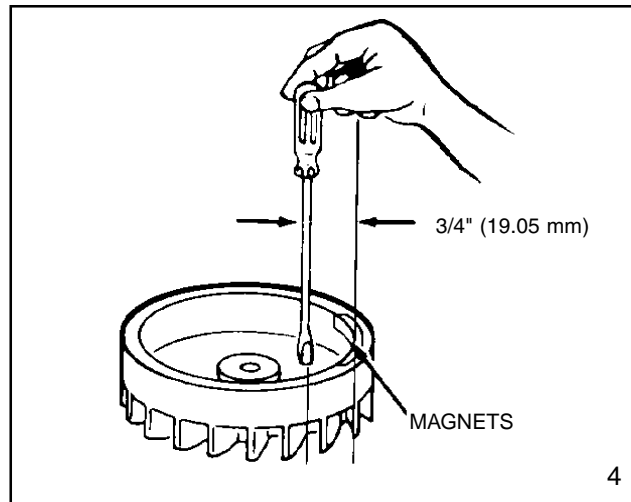
The **flywheel key** locates the flywheel to the crankshaft in the proper position for ignition timing. If a flywheel key is sheared, or partially sheared, the engine will not start or can be difficult to start (diag. 3).

NOTE: Always replace flywheel keys by Model and Specification Number. Tecumseh has some keys that look similar but affect ignition timing.



TESTING PROCEDURE

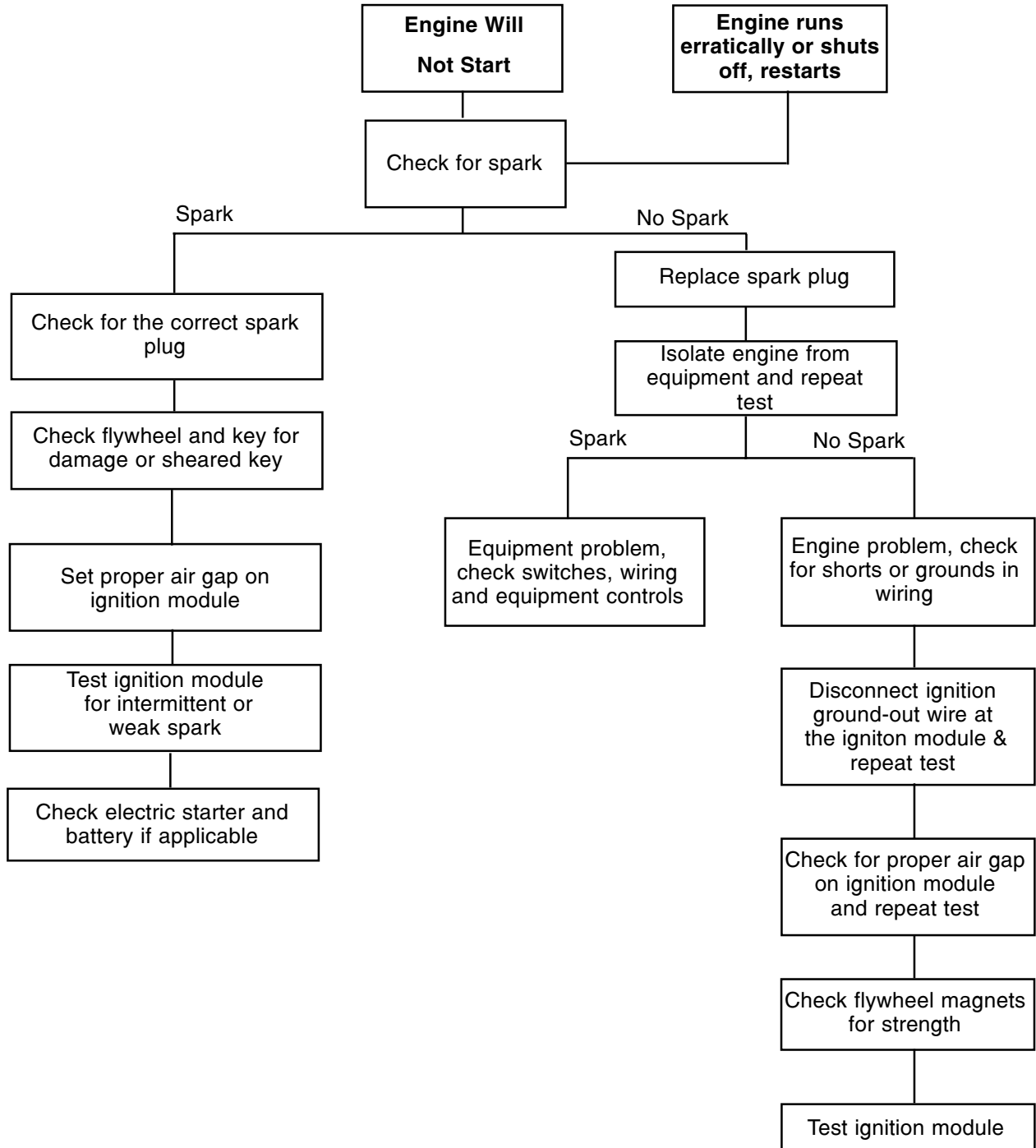
1. Check for spark using a commercially available spark tester and following the tester's recommended procedure.
2. Check the spark plug for cracks in the porcelain, pitted or burned electrodes, excessive carbon buildup, and proper .030" (.762 mm) air gap setting. Replace if questionable. Try to start and run the engine. If the engine will not start or run properly proceed to step #3.
3. Attach the spark plug wire to the spark plug tester and ground the tester as in step #1. Remove the blower housing, disconnect the ignition grounding lead at the ignition module. Reinstall the blower housing and crank the engine over. If spark occurs, check the ignition switch, safety interlock switches, or electrical wiring for shorting to ground.



4. Check the air gap between the flywheel magnets and the laminations of the ignition module. It should be .0125" (.3175 mm) or use gauge part # 670297.
5. Check the flywheel magnets for the proper strength using this rough test. Hold a screwdriver at the extreme end of the handle with the blade down, move the blade to within 3/4 inch (19.05 mm) of the magnets. If the screwdriver blade is attracted to the magnets, the magnetic strength is satisfactory (diag. 4).
6. Examine the ignition module and lamination assembly for cracks in insulation or other damage, which would cause shorts or leakage of current.
7. Check the operation of the ignition module using an approved tester following the instructions furnished with the test unit, or booklets offered by the Tecumseh Products Co. Engine and Transmission Group Service Division.

Ignition modules are permanently attached to the lamination and must be serviced as an assembly.

FOUR CYCLE IGNITION TROUBLESHOOTING



SERVICE

To remove the ignition module or the flywheel from the engine, see Chapter 9 under "Disassembly".

SPARK PLUG SERVICE

Spark plugs should be removed, cleaned, and adjusted periodically.

Check the air gap with a spark plug gap gauge and adjust accordingly. Set the spark plug gap at .030" (.762 mm) (diag. 5).

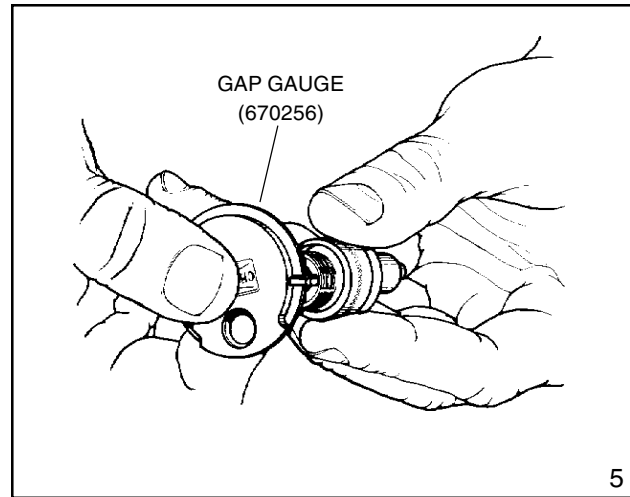
Replace the plug if the points on the base of the plug are pitted or burned, or if the porcelain is cracked anywhere.

When reinstalling the plug make sure it is clean of all foreign material.

NOTE: DO NOT USE A SAND BLASTER TO CLEAN PLUGS, MICROSCOPIC PARTICLES LEFT IN THE PLUG CAN SCORE THE ENGINE CYLINDER DURING OPERATION. USE A SOLVENT AND A WIRE BRUSH TO CLEAN, AND USING EYE PROTECTION, BLOW OUT THOROUGHLY WITH COMPRESSED AIR.

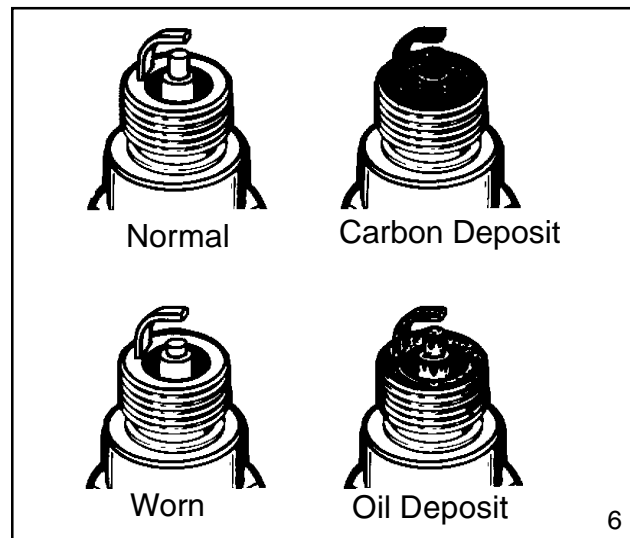
When replacing a spark plug consult the parts breakdown for the correct spark plug to be used in the engine being serviced.

Install the spark plug in the engine and tighten it to 180 inch pounds (20.5 Nm) torque. If a torque wrench is not available, screw the spark plug in as far as possible by hand, and use a spark plug wrench to turn the spark plug 1/8 to 1/4 of a turn further if using the old spark plug, or 1/2 of a turn further if using a new spark plug.



CONDITIONS CAUSING FREQUENT SPARK PLUG FOULING

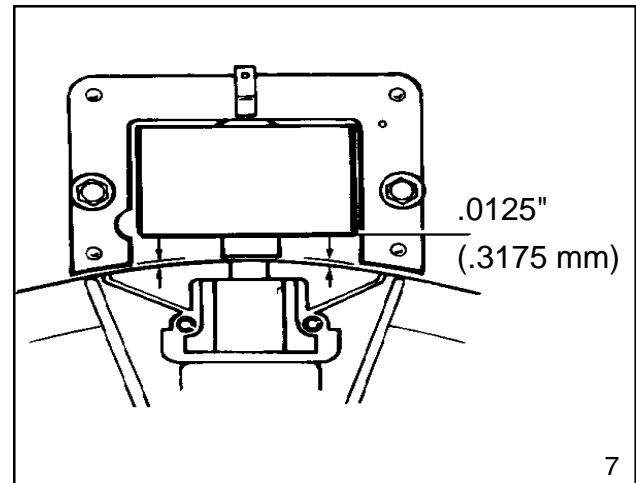
1. Carburetor setting is too rich or the air cleaner is restricted.
2. Partially closed choke shutter.
3. Poor grade of gasoline.
4. Improper fuel.
5. Restricted exhaust system.
6. Incorrect spark plug.
7. Incorrect spark plug gap.
8. Oil level is too high, or the breather is restricted.
9. Faulty piston rings.
10. Weak ignition system.



IGNITION TIMING CHECK

In order for an engine to run effectively and efficiently, the spark must ignite the compressed air-fuel mixture when the piston is in a specific position to deliver maximum power. This position is known as Before Top Dead Center (BTDC). If the mixture is ignited too soon, kickback can be experienced due to preignition. If the mixture is ignited too late, loss of power can be experienced due to retarded spark. A partially sheared or the wrong flywheel key can cause kickback, loss of power, or an inability to start the engine with a good spark. Check the flywheel key if one of these symptoms exist. See Chapter 9 under "Service" for the disassembly procedure.

Timing on a solid state module is not adjustable. The air gap check consists of having the proper .0125" (.3175 mm) air gap gauge, part # 670297 between the flywheel magnets and the laminations of the module while tightening the mounting screws to the proper torque. Remove the air gap gauge and rotate the flywheel to check for any possible striking points. If none are found, the air gap is set correctly and the air gap check is completed (diag. 7).



SERVICE TIPS

DO NOT:

- Interchange flywheels, flywheel keys, or spark plugs.
- Use flywheels with cooling fins that are broken off.
- Use a standard business card as an air gap gauge.
- Attempt to reglue the spark plug lead back into a solid state module.
- Store a solid state module within 20 feet (6.1 meters) of an unshielded welder.

CHAPTER 9 INTERNAL ENGINE AND CYLINDER

GENERAL INFORMATION

This chapter covers the cylinder block, piston and rod assemblies, cylinder head, crankshaft, camshaft, valve train, breather, cylinder cover, flywheel, counterbalance systems, and lubrication systems. The governors and the governor systems are covered in Chapter 4.

All Tecumseh engines covered in this manual are four cycle engines with the valves in the engine head. The crankshaft position is designated as either horizontal or vertical as the engine rests on its base. The engines identified by decals or model as XL (Extra Life) or XL/C (Extra Life / Commercial) are made using aluminum alloy diecast around a cast iron cylinder liner. However, not all engines with cast iron cylinder liners are identified as XL or XL/C.

OPERATION

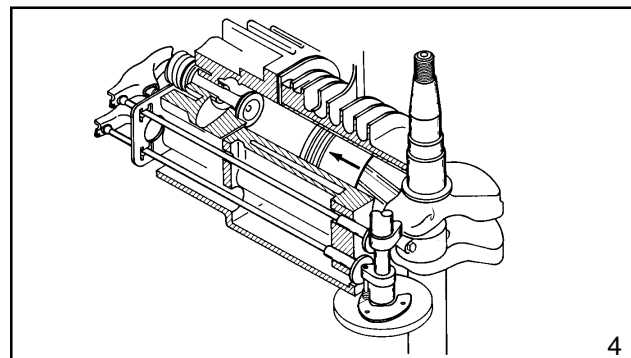
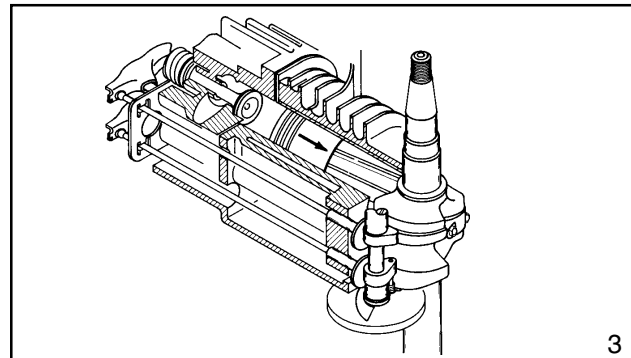
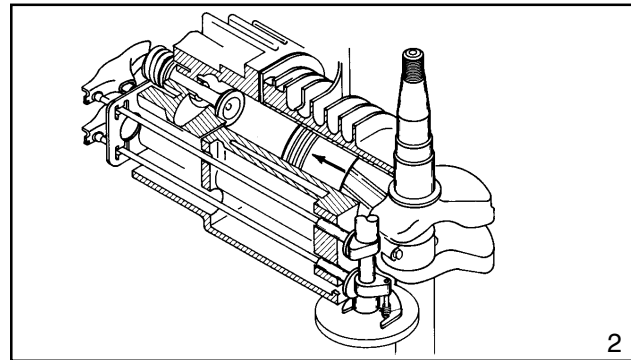
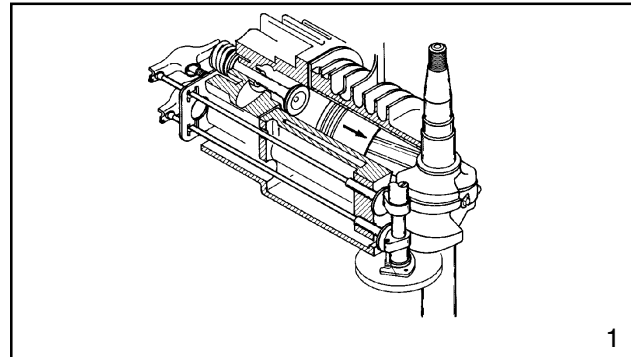
4-CYCLE ENGINE THEORY

All 4-cycle engines require four piston strokes or cycles to complete one power cycle. The flywheel or the equipment load on the crankshaft provides the inertia to keep the engine running smoothly between power strokes.

The engine camshaft gear is twice as large as the mating gear on the crankshaft to allow proper engine valve timing for each cycle. The crankshaft makes two revolutions for every camshaft revolution.

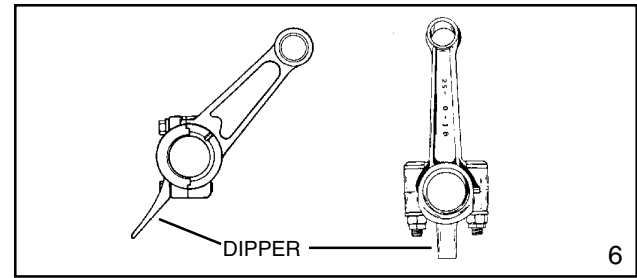
1. **INTAKE.** The intake valve is open and the exhaust valve is closed. The piston is traveling downward creating a low pressure area, drawing the air-fuel mixture from the carburetor into the cylinder area above the piston (diag. 1).
2. **COMPRESSION.** As the piston reaches Bottom Dead Center (BDC) the intake valve closes. The piston then rises, compressing the air-fuel mixture trapped in the combustion chamber due to both valves being closed (diag. 2).
3. **POWER.** During this piston stroke both valves remain closed. As the piston reaches the Before Top Dead Center (BTDC) ignition point, the spark plug fires, igniting the air-fuel mixture. In the time it takes to ignite all the available fuel, the piston has moved to Top Dead Center (TDC) ready to take the full combustive force of the fuel for maximum power during downward piston travel. The expanding gases force the piston down (diag. 3).
4. **EXHAUST.** The exhaust valve opens. As the piston starts to the top of the cylinder, the exhaust gases are forced out (diag. 4).

After the piston reaches Top Dead Center (TDC), the four cycle process will begin again as the piston moves downward and the intake valve opens.

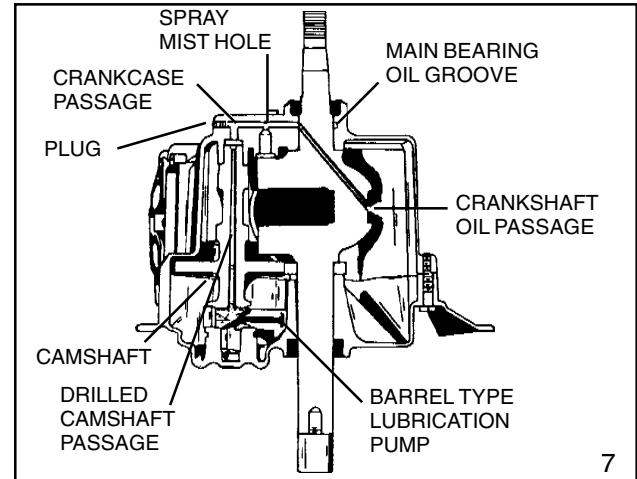


LUBRICATION SYSTEMS

The lubrication system used with all Tecumseh horizontal crankshaft engines covered in this manual utilize a splash type system. An oil dipper on the connecting rod splashes oil in the crankcase to lubricate all internal moving parts. The oil dipper is either bolted on or may be cast on to the cap with one of the rod bolts (diag. 6).

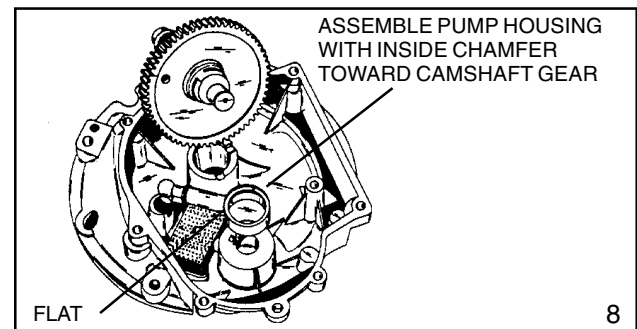


All vertical shaft engines use a positive displacement plunger oil pump or a rotary oil pump. Oil is pumped from the bottom of the crankcase, up through the camshaft and over to the top main bearing. Oil under pressure lubricates the top crankshaft main bearing and camshaft upper bearing (diag. 7). A crankshaft drilling also provides oil to the crankpin journal on engine models OHV 13.5 - 16.5.

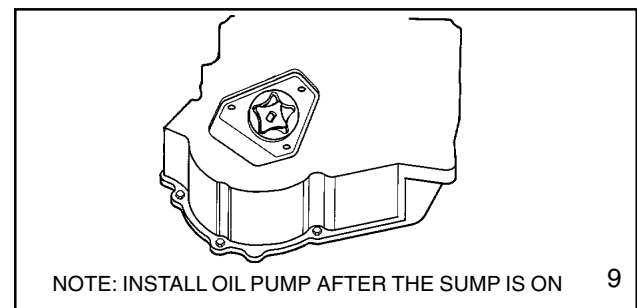
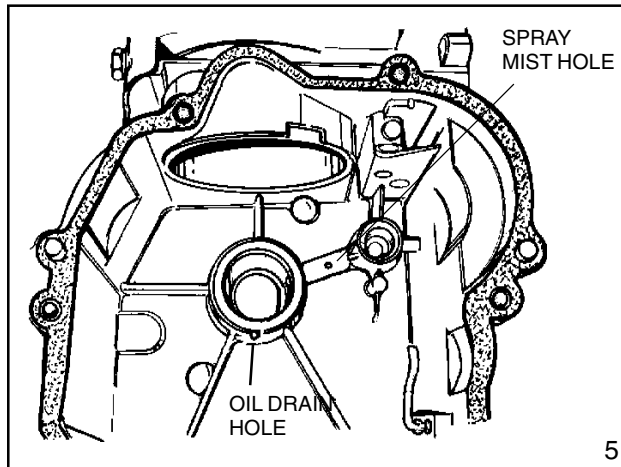


On all Tecumseh vertical shaft 4-cycle engines, the oil is sprayed out under pressure through a small hole between the top camshaft and crankshaft bearing to lubricate the piston, connecting rod, and other internal parts (diag. 5).

The plunger style oil pump is located on an eccentric on the camshaft. As the camshaft rotates, the eccentric moves the barrel back and forth on the plunger forcing oil through the hole in the center of the camshaft. The ball on the end of the plunger is anchored in a recess in the cylinder flange (diag. 8).

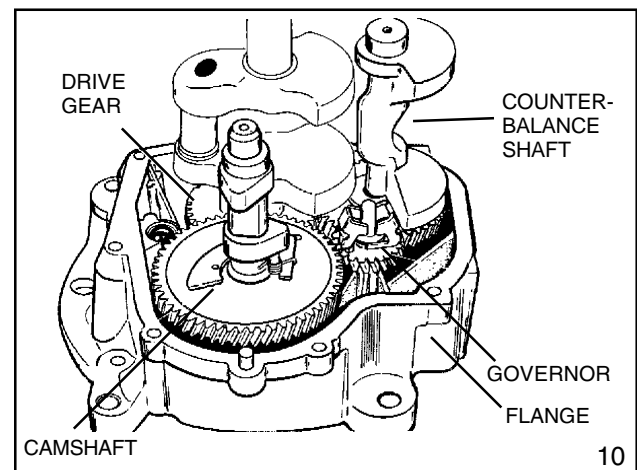


The rotary pump is driven by the camshaft. It uses a lobed gear in a rotating ring to provide positive oil displacement (diag. 9).



COUNTERBALANCE SYSTEMS

Some Tecumseh engines may be equipped with an Ultra-Balance® counterbalance system. This system uses a single weighted shaft that is driven off the crankshaft. This shaft's function is to counteract the imbalance caused by the counterweights on the crankshaft (diag. 10).



A dual shaft counterbalance is also used on some engine models. A gear on the crankshaft drives the counterbalance with the thicker gear, which in turn drives the second counter balance shaft. For timing of either counterbalance system, see " Engine Assembly Procedure " in the Service section of this chapter.

COMPONENTS

The **cylinder block** houses the piston, crankshaft, and along with the cylinder cover all the internal components. The block is a one piece diecast aluminum alloy cylinder casting which may have a cast iron liner (diag. 10).

The **piston** transmits the force of the burning and expanding gases through the connecting rod to the crankshaft.

The **piston rings** provide the seal between the cylinder wall and the piston. The rings keep the combustion pressures from entering the crankcase and also wipe the oil off the cylinder wall and return it to the sump.

The **connecting rod** assembly is the link between the piston (piston pin) and the crankshaft.

The **cylinder head** is a one piece aluminum alloy casting that is bolted to the top of the cylinder block. The overhead design contains all of the valve train except for the camshaft, lifters, and push rods.

The **crankshaft** converts the up and down piston movement to the rotational force (torque) by an offset crankpin or rod journal.

The **camshaft** lobes push the lifters at the proper time to allow air and fuel in and exhaust out of the cylinder. Teeth on the camshaft gear time the camshaft to the crankshaft.

The **valves** allow air-fuel mixture to enter the cylinder and exhaust gases to exit. The valves provide a positive seal when closed.

The **valve springs** return the valves to the closed position and must be strong enough to maintain valve lifter and cam lobe contact. The valve retainers lock the spring to the valve stem.

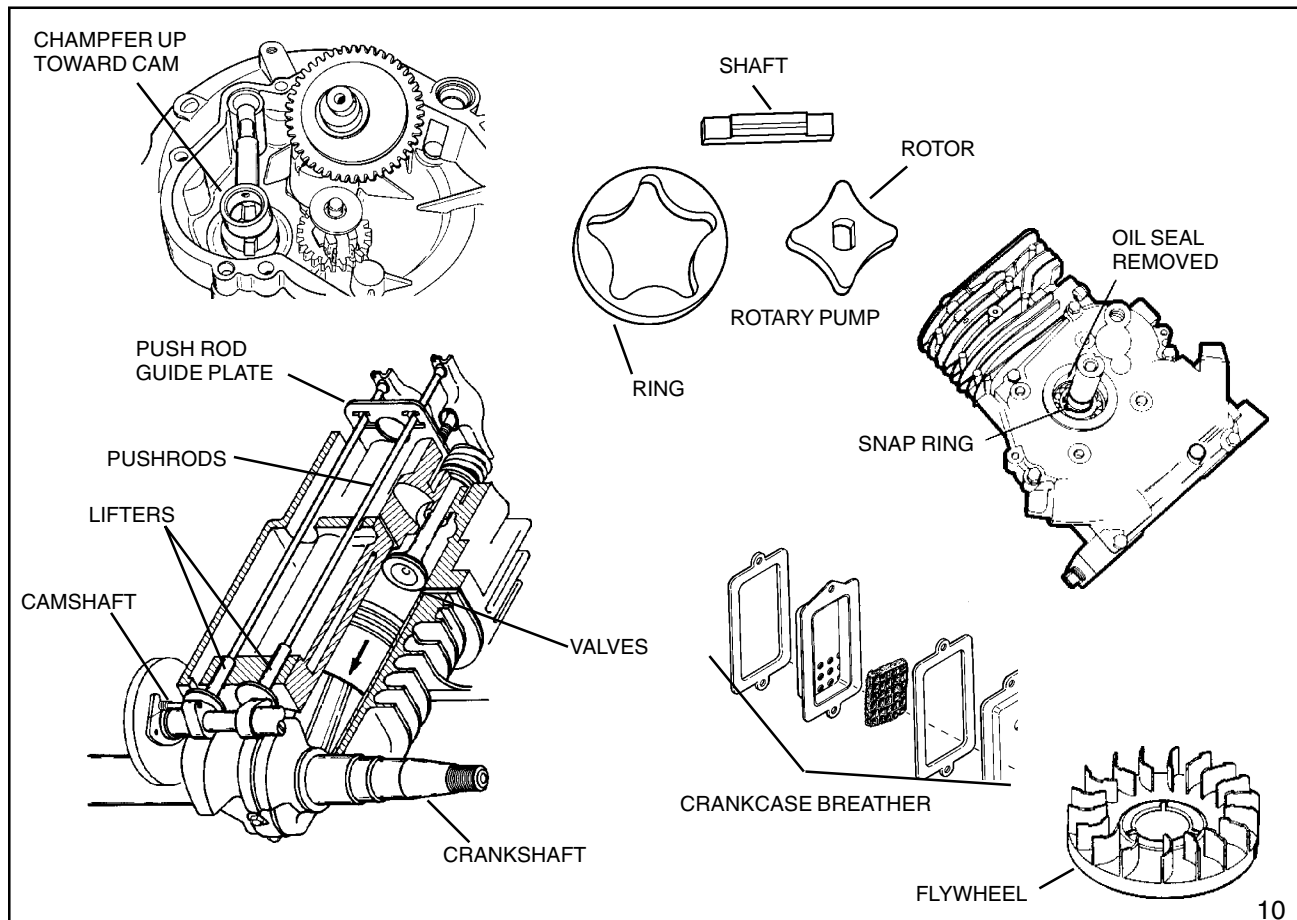
The **valve lifters** maintain contact on the camshaft, move the **push rods** to pivot the **rocker arms** and move the valves.

The **crankcase breather** is a one way check valve that allows air out and prevents air from coming in. It allows the engine to develop a partial vacuum in the crankcase during operation.

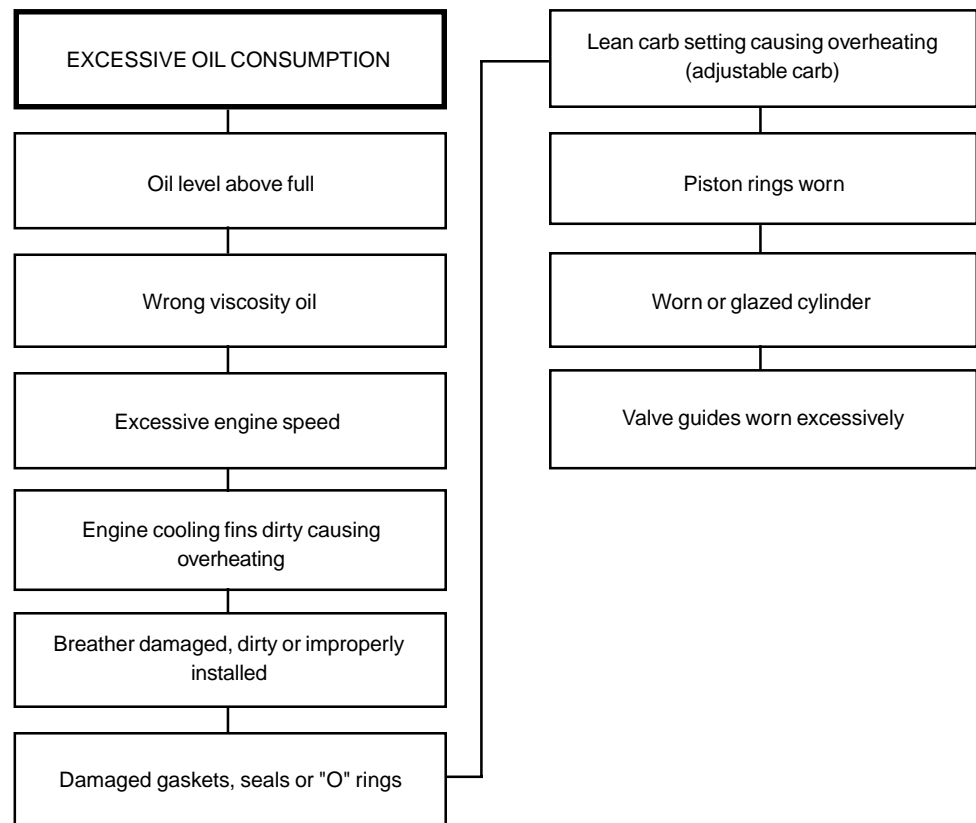
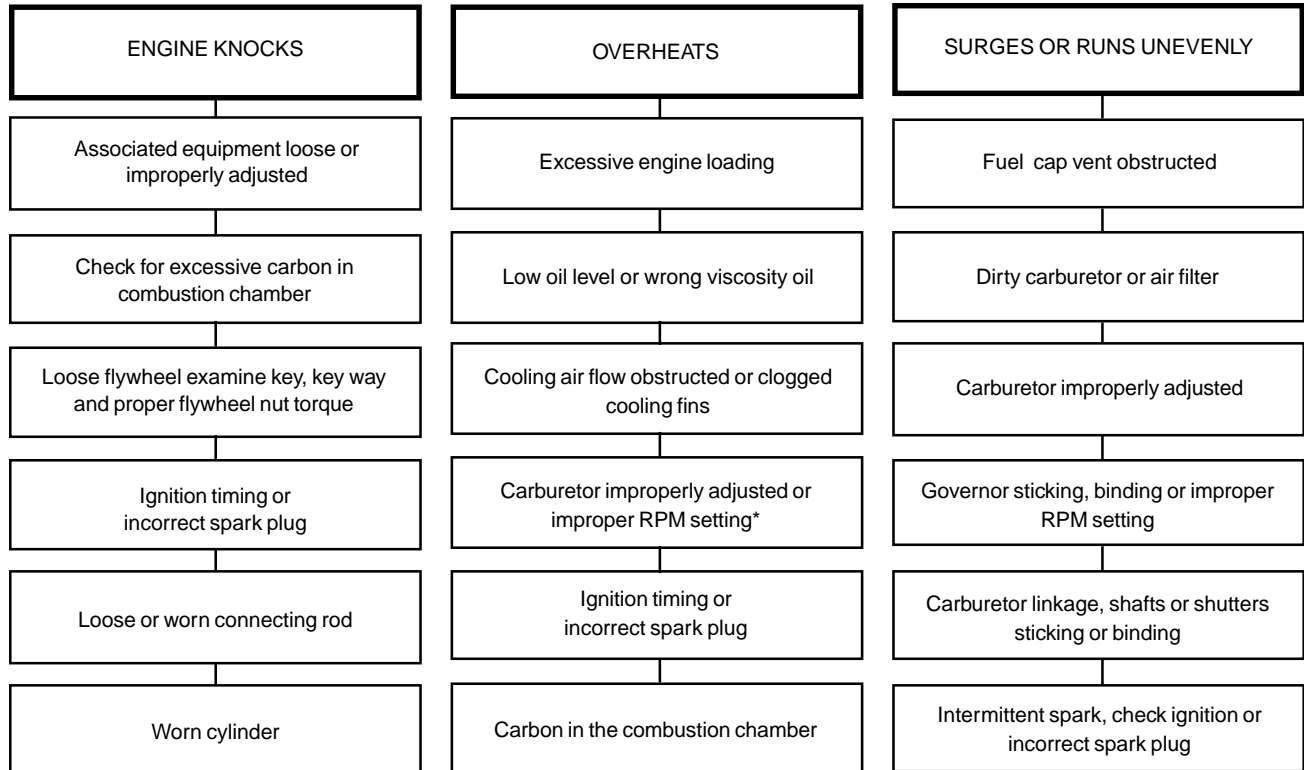
The **cylinder cover** provides the bearing surface for the power take off (P.T.O.) end of the crankshaft and camshaft. This bolted on cover is removed to provide access to all internal components.

The **oil pump** (vertical shaft only) consists of a steel plunger and a nylon or aluminum housing that rides an offset on the camshaft. The rotary pump consists of a lobed gear in a rotating ring that is driven by the camshaft.

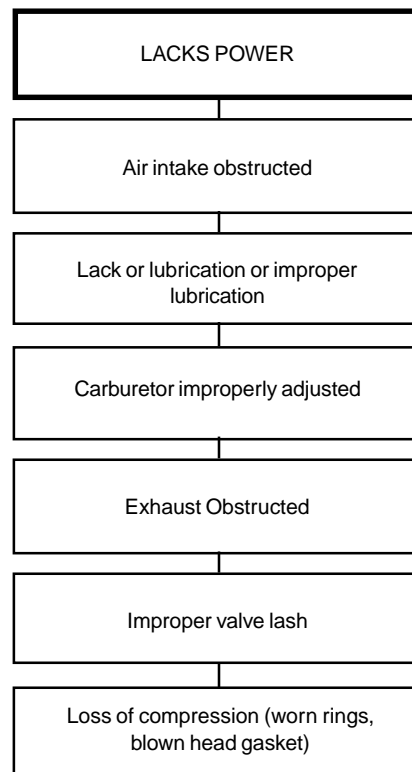
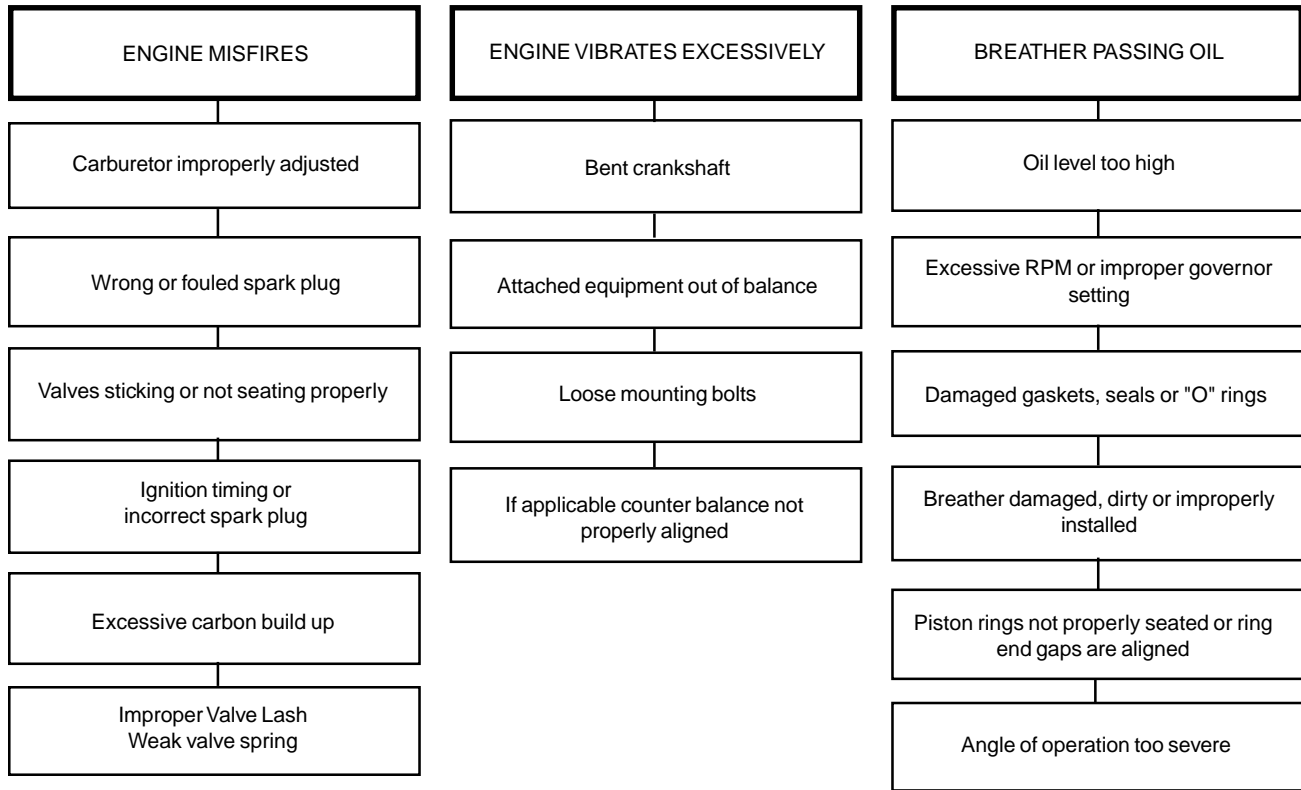
The **flywheel** provides the mass to smooth the effects of one power stroke every other crankshaft revolution. Flywheels are made of aluminum alloy or cast iron. The flywheel fins act as a fan to cool the engine.



ENGINE OPERATION PROBLEMS



ENGINE OPERATION PROBLEMS



TESTING

ENGINE KNOCKS

1. Check the blade hub, blade adapter, or crankshaft coupler for loose fit, loose bolts, or crankshaft key damage. Remove, inspect, replace if necessary. Reinstall and re-torque the bolts to the proper torque.
2. Check the flywheel key and the flywheel and crankshaft keyway for wear or partial shearing. Replace if any damage is evident. Tighten the flywheel nut to the proper torque.
3. Check for the correct ignition module air gap.
4. Remove the cylinder head and check for excessive carbon in the combustion chamber. Also check that the head gasket fit is correct, and the spark plug for proper reach and heat range (correct spark plug for the engine).
5. Check for the proper valve lash using a feeler gauge.
6. Check the internal components (piston, cylinder, connecting rod, crankshaft journal) for excessive clearance. See Chapter 10 under "Specifications".

ENGINE OVERHEATS

1. Make sure the engine is not being overloaded. Remove excess load (sharpen blades, limit operation speed, process less material).
2. Check the oil level and viscosity. Add or replace as necessary.
3. Check for clogged cooling fins or obstructions to the air flow. Remove the blower housing, clean and reinstall.
4. Check the carburetor for correct adjustment or remove and clean the carburetor using tag wire and compressed air. See Chapter 3 under "Service."
5. Check the engine R.P.M. setting using a vibratach or other tachometer and compare it to the R.P.M. settings found on microfiche card #30 according to the engine model and specification number. Adjust as necessary.
6. Check the ignition timing. See Chapter 8 "Ignition - Service."
7. Remove the cylinder head to check for excessive carbon buildup or a leaking head gasket. Clean or replace as necessary.

SURGES or RUNS UNEVENLY

1. Check the fuel cap to make sure it is venting. Loosen the cap and retry engine operation.
2. Replace or clean the air filter.
3. Check the carburetor adjustment or clean the carburetor. See Chapter 3 under "Service."
4. Check the engine R.P.M. setting using a vibratach or other tachometer and compare it to the R.P.M. settings found on microfiche card # 30 according to the engine model and specification number. Adjust as necessary.
5. Visually check all linkages. Check the governor shaft, throttle shaft, or pivot points for binding.
6. Check the ignition module operation using a gap type tester installed between the high tension lead and spark plug. Check for intermittent spark.

ENGINE MISFIRES

1. Check the spark plug for the proper application or a fouled condition. Replace if questionable.
2. Reset the carburetor following the adjustment procedure or clean the carburetor. See Chapter 3 under "Service."
3. Check the ignition timing. See Chapter 8 under "Service."
4. Check for carbon buildup in the combustion chamber.
5. Check valve lash. Inspect the valves and valve seats for leakage. Check for scoring or discoloration on the valve stem in the valve guide area. Recut the valves and seats if questionable. See "Valve Service" in this chapter.

ENGINE VIBRATES EXCESSIVELY

1. Remove the spark plug wire. Check the engine crankshaft on the PTO end for bends using a straight edge, square or a dial indicator. Blades or adapters must be removed. Significant deflection will cause a vibration problem.
2. Check the engine mounting bolts, make sure they are tight.
3. Remove and check the attached equipment for an out of balance condition.
4. If the engine is equipped with a counterbalance shaft, check the gear timing to determine if the counterbalance is out of time.

BREATHER PASSING OIL

1. Check the oil level, make sure the engine is not overfilled. Also verify that the viscosity rating on the container of the oil being used is to specification.
2. Check the angle of operation. Avoid prolonged use at a severe angle.
3. Check the engine R.P.M. setting for excessive R.P.M. using a vibratach or other tachometer and compare it to the R.P.M. settings found on microfiche card # 30 according to the engine model and specification number. Adjust the high and low R.P.M. as necessary.
4. Check for leaking or damaged gaskets, seals, or "O"-rings. External leaks may not be evident; however, the leak may prevent the engine from achieving a partial crankcase vacuum.
5. Check the breather for damage, dirty condition, or improper installation. The oil return hole(s) must face down.
6. Check the engine compression using a compression tester. If the engine has weak compression, determine the cause of weak compression: worn rings, leaking head gasket, or leaking valves. Follow the compression tester's procedure.

2 and 4-CYCLE RPM SETTINGS												30

NOTE: MICROFICHE CARD 30 RPM'S ARE NOT ON PAPER
NOTE: RPM SETTINGS CAN ALSO BE FOUND ON THE COMPUTERIZED PARTS LOOK UP SYSTEMS.

11

EXCESSIVE OIL CONSUMPTION

1. Check the oil level, oil viscosity on the container of the oil being used, and oil condition. Replace and fill to the proper level.
2. Check the angle of operation. Avoid prolonged use at a severe angle.
3. Check for leaking or damaged gaskets, seals, or "O"-rings. External leaks may not be evident, however, the leak may prevent the engine from achieving a partial crankcase vacuum.
4. Check the engine R.P.M. setting using a vibratach or other tachometer and compare it to the R.P.M. settings found on microfiche card # 30 according to the engine model and specification number. Adjust as necessary. The computer parts lookup systems also have RPM information listed in each individual engine parts list.
5. Check the breather for damage, dirty condition, or improper installation. The oil return hole(s) must face down.
6. Clean the cooling fins to prevent overheating.
7. Check the carburetor setting causing a lean running condition, overheating the engine.
8. Check the engine compression using a compression tester. If the engine has weak compression, determine the cause of weak compression: worn rings, leaking head gasket, or leaking valves. Follow the compression tester's procedure.
9. Check the valve guide clearance for excessive wear.

LACKS POWER

1. Check the air intake for an obstruction (dirty filter, oil saturated filter, other debris).
2. Check the oil level, oil viscosity on the container of the oil being used and oil condition. Replace and fill to the proper level.
3. Readjust the carburetor or remove the carburetor for cleaning. See Chapter 3 under "Service."
4. Check the exhaust port or muffler for a restriction preventing proper exhaust flow.
5. Check the engine valve lash. Reset the valves at the proper lash.
6. Check the valves for proper seating and valve guide clearance. Recondition the valves and seats. Replace the valves if necessary. See "Cylinder Head and Valve Train Service" in this chapter.
7. Check the ignition timing. Check the flywheel key for partial shearing.

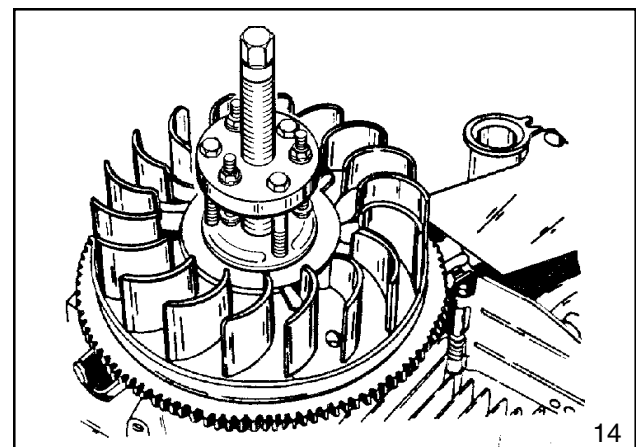
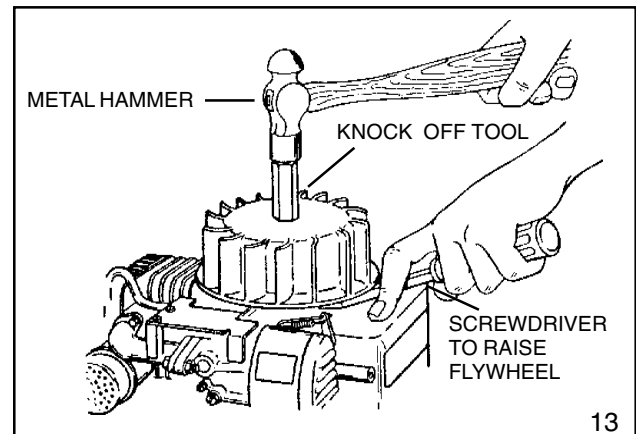
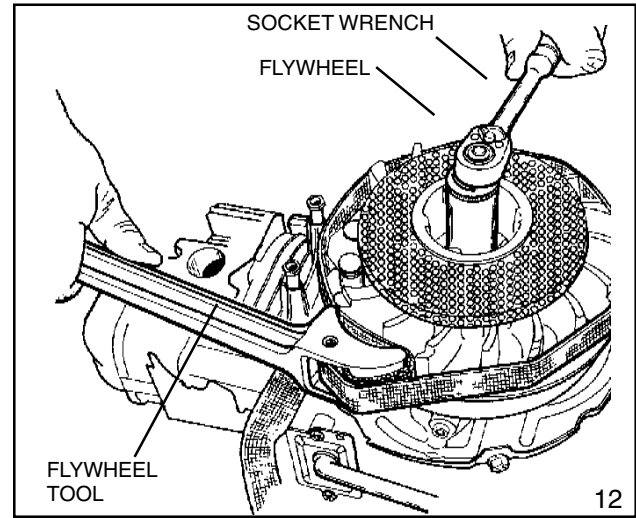
SERVICE

DISASSEMBLY PROCEDURE

The following procedures apply to most engine models. Actual procedure may vary.

1. Disconnect the high tension lead from the spark plug. Remove the spark plug.
2. Drain the oil from the crankcase. Drain or shut off the fuel supply.
3. Remove the air cleaner assembly.
4. Remove the fuel tank if it is attached to the engine. Fuel tanks may be held on with bolts, screws, or some models require taps upward with a soft face hammer loosening the plastic tank wedges in the blower housing slots.
5. Remove the blower housing by first unscrewing the screw holding the dipstick tube to the blower housing and removing the remaining bolts holding on the blower housing.
6. Unplug the ignition kill wire from the terminal on top of the ignition module and unbolt the ignition module.
7. Locate the piston at Top Dead Center (TDC) on the compression stroke for easier valve train service.
8. Relieve the compliance brake pressure on the flywheel if applicable. Compress the spring by moving the lever toward the spark plug end and when the hole in the lever aligns with the hole in the bracket secure the lever in this position with alignment tool part # 670298.
9. Remove the flywheel nut, washer, and starter cup. Use a part # 670305 strap wrench to hold the flywheel from turning (diag. 12). Thread the appropriate flywheel knock-off tool (7/16" / 11.112 mm use part # 670103, 1/2" / 12.7 mm use part # 670169, 5/8" / 15.875 mm use part # 670314, 11/16" / 17.462 mm use part # 670329) on the crankshaft until it bottoms out, then unthread it one complete turn. Lift upward under the flywheel using a large screwdriver while avoiding contact with the alternator coils or magnets, and tap sharply and squarely on the knock-off tool to break the flywheel loose. If necessary, rotate the flywheel a half turn and repeat until it loosens (diag. 13). A flywheel puller (part # 670306) may be used on flywheels with cored holes (diag. 14).

NOTE: DO NOT USE A JAW TYPE PULLER.



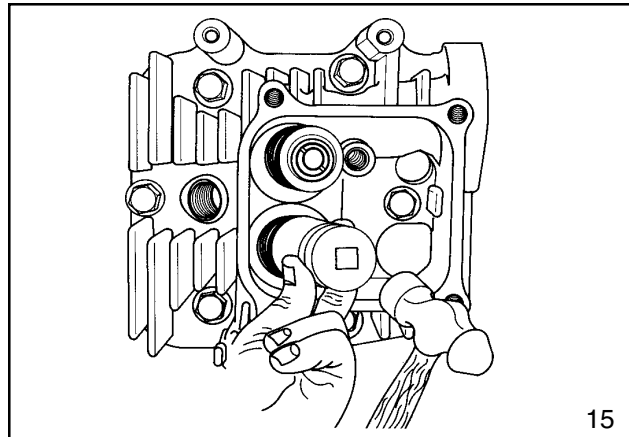
10. Remove the flywheel key and alternator if equipped, and baffle plate.
11. Remove the muffler.
12. Remove the intake pipe, spacer if equipped, and the carburetor. Be careful not to bend or damage the linkage when removing. Mark the hookup points or diagram the linkage arrangement to aid in reassembly.
13. Remove the head by first removing the valve cover. The push rod guide plate must be removed to access one of the head bolts. Remove the rocker arms by loosening the two locking nuts or allen head screws. Use a 3/16" Allen wrench and a 7/16" wrench on OHH, OVRM and OHV 11-13 use a 1/2" wrench, OHV13.5 - 17 use a 3/16" allen and 1/2" wrench. Remove the rocker arm nuts or rocker arm bearings followed by the rocker arms, rocker arm studs, guide plate, and push rods. Remove the head bolts, head, and head gasket.

NOTE: ON SOME OHV ENGINES THE EXHAUST PUSH ROD CAN ONLY BE REMOVED AFTER THE HEAD IS OFF. YOU MUST HAVE IT BACK IN BEFORE RE-ASSEMBLY.

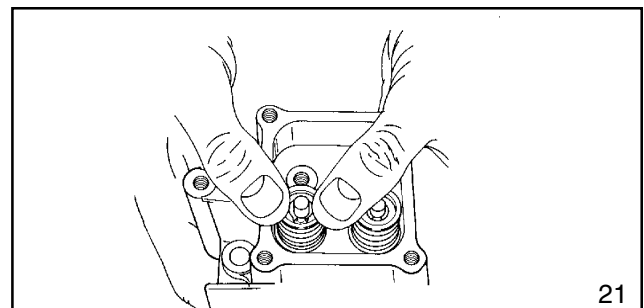
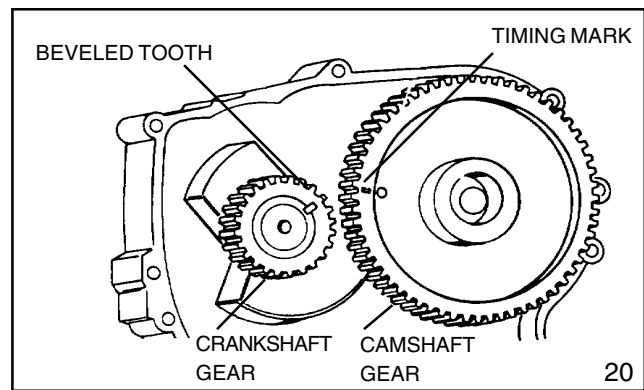
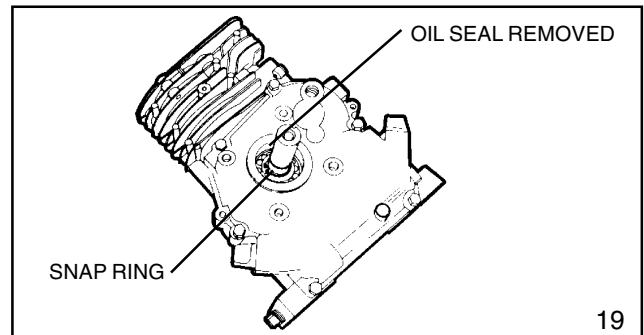
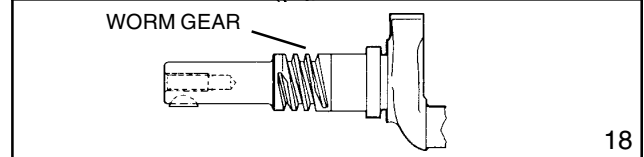
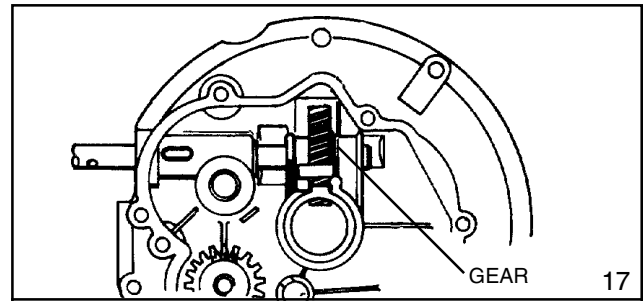
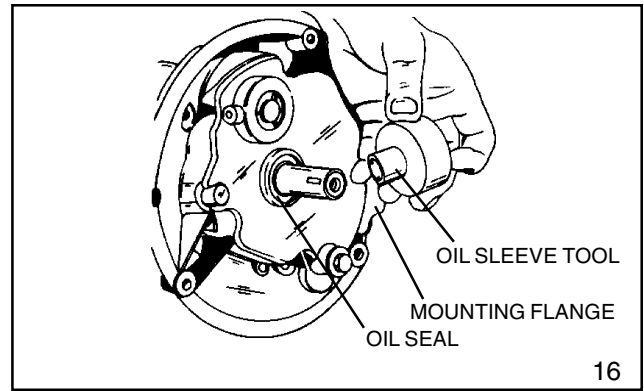
On engine models OHM, OHSK120, OVM, OVXL and OHV, with independent cylinder head and rocker box, the valve springs, caps, retainers, and retainer screw must be removed to allow the rocker box to separate from the head. Remove the jam nut, adjusting nut, rocker arm bearings, rocker arms, push rods, guide plate, and the rocker arm retainer screw.

Next to prevent valve or piston damage turn the piston down in the cylinder. Then place a 3/4" (19.05 mm) deep socket over the valve cap and strike the top with a steel hammer (diag. 15). This action loosens the cap. Remove the cap, retainers, and valve springs. Remove the rocker arm housing, head bolts, head, head gasket and valves. Notice the "O"rings used to seal the rocker box, valve stems, and push rod tubes.

14. Remove the crankcase breather if necessary.



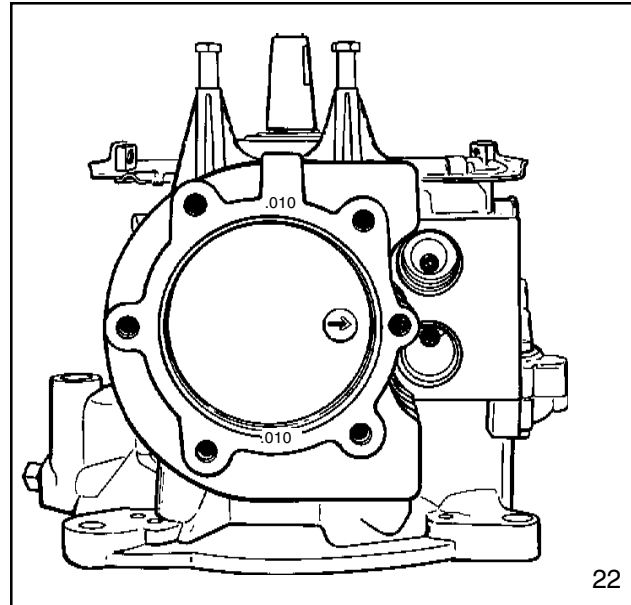
15. Remove the cylinder cover or mounting flange using a seal protector positioned on the seal to prevent seal damage. The crankshaft must be free of rust or scale to slide the cover or flange off the crankshaft. OHH engines with a ball bearing on the P.T.O. end of the crankshaft require the oil seal and the snap ring to be removed prior to the cylinder cover removal. For engines equipped with 8-1/2:1 gear reduction, turn the crankshaft to roll the reduction shaft gear off the crankshaft worm gear when removing the cylinder flange (diag. 16, 17, 18, 19).
16. On engines equipped with 8-1/2 :1 gear reduction, remove the auxiliary shaft from the cover by removing the retaining ring and sliding the shaft out of the washers and drive gear.
17. Align the timing marks on the camshaft and crankshaft gears and remove the internal components (diag. 20).
18. Remove the lifters, rod cap, and counterbalance shaft or gears if applicable.
19. Before removing the piston, remove any carbon from the top of the cylinder bore to prevent ring breakage. Push the piston out the top of the cylinder bore.
20. Remove the valves from the head on models OHH and OVRM by supporting the valves with fingers while compressing the valve springs, one at a time, with thumbs. Slide the large opening in the retainer toward the valve stem to remove (diag. 21). On all other overhead valve engine models, place a 3/4" (19.05 mm) deep socket over the valve cap and strike the top with a steel hammer. This action loosens the cap. Remove the cap, retainers, and valve springs. The valve springs must be assembled on the same valve they are removed from (diag. 15).



CYLINDERS

Visually check the cylinder for broken or cracked fins or a scored cylinder bore. Check the main bearing for wear or scoring. If the main bearing is worn or scored it can be replaced on some models. See "Crankshaft Bearing Service" in this chapter.

Use a dial bore gauge or transfer gauge with a micrometer to accurately measure the cylinder bore. Measure in the piston travel area approximately 1/2" to 3/4" (12.7-19.05 mm) from the top and the bottom. Measure at 90 degrees to the piston pin, 45 degrees to the piston pin, and even with the piston pin as the piston would appear when assembled. A rigid hone is recommended to "true" any cylinder irregularities. If the cylinder bore is worn more than .005" (.127 mm) oversize, out of round or scored, it should be replaced or re-sized to .010" or .020" (.254-.508 mm) oversize. In some cases engines are built with oversize cylinders. If the cylinder is oversize, the oversize value will be imprinted in the top of the cylinder (diag. 22).



To recondition a cylinder, use a commercially available hone of the proper size. Chuck the hone in a drill press with a spindle speed of about 600 R.P.M. Tecumseh recommends 380 grit for finish in a standard cross hatch.

Start with coarse stones and center the cylinder under the drill press spindle. Lower the hone so the lower end of the stones contacts the lowest point in the cylinder bore.

Rotate the adjusting nut so that the stones touch the cylinder wall and begin honing at the bottom of the cylinder. A light honing oil should be used to lubricate and cool while honing. Move the hone up and down at a rate of 50 strokes per minute to avoid putting ridges in the cylinder wall. Every fourth or fifth stroke, move the hone far enough to extend the stones one inch beyond the top and bottom of the cylinder bore.

Check the bore diameter every twenty or thirty strokes for size and a 35° - 45° crosshatch pattern. If the stones collect metal, clean the stones with a wire brush when the hone is removed.

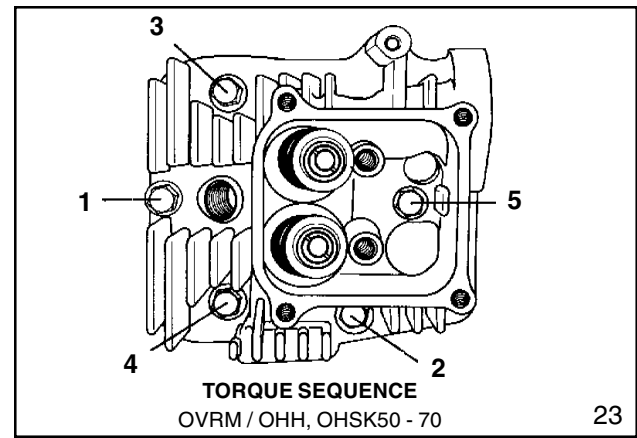
If cylinder oversizing is needed we recommend boring the cylinder. This service is offered by many Service Dealers. You also may wish to contact a local machine shop.

Clean the cylinder and crankcase with warm, soapy water, rinse with clean water, and dry thoroughly. Continue the cleaning procedure until a clean white cloth wiped on any internal surface reveals no honing residue or dirt.

Replace the piston and the piston rings with the correct oversize parts as indicated in the parts manual.

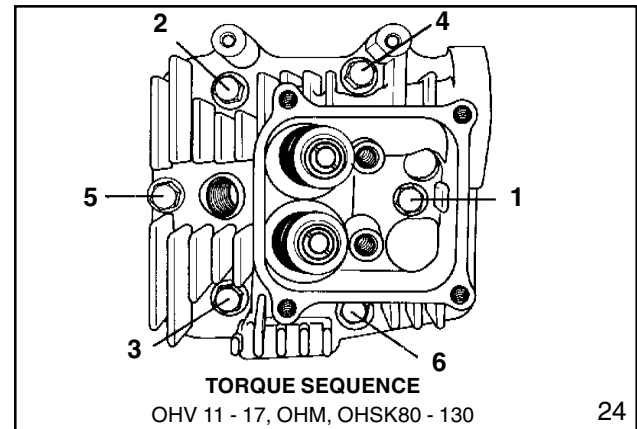
CYLINDER HEAD AND VALVE TRAIN SERVICE

Check the cylinder head for warpage by placing the head on a precision flat surface. If warped in excess of .005" (.127mm), replace the head. Slight warpage can be corrected by placing a sheet of #400 wet /dry sandpaper on a precision flat surface and rubbing the head gasket surface in a circular pattern until the entire gasket surface shows evidence of sanding. A small amount of honing oil on the sandpaper will make it easier to slide the head. Always replace the head gasket and torque the head bolts in 60 inch pound (6.7 Nm) increments in the numbered sequence (diag. 23 & 24).

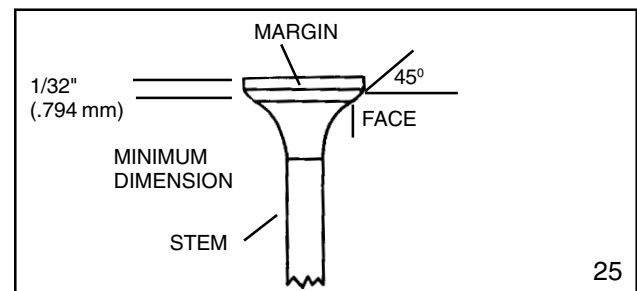


Valves, Springs, And Push Rods

The valves should be checked for proper lash, sealing, and wear. Valve condition is critical for proper engine performance. Valve lash should be checked before removal of the engine head if any of the following conditions are experienced; a popping is heard through the intake or exhaust, an engine kickback is experienced, or when excessive valve train noise is heard.

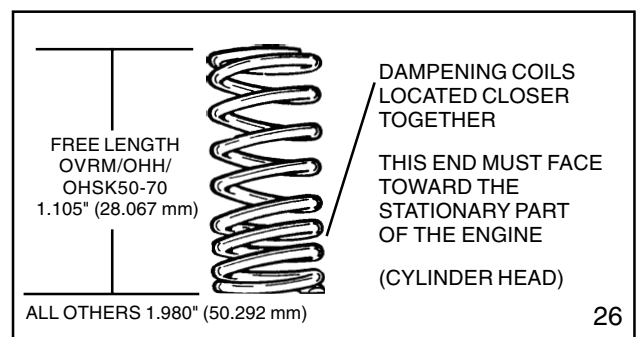


Valve lash (between the rocker arm and valve stem) should be set or checked when the engine is cold. The piston should be at T.D.C. on the compression stroke (both valves closed). See specification section.



When servicing the valves, all carbon should be removed from the valve head and stem. If the valves have been checked and are in a usable condition, the valve face should be ground using a valve grinder to a 45 degree angle. If after grinding the valve face the margin is less than 1/32 of an inch (.794 mm), the valve should be replaced (diag. 25).

Valves are not identical. Valves marked "EX" or "X" are installed in the exhaust valve location. Valves marked "I" are installed in the intake valve location. If the valves are unmarked, the smaller valve (head) is installed in the exhaust valve location.



If the spring has dampening coils, the valve spring should be installed with the dampening coils away from the valve cap and retainers (diag. 26).

The valve springs should be checked for both ends being parallel and the free length being at least 1.105" (28.067 mm) for OHH and OVRM engines, 1.980" (50.292 mm for OHM, OVM, OHSK, OVXL, and OHV engines when the valves are removed for service. Replace the springs if necessary.

The push rods should be checked for straightness and the ends for wear. If the push rod ends are worn or damaged, inspect the corresponding rocker arm socket or valve lifter for wear. Replace if necessary.

PISTONS, RINGS, AND CONNECTING RODS

Piston

The piston should be checked for wear by measuring near the bottom of the skirt 90 degrees from the piston pin hole with a micrometer. Check the ring side clearance using a feeler gauge with a new ring. Clean all carbon from the piston top and the ring grooves before measuring. Visually inspect the piston skirt area for scoring or scratches from dirt ingestion. If scoring or deep scratches are evident, replace the piston.

If the cylinder bore needs re-sizing, an oversize piston will be necessary. Oversize pistons are identified by the imprinted decimal oversize value imprinted on the top of the piston (diag. 27).

Piston Rings

After the cylinder bore diameter has been checked and is acceptable to rebuild, the ring end gap should be checked using new rings. Place a new compression ring squarely in the center of the ring travel area. Use the piston upside down to push the ring down (diag. 28) and measure the gap with a feeler gauge. The ring end gap must be within the specification to have adequate oil control (diag. 29). This procedure will assure correct piston ring end gap measurement. Ring side clearance should also be checked with a feeler gauge when using new rings with an old piston (diag. 30).

Replace the rings in sets and install the piston, rings, and rod assembly in the cylinder bore with the ring end gaps staggered. When installing new rings in a used cylinder, the cylinder wall should be de-glazed using a commercially available de-glazing tool or hone.

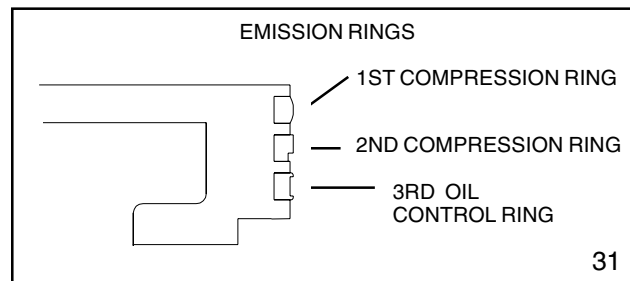
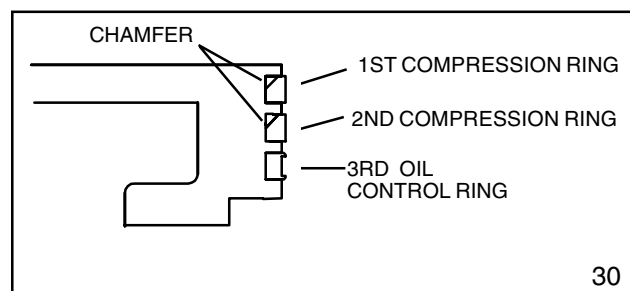
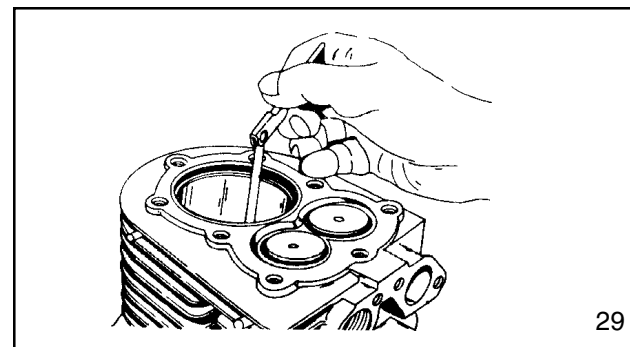
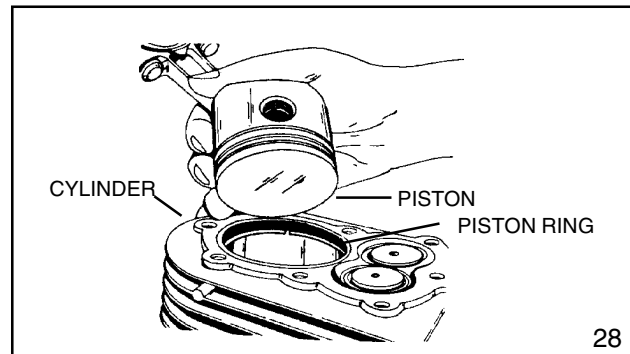
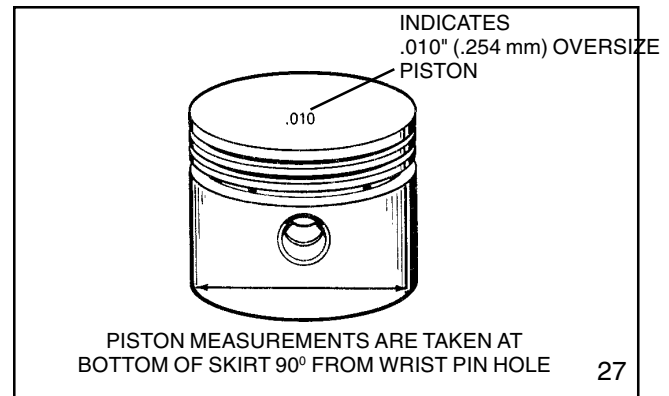
Use a ring expander to remove and replace the rings. Do not spread the rings too wide or breakage will result.

Piston Ring Orientation

If the top compression ring has an inside chamfer, this chamfer must face UP. The second compression ring will have either an inside chamfer or an outside notch. The rule to follow is an inside chamfer always faces up. An outside notch (diag. 31) will face down or towards the skirt of the piston.

The oil control ring can be installed with either side up. The expander (if equipped) end gap and the ring end gap should be staggered (diag. 31).

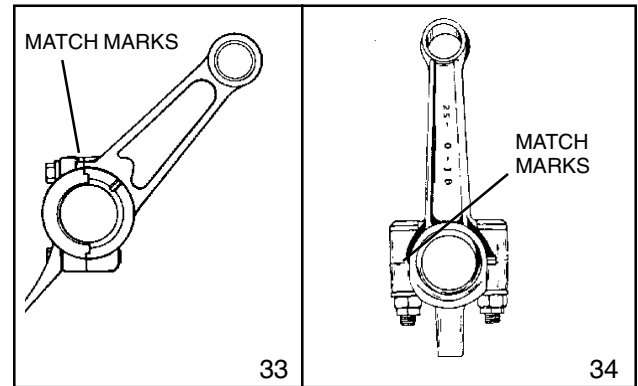
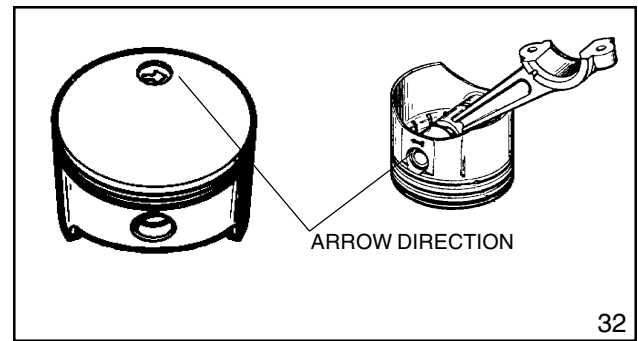
NOTE: Always stagger the ring end gaps on re-assembly.



CONNECTING RODS

Some engine models have offset piston pins (not centered) to centralize the combustion force on the piston. When installing the connecting rod to the piston it is imperative that the rod be installed correctly. On engine models OVM, OHM, OHSK120 - 130, and OVXL, the piston will have an arrow stamped on the top of the piston. On OHV 13.5 - 17 engines, an arrow is found on the piston skirt. The arrow on the top of piston or on the piston skirt must point toward the push rods or the carburetor side of the engine when installing it in the cylinder. (diag. 32) If the piston does not have an arrow, the piston can be installed either direction on the connecting rod. **On all engine models, the match marks on the connecting rod and cap must align and face out when installing the piston assembly into the engine (diag. 33 & 34).**

On horizontal shaft engines, oil dippers are attached to the bottom connecting rod bolt. Some engines have the oil dipper cast in the rod cap. Consult the specification chart for the proper rod bolt torque when installing the cap. The rod bolts should be torqued in 50 inch pound (5.65 Nm) increments until the specified torque is achieved.



CRANKSHAFTS AND CAMSHAFTS

Inspect the crankshaft visually and with a micrometer for wear, scratching, scoring, or out of round condition at the bearing surfaces. Check for bends on the P.T.O. end using a straight edge, square or a dial indicator.

CAUTION: NEVER TRY TO STRAIGHTEN A BENT CRANKSHAFT.

The timing marks on the camshaft and the crankshaft gears must be aligned for proper valve timing. (diag. 35 & 36).

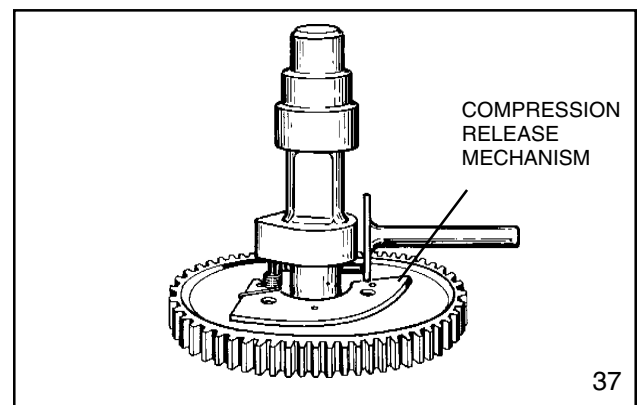
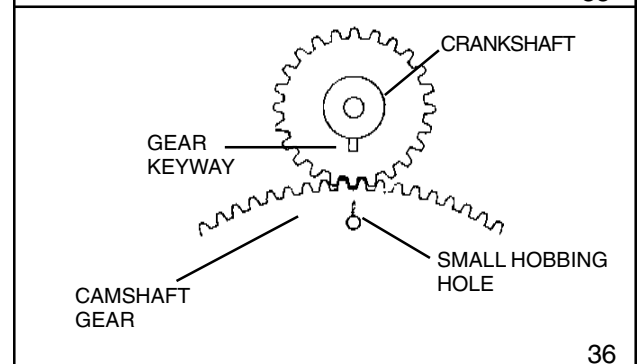
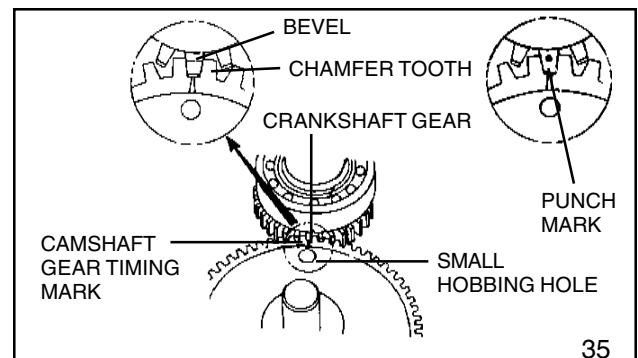
Camshafts

Check the camshaft bearing surfaces for wear using a micrometer. Inspect the cam lobes for scoring or excessive wear. If a damaged camshaft is replaced, the mating crankshaft and governor gear should also be replaced. If the crankshaft gear is pressed on it is not serviceable and the crankshaft must also be replaced.

Clean the camshaft with solvent and blow all parts and passages dry with compressed air, making sure that the pins and counterweights are operating freely and smoothly on mechanical compression relief types.

OHH and OHSK50 - 70 engines use serviceable MCR components and must be assembled as illustrated in "Assembly" with a thrust washer placed on the camshaft next to the compression release weight.

NOTE: Some OHH models used on chipper/shredders may not require a compression release.



Mechanical Compression Release (MCR) camshafts have a pin located in the camshaft, that extends above the intake or exhaust cam lobe, to lift the valve to relieve the engine compression for easier cranking. When the engine starts, centrifugal force moves the weight outward and the pin will drop back down. The engine will now run at full compression (diag. 38).

Some OHH engines use a composite camshaft. This camshaft is used on OHH/OHSK 50-70 engines that have been manufactured after DOM (date of manufacture) 7048. This change that took place in February of 1997 and is basic on the OHH engines, except those units that use extended camshafts which will continue to use a cast iron camshaft. A camshaft kit replaces the old camshaft and includes compression release components and two light tension valve springs. It is **CRITICAL** that the new valve springs be installed or lobe damage will occur on the camshaft.

NOTE: You must install the thrust washer between the cover and cam to prevent wear.

Some OVRM engines use a ramp compression release (RCR) system that works with the intake valve. The ramp is located on the backside of the intake cam lobe. The ramp delays the intake valve closure, resulting in lower emissions and reduced compression for easier pull starting (diag. 39).

Valve Seats

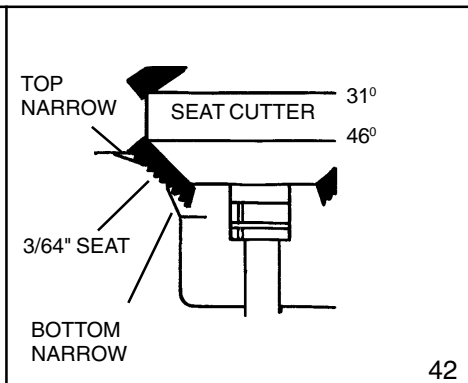
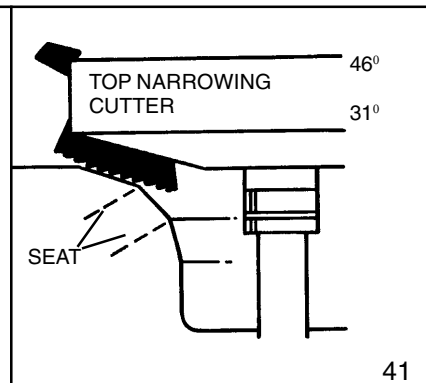
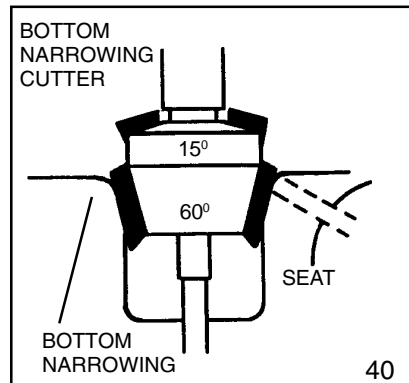
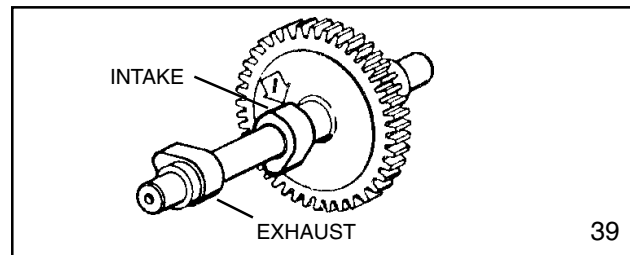
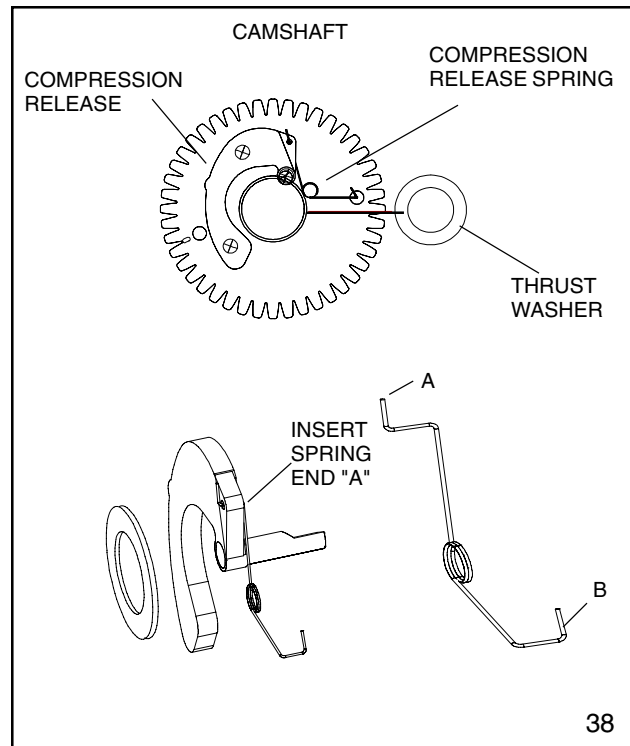
Valve seats are not replaceable. If they are burned, pitted, or distorted they can be reground using a grinding stone or a valve seat cutting tool. Valve seats are ground to an angle of 46 degrees to a width of 3/64" (1.91 mm).

The recommended procedure to properly cut a valve seat is to use the Neway Valve Cutting System, which consists of three different cutters. OVRM and OHH engines have a small combustion chamber and require the use of a special Neway cutter #103 for the 46 and 31 degree combination cutter. The 60 degree cutter is Neway cutter # 111. The tapered pilots required are; Neway # 100-1/4-1 for the .249" (6.325 mm) exhaust guide, and Neway #100-1/4 for the .250" (6.35 mm) intake guide. Consult the cutter's complete procedure guide for additional information.

First, use the 60 degree cutter to clean and narrow the seat from the bottom to the center (diag. 40).

Second, use the 31 degree cutter to clean and narrow the seat from the top toward the center (diag. 41).

Third, use the 46 degree cutter to cut the seat to a width of 3/64" (1.191 mm) (diag. 42). Check the contact area of a new or reconditioned valve face on a finished valve seat. Using fingers, snap the valve sharply against the corresponding valve seat and view the line imprinted on the valve face. The contact area or line should be continuous and appear on the upper 1/3 of the valve face. Re-cut the seat to move the contact area higher or lower if necessary and recheck the contact area.



VALVE LIFTERS

When removing the lifters, mark the lifters to install the lifter in the same position as it was removed from. The valve lifters may be slightly different lengths. Visually check the lifter for wear on the cam contact surface and push rod contact surface.

VALVE GUIDES

Engine models OVM, OHM, OHSK80 - 130, and OVXL have valve guides that can be reamed 1/32" (.794 mm) oversize or be replaced as service parts. All other overhead valve engines have valve guides that are permanently installed in the cylinder head. If the guides get worn excessively, they can be reamed oversize to accommodate a 1/32" (.794 mm) oversize valve stem.

The guides should be reamed oversize with a straight shanked hand reamer or low speed drill press. Refer to the "Table of Specifications" (Chapter 10) to determine the correct oversize dimension. Reamers are available through your local Tecumseh parts supplier. Consult the tool section in Chapter 11 for the correct part numbers.

The upper and lower valve spring caps must be redrilled to accommodate the oversize valve stems.

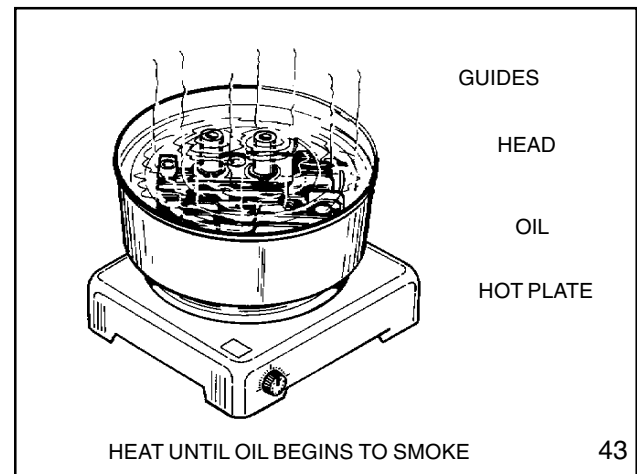
After oversizing the valve guides, the valve seats must be recut to align the valve seat to the valve guide.

VALVE GUIDE REMOVAL (WHERE APPLICABLE, CONSULT PARTS MANUAL)

1. Submerge the head in a container of oil so that both guides are completely covered with oil.
2. Heat the oil on a hot plate approximately 15-20 minutes until the oil begins to smoke. Oil temperature must be 375° - 400°F (190° - 204°C).

⚠ CAUTION : USE PROTECTION FOR EYES AND HANDS, BE CAREFUL ! THE HOT OIL AND HEAD CAN EASILY CAUSE BURNS.

3. Using a pliers, remove the head from pan of oil. Carefully drain the excess oil out of the head. Quickly work the next two steps while the head is hot to prevent pressing the guides out with the head too cool. Guides removed too cool will permanently damage the head by removing aluminum necessary to hold the new guides in place.
4. Place the head on the bed of an arbor press on parallels with the snap rings on the long ends of the guides facing down.
5. Using a 1/2" (12.7 mm) diameter, 6" (15.24 cm) drift punch located in the center of the old valve guide, push the guide out of the head with the arbor press. Do not allow the drift punch to contact the head during this step.



VALVE GUIDE INSTALLATION

1. Install the snap rings on the new replacement valve guides. Place the valve guides in a freezer for an hour or longer to ease assembly.
2. Submerge the head in a container of oil so that the valve guide bores are completely covered with oil. Heat the container on a hot plate approximately 15-20 minutes until the oil begins to smoke. Oil temperature must be 375° - 400°F (190° - 204°C).

⚠ CAUTION : USE PROTECTION FOR EYES AND HANDS, BE CAREFUL ! THE HOT OIL AND HEAD CAN EASILY CAUSE BURNS.

3. Using a pliers, remove the head from pan of oil. Carefully drain the excess oil out of the head. Quickly work the next two steps while the head is hot to prevent damage to the guides or the head.
4. Place the head on a 6" x 12" (15.24 x 30.5 cm) piece of wood with the head gasket surface down.
5. Insert the new guides in the head with the long end of the guides up. It may be necessary to use a rubber or rawhide mallet to fully seat the new guide to the snap ring.

NOTE: DO NOT USE A STEEL HAMMER TO SEAT THE NEW GUIDE, GUIDE OR HEAD DAMAGE WILL RESULT.

6. Allow the head to cool and re-cut both valve seats using a Neway cutter to align the new guides to the valve seats.

CRANKCASE BREATHERS

The breather element and case can be cleaned using cleaning solvent. Make sure the small drain hole or holes are clean and installed down to allow return of oil back into the crankcase.

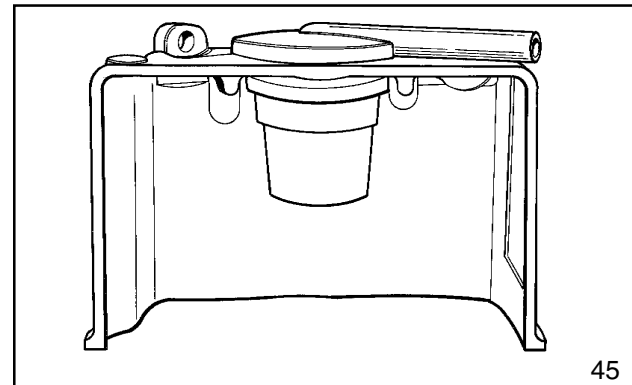
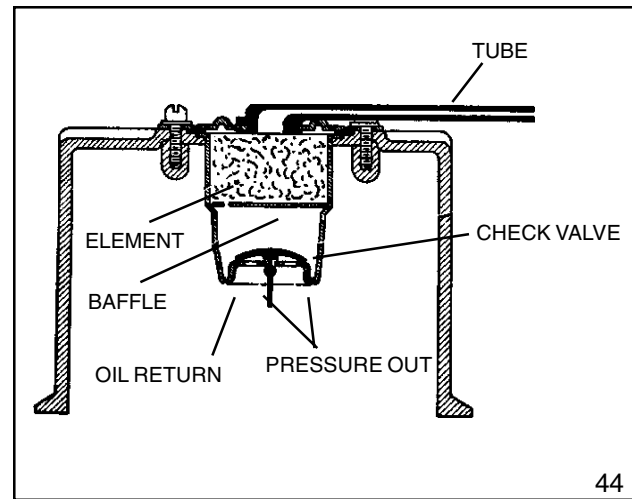
Top Mounted Breather

This type of breather is mounted in the top and rear of the cylinder block in vertical shaft engines. The umbrella check valve allows positive pressure to be vented through the element and out the tube. Most engines have the breather tube connected to the air cleaner assembly (diag. 44).

Late production OVRM engines use the rubber boot and breather tube as a "pop in" design. Mark or note the location of the breather tube. Use a large flat blade screwdriver to pry the boot up and lift the breather assembly out. Be careful not to drop the breather body out of the rubber boot when removing (diag. 45).

A new breather tube boot is recommended for replacement to assure proper crankcase seal. Apply engine oil to the breather tube boot and push the breather in until the top shoulder of the boot contacts the crankcase.

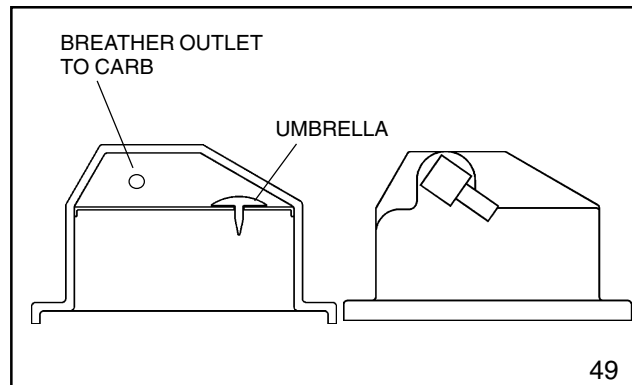
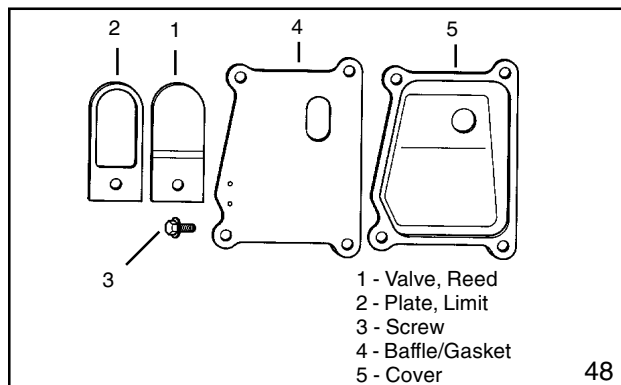
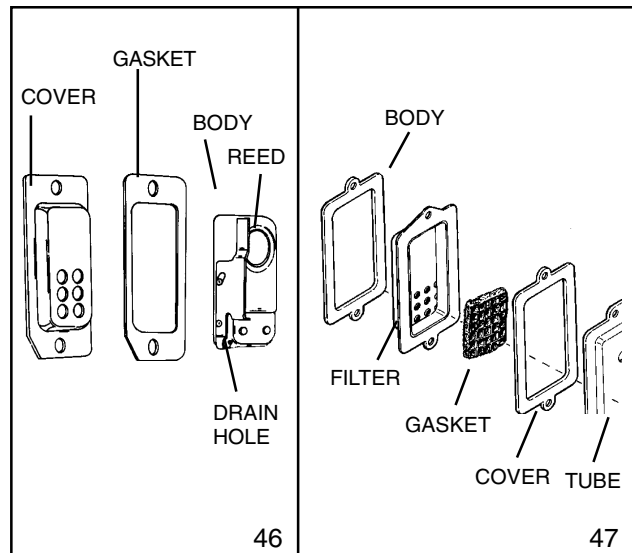
OHH engines use an umbrella valve type breather that is found in the rocker arm cover. Use solvent and compressed air to clean the area if necessary. Individual components are serviced only by the replacement of the complete cover.



Side Mounted Breather

This type of breather mounts over the valve compartment and uses a reed style check valve. Clean the internal element or reed area with solvent and compressed air if necessary. When installing, the drain holes must be open and be on the bottom.

On OHV13.5 - 17 engines, align the reed valve and plate parallel to the top surface of the breather opening in the crankcase. If the plate has a notched corner, install the notch toward the P.T.O. side of the engine. If the plate is marked, install the plate with the mark facing out. Hold the reed valve and plate in this position while tightening the screw.



CYLINDER COVER, OIL SEAL, AND BEARING SERVICE

The following procedures, except oil seal replacement, require the engine to be disassembled. See "Engine Disassembly Procedure" in this chapter.

Cylinder Cover

Clean and inspect the cover, looking for wear and scoring of the bearing surfaces. Measure the bearing surface diameters using a micrometer and check the specifications for worn or damaged parts. Replace as necessary.

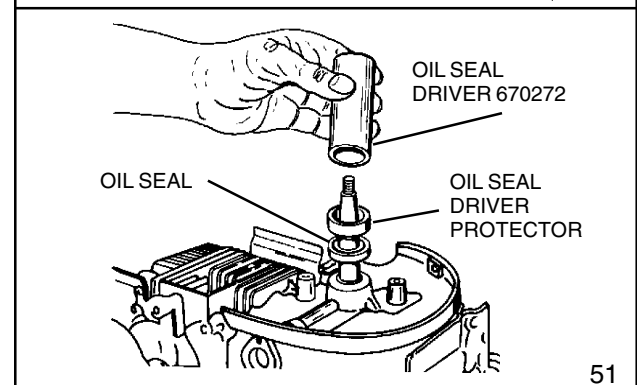
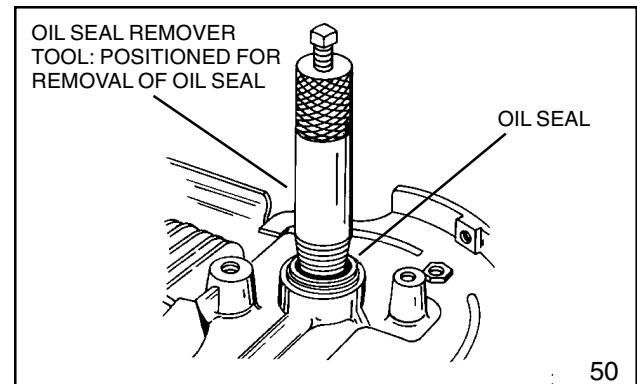
When reinstalling the cover, apply a drop of Loctite 242 to the cover screw threads and torque the cover screws to the recommended specification. Always use new gaskets and new oil seals installed using seal protectors after the cover is removed.

Oil Seal Service

NOTE: BEFORE REMOVING THE OIL SEAL, CHECK TO SEE IF THE SEAL IS RAISED OR RECESSED. WHEN INSTALLING A NEW OIL SEAL, TAP IT INTO POSITION GENTLY UNTIL IT IS SEATED INTO ITS BOSS. SOME SEALS ARE NOT POSITIONED FLUSH TO THE CYLINDER COVER. ATTEMPTING TO INSTALL THE SEAL TOO FAR IN CAN CAUSE DAMAGE TO THE OIL SEAL AND ENGINE.

If the crankshaft is removed from the engine, remove the old oil seals by tapping them out with a screwdriver or punch from the inside. If the crankshaft is in place, remove the seal by using the proper oil seal puller (diag. 50).

Select the proper seal protector and driver from the tool list in Chapter 11 to install a new oil seal. Place the oil seal over the protector and place it over the crankshaft. Drive the seal into position using the universal driver part no. 670272. The seal protector will insure that the seal is driven in to the proper depth (diag. 51).

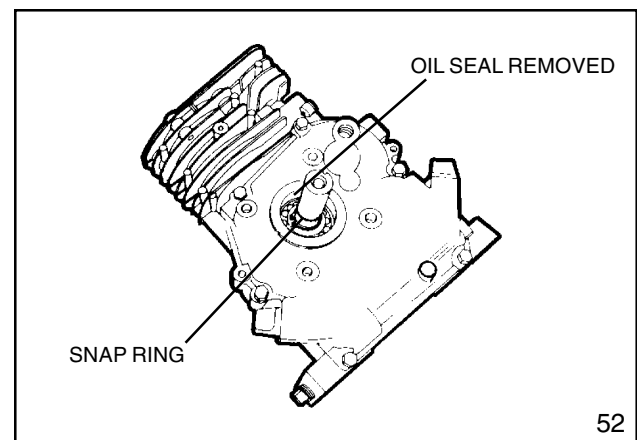


CRANKSHAFT BEARING SERVICE

Ball Bearing Service

Remove the two bearing retainer screws and washers. Remove the ball bearing in the cylinder cover by pressing the bearing from the outside of the cover toward the inside using an arbor press.

Install a new ball bearing by pressing the bearing from the inside of the cover toward the outside until the bearing contacts the shoulder. Install the two bearing retainer screws with washers and tighten to 45 in. lbs. (5.0 Nm) of torque.



SERVICE BUSHING

We are supplying this bushing for service repair. After the bushing has been installed, it requires line reaming to the proper size.

Following the chart below, have a reputable machine shop do this work for you.

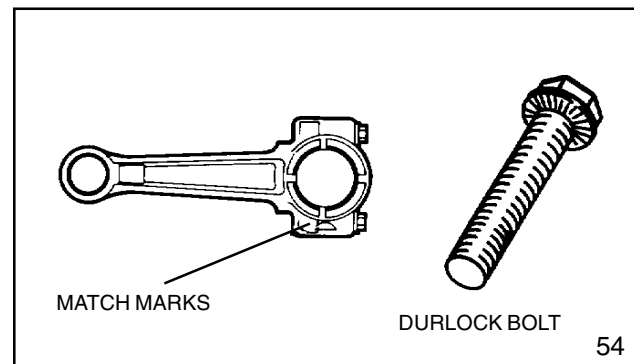
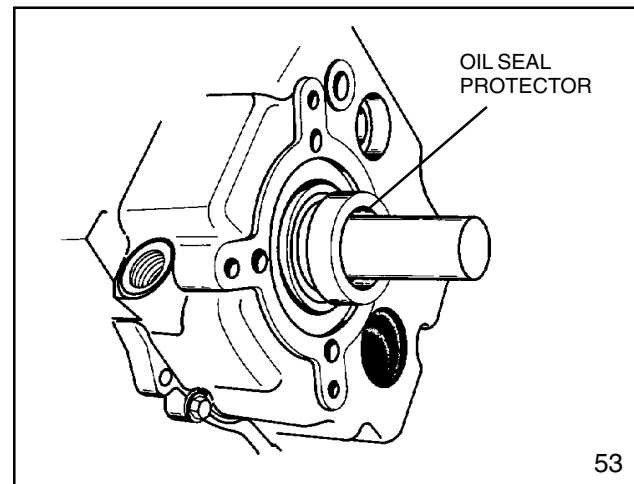
BUSHING SIZE CHART

BUSHING SERVICE PART NUMBER	FINISHED REAM BORE DIAMETER
309798755 - .8760" (22.226 - 22.250 mm)
31461	1.0000 - 1.0005" (25.4 - 25.413 mm)
31462	1.0000 - 1.0005" (25.4 - 25.413 mm)
31546	1.0000 - 1.0005" (25.4 - 25.413 mm)
33368	1.1880 - 1.1890" (30.175 - 30.2 mm)
34836	1.0005 - 1.0010" (25.413 - 25.425 mm)
34837	1.0005 - 1.0010" (25.413 - 25.425 mm)
35377	1.3765 - 1.3770" (34.950 - 34.976 mm)
35400	1.3765 - 1.3770" (34.950 - 34.976 mm)

ENGINE ASSEMBLY

The following procedures apply to most engine models. Actual procedure may vary.

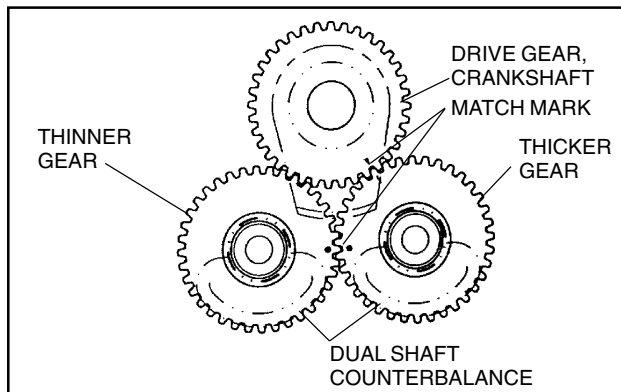
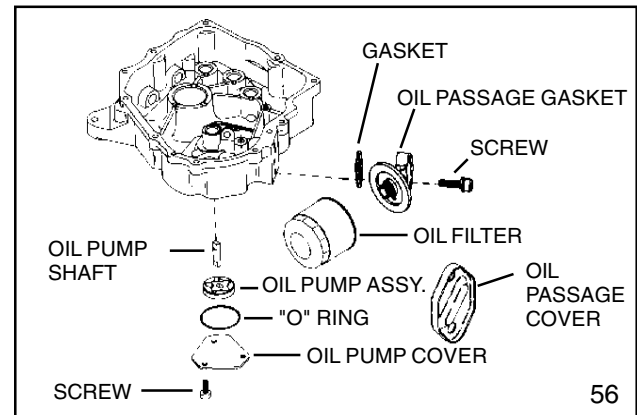
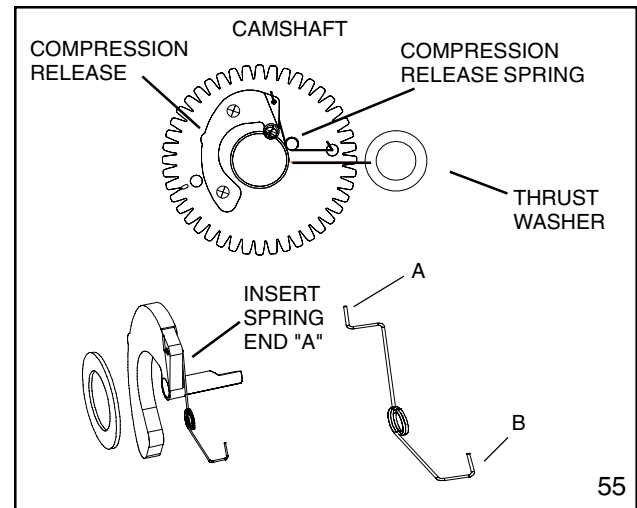
1. Use new gaskets and seals at all locations. Clean all internal engine parts with solvent and blow dry with compressed air or allow to dry.
2. Using the correct seal protector (see Chapter 11 under "Tools"), apply engine oil to the crankshaft bearing surfaces and insert the tapered end of the crankshaft in the crankcase. Slide the crankshaft in until it bottoms.
3. Apply engine oil to the piston skirt, rings, connecting rod bearing surface, and the cylinder bore. Using a band type ring compressor, stagger the ring end gaps, compress the rings, and push the piston assembly into the cylinder with the match marks on the connecting rod facing out of the crankcase and the arrow on the top of piston or on the piston skirt pointing toward the push rod location or the carburetor side of the engine if applicable. Push the piston assembly in until the rod is positioned on the crankshaft rod journal surface.
4. Align the match marks on the rod cap and rod, install the rod cap bolts and dipper if applicable and tighten the bolts in equal increments to the specified torque.



- Assemble the compression release components to the camshaft on engine models OHH and OHSK50-70. Install spring end "A" through the release from the pin side, insert spring end "B" through the camshaft gear, and slide the release pin in the small hole near the center of the cam gear. Assemble the thrust washer on the camshaft next to the compression release. (diag. 55)

NOTE: Some OHH models used on chipper/shredders may not require compression release mechanisms.

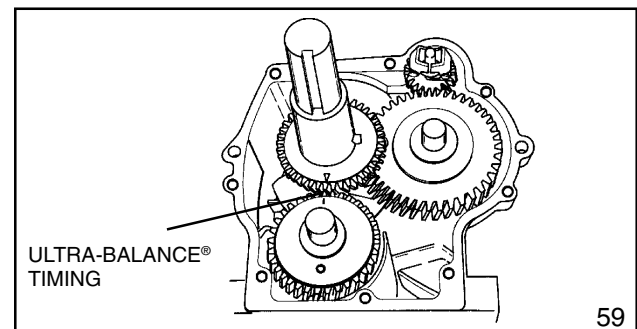
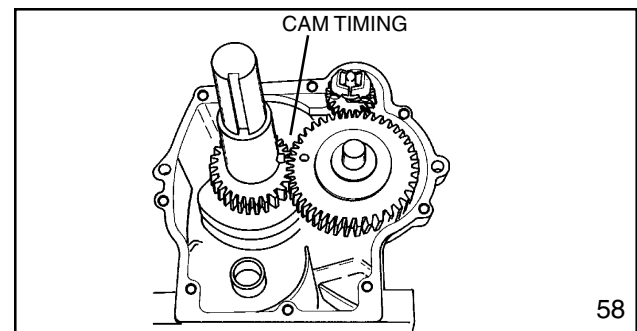
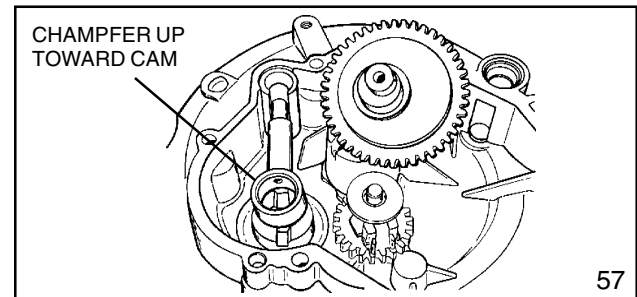
- Some OHV11 - 17 engines come equipped with a spin on oil filtration system. If the engine is not equipped with a filter, one may be added IF THE SUMP HAS AN OIL PASSAGE COVER. The kit part number 36435A should be ordered to upgrade the engine if desired.
- Install the lifters, camshaft, barrel and plunger style oil pump (chamfered side toward the gear) if applicable, ultra-balance shaft or dual balance shafts if applicable. Align the timing mark or notched tooth on the crankshaft gear to the mark or hole in the camshaft gear. If equipped, time the Ultra-balance® with the piston at Top Dead Center (T.D.C.). Slide the drive gear over the keyway in crankshaft while aligning the timing marks on the gears.



a. Dual Balance Shaft

Time the dual shaft counterbalance system with the piston at T.D.C. Install the counterbalance with the thicker gear in the far right boss in the crankcase and the other counterbalance shaft with the thinner gear in the far left boss while aligning the timing marks. Slide the drive gear over the keyway in the crankshaft while aligning the timing mark with the thicker counterbalance gear.

NOTE: Engines equipped with rotary oil pumps must have the drive shaft and pump assembled after the sump cover is installed.



8. Mount the cylinder cover or flange with the governor gear assembly installed to the crankcase using dowel pins to position the cover and a new gasket. Install the cover down onto the crankcase and slightly rotate the crankshaft to allow the governor gear to mesh. Do not force. Apply a drop of blue Loctite 242 to the cover screw threads and tighten to the specified torque.

On engines with ball bearings in the cover, install a thrust washer (if applicable) over the crankshaft, followed by the retaining ring.

On OHV 13.5 -17 engines, install the oil pump drive shaft into the slot in the end of the camshaft. Apply engine oil and install the oil pump ring and rotor, followed by a new "O" ring and the pump cover. Tighten the screws to 50-70 inch pounds (5.5 - 8 Nm) torque.

9. Install the breather assembly.
10. Rotate the crankshaft to place the piston at Top Dead Center (TDC) on the compression stroke.

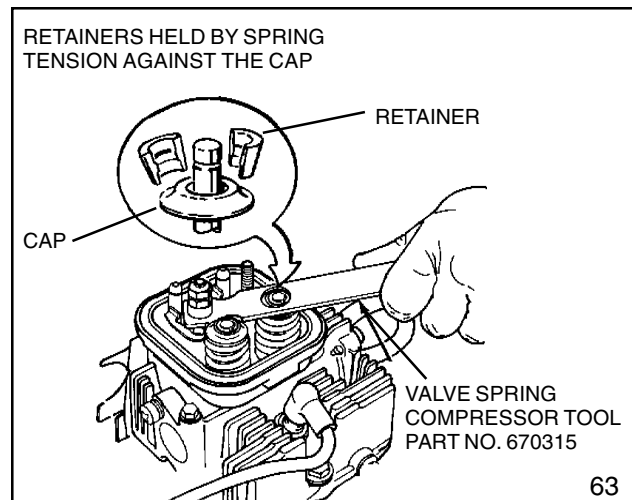
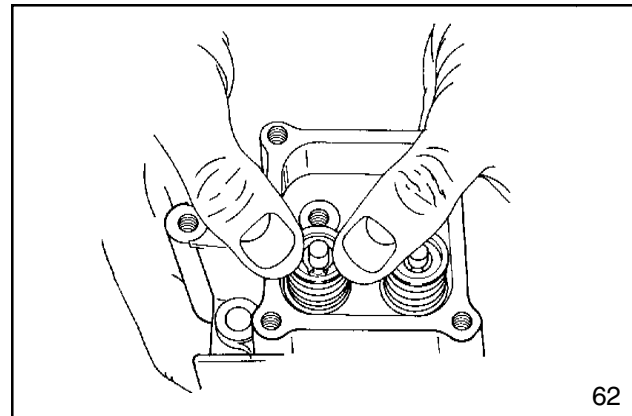
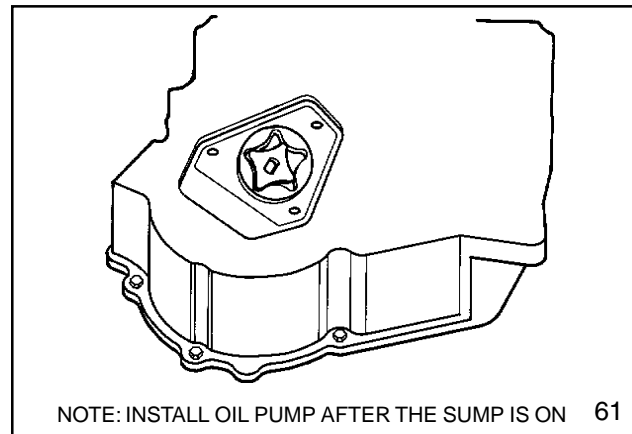
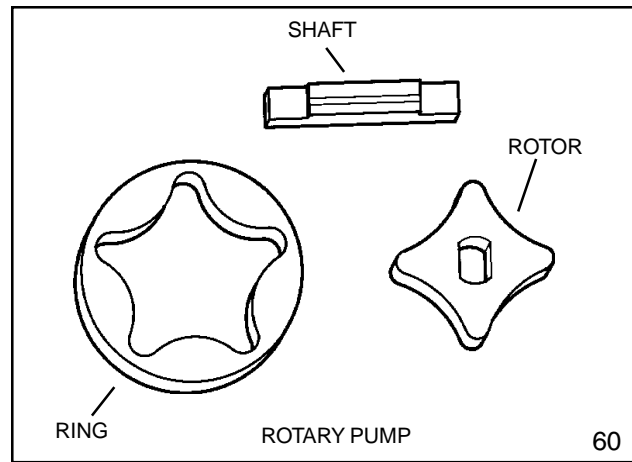
NOTE: Always cut the valve seats, never only lap the seats.

11. Pre-assemble the valves and spring assemblies into the cylinder head on all engine models **EXCEPT** OHM, OHSK80-130, OVM, OVXL (diag. 65 on page 79). Use a small block to support the valves tight to their seats while placing the head on a flat surface. For models OHH and OVRM, install the springs (dampening coils toward the head) and retainers on the valves and use fingers to compress the springs until the notch in the retainer is located in the notch in the valve stem. Repeat the procedure for other valve.

For OHV models, place the springs (dampening coils toward the head) over the valve guide and place the valve caps on the springs with the larger opening away from the springs. Use spring compressor tool part # 670315A installed on a rocker arm stud, and either turn the stud in or secure with a locking nut as shown so about 1-1/2" (38.1 mm) of the stud is exposed. Compress the spring and install the valve retainers to lock the valve to the valve cap. Repeat the procedure for other valve.

Install the cylinder head using a new head gasket. On OHV 11-13 models, place the push rods in the block before installing the head and head gasket. Tighten the head bolts in the numbered sequence using 60 inch pound (6.8 Nm) increments to the specified torque.

NOTE: Tecumseh strongly recommends you order a complete seal kit. Replace all "O" ring and gaskets in kit.



12. STEPS 12A -12G APPLY ONLY TO EARLY PRODUCTION ENGINE MODELS OHM, OHSK120, OVM AND OVXL. CONTINUE WITH STEP 13 FOR CURRENT PRODUCTION MODELS.

a. Install the push rods with the cupped ends of the rods placed on top of the lifters. Visually check correct placement through the valve box opening. Use lubricated new "O" ring seals for both ends of the push rod tubes and install the push rod tubes in the crankcase.

b. Install the valves into the head, and using a new head gasket, place the head on the cylinder block. Tighten the head bolts in the numbered sequence using 60 inch pound (6.8 Nm) increments to the specified torque.

c. Install the rocker arm housing, push rod guide plate with the legs facing up, new rocker arm studs with "O" rings under the guide plate. Install the valve box to head retaining screw using a flat washer and a new "O" ring. Tighten the screw and the studs to the specified torque.

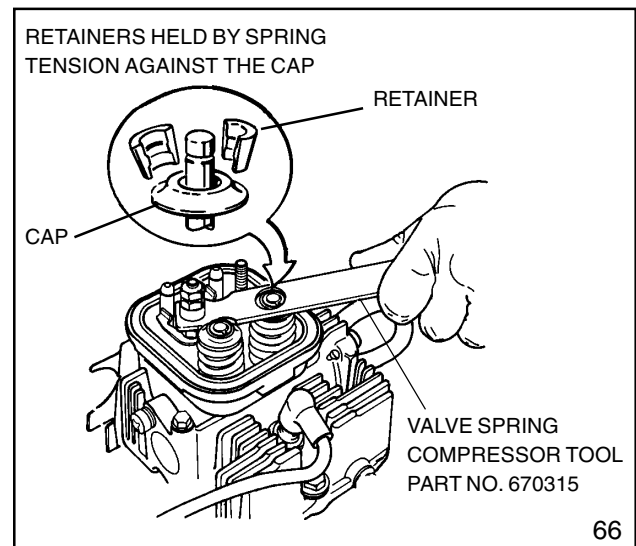
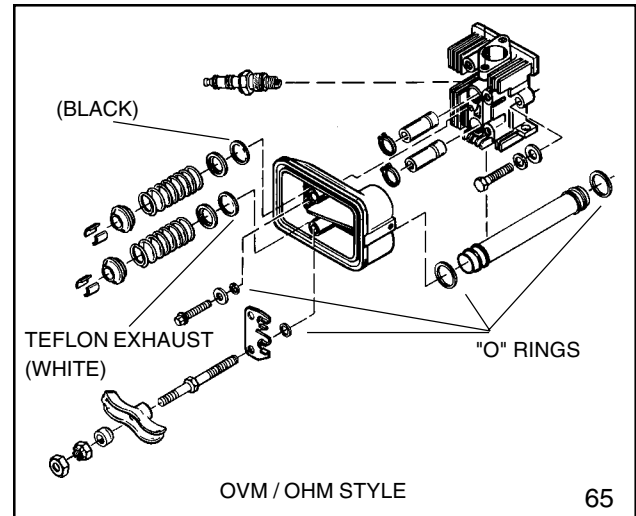
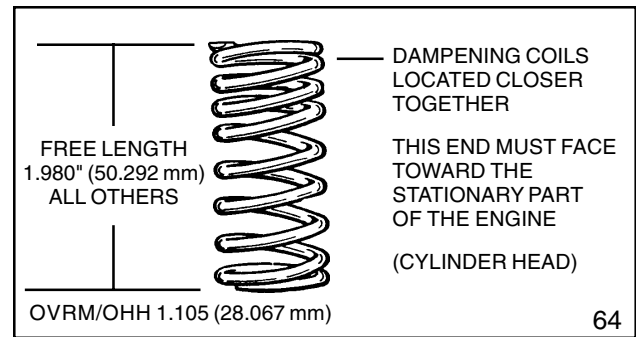
d. Lift each valve up until it contacts the seat and hold the valve in this position. Use a 12 inch (30.5 cm) piece of fuel line and wedge one end on each side of the valve stem through the port opening to hold the valve.

e. Bolt the valve spring compressor tool part # 670315A on a rocker arm stud using the rocker arm bearing and locking nut (diag. 66).

f. Install the new o-rings (white o-ring on the exhaust guide) followed by valve spring caps, valve springs with the dampening coils toward the head, (diag. 64) and valve spring retainers with the larger opening away from the engine.

g. Compress the valve spring with the tool and insert the two retainers into the keeper so the inside ridge of the retainer locks into the valve stem groove. Repeat the procedure for the other valve (diag. 66).

NOTE: TORQUE THE CYLINDER HEAD FOLLOWING THE SEQUENCE ON PAGE 69.



13. On engine models OHH and OVRM, install the push rods on the lifters, and rocker arms and lock nuts on the rocker arm pivot screws. Fasten the screw to the head with the push rod guide plate tabs facing up. Turn the screws in until slight play exists between the valve stem and rocker arm.

On OHM, OHSK120, OVM, and OVXL models, install the rocker arms, rocker arm bearings, and new rocker arm adjusting nuts on the studs. Tighten the adjusting nut until slight play exists.

On OHV 11-13, OHSK80-130, OHV110-145 models, install the push rods on the lifters, place the rocker arms on the rocker arm screws followed by the locking nut, washer, and push rod guide plate (with the tabs up). Turn the screws in until slight play exists between the valve stem and rocker arm.

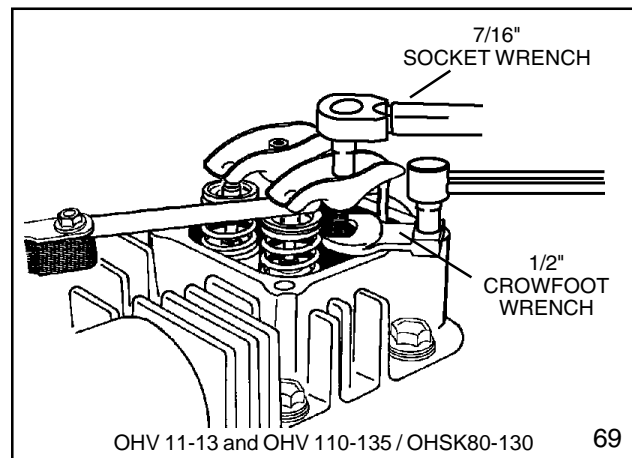
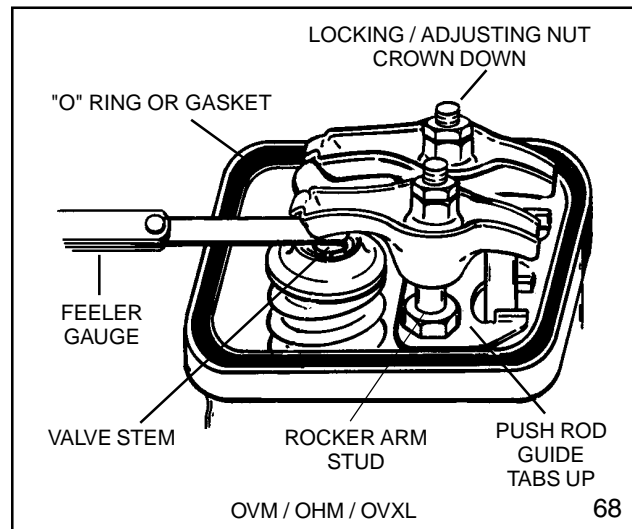
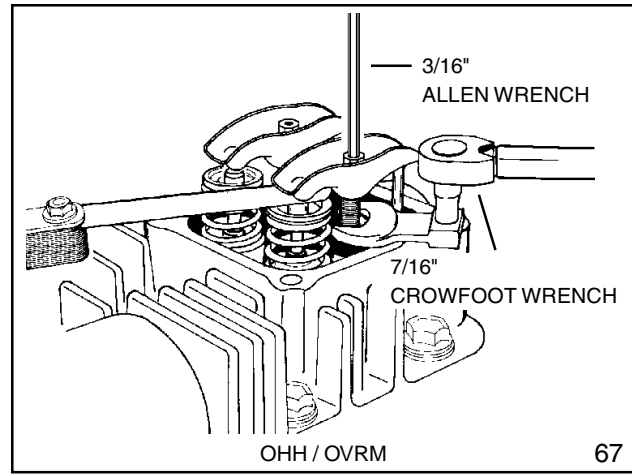
On OHV13.5 -17 models, install the guide plate with the rocker arm studs and torque to 190 in. lbs. (21.5 Nm). Insert the push rods in the lifter sockets with the longer steel end toward the rocker arms. Place the rocker arms onto the studs with the socket end toward the push rod and thread the rocker arm bearings on until excessive play is removed.

14. Set the valve lash with the engine cold, the piston at T.D.C., and both valves closed. Insert the specified feeler gauge between the rocker arm and valve stem. Adjust until a slight sliding drag is felt.

On models OHH and OVRM, lock this position by holding an 3/16" Allen wrench on the pivot ball screw while tightening the lock nut to 120 in. lbs. (13.5 Nm) of torque. A 7/16" crowfoot will be needed to torque the lock nut. Rotate the crankshaft at least one full turn to check push rod movement and valve lash (diag. 67).

On models OVM, OHM, OHSK120 and OVXL, with a 1/2" crowfoot, tighten down the rocker arm studs to 190 in. lbs. (21.5 Nm). Adjust the rocker arm hex nut with a 1/2" wrench to set the correct valve lash and tighten the locking jam nut to 18 in. lbs. (2 Nm). Rotate the crankshaft at least one full turn to check push rod movement and valve lash (diag. 68).

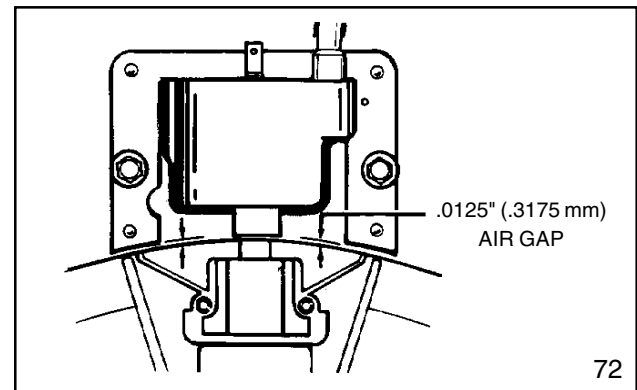
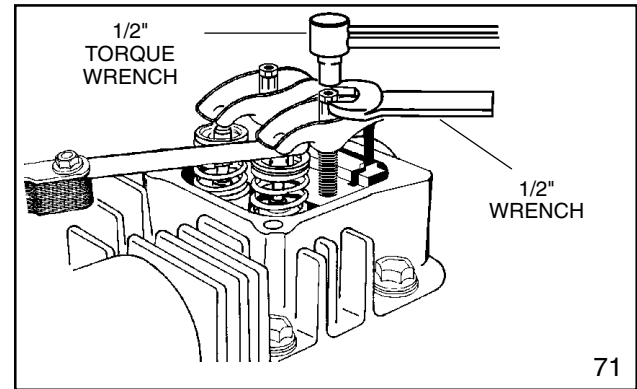
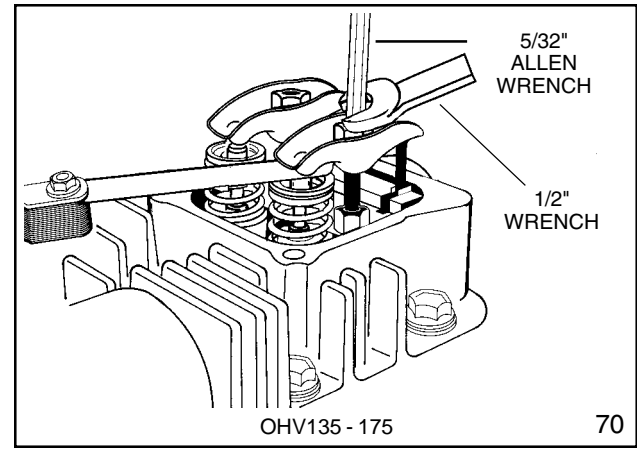
On models OHV 11-13, OHSK80-130, OHV110-145, hold the rocker arm pivot bearing using a 7/16" wrench or socket while using a 1/2" crowfoot to tighten the lock nut to 120 in. lbs (13.5 Nm) of torque. Rotate the crankshaft at least one full turn to check push rod movement and valve lash (diag. 69).



On models OHV 135 - 175 hold a 1/2" wrench on the rocker arm bearing while tightening the 5/32" Allen head set screw to 75 in. lbs. (8.5 Nm) of torque. Rotate the crankshaft at least one full turn to check push rod movement and valve lash (diag. 70).

Current production models OHV135 - 175 use a 1/2" wrench to tighten the rocker arm bearing to the correct valve lash. Once adjusted use a 1/2" socket and torque the jam nut to 130 inch pound (14.7 Nm). Rotate the crankshaft one full turn to check push rod movement and correct valve lash (diag. 71).

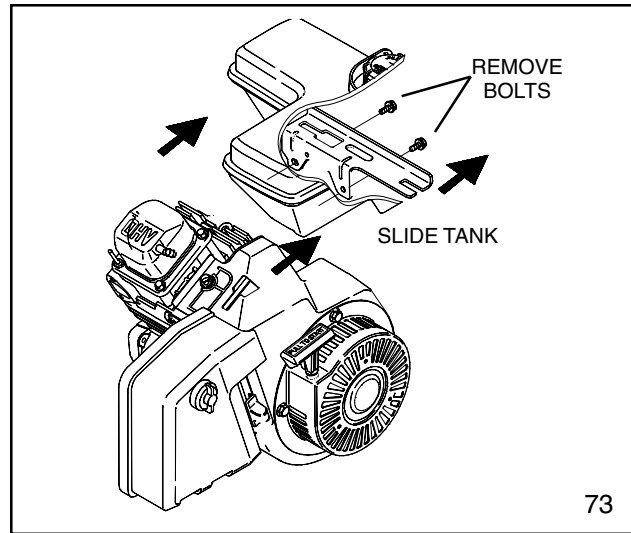
15. Install the rocker arm cover using a new gasket or o-ring and tighten the screws to the specified torque. Connect the breather hose to the valve cover fitting on model OHH.
16. Attach the backing plates or baffles. Attach the governor arm lever if removed.
17. Attach the alternator coil if applicable and route the wires away from the flywheel area.
18. Install the flywheel spacer if applicable, flywheel key, flywheel, starter cup (if applicable), bevelled washer (concave surface in), and flywheel nut. Use strap wrench part # 670305 to hold the flywheel and tighten the nut to the specified torque.
19. Install the ignition module using a part # 670297 .0125" (.3175 mm) air gap tool between the flywheel magnets and the laminations of the module (diag. 72). Tighten the mounting screws, remove the tool, and check for contact while rotating the flywheel. None should be found. Attach the ignition ground lead to the module terminal.
20. Install the blower housing on all engines with the speed control mounted on the blower housing or engine block, and attach the ignition groundout lead at the control if applicable.
21. Install the intake pipe, speed control, carburetor, and air cleaner assembly while hooking the throttle and governor linkage. Install the blower housing on all engines with intake pipe mounted speed control brackets. Check the governor and speed control hook-up and adjustment - see Chapter 4 under "Service".



22. Attach the fuel tank (if applicable) using bolts or wedging the tank in the blower housing slots provided. Attach the fuel line and secure with clamps.
23. Slide the fuel line on the carburetor fitting and secure with a clamp. Slide the breather tube on the carburetor or air cleaner fitting if applicable.

NOTE: If the tank is supplied by the O.E.M. replace the fuel filter. Tecumseh's tanks have a fuel filter in the tank and service is not necessary.

24. Fill the engine with oil to the full mark on the dipstick. Add fresh fuel to the fuel tank and secure the cap.
25. Install the spark plug and high tension lead. Mount the engine to the equipment and connect wiring and control cables. OVRM rotary mower engines require the blade to be secured to the blade hub adapter and crankshaft before attempting to start the engine.
26. Start the engine and allow it to run approximately five minutes to reach operating temperature. Optimize the carburetor if adjustable, verify top no load and idle RPM settings.



CHAPTER 10

ENGINE SPECIFICATIONS AND SEARS CRAFTSMAN CROSS-REFERENCE

The engine specifications listed on the following pages include tolerances that are considered acceptable to achieve normal engine operation. Observed values inside the listed tolerance range are satisfactory and require no adjustments.

OVERHEAD VALVE SEARS CRAFTSMAN CROSS REFERENCE

Craftsman	Tecumseh	Craftsman	Tecumseh	Craftsman	Tecumseh
143.366012	OVM120-200004	143.406152	OVXL120-202050D	143.971200	OHV125-203023C
143.366072	OVM120-200006	143.406162	OVXL125-202051D	143.971201	OHSK120-222026F
143.366202	OVM120-200012	143.414432	OVRM50-52901A	143.971300	OHV135-206901A
143.366212	OVM120-200014A	143.416012	OVXL120-202056D	143.975003	OHH50-68044D
143.366232	OVM120-200015A	143.416042	OVXL125-202401	143.975005	OHH50-68004D
143.376012	OVM120-200017A	143.416082	OVXL125-202403	143.975009	OHH50-68113D
143.376032	OVM120-200012A	143.426092	OVXL120-202063E	143.975501	OHSK55-69507A
143.376072	OVM120-200006A	143.426112	OVXL120-202062E	143.975503	OHSK55-69509A
143.376082	OVM120-200018A	143.426122	OVXL125-202064E	143.976001	OHH60-71101A
143.384132	OVRM905-42002	143.426142	OVXL120-202034E	143.981200	OHV125-203023D
143.384142	OVRM905-42003	143.426152	OVXL120-202039E	143.981201	OHSK120-223609A
143.384152	OVRM905-42001	143.426172	OVXL125-202067E	143.985001	OHH50-68036F
143.384162	OVRM905-42004	143.436032	OHV125-203013A	143.985005	OHH50-68113F
143.384182	OVRM905-42005	143.436042	OHV125-203012A	143.985501	OHH55-69020E
143.384192	OVRM905-42006	143.436092	OHV125-203015A	143.985503	OHSK55-69514B
143.386012	OVM120-200020B	143.436102	OHV125-203018A	143.985505	OHSK55-69514C
143.386032	OVM120-200006B	143.436132	OHV125-203020A	143.986001	OHH60-71101C
143.386092	OVM120-200014B	143.436152	OHV125-203023A	143.986003	OHH60-71116C
143.386102	OVM120-200018B	143.796112	OHSK120-222005	143.986702	OVRM65-22016B
143.386152	OVM120-200015B	143.806062	OHSK120-222005A	143.986704	OVRM65-22017B
143.386162	OVM120-200022A	143.816042	OHSK120-222007B	143.986714	OVRM65-22020B
143.394092	OVRM905-42008	143.836052	OHSK120-222015C	143.986716	OVRM65-22026B
143.394102	OVRM905-42010	143.941200	OHV125-203023B	143.986718	OVRM65-22029B
143.394112	OVRM905-42011	143.941201	OHSK120-222015D	143.991200	OHV125-203050D
143.394192	OVRM905-42007	143.951600	OHV165-204402B	143.991201	OHSK125-223701A
143.394202	OVRM905-42009	143.951602	OHV165-204403B	143.991203	OHSK125-223702A
143.394212	OVRM905-42012	143.951602	OHV165-204403B	143.991300	OHV13-203211B
143.396012	OVXL120-202031C	143.955003	OHH50-68001A	143.995007	OHH50-68004F
143.396032	OVXL120-202036C	143.955007	OHH50-68004A	143.996001	OHH60-71138C
143.396062	OVXL120-202034C	143.961201	OHSK120-222026E	143.996005	OHH60-71140C
143.396072	OVXL120-202035C	143.965007	OHH50-68001B	143.996007	OHH60-71146C
143.396092	OVM120-200023C	143.965009	OHH50-68036B	143.996009	OHH60-71167C
143.396112	OVXL120-202039C	143.965011	OHH50-68044B	143.996501	OHSK65-71901A
143.396132	OVXL120-202040C	143.965013	OHH50-68004B	143.996503	OHSK65-71902A
143.404112	OVRM50-52901	143.965015	OHH50-68060B	143.996505	OHH65-71702A
143.406012	OVXL120-202040D	143.965017	OHH50-68060C	143.996507	OHH65-71704A
143.406052	OVXL120-202034D	143.965019	OHH50-68044C	143.996702	OVRM105-21024E
143.406062	OVXL120-202035D	143.965021	OHH50-68036C		
143.406072	OVXL120-202047D	143.965023	OHH50-68004C		
143.406132	OVXL120-202039D	143.965501	OHH55-69020A		
143.406142	OVXL120-202049D	143.965503	OHH55-69020B		

ENGINE SPECIFICATIONS

Specifications	OVRM40		OVRM50-6.75 OVRM105				OVRM120		OHH50 OHSK50			
	Standard English	Metric mm	Standard English	Metric mm	Standard English	Metric mm	Standard English	Metric mm	Standard English	Metric mm		
Displacement (in ³) (cc)	9.06	148.50	10.49 Note (A)	171.93 Note (A)	11.9 Note (A)	195.04 Note (A)	10.49	171.93				
Stroke	1.844	46.838	1.938	49.225	1.938	49.225	1.938	49.225				
Bore	2.500 2.501	63.500 63.525	2.625 2.626 Note (B)	66.675 66.700 Note (B)	2.795 2.796 Note (B)	70.993 71.018 Note (B)	2.625	66.675	2.626	66.700		
Ignition Module Air Gap	.0125	.3175	.0125	.3175	.0125	.3175	.0125	.3175				
Spark Plug Gap	.030	.762	.030	.762	.030	.762	.030	.762				
Valve Clearance In./Ex.	.004 .004	.1016 .1016	.004 .004	.1016 .1016	.004 .004	.1016 .1016	.004	.1016	.004	.1016		
Valve Seat Angle	46°		46°		46°		46°					
Valve Seat Width	.035 .045	.889 1.143	.035 .045	.889 1.143	.035 .045	.889 1.143	.035	.889	.045	1.143		
Valve Guide Oversize Dimension	INT. .2807 EX. .2787 .2817	INT. 7.130 EX. 7.079 7.155 7.104	INT. .2807 EX. .2787 .2817	INT. 7.130 EX. 7.079 7.155 7.104	INT. .2807 EX. .2787 .2817	INT. 7.130 EX. 7.079 7.155 7.104	INT. .2807 EX. .2787 .2817	INT. 7.130 EX. 7.079 7.155 7.104	.2807	7.135	.2817	7.155
Crankshaft End Play	.006 .027 Note (C)	.1524 .6858 Note (C)	.006 .027 Note (C)	.1524 .6858 Note (C)	.006 .027 Note (C)	.1524 .6858 Note (C)	.006	.1524	.027	.6858	Note (C)	Note (C)
Crankpin Journal Dia.	.8610 .8615	31.869 21.882	.9995 1.000	25.362 25.400	.9995 1.000	25.362 25.400	.9995	25.362	1.000	25.400		
Crankshaft Dia. Flywheel End Main Brg.	.9985 .9990	25.362 25.375	.9985 .9990	25.362 25.375	.9985 .9990	25.362 25.375	.9985	25.362	.9990	25.375		
Crankshaft Dia. P.T.O. Main Brg.	.9985 .9990	25.362 25.375	1.0005 1.0010	25.413 25.425	1.0005 1.0010	25.413 25.425	.9985	25.362	.9990	25.375		
Conn. Rod Dia. Crank Brg.	1.0005 1.0010	25.413 25.425	1.0005 1.0010	25.413 25.425	1.0005 1.0010	25.413 25.425	1.0005	25.413	1.0010	25.425		
Camshaft Bearing Diameter	.4975 .4980	12.637 12.649	.4975 .4980	12.637 12.649	.4975 .4980	12.637 12.649	.4970	12.624	.4975	12.637		
Piston Dia. Bottom of Skirt	2.4950 2.4520	63.373 63.378	2.6204 2.6220	66.558 66.599	2.6204 2.6220	66.558 66.599	2.6204	66.558	2.6220	66.599		
Ring Groove Side Clearance 1st & 2nd Comp.	.0020 .0050	.051 .127	.0020 .0050	.051 .127	.0020 .0050	.051 .127	.0020	.051	.0050	.127		
Ring Groove Side Clearance Bottom Oil	.0050 .0035	.013 .089	.0050 .0035	.013 .089	.0050 .0035	.013 .089	.0050	.013	.0035	.089		
Piston Skirt to Cylinder Clearance	.0040 .0058	.102 .147	.0030 .0056	.076 .142	.0030 .0056	.076 .142	.0030	.076	.0056	.142		
Ring End Gap	.010 .020	.254 .508	.010 .020	.254 .508	.010 .020	.254 .508	.007	.178	.017	.432		
Cylinder Main Bearing Diameter	1.0005 1.0010	25.413 25.425	1.0005 1.0010	25.413 25.425	1.0005 1.0010	25.413 25.425	1.0005	25.413	1.0010	25.425		
Cylinder Cover / Flange Main Brg. Diameter	1.0050 1.0010	25.413 25.425	1.0050 1.0010	25.413 25.425	1.0050 1.0010	25.413 25.425	1.0050	25.413	1.0010	25.425		

Note A: OVRM60, 21000 spec. numbers with a "B" suffix and all OVRM 65, 22000 spec. numbers have a displacement of 11.9 (195.04).

Note B: All OVRM 60, 21000 spec. numbers with a "B" suffix and all OVRM 65, 22000 spec. numbers have a 2.795"/2.796 (70.993/71.018) Bore.

Note C: All engines equipped with a ball bearing will have "0" End Play.

ENGINE SPECIFICATIONS (Continued)

Specifications	OHH and OHSK55 - 70		OHSK80 - 110 Note (D)		OHM, OHSK, OVM, OVXL120,130 & OHV11-13		OHV13.5 - 17	
	Standard English	Metric mm	Standard English	Metric mm	Standard English	Metric mm	Standard English	Metric mm
Displacement (in ²) (cc)	11.9	195.04	19.43	318.46	21.82	357.63	29.9	490.06
Stroke	1.938	49.225	2.532	70.993	2.532	70.993	3.00	76.6
Bore	2.795	70.993	3.125	79.375	3.312	84.125	3.562	90.475
	2.796	71.018	3.126	79.400	3.313	84.150	3.563	90.500
Ignition Module Air Gap	.0125	.3175	.0125	.3175	.0125	.3175	.0125	.3175
Spark Plug Gap	.030	.762	.030	.762	.030	.762	.030	.762
Valve Clearance In./Ex.	.004	.1016	.004	.1016	.004	.1016	.004	.1016
	.004	.1016	.004	.1016	.004	.1016	.004	.1016
Valve Seat Angle	46°		46°		46°		46°	
Valve Seat Width	.035	.889	.035	.889	.035	.889	.042	1.0671
	.045	1.143	.045	1.143	.045	1.143	.052	1.321
Valve Guide Oversize Dimension	.2807	7.130	.3432	8.717	.3432	8.717	.3432	8.717
	.2817	7.155	.3442	8.743	.3442	8.743	.3442	8.743
Crankshaft End Play	.006	.1524	.002	.051	.002	.051	.0025	.064
	.027	.6858	.042	.067	.042	.067	.0335	.851
	Note (C)	Note (C)						
Crankpin Journal Dia.	.9995	25.362	1.3740	34.900	1.3740	34.900	1.6223	41.206
	1.000	25.400	1.3745	34.912	1.3745	34.912	1.6228	41.219
Crankshaft Dia. Flywheel End Main Brg.	.9985	25.362	1.3745	34.912	1.3745	34.912	1.6245	41.262
	.9990	25.375	1.3750	34.925	1.3750	34.925	1.6250	41.275
Crankshaft Dia. P.T.O. Main Brg.	.9985	25.362	1.3745	34.912	1.3745	34.912	1.6245	41.206
	.9990	25.375	1.3750	34.925	1.3750	34.925	1.6250	41.275
Conn. Rod Dia. Crank Brg.	1.0005	25.413	1.3775	34.988	1.3775	34.988	1.6234	41.234
	1.0010	25.425	1.3780	35.001	1.3780	35.001	1.6240	41.250
Camshaft Bearing Diameter	.4970	12.624	.6230	15.824	.6230	15.824	.6235	15.837
	.4975	12.637	.6235	15.837	.6235	15.837	.6240	15.850
Piston Dia. Bottom of Skirt	2.7904	70.876	3.1195	79.235	3.3095	84.061	3.5595	90.411
	2.7920	70.917	3.1205	79.261	3.3105	84.087	3.5605	90.437
Ring Groove Side Clearance 1st & 2nd Comp.	.0020	.051	.0020	.051	.0020	.051	.0020	.051
	.0050	.127	.0040	.127	.0040	.127	.0040	.127
Ring Groove Side Clearance Bottom Oil	.0050	.013	.0010	.0254	.0010	.0254	.0009	.0229
	.0035	.089	.0030	.076	.0030	.076	.0029	.074
Piston Skirt to Cylinder Clearance	.0030	.076	.0015	.038	.0015	.038	.0015	.038
	.0056	.142	.0035	.089	.0035	.089	.0030	.089
Ring End Gap	.007	.178	.010	.254	.010	.254	.012	.305
	.017	.432	.020	.508	.020	.508	.022	.559
Cylinder Main Bearing Diameter	1.0005	25.413	1.3765	34.963	1.3765	34.963	1.6265	41.313
	1.0010	25.425	1.3770	34.976	1.3770	34.976	1.6270	41.326
Cylinder Cover / Flange Main Brg. Diameter	1.0050	25.413	1.3765	34.963	1.3765	34.963	1.6265	41.313
	1.0010	25.425	1.3770	34.976	1.3770	34.976	1.6270	41.326

Note A: OVRM60, 21000 spec. numbers with a "B" suffix and all OVRM 65, 22000 spec. numbers have a displacement of 11.9 (195.04).

Note B: All OVRM 60, 21000 spec. numbers with a "B" suffix and all OVRM 65, 22000 spec. numbers have a 2.795"/2.796 (70.993/71.018) Bore.

Note C: All engines equipped with a ball bearing will have "0" End Play.

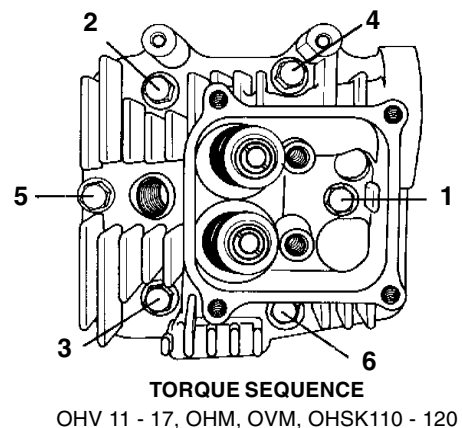
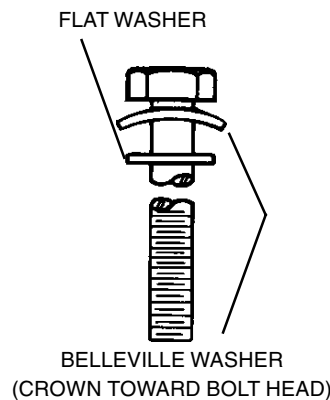
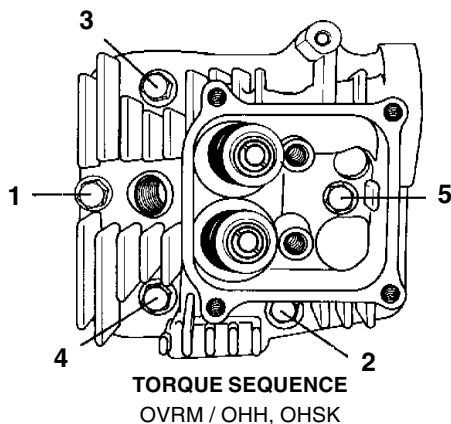
Note D: For OHSK110 models with specification number starting with 223000 have a displacement of 21.82 (357.63 cc).

OVERHEAD VALVE TORQUE SPECIFICATIONS

The torque specifications listed in this chart are to be used for replacing components after disassembly, not for checking an existing engine bolt torque. Checking a torque value on a new or used engine may be lower due to torque relaxation that occurs on all engines from thermal expansion and contraction. However, sufficient clamping force exists and a re-torque is not necessary.

Specifications below ten ft. lbs. torque are listed only as in. lb. measurements to encourage the use of an inch pound torque wrench for greater torque accuracy.

	In. lbs.	ft. lbs.	Nm	OVRM	OHH50-65 OHSK50-70	OVXL, OHM, OVM, & OHSK	OHV 11-13	OHV 110-135 206 Series	OHV135-145 203 Series OHV15-17.5 204 Series
Cylinder Head Bolts	230	19	26	X	X	X	X	X	X
Conn. Rod Bolts	105	-	12	X	X				
Conn. Rod Bolts	220	18.3	24.8			X	X	X	X
Cyl. Cover or Flange	115	9.5	13	X	X				
Cyl. Cover or Flange	125	10.5	14			X	X	X	X
Flywheel Nut	450	35	51	X	X				
Flywheel Nut Cast Iron	550	46	62		X				
Flywheel Nut	700	58	79			X	X	X	X
Spark Plug	250	21	28	X	X	X	X	X	X
Ign. Mounting (Direct to Cyl.)	45	-	5	X	X				
Ign. Mounting (Direct to Stud)	45	-	5			X	X	X	X
Ign. Mounting Stud to Cyl.	40	-	4.5			X	X	X	X
Intake Pipe to Head	115	-	13	X	X	X	X	X	X
Carburetor to Intake Pipe	70	-	8	X	X	X	X	X	X
Fuel Shut Off Solenoid to Carb.	17	-	2				X	X	X
Muffler Mtg. (Flanged)	75	-	8.5	X					
Muffler Mtg. (Rect.)	65	-	7.5	X					
Muffler Mtg. (Oval)	45	-	5	X					
Muffler Mtg.	100	-	11.5		X				
Muffler (Flanged) to Manifold (Flanged)	200	16.5	22.5			X		X	
Muffler Clamp to Manifold	80	-	9						X



OVERHEAD VALVE TORQUE SPECIFICATIONS

The torque specifications listed in this chart are to be used for replacing components after disassembly, not for checking an existing engine bolt torque. Checking a torque value on a new or used engine may be lower due to torque relaxation that occurs on all engines from thermal expansion and contraction. However, sufficient clamping force exists and a re-torque is not necessary.

Specifications below ten ft. lbs. torque are listed only as in. lb. measurements to encourage the use of an inch pound torque wrench for greater torque accuracy.

	In. lbs.	ft. lbs.	N/M	OVRM	OHH50-65 OHSK50-70	OVXL, OHM, OVM	OHSK & OHV 11-13	OHV 110-135 206 Series	OHV135-145 203 Series OHV15-17.5 204 Series
Manifold Mtg. (Shoulder Bolt)	160	13.5	18			X	X	X	X
Recoil Starter	25	-	3	X					
Recoil Starter	50	-	5.5		X	X	X		
Recoil Starter	40	-	4.5						X
Recoil Starter	80		9			X	X	X	X
Electric Starter to Cylinder	100	-	11	X	X	X	X		
Electric Starter to Cylinder	150	12.5	17					X	X
Rocker Arm Hex Jam Nut	18	-	2			X	X 1		
Rocker Arm Lock Allen Screw	75	-	8.5						X
Rocker Adjusting Jam Nut	130	10.8	14.7						X 1
Rocker Arm Stud Lock Nut	120	10	13.5	X	X	X	X 1	X 1	
Rocker Arm Studs	190	15.8	21.5			X	X		X
Rocker Box Cover	40	-	4.5	X	X				
Rocker Box Cover	18	-	2			X			
Rocker Box Cover (4 screws)	55	-	6				X	X	X
Alt. Coil Assy. to Cylinder	25	-	3						X
Alt. Coil Assy. to Cylinder	65	-	7		X				
Alt. Coil Assy. to Cylinder	90	-	10			X	X	X	
Alt. Coil Assy. to Lamination	30	-	3.5	X					

NOTE 1: A jam nut is described as a nut which is placed above the rocker arm and bearing. A lock nut is positioned below the rocker arm and bearing.

CHAPTER 11. EDUCATIONAL MATERIALS AND TOOLS

AVAILABLE TECHNICIAN'S HANDBOOKS

692508

Covers the diagnosis and repair of Tecumseh 2-cycle engines. Except the TC Engine and TVS840.

692509

Covers the diagnosis and repair of the Tecumseh 4-cycle light/medium frame engines.

691462A

Covers the diagnosis and repair of Tecumseh 4-cycle large frame engines.

691218

Covers the diagnosis and repair of Peerless® power train components.

694782

Contains technical information for the repair of the TC series, 2-cycle engines.

694988

Contains diagnosis and technical information for the repair of TVS840, HSK/HXL845/850, 2-cycle engines.

695244A

Covers the diagnosis and repair of the OVRM/OVM/OHM/OHV 4-cycle overhead valve engines.

695578

Covers the diagnosis and repair of the Vector Series, 4-cycle engines.

AVAILABLE FOREIGN TECHNICIAN'S HANDBOOKS

694732 Spanish

This manual covers the following models:
VH80, VH100, HH80, HH100, HH120, OH120-180
Model numbers are located on the engine shroud.

695555 Spanish

Covers the diagnosis and repair of the Tecumseh 4-cycle light/medium frame engines.

695657 German

Covers the diagnosis and repair of the Tecumseh 4-cycle light/medium frame engines.

695562 French

Covers the diagnosis and repair of the Tecumseh 4-cycle light/medium frame engines.

VIDEO PROGRAMS

695015

Carburetor Troubleshooting. Covers identification of carburetors used on Tecumseh engines and how to troubleshoot and repair them. VHS only.

695059

Understanding Tecumseh Ignition Systems. A basic program designed to give the small engine technician first hand knowledge of Tecumseh ignition systems so the technician can understand the system and perform repairs to it. VHS only.

695148

Teardown and reassembly of the 900 series transaxles. This video will show a complete step-by-step procedure for teardown and reassembly of the 900, 910 and 920 series transaxles.

695185

Electrical Troubleshooting. This video training program will assist the small engine technician in the proper procedures for troubleshooting electrical systems on outdoor power equipment.

695285

An in-depth look at the 800 series transaxles. Detailing the teardown and reassembly procedures for the 800, 801 and 820 transaxles.

SPECIAL BOOKLETS

INSTRUCTIONAL GUIDE

692738

Assists in the use and understanding of the Tecumseh Master Parts Manual. Illustrates time saving features incorporated into the manual. Explains new carburetor parts breakdown format.

4-CYCLE ENGINE FAILURE ANALYSIS

695590

This booklet is designed as a tool for the average technician to correctly assess the cause of failure.

CARBURETOR TROUBLESHOOTING BOOKLET

695907

This booklet is designed as a quick reference to carburetion problems and related repair procedures.

IGNITION SYSTEMS TROUBLESHOOTING BOOKLET

694903

This booklet contains information on the identification, possible problems and related repair procedures of Tecumseh Ignition Systems.

SPECIAL TOOLS BOOKLET

694862

This booklet depicts all specialty tools offered by Tecumseh which can be used on 2 and 4 cycle engines and Peerless units.

QUICK REFERENCE CHART BOOKLET

695933

This booklet contains the quick reference information found on Tecumseh wall charts.

This booklet is designed to be used as a work bench quick reference guide when servicing Tecumseh engines and motion drive systems.

TESTER BOOKLETS

694529

Test procedures for Tecumseh electrical components using Graham-Lee Tester 31-SM or 31-SMX-H.

694530

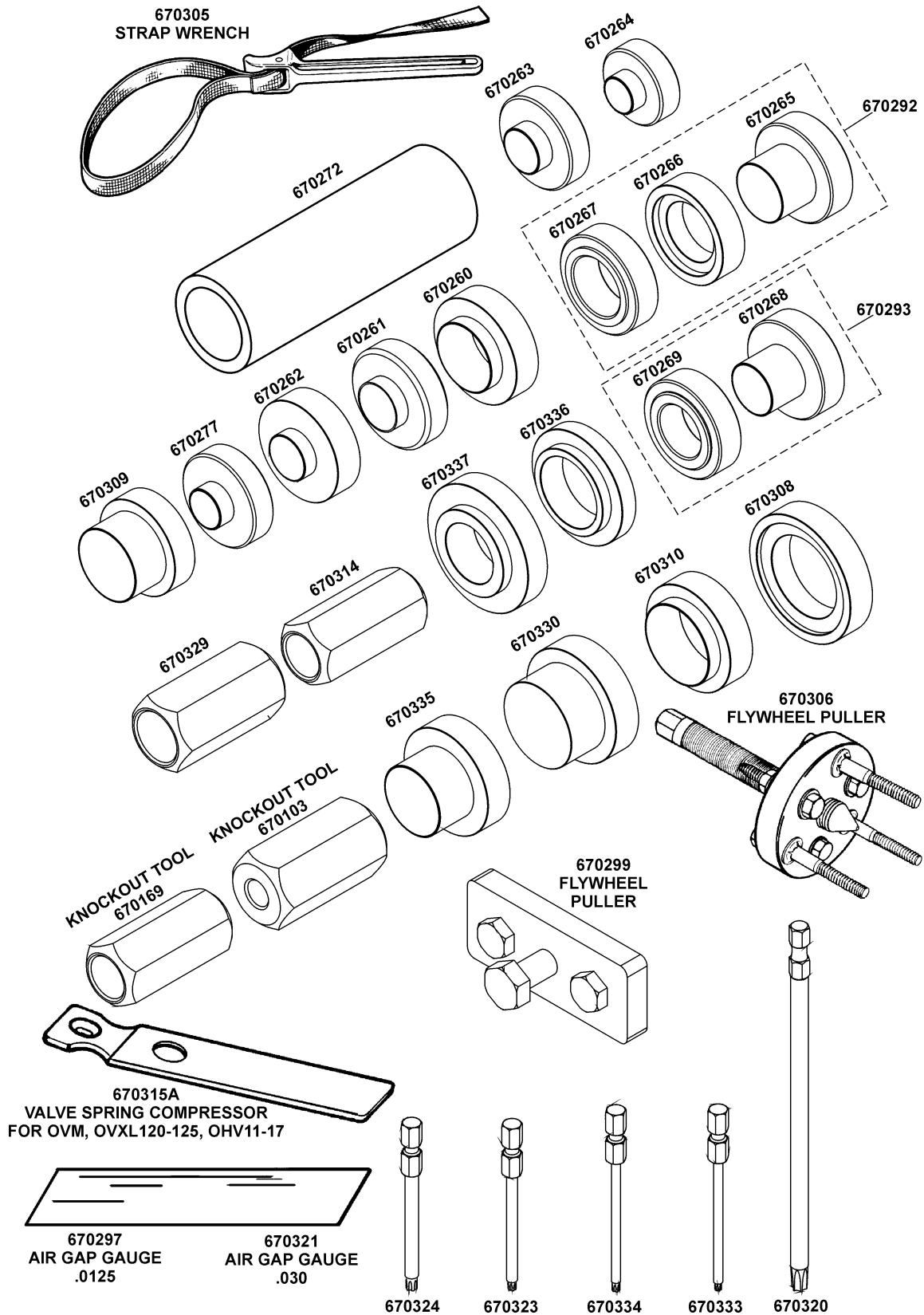
Test procedures for Tecumseh electrical components using Merco-O-Tronic Tester 9800. (Tests are similar for 98, 98A and 79.)

TOOLS

TOOL KIT 670195E

Kit contains tools for 2- and 4-cycle engines.

Includes all items on this page but items may be purchased separately.



670305
STRAP WRENCH

670272

670264

670263

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670329

670314

670330

670310

670306
FLYWHEEL PULLER

KNOCKOUT TOOL
670169

KNOCKOUT TOOL
670103

670335

670299
FLYWHEEL PULLER

670315A
VALVE SPRING COMPRESSOR
FOR OVM, OVXL120-125, OHV11-17

670297
AIR GAP GAUGE
.0125

670321
AIR GAP GAUGE
.030

670324

670323

670334

670333

670320

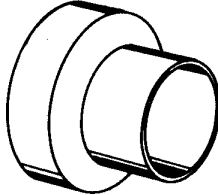
OIL SEAL DRIVER



No. 670195D Tool Kit. Contains special tools commonly used in servicing 2 and 4 cycle engines.

OIL SEAL PROTECTOR/INSTALLER

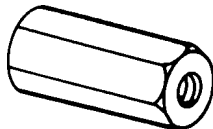
Consult the specification chart or measure the shaft diameter to determine the correct tool.



Use with:

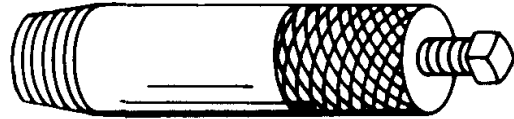
- No. 670260. 1-3/16" crankshaft bearing diameters.
- No. 670261. 13/16" crankshaft bearing diameters.
- No. 670262. 3/4" Crankshaft bearing diameters.
- No. 670263. 5/8" extended camshaft.
- No. 670264. 1/2" extended camshaft.
- No. 670277. 35/64" 8-1/2:1 Aux. Shaft.
- No. 670292. 1" crankshaft bearing diameters assy. for recessed, raised, or flush seal position.
- No. 670293. 7/8" crankshaft bearing diameters assy. for recessed or flush seal position.
- No. 670308. Adapter for raised or flush seal position, used with 670309.
- No. 670309. 1-3/8" crankshaft bearing diameters protector, use with 670308.
- No. 670310. 1-3/8" crankshaft bearing diameter for recessed seal position.
- No. 670330. 1-1/2" extended camshaft.
- No. 670335. 1-1/8" crankshaft bearing diameters.
- No. 670336. 1-1/8" crankshaft bearing diameter recessed seal.
- No. 670337. 1" to be used with 670265 and 670266 recessed and raised.

FLYWHEEL KNOCK-OFF TOOL



- †No. 670103 - Knock-off tool (right hand) (7/16").
- †No. 670169 - Knock-off tool (right hand) (1/2").
- †No. 670314 - Knock-off tool (right hand) (5/8").
- †No. 670329 - Knock-off tool (right hand) (3/4").

OIL SEAL REMOVER

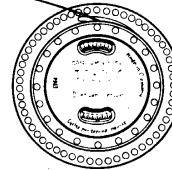


Consult the specification chart or measure the shaft diameter to determine the correct tool.

Use with:

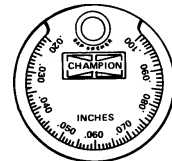
- No. 670287. 7/8" crankshaft bearing diameters.
- No. 670288. 3/4" crankshaft bearing diameters.
- No. 670289. 13/16" crankshaft bearing diameters.
- No. 670290. 1" crankshaft bearing diameters.
- No. 670312. 1-3/8" crankshaft bearing diameters.
- No. 670331. 1.5" crankshaft bearing diameters.

VIBRATION TACHOMETER



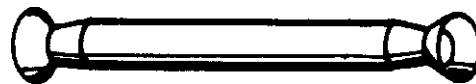
No. 670156 Vibration tachometer.

TAPER GAP GAUGE



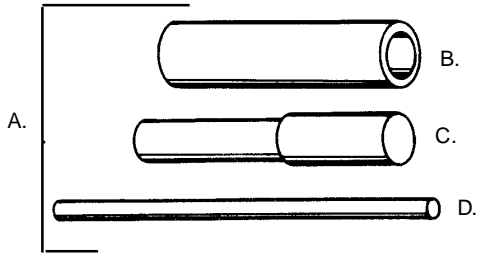
No. 670256 Taper Gap Gauge

VALVE LAPPING TOOL



No. 670154A Valve lapping tool.

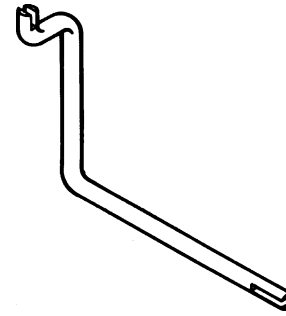
BUSHING TOOL KIT



Rebushing tool kit for use on OHM, OHSK110, 120, OVM, OHV11-13 AND OVXL. 1-3/8" main bearing.

- A. None
- B. None
- C. No. 670311 - Bushing Driver/Installer.
No. 670317 - Bushing Driver/Installer.

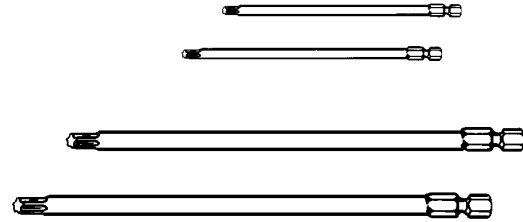
OVRM AND OHV11-16.5 SPEED ADJUSTMENT TOOL



No. 670326

TORX DRIVERS

Torx 8	670334
Torx 10	670333
Torx 15	670323
Torx 20	670324
Torx 25	670319
Torx 30	670320



No. 670298 Alignment Tool.

**1/32" (.794 mm)
OVERSIZE VALVE GUIDE REAMER**

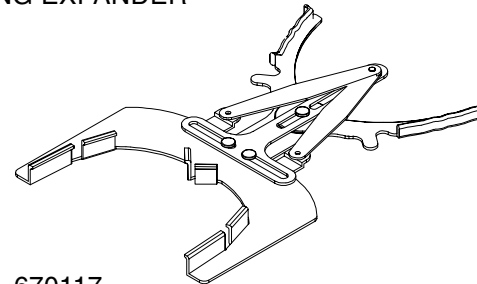


No. 670283. Used on OHH on Intake and Exhaust, and OVRM40-60 Intake valve guide. Oversize diameter .2807/.2817 (7.130 - 7.155 mm)

No. 670328. Used on OVRM40-60 Exhaust valve guide. Oversize diameter .2787/.2797 (7.079 - 7.104 mm).

No. 670284. Used on OVXL/OVM/OHM120, OVXL125 and OHV11-16.5 Intake and Exhaust. Oversize diameter .3432/.3442 (8.717 - 8.743 mm).

RING EXPANDER



No. 670117